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NEW INDIAN CHALCIDOIDEA (*PARASITIC HYMENOPTERA*).

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INTRODUCTION.

Among the various major groups of Hymenoptera the super-family Chalcidoidea, popularly called the "fairy flies," is economically the most important. Very few groups of insects approach it in its complexity of morphological and ecological features. Except for one or two minor groups such as the Agaontidae and the Megastigminae they are parasites of the various classes of insects, which in their turn are pests of economic plants. Some of them are also hyper-parasites and attack eggs, larvae, etc., of other parasitic Hymenoptera, including Chalcids.

Very little work, either systematic or bionomic, has been done on these insects in India. Occasional descriptions of the Chalcids of India have appeared in periodicals, most of which are not readily accessible. The earliest description of an Indian species was by Fabricius, while Kirby, Motschulsky and Walker described a number of species from Ceylon and continental India. Mayr added a few species to these records, and in 1898, Dalla Torre listed thirty Indian species. Several new forms were later described by Cameron, Westwood, Howard, Ashmead, Crawford, Rohwer, Gahan, Girault and Weld. Ramakrishna Ayyar[1], besides describing a few species, recently published references to some three hundred species, which have so far been described from India and Ceylon.

I became interested in these wasps in the course of my studies on gall midges, which are very heavily parasitized by the Chalcids. I made collections in different parts of India and have also examined the named collections in the Agricultural Research Institute, Coimbatore, and the Zoological Survey of India, Indian Museum, Calcutta. Numerous undetermined specimens collected at different times by the officers of the Zoological Survey were kindly placed at my disposal by Dr. Baini Prashad, Director, Zoological Survey of India. Dr. T. V Ramakrishna Ayyar, Government Entomologist, Coimbatore, very generously loaned me the material from the Coimbatore Institute and also donated the types of some new species to the collection of the Zoological Survey. Numerous specimens were also collected by one of my sisters Miss M. Meenakshi. In the course of my studies I came across several new forms, some of which are described in this paper.

I take this opportunity of recording my grateful thanks to Dr. Baini Prashad, Director, Zoological Survey of India for giving me facilities

[1] Ayyar, T. V. Ramakrishna, *Spol. Zeyl.*, XIII, pp. 235-254, (1925); also see Ayyar, T. V. Ramakrishna and Margabandhu, V., *Journ. Bombay Nat. Hist. Soc.*, XXXVII, pp. 193-196 (1934).

for work in the laboratories of the Zoological Survey and for helping me in my work. To Dr. T. V. Ramakrishna Ayyar, Government Entomologist, Agricultural Research Institute, Coimbatore, I am indebted for the loan of the valuable collection of Chalcids, for going through the manuscript and many helpful suggestions.

Family CHALCIDIDAE.

Subfamily *LEUCOSPIDINAE.*

Genus **Polistomorpha** Westwood.

1839. *Polistomorpha,* Westwood, *Zeitschr. Entomol.*, I, p. 265.
1874. *Polistomorpha,* Walker, *Thesaur. Entomol. Oxon.*, p. 133.
1890. *Polistomorpha,* Schletterer, *Berlin. Entomol. Zeit.*, XXXV, p. 292.
1904. *Polistomorpha,* Ashmead, *Mem. Carnegie Mus.*, I (4), pp. 247, 402.
1906. *Polistomorpha,* Ducke, *Bull. Soc. Entomol. France,* pp. 163-166.
1909. *Polistomorpha,* Schmiedeknecht, *Gen. Ins.*, fas. 97, p. 14.
1922. *Polistomorpha,* Weld, *Proc. U. S. N. Mus.*, LXI, p. 4.

Polistomorpha was erected as a subgenus of *Leucospis* Fab. in 1839 by Westwood to accommodate a Chalcid which he described under the specific name *surinamensis*; it was given generic status by Walker in 1874. About six species have so far been described, a key for which was published by Ducke in 1906. No member of this genus has been previously recorded from India. One specimen in a series of Chalcids received from Dr. T. V. Ramakrishna Ayyar, Coimbatore, belongs to this genus and is described here as a new species under the name *Polistomorpha indica,* sp. nov. This species appears to differ from the typical forms mainly in the absence of the spur on the hind coxae. Its relationship to the known forms is shown in the key below which is modified from Ducke.

The genus is recognised by the following characters: Vertex not cornuted, posterior margin of head straight, third antennal segment as long as or longer than the second; pronotum equally broad both anteriorly and posteriorly; scutellum normal, never heart-shaped; central part of metathorax projecting; hind coxae with or without a strong erect spur on the upper side; abdomen spindle-shaped, never compressed, with or without median longitudinal furrow towards the posterior end, apex pointed; ovipositor limited to the underside of the abdomen.

Key to species.

I. Hind coxae unspurred above; small species—

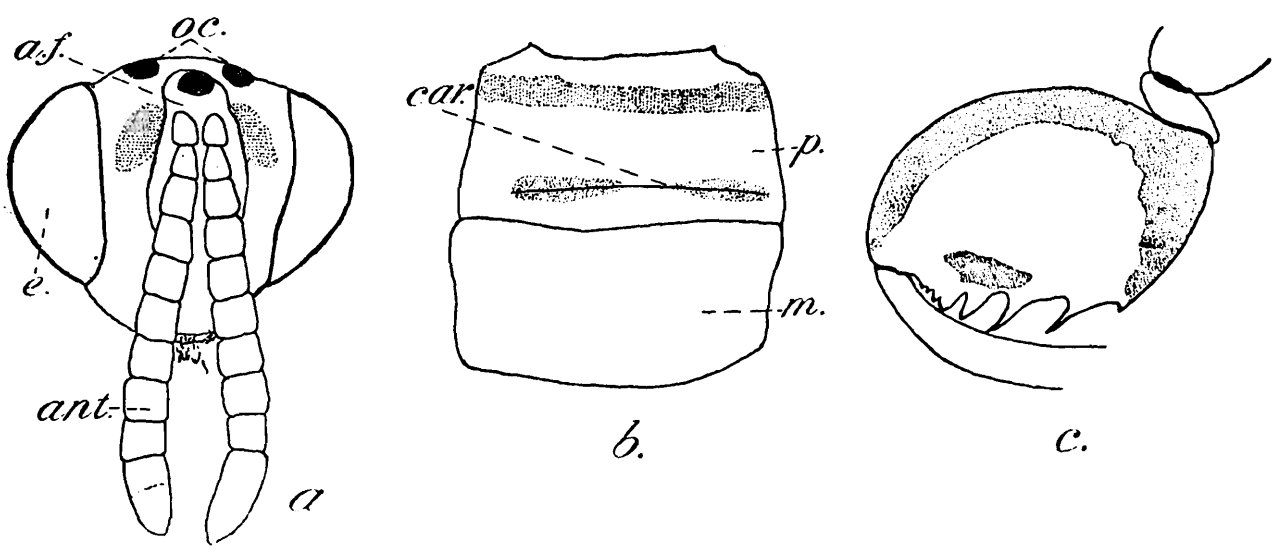
A. Hind femur with over 10 teeth, first tooth large, rest small; carina on the yellow band on pronotum faint ..... *P. bulbiventris* (Cresson).

B. Hind femur with only 5 teeth; first short; second, third and fourth long; fifth large and tridentate; carina on the yellow band on pronotum well developed ..... *P. indica,* sp. nov.

II. Hind coxae spurred above; large species—	
A. Hind femur with 6 or 7 teeth, first larger than the rest—	
1. Body black . .	*P. sphegoides* Walker.
2. Body testaceous—	
a. Fourth dorsal segment shiny, punctation coarse, first tooth of hind femur triangular	*P. nitidiventris* Ducke.
b. Fourth dorsal segment somewhat opaque, punctation fine, first tooth of hind femur very long, sharp	*P. fasciata* Westwood.
c. Fourth dorsal segment opaque, finely and densely punctate, first tooth of hind femur large, triangular	*P. surinamensis* Westwood.

Polistomorpha indica, sp. nov.

Female.—7·5 mm. long. Body shiny and sparsely setose. Head partially hidden beneath the thorax, densely umbilicately punctate, villous; frons more hairy than the back and occiput; eyes dark brown and finely pubescent; posterior ocelli widely separated. Antennae about one and a half times the vertical length of the head, very finely pubescent; segments 11; funicle 7-articulate; club biarticulate. Thorax much sculptured; pronotum with one distinct transverse carina parallel to the hind margin, somewhat faint at the ends; apparently more coarsely punctate than the mesoscutum; scutellum sculptured, similar to the pronotum. Fore wings smoky from about the basal half onwards. Front coxae densely setose; hind coxae densely and finely punctate and setose, unspurred apically; hind femur finely punctate and setose, teeth 4 simple, 1 compound; first tooth short, small; second long and sharp; third longer and sharper; fourth short and obtusely pointed; fifth or the compound tooth tridenticulate; hind tibia as long as femur. Abdomen shiny, densely and finely punctate.



TEXT-FIG. 1. *Polistomorpha indica,* sp. nov. *a.* head in front view; *a. f.* antennal fovea; *ant.* antenna; *b.* pronotum and mesonotum from above; *c.* hind femur; *car.* carina; *e.* eye; *m.* mesonotum; *oc.* ocelli; *p.* pronotum (spots and markings shaded).

Body colour mostly black with yellow spots or markings; small, oblong yellow spots on frons on either side of the apex of scape of antennae; pedicel of antennae black; funicle dark reddish brown; a moderately narrow, transverse, yellowish band anteriorly on pronotum reaching

almost down to the lateral margin of the latter; narrow transverse yellow bands on either ends of the carina on pronotum, growing fainter inwards and almost completely absent in the middorsum; tegulae dark testaceous; a transverse brownish yellow band posteriorly on scutellum, broader at the ends than in the middle; front coxae testaceous; femur dark brown except for a linear-triangular brownish yellow spot apically; tibia dark testaceous except in front, where it is brownish yellow for the whole length; mid leg almost similar to the fore leg except that the coxae are darker and the longitudinal yellow stripe on tibia is broader; hind coxae reddish brown except for a basal yellowish spot above; femur olive-brown except for a large irregular, basal yellowish spot on the outer side continuing anteriorly to apex and except for an oblong spot posteriorly just above the fourth tooth; a yellow line on hind tibia, from basal third, broadening apically; three transverse yellowish bands on abdomen, anterior band broad and short, middle broader and longer, posterior narrow and very long; also a small crescentric yellow spot sub-apically on the middorsum.

Type.—Female, on pin. Coll. T. V. Ramakrishna Ayyar, v. 1915. Yercaud, S. India. In the collections of Zoological Survey of India (Ind. Mus.), Calcutta, No. $\frac{891}{H3}$.

Genus **Leucospis** Fabricius.

1775. *Leucospis*, Fabricius, *Syst. Entomol.*, I, p. 361.
1874. *Leucospis*, Westwood, *Thesaur. Entomol. Oxon.*, p. 135.
1890. *Leucospis*, Schletterer, *Berlin. Entomol. Zeitschr.*, XXXV, pp. 141-302.
1894. *Exochlaenus*, Shipp, *Entomologist*, XXVII, p. 245.
1904. *Leucospis*, Ashmead, *Mem. Carnegie Mus.*, I (4), p. 247.
1909. *Leucospis*, Schmiedeknecht, *Gen. Ins.*, fas. 97, p. 14.
1922. *Leucospis*, Weld, *Proc. U. S. N. Mus.*, LXI, pp. 4-35.

This genus was erected by Fabricius in 1775 and was comprehensively dealt with by Schletterer in 1890 in his monograph on the subfamily Leucospidinae. In 1894 Shipp transferred the species *Leucospis anthioides* Westwood to a new genus, which he named *Exochlaenus*; this was accepted by Ashmead in 1904 and by Schmiedeknecht in 1909. In his recent monograph on the subfamily Leucospidinae Weld has reunited under *Leucospis* Fab. all the species referred to *Exochlaenus* Shipp, which according to him is not distinct from the former. I originally held the view that *Exochlaenus* may be considered as a subgenus of *Leucospis* and Dr. Ramakrishna Ayyar also shared the same view, but after studying a large number of new and known forms I agree with Weld in considering *Exochlaenus* as a synonym of *Leucospis*.

The species of this genus are relatively more numerous in the tropics, where they are generally found as parasites in the nests of honey bees. Five species are already known from India and three new ones are described below.

Leucospis meenakshiae, sp. nov.

This species, with which I associate the name of one of my sisters who collected numerous Chalcids for me, very closely approaches the Philippinese species *Leucospis ornatifrons* Weld in Weld's key to the

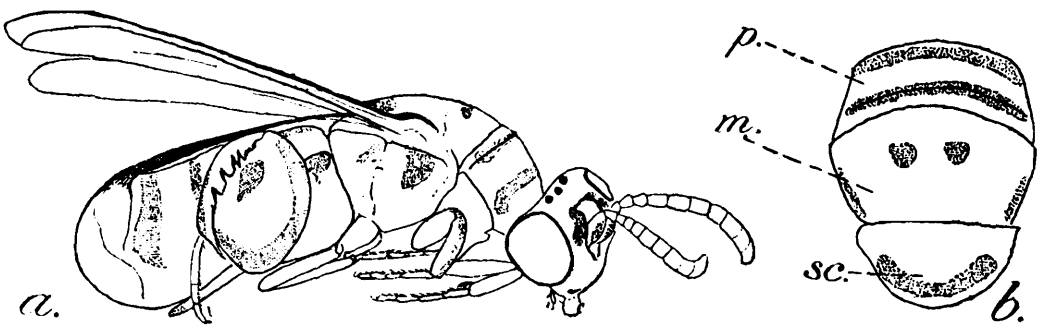
world species of the genus *Leucospis* Fab. It is, however, quite distinct from a specimen received from Dr. Ramakrishna Ayyar, which I identified as *Leucospis ornatifrons* Weld. It is distinguished from the same by its larger size, red spots and markings, ovipositor reaching the posterior margin of scutellum and clouded fore wings. It is further remarkable on account of its extremely long ovipositor, which extends forward more than in all the other known species.

Female.—9·25 mm. long. Body mostly black, spotted yellow and orange red, finely punctate and moderately setose. Antennae about two thirds the length of the body, moderately slender; segments 12, club biarticulate; scape longer than the following two segments, fusiform; pedicel about half shorter than the first segment of the funicle; second and third segments of funicle sub-equal; fourth segment about three-fourths the length of the third; the succeeding segments nearly equal in length, but shorter. Scapal furrow apically about one fourth the interorbital width. Pronotum one half shorter than the mesoscutum in the median line; with one transverse carina parallel to the hind margin, posterior in situation and ends reaching very nearly to the lateral margins; punctation umbilicate and coarse. Mesoscutum with a coarser punctation than pronotum. Lateral foveae on metanotum rugosely punctate. Hind coxae closely punctate. Hind femur less so than coxae, with a length about one seventh greater than its breadth, with five teeth; basal tooth small, sharp; second and third long, sharp (second also a little shorter and stouter than third); fourth tooth equal in length to second, somewhat stout, bluntly pointed; last tooth broad, compound, tridenticulate and blunt. Hind tibiae about three fourths the length of the femur; produced apically into a stout, straight, acutely pointed, spinous process on the outside and with a short slender spur sub-apically on the inner side. Fore wings uniformly clouded and brown.

Seen from above abdomen has a length about twice its greatest width; second tergite largest, with longitudinal, moderately broad furrows on either side of a median ridge; third tergite covered; fourth and fifth shorter than sixth, beyond which the abdomen is compressed. Seen from the side the abdomen is straight along the dorsal line, wide posteriorly and broadly rounded apically; finely umbilicately punctate, more hairy apically than basally. Ovipositor reaches the posterior margin of the scutellum.

Body spotted or marked as follows: hind femur rich gamboge-yellow, except for the teeth and for a large, central, reddish brown area on the outer side touching margin near the apex beneath and again between first and third teeth; also an oval yellow spot near apex and beneath on the outer side; a pale yellow longitudinal stripe behind on the outer side on hind tibiae extending from the basal third to about the apex. Rest of the body brick red or orange as follows: scape below; an oval spot between eyes and antennal foveae, touching the edges of the latter and extending from vertex to about half the length downwards of the foveae, differing in these respects from *L. ornatifrons* Weld; a broad anterior band dilated at ends and a posterior, narrow, short, reddish band, very narrow in the middorsum and superimposed

on the transverse carina on pronotum; two small, conspicuous, suborbicular spots in the center on either si de of th middrosum on mesoscutum, which is also margined laterally; submarginal band broader



TEXT-FIG. 2. *Leucospis meenakshiae*, sp. nov. *a.* profile view with the head slightly turned to one side to show details of markings on face; *b.* thorax from above; *m.* mesonotum; *p.* pronotum; *sc.* scutellum (spots and markings shaded).

at the ends than in the middle, posteriorly on the scutellum; an obtriangular large spot below the tegulae; front tibiae on the inner and front sides; a spot above at base on hind coxae; two long, oblique, sublongitudinal spots on second tergite on either side of the submedian foveae; transverse band on fifth tergite; a transverse band posteriorly on sixth tergite, becoming broader downwards at the sides; hypopygium brownish yellow apically.

Metanotum unspotted; front and mid coxae unspotted; hind coxae unspotted apically; abdomen without a crescent-shaped spot at apex.

Type.—Female. Coll. Miss M. Meenakshi, 29-xi-1932. Girls' Christian High School, Tanjore, Madras Presidency, S. India, in the collections of Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{893}{H3}$.

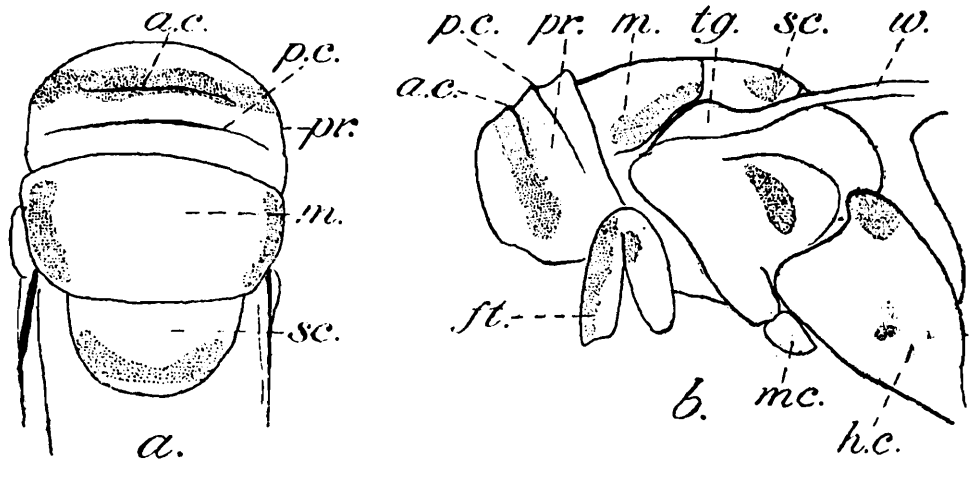
Leucospis bombayensis, sp. nov.

This new species is based on a Chalcid from Bombay in the collections of the Zoological Survey. The presence of an anterior carina on pronotum and other characters place this species with *L. guzaretensis* Westwood in Weld's key to species. It is distinguished from the same by its smaller size, presence of markings on sixth abdominal tergite, absence of a basal band on hind femur, which is quite differently marked and wings without any purple iridescence. It has a superficial resemblance to *L. ornatifrons* Weld but is readily separated by the presence of two carinae on pronotum instead of one and by variations in the colour of the spots and markings.

Female.—5·5 mm. long. Body moderately setose and moderately sculptured. Antennae less than one third the length of the body; segments 12; pedicel subequal to the first segment of the funicle; second and third segments of funicle subequal; fourth a little longer; fifth subequal to third; club short, biarticulate; scapal furrow apically about one half the interorbital width. Pronotum about two thirds the mesoscutum in the median line; with two transverse carinae parallel to the hind margin; anterior carina short, nearly as high as the posterior

which latter is a little longer but does not reach the sides; punctation coarse. Mesoscutum with a punctation coarser than on pronotum. Metanotum with a broad anterior carina. Hind coxa with a sharp angle above at base, sparse serrations above subapically, closely and minutely punctate, densely covered with long setae below. Hind femur somewhat coarsely punctate, with a length about twice its breadth; teeth 7 below; basal tooth large, broad, blunt; second tooth minute, blunt; third about as long as the basal, stout, pointed; fourth and fifth subequal, a little longer than third, pointed; sixth similar to third; seventh large, short, compound, penta-denticulate. Hind tibia about three fourths the length of hind femur; apically produced into a short, stout, slightly curved, moderately sharp, spinous process and with a weak spur subequal to the process. Fore wings hyaline basally, clouded from about the stigmal vein to apex.

Seen from above abdomen about half the length of the body and about thrice the greatest width which is in the region of the sixth tergite; somewhat narrow in the region of the second tergite; the second tergite somewhat longer than the sixth in the median line, with a single deep groove not reaching forward of the tip of ovipositor but without any ridges; broadly rounded at apex. Seen from the side abdomen with a slight depression in the region of 3-5th tergites, *i.e.*, in the middle. Ovipositor almost reaching the anterior margin of the second tergite, at least never shorter than the middle of the same.



TEXT-FIG. 3. *Leucospis bombayensis*, sp. nov. *a.* dorsal view of thorax; *abd.* abdomen *a.c.* anterior carina on pronotum; *b.* profile view of thorax; *f.t.* fore tibia; *h.c.* hind coxa; *m.* mesonotum; *m.c.* mid coxa; *p.c.* posterior carina on pronotum; *pr.* pronotum; *sc.* scutellum *tg.* tegula; *w.* wing (markings shaded).

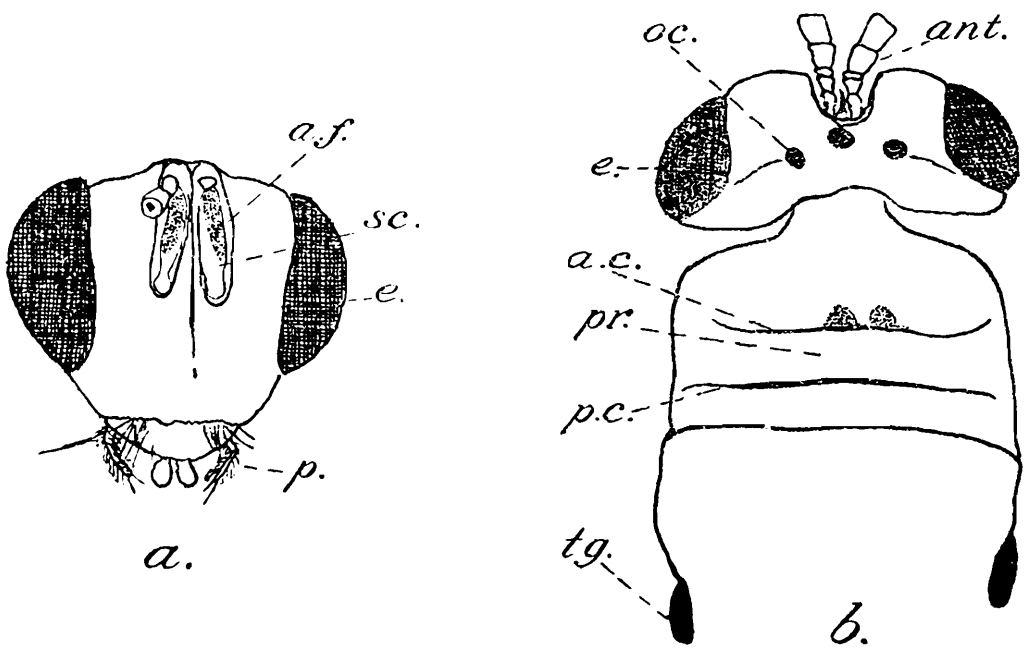
General colour of the body black except that the fore and mid legs inclusive of their coxae and the coxae and tarsi of hind legs are brownish red. Spotted or marked white as follows: Scape below, except for a short portion basally; a broad transverse, anteriorly curved band on pronotum, reaching low down laterally, covering the anterior carina and dilated at ends; broad marginal bands on mesoscutum laterally; oblique band on mesopleura; a posterior submarginal, broad band on scutellum, dilated at ends, straight posteriorly and curved anteriorly; a short, longitudinal subapical band below on the outer side of front femur; ore tibia in fr ont; hind coxa above at basal upper angle, another below

subapically; hind femur on the outer side except for a large, triangular, very dark reddish area subapically and posteriorly including teeth; hind tibia behind; two closely approximated, subtriangular spots anteriorly in the middorsum on the second abdominal tergite, with the bases of the triangles turned forwards; narrow band on fifth tergite; another large, fusiform, submarginal mark posteriorly on the sixth tergite on either side of the median fovea.

Type.—Female on pin. Coll. R. B. S. Sewell and H. S. Rao, 24-iii-1930. Satara, Bombay Presidency, W. India, in the collections of Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{894}{H3}$.

Leucospis ramakrishnai, sp. nov.

The presence of two carinae on pronotum places this new species with *L. guzaretensis* Westwood, which it resembles more closely than the *L. bombayensis* described above. It is distinguished from the former mainly by its immaculate hind femur, while from the latter it is readily separated by its larger size and fewer spots and markings. I have named the species after its collector, Dr. Ramakrishna Ayyar.



TEXT-FIG. 4. *Leucospis ramakrishnai,* sp. nov. *a.* head viewed in front; *a.c.* anterior carina on pronotum; *a.f.* antennal fovea; *ant.* antenna; *b.* dorsal view of head and thorax; *e.* eye; *oc.* ocellus; *p.* palpus; *p.c.* posterior carina on pronotum; *pr.* pronotum; *sc.* scape; *tg.* tegula (spots shaded).

Female.—10 mm. long. Body black, sparsely pubescent. Head much sculptured, densely covered with long hairs; eyes densely pubescent; terminal part of the antennae broken, scape with a longitudinal yellowish white spot below. Pronotum finely umbilicately punctate, with two carinae parallel to its hind margin and with two closely approximated, subtriangular, yellowish white spots on the middorsum just in front of the anterior carina, the bases of the triangles being turned forwards; mesonotum coarsely punctate; less pubescent than pro-

notum; scutellum and metanotum umbilicately punctate and almost devoid of hairs. Fore and mid legs dark reddish brown; hind coxae entire on upper margin; hind femur black, deeply punctate, sparsely pubescent, teeth large and 7 in number, basal tooth short and broad followed by 4 teeth which gradually grow shorter, a large sixth tooth after some gap, last tooth compound and tetradenticulate; hind tibia black, finely punctate, without hairs, with two short, longitudinal, yellowish white lines apically; hind tarsus dark brown. Wings smoky black and with a purplish iridescence. Metanotum broadly rounded behind. Abdomen subcompressed, about as long as the rest of the body, straight along the mid dorsal line in the side view, black, finely punctate and pubescent; sixth tergite with two very minute, brownish red, round spots on either side of the median longitudinal sulca. Ovipositor reaching forward of the second tergite.

Type.—Female on pin. Coll. T. V. Ramakrishna Ayyar, Pusa, Bihar, N. E. India, 23-v-1906. In the collections of Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{885}{H3}$.

Subfamily *CHALCIDINAE.*

Tribe CHALCIDINARIAE.

Genus **Pseudochalcis** Kirby.

1862. *Halticella* (*partim*), Walker, *Trans. Entomol. Soc. London*, I, p. 360.
1883. *Pseudochalcis*, Kirby, *Journ. Linn. Soc. London*, XVII, p. 62.
1904. *Pseudochalcis*, Ashmead, *Mem. Carnegie Mus.*, I (4), p. 249.
1909. *Pseudochalcis*, Schmiedeknecht, *Gen. Ins.*, fas. 97, p. 23.

This genus is being recorded for the first time from India. It is distinguished from *Chalcis* Fab. by the characteristic shape of the abdomen, the femoral teeth not being very minute and by the other characters given below. I believe that the shape of the abdomen, as given by Ashmead in his tables, is not a constant feature.

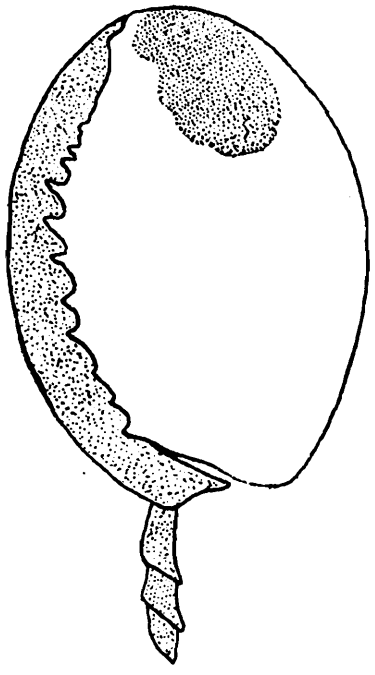
Metathorax with two teeth on each side, scutellum with a short, thick projection behind, hind femur with 7-8 teeth beneath.

Pseudochalcis indica, sp. nov.

This species appears to differ from others of the genus mainly in the shape of the abdomen.

Female.—5 mm. long. Body black. Head finely punctate; densely villous in front and at the back; eyes with a few scattered hairs; front ocellus on the vertex of the scapal furrows. Antennae black, pubescent; segments of the funicle, exclusive of the first, are subequal; club biarticulate. Thorax finely umbilicately punctate, pubescence normal. Scutellum umbilicately punctate; tegulae yellowish brown. Fore femur black to dark reddish brown basally, yellowish apically; rest of the fore legs yellowish; femur of mid legs reddish brown, knee yellowish, tibiae brick red; hind coxae basally black, brick red beyond, glabrous and shiny on the flattened upper side, pubescent and finely punctate beneath; femur purplish brown, very finely

punctate, finely pubescent, apex yellowish brown, teeth rather long and prominent, over 10 in number; tibiae and tarsi yellowish brown,



TEXT-FIG. 5. *Pseudochalcis indica*, sp. nov. Hind femur, tibia and basal tarsal segments (spots shaded).

finely pubescent. Abdomen short, broad above, narrow beneath, second apparent segment dark reddish at the sides and black above, other segments shiny black, finely punctate and villous. Ovipositor short.

Type.—Female on pin. Coll. F. H. Gravely, Barkuda Island, Chilka Lake, Madras Presidency, 3-16-viii-1919. In the collections of Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{886}{H3}$.

Genus **Stypiura** Kirby.

1834. *Chalcis (partim)*, Perty, *Del. Anim. Art.*, p. 134.
1883. *Stypiura*, Kirby, *Journ. Linn. Soc. London*, XVII, p. 59, pls. iii, figs. 28-30.
1904. *Stypiura*, Ashmead, *Mem. Carnegie Mus.*, I (4), pp. 249, 250.
1909. *Stypiura*, Schmiedeknecht, *Gen. Ins.*, fas. 97, p. 23.

This genus, apparently monotypic, has not been recorded previously from India. It is distinguished from *Pseudochalcis* Kirby mainly by the emarginate or bidentate raised scutellar process and unarmed metathorax.

Antennae with 11 segments, scutellum ending in a raised bidentate or emarginate plate, metathorax armed or unarmed, marginal vein long, stigmal vein moderately long, hind femora with one large tooth followed by 6 or 7 smaller ones.

Stypiura variabilis, sp. nov.

This variable species is described from a series of Chalcids in the collections of the Zoological Survey of India, labelled as ' Chalcid No. 4 ' by Luigi Masi. The specimens had not been referred to any genus

and had not been also described so far. The series includes specimens collected from such distant localities as Assam, Karachi and Travancore.

Female.—4 mm. long. Body black. Head viewed in front triangular, heavily punctate and densely covered with silvery white, shiny, long hairs both on the frons and on the back; eyes dark brown, glabrous; posterior ocelli placed below the occipital ridge on the vertex; scapal furrows rather deep. Antennae short, stout, black, inserted a little above an imaginary line drawn from the basal margins of the eyes; with numerous, white, minute, dotted hairs; segments 11; scape linear-fusiform, black, glabrous, shiny; pedicel very short, broader than long; funicle with 7 segments; first segment long, broader apically than basally, second segment a little shorter, also a little dilated at apex, each of the remaining segments of funicle nearly equal; club biarticulate, twice the length of the last segment of the funicle, somewhat reduced towards the truncate apex. Tegulae brownish red, sometimes yellowish white, with or without a dark upper margin. Fore legs reddish brown, except the basal moiety of the femur, which latter is black and the yellowish brown tarsus. Mid legs mostly reddish brown, sometimes yellowish brown. Hind coxa dark reddish brown, dark brick red or black, villous; femur brick red, finely punctate, pubescent, with or without a large or small, diffuse, subhemispherical or irregular, black spot touching the lower margin, extending up to the middle, sometimes as large as the outer surface of the femur; teeth moderately developed; knee tipped yellowish brown above a little from the base; tarsus brown. Fore wings hyaline, veins dark brown. Abdomen short, shiny black; second apparent segment large, glabrous, shiny; third finely punctate, finely pubescent in the middle; other segments finely pubescent and punctate posteriorly. Ovipositor short.

Cotypes.—Female on pin, Myawadi, Amherst District, Burmo-Siamese Frontier, Coll. F. H. Gravely, 24-26-xi-1911, in the collections of the Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{887}{H3}$; Female on pin, Mangaldai, Assam, Coll. S. W. Kemp, 6-i-1911, in the collections of Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{888}{H3}$.

Localities.—Sadiya, Assam, Mus. Coll., No. $\frac{1208}{H3}$; Margherita, Assam, Mus. Coll., Nos. $\frac{9547}{H3}$, $\frac{9584}{H3}$, $\frac{9591}{H3}$, $\frac{9595}{H3}$, $\frac{9609}{H3}$; Calcutta, Mus. Coll., Nos. $\frac{1659}{H3}$, $\frac{2131}{H3}$, $\frac{3144}{H3}$; Karachi, Coll. Cuming, No. $\frac{889}{H3}$; Maddathoray, Travancore, S. Madras at the base of the W. Ghats, Coll. Annandale 17-xi-1908, No. $\frac{890}{H3}$. In the collections of the Zoological Survey (Ind. Mus.), Calcutta.

Tribe SMICRINARIAE.

Genus **Spilochalcis** Thomson.

1875. *Spilochalcis*, Thomson, *Hymenop. Skand.*, IV, p. 15.
1904. *Spilochalcis*, Ashmead, *Mem. Carnegie Mus.*, I (4), pp. 251, 253, 413-447.
1909. *Spilochalcis*, Schmiedeknecht, *Gen. Ins.*, fas. 97, p. 37.

This genus comprises numerous species, which are extremely variable in their colouration and spotting. Most of the species of this genus

described so far are from Brazil, South America but Cameron[1] has described one species from Simla. Ashmead has comprehensively dealt with the genus and has published a key of all the species described by him.

Antennae with 13 segments; scape normal, *i.e.*, not very long and not extending beyond the ocelli. Thorax generally never wholly black; pronotum anteriorly acute or nearly so; scutellum unarmed at apex or armed with an emarginate or bidentate plate; metathorax unarmed or armed with 2-4 teeth or projections; middle tibia with an apical spur in the male; hind femur armed with one or two large, long or moderately long teeth basally, followed by numerous smaller teeth (more than 20 or so in number) or armed with one large tooth near the base followed by many small or minute teeth from 10-20 or more. Abdomen fusiform, sometimes subglobose or conically pointed in the female; petiole short, stout, rarely longer than thick, not carinate; eighth segment in female normal or nearly so, *i.e.*, not produced into a stylus.

Spilochalcis indica, sp. nov.

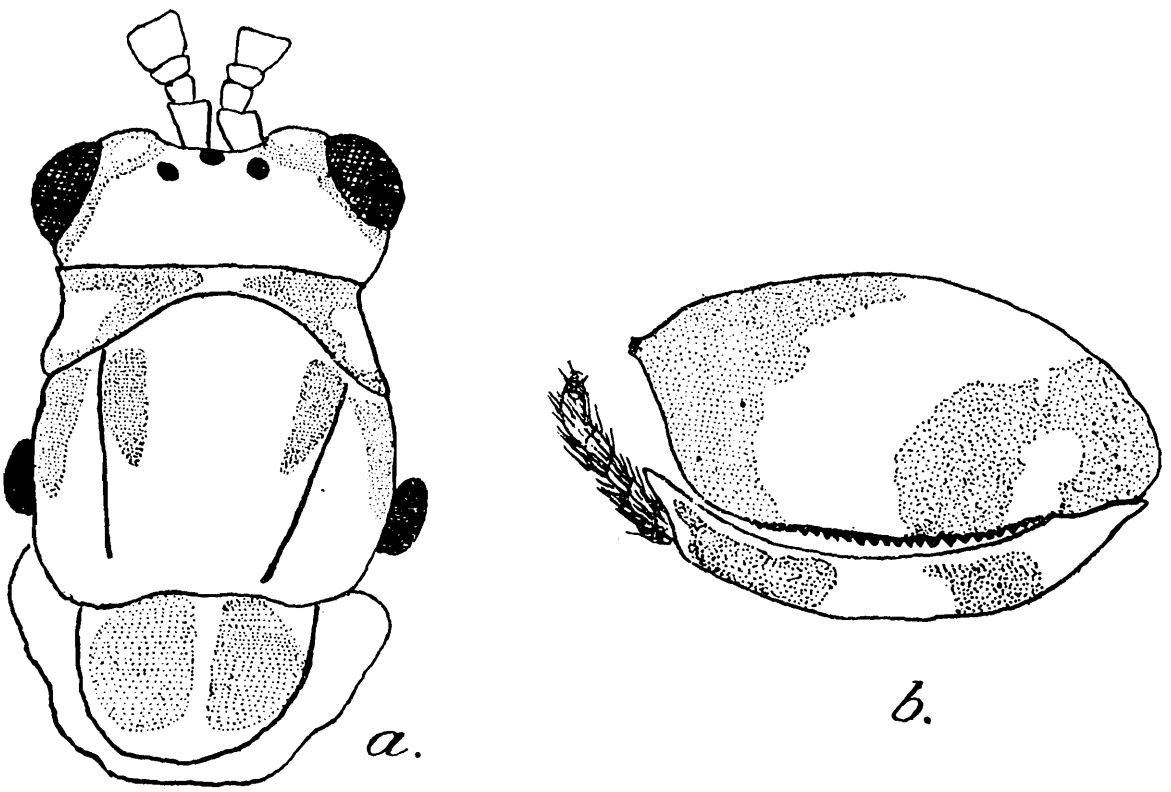
This new species is based on a unique specimen in the collection of the Zoological Survey. The species approaches most near to *S. janeiroensis* Ashmead, described from Rio de Janeiro, Brazil, but is easily distinguished by several important characters. It also differs from the other Indian species *S. simlaensis* Cam. in its smaller size and the spotting of the thorax.

4·5 mm. long, moderately densely clothed with long silvery white hairs. Antennae about one third the length of body, second segment of funicle about half the length of first. Head and thorax roughly half the length of the body; parapsidal furrows well formed; middle lobe of mesonotum umbilicately punctate; scutellum prominent, with an emarginate raised plate posteriorly, with a punctation similar to that on mesonotum; metanotum coarsely tubercular, armed with a pair of somewhat closely approximated, short, stout blunt processes a little above the attachment of the pedicel. Tibia of mid leg armed apically. Hind coxa one tenth shorter than the hind femur, which latter has a length about twice its breadth, basally with one very large tooth followed by numerous minute ones. Pedicel of abdomen a little less than one third the length of the rest of the abdomen and with a thickness nearly equal to the length, bicarinate above subapically. Abdomen subglobose.

The general colour and the spots or markings are as follows: Body mostly black, spotted or marked with yellow. Scape yellow beneath and brownish above, funicle yellowish brown except for the brown above basally. Frons yellow; orbit margined yellow posteriorly; a black spot, narrowly margined yellow posteriorly, on the occiput between the eye and the lateral ocellus and just in front of the latter; the back of the head, occiput, vertex black; cheek yellow. Thorax mostly black; pronotum yellow except in the middorsum and except for a subreniform large black spot on each side postero-laterally, *i.e.*, on the

[1] Cameron, P., *Journ. Bombay Nat. Hist. Soc.*, XIV, pp. 438-439 (1903).

shoulder; middle lobe of mesonotum black except for a pair of linear-triangular large yellow spots anteriorly, inside of and just touching the



TEXT-FIG. 6. *Spilochalcis indica*, sp. nov. *a*. dorsal view of head and thorax with the former slightly turned to one side; *b*. hind leg (spots and markings shaded).

parapsidal furrows, with the bases of the triangles turned forwards; lateral lobes black except for a large broadly triangular (with rounded angles) yellow spot antero-laterally, the apex of the triangle reaching farther behind than the middle of the lobe; tegulae brown; scutellum yellow but for a median longitudinal, anteriorly expanded black line; axillae black; metanotum black. Fore legs yellow except for longitudinal dark brown spots above on the femur and the middle of tibia. Mid legs similar to the fore legs except that the coxa is mostly testaceous black. Hind legs yellow except the coxa which has a large black spot above at the base; for an irregular broad band, broader above than below, on the outer side; and for spots on the inner and outer sides of femur and except for the bands on tibia. Pedicel black. Abdomen polished black, immaculate.

Type.—On pin. Coll. H. S. Rao, Shillong, Khasi Hills, Assam, 15-xi-1930, in the collections of Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{892}{H3}$.

Family EUCHARIDAE.

Genus **Schizaspidia** Westwood.

1835. *Schizaspidia*, Westwood, *Proc. Zool. Soc. London*, III, p. 69.
1904. *Schizaspidia*, Ashmead, *Mem. Carnegie Mus.*, I (4), pp. 268, 269.
1909. *Schizaspidia*, Schmiedeknecht, *Gen. Ins.*, fas. 97, p. 76.

This is a small genus comprising about eight species[1]. The genotype, *S. furcifera* Westwood, was described from India and Clausen[2] has recently described another species, *S. manipurensis*, from Assam.

Body short, stout; antennae short, stout, segments 13; scutellum large, scutellar process broad, produced behind a little over the abdomen but not very long; metathorax without teeth; metapleura without a hump-like process.

Schizaspidia indica, sp. nov.

This species differs from *S. furcifera* Westwood by its larger size, general colouration of the body and in having an umbilicately punctate thorax. It also appears to be distinct from *S. manipurensis* Clausen.

Male.—4 mm. long. Body black with a metallic dark green lusture. Head black. Coarsely and umbilicately punctate. Antennae long, slender, brownish yellow, densely hairy, terminal part broken; basal segments elongate, cylindrical; pedicel very broad and short. Coxa concolourous with the thorax, rest of the legs brownish. Wings hyaline, pubescence brown; submarginal vein dark brown, long; marginal vein shorter, stigmal vein absent, stigma being sessile; postmarginal vein long. The bidentate spiny scutellar process about as long as the petiole of the abdomen. Abdomen dark metallic green, last segment slightly brownish along the anterior and posterior margins.

Type.—Male, on pin. Mus. Coll. Assam. In the collections of Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{879}{H3}$.

Family ENCYRTIDAE.

Subfamily *EUPELMINAE.*

Tribe EUPELMIARIAE.

Genus **Neanastatus** Girault.

1915. *Neanastatus*, Girault, *Mem. Queensland Mus.*, IV, p. 29.

The exact position of this genus in Ashmead's tables cannot accurately be determined; his tables of the subfamily are unsatisfactory in several respects.

Ramakrishna Ayyar (*loc. cit.*) lists two species of this genus, *viz.*, *pulchericorpus* (Girault) and *trochantericus* Girault, from India and Ceylon. The relationship of the new species described here to the known species is shown in the key on the following page.

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[1] L. Masi, Genoa, has erected a species *S. scutellaris* Masi for a specimen in the collections of the Zoological Survey of India (Ind. Mus.) bearing the label: Calcutta, Mus. Coll., 25th June 1907, 157/H3. I have not been able to trace the description of this species in the literature available here. This species differs from the new species described above in the following respects: Frons with longitudinal striae on either side of the antennal foveae not reaching the insertion of the antennae; occiput transversely striate; bidentate scutellar process comparatively longer.

[2] Clausen, *Proc. Entomol. Soc. Washington*, XXX, pp. 83, 85 (1928).

The genus can be recognised by the following characters: Head viewed in front subtriangular, only as wide as the greatest width of the thorax; face convex; frons broad; eyes not large, not convergent; genal sulcus distinct; mandibles tridentate. Antennae inserted just below the eye, segments 10, ring joint 1, club biarticulate. Scutellum with a broad base and a median groove. Tibial spurs of mid legs as long as the tarsi, stout, spiny, at apex ending in several stout spines. Marginal and submarginal veins not differentiated, very long; stigmal vein well developed; postmarginal vein very long, thrice or more the length of the stigmal vein. A long oblique hairless, transparent line runs cephalo-distad towards the base of the stigmal vein, but does not quite reach it for some distance. Abdomen conic-ovate; ovipositor not exerted.

Key to species.

I. Body metallic green or dark metallic green, mixed with black; trochanters of mid legs unarmed—

A, Head lemon yellow, except for the centre of vertex between the posterior ocelli; mesopleura with a large, triangular, yellow spot in front; except basal half of hind coxae and femora, the hind legs are yellow — *N. pulchericorpus* (Girault).

B. Head brownish black, hind legs uniformly brownish black — *N. ramakrishnai*, sp. nov.

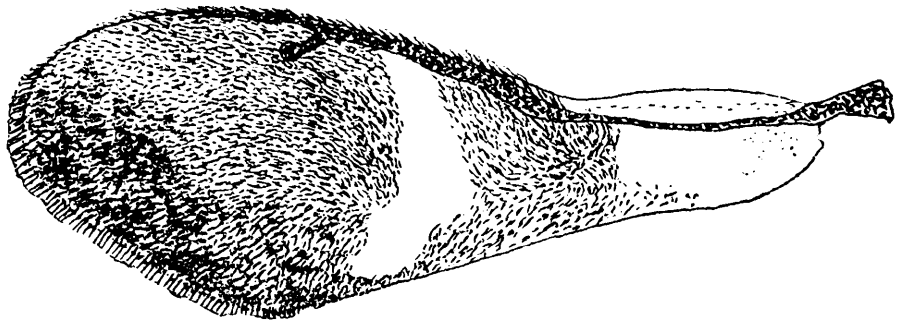
II. Body orange yellow, trochanters of mid legs with a spine dorsally — *N. trochantericus* Girault.

Neanastatus ramakrishnai, sp. nov.

This new species, named after Dr. Ramakrishna Ayyar is described from a Chalcid taken at Howrah, near Calcutta. It apparently differs from the typical *Neanastatus* Girault in the apical tibial spur of the mid leg not being as long as the tarsus and in the somewhat slightly exerted ovipositor, in which respects it approaches the genus *Solindinelleus* Girault. I, however, believe that in spite of these slight variations, it is referrable to the genus *Neanastatus* Girault.

Female.—2 mm. long. Body metallic green and black. Head brownish black, finely and minutely punctate in front, metallic green behind; face convex with two slight grooves for the antennae. Antennae with 10 segments; scape brown, long; ring joint 1; funicle 7-articulate, segments short, subcylindrical, dark brown, the two terminal ones nearly equal to each other; club biarticulate, apparently excavated on the inner side (?), with a length about four times that of the terminal segments of the funicle. Thorax smooth, dark bluish black; concave depression on the mesonotum metallic green; scutellum finely punctate. Fore wings dark brown, hyaline in the region of the subcostal vein; with a long oblique, transparent, white, hairless, moderately broad band running cephalo-distad to the base of the stigmal vein but not quite reaching it for some distance; lighter near the apex; marginal vein about two fifths the length of the submarginal vein; postmarginal vein apparently thrice the length of the stigmal vein. Fore legs uniformly brownish black, tibiae pubescent, knee brownish; mid legs

uniformly dark brown, knee dark reddish brown, tibiae longer than the tarsi, tridentate, apical spur stout, a little longer than the first tarsal



TEXT-FIG. 7. *Neanastatus ramakrishnai*, sp. nov. Wing.

segment, subserrate; first tarsal segment swollen, compressed, 7-dentate below on either side; second segment tridentate; third segment bidentate; fourth or the terminal segment with two very minute, rudimentary teeth; hind legs brownish black, tibiae with one slender, subapical, lateral spur. Abdomen black.

Type.—Female, on pin. Coll. M. S. Mani, Howrah, near Calcutta, 17-iii-1934. In the collections of Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{882}{H3}$.

Family EULOPHIDAE.

Subfamily *ELACHERTINAE.*

Tribe EUPLECTRIARIAE.

Genus **Euplectrus** Westwood.

1832. *Euplectrus*, Westwood, *Philos. Mag.* (3), I, p. 128.
1857. *Diplectron*, Dahlbom, *Oef. Vet.-Akad. Förh.*, XIV, p. 292.
1904. *Euplectrus*, Ashmead, *Mem. Carnegie Mus.*, I (4), p. 351.
1909. *Euplectrus*, Schmiedeknecht, *Gen. Ins.*, fas. 97, p. 402.

Ramakrishna Ayyar (*loc. cit.*) has recorded five species of this genus from Ceylon and Continental India. I describe below one new species, the relationship of which to the known Indian species is shown in the key below.

The species of the genus *Euplectrus* are distinguished from those of the allied genera by the following characters: Scape not abnormally enlarged in either sex, but long and slender; postmarginal vein distinctly longer than the stigmal vein.

Key to species.

I. All legs, including their coxae, coloured yellow or white uniformly—
  A. Pedicel armed with pairs of long, stout, bristles both basally and apically; legs yellow — *E. ceylonensis* Westwood.
  B. Pedicel unarmed, without bristles—
    1. Scutellum punctate, posterior ocelli placed near the margin of the eyes, pubescence whitish — *E. leucostomus* Rohwer.
    2. Scutellum finely umbilicately punctate in the middle, posterior ocelli placed at a distance from the margin of the eyes, pubescence brownish . — *E. euplexiae* Rohwer.

II. Legs differently coloured; black, brown, reddish brown or a combination of these—	
A. Pedicel shorter than the first segment of the funicle—	
1. Scape white, segments of funicle unequal; hind coxa uniformly coloured black	*E. bussyi* Crawford.
2. Scape brown, segments of the funicle subequal; hind coxa black basally and reddish brown apically	*E. himalayaensis*, sp. nov.
B. Pedicel as long as the first segment of the funicle or nearly so	*E. nyctemerae* Crawford.

Euplectrus himalayaensis, sp. nov.

Female.—2·5 mm. long. Body black. Head smooth, with a breadth about two fifths the height, sparsely covered with long, slender, stiff hairs. Antennae dark brown, inserted low down below the level of an imaginary line drawn from the bases of the eyes, about three fifths the length of the body; segments 8; scape brown, slender, subcylindrical, with a length about one third of the funicle, pedicel subcylindrical apically, narrowed basally, with a length about one fourth that of the scape; funicle with 4 segments, first segment with a length about twice that of the pedicel; second, third and fourth segments nearly equal to each other and each about one half shorter than the first segment; club ovate-lanceolate, stouter and a little darker than the other segments, with a length about one half greater than that of the last segment of the funicle, reduced to a pointed apex, apparently biarticulate. Thorax

Text-fig. 8. *Euplectrus himalayaensis*, sp. nov. Distal part of hind leg showing the apical tibial spur.

roughly half the rest of the body, finely and minutely striate, sparsely covered with long hairs; scutellum subacutely produced forwards; parapsidal furrows complete and well developed; metathorax with a longitudinal carina in the median line. Fore wings with a length about twice the breadth; submarginal vein about two thirds the length of the marginal vein; postmarginal vein about twice the length of the stigmal vein and about equal to the submarginal veins. Fore coxa reddish brown, other parts of the fore legs brown. Mid legs uniformly brown, their tibiae densely and shortly setose. Hind coxa black basally, reddish brown apically; other parts of the hind legs brown; their tibiae moderately and shortly setose, the outer spur with a length about half

that of the tarsus, which latter has rather long setae. Abdomen depressed, black basally, ventrally brown in the middle, seen from above with a length a little greater than the breadth.

Type.—Female, on pin. Coll. Jenkins, Darjiling, E. Himalayas, 8-viii-1909, in the collections of Zoological Survey (Ind. Mus.), Calcutta, No. $\frac{876}{H3}$.

NOTES ON SOME RARE AND INTERESTING FISHES FROM THE ANDAMAN ISLANDS, WITH DESCRIPTIONS OF TWO NEW FRESHWATER GOBIES.

By DEV DEV MUKERJI, *M.Sc., Zoological Survey of India, Calcutta.*

(Plate VI).

Our knowledge of the freshwater and the littoral marine fish-fauna of the Andaman Islands is very limited, and is mainly based on four papers, two by Blyth[1], one by Day[2] and the fourth and the last by Annandale and Hora[3]. With the exception of Annandale and Hora, the other authors did not give particulars as to the type of environments in which the various species were found, nor did they pay attention to the remarkable forms that are found in the streams of the jungle-clad hills of these islands. In these islands there are a few freshwater streams which in the hilly areas turn to mountain rapids; but these also, except during the rainy seasons, are insignificant, and very shallow. Nevertheless, their fish-fauna offers very interesting forms for study. Large natural tanks and ponds are rare on these islands, but as a result of comparatively recent development of the activities of the Penal Settlement and local agriculture, a number of fairly large reservoirs, tanks and ponds have been dug up in various localities.

Among the principal species of fish known to thrive in these and other fluviatile waters, are certain members of the families, Ophicephalidae, Cyprinidae, Cyprinodontidae, Gobiidae, Eleotridae and Syngnathidae. The species are as follows:

Ophicephalus gachua Ham. Buch.
Labeo rohita (Ham. Buch.)
* *Rasbora daniconius* (Ham. Buch.)
Panchax panchax (Ham. Buch.)
* *Aplocheilus melastigma* (McClell.)
Glossogobius giuris (Ham. Buch.)
Eleotris fusca (Bl. & Schn.)
Syciopterus garra Hora.
Ophiocara ophicephalus (Kuhl & van Hasselt).
Doryichthys insularis Hora.

Of the ten species, the well known Indian carp, *Labeo rohita* has been introduced within recent years into the Andaman Islands in the "fingerling" stage from the neighbourhood of Calcutta, and though precise information about the breeding of the species in these places is still wanting, specimens of the species have been found to grow and thrive fairly well in certain tanks in the neighbourhood of Port Blair. It may also be presumed that several other smaller species such as *Rasbora*

[1] Blyth, *Journ. Asiat. Soc. Bengal*, XXVII, pp. 270-272 (1858); *Journ. Asiat. Soc. Bengal*, XXIX, pp. 145-147 (1860).
[2] Day, *Proc. Zool. Soc. London*, pp. 677-705 (1870).
[3] Annandale and Hora, *Rec. Ind. Mus.*, XXVII, pp. 33-41, pl. ii (1925).
* The species marked with an asterisk are recorded here for the first time from the Andaman Islands.

daniconius, Panchax panchax, Aplocheilus melastigma, etc., have also been introduced along with *Labeo rohita.* The introduction of *Ophicephalus gachua* in the fresh waters of these islands must also have been, as in the case of other distant oceanic islands, effected through human agency. The rest of the species which are invariably found in muddy and rocky streams, are not true fresh-water forms but consist mainly of highly adaptable marine species, and I fully concur with the opinion that the " fluviatile fish-fauna of the Andamans has been derived from the surrounding sea rather than from any other territory "[1]. The stream-fauna of these islands, therefore, offers a very fascinating field of study from the standpoint of evolution of the freshwater forms from the marine element.

In regard to the occurrence of Siluroid fishes in the Andaman Islands, Day (*op. cit.,* p. 677) remarked that they " are very rare " He reported only 5 species, belonging to the families Plotosidae and Ariidae. Of these, *Plotosus canius* Ham. Buch. and *Plotosus anguillaris* (Bl.) were " found in the muddy estuaries in considerable numbers ", but no mention is made of the respective localities of the three Ariid fishes, *e.g., Arius sumatranus* Benn. (=*A. venosus* Cuv. & Val.), *A. andamanensis* Day (=*A. thalassinus* Rüpp.) and *Ketengus typus* Bleeker. It is apparent, however, that the first two species came from the open sea, while the third was procured from some brackish water area near the shore. So far we are totally ignorant of the occurrence of any of the true fluviatile Siluroid fishes in these islands, though it is probable that certain species may have been introduced with *Labeo rohita.*

The Andaman Islands are rocky for the most part and are surrounded by extensive coral reefs ; the water, except during the monsoons, is beautifully clear. Consequently, it is possible to observe even at considerable depths, the movements of the various fishes, crustaceans and other animals inhabiting the coral beds which are conspicuous for their exquisite assortment of colour. The fish-fauna of the coral reefs around these islands is of unusual interest, and environmental conditions are particularly suitable for the study of the fauna.

In the course of preliminary investigations in connection with the establishment of a shell-fisheries department at Port Blair, several parties from the Zoological Survey of India, including the author, have since 1929 been visiting the islands from time to time. In 1930, a five-years' Fishery Research scheme (1930-1935) was sanctioned by the Government of India and the successive Fisheries Research Officers stationed at Port Blair, have since been in a position to investigate the fauna of the Andaman waters more intensively. As a result of these activities very large and valuable series of Andaman fishes, both fresh-water and marine, have accumulated in the collections of the Zoological Survey of India. In view of the importance of these collections on one hand, and the dearth of our knowledge of the fishes of the Andaman Islands, on the other, it has been decided to make a thorough study of the collections and to report on them from time to time. At the instance of Dr. Baini Prashad, Director of the Zoological Survey of India and Dr. S. L. Hora I have undertaken this study.

[1] Annandale and Hora, *op. cit.,* p. 35.

In the present communication I deal with a portion of the collection made in 1934 by Dr. H. Srinivasa Rao from several muddy and rocky streams, coral beds and pebbly shores.

Of the twelve species under report, five come from small freshwater streams and pools, and five from coral reefs, while the remaining two were taken near the shore from among stones and gravel. Below I give a complete list of the species arranged according to their respective habitats:

I. MUDDY OR ROCKY STREAMS:
- *Awaous melanocephalus* (Bleek.)
- *Eleotris fusca* (Bl. & Schn.)
- *Glossogobius giuris* (Ham. Buch.)
- *Raogobius andamanicus*, gen. *et* sp. nov.
- *Vaimosa koumansi*, sp. nov.

II. CORAL REEFS:
- *Bathygobius fuscus* (Rüpp.)
- *Zonogobius semidoliatus* (Cuv. & Val.)
- *Tripterygion* (*Enneapterygius*) *fasciatum* Weber
- *Doryrhamphus melanopleura* (Bleek.)
- *Choeroichthys sculptus* (Günther)

III. PEBBLY SHORE:
- *Blennius semifasciatus* Rüpp.
- *Plesiops nigricans* (Rüpp.)

I wish to express here my sincere thanks to Dr. Baini Prashad, Director, Zoological Survey of India, for giving me the opportunity to study the material and for kindly going through the manuscript. To Dr. S. L. Hora, I am greatly indebted for help and useful suggestions. I am also thankful to Dr. H. Srinivasa Rao for the excellent preservation of the material and for helping me with useful information. Messrs. S. C. Mondul and R. C. Bagchi have drawn the accompanying illustrations under my supervision, and my best thanks are due to them.

Family GOBIIDAE.

Genus **Awaous** Cuvier & Valenciennes (1837).[1]

Awaous melanocephalus (Bleeker).

1849. *Gobius melanocephalus*, Bleeker, *Verh. Bat. Gen.*, XXII, p. 33.
1849. *Gobius personatus*, Bleeker, *Verh. Bat. Gen.*, XXII, p. 34.
1849. *Gobius grammepomus*, Bleeker, *Verh. Bat. Gen.*, XXII, p. 34.
1851. *Gobius grammepomus*, Bleeker, *Nat. Tijd. Ned. Ind.*, IX, p. 200.
1861. *Gobius litturatus*, Heckel MS., Steindachner, *Sitzb. Akad. Wien*, XLII, p. 289.
1861. *Gobius grammepomus*, Günther, *Cat. Fish. Brit. Mus.*, III, p. 64.
1870. *Gobius Stoliczkae*, Day, *Proc. Zool. Soc. London*, p. 692.
1878. *Gobius personatus*, Day, *Fish. India*, p. 292, pl. lxiii, fig. 6.
1879. *Awaous personatus*, Bleeker, *Contrib. faune Ichth. l'ile Murice*, *Verh. Akad. Amsterdam*, XVIII, p. 17.
1895. *Gobius grammepomus*, Boulenger, *Ann. Mag. Nat. Hist.*, (6), XV, p. 185.

[1] In preferring the name *Awaous* to *Chonophorus*, adopted by most of the American ichthyologists, I entirely subscribe to the views advanced by Koumans ('A preliminary revision of the genera of the Gobioid fishes with united ventral suckers', *Proefschrift Lisse*, pp. 82-84, 1931).

1913. *Gobius melanocephalus*, Weber, *Siboga Expeditie, Fische*, p. 465.
1913. *Gobius melanocephalus*, Weber, *Nova Guinea*, IX, pt. 4, p. 599.
1913. *Gobius melanocephalus*, de Beaufort, *Bijd. Dierk., Amsterdam*, XIX, p. 139.
1927. *Gobius melanocephalus*, Barnard, *Ann. S. Afric. Mus.*, XXI, p. 818.
1927. *Chonophorus melanocephalus*, Herre, *Bureau Sci. Manila, Monogr.* 23, pp. 216-218, pl. xvii, fig. 1.
1928. *Chonophorus melanocephalus*, Fowler, *Mem. Bernice P. Bishop Mus.*, X, p. 410.

In the collection under report there is a single specimen of the species collected (27-xii-33) by Dr. Rao from " shallow stream near base camp, N. Andamans " It was found " sticking to stones or hidden amongst gravel ; very elusive and quick in movements " The specimen is in a good state of preservation and is 33 mm. long excluding the caudal fin.

A. melanocephalus is a very characteristic, wedge-shaped and strikingly coloured goby of the mountain torrents, swiftest rivers and shallow and rapid gravelly streams. Its horizontal ventral profile, broad fins and powerful sucking disc are particularly suited for clinging to the bottom under the shelter of rocks and boulders. The form of its snout and mouth, which is very peculiar, is certainly " an adaptation for life as a bottom dweller as it nuzzles around for food under the rocks." The species rarely exceeds 135 mm. in length and presents considerable variation in colouration and in certain body proportions. Herre (*op. cit.*, p. 217) has observed that " specimens from wide shallow streams being much paler than those living under rocks in mountain torrents."

A. melanocephalus is very closely related to *A. genivittatus* (Cuv. & Val.), *A. lachrymosus* (Peters), and *A. ocellaris* (Broussonet), and although these three species are probably valid, as considered by several authors, it is by no means easy to separate them, in view of the wide range of variation of colouration and of different body proportions in each of the species. The specimen under report is provided with a black patch beneath the eyes, which invariably characterises both *A. genivittatus* and *A. lachrymosus*, but is not reported so far to have been found in *A. melanocephalus* ; the rest of the characters, however, clearly indicate that it should be referred to the latter species.

Originally the species was described from Java under three separate names by Bleeker (*vide* synonymy) which he afterwards united under the name *Gobius grammepomus*. It has since been found from the Andamans, Ceylon, and Madras eastwards to Celebes, Buru, and Amboina.

Raogobius, gen. nov.

The new genus represents small and delicately built gobies with an elongate and compressed body and a depressed head. The neck and the crown of the head are flattened in such a manner as to give the latter a characteristic snake-like appearance. The body is almost naked except for the region of the caudal peduncle which is partly covered with very thin but large cycloid scales. The eyes are superior, but do not project above the dorsal profine. They are situated in the anterior half of the head. The interorbital width is almost equal to the diameter of the eye. The snout is a little longer than the orbital width. The nostrils are not tubular. The mouth is oblique ; the jaws are subequal, the lower one being somewhat better developed. The premaxilla is protractile ; the maxilla extends backwards to below the anterior third

of the eyes. The teeth are fixed and widely set; they are rather long and needle-like and are curved backwards at the tips. In the upper jaw they are arranged in a single well defined row, while in the lower jaw they are distributed in two rows which are somewhat irregular. The tongue is faintly notched. The gill-openings are moderate; the isthmus is broad. The inner edge of the shoulder-girdle is devoid of fleshy flaps. The dorsal fins are inserted well apart. The first dorsal is composed of six slender and flexible spines, which, in certain specimens (males ?) may be produced into filaments. The second dorsal is provided with ten (1/9) rays, the last branched one being divided to the root. The anal fin is similar to the second dorsal but has thirteen (1/12) rays. The ventral fins are united, forming a well developed disc which is somewhat oblong and situated below the pectorals. The pectorals are long and devoid of free silken rays. The caudal fin is lanceolate.

Genotype.—*Raogobius andamanicus*, sp. nov., collected from a muddy stream, south-west of Golf course, Aberdeen, Port Blair, Andamans (February 12, 1934).

Relationship.—According to Koumans'[1] key to the genera belonging to the subfamily Gobiinae, *Raogobius* occupies a place intermediate between *Schismatogobius*[2] and *Mirogobius*[3], but differs from either in the following characters :—

i. The region of the caudal peduncle is covered with thin cycloid scales.
ii. The maxilla extends backwards to below the anterior third of the eyes.
iii. In the upper jaw the teeth are arranged in a single row, while in the lower jaw they are in two rows.
iv. The tongue is faintly notched.
v. The first dorsal fin is composed of six spines.
vi. The second dorsal fin is provided with ten (1/9) rays.
vii. The caudal fin is lanceolate.

Comparing these characters with those of *Schismatogobius* and *Mirogobius*, it will be found that *Raogobius* essentially differs from *Schismatogobius* in characters,[4] (i), (ii), (iii) and (vi), while from *Mirogobius* it can easily be separated by characters, (ii), (iii), (v),[5] (vi)[6] and (vii).

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[1] Koumans, ' A preliminary revision of the Gobioid fishes with united ventral fins ' *Proefschrift Lisse*, iv+174 pp. (1931).

[2] de Beaufort, ' On some new Gobiidae from Ceram and Waigen ' *Zool. Anz.*, XXXIX, p. 139 (1912); and ' Fishes of the Eastern part of the Indo-Australian Archipelago with remarks on its zoogeography ' *Bijd. Dierkunde*, XXIX e, p. 142; *Schismatogobius bruynisi*, pl. ii, fig. 2 (1913).

[3] Herre, ' Gobies of the Philippines and the China sea ' *Bureau Sci. Manila, Monogr.* 23, p. 91; *Mirogobius stellatus*, pl. vi, fig. 4 (1927).

[4] Unfortunately the character of the tongue in *Schismatogobius* is not known; a comparison of this structure is, therefore, not possible.

[5] In the original definition of *Mirogobius* it is mentioned that there are 4-5 spines in the first dorsal fin, but in the figure of *M. stellatus*, the type-species, 6 spines have been shown. Koumans has taken this discrepancy with due caution. This is an " error of artist " as pointed out by Herre in his own hand-writing in the copy of his paper before me.

[6] In the original definition of *Mirogobius* as also in Koumans' description, the genus has been characterised by the possession of 8 (1/7) rays in the second dorsal fin. In the key, on the other hand, Koumans has put " 9-11 " rays for the same. This is obviously an error.

In so far as its general facies is concerned, *Raogobius* has a much closer resemblance to *Schismatogobius* than to *Mirogobius*.

I have great pleasure in associating the name of the genus with that of Dr. H. Srinivasa Rao of the Zoological Survey of India.

Raogobius andamanicus, sp. nov.

(Plate VI, figs. 1 & 2.)

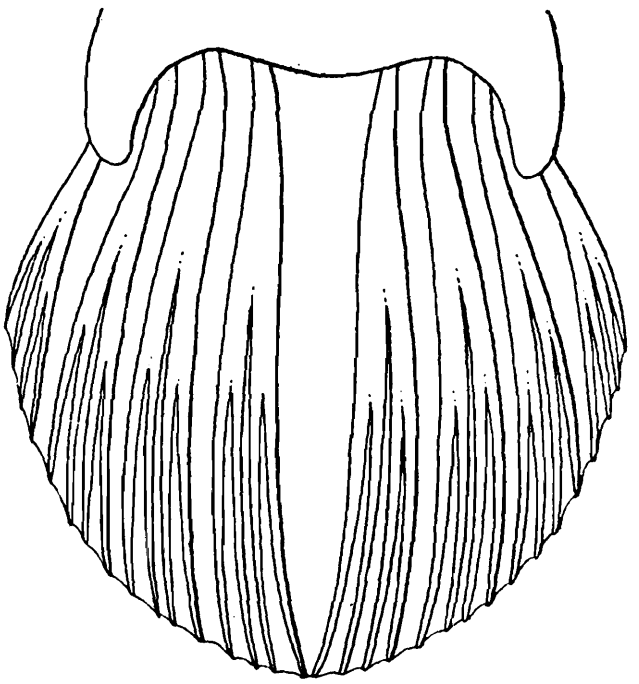
D. VI, I/9 ; A. I/12 ; P. 13 ; V. 8 ; C. 13 (excluding the small compact outer rays).

In general outline this small goby is elongated, narrow and more or less spindle-shaped. The body behind the head is considerably compressed from side to side. The flatness of the head as also of the crown gives the fish a snake-headed appearance. The maximum depth of the body which lies in a vertical plane below the middle of the spinous dorsal is contained almost 7 times in the length of the body excluding the caudal fin. The caudal peduncle is nearly as long as high. The head is longer than broad and slightly broader than deep. Its length is contained 4·2 times in the length of the body. The snout is obtusely pointed and is a little longer than the orbital width. Its length is contained less than 3·5 times in the length of the head. The cheeks are somewhat fat and consequently the width of the head is greater than the maximum width of the body. The eyes are moderate and sub-elliptical ; they are supero-lateral, placed entirely in the anterior half of the head, and are separated by a concave interspace which is slightly narrower than the orbital width. The diameter of the eye is contained 5 times in the length of the head. The non-tubular anterior nostrils are situated nearer the margin of the eyes than the tip of the snout.

The dorsal fins are separated by a distance which equals almost the three-fourths of the base of the spinous dorsal. The spinous dorsal is inserted midway between the tip of the snout and the posterior end of the rayed dorsal. Its spines are longer than half the depth of the body below them, the penultimate one being the longest. The origin of the second dorsal is one ray in advance of that of the anal. The second dorsal is lower than the first and its rays are more or less of equal size ; it falls short of the caudal when adpressed. The anal fin is nearly as high as the rayed dorsal ; both these fins are similar in shape and are angulate posteriorly. Their margins are nearly straight. The pectorals are obtusely pointed and are as long as the length of the head behind the snout ; their central rays are about twice as long as the marginal ones, extending to below the fourth dorsal spine. All the rays of the ventrals are tetra-radiate distally and form a very effective adhesive disc. The frenum is thick and sub-tubulate ; its bihorned free margin is characteristic of the species. (Text-fig. 1). The caudal fin is as long as the head ; it is about half as broad as long.

Except for the posterior fourth, the body is naked, but covered with granular mucous which when removed may leave small pits in the skin

resembling rudimentary scales. The other characters are as given under the generic description.



TEXT-FIG. 1.—Enlarged view of ventral disc of *Raogobius andamanicus*, gen. *et* sp. nov., showing characteristics of rays and frenum. ×30.

The general colouration in alcohol is straw yellow but becomes pale brownish in the abdominal region. The top of the head is dark. The whole of the body as also the inter-radial membrane of all the fins are thickly spattered with very fine blackish dots. There are six fairly large black transverse blotches along the upper half of the sides of the body. Four anterior ones of these are semi-ovoid in shape and are almost equidistant from each other. The fifth one, situated below the posterior end of the rayed dorsal, is somewhat smaller than the preceding ones and is indistinct, while the sixth one, at the root of the caudal fin is the largest of all the blotches and is somewhat rounded. This *Nemachilus*-like colour pattern is very characteristic of the species, and seems to be rather unusual[1] among gobioid fishes. The anal fin is tipped with black. The rest of the fins are pale brownish.

The species is described from a single specimen, 21 mm. long excluding the caudal fin.

Type-specimen.—No. F 11788/1, preserved in the collection of the *Zoological Survey of India, Indian Museum, Calcutta.*

Remarks.—From its general facies, lepidosis, character of the adhesive disc, the development of the frenum, and the characteristic colouration, it appears that *Raogobius andamanicus* is an inhabitant of rocky mountainous streams and that somehow the type specimen has drifted to a muddy stream.

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[1] The characteristic Siamese goby, *Pipidonia quinquecincta* Smith (*Proc. U. S. Nat. Mus.*, LXXIX, pp. 39, 40, fig. 19, 1931) has a more or less similar colour pattern.

Measurements in millimetres.

Length of body without caudal	21·0
Height of body	3·5
Length of head	5·0
Breadth of head	3·0
Height of head	2·0
Length of snout	1·5
Diameter of eye	1·0
Interorbital width	0·75
Length of spinous dorsal	2·5
Length of rayed dorsal	4·0
Length of anal	5·5
Length of pectorals ..	4·0
Length of ventrals	3·0
Length of caudal	5·0
Length of caudal peduncle	3·0
Least height of caudal peduncle	2·5

Genus **Bathygobius** Bleeker (1878).

Bathygobius fuscus (Rüppell).

1927. *Bathygobius fuscus*, Herre, *Bureau Sci. Manila, Monogr.* 23, pp. 113-115, pl. viii, fig. 2 (see synonymy).

The species is represented in Dr. Rao's collection from the Andamans by a single specimen, 25 mm. long excluding the caudal fin. It was taken (31.i.34) at Brookesabad from under stones and dead corals between tide marks.

B. fuscus is one of the most widely distributed of the Indo-Pacific gobies of the tide pools, rocky and shallow coastal waters and river mouths of India, the East Indies, Samoa, Marcus Island, the Hawaiian Islands and the West Indies. Herre (*op. cit.*, p. 115) has observed that " among the islands of Sulu Archipelago it is abundant in the shallow water of salt water lagoons where it is more or less exposed at low tide, when it seeks shelter in pools and holes in coral sands ; it can evidently thrive in water of rather high temperatures since the puddles in which it stays when the tide is out soon become excessively warm."

Of a number of aquatic gobies that inhabit such brackish water areas of the Gangetic Delta as are subject to immersion and desiccation with the rise and fall of the river, certain species, such as, *Apocryptes bato*, *Pseudapocryptes lanceolatus*, *Taenioides rubicundus*, *Stigmatogobius sadanundio*, etc., show wonderful adaptability to their very stable environment. Not unlike, *B. fuscus*, some of them can thrive in considerably warm waters of the pools and puddles when the tide is low, while others habitually make suitable burrows as to have access to a cooler medium. The study of the different aspects of ecology of the goboioid fishes of the Gangetic Delta is one of particular interest and importance.

Genus **Zonogobius** Bleeker (1874).

Zonogobius semidoliatus (Cuv. & Val.).

1837. *Gobius semidoliatus*, Cuvier & Valenciennes, *Hist. Nat. Poisson.*, XII, p. 51.
1861. *Gobius semidoliatus*, Günther, *Cat. Fish. Frit. Mus.*, III, p. 31.
1876-81. *Gobius semidoliatus*, Günther, *Fische der Sudsee*, II, p. 174, pl. cix, fig. 4.
1878. *Gobius semidoliatus*, Day, *Fish. India*, p. 295, pl. lix, fig. 6.
1905. *Zogobobius semidoliatus*, Jordan & Seale, *U. S. Bur. Fish. Bull.*, XXV, p. 397, fig. 86.
1913. *Gobius semidoliatus*, Weber, *Siboga Expeditie, Fische*, p. 462.
1927. *Zonogobius semidoliatus*, Herre, *Gobies of the Philippines and the China Sea, Manila*, pp. 200, 201, pl. xxx, fig. 2.
1928. *Zonogobius semidoliatus*, Fowler, *Mem. B. P. Bishop Mus.*, X, p. 414.
1934. *Zonogobius semidoliatus*, Smith, *Journ. Siam Soc. Nat. Hist. Suppl.* IX, No. 3, p. 325.

This species is represented in Dr. Rao's collection by a single specimen, 19 mm. long excluding the caudal fin. It was taken (14.xi.34) in a crevice of a coral rock at N. W Ross Island, Andamans. It agrees very well with the detailed description of the species given by Herre and Fowler in their respective works cited above.

It appears, however, of special interest to note that the posterior rays of the pectoral fins as also the outer ones of the ventrals of the specimen under report have numerous proximal branchings which are modified into thickened appendage-like processes, resembling those of the Scorpaenidae and Cottidae. In the latter group of fishes such modified rays of the paired fins play an important role in the progression of the animals of the rocky substratum, and it appears probable that the similarly modified rays of the paired fins of the Coral reef-dwelling *Zonogobius semidoliatus* may also have a similar function.

Fishes of the genus *Zonogobius* are tiny gobies usually with a variegated colouration, with large head and nape. *Z. semidoliatus* is a bright chestnut and beautifully marked species. It is found on Coral reefs from the Red Sea eastward throughout the East Indies and south-east in the Pacific ocean to the Samoan and Tonga Islands. The species was originally described from Vanicola, Red Sea. Hithertofore only two small specimens are known to have been procured by Day from the Andamans, one of which is figured in the *Fishes of India*. Recently, the species has been reported from Siam by Smith (*op. cit.*) " but whereas in other waters the fish is found on Coral reefs, the only known occurrence of the fish in local (Siamese) waters was in a littoral tide pool at Lem Ling, south-east Siam."

Genus **Glossogobius** Gill (1859-1860).

Glossogobius giuris (Ham. Buch.).

1927. *Glossogobius giurus*, Herre, *Gobies of the Philippines and the China Sea, Manila*, pp. 161-164, pl. xxvii, fig. 1 (see synonymy).

This common goby is represented in Dr. Rao's collection from various streams and pools in both North and South Andamans by several specimens of varying sizes.

G. giuris is one of the largest true gobies of the fresh, brackish and salt waters, growing to a length of about 350 mm. Its size, abundance

and delicate taste make it a very important market fish. The species appears to grow to its maximum size usually in fresh water lakes. It is very variable in regard to colouration, different body proportion, etc., and has a very wide distribution, occurring from the east coast of Africa eastward at least as far as Celebes and northward to China.

Genus **Vaimosa** Jordan and Seale (1906).[1]

Vaimosa koumansi, sp. nov.

(Plate VI, figs. 3 & 4.)

D. VI, 1/7 ; A. 1/6 ; P. 16 ; C. 13 (excluding the small compact outer rays) ; L. l. ±25 ; L. tr. ±7.

In general facies this new goby is moderately elongated and resembles ordinary stoutly built gobies ; but its large, broad and blunt head and the enlarged fins give the fish a characteristic appearance. The body behind the head is laterally compressed in a moderate degree, while the head is rather flat from above downwards. Both the dorsal and ventral profiles of the body are more or less evenly arched. The maximum depth of the body which lies in a vertical plane below the middle of the spinous dorsal is contained about 4·5 times in the length of the body excluding the caudal fin. The caudal peduncle is fairly long and is more than 1·7 times longer than high. The head is considerably longer than broad and as broad as deep ; it is broader than the body. The length of the head is contained almost 3 times in the length of the body. The snout is rather short, convex and broad anteriorly ; it is slightly longer than the orbital width ; its length is contained 4 times in the length of the head. The cheeks are broad, full and considerably fat, giving the head a swollen appearance. The eyes are prominent and somewhat oblique ; they are supero-lateral in position and placed entirely in the anterior half of the head ; the gaze is directed partly upwards. The diameter of the eye is contained 5 times in the length of the head. The interorbital space is narrow and concave and is about half as wide as the orbit. The anterior nostrils are tubular and are situated nearer the tip of the snout than the margin of the eye.

The mouth is terminal and slightly oblique ; its gape is very wide, extending considerably beyond the eye. The angle of the maxillary extends nearly to the lower posterior angle of the preoperculum. The lips are broad and thick, the upper one being protractile. The long sloping chin is rather prominent. The upper jaw has an outer row of widely spaced, enlarged, curved and pointed teeth and one or two inner rows of very minute teeth. The teeth in the lower jaw are pluriserial, the outer series being somewhat enlarged and hooked. The tongue is adnate and from rounded to subtruncate.

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[1] The new species is referable, in the present state of our knowledge, to the genus *Vaimosa* which is variable within rather narrow limits as to certain features, *viz.*, teeth, tongue, degree of squamation of operculum and top of head. For critical notes on the genus and the confusions that exist in the definition of *Vaimosa* reference may be made to Dr. H. M. Smith's remarks (*Journ. Siam. Soc. Nat. Hist. Suppl.*, IX, No. 1, pp. 68, 69, 1933).

The body is covered with large ctenoid scales, which are of more or less equal size throughout, except for the chest region, where they are comparatively small. Anteriorly the scales appear to be cycloid but microscopic examination shows that they are weakly ctenoid. Before the dorsal fin there are 6-7 scales. The operculum is provided with a few large scales which are imbedded in the skin and are, therefore, likely to be overlooked.

The dorsal fins are separated by a short distance which equals less than half the base of the spinous dorsal. The origin of the spinous dorsal is midway between the tip of the snout and the middle of the second dorsal. The length of its base is slightly less than that of the rayed dorsal. Its height is almost equal to the depth of the body below it. The spines are inequal in length; the fourth one is the longest, while the sixth one is the shortest. The insertion of the second dorsal is about 2 rays in advance of that of the anal. Both the second dorsal and the anal are short and more or less similar in outline. The rayed dorsal is almost as high as the spinous dorsal and its posterior rays are the longest. It falls slightly short of the caudal fin when adpressed. The anal fin is a little lower than the second dorsal, and like the latter, its posterior rays are the longest; when adpressed it bearly reaches the root of the caudal. Both the second dorsal and the anal are angulate posteriorly. Most of the rays of the second dorsal are tetra-radiate distally, while those of the anal are tri-radiate. The pectorals are rather long and broad; they are shorter than the head but longer than the ventrals, and have a rounded margin. The ventrals form an enlarged adhesive disc which is nearly twice as long as broad; the frenum is moderately thick and large and is rather subtubulate. The margin of the ventrals is finely incised and distally their rays are tetra to penta-radiate. The ventral disc reaches as far as the anal papilla, which is somewhat short and cylindrical and is situated nearer the root of the caudal than the tip of the snout. The anal opening is situated just in front of the insertion of the anal fin. The caudal fin is rounded and slightly shorter than the length of the head; it is a little longer than high.

The general colouration of the body in alcohol is yellowish green, the upper portion being more or less dusky, interspersed with specks and blotches of dark brown. On the sides of the head there are 5 to 6 broad curved bands of brown which alternate with broader ones of the ground colour. There appear to be two dark cross bands across the spinous dorsal; posteriorly it is provided with an obscure blackish patch. The second dorsal has from 2 to 3 similar cross bands. The caudal fin has from 3 to 4 more or less zig-zag vertical bands restricted to its anterior two-thirds. All the vertical fins are dusky and their inter-radial membrane is thickly spattered with fine black dots. Both the pectorals and the ventrals are colourless with a thinly pigmented inter-radial membrane.

Relationship.—Vaimosa koumansi is very closely allied to *V macrognathus* Herre[1] described from Lake Taal, Balangas, Luzon, but differs

[1] Herre, *Gobies of the Philippines and the China Sea, Manila*, pp. 145, 146, pl. x, fig. 2 (1927).

from it in different body proportions, colouration, etc. The pointed pectorals and the caudal fins of *V macrognathus* readily differentiate it from *V koumansi* in which both the fins are rounded.

The species is here described from a single specimen collected (3.i.34) by Dr. H. S. Rao from " pools amidst rocks in the course of a hill stream (with no flowing water except a slight trickle) half a mile from camp, Austen Straits, N. Andaman "

I have great pleasure in associating the name of this new Andamanese goby with that of Dr. F. P. Koumans of the Rijks Museum of Natural History in Leiden, Holland, as a slight recognition of his valuable studies of the gobioid fishes.

Type-specimen.—No. F11789/1, preserved in the collection of the *Zoological Survey of India, Indian Museum, Calcutta.*

Measurements in millimetres.

Length of body without caudal	29·0
Height of body	6·5
Length of head	10·0
Breadth of head	6·0
Height of head	6·0
Length of snout	2·5
Diameter of eye	2·0
Interorbital width	1·0
Length of spinous dorsal	4·0
Length of rayed dorsal	4·5
Length of anal	3·5
Length of pectorals	7·0
Length of ventrals	6·0
Length of caudal	8·5
Length of caudal peduncle	7·0
Least height of caudal peduncle	4·0

Family ELEOTRIDAE.

Genus **Eleotris** (Gronow) Bloch and Schneider (1801).

Eleotris fusca (Bl. and Schn.).

1927. *Eleotris fusca,* Herre, *Gobies of the Philippines and the China Sea, Manila* pp. 30-33, pl. ii, fig. 1 (see synonymy).

This eleotrid is fairly common in small streams and creeks in the South Andaman. It is usually of a uniform dark colour in life and of retiring habits, often lying perfectly concealed for hours among bottom weeds, stones and gravels. Previous observations show that the fish is a voracious and indiscriminate feeder ; it has been found to feed, in addition to vegetable matter, on small mollusca, crustacea, and fishes.

In the collection under report the species is represented by five specimens varying from 35 mm. to 70 mm. in length excluding the caudal fin. They were taken (14.ii.34) at a " creek near Dhoby line, Aberdeen, Port Blair "

E. fusca is a widely distributed species of the Indo-Pacific region and is quite common in the shallow bays, river mouths, streams and creeks. According to Günther [1] the species reaches a length of "ten inches," that is, about 255 mm., while according to Barnard[2] it grows "upto 260 mm." I have, however, no knowledge of the Indian individuals usually growing even to "8 inches in length" as indicated by Day.[3]

Family BLENNIDAE.

Subfamily *CLININAE.*

Genus **Tripterygion** Risso (1826).

There has been a certain amount of difference of opinion among ichthyologists in reference to the systematic position and affinities of the genera *Tripterygion* Risso[4] (emended to *Tripterygium* by authors), *Enneapterygius* Rüppell [5] and *Helcogramma* McCulloch and Waite[6]. The fishes of these highly specialised blennid genera are remarkable in that their body, except for the head and belly, is covered with well developed ctenoid scales. Unlike most other blennid fishes their dorsal fin is divided into three distinct parts. The very close similarity that exists between *Tripterygion* and *Enneapterygius* induced certain authors[7] to consider them as synonymous, while others [8] have regarded them as distinct chiefly on the character of the lateral line and the relative heights of the first and the second dorsal fins. In *Tripterygion* the lateral line is continuous, while in *Enneapterygius* it is interrupted below the middle of the second dorsal. In *Helcogramma*, on the other hand, the lateral line is incomplete, ending below the end of the second dorsal. Besides these, there is not a single character ascribed to the genera in question that can separate them. The character of the lateral line has often been found to be very variable in many genera of fishes, and it does not seem justifiable to recognise generic distinction on such a variable character. Further, the relative heights of the various fins can hardly be considered to be of any great taxonomic value. I am inclined, therefore, to think, that both *Enneapterygius* and *Helcogramma* should be regarded no more than subgenera of *Tripterygion.*

The geographical distribution of the genus *Tripterygion* extends from the Mediterranean, Bay of Bengal, Indo-Australian Archipelago to New Zealand, etc. Its occurrence in Indian waters was so far doubtful, for, in recording *T trigloides* from India, Day remarked in his *Fishes*

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[1] Günther, *Fische der Südsee*, II, p. 188 (1876).
[2] Barnard, *Ann. S. African Mus.*, XXI, p. 810 (1927).
[3] Day, *Fish. India*, p. 313 (1878).
[4] Risso, *Hist. Nat. Principal Product. Eur. Merid.*, III. p. 241 (1826).
[5] Rüppell, *Neue Wirbelt. Fische*, p. 2, (1835).
[6] McCulloch and Waite, *Rec. S. Austral. Mus.*, I, p. 51 (1918).
[7] Klunzinger, *Verh. Zool. bot. Ges. Wien*, XXI, p. 498 (1871); Regan, *Ann. Durban Mus.*, II, p. 77 (1918); Norman, *Ann. Mag. Nat. Hist.* (9), IX, p. 322 (1922); Weber, *Siboga Expeditie, Fische*, p. 545 (1913); McCulloch, *Mem. Austral. Mus.*, V, pt. iii, p. 347 (1929).
[8] Jordan and Evermann, *U. S. Fish. Comm. Bull.*, XXIII, p. 495, 1903 (1905); Fowler, *Mem. B. P. Bishop Mus.*, X, p. 427 (1928); Barnard, *Ann. S. African Mus.*, XXI, pp. 868, 869 (1927).

of India : " I have never obtained any species of the genus in India, nor seen specimens from thence. That it exists there however is certain, as amongst Sir W. Elliot's drawings coloured illustrations of a male and a female of one species are given which may be " *T. trigloides.* Sir Elliot's specimens which were collected from amongst rocks at Waltair, were packed to be sent to Europe, but unfortunately were all destroyed in a storm. The genus, it appears, has so far not been rediscovered in Indian waters.

In the collection of fishes from the Andamans there is a single well preserved specimen of *Tripterygion* which I refer to the following species :

Tripterygion (Enneapterygius) fasciatum M. Weber.

1913. *Tripterygium fasciatum,* Weber, *Siboga Expeditie, Fische,* p. 548, fig. 118.

D. III ; XII, 9 ; A. 18 ; P. VII/9 ; C. 15 ; L.1.30 ; L. tr. $2\frac{1}{2}/6$.

Weber described the species from three specimens varying from 24 to 27 mm., taken from the Coral reefs in Seba and in Karakelang Islands, Dutch East Indies. The specimen under report is 21 mm. long excluding the caudal fin. It was collected by Dr. Rao from under stones and dead corals between tide marks at Brookesabad, Andamans (31 .x. 34). It agrees in all important characters with the Siboga species ; but as it differs slightly in colouration the following short description may prove useful.

The colouration of the specimen in alcohol is pale brown to white. There are on the sides six pairs of dark brown irregularly vertical bars which are more or less confluent. The head is marked with fine brown dots above which become larger, deeper and denser on the cheeks forming two triangular patches below the eyes. The lower surface of the head is whitish with a few scattered dark brown dots. The snout is tipped with black. The first spinous dorsal is blackish ; while the rest of the fins are more or less pale and olivaceous, except for the bases of the soft dorsal and anal which are studded with series of black, dots. At the bases of the pectorals, that is, at the humeral region there are black patches. The caudal fin is provided with a narrow black ring at the root.

Remarks.—Tripterygion fasciatum is a very close ally of *T. hemimelas* Kner and Steindachner[1] and *T atriceps* Jenkins,[2] described from Samoa and Honolulu respectively. It can, however, be readily distinguished from either species by the possession of lesser number of scales on the body and soft rays in the second dorsal and anal fins. It may not be out of place to mention that Fowler[3] has regarded *T. atriceps* a synonym of *T hemimelas.* But Jenkins' species can easily be separated from *T hemimelas* by the possession of greater number of soft rays in the anal fin (I/20 *versus* I/17-18). As the character of the anal fin of *T. atriceps* is established by Jenkins by an examination of ten specimens of the species and later substantiated by Jordan and Evermann[4]

[1] Kner and Steindachner, *Akad. Wiss. Wien Sitz.,* LIV, p. 371 (1866).
[2] Jenkins, *U. S. Fish. Comm. Bull.,* XXII, p. 505, fig. 46, 1902 (1903).
[3] Fowler, *Mem. B. P. Bishop Mus.,* X, pp. 427, 428 (1928).
[4] Jordan and Evermann, *U. S. Fish. Comm. Bull.,* XXIII, p. 495, 1903 (1905).

by a re-examination of the type series as also an additional material of 37 specimens from Waikiki reef near Honolulu, it appears reasonable, in my opinion, to assign a distinct rank to *T. atriceps.*

T. fasciatum and it allies are dainty little fishes common in the holes and crevices in the coral rocks. They can be " most successfully, collected by lifting up large pieces of rock and breaking them to pieces over a bucket or fine-meshed net."

Subfamily *BLENNIINAE.*

Genus **Blennius** Linnaeus (1858).

Blennius semifasciatus Rüppell.

(Plate VI, fig. 5.)

1835. *Blennius semifasciatus*, Rüppell, *Neue Wirbelt. Fische*, p. 134.
1861. *Blennius semifasciatus*, Günther, *Cat. Fish. Brit. Mus.*, III, p. 214.

This is perhaps one of the rarest species of the genus *Blennius.* Since Rüppell's discovery from " Massuah (Red Sea) " it has not been, as far as I can find from the literature on the subject, reported by any other ichthyologist. Günther had no specimen in the collection of the British Museum and the short description of *B. semifasciatus* given by him in the *Catalogue* is only a recast of Rüppell's original description.

In the collection of the Zoological Survey of India there are three specimens, varying from 35 to 50 mm. in length excluding the caudal fin, which are labelled as " *Blennius semifasciatus* " These specimens were taken on the 14th January, 1889 on the Orissa coast, 3 miles east of Kanarak by the late Colonel A. Alcock, the then Surgeon Naturalist to the Marine Survey of India. Unfortunately the specimens bear no other legend and it can only be presumed that they were determined by Colonel Alcock himself. This very interesting find of the species from the Indian waters, however, remains yet to be recorded. The specimens are in a fair state of preservation and they fit in so nicely with the description of *B. semifasciatus* that there can be no doubt of their being conspecific with that species.

In Dr. Rao's collection from the Andamans there is a single specimen taken at N. W. Ross Island (14.i.34). The specimen is in an excellent state of preservation and is 26 mm. long excluding the caudal fin. Comparing the specimen with those of Alcock's *B. semifasciatus* from the Orissa coast I am convinced that it is referable to the same species.

In view of the rarity of this interesting Blenny in the Museum collections and of the inadequacy of its description I give below a detailed account of the species from the four specimens before me :

D. XI/15 ; A. 18 ; P. 14 ; C. 13.

Blennius semifasciatus is a beautifully coloured small species in which the body is considerably compressed from side to side, specially in the region behind the middle of the body. The head is somewhat wedge-shaped, being gradually thin and compressed from below upwards. It is almost as high as long and a little higher than broad. Its length is

contained from 3·0 to 3·5 times in the length of the body without the caudal fin; its width is contained about 1·3 times in its own length. The maximum depth of the body which lies in a vertical plane in the region of the ventrals, is contained from 3·6 to 4·0 times in the length of the body. The eyes are circular and prominent. They are situated close to the upper profile, and almost in the anterior half of the head. The diameter of the eye is contained from 3·3 to 4·6 times in the length of the head. The anterior profile of the snout is rather blunt and subvertical; its length is nearly equal to the diameter of the eye. The interorbital space is very narrow and concave; it is from half to three-fourths the orbital width. There is no crest on the head. A pair of fringed tentacles are present above the orbit. A short and simple tentacle also arises from each anterior nostril in some specimens. The mouth is large and terminal; its gape extends below the middle of the eyes. The lips are fairly well developed, specially the lower one which is considerably broad. The teeth are slender, sharp and close-set. In the upper jaw there are twenty-four incisiform teeth, while in the lower there are only twenty. Each jaw is provided with an enlarged and slightly recurved canine. The gill-opening is large and lateral. The skin is naked and smooth. The lateral line consists of simple tubes. It is superior at the beginning for about half the length of the body, beyond which it slopes down.

The origin of the spinous dorsal appears to vary in accordance with age. In the half-grown specimens it is situated nearly midway between the angle of the opercles and the anterior margin of the orbit, while in young examples the fin may be inserted much nearer the former. The spines are slender and subequal with flexible tips in some specimens. The commencement of the rayed dorsal is almost equidistant between the posterior margin of the eyes and the root of the caudal fin. The first ray of the second dorsal is small. The rayed dorsal is a little higher than the spinous one. Both the dorsal fins are continuous. In young specimens there is a notch between the two dorsal fins which may be absent or indistinct in grown up individuals. The anterior spines of the anal are provided with fleshy prominences only in adult individuals. All the anal rays have free fleshy tips. The pectorals are broad and somewhat shorter than the head. Their median rays are the longest, while a few lower ones are provided with free tips. The pectoral rays reach as far as the vent which is situated very close in front of the anal. The ventrals are jugular with slightly prolonged rays. The caudal fin is rather short and somewhat rounded. Its length is contained from 5·2 to 6·5 times in the length of the body.

Günther's description of the colouration of specimens in spirit, quoted below, agrees in all respects with that of the specimen before me: "Brown; back with seven dark cross bars, each formed by two streaks; whitish lines diverge from the eye downwards; opercles and pectoral fins dotted with whitish; a blackish spot between the first and the second dorsal spines"

Remarks.—As already mentioned above, *B. semifasciatus* was originally described by Rüppell from the Red sea. The record of the species from the Andamans and its discovery from the Orissa coast by Colonel Alcock greatly extend its range of distribution.

Measurements in millimetres.

	Orissa coast			Andamans
Length of body without caudal	50·0	46·0	35·0	26·0
Length of head	14·0	13·0	10·0	8·5
Depth of body	13·0	12·0	9·5	6·5
Width of head	10·5	10·0	7·0	6·0
Height of head at occiput	14·0	12·0	9·5	7·0
Length of snout	3·0	3·0	2·5	2·5
Diameter of eye	3·0	3·0	3·0	2·5
Interorbital width	0·75	0·75	0·75	0·5
Height of spinous dorsal	6·0	6·0	4·5	2·5
Height of rayed dorsal	8·0	6·0	4·5	3·0
Length of pectorals	10·5	11·0	8·0	7·0
Length of ventrals	7·0	7·0	5·0	4·0
Length of base of anal	19·0	19·0	13·0	12·0
Length of caudal	8·0	7·0	6·5	5·0
Length of caudal peduncle	4·0	4·0	3·0	2·5
Least height of caudal peduncle	4·0	4·0	3·0	2·5
Gape of mouth	6·0	6·0	4·0	3·0

Family SYNGNATHIDAE.

Subfamily *DORYRHAMPHINAE.*

Genus **Doryrhamphus** Kaup (1856).

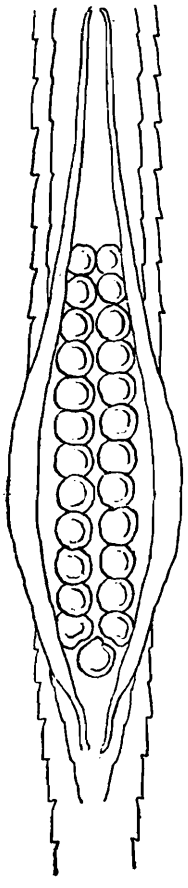
Doryrhamphus melanopleura (Bleeker).

1858. *Syngnathus melanopleura,* Bleeker, *Nat. Tijds. Ned. Ind.,* XV, p. 464.
1922. *Doryrhamphus melanopleura,* Weber, and de Beaufort, *Fish. Indo-Austral. Archipel.,* IV, pp. 64, 65, fig. 27.
1928. *Doryrhamphus, melanopleura,* Fowler, *Mem. Bernice P. Bishop Mus.,* X, p. 111.

D. 23 ; P. 19 ; A. 4 ; C. 10 ; Rings 18+13 ; Subdorsal rings 4+3.

In Dr. Rao's collection there is a single well preserved male specimen of the species, 31 mm. long, excluding the caudal fin. It was taken in a crevice on coral rock between tide marks, north-west of the Ross Island. The abdominal brood pouch, which is well developed and holds developing embryos, is 13 mm. long and is as broad as or slightly broader than the abdomen. It is formed by the lateral cutaneous folds, which are temporarily glued in the median line. The egg capsules are large and spherical ; there are 25 of them, 24 of which are arranged in two rows of 12, while the remaining one is situated medially at the posterior end (Text fig. 2). They are placed close toegether in isolated cells of the abdominal skin. They are more or less of equal size and have an outer diameter of 1·25 mm. Through their thin and transparent outer membrane the developing embryos can be very clearly seen. The embryos completely coil round the yolk-mass, the free portion of the tail reaching the head. Indications of myomeres throughout the greater part of the body are apparent. Optic vescicles, brain divisions, and

the notochord are also discernible. The embryos are destitute of chromatophores ; they are uniformly white, having a light yellowish



Text-fig. 2.—Abdominal brood pouch of *Doryrhamphus melanopleura*, opened to show structure and arrangement of egg capsules. ×7.

tinge over the head. The yolk mass is round having a diameter of about 0·5 mm. ; it is granular and yellowish in colour.

D. melanopleura is an attractive small shore fish of the Indo-pacific region, having a graceful and stout build and a beautiful colouration. Dr. Rao observed that in life the fish is of a orange-brown colour. The fan-like caudal fin is deep black with three distinct white spots, two of which are situated near the root of the fin while the third one is in the middle towards the free margin.

The species was originally described by Bleeker from Nova Semla, Cocos Islands, Indian Ocean. It has since been found in Mauritius, East Indies, Japan, Samoa and in the Hawaiian Islands.

Genus **Choeroichthys** Kaup (1856).

Choeroichthys sculptus (Günther).

1870. *Doryichthys sculptus*, Günther, *Cat. Fish. Brit. Mus.*, VIII, p. 185.
1922. *Choeroichthys sculptus*, Weber and de Beaufort, *Fish. Indo-Austral. Archipel.*, IV, pp. 61, 62, fig. 26.
1928. *Choeroichthys sculptus*, Fowler, *Mem. Bernice P. Bishop Mus.*, X, pp. 110, 111.

D. 31 ; P. 22 ; A. 4 ; C. 11 ; Rings 18+21 ; Subdorsal rings 4+2.

The species is represented in the collection by a single well preserved female specimen, 50 mm. long excluding the caudal fin ; it was collected

(31.i.34) from under stones and dead corals between tide marks, Brookesabad, Andamans. It agrees in all respects with the description of the species given by Weber and de Beaufort as also with the detailed account of colouration, etc., given by Fowler from a specimen from the Society Islands.

C. sculptus is a small shore fish, rarely exceeding 60 mm. in length. It is an inhabitant of the Coral reefs. The species was originally reported by Günther from the Fiji Islands. Its range extends from East Africa to the Philippines, Japan, Fiji, and Society Islands.

Family PLESIOPIDAE.

Genus **Plesiops** Schinz (1822).

Plesiops nigricans (Rüppell).

1929. *Plesiops nigricans*, Weber and de Beaufort, *Fish. Indo-Austral. Archipel.*, V, pp. 375-377 (see synonymy).

The species is represented in the collection under report by a single specimen, 30 mm. long excluding the caudal fin. It was taken (22.ii.34) at south-east coast of the Long Island, Middle Andamans, between stones at moderate tides.

The colouration of the specimen in alcohol is dusky with somewhat irregularly vertical broad alternating bands of dark and light grey. The light-edged dark ocellus on the operculum which is characteristic of the species, is very obscure in the present specimen. Both the dorsals as also the anal are edged with white. The rest of the fins are dark.

P. nigricans grows to a length of about 190 mm. and is widely distributed in the Indo-Pacific region.

EXPLANATION OF PLATE VI.

Raogobius andamanicus, gen. *et* sp. nov.

FIG. 1.—Lateral view of type specimen. ×6.

FIG. 2.—Ventral view of head and anterior part of body of same ×6.

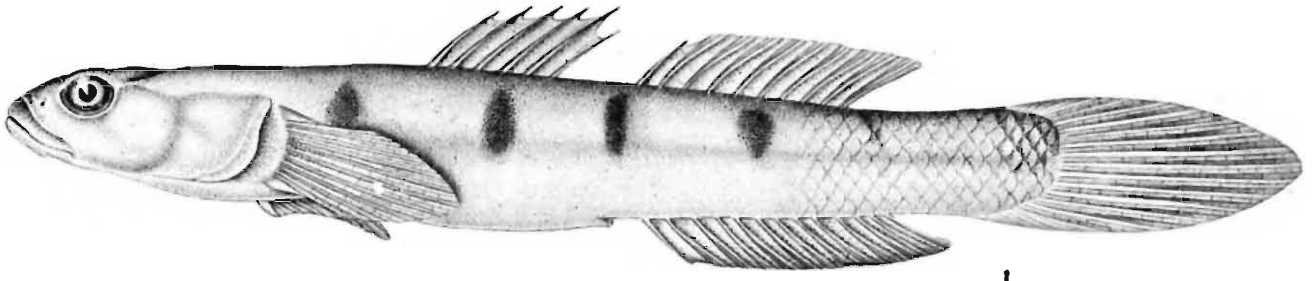
Vaimosa koumansi, sp. nov.

FIG. 3.—Lateral view of type specimen. ×4.

FIG. 4.—Ventral view of head and anterior part of body of same. ×4.

Blennius semifasciatus Rüppell.

FIG. 5.—Lateral view of a specimen from Andaman Islands. ×3½.



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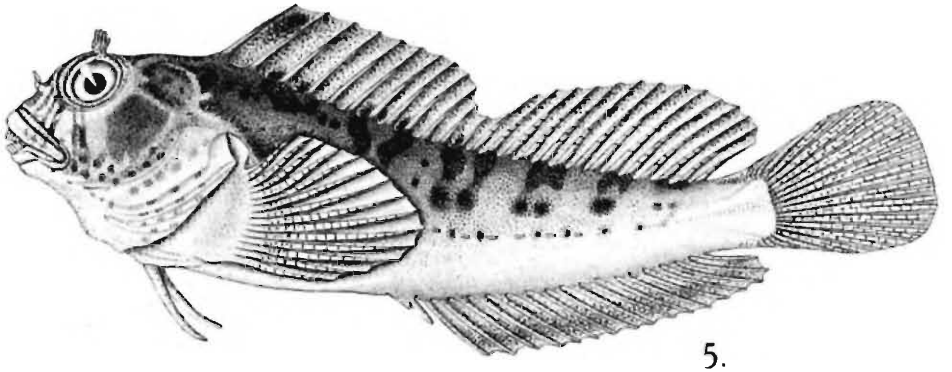

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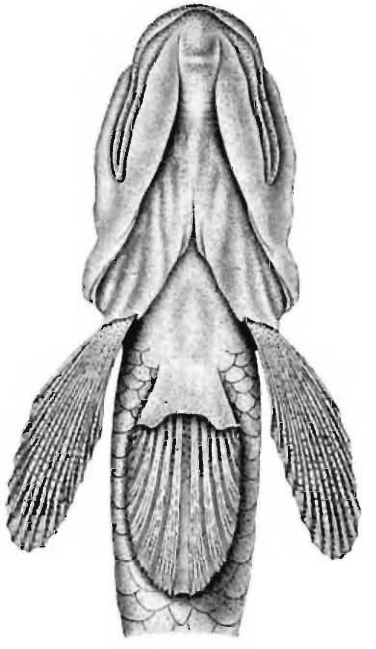

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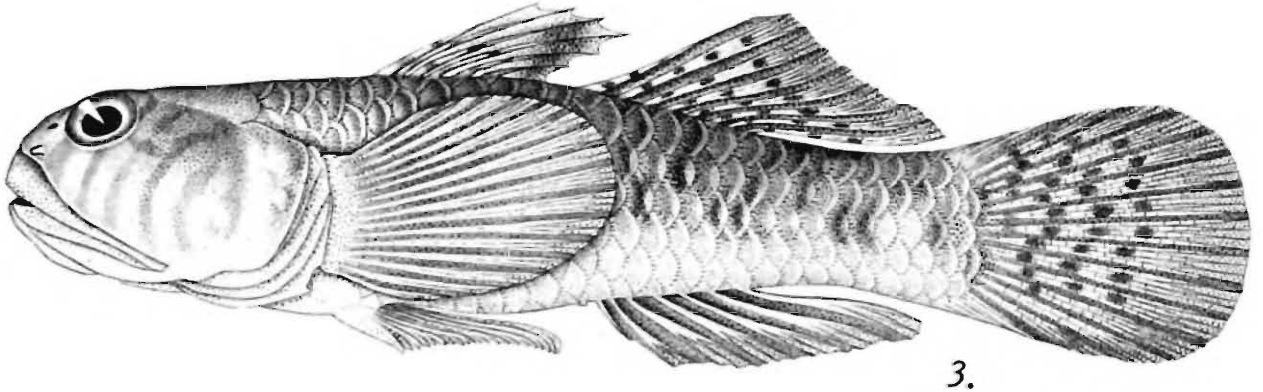

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S. Mondul & R. Bagchi del.

Fishes of the Andaman Islands.

REPORT ON SOME AMPHIPODA, ISOPODA, AND TANAIDACEA IN THE COLLECTIONS OF THE INDIAN MUSEUM.

By K. H. Barnard, *D.Sc., F.L.S., South African Museum, Cape Town.*

The collection on which this report is based, though not extensive, has proved very interesting. In addition to records of new localities for species already known from India, seven new species are proposed in the Amphipoda, and one each in the Isopoda and the Tanaidacea.

Some differences of opinion are to be found, as is only to be expected between different authors. The separation of *Talorchestia* and *Orchestia*, for example, is a tricky point; and the problem arising from the specimens of *Hyale brevipes* in the present collection is only stated, but by no means answered.

The presence in Tibet of a subspecies of *Gammarus pulex* recently described from northern Siberia is noteworthy.

An attempt has been made to sort out the species of *Grandidierella*, and with the concurrence of the Director, Zoological Survey of India, the description of a new species of this genus from South Africa is included.

Among the Isopoda is a second species of the curious Anthurid genus *Xenanthura*.

To Dr. B. Prashad, Director of the Zoological Survey of India and to Dr. B. Chopra I express my thanks for the privilege of studying this collection, which has mostly been brought together by various members of the staff of the Survey.

AMPHIPODA.

Family Ampeliscidae.

Ampelisca pusilla Sars.

1920. Chilton, *Rec. Ind. Mus.* XIX, p. 79.
1921. *id., Mem. Ind. Mus.* V, p. 523.

Locality.—Neendakara Bay, Travancore. H. S. Rao and M. Sharif. February 1928. 39 ♂♂, ovig. ♀♀, and juv.

Remarks.—Chilton has discussed the probable identity of the Indian and Norwegian forms. Pending a thorough revision of the genus no further comment is possible.

Family Oedicerotidae.

Oediceros sp.

Locality.—Karitalachal, Cochin, S. India. H. S. Rao. January 1928. 3 ovig. ♀♀.

Remarks.—These small specimens, measuring 2 mm. in length, appear to belong to this genus, but the material is too scanty to attempt a specific determination.

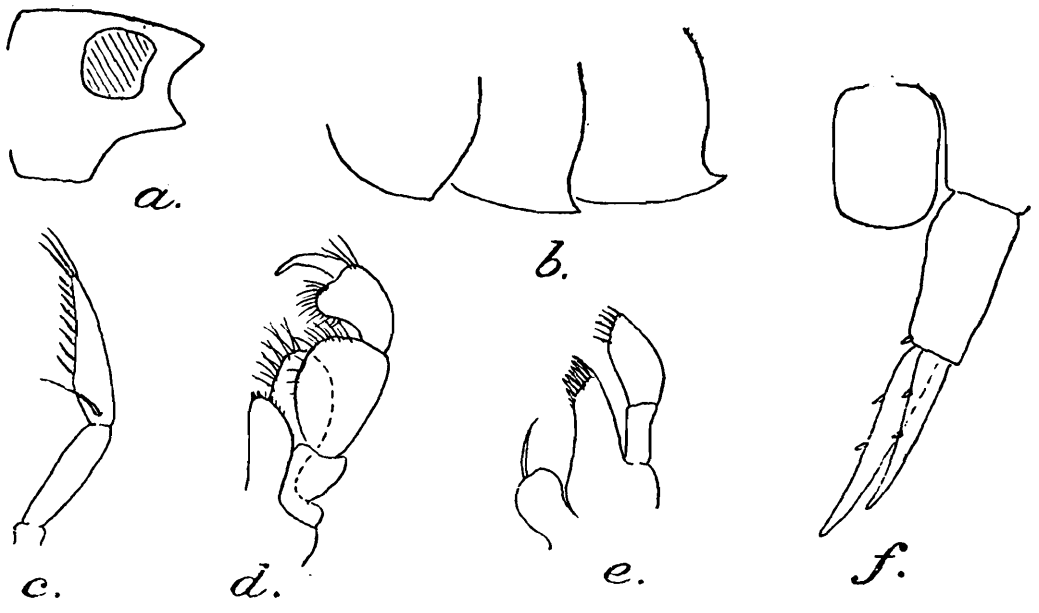
Family CALLIOPIIDAE.

Paracalliope indica, sp. nov.

? 1890. Giles, *J. Asiat. Soc. Bengal* LIX, p. 70, pl. ii, fig. 6. (*Parapleustes pictus.*)
? 1906. Stebbing, *Das Tierreich* XXI, p. 297. (*Calliopius pictus.*)
1921. Chilton, *Mem. Ind. Mus.* V, p. 529, fig. 3. (*Paracalliope fluviatilis non* Thomson.)

Locality.—Salt Lakes, Calcutta, Lower Bengal. 23-24th February 1928. Dr. B. N. Chopra. 2 specimens (apparently ♂♂). 4·5 mm.

Description.—Antero-lateral angles of head moderately acute; rostrum not prominent. Eyes very large, rounded-quadrangular, separated dorsally by a distance equal to half a diameter. Hind margins of peraeon and pleon segments dorsally entire. Side-plates 1-4 with few and slight setiferous indents on lower margins; hind margin of 4 feebly excavate.



TEXT-FIG. 1.—*Paracalliope indica,* sp. nov. *a.* head; *b.* pleon segments 1-3; *c.* mandibular palp; *d.* maxilliped; *e.* maxilla 1; *f.* telson and uropod 3.

Postero-inferior angle of pleon segment 1 subrounded, with indication of a slight point; of segments 2 and 3 shortly produced in acute points, the margin above the point on segment 3 indented and sinuous. Telson, width slightly more than half the length, posterior margin evenly rounded.

Antenna 1, 1st joint stout, 2nd much more slender, $\frac{2}{3}$ length of 1st, 3rd scarcely $\frac{1}{2}$ length of 2nd. Antenna 2 subequal in length to 1st antenna, 4th and 5th joints subequal. Flagella of both antennae 16-17-jointed, with calceoli on the basal 6-7 joints.

Upper lip entire. Lower lip with inner lobes.

Mandible, spine-row very feeble, molar well developed, palp with 3rd joint equal to 1st *plus* 2nd, the latter without setae, 3rd joint with one long basal seta, about 8 spine-setae on margin, and 3 apical setae.

Maxilla 1, inner lobe with a single long seta, palp with 1st joint rather slender, parallel-sided, 2nd ovate. Maxilla 2, inner lobe with setae on apex only.

Maxilliped, outer margin of base of outer lobe very short, 2nd joint of palp broadly ovate, 3rd lobed on inner apex, 4th unguiform.

Gnathopods 1 and 2, compare Chilton's figs. 3 *d* and *e* of *P. fluviatilis* (*l. c.*, 1921). Peraeopods 1-4, also compare Chilton's figure 3*a*. Peraeopod 5 missing from both specimens.

Uropods 1 and 2, peduncle and rami completely spineless; outer ramus in uropod 1 slightly shorter, in uropod 2 distinctly shorter than inner ramus. Uropod 3, peduncle with 1 apical spinule, outer ramus shorter than inner, both with 2 spinules on upper margin.

Remarks.—Thanks to Mr. A. G. H. Helson, of Canterbury College, Christchurch, N. Z., I have been able to examine some typical examples of the New Zealand *Paracalliope fluviatilis*. I have also seen some of the Chilka Lake specimens identified by Chilton as this species.

The present two specimens are identical with the Chilka Lake specimens, and in my opinion they cannot be regarded as conspecific with the true New Zealand *fluviatilis*, as they differ in the following characters: larger eyes, mandibular palp more slender, especially the 3rd joint, the inner lobe of maxilla 1, the lack of setae on inner lobe of maxilla 2, the much broader 2nd joint of palp of maxilliped, the complete absence of spinules on uropods 1 and 2, and their reduction to 2 on the rami of uropod 3, and the postero-inferior angles of pleon segments 1-3—a series of characters which seems to justify specific separation.

The last mentioned character is that most easily observed, and which attracted attention as it did not coincide with Chilton's fig. 3*a*. In *P. fluviatilis* the postero-inferior angle of segment 3 is quadrate (Stebbing. 1906, *l. c.*, p. 297 says: subquadrate). Thomson's original figure is useless. Chilton does not refer to this character, which in his 1921 figure of the whole animal is incorrectly drawn: even as drawn it does not agree with the New Zealand specimens, and still less with the Indian specimens.

The Philippine Island specimens of *P. fluviatilis* might well be re-examined (Chilton, 1920, *Philipp. J. Sci.* XVII, p. 513).

Family GAMMARIDAE.

Gammarus pulex (Linn.).

1894. Sars, G. O., *Crust. Norway* I, p. 503, pl. clxxvii, fig. 2.
1908. Chevreux, *Trav. Soc. Imp. Nat. St. Petersb.* XXXVII, pp. 91-110.
1914. Tattersall, *Rec. Ind. Mus.* X, p. 213.
1914. [Annandale], *ibid*, p. 215.
1922. Tattersall, *Mem. Asiat. Soc. Bengal* VI, p. 451, pl. xx, figs. 19-27.
1934. Ueno, *Mem. Connectic. Ac. Sc.* X, p. 63, pls. iii-vii.

Subsp. **extensus** Mart.

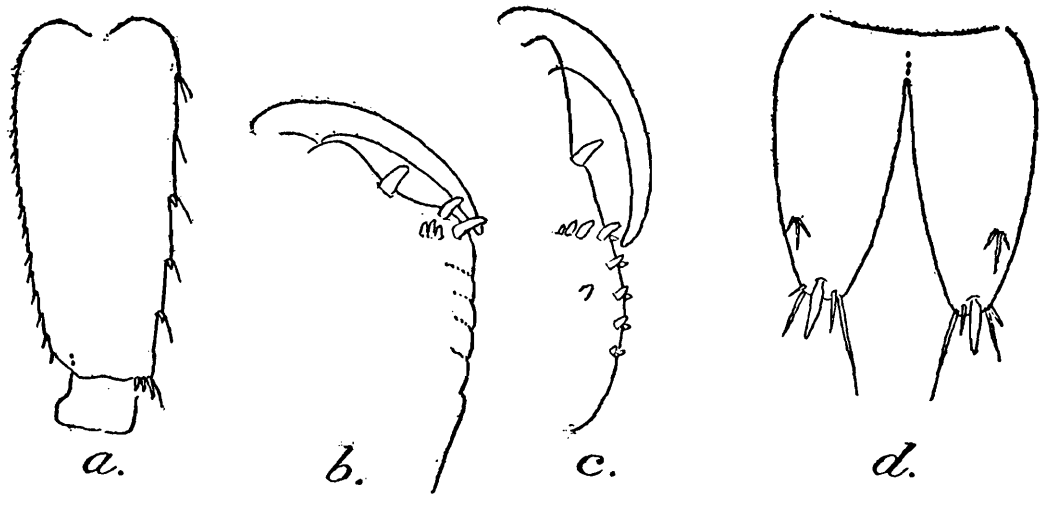
1932. Martynov, *Ann. Mus. Zool. Ac. Leningrad* XXXII, p. 533 (Engl. p. 538), fig. 1 *a, b, c.*

Locality.—Dochen, Tibet, 14,700 ft. Lt.-Col. F. M. Bailey. 21st June 1928. 1 immature ♀. 13 mm.

Description.—Resembling in general *pulex*. Eyes and lateral lobes of head as in *pulex*. Postero-interior angle of pleon segment 3 acutely pointed (*cf* Chevreux & Fage, *Amph. France*, fig. 264, 1925, and Ueno,

pl. 4, 1934). Pleon segments 4-6 each with 2 medio-dorsal spinules and one dorso-lateral, with 1-2 minute setae in each group. Telson with one apical spine on each lobe, flanked by 2 unequal spine-setae on each side, a group of 3 spinules at $\frac{2}{3}$ length, no spine in basal third.

Antenna 1, flagellum 21-jointed, not strongly setose, accessory flagellum 3-jointed, the 3rd joint minute, its length equal to width of 2nd joint. Antenna 2, flagellum 10-jointed, not strongly setose. Maxilla 1 with 1 spinule on outer margin of 2nd joint of palp.



TEXT-FIG. 2.—*Gammarus pulex* (Linn.) subsp. *extensus* Mart. *a*. 2nd joint of peraeopod 5; *b*. palm of gnathopod 2 (long setae in notches on lower margin omitted); *c*. palm of gnathopod 1; *d*. telson. (In *b* and *c* the series of three submarginal spines and the single one in *c* are on the inner surface.)

Gnathopods 1 and 2 as in *pulex*; details of palms see fig. 2 *b*, *c*.

Peraeopods 3-5, 2nd joints more elongate than in *pulex*; in peraeopod 3 2nd joint half as long again as broad, in peraeopod 4 twice as long as broad, in both peraeopods about the same width throughout its length, lower hind corners rounded-quadrangular; in peraeopod 5 2nd joint twice as long as basal width, slightly and evenly tapering, lower hind corner bevelled off.

Uropod 3, no spinule on outer margin of peduncle, inner ramus nearly as long as 1st joint of outer ramus.

No accessory branchiae.

Remarks.—This is a very interesting specimen. *G. pulex* extends right across the Palaearctic region from west to east (Tattersall 1922: Japan), and from low levels up to considerable altitudes (Chevreux 1908: Turkestan 10,500 ft.; Tattersall 1914: Pamirs 15,600 ft.). In spite of a certain amount of variability (see Chevreux *l. c.*) these records undoubtedly apply to *pulex* (see also Ueno *l. c.* p. 69).

Probably Giles' record (1888, *J. Asiat. Soc. Bengal* LVII, p. 220) of *G. fluviatilis* from the Pandar Lake, 11,000 ft. in the Hindu-Kush Range is also to be referred to this species.

Recently, however, Martynov has described a form from a locality in the basin of the River Lena in Siberia (presumably at or near sea-level), which he considers worthy of subspecific rank and has named *extensus* in allusion to the unusually elongate 2nd joints of peraeopods 3-5. Additional features are the 3-jointed accessory flagellum and the single spine at the end of each lobe of the telson.

It is particularly interesting to find this form at a high altitude in Tibet. From the above description it will be seen that the present ♀ specimen agrees with Martynov's ♂ specimens except in having fewer flagellar joints in both antennae (Martynov : ant. 1 28-29-jointed, ant. 2 16-jointed), and the slightly less elongate 2nd joint of peraeopod 5. These differences may well be sexual (*cf.* Ueno, *l.c.*).

Recently Ueno has reported on the abundant material collected by the Yale North India Expedition to Kashmir and Ladak. Ueno has discussed and figured several variable features, but apparently has not seen Martynov's 1932 description of the subsp. *extensus* ; he finds that in general the 2nd joints of peraeopods 3-5 are narrower and more elongated in the specimens from lower altitudes in Kashmir than in those from the higher altitudes in Ladak.

G. annandalei Tattersall 1922, and *gregoryi* Tattersall 1924 also possess more elongate 2nd joints in peraeopods 3-5 than typical *pulex*, but are separated by other characters (*e.g.*, uropod 3). Both these species occur in Yunnan, Western China, at moderate altitudes, and Annandale (*l.c.*) mentions some specimens of *pulex* (identified by Stebbing) also from Yunnan. An overlapping of the distribution of these three species and the subspecies therefore seems to occur in the high Central Plateaux, and all opportunities should be taken of collecting as many examples as possible from different localities.

Eriopisa Stebbing.

1890. Stebbing, *Ann. Mag. Nat. Hist.* (6) V, p. 193.
1894. Sars, G. O., *Crust. Norway* I, p. 514, pl. clxxxi.
1931. Schellenberg, *Arch. Hydrobiol.* Suppl. Bd. VIII, p. 507.
1933. *id.*, *Mitt. Zool. Mus. Berlin* XIX, pp. 407, 409.

Schellenberg has shown that "*Niphargus*" *chilkensis* Chilton 1921 and *philippensis* Chilton 1920 do not belong to the genus *Niphargus*. In fact it is strange that Chilton, having set out all the characters in which *chilkensis* differed from the diagnosis of *Niphargus*, should have completely ignored the genus *Eriopisa*.

While these two species are to be included in *Eriopisa*, two other species hitherto included in this genus, *viz.*, *sechellensis* Chevr. 1901 and *capensis* Brnrd. 1916, must be excluded and referred to another genus *Eriopisella* Chevr. 1920 (Schellenberg, *l.c.* 1933).

Eriopisa chilkensis (Chilton).

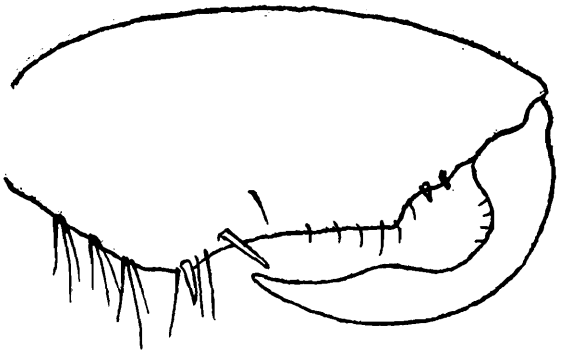
1921. Chilton, *Mem. Ind. Mus.* V, p. 531, fig. 4 (*Niphargus* c. ♂) [*non* Chilton, *Mem. Asiat. Soc. Bengal* VI, p. 534, fig. 1.]

Localities.—Salt Lakes, Lower Bengal. 23-24th February 1928. Dr. B. N. Chopra. A lot ♂♂ and juv. (2 tubes).

Salt Lakes, Lower Bengal. 9th March 1928. Dr. B. N. Chopra. 3 ♂♂.

Tiruppunithura, Cochin, amongst weeds in brackish channel on road to Travancore. H. S. Rao and M. Sharif. December 1927. 1♂.

Tirunayamkudam, Vembanad Lake, Travancore. H. S. Rao and M. Sharif. January 1928. 1 ovig. ♀.



TEXT-FIG. 3.—*Eriopisa chilkensis* (Chilton). Inner view of gnathopod 2 ♂.

Remarks.—There are several ♂♂ and juveniles, but the only ovigerous ♀ is that from Vembanad Lake. A figure is given of the hand of gnathopod 2 of the largest ♂, measuring 12 mm. in length (uropods excluded).

The ♀ measures 4·5 mm. (excl. uropods) and carries 4 embryos. The 2nd gnathopod is shaped exactly like that of the ♂, but on a smaller scale, the palm is almost straight, and the finger is evenly curved. The 3rd uropods are exactly like those of the ♂.

One cannot be absolutely certain that the Talé Sap ♂ specimen (Chilton 1925) belongs to this species; the ♀♀ from the same area are *Eriopisella sechellensis* (*vide infra*).

Eriopisella Chevreux.

1920. Chevreux, *Bull. Soc. Zool. France* XLV, p. 81.
1925. Chevreux & Fage, *Faune de France, Amphip.*, p. 220.
1933. Schellenberg, *Mitt. Zool. Mus. Berlin* XIX, pp. 408, 409.

In addition to the species mentioned below, this genus contains *capensis* Brnrd. 1916, and *pusilla* Chevr. 1920. It is separated from *Eriopisa* by the acute antero-inferior angle of side-plate 1, the very slender mandibular palp, inner plate of maxilla 1 with 2-3 setae at apex only, inner plate of maxilla 2 narrow and without setae on inner margin, and the short almost styliform 2nd joint of the outer ramus of 3rd uropod.

Eriopisella sechellensis (Chevreux).

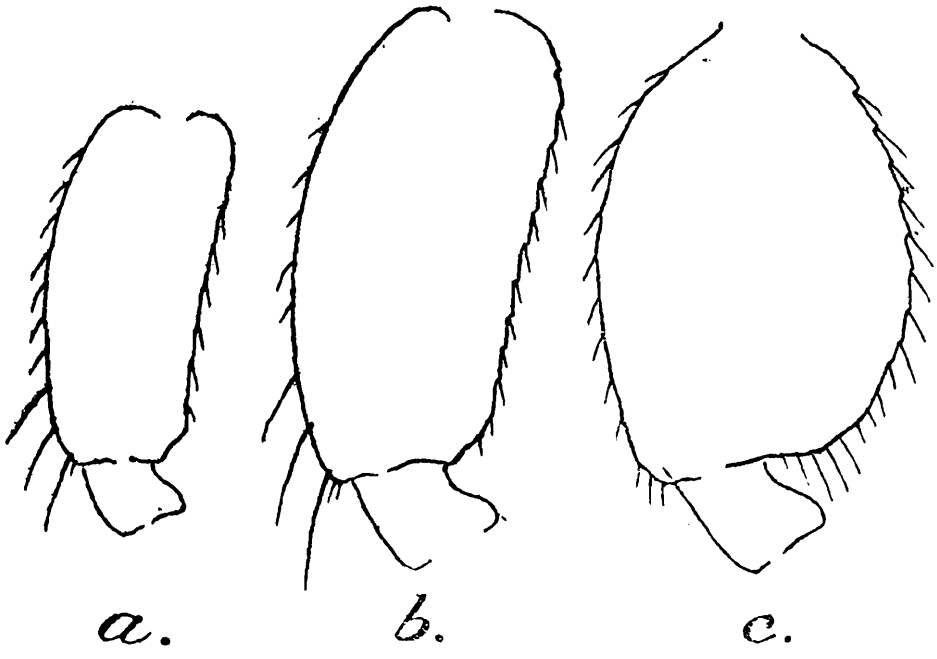
1901. Chevreux, *Mem. Soc. Zool. France* XIV, p. 403, figs. 19-23. (*Eriopisa s.*)
1925. Chilton, *Mem. Asiat. Soc. Bengal* VI, p. 534, fig. 1. (*Niphargus chilkensis* ♀♀, *non* Chilton 1921.)

Locality.—In stake-net Manumbam Channel, Travancore. H. S. Rao. January 1928. 32 ♂♂, ovig. ♀♀, and juv.

Remarks.—Except that the 2nd joint of peraeopod 5 is rather broader than represented in Chevreux's figure, there are no distinguishing

features. The specimens measure up to 5·5 mm. in length; and are pale straw colour, the eyes reddish.

Distribution.—Seychelles; Talé Sap, Siam.



TEXT-FIG. 4.—*Eriopisella sechellensis* (Chevr.). *a*, *b*, *c*. 2nd joints of peraeopods 3, 4, 5.

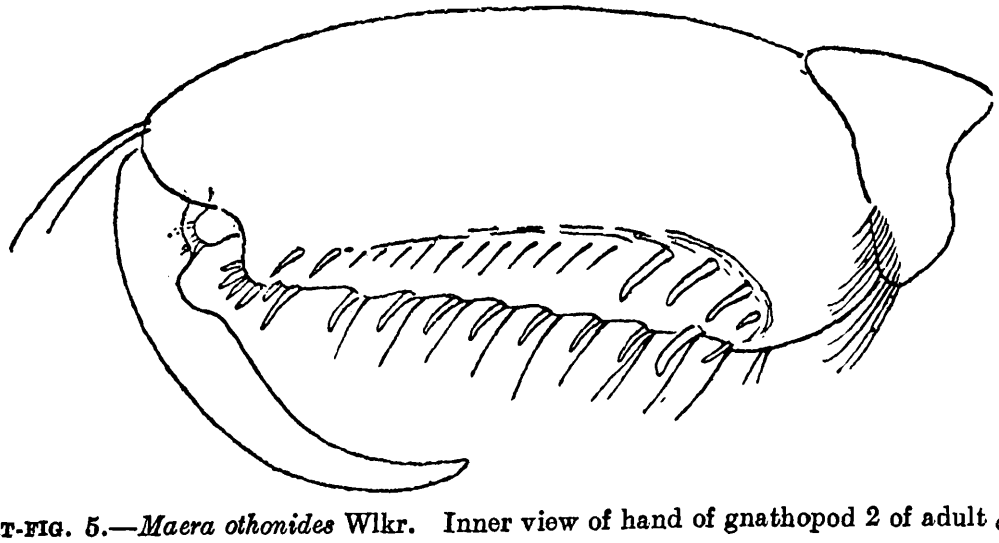
Maera othonides Walker.

1904. Walker, *Herdman's Ceylon Pearl Fish. Rep.* II, p. 271, pl. v, fig. 29.
1905. *id.*, *Fauna Geogr. Mald. Laccad. Arch.* II, p. 927.
1921. Chilton, *Mem. Ind. Mus.* V, p. 535, fig. 5.

Localities.—In stake-net Manumbam Channel, Travancore. H. S. Rao. January 1928. 4 ♂♂, 1 juv.

Quilon, Travancore. H. S. Rao and M. Sharif. February 1928. 4 ♂♂, 2 ovig. ♀♀.

Cochin Harbour, S. India. H. S. Rao. December 1927 2 immat ♂♂, 1 ovig. ♀.



TEXT-FIG. 5.—*Maera othonides* Wlkr. Inner view of hand of gnathopod 2 of adult ♂.

Remarks.—Characteristic of this species are the densely pubescent hind half of body (pleon segments 1-6), the setae extending even on to

the telson, the pubescent 3rd uropods, the very stout 3rd joint of the mandibular palp (a feature also found in *Ceradocus rubromaculatus*), and the 2nd gnathopod of the adult ♂. A figure of the latter is here given.

Peraeopods 3-5, 2nd joint oblong, slightly narrowing distally in peraeopod 5, hind margin straight, feebly notched in peraeopod 3, distinctly so in peraeopod 4, and serrate in peraeopod 5, upper and lower hind corners quadrangular, the lower corners sharper than the upper ones. Length : 11 mm.

Distribution.—Ceylon ; Maldive Archipelago ; Chilka Lake.

Elasmopus Costa.

1932. Stephensen, *Annot. Zool. Jap.* XIII, p. 487 (synopsis of species).

Elasmopus subcarinatus (Haswell).

1904. Walker, *l.c.*, p. 275, pl. v, fig. 34.
1909. *id.*, *Trans. Linn. Soc. London* XII, p. 335.
1927. Gravely, *Bull. Madras Govt. Mus.* (n.s.) I, p. 123.

Locality.—Tuticorin Pearl Banks. B. Prashad. April 1927. 2 ♂♂.

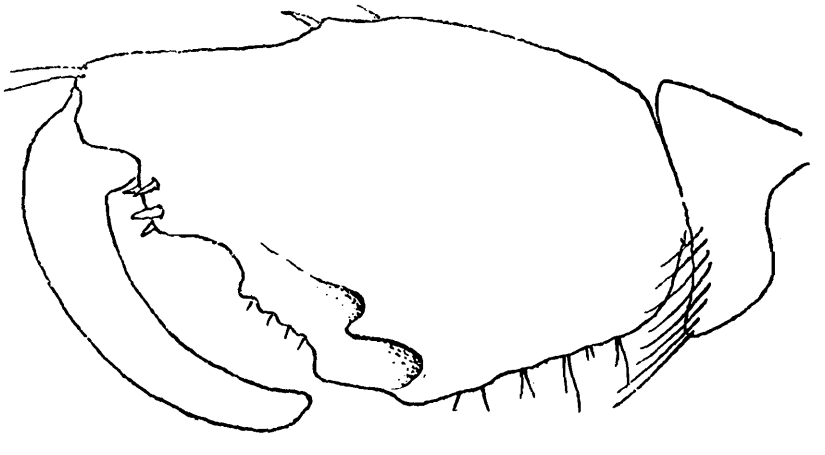
Distribution.—Australia ; New Zealand ; Ceylon ; Gulf of Manaar ; Indian Ocean.

Parelasmopus suluensis (Dana).

1888. Stebbing, *Challenger Rep.* XXIX, p. 1029, pl. c.
1901. Chevreux, *Mem. Soc. Zool. France* XIV, p. 412, figs. 32-39 (*setiger*).
1904. Walker, *l.c.*, p. 278, pl. vi, fig. 38.
1905. *id.*, *l.c.*, p. 929.
1909. *id.*, *l.c.*, p. 334.
1922. Chilton, *K. Sv. Vet. Ak. Handl.* LXIII, 3, p. 7, fig. 3.

Locality.—Tuticorin Pearl Banks. B. Prashad. April 1927. 1 ♂, 2 ovig. ♀♀.

Remarks.—None of the specimens have setae on the peraeon or pleon segments. The ♂ (13 mm.) has a 3-jointed accessory flagellum, a blunt tip to the finger of gnathopod 2 (see also Walker 1909), palm



Text-fig. 6.—*Parelasmopus suluensis* (Dana). Inner view of hand of gnathopod 2 ♂.

oblique as in Stebbing's figure, peraeopods 3-5 densely setose (as in *setiger*), and each lobe of the telson with 4 spines (as in *setiger*).

The 2 ♀♀ (9 mm.) have both lost the 1st antennae, peraeopods 3-5 are not densely setose, telson as in ♂.

Walker (1904, p. 278, footnote) noted a certain intermingling of the characters of *suluensis* and *setiger*, and in view of the present specimens there can be but little reason for keeping the latter species separate.

Stebbing's statement in *Das Tierreich* (1906, p. 417) that the 4th pleon segment has *two* pairs of upturned teeth is evidently a slip.

Distribution.—Sulu Sea ; Ceylon ; Seychelles ; Maldive and Laccadive Archipelago ; Red Sea ; British East Africa ; N. W. Australia.

Quadrivisio Stebbing.

1907. Stebbing, *Rec. Ind. Mus.* I, p. 159.
1933. Stephensen, *Zool. Jahrb. Abt. Syst.* LXIV, p. 420.

Stephensen has described a second species of this genus from Bonaire Island, Dutch West Indies.

Quadrivisio bengalensis Stebbing.

1907. Stebbing, *l.c.*, p. 160, pl. vii.
1913. Chevreux, *Voy. Alluaud & Jeannel Afr. Orient. Amphip.*, p. 15, fig. 1.
1921. Chilton, *Mem. Ind. Mus.* V, p. 537, fig. 6.
1925. *id.*, *Mem. Asiat. Soc. Bengal* VI, p. 534.

Localities.—Salt Lakes, Lower Bengal. Dr. B. N. Chopra. 23-24th February 1928. 2 ♂♂, 4 immature.

Isolated Pond, S. side Church Hill, Vizagapatam. H. S. Rao and G. Varugis. May, June 1926. A lot ♂♂.

Mundattalkari, Vaikom, Travancore. H. S. Rao and M. Sharif. January 1928. 1 ♂, 1 ♀.

Kurumbil Kayal, Travancore. H. S. Rao and M. Sharif. January 1928. 1 ♂.

Shertallai, Travancore. H. S. Rao and M. Sharif. February 1928. A lot ♂♂, ovig. ♀♀, and juv.

Veli Lake, Trivandrum, Travancore. M. Sharif. February 1928. 26 ♂♂, ovig. ♀♀, and juv.

Remarks.—The dorsal denticles on the pleon are certainly a variable feature, irrespective of sex ; in mature specimens from one and the same locality, *e.g.*, Veli Lake and Shertallai, they are quite obsolete in some, in others strongly developed.

Distribution.—Port Canning (Lower Bengal) ; Chilka Lake ; Talé Sap (S. E. Siam) ; British East Africa, Zanzibar.

Family TALITRIDAE.

Talitrus Latr.

1906. Stebbing, *Das Tierreich* XXI, p. 524.
1925. Hunt, *J. Mar. Biol. Assoc. Plymouth* XIII, p. 854.
1934. Burt, *Ceylon J. Sci.* (B) XVIII, p. 181.
1934. Carl, *Rev. Suisse de Zool.* XLI, p. 741.

Talitrus sp.

Locality.—Mule track between Mao-Hsao and Namkham, 3,700 ft., Northern Shan States, Burma. H. S. Rao. November 1926. 3♀♀.

Remarks.—With only three specimens, all ♀♀, I do not propose to attempt a specific determination. The genus has been recorded from Ceylon (Burt) and the Nilgiris (Carl), and representatives may be expected to be plentiful in the forest areas of Burma ; future collecting will no doubt bring to hand more extensive material.

Orchestia Leach.

1906. Stebbing, *Das Tierreich* XXI, p. 530.

Judging from the figure of the 1st gnathopod ♀, I feel inclined to suggest that Tattersall's *Talorchestia japonica* (1922, *Mem. Asiat. Soc. Bengal* VI, p. 452, pl. xxi, figs. 1-10) is really an *Orchestia*, especially as Schellenberg (1931, *Arch. Hydrobiol.* Suppl. Bd. VIII, p. 498) has transferred even *malayensis* to the latter genus.

Orchestia platensis Kröyer.

1921. Chilton, *Mem. Ind. Mus.* V, p. 538, fig. 7 (references).
1928. Schellenberg, *Trans. Zool. Soc. London* XXII, p. 658.
1929. Tattersall, *Ann. Mag. Nat. Hist.* (10) III, p. 96.
1932. Barnard, *Discovery Rep.* V, p. 218.
1932. Schellenberg, *Zool. Anz.* CI, p. 61, fig. 1.

Locality.—Amongst fibres of rotting cocoanut tree on edge of back-water west of Manumbam, Travancore. H. S. Rao. January 1928. 3 ♂♂, 7 ♀♀.

Remarks.—The 2nd antennae of the ♂♂ are only slightly more robust than those of the ♀♀ (*cf.* Schellenberg, 1926, *Deutsch. Südpol. Exp.*, p. 371), though the 5th peraeopods show the normal moderate expansion of the 4th and 5th joints.

Orchestia floresiana Weber.

1922. Tattersall, *Mem. Asiat. Soc. Bengal* VI, p. 453, pl. xxi, figs. 11-20 (*malayensis*).
? 1925. *id.*, *Rec. Ind. Mus.* XXVII, p. 241 (*malayensis*).
1931. Schellenberg, *Arch. Hydrobiol.* Suppl. Bd. VIII, p. 498 (var. *thienemanni*).
1935. Stephensen, *Bull. B. P. Bishop Mus.* No. 142, p. 24, figs. 4-6.

Locality.—Salt Lakes, Lower Bengal. Dr. B. N. Chopra. 23-24th February 1928. 3 ♂♂, 14 ♀♀.

Remarks.—The scabrous knob on the 4th joint (merus) of gnathopod 1 ♂, and the very numerous and regular serrulations on hind margin of 2nd joint of peraeopod 5 are characters of this species.

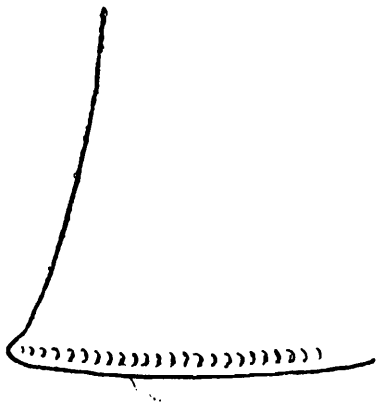
In the present specimens the 6th joint of gnathopod 1 ♀ does not narrow evenly (as in *T martensii*, see Chilton, *l.c.*, 1921, fig. 8*e*), but is parallel-sided for about $\frac{5}{8}$ its length, where the lower distal angle is bevelled off (*cf.* Schellenberg, fig. 2 m.) ; the base of the finger is half the width of the 6th joint. The latter can scarcely be called " strictly simple ", but it has no definite rounded lobe as figured for *japonica* (Tattersall, 1922, *l.c.*, pl. xxi, fig. 1).

The telson is not so shortly triangular as in Tattersall's figure, and the flagellum of antenna 1 is 3-4-jointed in ♀, 4-5-jointed in ♂. The peduncle of uropod 1 usually has 5 spines, but there may be only 4,

or sometimes a small 6th spine. The outer ramus of uropod 2 has only 2 spines.

The fewer indents (19-20 instead of about 30) on hind margin of 2nd joint of peraeopod 5, and greater number of spines on the uropods are characters found both in the Javanese variety and the Andaman specimens.

Along the lower margins of pleon segments 2 and 3 is a series of minute submarginal ridges giving a crimped appearance. This sculpturing



TEXT-FIG. 7.—*Orchestia floresiana* Weber. Postero-inferior angle of pleon segment 3.

can be seen by transmitted light, but is best observed by reflected light on a dried specimen. This feature is not mentioned in the original description, or by Schellenberg, consequently the type specimens of both *malayensis* and var. *thienemanni* should be re-examined. Similar sculpturing occurs in the South African species *Talorchestia ancheidos*.

Since this was written, Stephensen (*l. c.*) has figured this curious feature.

Length : ♂ 8-9 mm., ♀ 9-10 mm.

Distribution.—Singapore ; ?Andaman Islands. The variety *thienemanni* was described from Java.

Talorchestia Dana.

1906. Stebbing, *Das Tierreich* XXI, p. 543.
1922. Tattersall, *Mem. Asiat. Soc. Bengal* VI, p. 452.
1925. Chilton, *China J. Sci. Art.* III, p. 283.

Tattersall in his key (pp. 454, 455) has accidentally transposed *australis* and *ancheidos* : and assumed that side-plates " 2-4 " are without a well-marked lobe on hind margin in *australis*, whereas my description only mentioned side-plate 2. As a matter of fact the character should not be used, as the lobe is present in *australis* as in other species, but is inconspicuous.

Talorchestia martensii (Weber).

1921. Chilton, *Mem. Ind. Mus.* V, p. 541, fig. 8.
1925. *id.*, *Mem. Asiat. Soc. Bengal* VI, p. 535 (referred to *gracilis*).
1927. Gravely, *Bull. Madras Govt. Mus.* (n.s.) I, p. 123 (identified as *gracilis* by Chilton).

Localities.—In pools close to Harbour Railway, Vizagapatam. H. S. Rao and G. Varugis. May, June 1926. A lot ♂♂, ♀♀, and juv.

Manakudi, Travancore. M. Sharif. February 1928. A lot ♂♂, ♀♀, and juv.

Chembu, Vembanad Lake, Travancore. H. S. Rao and M. Sharif. January 1928. 5 ♂♂, 6 ♀♀.

Remarks.—These specimens agree with the Chilka Lake form figured by Chilton. I am not prepared to follow Chilton in identifying this form with Dana's *gracilis*. If Bate's figure (*Cat. Amph. Brit. Mus.* 1862, pl. ii, fig. 5) of Dana's species is correct (I have not seen Dana's original figure), there is the difference in the breadth of the 2nd joints of peraeopods 3-5, a character utilised by Stebbing (1906) in his key. Chilton may be correct, but one would like a little more evidence.

The hind margin of pleon segment 3 has a few minute serrations, thus Tattersall's key (1922, p. 454) breaks down on this character. The distinction between *japonica* Tattersall and *martensii* seems to be in the relative breadth of 2nd joint of gnathopod 2 ♂ and the shape of 2nd joint of gnathopod 2 ♀; the former is much narrower in *martensii*, and the latter has the greatest width about the centre in *martensii*, but near the base in *japonica*.

There is no crimping or sculpturing near lower margins of pleon segments 2 and 3 in the present specimens.

Distribution.—Flores, East Indies; Chilka Lake. Also Gulf of Manaar and Talé Sap, Siam.

Parorchestia Stebbing.

1906. Stebbing, *Das Tierreich* XXI, pp. 557, 735.
1909. Chilton, *Subantarctic Is. N. Zeal.*, p. 636.
1915. Chevreux in Sarasin & Roux, *Nova Caled. Zool.* II, p. 8.
1915. Baker, *Phillip. J. Sci.* X, p. 252.
1916. Barnard, *Ann. S. Afr. Mus.* XV, p. 226.

Baker's two species *luzonensis* and *lagunae* would seem to be the ♀ and ♂ respectively of one and the same species (*luzonensis*). I have not seen Chevreux's work (*P. sarasini* and *pusilla*).

Parorchestia notabilis, sp. nov.

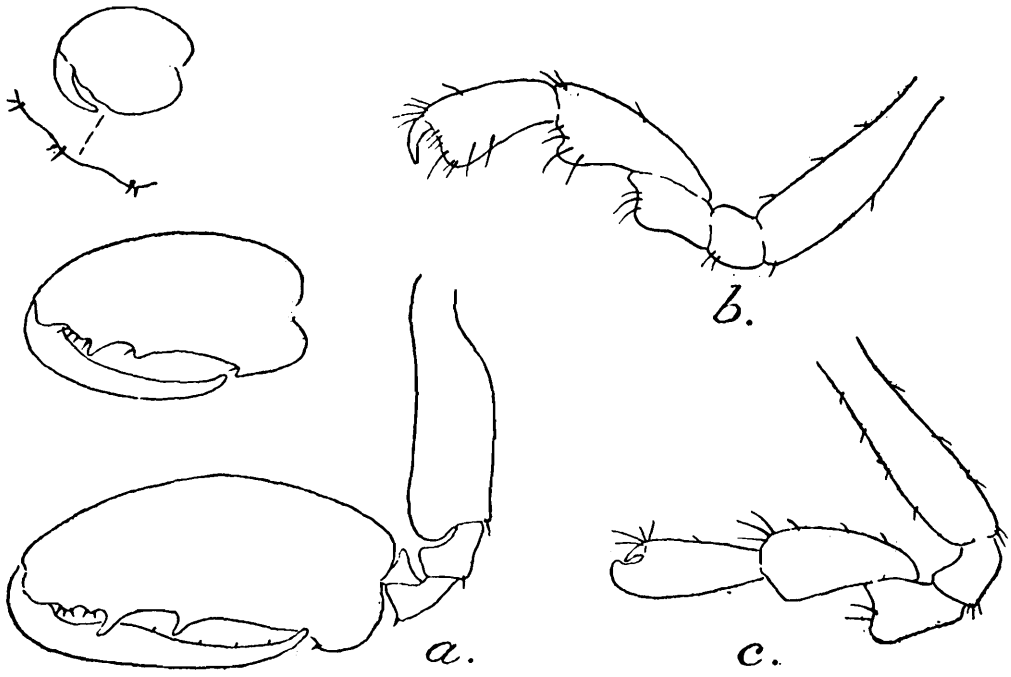
Localities.—From rotten screw-pine, Vypin, Cochin State. H. S. Rao. January 1928. 30 ♂♂, 42 ovig. ♀♀, 7 juv.

Cheppanam, Cochin State. H. S. Rao. January 1928. 6 ♂♂, 11 ♀♀.

Cheriya Kadamakudi, Cochin. H. S. Rao. January 1928. 4 ♂♂, 4 ovig. ♀♀.

Description.—Eyes large, subcircular, narrowly separated dorsally. Side-plate 1 smaller than and partly concealed by side-plate 2, 2-4 with small projection on hind margin, lower margins of 1-4 with minute and widely spaced spinules. Postero-inferior angle of pleon segment 3

quadrate with small blunt point, margin above smooth. Telson subtriangular, the apex rounded-truncate, with 2-3 setae at each corner.



TEXT-FIG. 8.—*Parorchestia notabilis*, sp. nov. *a*. stages in growth of hand of gnathopod 2 of males respectively 3, 5, and 10 mm. in length ; *b*. gnathopod 1 ♀ ; *c*. gnathopod 2 ♀.

Antenna 1 reaching slightly beyond apex of peduncle of antenna 2, 2nd and 3rd peduncular joints subequal, each slightly longer than 1st, flagellum 8-10-jointed. Antenna 2 about $\frac{1}{3}$ length of body, 4th peduncular joint about $\frac{2}{3}$ length of 5th, flagellum 12-jointed. Mouthparts typical.

Gnathopod 1 typical, stronger in ♂ than ♀. Gnathopod 2 ♀ typical. In ♂ strongly developed, 6th joint ovate, the straight palm occupying the greater part of hind margin, from which it is separated by a slight step, one conical tooth in middle of palm, a slightly larger one distally, and 2 small rounded projections between the latter and the hinge, inner margin of finger sinuous.

Peraeopods 3-5, 2nd joints broadly oval, hind margins with slight and widely-spaced setiferous indents. Fingers of all peraeopods not markedly constricted.

Uropods 1 and 2, marginal spines fewer on the outer than on the inner rami. Uropod 3, peduncle with 1 stout spine on outer margin, ramus shorter than peduncle, tipped with 4-5 setae.

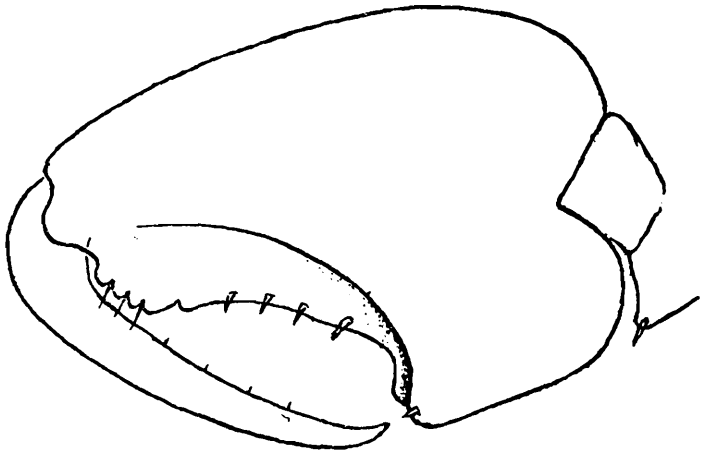
Length : ♂ 9-10 mm., ♀ (ovig.) 5-7 mm. Straw coloured, eyes black.

Parorchestia sp.

Locality.—Port Blair, St. B 7, Andaman Islands. Dr. S. W. Kemp.

Remarks.—One ♂ 6·5 mm., 3 ovig. ♀♀ largest 5·5 mm., and 4 juv. ♂♂ are to be referred to a species of this genus, but I do not feel inclined on

such scanty material to apply a specific name. A figure of the hand of gnathopod 2 ♂ is given.



TEXT-FIG. 9.—*Parorchestia* sp. Port Blair, Andaman Is. Outer view of gnathopod 2 ♂.

Hyale Rathke.

1906. Stebbing, *Das Tierreich* XXI, pp. 559, 735.

The series of specimens from the following localities provides an interesting problem in systematics, the solution of which must await the comparison of material from more numerous localities. Although here recorded as forms of one species, mainly in deference to Schellenberg's 1928 opinion (*vide infra*), I incline to the opinion that two distinct species should be recognized.

Hyale brevipes Chevr.

Typical form (*cf.* Chilton's figures).

1901. Chevreux, *Mem. Soc. Zool. France* XIV, p. 400, figs. 15-18.
1903. Walker & Scott, *Nat. Hist. Sokotra*, p. 219, pl. xiv a, fig. 3 *a-e* (*nilssoni non* Rathke).
1921. Chilton, *Mem. Ind. Mus.* V, p. 545, fig. 9.
1925. *id.*, *Mem. Asiat. Soc. Bengal* VI, p. 536.
1933. Shoemaker, *Amer. Mus. Novit.* No. 598, p. 18, figs. 10, 11.

Locality.—Large creek close to Tumidalametta Hill, 336 ft., Vizagapatam. H. S. Rao and G. Varugis. May, June 1926. A lot ♂♂, ovig. ♀♀, and juv.

Remarks.—Antennae shorter than in the descriptions of Chevreux and Chilton, the 2nd antennae being equal to the head *plus* first 2 peraeon segments; flagellum of antenna 1 8-jointed, of antenna 2 8-10-jointed.

Gnathopod 1 as in Chilton's figure of ♀ (9 *d*), but 6th joint broader in proportion to length in ♂ than in ♀; anterior apex of 2nd joint not prominent. Finger in ♂ tapering evenly, not abruptly narrowed (aquiline) as in Chevreux's fig. 18.

Gnathopod 2, 2nd joint with anterior apex not so prominently lobed, especially in ♀ where it is merely rounded; 6th joint in ♀ as in Chilton's fig. 9 *e*, with a very slight indent on hind margin; 6th joint in ♂ as here figured for the aquiline form (fig. 10 *d*), the palm defined by a definite though blunt angle, with 2-3 stout spines.

Hind margin of 6th joint of peraeopod 5 with a single fine setule at about ¾ its length (in peraeopod 4 3-4 such setules).

Length 5-6 mm. (♀♀ smaller than ♂♂).

Distribution.—Seychelles ; Sokotra ; Red Sea ; Ceylon ; Maldive Archipelago ; Talé Sap, Siam ; West Indies.

AQUILINE FORM.

1928. Schellenberg, *Trans. Zool. Soc. London* XXII, p. 658.

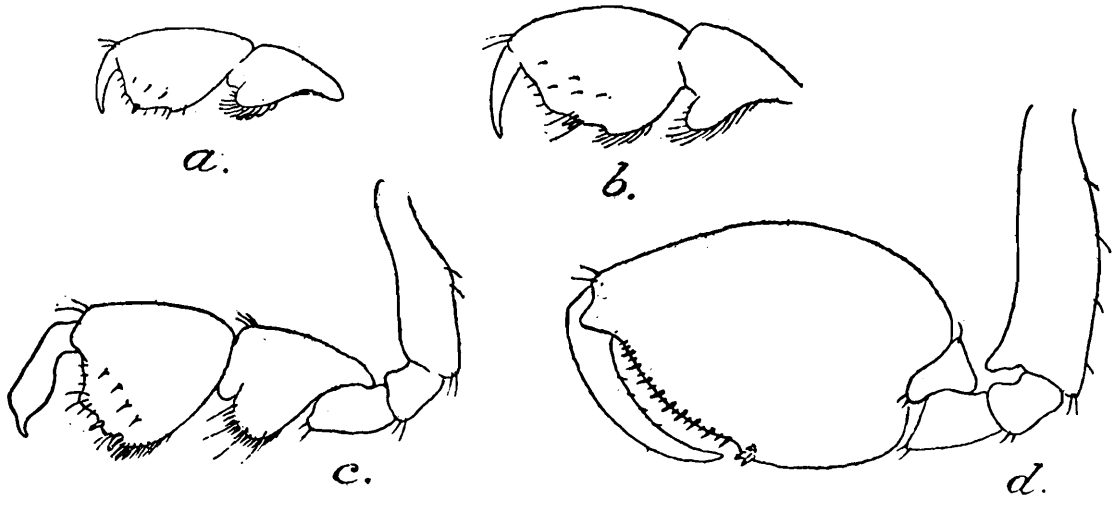
Localities.—Kayankulam Bar, Travancore. H. S. Rao and M. Sharif. February 1928. A lot ♂♂, ovig. ♀♀, and juv.

Tannirmukkam, Vembanad Lake, Travancore. H. S. Rao and M. Sharif. January 1928. A lot ♂♂, ovig. ♀♀, and juv.

Cheppanam, Cochin State. H. S. Rao. January 1928. 1♂, 1♀.

Chellanum, Cochin State. H. S. Rao. January 1928. A lot ♂♂, ovig. ♀♀, and juv.

Remarks.—As far as can be judged in the absence of figures, Schellenberg's Suez Canal specimens are very like the present specimens. The former, however, have the finger of gnathopod 1 ♂ thick but " symmetrically-formed ", and thus lack one of the features which are so distinctive of the latter specimens, and which has suggested the name given above to this form.



TEXT-FIG. 10.—*Hyale brevipes* Chevr. Aquiline form. *a, b.* 1st and 2nd gnathopods ♀ ; *c, d.* 1st and 2nd gnathopods ♂, the latter in inner view to show apex of 5th joint.

The aquiline finger and the broad hand of gnathopod 1 ♂, and the hands of both gnathopods 1 and 2 ♀ in the present specimens show an extraordinary resemblance to those of *Allorchestes aquilinus* (Costa). There is also the same sexual difference in the maxilliped, though the flagellum of antenna 2 is shorter (16-jointed) than in the description of Chevreux and Fage (1925, *Faune de France, Amphip.*, p. 289, figs. 300, 301).

In two points, however, they differ : *A. aquilinus* apparently has no armature on the hind margin of 6th joint of peraeopod 5, whereas our specimens have 2 groups of 2-3 stout spinules (less marked in ♀ than in ♂) ; secondly (and this is a generic difference between *Allorchestes* and *Hyale*) the 5th joint of gnathopod 2 ♂ has only a very short blunt

lobe on inside, whereas in *aquilinus* it is produced as a distinct, though narrow process between the 4th and 6th joints.

The typical form and the aquiline form differ markedly in the armature of the hind margin of 6th joint of peraeopod 5, and in gnathopod 1 ♂ and both gnathopods ♀.

Differences in length of the antennae are perhaps of no great importance (*vide supra*), and it remains to be determined to what extent they vary in different colonies or localities.

The only facts which might be claimed as showing a transition between the two forms are: on the one side Schellenberg's description of the symmetrically formed finger of gnathopod 1 ♂, and on the other side Chevreux's figure of the same joint in his original description of *brevipes* (*l.c.*, fig. 18).

I submit, however, that these are outweighed by the differences, and that the aquiline form here figured should be given a specific name, unless it can be proved that the " aquiline " form is but the fully developed stage of the " typical " form, in which case the difference in the hind margin of 6th joint of peraeopod 5 (a character used in the specific diagnoses of other species also) must go by the board.

Length 6-7 mm. (♀♀ smaller than ♂♂).

Parhyalella Kunkel.

1910. Kunkel, *Trans. Connect. Ac. Sci.* XVI, p. 74.
1917. Stebbing, *Ann. Mag. Nat. Hist.* (8) XX, p. 435. (*Exhyalella.*)
1925. Barnard, *Ann. S. Afr. Mus.* XX, p. 359.

The genus contains one species from Bermuda and one from Natal. Its presence in India is interesting, though not unexpected.

Parhyalella indica, sp. nov.

Locality.—Tuticorin Harbour, shore collecting. H. S. Rao. February, March 1926. ♂♂, ovig. ♀♀, and juv.

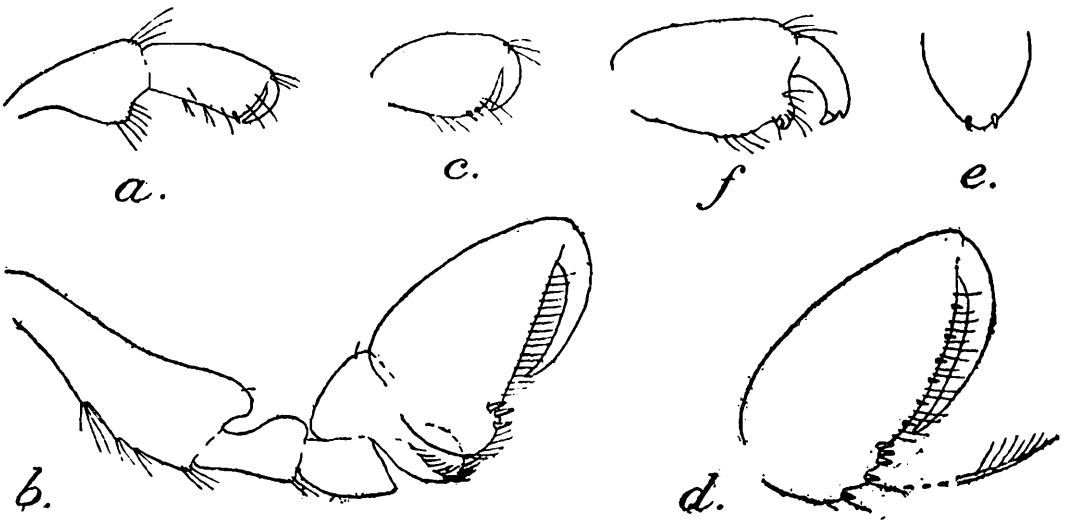
Description.—In general very like *natalensis* (Stebb.) and differing only in a few characters, which may later prove to be unimportant, but to which it is desirable to draw attention.

Flagella of both antennae 13-14-jointed (*natalensis*: 17-18).

Gnathopod 1. In the ♂ the palm is more convex than in ♀, defined by 2 spines. In none of the present specimens does the 6th joint show the peculiarities of the *fully developed* ♂ of *natalensis*, a figure (fig. 11 *f*) of which is given here for comparison.

Gnathopod 2. The lobes on the anterior apices of 2nd and 3rd joints are better developed in ♀ than in ♂, especially that on the 2nd joint, as is also the case in *natalensis*. The 6th joint has a slightly convex palm in ♂, furnished with spines and setae; in the ♀ the palm is straight and is furnished with a dense brush of setae; in both sexes the palm is defined by a slight notch and 3 spines, posterior to which in ♂ there are 2 more notches, each with a spine and seta; except that the palm is more densely setose in both ♂ and ♀ *natalensis*, the present specimens are in close agreement, but whereas in ♂ *natalensis* the palmar

setae are perfectly simple, in *indica* both those on the palm and posterior to it are unilaterally plumose.



TEXT-FIG. 11.—*Parhyalella indica*, sp. nov. *a*, *b*. 1st and 2nd gnathopods ♀ ; *c*, *d*. hands of 1st and 2nd gnathopods ♂ ; *e*. telson ; *f*. hand of gnathopod 1 ♂ of *P. natalensis* (Stebb.) for comparison.

Peraeopods 3-5, 2nd joint less broadly expanded than in *natalensis*.

Telson obtusely ovoid (when flattened), bearing 2 spinules near the apex (as in *natalensis*).

Length 7-8 mm. Colour (as preserved) uniform whitish, eyes black.

Remarks.—It is quite likely that this species will be merged in *natalensis* later, as both occur in the same faunal region. Nevertheless they are separated by a big distance, and for the present it is preferable to insist on even small structural differences.

Stebbing's figures of *natalensis* (*Ann. Durban Mus.* II, pl. xi, 1918) seem to have suffered in the course of lithographing and printing, and the present opportunity is taken of giving a figure of the peculiar hand of gnathopod 1 of the ♂ ; the other figures here given will also apply to *natalensis*, bearing in mind the points of difference set out above.

Family AORIDAE.

Grandidierella Coutière.

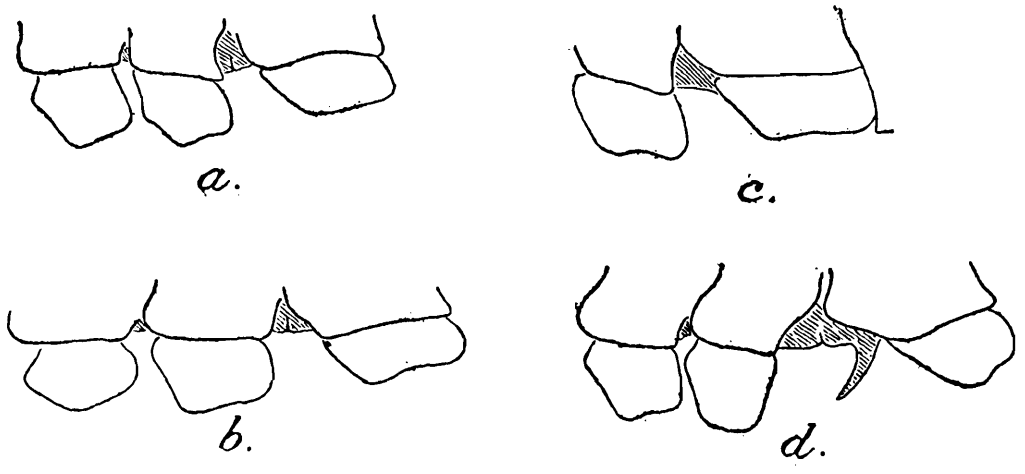
1904. Coutière, *Bull. Soc. Philomath. Paris* (9) VI, pp. 166, 173.
1908. Stebbing, *Rec. Ind. Mus.* II, p. 120.
1921. Chilton, *Mem. Ind. Mus.* V, p. 548.
1925. Chevreux, *Bull. Soc. Zool. France* L, p. 392.

It is with regret that I feel obliged to reopen the question of the synonymy of *G. megnae* (Giles), which Chilton had, apparently so satisfactorily, settled. Eventually perhaps we may unite the several forms under one specific name with varietal names, but for the present I submit that this is another case where the recording of forms from different localities under one name, without even varietal names, is certain to lead to trouble.

Whether in carrying out this principle of recording the forms under separate names, I have myself erred in assigning Chilton's form 1 (1921)

to Stebbing's *bonnieri*, Tattersall's (1922) Chinese specimens to *megnae*, and Chilton's (1925) Talé Sap form to a new species, must be decided by other students. Tattersall (1922) accepts Chilton's synonymy, and says that all his Chinese specimens belong to Chilton's form 1; but there are obvious differences in his figures. He alone up to the present seems to me to have had the true *megnae* of Giles.

In the specimens here assigned to *bonnieri*, there are ventral (sternal) spiniform processes on two of the peraeon segments in the adult ♂, a feature which is paralleled by certain species of other genera in this family (*e.g.*, *Lembos* and *Lemboides*). On the other hand no such processes are found in the form described as *gravipes*, nor in *gilesi*. Examples of *macronyx* (Chilton's form 2), the Chinese *megnae*, and *mahafalensis* should be examined for this character.



TEXT-FIG. 12.—*Grandidierella* Males. *a*. side-plates 1-3 of *gilesi* Chilton; *b*. the same of *gravipes*, sp. nov.; *c*. side-plates 1 and 2 of *mahafalensis* Cout. (drawn from Coutiére 1904); *d*. side-plates 1-3 of *bonnieri* Stebb.

Another feature, to which Giles, Stebbing and Schellenberg have referred, is the shape of the side-plates. I give figures of those of the three forms here examined, to show how largely they may differ. It will be observed that those of the form here identified with *bonnieri* agree well with Stebbing's upper figure (♂), except the 3rd side-plate. Stebbing, however, seems to have based his description on the ♀, where the side-plates in all the species are less distinctive than in the ♂. None of the present specimens will fit Giles' figure, nor his description of the 3rd side-plate as being the deepest.

While dealing with this genus, the opportunity is taken of including the description of a South African new species. This species also shows distinctively shaped side-plates in ♂, associated with a 1st gnathopod which, though built on the same plan as that of *bonnieri*, nevertheless differs in detail.

In view of these facts, it is merely confusing to speak of one variable "species" widely distributed over the tropical and subtropical regions; and it is even possible that a more detailed study and comparison will reveal that the Cameroon and Dutch West Indies specimens are specifically separable without incurring the criticism of "splitting".

The following synopsis of the species seems to show that they are easily run down and well distinguished :—

I. Ocular lobes short, obtuse. 6th joint gnathopod 2 ♂ with straight or convex palm.	
A. 6th joint gnathopod 1 ♂ broad, ovoid or subquadrangular.	
1. 6th joint gnathopod 2 ♂ distinctly widened to palm. 6th joint gnathopod 1 ♀ smaller than the trapezoidal 5th joint . . .	*megnae* (Giles).
2. 6th joint gnathopod 2 ♂ parallel-sided. 6th joint gnathopod 1 ♀ larger than the triangular 5th joint. Uropod 3 ♂ uncinately curving outwards	*gravipes*, sp. nov.
B. 6th joint gnathopod 1 ♂ narrow, at least at base. 6th joint gnathopod 2 ♂ nearly or quite parallel-sided.	
1. 4th joint gnathopod 2 ♂♀ not prominent. 6th joint gnathopod 2 ♂ shorter than 5th, nearly parallel-sided.	
a. 2nd joint gnathopod 1 ♂ moderate, nearly parallel-sided, cross-section subtriquetral.	
i. Side-plates 1 and 2 ♂ with even margins.	
a. A medio-ventral spine on peraeon segments 1 and 2 ♂	*bonnieri* Stebb. (Chilton's form 1).
b. Ventral spines ? . .	*mahafalensis* Coutière.
ii. Side-plates 1 and 2 ♂ with pointed projections on lower margins. No ventral spines	*lignorum*, sp. nov. (S. Africa).
b. 2nd joint gnathopod 1 ♂ robust, ovoid, cross-section ovoid. 7th joint long	*macronyx*, sp. nov. (Chilton's form 2).
2. 4th joint gnathopod 2 ♂♀ prominent. 6th joint gnathopod 2 ♂♀ equal to 5th, parallel-sided. 4th-6th joints with long plumose setae	*gilesi* Chilton.
II. Ocular lobes produced, subacute. 6th joint gnathopod 2 ♂ with concave palm	*elongata* Chevreux. (Senegal).

Grandidierella megnae (Giles).

1888. Giles, *J. Asiat. Soc. Bengal* LVII, p. 231, pl. vii, figs. 1-4.
1922. Tattersall, *Mem. Asiat. Soc. Bengal* VI, p. 455, pl. x, figs. 1-12.

There are no examples of this species in the present collection.

Gnathopod 1 ♂, 2nd joint robust, a single (apparently) spinous process at inner apex of 5th joint, 6th joint broad, 7th subequal in length to 6th ; in ♀ 5th joint trapezoidal (somewhat broadly rounded on inner margin in Tattersall's figure), 6th joint not longer than 5th, distinctly widened towards the moderately oblique palm.

Gnathopod 2 ♂, 6th joint distinctly widened towards the palm.

Distribution.—Megna Flats, Bay of Bengal ; China.

Grandidierella gravipes, sp. nov.

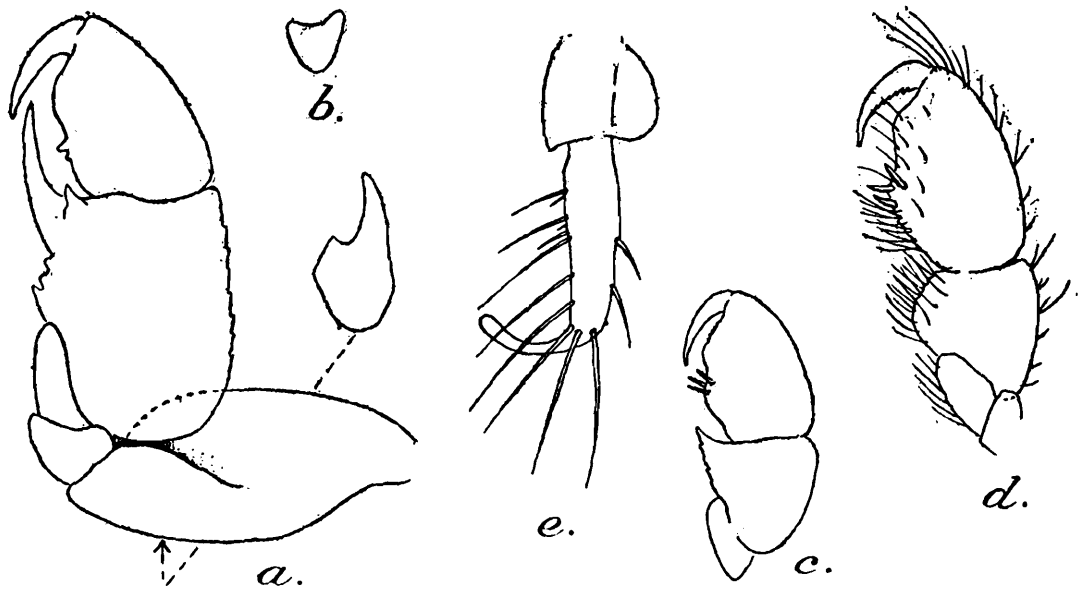
1925. Chilton, *Mem. Asiat. Soc. Bengal* VI, p. 536, fig. 2 (*megnae* non Giles).
? 1925. Schellenberg, *Kenntn. Meeresf. Westafr.* III, *Amphip.*, p. 166, fig. 17 (*megnae* Chilton, *non* Giles).

Localities.—Vembanad Lake, Travancore. H. S. Rao and M. Sharif. January 1928. 22 ♂♂, ovig. ♀♀, and juv.

Mundattalkari, Vaikom, Travancore. H. S. Rao and M. Sharif. 12 ♂♂, ♀♀, and juv.

Description.—No ventral spiniform processes in ♂. Ocular lobes obtuse. Antennae strongly setose.

Gnathopod 1 ♂, 2nd joint robust, ovoid, lower margin rounded, inner upper edge expanded, outer upper edge obsolete except distally, between the ridges a concavity into which the 5th joint fits when the limb is retracted, cross-section ovoid (fig. 13 *a*) ; 5th joint flat or slightly concave on inner face, convex externally, upper margin with minute setiferous notches, the smaller of the two spinous processes at the inner apex is on the outer surface (and liable to be overlooked), the larger on the inner surface ; 6th joint almost as broad at base as distal width of 5th joint, the two joints together when extended almost lanceolate in shape (disregarding the big process of 5th joint) ; 7th shorter than 6th. In young ♂ the gnathopod is very similar to that of ♀ (6th joint larger than 5th), but with indication of the development of the big process on inner apex of 5th joint. Gnathopod 2 ♂ with 6th joint parallel-sided.



TEXT-FIG. 13.—*Grandidierella gravipes*, sp. nov. *a*. outer view of gnathopod 1 adult ♂ (setae omitted) with cross-section of 2nd joint at level of arrow ; *b*. cross-section of same joint of *bonnieri* for comparison ; *c*. gnathopod 1 of young ♂ ; *d*. gnathopod 1 ♀ ; *e*. uropod 3 ♂.

Gnathopod 1 ♀, 5th joint subtriangular, inner margin rounded, 6th joint longer and larger than 5th, palm very oblique, sinuous, with 3 stout spines at defining angle, 7th with inner margin serrulate.

Uropod 3♂, apex of ramus uncinately curved outwards, thin, transparent, and slightly spatulate.

Remarks.—Gnathopod 1 is distinctive in both sexes. In no other species is the 6th joint in ♀ longer and larger than the 5th.

As regards the 3rd uropod in ♂, Stebbing (1908, p. 123, pl. vi, urp. 3) mentioned that one of his ♂ specimens had the ramus curved *inwards* ; although the curvature was symmetrical on both sides, he considered it abnormal. I did not find a similar curved ramus in any of the specimens here assigned to *bonnieri* ; and it can in no way be confused with the very distinctive form of ramus exhibited by every adult ♂ of the present species.

Schellenberg's original intention of describing his Cameroon specimens as distinct from *megnae* was certainly correct; but I would not like to say whether they are conspecific with the Indian form here described.

Distribution.—Talé Sap, Siam; ? Cameroon.

Grandidierella bonnieri Stebbing.

1908. Stebbing, *Rec. Ind. Mus.* II, p. 120, pl. vi.
1921. Chilton, *Mem. Ind. Mus.* V, p. 548, figs. 10 *a-l* (form 1 ; *megnae, non* Giles).
? 1933. Stephensen, *Zool. Jahrb. abt.Syst.* LXIV, pp. 434, 446.

Localities.—In pools close to Harbour Railway, Vizagapatam. H. S. Rao and G. Varugis. May, June 1926. Several ♂♂ and ovig. ♀♀, more or less mutilated.

West Narakkal, Cochin. H. S. Rao. January 1928. 1 ♂ 7 mm. 1 ovig. ♀ 5·5 mm., 3 juv.

Kayankulam Kayal, Travancore. H. S. Rao and M. Sharif. February 1928. 1 immat. ♂, 12 ovig. ♀♀, 1 juv.

Among weeds in brackish channel on road to Tiruppunithura, Cochin H. S. Rao and M. Sharif. December 1927. 29 ♂♂, ovig. ♀♀, and juv.

In mud opposite Vizag. railway station, Vizagapatam. H. S. Rao and G. Varugis. May, June 1926. A lot ♂♂, ovig. ♀♀, and juv.

Kayankulam Bar, Travancore. H. S. Rao and M. Sharif. February 1928. 2 ♂♂, 8 ovig. ♀♀, 2 juv.

Manakudi, Travancore. M. Sharif. February 1928. 8 ♂♂, 6 ovig. ♀♀.

Description.—A medio-ventral spiniform, backwardly directed process on peraeon segment 1 in (adult) ♂, and a smaller one on segment 2.

Gnathopod 1 ♂, 2nd joint moderate, nearly linear (not ovoid), lower margin rounded, upper margin keeled along both inner and outer edges, the former not expanded and raised as in *gravipes*, cross-section therefore triquetral (fig. 13 *b*); 5th joint not narrowing distally, a strong spinous projection on inner apical corner, a smaller one on distal margin, and a small one on lower margin at about $\frac{2}{3}$ length; 6th joint narrow at base, distally somewhat expanded and rounded; 7th not longer than 6th, somewhat expanded on inner margin proximally, outer margin nearly straight.

Gnathopod 1 ♀, 5th joint trapezoidal, 6th shorter than 5th, ovoid, palm very oblique.

Gnathopod 2 ♂♀, 6th joint almost parallel-sided.

Remarks.—Stephensen says (*l.c.*, p. 434) the Dutch West Indies specimens were not dissected, but had gnathopod 1 and other limbs not different from Stebbing's figure. Nevertheless I think they should be re-examined.

Distribution.—Port Canning, Bengal; Chilka Lake; Bonaire and Curaçao, Dutch West Indies.

Grandidierella macronyx, sp. nov.

1921. Chilton, *Mem. Ind. Mus.* V, p. 548, figs. 10 *m*, *n*, *o*. (form 2 ; part *megnae*, *non* Giles).

Description.—Gnathopod 1 ♂, 2nd joint robust, 5th slightly narrowing distally, spinous process on distal margin much larger than that on inner distal angle ; 6th joint narrow, inner distal margin with angular tooth ; 7th longer than 6th. Gnathopod 2 ♂ and gnathopods 1 and 2 ♀ ?

Distribution.—Chilka Lake.

Grandiderella gilesi Chilton.

1921. Chilton, *Mem. Ind. Mus.* V, p. 552, fig. 11.
1925. *id.*, *Mem. Asiat. Soc. Bengal* VI, p. 537.

Localities.—Large creek close to Tumidalametta Hill, 336 ft. Vizagapatam. H. S. Rao and G. Varugis. May, June 1926. 1 ♀.

On stake-net, Manumbam channel, Travancore. H. S. Rao. January 1928. A large number ♂♂, ovig. ♀♀, and juv.

Remarks.—No ventral spiniform processes on peraeon segments in ♂.

Distribution.—Chilka Lake ; Talé Sap ; Patani River, Siamese Malay States.

Grandidierella mahafalensis Coutière.

1904. Coutière, *l.c.*, pp. 166-173, figs. 1-19.

I have interpolated this species where it apparently belongs in the key, and give a figure of the side-plates 1 and 2 ♂ enlarged from Coutière's very small habitus figure. These plates clearly differ from those of the specimens here assigned to *bonnieri*. The really conclusive criterion as to the distinctness of these species is the presence or absence of sternal spines.

Distribution.—Madagascar.

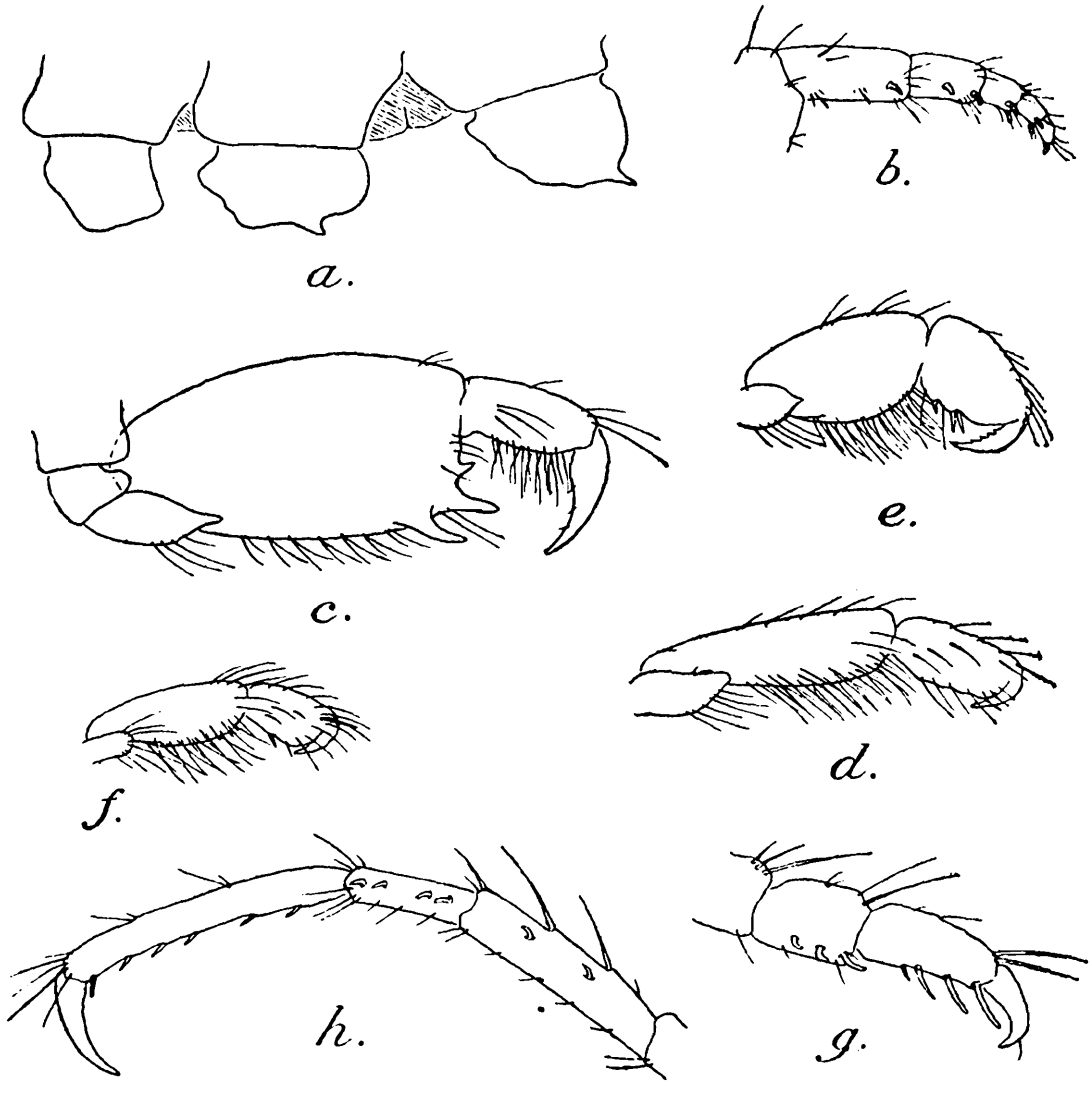
Grandidierella lignorum, sp. nov.

Locality.—Keurbooms River estuary, Plettenberg Bay, South Africa. (K. H. B. January 1931.) Under water-logged tree-trunks and drift-wood. ♂♂, ♀♀, and juv.

Description.—Ocular lobes short, obtuse. In ♂ side-plate 1 subtriangular, margin undulate, with a sharp point on lower anterior angle, side-plate 2 longer than deep, margin undulate, with a sharp point, but smaller than that on side-plate 1, side-plate 3 subquadrangular.

Antennae moderately setose. Antenna 1 slender, much longer in ♂ than ♀, 2nd peduncular joint $1\frac{1}{2}$ times 1st in ♂, $1\frac{1}{4}$ in ♀, 3rd nearly 4 times in length of 2nd in ♂, not quite 3 times in ♀, flagellum 18-19-jointed in ♂, 16-jointed in ♀, accessory flagellum microscopic, barely visible. Antenna 2 moderate, nearly as long as antenna 1 in ♀, in ♂ shorter and very stout, 5th peduncular joint about $\frac{2}{3}$ length of 4th, flagellum 5-jointed in ♂, with a stout curved spine on either side of each joint, in ♀ 4-jointed, with slender spines.

Gnathopod 1 ♂, 2nd joint moderate, parallel-sided, subtriquetral in cross-section (*cf.*, *bonnieri*), 5th with pointed process on lower distal



Text-fig. 14.—*Grandidierella lignorum*, sp. nov. South Africa. *a.* side-plates 1-3 ♂; *b.* flagellum of antenna 2 ♂; *c.* inner view gnathopod 1 ♂ (finger drawn slightly too long); *d.* gnathopod 2 ♂; *e.* gnathopod 1 ♀; *f.* gnathopod 2 ♀; *g.* 5th-7th joints of peraeopod 3; *h.* 4th-7th joints of peraeopod 5.

corner, a smaller one between it and junction of 6th joint, and a third process on hind margin, subapical and arising from inner surface of joint. 6th fusiform, narrow basally, inner edge thin, cultrate, 7th shorter than 6th, slightly enlarged at base, outer margin gently curved. In ♀ 5th joint ovoid-subtrapezoidal, 6th shorter and smaller, oval, with oblique palm marked with 2 stout spines.

Gnathopod 2 ♂, 5th joint rather elongate, 6th slightly more than ½ length of 5th, parallel-sided (or slightly fusiform), palm short, transverse, lower margin slightly undulate. In ♀ similar but not so elongate as in ♂, 6th joint very slightly wider at transverse palm than at base.

Peraeopods in general as in Stebbing's figures of *bonnieri*. Fifth joint in peraeopods 1 and 2 nearly twice as long as broad (*cf.*, Tattersall's fig. 7, *l.c.*, 1922). Fifth and 6th joints in peraeopod 3, and 4th and 5th joints in peraeopods 4 and 5 with stout, more or less curved, submarginal (on outer surface) spines in addition to the marginal armature. Distal

part of hind margin of 2nd joint in peraeopod 4 with a few plumose setae, whole margin of 2nd joint in peraeopod 5 with numerous plumose setae.

Uropod 3 with straight ramus in both sexes.

Length 5·5—6 mm. Colour: whitish with grey dendritic speckling, eyes black.

Remarks.—Giles and Schellenberg have referred to the association of *Grandidierella* with logs and drift-wood; Giles stating that the animals merely took advantage of the opportunity of concealing themselves, and Schellenberg observing that the animals are not to be regarded as true boring Crustacea. The South African specimens were taken lying on the mud after a log had been lifted up, and also from hollows on the underside of the log. It is hoped that this association with logs will not be cited in evidence of the "floating log" theory of distribution.

Family PHOTIDAE.

Photis digitata, sp. nov.

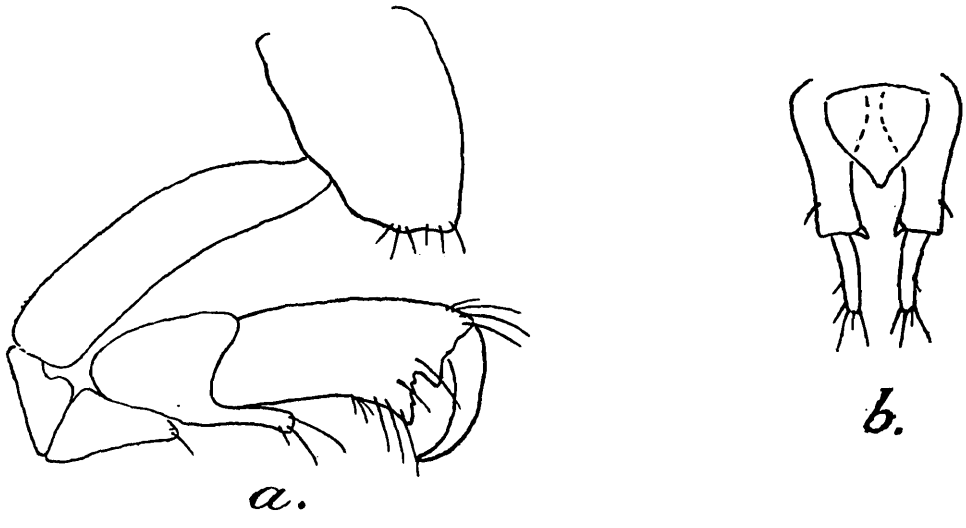
1921. Chilton, *Mem. Ind. Mus.* V, p. 554, fig. 12 (*longicaudata, non* Bate & Westwood).
1925. *id., Mem. Asiat. Soc. Bengal* VI, p. 537 (*longicaudata* ?).

Localities.—Between Ernakulam and Edappalli, Cochin. H. S. Rao. January 1928. 1 ♂, 2 ovig. ♀♀.

In stake-net Manumbam Channel, Travancore. H. S. Rao. January 1928. 10 ♂♂.

Description.—Ocular lobes reaching to middle of 1st joint of antenna 1. Eyes large, round-oval. Telson triangular, apically pointed.

Flagellum of 1st antenna 6-jointed, of 2nd antenna 5-jointed.



TEXT-FIG. 15.—*Photis digitata*, sp. nov. *a*. side-plate and gnathopod 2 ♂; *b*. telson and 3rd uropods.

Gnathopod 2 ♂, 2nd joint considerably more elongate and narrower than in *longicaudata* (this joint not figured by Chilton), 5th joint with lower lobe produced in a digitate process extending half way along hind margin of 6th joint, the latter elongate, its breadth $1\frac{2}{3}$ (Chilton's figure) to 2 times in its length, palm with prominent defining angle and a large

triangular tooth near the hinge. In ♀ limb less elongate (see Chilton's figure), the digitate process of 5th joint not so developed as in ♂, but prominent, palm oblique, in the present specimens more concave than in Chilton's figure.

Uropod 3, outer ramus more slender than and slightly shorter than peduncle, 2nd joint very minute, inner ramus reduced to a mere spinule.

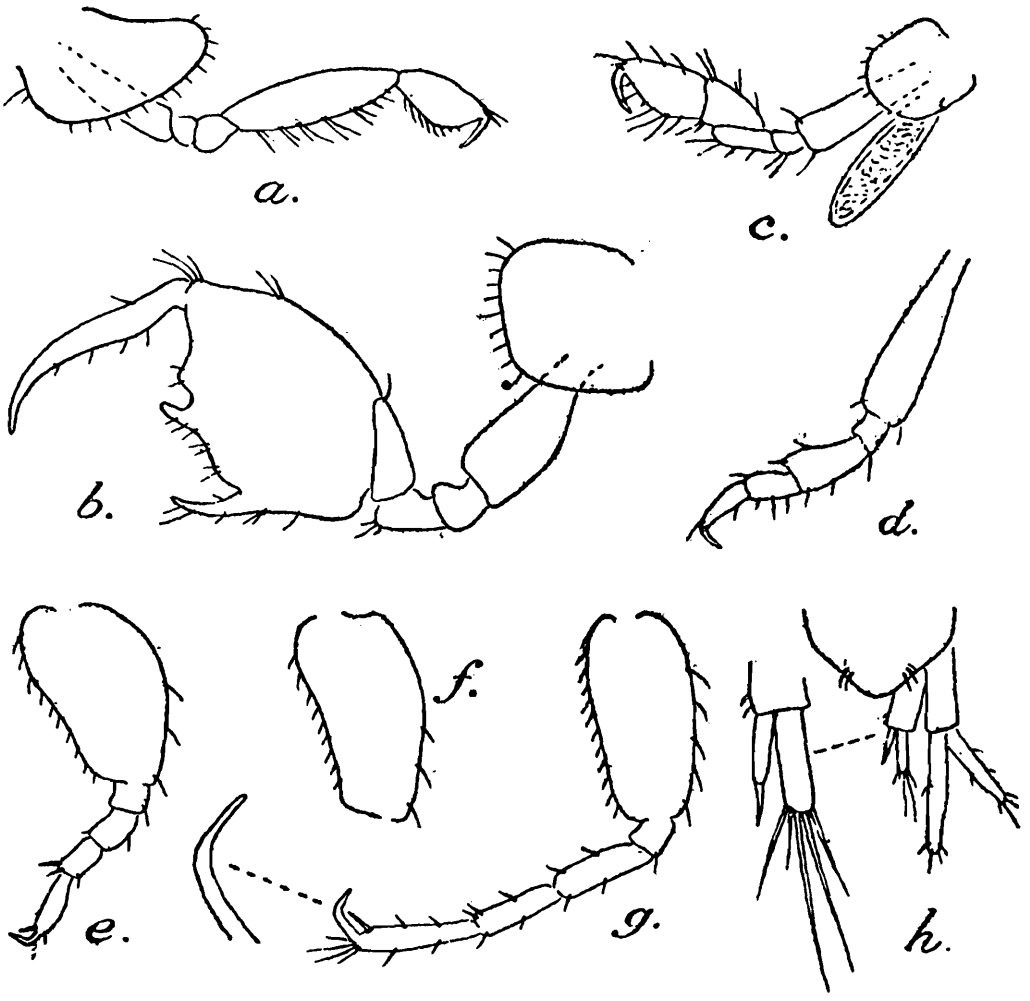
Length 3mm. Colour (as preserved) whitish, with grey mottling chiefly on peraeon segments 2-4, side-plates 1-4 and pleurae of pleon segments 1-3, a transverse band on hind margins of peraeon segments 5-7, peduncles of uropods 1 and 2; eyes black.

Remarks.—The very distinctive 2nd gnathopod of ♂, together with the 3rd uropod, and perhaps also the telson, seem to justify specific rank for this form.

Distribution.—Chilka Lake; Talé Sap, Siam.

Photis geniculata, sp. nov.

Locality.—Vatta Kayal, Alleppey, Travancore. H. S. Rao and M. Sharif. January 1928. ♂♂, ovig. ♀♀, and juv.



TEXT-FIG. 16.—*Photis geniculata,* sp. nov. *a.* gnathopod 1 ♂; *b.* gnathopod 2 ♂; *c.* gnathopod 2 ♀; *d.* peraeopod 1; *e.* peraeopod 3; *f.* 2nd joint of peraeopod 4; *g.* peraeopod 5; *h.* telson and uropods 2 and 3, with the latter further enlarged.

Description.—Ocular lobes strongly produced, extending to, or almost to end of 1st joint of antenna 1. Eyes large, occupying whole of the lobe. Head including ocular lobes equal in length to peraeon segments

1 and 2 together. Peraeon and pleon smooth. Side-plate 1 much the largest, expanding below, lower hind corner quadrangular, lower front corner produced forwards covering the mouth-parts, bluntly rounded (*cf. Liljeborgia*) side plates 2-4 smaller, quadrangular, about as long as deep, lower angles rounded, 4 not excavate behind, lower margins of 1-4 sparsely setose ; 5-7 decreasing in size, 5 and 6 bilobed, 7 ovoid.

Postero-inferior angle of pleon segment 3 rounded. Telson short, subtriangular, with 2 pairs of setules near apex.

Antenna 1 slender, very strongly setose, 1st and 3rd joints subequal, 2nd slightly longer, flagellum subequal to 2nd plus 3rd joints, 7-8-jointed, no accessory flagellum. Antenna 2 a little longer than antenna 1, in ♀ slightly stouter than 1st, but still slender, in ♂ considerably stouter than antenna 1, sparsely setose, flagellum 7-jointed, slightly longer than 5th peduncular joint.

Mouth-parts as in *Photis*, but mandibular palp rather slender (*cf.*, *Podoceropsis*, Sars, *Crust, Norway* I, pl. cciv).

Gnathopod 1, 2nd joint not distally expanded, 5th fusiform, 6th rather more than half length of 5th, palm oblique.

Gnathopod 2 ♀ a little larger than gnathopod 1, 5th joint not produced at lower distal corner, 6th ovate, not wider than 5th, palm oblique. In ♂ greatly enlarged, 2nd joint enlarged distally, 5th comparatively small, cup-shaped, 6th large, obliquely oval, palm oblique, defined by a prominent spiniform process, with another smaller process in middle and a low rounded projection between the latter and hinge, finger with sinuous inner margin.

Peraeopods 1 and 2 not very stout, feebly setose, unguis straight.

Peraeopods 3-5, 2nd joint in peraeopod 3 obliquely ovate, hind margin slightly concave, in peraeopod 4 more oblong, in peraeopod 5 oblong-oval, hind margin in all three peraeopods entire, with sparse setules ; 3rd-6th joints not strongly spinose or setose ; unguis in all three peraeopods slender, geniculate, without accessory denticle on outer margin.

Uropods 1 and 2 moderately spinose. Uropod 3, outer ramus a little shorter than peduncle, tipped with 4-5 setae, inner ramus sbout $\frac{2}{3}$ length of outer ramus, tipped with one spine which reaches a trifle beyond apex of outer ramus.

Length 3 mm. Colour, as preserved, whitish with greyish speckling on peraeon and pleon, eyes black.

Remarks.—The first glance at the 2nd gnathopod of the ♂ gave the impression that these specimens were *Podoceropsis insignis* Chilton 1921 ; closer examination, however, showed that they could not belong to this species in spite of the brevity of Chilton's description. Chilton describes only the antennae and gnathopods, leaving it to be presumed that the other features, such as the peraeopods and uropods, were typical of the genus (*cf.*, Sars, *Crust, Norway* I, pls, cciv, ccv).

The strongly produced ocular lobes resemble those of *Photis dolichommata* Stebb. The antennae are not densely setose as in *Podoceropsis insignis*. The mandibular palp is more like that of *Podoceropsis* than that of *Photis*. The 5th joint of 1st gnathopod proportionately to the 6th is longer than in Chilton's species.

The large size of the 1st side-plate and the geniculate ungues of peraeopods 3-5 are sufficiently distinctive to justify a new specific name for the present specimens. The inclusion of the species in the genus *Photis*, however, is to be regarded as a *pis aller*.

Family AMPITHOIDAE.

Ampithoe ramondi (Audouin).

1826. Audouin, *Descr. Egypte.* I, p. 93, Crust. pl. xi, fig. 6 (♀).
1846. Lucas, *Expl. Alger.* I, p. 54, *Crust.* pl. v, fig. 3 (♂).
?1888. Giles, *J. Asiat. Soc. Bengal* LVII, p. 240, pl. x, figs. 1-7 (*inda*).
1904. Walker in Herdman, *Ceylon Pearl Fish. Rep.*, p. 290, pl. vii, fig. 46 (*intermedia*).
1909. *id.*, *Trans. Linn. Soc. London* XII, p. 342, pl. xliii, fig. 9 (*lobata*).
1916. Barnard, *Ann. S. Afr. Mus.* XV, p. 253 (*vaillanti*) (references).
1928. Schellenberg, *Trans. Zool. Soc. London* XXII, p. 665.

Locality.—Tuticorin Pearl Banks. B. Prashad. April 1927. 1 ovig. ♀. 7 mm.

Remarks.—It is probable that *A. inda* (M. Edw.) 1830 should be included in the synonymy of this species.

Distribution.—Western Europe; Mediterranean; Indian Ocean; Southern Pacific; Azores; South Africa.

Family COROPHIIDAE.

Corophium triaenonyx Stebbing.

1904. Stebbing, *Spol. Zeylanica* II, p. 25, pl. vi A.
1921. Chilton, *Mem. Ind. Mus.* V, p. 555.

Localities.—Backwater between Ernakulam and Edappalli, Cochin. H. S. Rao. January 1928. 31 ♂♂, ovig. ♀♀, and juv.

Quilon, Travancore. H. S. Rao and M. Sharif. February 1928. A lot ♂♂, ovig. ♀♀, and juv.

Neendakara Bar, Travancore. H. S. Rao and M. Sharif. February 1928. 13 ♂♂, ovig. ♀♀, and juv.

Vembanad Lake, Travancore. H. S. Rao and M. Sharif. January 1928. 3 ♂♂, 1 ♀.

Remarks.—Chilton (1921) doubted whether *triaenonyx* was more than a local variety of *crassicorne*, thereby completely ignoring the character of pleon segments 4-6, which are distinct in the former, and coalesced in the latter species. As this character is accepted by other authors (*e.g.*, Sars, Chevreux and Fage) Stebbing's species may be allowed to stand.

Distribution.—Ceylon; Chilka Lake. I have also collected the species in South Africa.

Family PODOCERIDAE.

Podocerus brasiliensis (Dana).

1904. Walker, *l.c.*, p. 296, pl. viii, fig. 52 (*synaptochir*).
1909. *id.*, *l.c.*, p. 243 (*synaptochir*).
1916. Barnard, *l.c.*, p. 279 (*synaptochir*).
1917. Stebbing, *Ann. Durban Mus.* I, p. 447.
1925. Barnard, *Ann. S. Afr. Mus.* XX, p. 366.
1927. Gravely, *Bull. Madras Govt. Mus.* (n.s.) I, p. 123.
1928. Schellenberg, *l.c.*, p. 674.

Locality.—Neendakara Bar, Travancore. H. S. Rao and M. Sharif. February 1928. 2 ♂♂, 5 ovig. ♀♀.

Remarks.—Although the identity of Walker's *synaptochir* appears to be correct, I am not aware that a direct comparison has been made with actual South American specimens. Dr. Gravely's specimens were identified by the late Dr. Chilton.

Distribution.—Ceylon; Gulf of Manaar; Suez, Port Said; Dar-es-Salaam, Zanzibar, Natal; Rio de Janeiro, and Antigua, W. I.

ISOPODA.

Family ANTHURIDAE.

1925. Barnard, *J. Linn, Soc. London* XXXVI, p. 109 (revision).
1927. Monod, *Bull. Soc. Zool. France* LII, p. 200.

Chilton in 1924 recorded *Calathura borradalei* from the Chilka Lake. This species has now been placed in the genus *Accalathura.* (Barnard, *l.c.*).

Cyathura indica Barnard.

1925. Barnard, *l.c.*, p. 140, pl. iv, fig. 7.

Locality.—Quilon, Travancore. H. S. Rao and M. Sharif. February 1928. 1 ovig. ♀.

Remarks.—There are three pairs of oostegites, enclosing 7 large ova.

Length 3·75 mm. Pale straw colour, with brown dendritic mottling forming a fairly well defined T-shaped mark on head, a median longitudinal line on the hinder peraeon segments, and irregular markings laterally; eyes black.

It is possible that the specimen recorded by Stebbing from Wasin, B. E. A. (1910, *Trans. Linn. Soc. London* XIV, p. 91), as *C. pusilla* should be identified with the present species because it had dark eyes—a point overlooked by me in my 1925 paper.

Apanthura sandalensis Stebbing.

1900. Stebbing, *Willey's Zool. Res.* pt. 5, p. 621, pl. lxv A.
1914. Barnard, *Ann. S. Afr. Mus.* X, p. 342*a*, pl. xxviii, D (*dubia*).
1924. Chilton, *Mem. Ind. Mus.* V, p. 881.
1925. Barnard, *l.c.*, p. 141.

Locality.—Tirunayamkudam, Vembanad Lake, Travancore. H. S. Rao and M. Sharif. January 1928. 1 specimen.

Remarks.—This is the largest recorded specimen of this species, measuring 16 mm. in length. The palm of the 1st peraeopod has a well marked tooth at its base, and the 6th and 7th joints of the 7th peraeopod are minutely serrulate as described by Stebbing and Barnard.

The antennae are not brush-like, and there are no signs of oostegites.

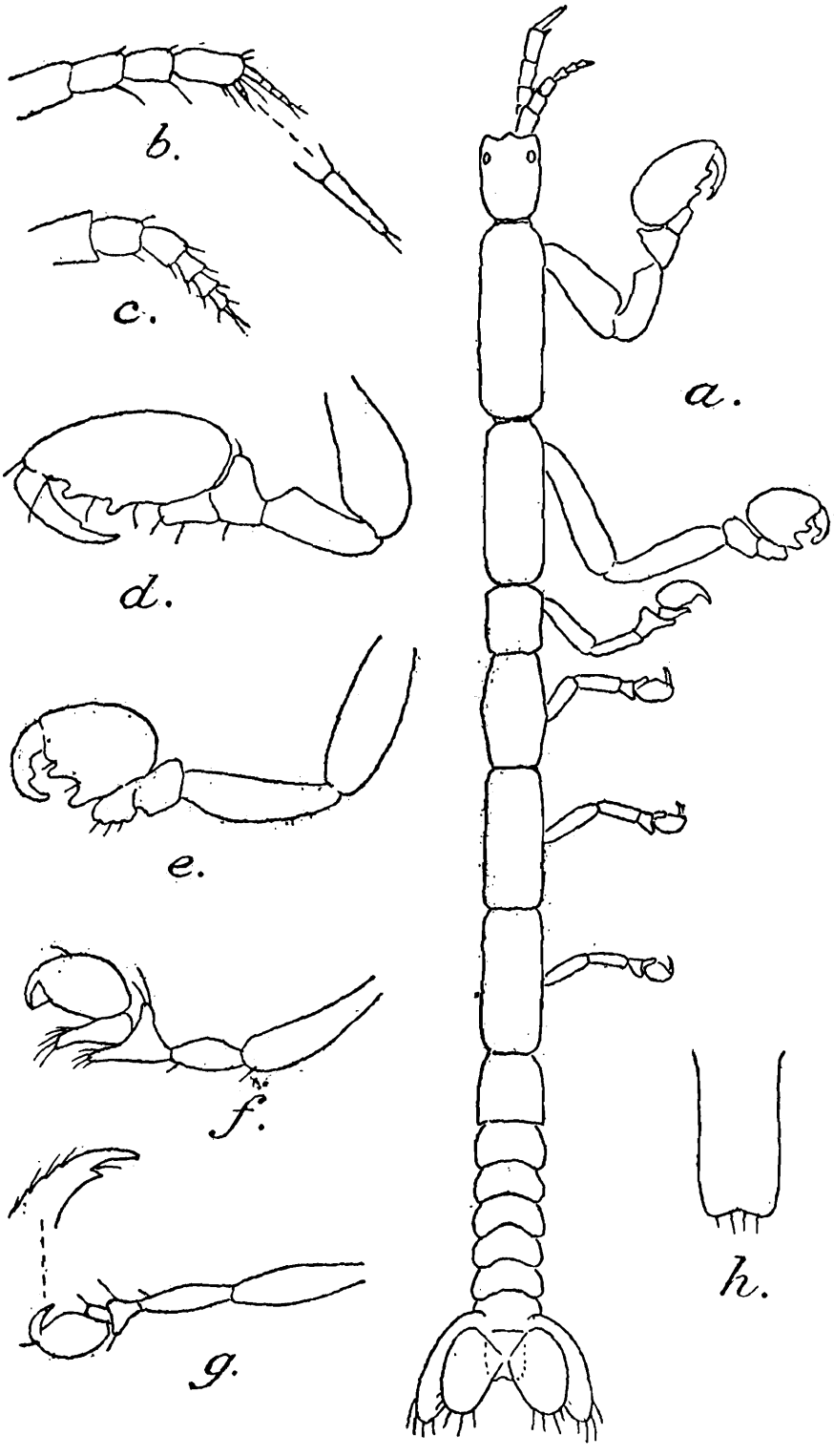
Pale yellowish, mottled with brownish dorsally on head, peraeon, pleon, telson and uropods; eyes black.

Distribution.—Loyalty Islands; Chilka Lake; Travancore, South India; South Africa.

Xenanthura orientalis, sp. nov.

Locality.—Vatta Kayal, Alleppey. H. S. Rao and M. Sharif. January 1928. 1 specimen.

Description.—Body very slender. Eyes composed of 5-6 lenses aggregated together. 7th peraeon segment apodous. Telson scarcely twice as long as broad, apex very slightly indented, with 4 setae.



Text-fig. 17.—*Xenanthura orientalis*, sp. nov. *a*. whole animal, antennae and legs of one side omitted; *b*. antenna 2, with secondary flagellum further enlarged; *c*. antenna 1; *d*. *e*, *f*. peraeopods 1, 2, and 3 respectively; *g*. one of peraeopods 4-6, with unguis further enlarged; *h*. telson.

Antenna 1, flagellum 4-jointed. Antenna 2, flagellum 4 (or 5)-jointed, the distal joints obscurely separated; secondary flagellum on 4th joint slender, 2-jointed.

Peraeopod 1, 5th joint apically blunt, 6th ovate, with 2 digitiform processes on palm, finger with slight knob at base of unguis.

Peraeopod 2, 5th joint crenulate on lower margin, apex blunt, 6th obovate, palm produced into 2 digitiform processes, finger curved, with knob at base of unguis.

Peraeopod 3, 4th joint triangular, lower apex produced, 5th with lower apex acutely produced, 6th ovate, with slight indication of a short palm.

Peraeopods 4-6 slender, 6th joint ovate, without any palm, finger obscurely serrulate on outer margin, and with a seta at base of unguis.

Uropod with endopod completely fused with peduncle, apically setose, exopod broadly oval, apically setose.

Length 4·5. Whitish, the dorsal surface faintly mottled with brown, eyes dark.

Remarks.—This specimen fully endorses the generic diagnosis based on the West Indies species *brevitelson* Brnrd. (Barnard, *l.c.*, 1925, p. 138), including the peculiar appendage or secondary flagellum on antenna 2. The Indian species is clearly distinguished by the details of its peraeopods. The apodous 7th peraeon segment indicates that the specimen is still juvenile.

The specimen was very delicate and was examined first in parachlorophenol+chloral hydrate, and afterwards mounted on a slide.

Family EURYDICIDAE.

Cirolana Leach.

1914. Vanhöffen, *Deutsch. Südpol. Exp.* XV (*Zool.* VII), pp. 496 *et seq.*
1925. Hale, *Trans. Roy. Soc. S. Australia* XLIX, pp. 129 *et seq.*
1930. Monod, *Ann. Sci. Nat. Zool.* (10) XIII, pp. 129-183.
1931. Nierstrasz, *Siboga, Exp. Monogr.* XXXIIc., pp. 149 *et seq.*

Among the numerous species of this genus there is a group of closely allied species characterized by a more or less conspicuous denticulation on the hind margins of some of the peraeon and pleon segments, and a sculptured telson. The following species fall into this group: *sculpta* M. Edw. 1840 (Malabar), *sulcata* Hansen 1890 (South Africa), *pleonastica* Stebb. 1900 (New Britain), *venusticauda* Stebb. 1902 and *fluviatilis* Stebb. 1902 (South Africa), *willeyi* Stebb. 1904 (Ceylon), *sulcaticauda* Stebb. 1904 (Maldives), *nigra* Chilton 1924 (Chilka Lake), and *pustulosa* Hale 1925 (Queensland).

C. sculpta still remains a *species inquirenda*, as it does not seem to have been recognized by subsequent authors (Krauss' 1843 record from South Africa is almost certainly erroneous: see Stebbing, *Mar. Invest. S. Africa* II, 1902, p. 51). *C. nigra* Chilton is in my opinion synonymous with *willeyi*.

C. sulcata is perhaps not strictly admissible in this group, but is included owing to a slight superficial likeness to *sulcaticauda*, and to the fact that it is also an inhabitant of the Indo-Pacific region.

The character of the frontal lamina is essential in diagnosing the species, and figures are given here supplementing the earlier descriptions of two species.

Another character, to which so far as I am aware, attention has been paid only by Vanhöffen (*l.c., supra*) is the openings of the vasa deferentia in the ♂. Vanhöffen gave figures for all the species described by him except *hirtipes*, of which species he thought he had no ♂♂. The reason for this exception is probably due to the fact that in this species there are no upstanding papillae (penial processes), the vasa deferentia opening by pores flush with the surface of the 7th sternite.

In some species a pair of very short conical papillae are present; and in other species paired digitiform processes of greater or lesser length are developed. Males of the latter species are easily distinguished, but the openings of the vasa deferentia when flush with the surface are not so easily observed, and a ♂ may be thought to be a ♀ with undeveloped brood-pouch.

The above mentioned species can be separated as follows :—

I. Head with rostral point (more or less separating the bases of the 1st antennae).	
A. Frontal lamina pentagonal (text), hexagonal (figure) . . .	*willeyi* (syn. *nigra*).
B. Frontal lamina quadrangular, with anterior extension to meet rostral point	*venusticauda*.
C. Frontal lamina rounded in front	*sulcaticauda*[1].
II. Head without rostral point, anterior margin evenly rounded, bases of 1st antennae contiguous.	
A. Frontal lamina narrow pentagonal, angular in front, not freely projecting.	
1. Frontal lamina widening to middle. Pleon not tuberculate. Telson grooved. Penial processes ♂ well developed .	*sulcata*.
2. Frontal lamina widest at base. Pleon tuberculate. Telson with double row of elongate tubercles. Vasa deferentia opening flush with surface	*pleonastica*.
B. Frontal lamina rounded in front.	
1. Frontal lamina freely projecting in front. Vasa deferentia opening flush with surface .	*fluviatilis*.
2. Frontal lamina presumably not freely projecting (judging from figure) .	*pustulosa*[2].

Cirolana pleonastica Stebbing.

1900. Stebbing, *Willey's Zool. Res.* V, p. 629, pl. lxvii A. [*non* Chilton 1924 and 1926].

Owing to the kindness of Dr. I. Gordon of the British Museum, I have been able to examine some co-types of this species from Blanche Bay, New Britain, and am thus able to supply a figure of the one important character which Stebbing omitted both in his description and his figure.

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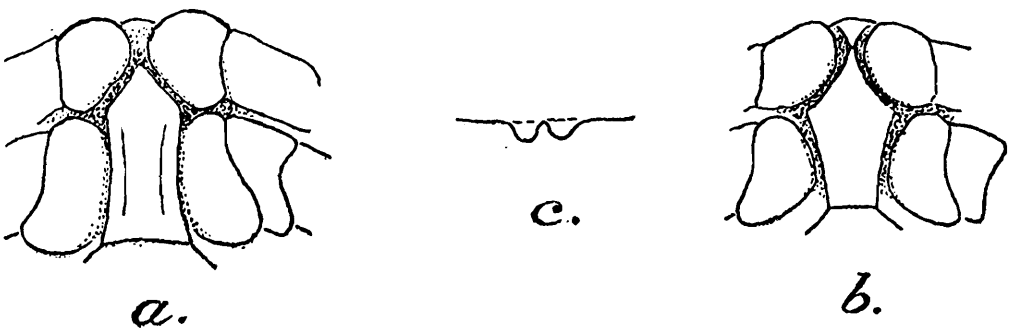
[1] Dr. Isabella Gordon of the British Museum informs me that in this species, as far as the poor condition of the specimens permits accurate study, there appears to be a tiny rostral point.

[2] Hale says " with a tiny median subtriangular process, which does not separate the first antennae ". The species would appear to fall under division II in the present key.

The frontal lamina is narrow pentagonal, widest at base, and slightly narrowing distally, the front apex angular, not projecting, and not visible beyond the margin of head when viewed from the dorsal aspect.



TEXT-FIG. 18.—*Cirolana*. *a*. frontal lamina and bases of antennae of *pleonastica* Stebb. (co-type ex Brit. Mus.); *b*. the same of *willeyi* Stebb. (*nigra* Chilton, Chilka Lake); *c*. penial processes on 7th peraeon sternite of *willeyi*.

The vasa deferentia open by pores flush with the surface of the 7th sternite.

Cirolana fluviatilis Stebbing.

1902. Stebbing, *Mar. Invest. S. Africa* II, p. 52.
1920. Barnard, *Ann. S. Afr. Mus.* XVII, p. 346, pl. xv, fig. 19 (frontal lamina).
1924. Chilton, *Mem. Ind. Mus.* V, p. 882, pl. lx, fig. 2 (*pleonastica non* Stebb.).
1926. *id.*, *Rec. Ind. Mus.* XXVIII, p. 180, fig. 2 (*pleonastica non* Stebb.).

Locality.—In stake-net, Manumbam, Travancore. H. S. Rao. January 1928. 23 immature specimens.

Description.—Anterior margin of head evenly convex, without rostral point. Bases of 1st antennae in contact, first two joints of peduncle not very clearly distinct, flagellum 7-8-jointed.

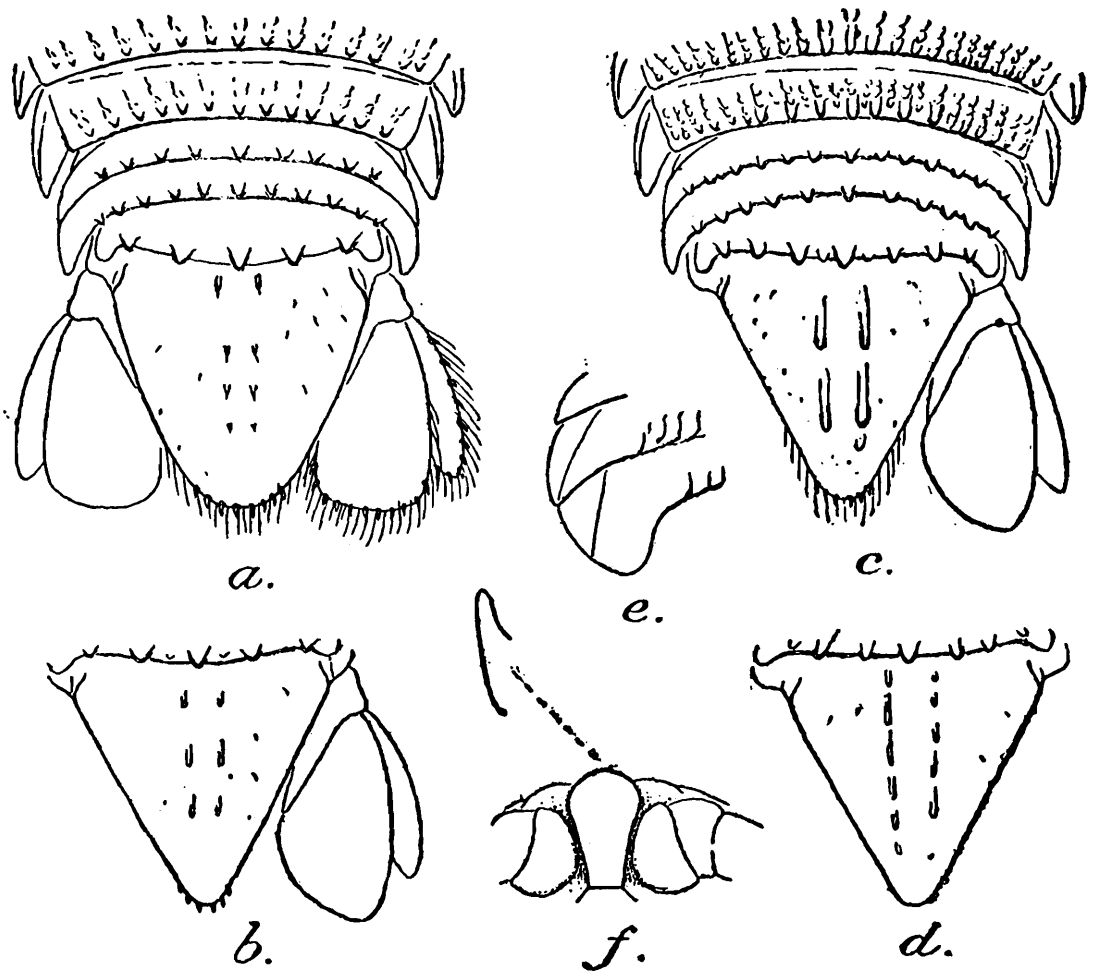
Frontal lamina nearly twice as long as broad, slightly widening to the freely projecting rounded anterior margin; in some specimens the anterior margin is semicircularly rounded, in others somewhat flattened, but never truncate.

Side-plates 6 and 7 with oblique ridge, more distinct on the 7th. Hind margins of hinder peraeon segments denticulate, denticulations beginning faintly on segment 4 and increasing in distinctness. On the lateral portions of segments 6 and 7 there are faint indications of a 2nd row of tubercles, which in the adult will cause the corrugated appearance. Pleon segments 2-5 also denticulate, segment 5 with 5 teeth.

Telson in young and half-grown broadly rounded at apex, with 8 spines among the plumose setae, a short ridge at each basal outer corner, a pair of small submedian tubercles at base, followed by two more pairs, the latter smaller and often inconspicuous (best seen in a dried specimen); scattered setae on surface of telson. In adult specimens from Chilka Lake (identified by Chilton as *pleonastica*) the telsonic apex is narrowly rounded, with 6 spines, the lateral margins straight, and the double row of median tubercles better developed.

Uropods, inner ramus broadly rounded, with 11 spines around distal margin, outer ramus slightly shorter, oval, apically narrowly rounded, with 11 spines along outer margin and around apex. In the adult a

slight change in the shape of the inner ramus occurs, as is best seen by comparing figs. 19 *a* and *b*.



Text-fig. 19.—*Cirolana fluviatilis* Stebb. *a*. peraeon segments 6 and 7 and pleotelson of juv., 5 mm. in length, Travancore ; *b*. telson of ♂, 8·5 mm., Chilka Lake (spines and setae on uropod omitted) ; *c*. co-type ♂, 11 mm., from East London, South Africa ; *d*. telson of strongly sculptured ♂, 11 mm., from Port Elizabeth, South Africa ; *e*. lateral view of pleon segments 2-4 (left side) ; *f*. frontal lamina and bases of antennae, with profile of former.

On peraeon segment 7 in adult ♂ from Chilka Lake the vasa deferentia open by two pores flush with the sternal surface.

Appendix masculina on pleopod 2 straight, not longer than inner ramus.

Remarks.—The present Travancore specimens are not fully mature but through the kindness of Dr. Chopra I have been able to examine some of the Chilka Lake specimens, including adult ♂ and ♀, identified by Chilton as *pleonastica*. Chilton's erroneous identification is excusable in view of Stebbing's omission to describe the frontal lamina of *pleonastica*. I have not seen the specimens from Talé Sap, but assume that they likewise are not the true *pleonastica*.

The change in the shape of the telson, from the broadly rounded apex of the young and half-grown, to the narrowly rounded apex of the adult, is interesting and important. The apex is slightly narrower in the adult ♂ than in the ovigerous ♀.

As the pleon of *fluviatilis* has never been figured, this deficiency is here remedied. The figures will serve also to confirm my identification of the Indian specimens with the species originally described from South Africa.

I have already (1920) indicated a certain amount of variation in the development of the ornamentation, but I did not then realize that this difference is to some extent sexual. Males are often far more strongly sculptured than the females, some of which latter barely show the crenulations on the pleon segments or the tubercles on the telson. This is especially noticeable in some small though ovigerous specimens, 7 mm. in length, from Keurbooms River (South Africa).

The slit on the lateral margin of the 4th pleon segment mentioned by Stebbing (1902, *l.c.*, p. 52) is really a ridge; there is a similar ridge on pleon segment 3, and both ridges are not peculiar to *fluviatilis*, but are found *e.g.* in *pleonastica* Stebb., *sulcata* Hansen, and (on 4th segment only) *venusticauda* Stebb.

Additional South African localities: St. Lucia Bay, Zululand (H. W. Bell-Marley, 1919, 1 ♂); Keurbooms River, Plettenberg Bay (K. H. B. January 1931. ♂♂ ♀♀ from submerged rotting logs in estuary).

Distribution.—Chilka Lake; Talé Sap, Siam; South Africa.

Cirolana willeyi Stebbing.

1904. Stebbing, *Spolia Zeylanica* II, p. 11, pl. iii.
1924. Chilton, *Mem. Ind. Mus.* V, p. 884, pl. lx, fig. 3 and text-fig. 6 (*nigra*).

Although not mentioned by Chilton, there is a most remarkable resemblance between *nigra* and *willeyi*. I have examined specimens of the former, including adult ♂ and ♀, from Maludaikuda, Chilka Lake. The ♀ is 6·5 mm., the ♂ 7 mm. in length, thus being larger than the measurement given by Chilton (5 mm.), but not as large as Stebbing's 8·75 mm. for *willeyi*.

An immature specimen, 4·3 mm. in length, agrees with Chilton's figure in having a rather broadly rounded telsonic apex. The adults, however, have the apex more narrowly rounded (as in *fluviatilis*) and resemble Stebbing's figure of *willeyi*. There is no trace of tubercles on the head and 1st peraeon segment in the ♂ such as Stebbing describes.

The head has a distinct rostral point as in *willeyi*. The frontal lamina, however, is definitely (in all three specimens) pentagonal, with the anterior apex meeting the apex of the rostral point. Stebbing says the frontal lamina is pentagonal in *willeyi*, but his figure shows it hexagonal, that is with the anterior apex truncated.

Stebbing's description of the coloration of *willeyi*, which is unusually strong for a member of this genus, exactly fits the present specimens.

In view of the similarity in the sculpture, making due allowance for the larger size of Stebbing's specimens, I have not the least doubt that *nigra* is the same species as *willeyi*, and that Stebbing's figure is either inaccurate, or was drawn from a different specimen from that on which the description was based, and exhibiting a slight abnormality.

The vasa deferentia open on the 7th sternite by 2 very short and almost contiguous papillae.

Distribution.—Lake Negombo, Ceylon; Chilka Lake.

Family IDOTEIDAE.

Synidotea variegata Collinge.

1917. Collinge, *Rec. Ind. Mus.* XIII, p. 2, pl. i.
1924. Chilton, *Mem. Ind. Mus.* V, p. 891, pl. lx, fig. 6.

Locality.—In stake-net, Manumbam, Travancore. H. S. Rao. January 1928. 3 juv.

Remarks.—These young specimens, 4-6 mm. in length, are probably referable to this species.

No trace of any oblique ridge on the peduncle of the opercular uropods can be seen; at the outer apex of the peduncle there are 3 plumose setae.

Distribution.—Gulf of Manaar; Chilka Lake.

Family ASELLIDAE.

Caecidothea kawamurai Tattersall.

1921. Tattersall, *Mem. Asiat. Soc. Bengal* VI, p. 417, pl. xv, figs. 11-18.
1927. Ueno, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, p. 360, fig. 3.

Locality.—From well in Otsu, Japan. Dr. Kawamura. July 1917. 3 ♂♂, 17, 19 and 28 mm. in length.

Remarks.—Only three features call for mention. One of the present specimens is considerably larger than Tattersall's largest ♂, which was 17 mm. in length. The largest specimen has only one uropod remaining; the outer ramus is $\frac{1}{3}$ the length of the inner ramus, which is $\frac{5}{6}$ the length of the peduncle.

Both the larger specimens have a series of conical tubercles on the under surface of the flagellum of the 2nd antenna, one tubercle on every fourth joint; towards the end of the flagellum they become feeble, and after the 75th joint cannot be traced. Each tubercle is surmounted by a small tuft of setae.

The penes are inserted far apart (as in *Asellus*), converging inwards at an angle of about 45°, meeting at approximately a right angle at the level of the middle of the peduncles of the 1st pleopods. Each penis is thus a little longer than half the distance separating the bases of the two; it is terete and very slightly clavate apically.

TANAIDACEA.

Family APSEUDIDAE.

1913. Nierstrasz, *Siboga Exp. Monogr.* XXXII *a*. (list of species to date).
1914. Vanhöffen, *Deutsch. Südpol. Exp.* XV (*Zool. VII*), p. 460.

Apseudes Leach.

1914. Barnard, *Ann. S. Afr. Mus.* X, p. 327 *a*.
1920. *id., ibid.*, XVII, p. 321.
1927. Stephensen, *Vid. Medd. Dansk. Naturh. For.* LXXXIII, p. 374.

Apseudes chilkensis Chilton.

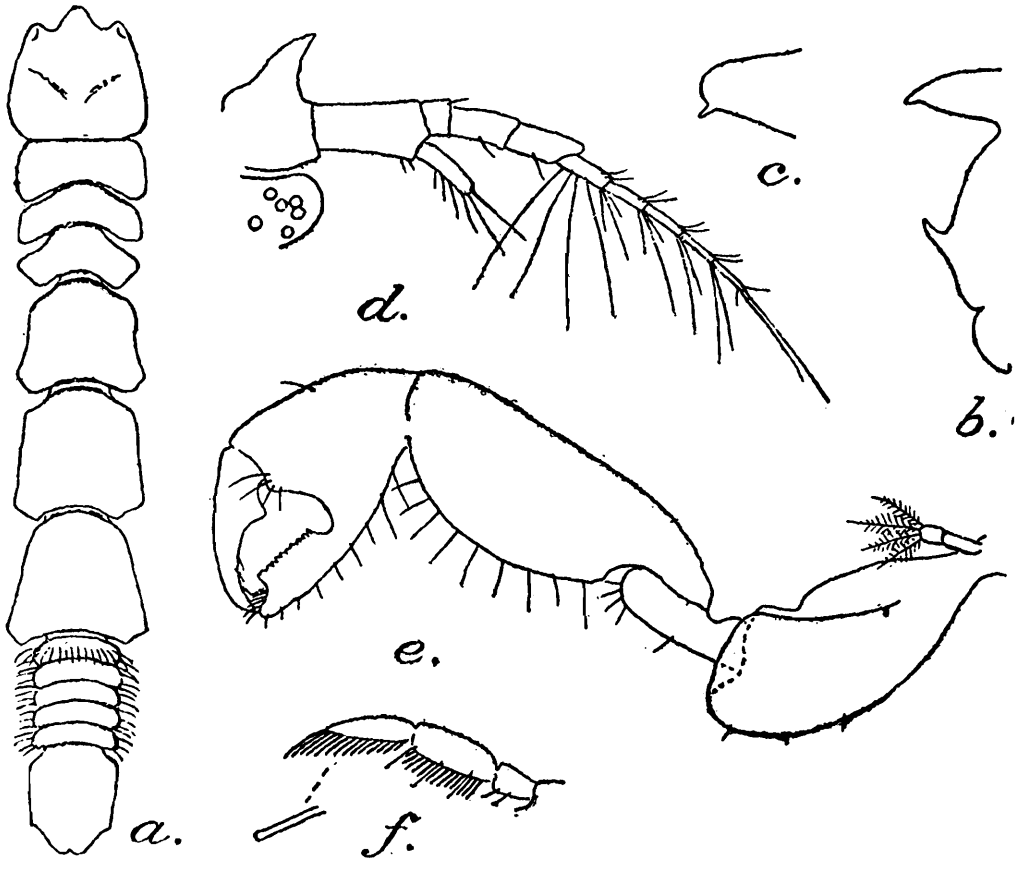
1924. Chilton, *Mem. Ind. Mus.* V, p. 879, text-fig. 1 and pl. lx, fig. 1.
1926. *id.*, *Rec. Ind. Mus.* XXVIII, p. 175, figs. 1 *a-r* (*sapensis*).

Localities.—Tirunayamkudam, Vembanad Lake, Travancore. H. S. Rao and M. Sharif. January 1928. 5 ♂♂, 2 ovig. ♀♀, 3 immat. ♀♀.

Vatta Kayal, Alleppey, Travancore. H. S. Rao and M. Sharif. January 1928. A lot ♂♂, ovig, ♀♀, and juv.

Salt Lakes, Calcutta, Lower Bengal. Dr. B. N. Chopra. 23-24th February 1928. 2 ♂♂, 2 ovig. ♀♀, 1 immat. ♀, 3 juv.

Description.—Body not very slender, approximately parallel-sided, the carapace not much wider, the pleon not much narrower, than the rest of the body, smooth. Carapace (head plus 1st peraeon segment) about as long as its greatest width (posteriorly), slightly narrower anteriorly, rostral point triangular, apex sharp. In the Lower Bengal specimens (as in those from Chilka Lake, which I have been able to examine) there is a distinct spiniform point directed ventrally, which in the ♂ is especially noticeable. Ocular lobes rounded, obscurely demarcated from the head by a shallow groove. Each eye consisting of 6-7 irregularly aggregated lenses, unpigmented.



TEXT-FIG. 20.—*Apseudes chilkensis—sapensis* Chilton. *a.* dorsal view of whole animal; *b.* profile of rostrum, epistome and upper lip, Travancore specimen; *c.* profile of rostrum of Lower Bengal specimen; *d.* antenna 2 and ocular lobe of head; *e.* peraeopod 1 ♂, outer view; *f.* mandibular palp.

Peraeon segments 2-4 (1st-3rd free segments) short, antero-lateral angles of anterior segment rounded. Segments 5-7 subquadrangular,

slightly wider posteriorly than anteriorly. Pleon segments distinct, laterally setose. A fringe of setae (often rubbed off) on 1st pleon segment (not on hind margin of 7th peraeon segment, as Chilton says). Telson oval-oblong. On each of peraeon segment 7 and pleon segments 1-6 a small medio-ventral spiniform process, feebler in ♀ than in ♂.

Antenna 1 in ♂ equal to distance between point of rostrum and middle or end of 5th peraeon segment, peduncular joints smooth, not dentate, inner flagellum in ♂ half as long again as peduncle, outer flagellum subequal to peduncle,[1] with 20-24 and 12-15 joints respectively, but the joints very obscurely demarcated and difficult to count; in ♀ both flagella subequal to peduncle.

Antenna 2 reaching to end of, or slightly beyond, apex of peduncle of antena 1, 1st peduncular joint with strong acute tooth on inner side, 2nd joint cylindrical, with apical scale (exopod), 3rd joint short, 4th and 5th subequal, flagellum of about 6 obscurely demarcated joints.

Epistome with small upturned spiniform process, often obscure.

Mandibular palp stout, 2nd and 3rd joints with comb-like series of stiff, blunt spines, those on 3rd joint increasing in length distally, a few setae in addition.

Maxillae 1 and 2 as in *A. spinosus* (Sars, *Crust. Norway* II, pl. i).

Maxilliped, 2nd (basal) joint stout, 3rd short but broad, 4th broad, 5th and 6th chopper-shaped, 4th-6th joints with numerous setae, inner plate with 4 coupling-hooks. Epipod large, with apical process as in *A. spinosus*.

Peraeopod 1 (gnathopod) ♂ robust, 2nd joint stout, keeled on inner anterior edge and on lower (posterior) edge, the 2-jointed exopod with 4 plumose setae, 3rd and 4th joints fused, 5th elongate-ovate, with spaced setae on lower edge, 6th with small triangular setose process near finger-hinge, followed by a semicircular excision, thumb with an inner incisiform crenulate cutting-edge, and subacute apex, finger curved, with tooth on inner margin near base. In ♀ slender and elongate, 2nd joint fusiform, 5th cylindrical, slightly widening distally, 6th minutely serrate apically, finger curved, narrowing rather rapidly.

Peraeopod 2, 2nd joint stout, the 2-jointed exopod with 5 plumose setae, 3rd joint short, 5th apically expanded, 6th obovate, 7th small, spiniform, margins of 5th and 6th with numerous close-set elongate spine-setae.

Peraeopods 3-7 similar to one another, but 2nd joint in peraeopods 3 and 4 not so stout, and fringes of plumose setae present only on peraeopod 7. The inner (lower) margins of 5th and 6th joints with double rows of spine-setae. Plumose setae only on outer (hinder) margins of 2nd, 4th and 5th joints and distal half of inner margin of 2nd joint. Finger spiniform.

Five pairs of pleopods, peduncle short, rami about twice as long, subequal (neither ramus 2-jointed).

Uropods slender and elongate, inner ramus equal to length of 7th peraeon segment plus pleo-telson, the outer ramus $\frac{1}{5}$ length of inner, both rami so obscurely jointed that the number of joints cannot be counted even approximately.

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[1] In most species apparently the outer one is the longer of the two flagella.

In ♂ the vasa deferentia open at the apex of the spiniform process on 7th peraeon sternite.

Length ♂ 7·5 mm., ♀ smaller. Whitish, with the digestive canal showing through more or less darkly. Spermatozoa in the vasa deferentia (seen through the integument) and after extrusion glistening white.

Remarks.—The growth and structure of the brood-pouch is interesting and deserving of closer study.

In non-ovigerous ♀♀, which to judge by size are in the penultimate stage, there are five pairs of little oval lamellae at the bases of the 1st-5th pairs of peraeopods. Those at the base of the 1st pair of peraeopods, though quite distinct in the immature, seem to disappear in the ovigerous animal; at least I have not succeeded in observing them. The actual brood-pouch is formed by the four hinder pairs of lamellae.

Some curious modifications occur in the fully developed brood-pouch. As the lamellae (oostegites) start by being *separate external* outgrowths of the ventral surface, one would expect them to remain separate when the animal undergoes its final or breeding moult. In some cases this does happen, *e.g.*, in some of the ovigerous ♀♀ from Vatta Kayal, all 4 pairs of lamellae are distinct. In other ♀♀ from the same lot, the 4 lamellae of one side are completely concrescent. In both the ovigerous ♀♀ from Vembanad Lake, both those from Lower Bengal, and some from Vatta Kayal, not only are the 4 lamellae of each side united, but they are united with those of the opposite side, so as to form a single complete ventral lamina, open only in front (like a kangaroo's pouch).

The above references are quoted in chronological order, but I do not wish to imply that I consider *sapensis* definitely a synonym of *chilkensis*; although after comparing topotypes from both Chilka Lake and Talé Sap with the present specimens I feel that eventually only one species will be recognized.

Chilton's figure (pl. lx, fig. 1) represents both the 2nd peraeon segment and the ocular lobes as too long. On the other hand in *sapensis* the ocular lobes are not indicated at all in the figure, though they are present in the specimens. Thus from the figures one might assume a difference which in fact is non-existant.

The Chilka Lake specimens have the 1st peduncular joint on antenna 2 strongly toothed, as in the description of *sapensis*, but which is not mentioned in that of *chilkensis*. The 1st and 2nd legs of the present specimens are more like those of *sapensis*, but the 2nd joint of peraeopod 1 is intermediate in character: it is considerably stouter than in typical *chilkensis*, but not so stout or so strongly produced apically as in *sapensis*. The latter feature somewhat depends on whether the leg is flexed (Chilton's figure) or extended.

The most noticeable difference is in the tooth of the fixed finger (5th joint) of peraeopod 1, and the 5th and 6th joints of peraeopod 2. In case it should later appear desirable to keep these two forms separate, the present specimens are referable as follows:—

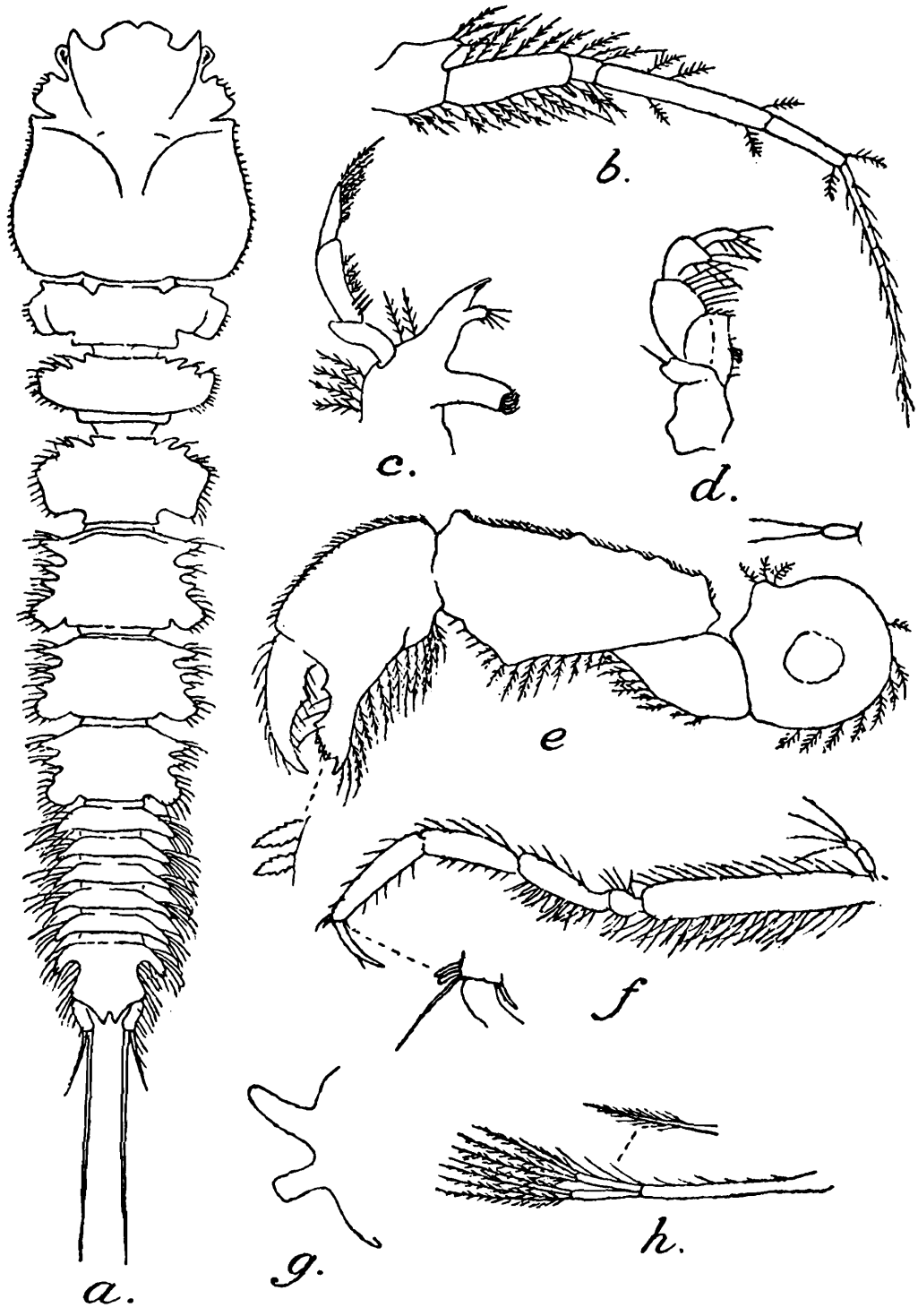
Lower Bengal, Salt Lakes	*chilkensis* form.
Travancore localities	*sapensis* form.

Apseudes gymnophobia, sp. nov.

Localities.—In rotting screw-pine, Vypin, Cochin. H. S. Rao. January 1928. 1 ♂.

Tiruppunithura, Cochin. H. S. Rao and M. Sharif. December 1927. 1 immature ♀.

Description.—Body not very slender, tapering evenly from the widest portion of the carapace, whole dorsal surface with very fine pilosity, giving place to plumose setae on the lateral portions, and



TEXT-FIG. 21.—*Apseudes gymnophobia,* sp. nov. *a.* whole animal; *b.* antenna 2 ♂; *c.* mandible; *d.* maxilliped; *e.* peraeopod 1 ♂, inner view with epipod from peraeopod 1 ♀; *f.* peraeopod 2 ♂; *g.* profile of epistome and upper lip ♂; *h.* pleopod.

especially thick on the pleurae of the pleon segments. Carapace slightly longer than its greatest width, frontal margin produced in two short truncate lobes with intervening notch; ocular lobes in lateral view rounded, with a slight dorsal crest which in dorsal view forms an acute point above the actual eye; the latter faintly pigmented. Lateral margin with two notches.

Peraeon segments increasing slightly in length to the 5th (=4th free segment), which is longest, 6th and 7th slightly shorter. Segment 2 with the anterior margin raised or costate on either side of the central articulation, where it butts against the hind margin of the carapace. Segments 3-7 with the lateral margins digitate or dentate.

Pleon segments distinct, narrower than peraeon, but with prominent subacute pleural processes.

Telson shorter than pleon, its basal part resembling one of the preceding pleon segments with lateral process on either side, distal part pentagonal, the apex shortly cleft.

On segment 3 (2nd free segment) a small medio-ventral conical tubercle pointing forwards, in both sexes; in ♂ a similar but very small tubercle on the 4th segment, obsolete in ♀.

Antenna 1, peduncle about equal to length of carapace, smooth, 1st joint slender, about $\frac{2}{3}$ length of carapace, with plumose setae on inner and outer margins, 2nd joint less than half length of 1st, with 1 or 2 plumose setae on margins, 3rd $\frac{2}{3}$ length of 2nd, outer flagellum about equal to 1st peduncular joint, 16 (♂) or 14 (♀)-jointed, inner flagellum 8 (♂) or 7 (♀)-jointed. Antenna 2 as long as peduncle of antenna 1, 1st joint with process on inner apex, 2nd with slightly sinuous outer margin, apical process minute, spiniform, concealed among plumose setae, 4th elongate in ♂, in ♀ not exceeding 2nd plus 3rd joints, 5th half length of 4th in ♂, in ♀ equal to 2nd, flagellum 11 (♂) or 8 (♀)-jointed.

Epistome in ♂ with 2 projections, the upper one projecting slightly upwards; in ventral view both are apically blunt but apparently not mutilated. In ♀ epistome evenly convex.

Mandible with plumose setae on outer surface of trunk, cutting-edge obscurely bidentate, secondary cutting-edge tipped with several setae, molar process prominent, palp stout, 2nd joint with 3 spine-setae near base, and short plumose setae on inner margin, 3rd joint with plumose setae increasing in length distally.

Maxillae 1 and 2 normal. Maxilliped, 2nd joint moderately broad, 3rd short and broad with 1 seta on outer margin, 4th ovate, 5th chopper-shaped, 6th cylindrical, 4th-6th setose, inner plate with 2 coupling hooks. Epipod normal (Sars, *l.c.*, pl. i).

Peraeopod 1 (gnathopod) in ♂ robust, 2nd joint subglobular, with subcentral (not terminal) point of attachment, the projecting hind margin with plumose setae, a knob on upper anterior margin, exopod not observed, 5th joint with small knobs on upper margin, thumb of 6th joint with basal tooth, incisiform cutting-edge set with a few short minutely serrulate spines, and unguiform apex, finger with basal tooth; all the joints with fine pilosity passing into longer plumose setae distally and on lower margin of 5th joint. In ♀ of same general shape, robust but not so robust as in ♂, exopod very minute, with 2 setae.

Peraeopods 2-7 similar to one another, slender, 2nd joint cylindrical, finger slender, with gently curved unguis : both margins of 2nd joint in ♂ with thick fringe of plumose setae, other joints less setose. In ♀ similar to ♂, but less setose, the thick fringes on 2nd joint absent. Exopod on peraeopod 2 distinct in both sexes, 2-jointed, pedunculate, with 4 setae.

Five pairs of pleopods ; peduncle slender, elongate, rami less than half length of peduncle, neither apparently 2-jointed.

Uropods, peduncle thickly covered with plumose setae, inner ramus approximately 20-jointed, outer ramus 7-jointed, jointing very obscure.

Female with 5 pairs of incipient brood-lamellae.

Length : ♂ 7·5 mm., ♀ slightly smaller. Whitish, the eyes faintly pink.

Remarks.—The lateral digitations of the peraeon segments produce some resemblance to *A. meridionalis* Richardson 1912, and *A. galapagensis* Richardson 1912.

The small size of the " scale " on antenna 2 points to *Parapseudes*, but inclusion in that genus is excluded by the presence of the normal 5 pairs of pleopods. The slender elongate peduncle of the latter is remarkable.

Possibly the absence of expanded (fossorial) joints on the 2nd peraeopod (*cf.*, *Pagurapseudes* Whitelegge), and its consequent similarity with the other peraeopods (3rd-7th) might suggest a generic separation, but for the present this is unnecessary.

The anti-nudist propensity of the specimens intensifies the difficulty of studying them.

NEW ORIENTAL DRAGONFLIES (ORDER ODONATA).

By F. C. Fraser, *Lt.-Col.*, *I.M.S.* (*Retd.*), *F.R.E.S.*

Whilst collecting and examining material for the work on Odonata, in the *Fauna of British India* series, I have come upon several new species, some in my own collection, others in material lent to me and in the British Museum collection. The descriptions of these will ultimately appear in the work mentioned but as there is likely to be some delay before the third volume is published, it seems preferable to publish the descriptions without further delay. Some of the species are not found within Indian limits so that they will not find a place in the *Fauna* volumes and their descriptions must therefore be published elsewhere. The following new species are described :—

Cephalaeschna biguttata.
Gynacantha incisura.
Epophthalmia frontalis malabarensis.
Agrion atrocyana.
Rhinocypha vitrinella.
Indophlebia asiatica.
Macromia flavovittata.
Agrion coomani.

The notation used throughout is the revised one of Dr. R. J. Tillyard.

Family AESCHNIDAE.

Cephalaeschna biguttata, sp. nov.

Male. Abdomen 47 mm. Hindwing 42 mm.

Head. Labium pale ochreous ; labrum darker ochreous ; rest of head, including frons, dark reddish brown with two small submedian spots on postclypeus and a diffuse blackish brown stripe on crest of frons ; eyes brownish ; occiput reddish brown. Prothorax pale yellow ; thorax reddish brown, darker on dorsum which is marked with narrow curved apple-green antehumeral stripes, the upper ends of which are truncate and converge on the antealar sinus ; laterally an oval citron yellow spot on centre of mesepimeron and a similar one on the centre of metepimeron. Legs reddish brown, distal end of femora blackish. Wings hyaline, not enfumed ; pterostigma bright ochreous between black nervures, rather long, braced, covering 3-4 cells ; membrane white ; reticulation rather close ; discoidal cell made up of 5 cells ; 4 to 5 median nervures in fore-wing, 3 to 4 in the hind ; 6 to 7 cubical nervures in all wings ; 7 cells in anal-loop ; 5 in anal-triangle ; nodal index— $\frac{14\text{-}21}{18\text{-}17}\Big|\frac{20\text{-}16}{16\text{-}16}$; other venational details as for genus. Abdomen dark reddish brown to black on dorsum, marked with yellow as follows,—segment 1 with a large spot on each side ; segment 2 with a linear steak on middorsal carina extending from base to apex of segment and a pair of narrow apical dorsal lunules ; laterally a broad stripe which involves the oreillets ; segments 3 to 8 with paired dorsal linear postjugal spots and paired apical lunules ;

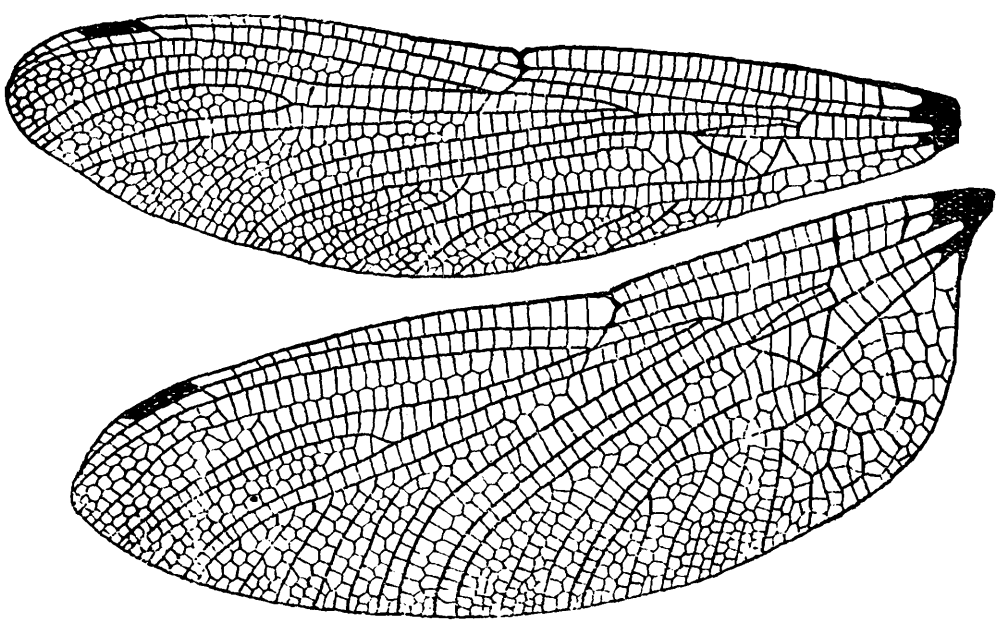
segment 9 with a pair of basodorsal spots ; segment 10 with a pair of subbasal linear spots lying obliquely on segment and converging apically. Anal appendages reddish brown ; superiors twice the length of segment 10, narrow at base and gradually dilated thereafter as far as their middle from which point they are of even width to apex which is obtuse and bears a minute point outwardly ; upper surface coated with long black hairs. Inferior appendage two thirds the length of superiors, narrowly triangular, apex pointed and curled gently upwards.

Distribution.—Assam. The *type*, a male in my own collection, is from Shillong, Khasi Hills and is the only species of the genus which I have seen from that district. The two yellow spots on sides of thorax, which strongly resemble the markings of *Boyeria vinosa* (an American Aeschnid), will serve to distinguish this species from all others of the genus.

Genus **Indophlebia,** nov.

(Text-fig. 1.)

Aeschnine dragonflies of rather large size coloured dark reddish brown marked with green and citron yellow and with wings more or less tinted and enfumed. Head large, globular ; face narrow, frons elevated steeply into a cone, triangular as seen from the front ; eyes very broadly contiguous ; occiput correspondingly small. Thorax short but robust ; legs moderately long and slim ; hind femora with 2 rows of short, closely-set spines of small size and with 5 or 6 more closely crowded ones at the distal end. Wings relatively short and broad, especially the hind in which the



Text-fig. 1.—Wings of *Indophlebia asiatica*, sp. nov., ♀.

basal or anal field shows a development of several minor loops arranged around the major anal-loop ; arc distal to the distal primary antenodal nervure ; reticulation very close ; *IRiii* forked slightly nearer pterostigma than node and with 2 rows of cells between its branches ; *IRii* well developed, extending to quite near the node ; *Rspl* straight, only a single row of cells between it and *IRiii* ; 2 rows of cells between *Cuii* and *IA*

at origins in hindwing; *subcostal nervure prolonged beyond the level of node in forewing*; all hypertrigones, median and cubital spaces traversed by several nervures; discoidal cells rather long, 5 to 6 celled; a well developed supplementary nervure running through discoidal field from discoidal cell; *IA* in all wings markedly pectinate; pterostigma short, about 2 mm. in length, braced; membrane very short. Abdomen tumid at base, remaining segments compressed and of even thickness except 8 and 9 which are a little dilated, and 10 which is very short and entirely without a dentigerous plate. Anal appendages rather long, slim; ovipositor of great length, extending beyond end of abdomen by at least the length of segment 9. Male unknown. Genotype,—*Indophlebia asiatica* sp. nov.

Distribution.—Sikkim and S. China only. This genus is closely allied to *Cephalaeschna* and only distantly allied to the *Aeschnophlebia* group, the only Asiatic representatives of which are known from Japan. It is distinguished from *Aeschnophlebia* by the median or basal space traversed by nervures, and from *Telephlebia*, from Australia, by the short pterostigma, the subcostal nervure prolonged beyond the node in the forewings only, by the absence of a dentigerous plate on segment 10 and by the enormous length of the ovipositor which is comparable to that of *Cordulegaster*.

Indophlebia asiatica, sp. nov.

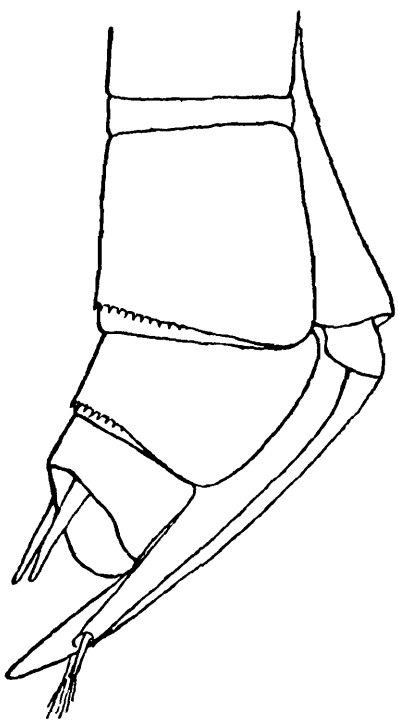
(Text-fig. 2.)

1916. *Caliaeschna (?) acutifrons* Ris, *Suppl. Ent.* No. 5, pp. 55, 56, pl. ii, fig. 5.

Female. Abdomen 50 mm. Hindwing 48 mm. Male unknown.

Head. labium and labrum ferruginous with obscure yellow spots at base of latter; anteclypeus brown; postclypeus olivaceous with two small punctate bright yellow depressions; frons dark ochreous; vesicle, which is very minute, black; occiput dark reddish brown; eyes olivaceous green. Prothorax and thorax dark reddish brown marked with bright citron yellow as follows,—narrow antehumeral stripes extending nearly up to antealar sinus, the upper ends grass green, antealar sinus grass-green, laterally two broad citron-yellow stripes edged narrowly below and behind with black, one on the mesepimeron, the other covering the whole of metepimeron (the upper halves of these stripes grass-green but this may be due to *post-mortem* changes), beneath dull reddish brown. Legs dark reddish brown, distal ends of femora black. Wings hyaline but enfumed smokey brown from apices to base, the central area from discoidal cells to slightly distal of node being almost clear; extreme bases to as far distal as level of arc and the discoidal cells bright amber yellow; pterostigma warm reddish brown, covering 4 cells; membrane dark cinereous; nodal index $\frac{23\text{-}26}{23\text{-}19}\Big|\frac{26\text{-}22}{19\text{-}23}$; 7 cubital nervures in forewing, 7-8 in the hind; 5-6 nervures in median space, of forewing, 5 in the hind; hypertrigones traversed 5-7 times in forewing, 5 in the hind; 5-6 cells in discoidal cells; anal-loop with 13-15 cells and with five other smaller loops arranged around its posterior border. Abdomen blackish brown on dorsum, reddish brown to ochreous on lower part of sides, marked with citron yellow as follows,—segment 1 with a quadrate

greenish yellow spot on each side ; segment 2 with a continuation of this spot as an irregular stripe on each side, a narrow middorsal stripe extending from base to jugal suture and continued very finely from there to apical border ; lastly a pair of narrow apical lunules ; segments 3 to 6 with baso-lateral triangular greenish spots, very narrow paired middorsal spots on jugal suture and a pair of apical lunules ; segment 7 with the apical lunules only ; remaining segments unmarked. Segments 8 to 10



Text-fig. 2.—Genitalia of *Indophlebia asiatica*, sp. nov., ♀, seen from the right side.

strongly tilted upwards by the bulky ovipositor, similar to what is seen in species of the genus *Tanypteryx*.

Distribution.—That of the genus. I have a female from Sikkim, taken at an altitude of 10,000 ft. during September. The prolongation of the subcostal nervure in forewing to beyond node will serve to distinguish this species from any other Indian Aeschnid. Type will be placed in the British Museum.

The far distal situation of the arc, the straight supplements to *IRiii* and *MA* with only a single row of cells intervening and the broad and short discoidal cell of hindwing which approaches that seen in genus *Chlorogomphus*, place this species as one of the most archaic in the subfamily *Aeschnidae*.

Heliaeschna uninervulata Martin.

In the *Journ. Bombay Nat. Hist. Soc.*, Vol. XXVIII, pp. 901, 902 (1922), I described *Amphiaeschna beesoni* as a new species. I find now that this is a race of Martin's *Heliaeschna uninervulata*, differing only in the size and the shape of the superior anal appendages which are broader after the incision, the latter being more cordate than oval. The occiput is olivaceous instead of black and lastly some details of the wing venation differ as follows,—only 3 rows of cells between *IRiii* and *Rspl* instead of

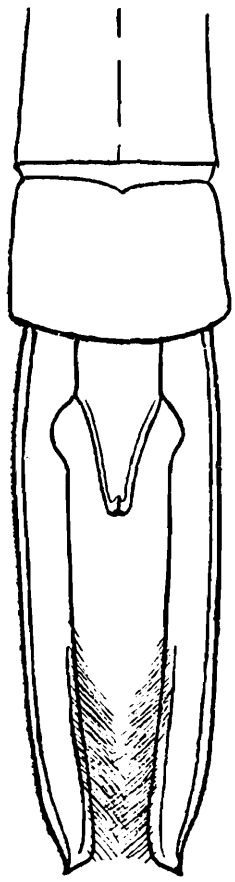
5; only 5-6 cells in discoidal triangles instead of 7; nodal index lower, $\frac{17\text{-}25}{20\text{-}17} \mid \frac{27\text{-}18}{17\text{-}20}$. There is a male in the Williamson collection from Burma, these two specimens being the only ones so far taken within Indian limits.

Gynacantha incisura, sp. nov.

(Text-fig. 3.)

Male. Abdomen 47 mm. Anal appendages 6·5 mm. Hindwing 45 mm.

Head.—Labium bright reddish brown; labrum and face ochreous, olivaceous laterally; a black T-shaped marking on superior surface of frons; eyes olivaceous green; occiput yellow. Prothorax ochreous; thorax olivaceous green with a linear spot of bright yellow on upper part of metepimeron on each side; legs pale reddish or rich ochreous; wings hyaline, untinted but with a narrow edging of brown at all apices; pterostigma ochreous between dark nervures, covering $3\frac{1}{2}$ cells; mem-



TEXT-FIG. 3.—Anal appendages of *Gynacantha incisura*, sp. nov., ♂.

brane cinereous; nodal index, $\frac{17\text{-}19}{18\text{-}17} \mid \frac{20\text{-}17}{14\text{-}19}$; 8 to 9 cells in anal-loop; only 5 cells in all discoidal cells; 6 to 8 cubital nervures in all wings; nervures in hypertrigones variable; only 4 rows of cells between forking of *IRiii*. Abdomen tumid at base, markedly constricted at segment 3; dark reddish brown on segments 1 to 3, black for remaining segments; some obscure apical lunules on segments 2 and 3 but markings largely lost through *post-mortem* changes. Anal appendages: superiors

black, inferior bright ochreous; shaped as shown in fig. 3, the superiors characterized by a deep incision near the base which follows after a dilatation somewhat like that seen in *G. dohrni*, but the apical portion very different from what is found in that species. Female unknown.

Distribution.—Loimwe, S. Shan States, 5,600 ft. Easily determined from all other Indian species by the shape of the superior anal appendages and by the discoidal cells with only 5 cells, which is most unusual in the genus. Type in my own collection will eventually be lodged in the British Museum.

Family LIBELLULIDAE.

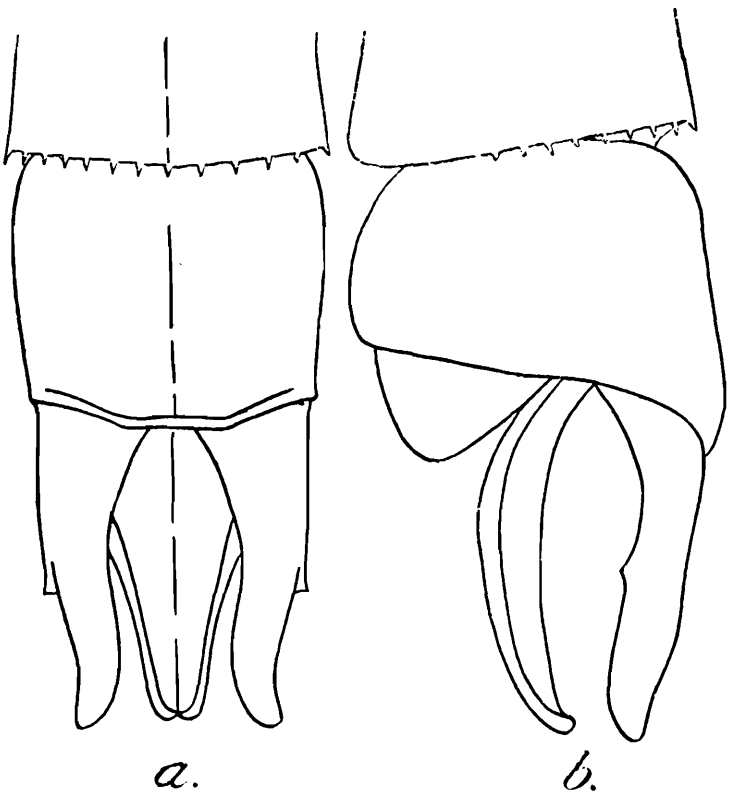
Macromia flavovittata, sp. nov.

(Text-figs. 4 & 5.)

Male. Abdomen 48 mm. Hindwing 41 mm.

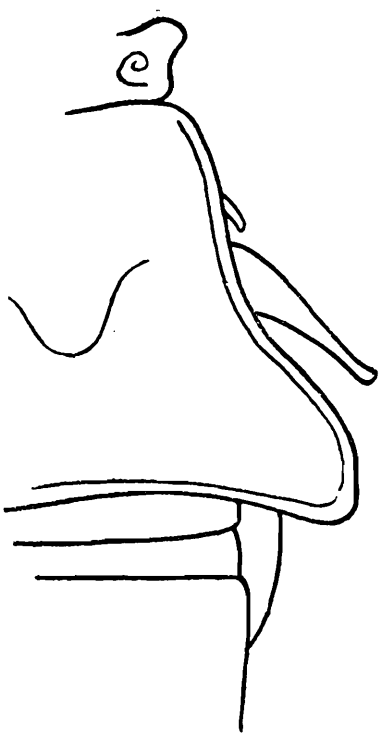
Head.—Labium with midlobe and bases of lateral lobes citron yellow, border of latter broadly brown; labrum bright ochreous very finely bordered with dark reddish brown; anteclypeus dark brown; postclypeus entirely bright citron yellow forming a conspicuous transverse band across face; frons citron yellow with the floor of sulcus above and the front aspect blackish brown; vesicle dark brown with the two points surmounting it bright yellow posteriorly; occiput black; eyes emerald green during life, glossy black behind. Prothorax and thorax dark reddish brown, the latter with a dark blue metallic reflex and marked with citron yellow as follows,—the antealar sinus, a rather narrow humeral stripe not quite attaining upper limit of dorsum, and laterally, an oblique stripe traversing mesepimeron and meeting its fellow on the opposite side by crossing tergum between the roots of wings; beneath two divergent yellow stripes on a reddish background. Legs black, tibial keels conspicuously yellow. Wings hyaline stippled with brown, apices enfumed rather more deeply than rest of wing; costa finely yellow to distal of pterostigma which latter is short, blackish brown and covers about 2 cells; membrane greyish white; nodal index $\frac{10\text{-}16}{10\text{-}10} \mid \frac{16\text{-}10}{11\text{-}12}$; anal-loop 7 celled; 5 cubital nervures in forewing, 3 in the hind; hypertrigones traversed 3 times in forewing, once in the hind; discoidal field beginning with 2 cells and continued as a single row for a distance of 5 cells; anal-triangle 2 celled. Abdomen black, ringed and spotted with citron yellow as follows,—segment 2 with a complete submedian ring occupying nearly half the length of segment and but slightly separated from base dorsally; segments 3 to 6 with paired basodorsal spots, triangular in shape with base resting on jugum and the apex nearly attaining to apex of segments; segment 7 with a broad basal annule deeply indented on middorsum posteriorly and occupying the basal two thirds of segment; segment 8 with a similar annule but shorter and broader; segment 9 with a linear basal dorsal spot; segment 10 unmarked, its dorsum flat and with but a feebly marked carina. Anal appendages dark reddish brown; superiors as long as segment 9, inner border concave but turning out apically, outer border convex near base, concave

near apex and bearing a very small spine at its maximum convexity; apex turned strongly out and very obtuse at end; seen in profile, directed



TEXT-FIG. 4.—Anal appendages of *Macromia flavovittata*, sp. nov., ♂. *a*. Dorsal view. *b*. Seen from the left side.

straight back; inferior of the same length, narrowly triangular, apex turned up somewhat and minutely emarginate.



TEXT-FIG. 5.—Genitalia of *Macromia flavovittata*, sp. nov., ♂.

Distribution.—Darjeeling District, Bengal. Type a male in my own collection from Mungpu, above the Teesta Valley, taken in May.

This species is closely allied to *M. flavicincta* and differs from it by the following points,—discoidal field in forewing with only a single row of cells at beginning, labrum not bordered broadly with black, no yellow spot behind eyes, abdominal segments 3 to 6 with paired dorsal spots instead of annules and lastly, by the different shape of the superior anal appendages which are rounded at apex. It agrees with *M. flavicincta* by the very rare feature of a yellow spot behind the vesicle. (This spot is however absent in my specimens of the latter species from Poona). The same features will serve to separate it from *M. cingulata.*

Epophthalmia frontalis malabarensis, subsp. nov.

1931. *Azuma frontalis* Fraser, *Rec. Ind. Mus.* XXXIII, pp. 447, 452.

Male. Abdomen 50-53 mm. Hindwing 44-46 mm.

Head similar to that of *E. frontalis frontalis* except that the colour is a much darker brownish red almost deepening to black, and the frons and vesicle are very dark metallic blue. Thorax dark blue metallic changing to dark reddish brown on lower parts of dorsum and on metepimeron; markings restricted, the antealar sinus bordered finely with yellow posteriorly, the antehumeral stripes very narrow and pointed above, the oblique stripe on sides very narrow and bordered before and behind with black. Wings hyaline, apices clear, tornus palely tinted with amber yellow in hindwing; nodal index, $\frac{8\text{-}17}{10\text{-}12}\left|\frac{16\text{-}8}{12\text{-}9}\right.$; hypertrigones traversed 3-4 times in forewing, twice in the hind; 4-5 cubital nervures in forewing, 3 in the hind; anal-loop 10-12 celled; pterostigma blackish brown, covering 2 cells; membrane grey with a blackish outer border. Abdomen black marked with bright citron yellow as follows,—segment 2 with a narrow annule similar to that seen in *E. frontalis* but narrower; segment 3 with a narrow annule filling the apical half of space lying between base of segment and jugal suture and broadly interrupted so that it appears as two spots viewed from above; segments 4 to 6 with small paired isolated subbasal spots (in teneral specimens, these spots may be continued laterally and basally to base of segment); segment 7 with a basal annule occupying basal fourth of segment; segment 8 with an annule of half this breadth and sometimes obsolete; segment 9 unmarked; segment 10 with a large rounded dorsal spot confluent or not with a smaller basodorsal spot. (This marking very variable and often more extensive.) Anal appendages blackish brown deepening to black at sides and apices; superiors but slightly longer than segment 10, of similar shape to *E. frontalis* but the lateral spine more prominent and the teeth following it more robust. Inferior appendage variable in length, much longer than superiors in most specimens but of the same length in a few, narrowly triangular with apex curled strongly upwards and minutely emarginate.

Female. Abdomen 55 mm. Hindwing 50 mm.

Closely resembles the male in all but sexual characters. Wings with apices tinted with amber as far proximal as node in forewing and for

nearly that distance in the hind (Adults lose this colouring largely as it appears to fade with age); a dark blackish brown ray in costal, subcostal and basal spaces of hindwing; nodal index higher but other details of venation as for male. The basal annule on segment 3 narrower, segment 9 with a narrow basal annule; segment 10 entirely yellow. Anal appendages shortly conical, yellow. In teneral specimens, less often in adults the yellow spots on frons much reduced, and those of the superior surface of same structure often entirely absent as in *E. vittata cyanocephala.*

Distribution.—Confined to the Western Ghats of India; Malabar and Coimbatore districts. I have taken specimens at Tamaracherry and Calicut and found it not uncommon in the Walayar Forest, on the Coimbatore-Malabar frontier. In the latter place it was in company with *E. vittata vittata* which species outnumbered it in the proportion of 20 to 1. It is easily distinguished from all others occurring within Indian limits except *E. vittata cyanocephala*, from Ceylon, by its extreme melanism and by the paired dorsal spots on abdomen instead of stripes or rings. The yellow spots on upper surface of frons will serve to distinguish it from the Ceylon species. Type and allotype in my own collection; cotypes deposited in the British Museum.

Family AGRIONIDAE.

Genus **Archineura** Kirby.

Mr. J. Cowley informs me that the name *Leucopteryx* which I had adopted for my new genus, the genotype of which is *L. hetaerinoides*, is preoccupied and so calls for a new name. However recently I have had an opportunity of comparing the species mentioned above with *Echo incarnata* Karsch and as a result I have no hesitation in placing them in the same genus. Both *incarnata* and *hetaerinoides* have little in common with the characters of genus *Echo* and undoubtedly deserve generic rank, and as Kirby's *Archineura basilactea* is a teneral specimen of the former species, it seems best to place both in genus *Archineura* with *A. incarnata* (Karsch) as genotype.

In addition to the six males in Mr. Morton's collection, one of which he has kindly given me, I have been able to examine an adult male and female of *A. incarnata* in the MacLachlan collection, as well as the type of *A. basilactea* Kirby in the British Museum. In this latter, the opaque white area at the base of the wings has a distinct pinkish tinge similar to that seen in species of teneral *Hetaerina* which have a similar red basal marking in the adult stage. Moreover the venation is similar to the specimens of *A. incarnata* so that there can be no doubt as to the identification of this specimen.

A. incarnata differs from *A. hetaerinoides* by having the opaque coloured basal wing spots in both fore- and hind-wings and also by having the neuration in this spot of a very close nature. The females of both species however are without the basal wing markings and the basal neuration is of an open character in both, so that the differential characters exist in one sex only. Both sexes have an extremely elongate pterostigma and this in itself is sufficient to remove them from genus *Echo.*

The female in the MacLachlan collection is in a fine state of preservation, as well as fully adult. Head and thorax are similar to the male but more robust; the abdomen is of very heavy build and dark brown with a coppery metallic reflex on the proximal segments, whilst segments 8 to 10 have a pale brownish yellow middorsal stripe continuous from segment to segment. The wings are very long and broad and are evenly tinted with pale brownish yellow, this deepening in the costal and subcostal spaces and between the costa and radius distal to node; venation bright ochreous throughout; pterostigma as elongate as in the male, pale creamy yellow framed darkly in thick nervures. Basal neuration more open than in the male.

Agrion atrocyana, sp. nov.

In the British Museum collection are three specimens of a very large Agrion which some time ago I had provisionally named *Pseudomatrona atrocyana.* A further examination has convinced me that save for the extraordinary shape of the wings, this species cannot be separated from genus *Agrion.* I am further convinced of this by comparing it with *Agrion atrata* which has the wings similarly broadly rounded at the apices although not nearly so broad as in *atrocyana.* A future revision of the genus *Agrion* may call for a separation of these two species which differ so strongly from the rest of the genus. The following is a description of the new species :—

Male. Abdomen 55 mm. Hindwing 47 mm.

Head.—Labium black; labrum and rest of head metallic peacock blue with green reflex in certain lights. Prothorax and thorax peacock blue, black beneath. Abdomen brilliant metallic emerald green, black beneath. Anal appendages one third longer than segment 10, forcipate, slim at base, expanded and compressed in apical half and with 3 robust spines on outer border; inferior slightly shorter, tapering to apex which is obtuse. Legs slim, of great length, black. Wings of great breadth, far more so than in *Matrona,* markedly rounded at apex, basal space entire, arc fractured, discoidal cell as long as median space, traversed 12 to 13 times; *IA* bifurcated, proximal limb running straight to base of wing; opaque black throughout with a steely blue reflex above and below; pterostigma absent in both sexes.

Female. Abdomen 47 mm. Hindwing 45 mm.

Similar to male in all respects save sexual characters.

One of the males is teneral and a beautiful metallic violet throughout.

Distribution.—Two males and a female from Tonkin, in the British Museum collection. I found these three specimens mixed up with those of *Matrona* which they so greatly resembled that the mistake perhaps was justifiable. The enormously dilated wings attracted my attention and it is this feature which is so remarkable and differentiates them from all others of the genus *Agrion.*

Agrion coomani, sp. nov.

Male. Abdomen 60 mm. Hindwing 46 mm.

Head.—Labium pale yellow; labrum glossy black marked with two bright chrome yellow pyriform spots; anteclypeus black; postclypeus brilliant emerald green metallic; rest of head a dull metallic green with an oval reddish brown spot on the outer side of each lateral ocellus; base of penultimate segment of antennae dull ochreous. eyes brown. *Prothorax* and *thorax* a beautiful metallic green on dorsum and sides, carneous beneath, this extending on to sides of thorax as a black bordered stripe on the postero-lateral suture and a second stripe on the posterior border of metepimeron. *Legs* black, coxae and trochanters paler; *wings* long and broad, out of proportion to the small head, body and slender abdomen; forewings hyaline bordered very narrowly with black, this border beginning as a dark costal ray broadening towards the node, then narrowing to apex which is rather broadly tipped with opaque black the inner edge gradually vignetted and not sharply limited as in *A. melli.* Posteriorly the narrow bordering is continued to as far as the level of discoidal cell. The neuration of the whole wing black and the nervures irrorated with this, giving a very coarse appearance to the neuration. Hindwings opaque black with a steely sheen from the apex to within 2 to 3 cells of the discoidal cell, proximal to which the neuration is coarsely black like the forewing, with the cell middles hyaline. Pterostigma absent. *Abdomen* brilliant metallic green throughout on dorsum, segments 8 to 10 black along the ventral borders, yellow beneath. *Anal appendages* black, of the usual generic shape.

Habitat.—Tonkin. The *type* is a male in the Paris Museum and there is another male in my own collection. This species is closely related to *A. melli* (*Ris*), agreeing with it in the colour of the body and labial marking. It differs from that species however by the apex of forewing less broadly black and this marking less sharply defined and by having the whole of the hindwing except base opaque black instead of only the apex as in *A. melli.* The possibility of this insect being the male of *A. grandaeva* (Selys) has not been overlooked but it seems more probable that the male described by Dr. Ris (*Suppl. Ent.* No. 1, p. 54 (1912), which is also from Tonkin, is more likely to be the true male as its neuration formulae agree very closely with the type female of *A. grandaeva,* whereas those of *A. coomani* differ widely. From *A. cornelia* and *laosica,* which belong to the same group, the new species is distinguished by its wings black instead of rich reddish brown.

Agrion laosica, Fraser.

Since I described this fine new species from Laos, Siam [*J. Siam Soc. Nat. Hist.* Suppl., Vol. IX, p. 128 (1933)], I have been able to compare it with *A. cornelia* which I collected in large numbers this year in Japan. I find that the new species is even nearer *cornelia* than I had at first suspected. I now note the following differences,—Labrum with a large yellow spot on each side as in *A. coomani* and *melli,* absent in *cornelia*; postclypeus brilliant metallic green, dull coppery bronze in *cornelia*; wings: distal fourth of forewing paler than the rest of wing

in *laosica*, darker than rest of wing in *cornelia*; no dark costal ray in *laosica*; the subapical dark brown band of hindwing much narrower than in *cornelia*; lastly the brilliant emerald green metallic of abdomen is replaced by peacock blue in *cornelia*.

Climacobasis modesta (Laidlaw).

I have received a single female of this rare insect from Dr. Kerr, who took it on Lankawi Island, Kedah, F. M. S., 17-VI-32. It differs from the type in some respects, possibly on account of its fully adult condition; the thorax is a beautiful crimson metallic colour closely resembling that seen in *A. haemorrhoidalis* and is pruinosed white beneath; the femora are coppery metallic; wings palely enfumed brown deepening towards the apices which are definitely dark brown to the level of the pterostigma in the forewing and to a short distance proximal of that organ in the hindwing; the inner edge of this dark apex gradually fades off into the body of the wing and is continued for a short distance along the posterior border of the wing; pterostigma very short, about half as broad as long, squared distally, very oblique and acute proximally, followed distally by 2 rows of cells as in some species of *Mnais*. Abdomen dark reddish brown throughout but deepening to almost black on the terminal segments. Abdomen 42 mm. Hindwing 38 mm. This specimen is in my own collection.

Rhinocypha vitrinella, sp. nov.

Male. Abdomen 20 mm. Hindwing 22 mm.

Head.—Labium black; labrum and clypeus glossy black; rest of head velvety black with a small oval yellow spot on the outer side of each posterior ocellus and a small round spot on the occiput. *Prothorax* and *thorax* velvety black, the former with a large transverse azure blue spot on the posterior lobe, the posterior border of the spot sinuous like a cupid's bow; the latter marked with azure blue as follows,—the mesothoracic triangle, which is short and broad, extending for less than half the length of dorsal carina; a narrow antehumeral stripe lying close to the mesothoracic triangle and slightly longer than it; a narrow humeral stripe incomplete above and below; a small oval spot on each side of dorsum internal to the upper end of humeral suture; an upper anterior spot followed by a short linear spot on anterior border of mesepimeron; a broad fascia, which may be pale blue or yellow, traversing the whole of lower side of thorax, nearly interrupted at the antero-lateral suture and rather broadly so at the postero-lateral suture; beneath black with two small yellow spots posteriorly. *Legs* black, tibiae not dilated or pruinosed. *Wings* of nearly equal length and breadth and of the same shape, nearly one third broader than in *R. perforata*; palely tinted with yellow and hyaline for the basal three fifths, opaque black with a blue steely reflex for the apical two fifths. Forewing opaque from apex to within 8 to 10 cells of node, the black area prolonged between the costa and radius for not more than 2 or 3 cells, the inner border of this area slightly oblique from costa outwards. Hindwing opaque from apex to within 5 cells of node, the inner border of this area nearly straight and

but slightly serrate, marked with vitreous spots as follows,—a subapical compact spot, 4 rows of cells deep, the first and third rows shorter than the others which are 7 cells in length; a medial row of parallel stripes lying between the apical spot and border of black area,—the posterior stripe lies between *MA* and *Cuii* and is about 15 cells long; the middle stripe lies between *Riv+v* and *IRiii* and is a little shorter, about 10 to 11 cells long; the anterior stripe lies between *Riii* and *IRii* and is of the same length as the posterior stripe. In the same line but separated from it by a few opaque cells is a continuation of the middle stripe which projects into the hyaline area for a distance of 3 cells. Pterostigma large and swollen, especially in the hindwing, black. *Abdomen* black marked with azure blue as follows,—segment 1 with a large quadrate spot on each side; segment 2 with a reniform apico-lateral spot and a short narrow ventro-lateral stripe; segment 3 with basal and apical lateral spots and a ventral stripe; segment 4 and sometimes 5 with a small apical lateral point; remaining segments unmarked. Anal appendages of the usual generic shape. Female unknown.

Distribution.—Assam. Several males from Cachar, Assam, collected by Mr. Chas. Antram. In volume II, *Odonata, Fauna of British India*, I described this species under the heading *R. whiteheadi* Kirby, under the impression that they were conspecific, not having the type of *whiteheadi* to study at the time. Dr. F. Ris had expressed the opinion that this latter was synonymous with *R. perforata perforata* and Dr. Laidlaw had endorsed it. Recently I compared the Cachar specimens with Kirby's type and found that they were not conspecific and that Drs. Ris and Laidlaw were correct in their surmise that *whiteheadi* was merely a specimen of *R. perforata perforata.* In the new species, the wings are relatively broader and more pointed at apices; the apical spot is a single compact one instead of split or made up of several rows; the black apical area is not prolonged along the costal border as in *perforata* and the vitreous spots are nearer the apical end of wing.

The type of *R. vitrinella* has been deposited in the British Museum, one male is in Mr. Morton's collection and the remainder are in mine.

THE NEMATODE GENUS *DELETROCEPHALUS* DIESING, 1851.

By P. A. MAPLESTONE, *D.S.O., M.B., Ch.B., D.T.M., School of Tropical Medicine, Calcutta.*

The genus *Deletrocephalus* was placed in the sub-family Trichoneminae by Baylis and Daubney (1926), but they state it is insufficiently described. Yorke and Maplestone (1926) placed it amongst a group of Strongyloidea insufficiently described to be more definitely classified.

Maplestone (1932) described a worm from the south American ostrich (*Rhea americana*) which he named *Quasistrongylus rheae* gen. *et* sp. nov. Travassos (1933) described a worm from the same host which he identified as *Deletrocephalus dimidiatus* Diesing, 1851. Comparison of Travassos' description and figures with my own leave no doubt that the two worms are identical, therefore *Quasistrongylus rheae* Maplestone, 1932 is a synonym of *Deletrocephalus dimidiatus*.

Travassos re-erected the sub-family Deletrocephalinae Railliet, 1916 to accommodate this species, but this seems unnecessary as the characters of the worm allow of its inclusion in the sub-family Strongylinae Railliet, 1893. It should be noted that Travassos says the internal leaf-crown is absent, but he figures a beaded line along the junction of the external leaf-crown and the anterior border of the buccal capsule. This is a common appearance in the case of worms with a double leaf-crown and indicates the points of origin of the internal leaf-crown. My own observations have shown that there is an internal leaf-crown composed of very numerous bristle-like elements.

It is accordingly proposed to define the genus *Deletrocephalus* as follows.

Deletrocephalus Diesing, 1851.

(Syn. *Quasistrongylus* Maplestone, 1932.)

Strongylinae. Head compressed laterally; mouth directed straight forwards, elliptical with its long axis dorso-ventral, surrounded by four sub-median and two lateral papillae. Two leaf-crowns present, the external composed of six broad crescentic elements, and an internal composed of very numerous fine elements. Buccal capsule large with an undulating anterior border and several pairs of stout teeth in its depth, duct of dorsal oesophageal gland nearly reaching its anterior border. *Male:* bursal formula—ventral rays cleft, all the laterals arise from a common trunk, externo-dorsal arises from a common trunk with the dorsal, dorsal ray forked at its extremity and gives off one or two lateral branches of varying size; spicules equal and similar; gubernaculum present. *Female:* vulva opens near anus on a large prominence, oviparous.

Parasites of birds.

Type species.—Deletrocephalus dimidiatus Diesing, 1851. In *Rhea americana*.

Syn. *Strongylus dimidiatus* Schneider, 1866. *Quasistrongylus rheae* Maplestone, 1932.

The specific characters have been fully described both by Maplestone (1932) and Travassos (1933) so it is not considered worth while giving them again.

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FIRST RECORD OF THE TRICHOGRAMMATID CHALCID GENUS *CHAETOSTRICHA* WALKER FROM INDIA, WITH A DESCRIPTION OF A NEW SPECIES.

By M. S. MANI.

(*From the Entomological Section, Zoological Survey of India, Indian Museum, Calcutta.*)

The genus *Chaetostricha*[1] of Haliday's manuscript was established by Walker[2] in 1851, with *C. dimidiata* as the type-species. Since then six more species of the genus have been described: *C. pretiosa* and *C. minutissimum* from America by Riley[3] and Packard[4] respectively, *C. werneri*, *C. schlicki* and *C. pulchra* from Denmark by Kryger[5] and *C. phaseoli* from West Indies by Dozier[6]. The genus has not been recorded from India so far. In an interesting collection of Trichogrammatid egg parasite of *Bruchus quadrimaculatus* Fabr. submitted to me for identification by Mr. Durga Das Mukerji, University Lecturer in Zoology, University College of Science, Calcutta, I found this genus represented by a new species, which I describe below under the name *C. mukerjii*, sp. nov. The genus runs between *Trichogramma* Westw. and *Lathromeris* Först. in Ashmead's tables[7]. It is distinguished from the former by its 7-articulate antennae (scape 1, pedicel 1, ring-joint 1, funicle joint 1, club joints 3) and from the latter by the long marginal fringes of its fore wings.

I thank Mr. Durga Das Mukerji for giving me an opportunity of studying this extremely interesting parasite.

Chaetostricha mukerjii, sp. nov.

This species differs materially from all the other species of the genus described so far and is readily distinguished by the indistinct apical segment of the club of antennae.

♀ ♂ Length about 0·4—0·5 mm. Head with a width about half the length of body, rather deeply and broadly grooved both in front and at the back. Antennae a little less than one third the length of body, brownish, rather densely clothed with long, fine setae, stout; scape somewhat attenuated beyond the basal half; pedicel about two thirds the length of scape, apical diameter about twice the basal; ring joint fairly thick; funicle joint about three fourths the length of pedicel, somewhat slender basally; club about twice the length of pedicel,

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[1] Förster and Girault have spelt as *Chaetosticha*, but I have adopted as correct the original spelling in Walker's paper.

[2] Walker, *Ann. Mag. Nat. Hist.*, (2) VII, p. 211, (1851).

[3] Riley, *Canad. Entomol.*, II, p. 161, (1879).

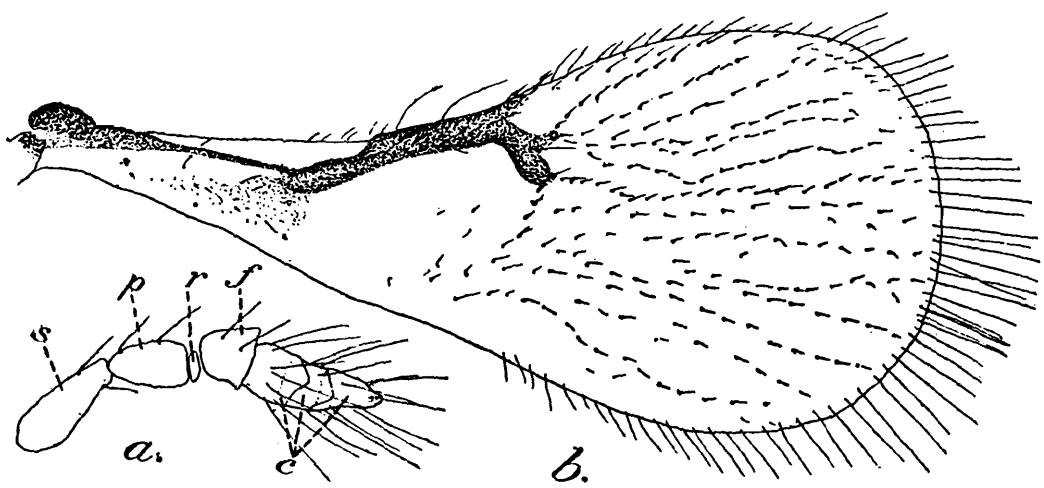
[4] Packard, *Proc. Boston Soc. Nat. Hist.*, XXI, p. 37, (1881).

[5] Kryger, *Kobenhaven Entomol. Medd.*, XII, pp. 306-309, (1922).

[6] Dozier, *Proc. Entomol. Soc. Washington*, XXXIV, p. 31, (1932).

[7] Ashmead, *Mem. Carnegie Mus.* I, (4), p. 360, (1904).

gradually tapering to a rounded tip, more slender than the funicle joint, triarticulate, basal two segments of almost equal lengths, apical segment somewhat more slender and longer, covered with longer setae than the other antennal segments. Eyes dark reddish brown. Ocelli



TEXT-FIG. 1. *Chaetostricha mukerjii*, sp. nov. *a*. antenna; *b*. fore wing; *c*. club; *f*. funicle joint; *p*. pedicel; *r*. ring joint; *s*. scape.

reddish, the lateral ones separated from the margin of eyes by a distance nearly equal to their diameters. Thorax half the length of body. Mesonotum and scutellum smooth, the latter of a length about two thirds that of the mesonotum in the median line and dark brownish to black in colour. Legs moderately setose, mostly brownish black, except the bases and apices of femur and tibia which are dirty white or brownish. Fore wing with a length a little over twice its greatest breadth; submarginal vein about three fourths the length of the marginal vein, both sooty brownish in colour. Abdomen black. General colour of body mostly dark brownish to black.

Cotypes. 2 ex. dissected on slide No. $\frac{901}{H\ 3}$, 1 ex. on slide No. $\frac{900}{H\ 3}$, 8 ex. on card No. $\frac{902}{H\ 3}$. In the collections of the Zoological Survey of India (Ind. Mus.), Calcutta. Coll. Durga Das Mukerji, Calcutta. Parasitic on the gram pest *Bruchus quadrimaculatus* Fabr.

RECORDS, NOTES AND DESCRIPTIONS OF *BREMUS* FROM ASIA (BREMIDAE: HYMENOPTERA).

By THEODORE H. FRISON, *Chief, Illinois State Natural History Survey, Urbana, Illinois.*

This paper is a report concerning material mostly sent to me for study and identification by Dr. Hem Singh Pruthi of the Zoological Survey of India, Indian Museum, Calcutta, India. In addition to the material from the Indian Museum I have incorporated some records and descriptions based upon specimens sent to me for study by the United States National Museum, Washington, D. C., and upon material in my own collection.

Holotypes of six new varieties and two new species are deposited in the collection of the Indian Museum. Holotypes of three new species and two new varieties are deposited in the United States National Museum because the descriptions are based upon their material. Paratypic specimens of some of the new species and varieties are deposited in the collection of the author.

My thanks are again due to Dr. Hem Singh Pruthi and the Indian Museum for the loan of most of this material, to the United States National Museum for the loan of the other material included in this paper, to Dr. O. W. Richards, Oxford, England, for numerous comparisons of typic material in the British Museum and other information, and to Dr. Carl Mohr, Associate Entomologist, Illinois State Natural History Survey, for making the drawings.

PART I.

NOTES ON SOME TYPES AND DETERMINATIONS OF FREDERICK SMITH.

Among the specimens sent to me by the Indian Museum for study were ten specimens in very poor condition which are without doubt a part of the material described and recorded by Frederick Smith (1878*a*) in his paper dealing with Hymenoptera in the "Scientific Results of the Second Yarkand Mission" and one specimen undoubtedly one of the cotypic specimens described in his paper (1878*b*) entitled "List of Hymenoptera obtained by Mr. Ossian Limborg east of Maulmain, Tenasserim Provinces, during the months of December, 1876, January, March and April, 1877, with descriptions of new species."

Since the records and status of some of these species have been in doubt, I deem it worthwhile to publish the following notes.

Bremus tunicatus (Smith).

1878. *Bombus vallestris* (in part), Smith, *Sci. Res. 2nd Yarkand Miss.*, Hymenoptera, p. 8.

1 worker, "Yark. Exp., Sind Valley, 122-F. S., Sind, 3474-10, ♀"; no doubt one of the specimens originally included by Smith (1878*a*)

in his description of *vallestris.* No determination label now on pin with specimen. Labelled as paratype of *B. vallestris.*

1 worker, " Yark. Exp., Sind Valley, 125-F. S., Sind, 3438-10, S, *Bombus vallestris* Smith." No doubt another specimen of typic series of *vallestris* Smith (1878*a*) and I have marked it as *lectotype* because specimen is associated with determination label.

Tunicatus Smith has priority over *vallestris* Smith.

Bremus oculatus var. **haemorrhous** (Richards).

1878. *Bombus vallestris* (in part), Smith, *Sci. Res. 2nd Yarkand Miss.*, Hymenoptera, p. 8.

1 worker, " Yark. Exp., Sind Valley, 127-F. S., Sind, 3473-10 S, *Bombus vallestris* Smith." No doubt one of the typic specimens of *vallestris.* Smith's type series of *vallestris* was a mixture of *oculatus* var. *haemorrhous* Richards and *tunicatus* Smith. Worker synonymous with *tunicatus* selected by author as lectotype (see above) to eliminate further confusion. Head of this specimen is too long to agree with statements in original description of *vallestris* and therefore precludes making this worker the lectotype. Worker of *tunicatus* does fit the " head-sub-rotundate " of original description. Specimen labelled, however, as a paratype of *vallestris.*

Bremus longiceps (Smith).

1 queen, " Leh, 2489-10, F. S.-663, S., *Bombus longiceps* Smith." This is a valid species and Richards (1928, p. 334) has been correctly using this name. Specimen selected and marked as *lectotype* of *longiceps.*

1 worker, " Yark. Exp., Leh, 3475-10, F. S.-633, S." Marked as *Lectomorphotype* worker of *B. longiceps.* Agrees in structural characters with queen but not selected as lectotype because queen has associated with it a determination label.

1 male, " Yark. Exp., Leh, 3478-10, F. S.-633, S." I consider this a true male of *longiceps* and have marked specimen as *lectoallotype.* There is no doubt this is the male mentioned in the original description.

Dover (1922) mentions one of these types.

B. oshanini Skorikov (1928-1933) is certainly very closely related if not identical with *longiceps* but I hesitate to place *oshanini* into synonymy because Asiatic bumblebees are so poorly known at the present time. The genitalia of the male seems to be identical with the figure given by Skorikov (1931). It should be mentioned here that Skorikov first used the name of *oshanini* in 1922 but did not actually describe this species, next in 1931 he figured the male claspers and finally in 1933 published a short description. I believe original date of description must date from 1931, but in any case if *oshanini* is identical with *longiceps,* as I believe, the latter name would have priority

Bremus montivagus (Smith).

1 queen, "Upper Tenass., 8386-4, Moolae, 3-6,000 ft., S, *Bombus montivagus* Smith." This specimen agrees well with the original description and without doubt is one of the cotypic specimens. I am informed by Dr. Richards that another queen of the cotypic series is in the British Museum. Richards' concept of *montivagus*, based upon the specimen in the British Museum, is the same as for this specimen.

Bremus melanurus subsp. **subdistinctus** (Richards).

1878. *Bombus altaicus* (in part), Smith, *Sci. Res. 2nd Yarkand Miss.* Hymenoptera, p. 9.

1 male, "Yark. Exp., Pangkong Valley, 3497-10, F. S.-783, S. *Bombus altaicus* ♂ Eversm." In exceedingly poor condition with part of thorax, entire head and most of legs missing. Genitalia seem to be identical with illustration of Skorikov (1931, p. 232) for *melanurus*. There seem to be a few black hairs on mesonotum between bases of wings. Wings light colored. Seems to agree best with the subspecies *subdistinctus* Richards. Male is of medium size.

1 male, "Yark. Exp., Pangkong Valley, 3491-10, F. S.-783, S." Another specimen of the series determined by Smith (1878*a*) as *B. altaicus*. Genitalia, as in preceding specimen, is apparently identical with *melanurus* as figured by Skorikov (1931, p. 232). Specimen in very poor condition. There seems to be a few black hairs on the mesonotum between the bases of the wings. Wings are rather light in color. Male is very small.

1 worker, "Yark. Exp., Leh, 3490-10, F. S.-663, S, *Bombus altaicus* Eversm." Without doubt one of the specimens recorded by Smith (1878*a*) as *altaicus*. The exact locality of "Leh" is not mentioned in the original description but is referred to in the same article as in Ladak, a name which is mentioned in the original description.

PART II.

General Systematic Account.

Genus **BREMUS** Jurine (1801).

Subgenus **SIBIRICOBOMBUS** Vogt (1911).

Bremus longiceps (Smith).

2 workers, Karakal, Bumboret Valley, Chitral, N. W. F. Prov., 22-25.VII.29 (B. N. Chopra).

Subgenus **LAPIDARIOBOMBUS** Vogt (1911).

Bremus flavothoracicus (Bingham).

1 queen, Onari, Garhwal, W. Himalayas, 11,000 ft., 27-VI-14 (Tytler); 2 queens, Onari, Garhwal, W. Himalayas, 11,000 ft., 20-VI-14 (Tytler).

The placement of this species in this subgenus does not rest upon characters of males, which are unknown, and, therefore, this assignment may be erroneous.

Bremus miniatus (Bingham).

1 worker, Ramnee, 21-X-07; 1 worker, Kanaul, British Garhwal, W. Himalayas, 18-X-07; 1 worker, Andaroun, Garhwal, W. Himalayas, 11,000 ft., VI-14 (Tytler).

Bremus oculatus var. **crassus,** nov.

Male.—Structurally similar to the male of *B. oculatus* as described by Frison (1933). Differs in coloration in that the pubescence on the thorax and first two abdominal tergites is dull yellow instead of hoary or whitish as in typical *oculatus*.

B. oculatus was placed originally by mistake in the subgenus *Sibiricobombus*. It belongs, however, to *Lapidariobombus* in its broadest sense.

Holotype.—Male, Simla Hills ($\frac{4953}{10}$). *Paratype.*—Male, Simla Hills ($\frac{4956}{10}$). Holotype deposited in the collection of the Indian Museum, Calcutta, India. Paratype deposited in the collection of the author.

Bremus semenovianus (Skorikov).

1 worker, Karakal, Bumboret Valley, Chitral, N. W. F. Prov., 22-25.VII-29 (B. N. Chopra); 2 workers, Ustui Gol, Rambhur Valley, Chitral, N. W. F. Prov., 8.VII.29 (B. N. Chopra); 1 worker, Mastuj, Chitral, N. W. F. Prov., 20-30.VIII.29 (B. N. Chopra).

Subgenus **PRESSIBOMBUS,** nov.

This new subgenus is proposed on the basis of characters presented by the male sex. The female is unknown or at present cannot be associated with its male.

The distinctive characters of the male genitalia (Fig. 1*b*) are as follows: head of sagitta (Figs. 1*b* and 1*c*) sickle-shaped when seen from above, but in addition considerably swollen and forming a secondary projection at lower outer angle, arm or stem of sagittae with a small projection on lower surface; when seen from above the squama (Fig. 1*b*) appears as a finger-like inward pointing projection and practically fused as one piece with the stipes, when seen from the front (Fig. 1*d*) the squama appears to have a smaller more rounded hump at base of finger-like projection; the volsellae (Fig. 1*b*) are peculiar because of their shortness and pointedness. Uncus of medium width tapering to apex. Inner and outer spathae not so distinctive and shaped as in figures 1*f* and 1*e*, respectively.

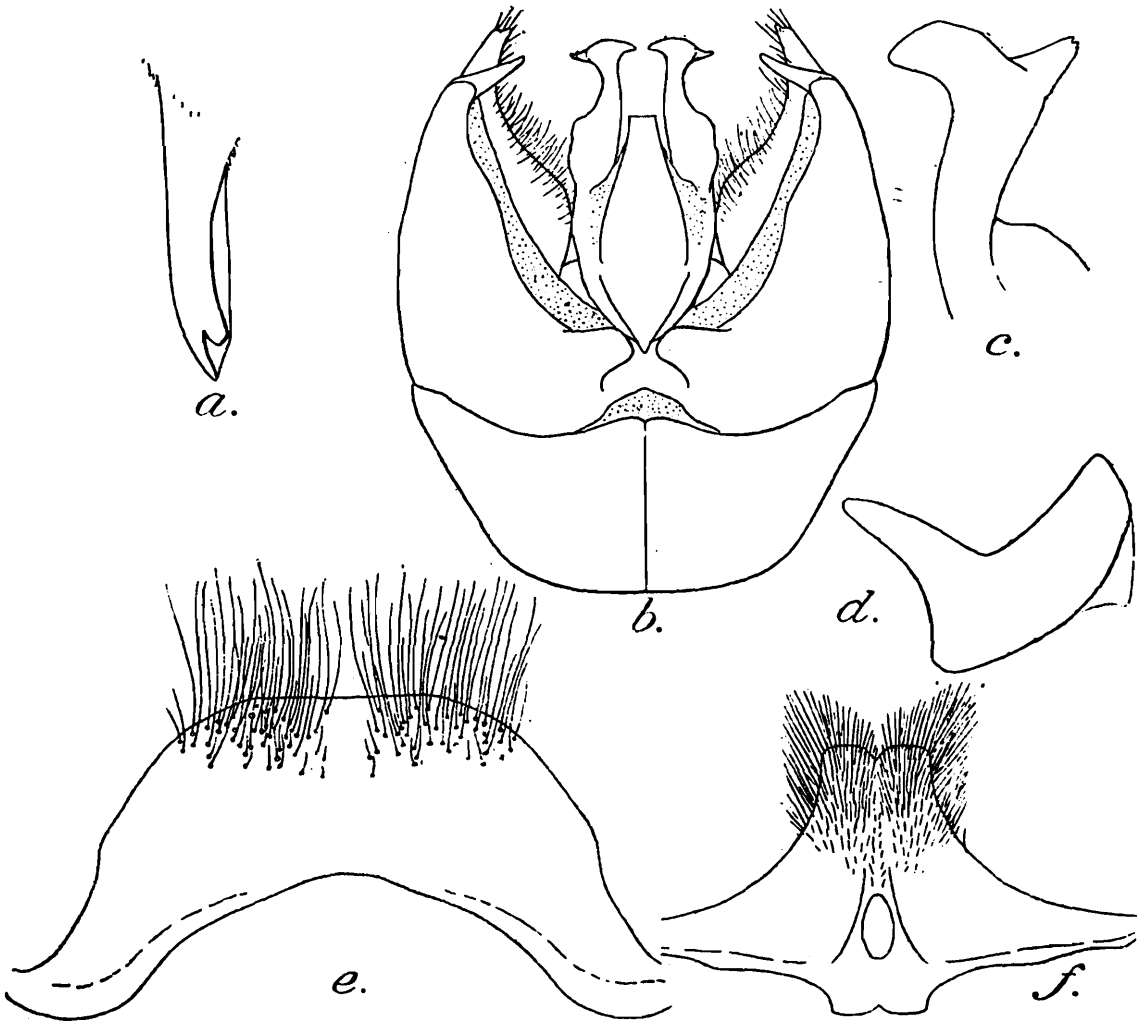
Mandibles two toothed. Malar space of medium length. Eyes normal. (Antennae are missing in type and hence proportions cannot be given).

Type: Bremus pressus, sp. nov. (*Original designation and monobasic*) as described in this paper.

Bremus pressus, sp. nov.

Male.—Pubescence coloured as follows: Face, occipital orbits and occiput with dense yellow hairs, a few of the longer hairs are black; sides and dorsum of thorax yellow, except for a black band between bases of wings; abdominal tergites with first yellow, second dominantly

yellow but with an admixture of black hairs, third and fourth segments brownish-black, fifth with basal portion brownish-black and posterior portion dull ferruginous, sixth and seventh segments dull ferruginous. Coxae, trochanters and femora with long yellow hairs, remaining segments with black, brownish or golden hairs, corbicular fringes brownish or golden in color. Ventral segments of abdomen mostly with long yellow hairs.



Text-fig. 1.—*Bremus pressus*, sp. nov. *a.* mandible showing two teeth; *b.* dorsal view of male genitalia; *c.* head of sagitta of male genitalia; *d.* squama of male genitalia as seen from the front; *e.* outer spatha of male; *f.* inner spatha of male.

Malar space of medium length, slightly longer than width at articulation of mandibles, polished, impunctate. Area between lateral ocelli and inner margin of compound eye with outer half weakly punctate and with some short depressed hairs, inner half polished and impunctate. Mandibles two toothed (Fig. 1*a*). Eyes normal. Wings in general hyaline, but with apical portions slightly stained with brown. Metabasitarsus over three times as long as greatest width and broadest at middle. Corbicular space well developed, convex and with very long hairs fringing sides, integument dark.

Genitalia as in figure 1*b*. Inner and outer spathae as in figures 1*f* and 1*e*. Also see statements under description of subgenus.

Length, 13 millimeters; spread of wings, 27 millimeters; width of abdomen at second segment, 5 millimeters.

Holotype.—Male, N. of Sandakphu, 11,000 ft., 1-X-06 (I. H. Burkill). The antenae are lacking. Deposited in the collection of the Indian Museum.

The genitalia of *pressus* is so distinct from that of any other male I know that I have considered it advisable to erect a new subgenus for its reception. The combination of greatly reduced squamae intimately fused with the stipes, the short and pointed tips of the volsellae, and the peculiar heads of the sagittae are apparently unique. In some respects this new subgenus is closest to *Lapidariobombus* Vogt in its broadest sense, but the characters of the genitalia just mentioned are very different from any species I know belonging to this complex.

Subgenus **HORTOBOMBUS** Vogt (1911).

Bremus religiosus, sp. nov.

Queen.—Similar in general morphological characters with females of the subgenus *Hortobombus* Vogt (1911). The pubescence is colored as follows: face, occipital orbits and occiput with dark hairs, a few hairs bordering sides of disk of clypeus are golden; thorax with pronotum and metanotum yellow, the yellow of pronotum extending down on sides of thorax well below bases of wings and with a strong tendency to become whitish, a broad black band between bases of wings, black to greyish on sides of meso- and metathorax; first abdominal tergite mostly yellow but with a tendency towards black hairs in the middle, second tergite dominantly black except for two well separated small patches of yellow on anterior margin and connecting with yellow on first tergite; third tergite black, fourth tergite white, fifth and sixth tergites essentially black and with some whitish hairs. Hairs on legs black, except on coxae and trochanters where many are somewhat whitish; integument dark. Wings brown, without a violaceous tinge.

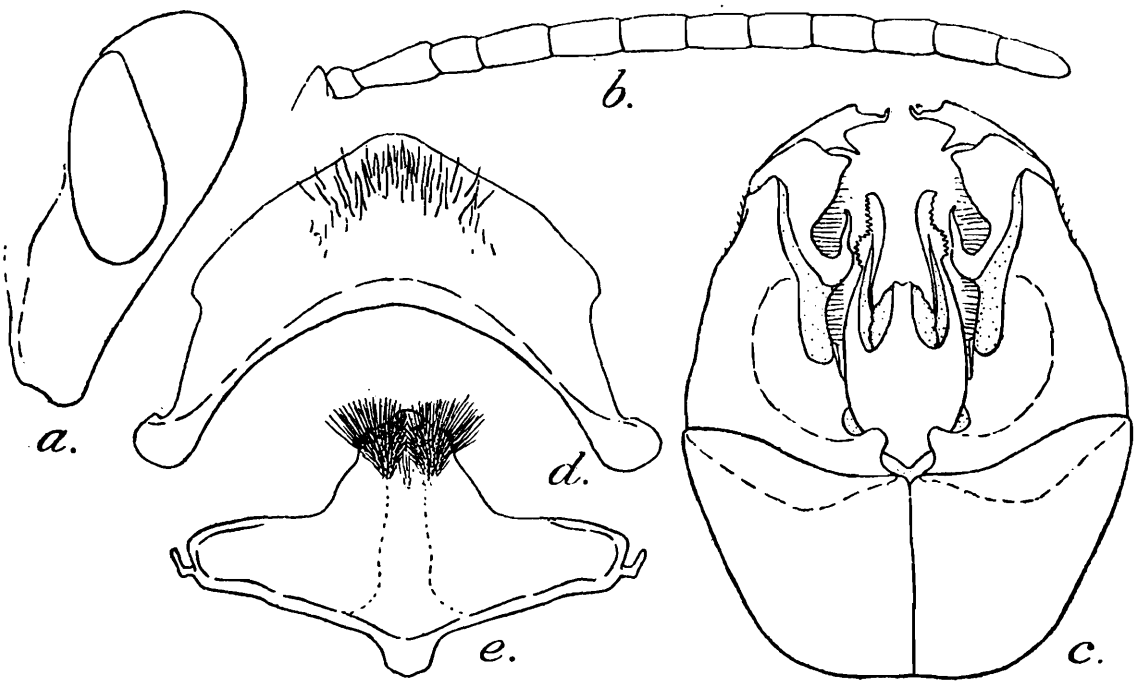
Malar space very long, about two and one-half times as long as width at articulation of mandibles, polished, impunctate. Clypeus strongly convex, polished, large punctures restricted to sides and apical angles, disk with punctures very faint, integument dark. Labrum with tubercle-like areas well developed and separated by cleft, shelf-like structure slightly rounded on anterior margin. Area between lateral ocelli and inner margin of compound eyes with outer half closely punctate, inner half polished and impunctate. Antennae with third segment about as long as fourth and fifth taken together, fourth much shorter than fifth. Mesobasitarsus with a very long and prominent sharp spine-like projection.

Length, 19 millimeters; spread of wings, 41 millimeters; width of abdomen at second segment, 9 millimeters.

Worker.—Similar to the queen in structure and in essential details of color pattern. Differs mainly in smaller size. Most workers show no traces of yellow pubescence on second abdominal tergites and sides of thorax and apical abdominal tergites sometimes with more greyish or whitish hairs.

Varying in size from 10 to 17 millimeters in length and other measurements in proportion.

Male.—Similar in general structure to most males of the genus *Hortobombus* Vogt (1911). The pubescence is colored in general about as in females and as follows: face and occipital orbits with long dark hairs and short yellowish ones intermixed, occiput mainly yellow but with some long dark hairs; dorsum of thorax yellow except for a definite black band between bases of wings, sides of thorax yellow; abdominal tergites with first and basal middle portion of second yellow, remainder of second and third black with some whitish tipped hairs; fourth and lateral margins of fifth whitish-yellow, remainder of fifth as well as sixth and seventh tergites black. Basal segments of legs with long whitish or yellowish hairs, corbicular fringes and hairs on remaining segments golden. Wings brownish without a violaceous tinge.



Text-fig. 2.—*Bremus religiosus*, sp. nov. *a.* head of male from a side view; *b.* antenna of male; *c.* dorsal view of male genitalia; *d.* outer spatha of male; *e.* inner spatha of male.

Malar space (Fig. 2*a*) very long, about two and one-half times as long as width at articulation of mandibles, polished, impunctate. Mandibles two-toothed. Eyes normal. Area between lateral ocelli and inner margin of compound eyes with outer half punctate and inner half polished and impunctate. Antennae (Fig. 2*b*) long, third segment slightly longer than fifth, fifth much longer than fourth.

Genitalia as in figure 2*c*. Inner and outer spathae as in figures 2*e* and 2*d*, respectively.

Length, 20 millimeters and other measurements in proportion.

Holotype.—Male, Gieh Yin Temple, Mt. Omei, China, 9,500 ft. alt., Aug. 10-11, 1925. *Allotype.*—Queen, Mt. Omei, China, 11,000 ft. alt. *Morphotype.*—Worker, Mt. Omei, Szechuen, China, 9,000-10,000 ft. alt., July 20, 1931 (Frison collection). *Paratypes.*—4 workers, Shin Kai Si, Mt. Omei, Szechuen, China, 4,400 ft. alt., Sept. 1-10, 1922;

1 worker, near Mupin, Szechuen, China, 2-8,000 ft., July, 1929; 6 workers and 9 males, Yachow, Szechuen, China, 2,200-5,000 ft. alt., Aug. 21-24, 1930; 2 workers, Gieh Yin Temple, Mt. Omei, China, 9,500 ft. alt., Aug. 10, 1925; 1 worker, Wa Si Geo, China-Tibet border, 5-6,000 ft. alt., Aug. 18, 1930; 2 workers, Da Shiang Lin Pass, China-Tibet border, 4,960 ft., Aug. 23, 1930; 1 worker, Washuan, Szechuen, China, alt. 11,000, July 25, 1925; 1 worker, Songpan, Szechuen, China, 8,000-9,500 ft. alt., July 12, 1924; between Yachow and Da Shiang Lin Pass, 6,000 ft. alt., Aug., 1923; 2 workers, Mt. Omei, Szechuen, China, 11,000 ft. Aug. 20, 1921; Szechuen, China, Aug. 1928; 1 male, near Washuan, Szechuen, China, 6,000 ft. alt., July 27, 1925; 1 male, Tatsienlu, China-Tibet border, 8-9,000 ft. alt., Aug. 16, 1930; 1 worker, same data as *morphotype* (Frison collection). All collected by D. C. Graham except those indicated as in Frison collection.

Holotype, allotype and numerous paratypes deposited in the collection of the United States National Museum. Morphotype and several paratypes deposited in the collection of the author. Two paratypes, male and worker, deposited in the collection of the Indian Museum.

In color this new species is very suggestive of *hortorum* (L.), but differs in the females in having the black band between the bases of the wings less sharply defined, the tendency for whitish or greyish hairs on sides of thorax, and the black hairs on fifth and sixth abdominal tergites. Furthermore the malar space is longer and the clypeus has less large punctures.

The male differs in its genitalia from such species as *supremus* (Mor.), *portschinskyi* (Rad.), and *saltuarius* (Skor.) as figured by Skorikov (1931) in the shape of volsellae and squamae. The large development of the inner spine at the tip of the volsellae is sufficient to separate the males of this new species from any other described form known to me.

Bremus securus, sp. nov.

Queen.—In general similar in morphological characters with the subgenus *Hortobombus* (Vogt).

Pubescence colored as follows: head with long hairs mostly black and an admixture of shorter yellowish ones; thorax on sides and dorsum yellow, except for a broad black band between bases of wings; abdominal tergites with first yellow, second with yellow dominating on sides and posterior margin and black in middle, third mostly black except for yellow posterior margin, fourth yellow, fifth essentially yellow but with a few black hairs in middle, sixth with hairs short and golden; legs with some long yellowish hairs on basal segments, remaining segments black or tinged with golden, corbicular fringes golden and integument dark.

Malar space very long, at least twice as long as width at articulation of mandibles, polished, impunctate. Clypeus strongly convex, polished, large punctures confined to apical angles and extreme sides, disk with numerous fine punctures. Labrum with tubercle-like areas well separated, shelf-like ridge with anterior margin slightly curved. Area between lateral ocelli and inner margin of compound eyes with outer third punctate and inner two-thirds polished and impunctate. Antennae

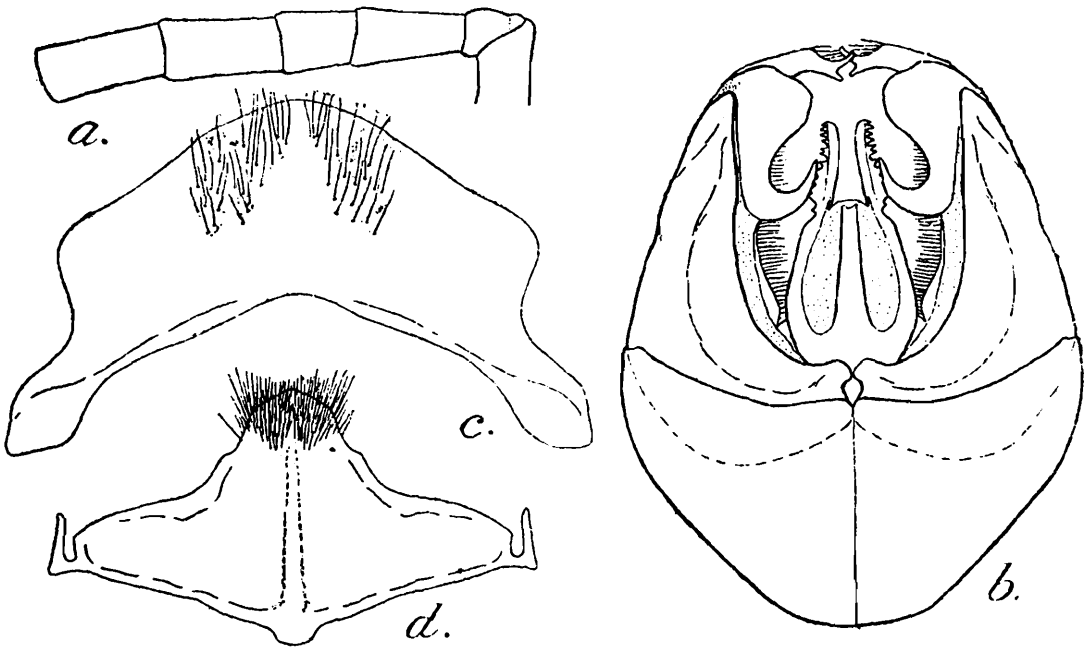
with third segment almost as long as fourth and fifth together, fifth segment much longer than the fourth, the fourth scarcely longer than broad. Mesobasitarsus with a pronounced spine-like projection at outer apical angle. Wings brown, without a violaceous tinge.

Length, 20 millimeters; spread of wings, 36 millimeters; width of abdomen at second segment, 9 millimeters.

Worker.—Similar to the queen in color and structure except for smaller size. In a few specimens there is more black pubescence on the second and third abdominal tergites than in others.

Varying in size from 11 to 16 millimeters and other measurements in proportion.

Male.—In general similar to other males belonging to the subgenus *Hortobombus.* Malar space very long, about two and one-half times as



TEXT-FIG. 3.—*Bremus securus*, sp. nov. *a.* basal portion of antenna of male; *b.* dorsal view of genitalia of male; *c.* outer spatha of male; *d.* inner spatha of male.

long as width at articulation of mandibles, polished, impunctate. Mandibles two toothed. Eyes normal. Antennae (Fig. 3*a*) long, third and fifth segments about of equal length, fourth much shorter than either third or fifth.

Pubescence with colours and pattern about as in queen, except sixth and seventh abdominal tergites have long black hairs and corbicular fringe is very golden.

Genitalia as in figure 3*b*. Inner and other spathae as in figures 3*d* and 3*c*, respectively.

Length, 13 millimeters and other measurements in proportion.

Holotype.—Male, Yachow, Szechuen, China, 2,200-5,000 ft. alt., Aug. 21-24, 1930. *Allotype.*—Lu Ding Chiao, Szechuen, China, 4-9,000 ft. alt., July 12-14, 1930. *Morphotype.*—Ningyuenfu, China, 6,000-10,800 ft. alt., July 24-26, 1928. *Paratypes.*—1 worker, same data as holotype; 2 workers, Mowchow, Szechuen, China, 1,400-4,500 ft. alt.,

July 10, 1924 ; 3 workers, Suifu, Szechuen, China ; 1 worker, same data as morphotype ; 2 workers, near Tang-Gu, China-Tibet border, 14,000 ft., August 3-6, 1930 ; 1 worker, 9 miles SW of Tatsienlu, Szechuen, China, 8,500-13,000 ft., June 25-27, 1923 ; 1 worker, Yu-Long-Si, Tibet, 15,600 ft., July 31-Aug. 7, 1930 ; 1 worker, Suifu, Szechuen, China, Apr.-May, 1928. All specimens collected by D. C. Graham.

Holotype, allotype, morphotype and numerous paratypes deposited in the collection of the United States National Museum. Several paratypes deposited in the collection of the author and two in the collection of the Indian Museum.

The females of this new species bear some resemblance to *religiosus* but are readily separated because of the pronounced yellow pubescence covering sides of thorax and greater amount of yellow on abdominal tergites. The males differ most noticeably in the shape of the tip of the volsella of the genitalia which in *religiosus* has a very large inner lower tooth at tip and in *securus* is lacking. *B. securus* differs from males of *saltuarius*, *portschinskyi* and *supremus* in having the volsella of the genitalia narrow as in *hortorum* (L.). The squama of *securus* differs from that of *hortorum* (L.), by having its inner lower projection different in shape and more spine-like and by the narrower heads of the sagittae. The males likewise differ from *ruderatus* Fabr., in these latter respects.

Subgenus **DIVERSOBOMBUS** Skorikov (1922).

Bremus mimeticus var. **gantokiensis** (Richards).

1 worker, Sikkim.

Bremus mimeticus var. **geminatus** (Richards).

1 queen, Naini Tal, Kumaon Hills, 6,500-8,000 ft., 1-9.V.30 (H. S. Pruthi); 3 workers, Dhobie Khud, below Sunny View, ca. 3 miles from Mussoorie, Dehra Dun dist., U. Provs., 21-27.VI.30 (B. N. Chopra); 1 worker, Naini Tal, 28-IX-07 (Mus. Coll.); 1 worker, Simla, W. Himalayas, 8,000 ft., 6-XII. 18 (Brunetti); 1 worker, Ramnee, British Garhwal, W. Himalayas, 20-X-07 (Mus. Coll.); 1 worker, Naini Tal, Kumaon, 6-7,000 ft., 08 (R. E. Lloyd); 1 worker, below Bhatta, 4 miles below Mussoorie, Dehra Dun dist., U. Provs., 16.VI.30, in Khud (B. N. Chopra); 1 worker, Company Khud, below Landour Bazar, Mussoorie, Dehra Dun dist., U. Provs., 18.VI.30 (B. N. Chopra); 3 workers and 1 male, Naini Tal, Kumaon, 6,400 ft. (N. Annandale); 1 worker, Round about Mussoorie, Dehra Dun dist., U. Provs., 15-16.VI-1-7.VII-30 (B. N. Chopra); 1 worker, Bhim Tal, Kumaon Hills, ca. 4,450 ft., cultivated fields, 18.V.30 (H. S. Pruthi); 1 worker, Kousanie, Dist. Almora, Kumaon Hills, ca. 6,000 ft., Forest round the P. W. D. Bungalow, 30.V-2.VI.30 (H. S. Pruthi); 1 worker, Bhim Tal, Kumaon, 4,500 ft., 22-27-IX-06 (N. Annandale).

Bremus mimeticus var. **insidiosus** (Richards).

2 queens, Mussoorie, U. Provs. alt. circ. 7,000 ft,, 20-26.V.05 (Brunetti); 1 queen Saraiya Tal, U. Provs. 7.V.30 (H. S. Pruthi); 2 queens, Kangra Valley, 4,500 ft., May 1899 (Dudgeon); 1 queen, Ramnee, British Garhwal, W. Himalayas, 20-X-07 (Mus. Coll.); 2 workers, Bhim Tal, ca. 4,450 ft., cultivated fields, 18.V.30 (H. S. Pruthi); 1 worker, Simla, W. Himalyas (jungle), 6,000-7,000 ft. VIII-IX-25 (B. N. Chopra); 1 worker, Sabathu, 3,000 ft. (Indian Museum); 1 worker, Broyi Khad under bridge on road to Upper Dhamsala, 4,900 ft., Punjab, 29.V.26 (S. L. Hora); 1 worker, Kasauli, Simla Hills, 6,300 ft., 15.V.08 (N. Annandale); 1 worker, below Bhatta, 4 miles below Mussoorie, Dehra Dun dist., U. Provs., Annandale 16.VI.30 in khud (B. N. Chopra.); 1 worker, Bhim Tal, 4,500 ft., Kumaon, 19-22-IX-06 (N. Annandale).

Bremus mimeticus var. **turneri** (Richards).

2 queens, Cherrapunji, Khasi Hills, Assam, 19-V-09 (B. Warren); 1 queen, Cherrapunji, Khasi Hills, Assam, 14-V-09 (B. Warren); 1 queen, Cherrapunji, Khasi Hills, Assam, 15-V-09 (B. Warren); 1 male, Nartiang, Khasi & Jaintia Hills district, Assam, 28-29.XI.30 (H. S. Rao).

Subgenus **SUBTERRANEOBOMBUS** Vogt (1911).

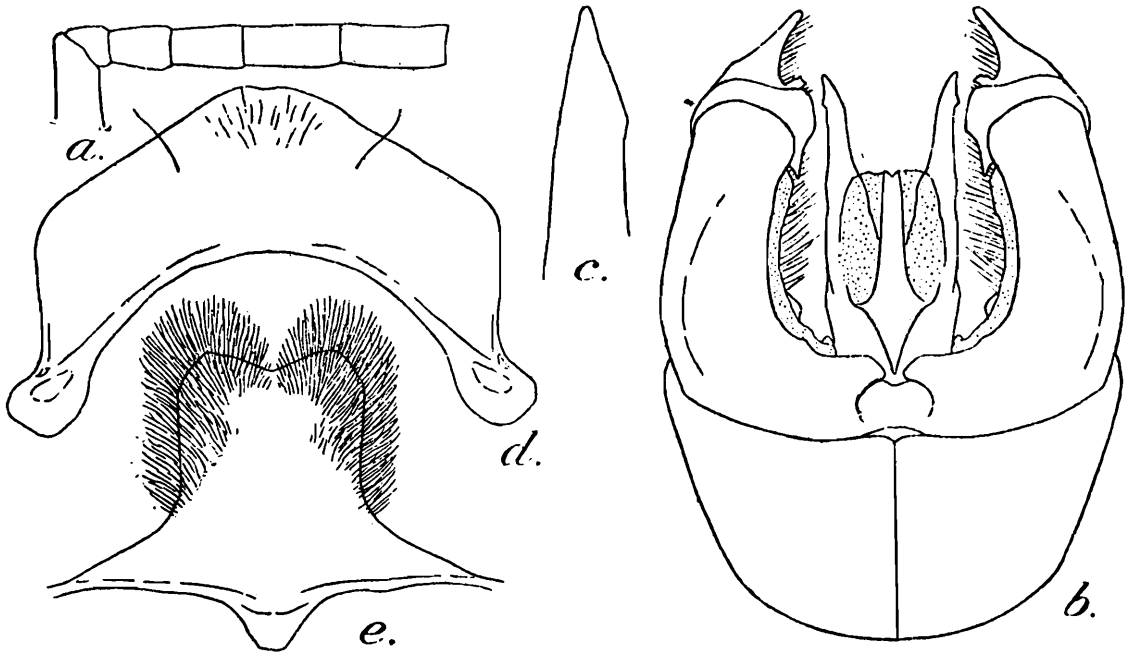
Bremus melanurus subsp. **subdistinctus** (Richards).

1 worker, Karakal, Bumboret Valley, Chitral, N. W. F. Prov., 22-25.VII.29 (B. N. Chopra).

Subgenus **AGROBOMBUS** Vogt (1911).

Bremus priscus, sp. nov.

Male.—Pubescence colored as follows: face and occipital orbits with dense yellow hairs and with a few long black hairs intermixed; occiput with both yellow and black patches, the yellow occupying the posterior and middle area and the black more as lateral patches; thorax with sides and dorsum dull yellow except for an indistinct black band between bases of wings; abdominal tergites with first and second segments dull yellow, third segment mostly yellow but with lateral patches of black, fourth, fifth, sixth and seventh segments dull yellow with a slight ferruginous tinge. Ventral abdominal segments with long yellow hairs. Legs mostly with yellow hairs, those surrounding corbicula are slightly ferruginous; integument of corbicula very dark reddish.



TEXT-FIG. 4.—*Bremus priscus*, sp. nov. *a.* basal portion of antenna of male; *b.* dorsal view of genitalia of male; *c.* head of sagitta of male genitalia; *d.* outer spatha of male; *e.* inner spatha of male.

Malar space long, about one and one-half times as long as width at articulation of mandibles, polished, impunctate. Area between ocelli

and inner margins of compound eyes mostly polished and smooth, punctures restricted to a narrow margin near compound eye. Mandibles two toothed. Eyes normal. Antennae (Fig. 4*a*) long, with the fifth segment much longer than the fourth, the fourth longer than third, fourth and third together longer than fifth ; middle segments slightly bowed. Wings very light brown, with apical area darkest. Corbicular space well developed and convex. Metabasitarsus three times as long as broad, basal third widest.

Genitalia as in figure 4*b*. Inner and outer spathae as in figures 4*e* and 4*d*, respectively. The tips of the volsellae taper to a point and with a small toothed hump on middle inner margin ; the squamae are somewhat transversely quadrate with a sharp backward direct point at inner lower angle ; the arms of the sagittae (Fig. 4*c*) are long and narrow, the heads not well differentiated so that they appear as if broken off, lower surface with a tooth ; uncus narrow and linear.

Length, 17 millimeters ; spread of wings, 33 millimeters ; width at second segment, 5 millimeters.

Holotype.—Male, Sandakphu, 10,500 ft., 2-10-06. Deposited in the collection of the Indian Museum. *Paratype.*—Male, Sikkim (Niceville). Deposited in the collection of the author. Both specimens are in poor condition.

This species belongs in that large complex of species belonging to the subgenera *Mucidobombus* Skorikov and *Agrobombus* Vogt. It differs, radically, however, from any species known to me. In some respects it comes closest to the species *mucidus* (Gerst.) of the subgenus *Mucidobombus* but it differs greatly and especially in the shape of the volsellae.

I should not be surprised if future studies of Asiatic bumblebees reveal that this species should be placed in a new subgenus. For the present, however, I leave it in the subgenus *Agrobombus* Vogt in its broadest sense.

Subgenus **BREMUS** Jurine, *s.s.* (1801).

Bremus tunicatus (Smith).

1 queen and 1 worker, Calcutta, 1920 (C. Dover); 4 queens, Sarol Garden, Chamba, Punjab, 20.V.27 (S. L. Hora); 1 queen, Matiana, Simla Hills, 9,300 ft., (N. Annandale) ; 1 queen and 4 workers, Phagu, Simla Hills, alt. 9,000 ft., 18-21.V.16 (N. Annandale); 2 queens, Theog, Simla Hills, c. 8,000 ft., 2.V.07 (N. Annandale); 1 queen, Phagu, Simla Hills, alt. 9,000 ft., 14-15.V.09 (N. Annandale); 1 queen, Theog, Simla Hills, c. 8,000 ft. (N. Annandale); 1 queen, Phagu, Simla Hills, alt. 9,000 ft., 12-V-09 (N. Annandale); 1 queen, Round about, Hurst Cottage, Bakrota Hill, Dalhousie, Punjab, 7,000 ft., V-VI.27 (S. L. Hora); 1 queen, Matiana, Simla Hills, 7,000 ft., 28-30.IV.17 (N. Annandale); 1 queen, Phagu, Simla Hill, 8,000 ft., 4-V.07 (N. Annandale); 1 queen, Trahgbul Rd. to Gilgit, alt. 10,000 ft., 21.6.95 ; 1 worker, Mussoorie, 2 workers, Naini Tal, May and June 1893 (Lucknow Mus.); 1 worker, Mussoorie, U. I rovs. alt. circ. 7,000 ped, 20-24.VI-05 (Brunetti); 9 workers, Karakal, Bumboret Valley, Chitral, N. W. F. Prov., 22-25.VII.29 (B. N. Chopra); 1 worker and 1 male, Kufri, Simla Hills (jungle), ca. 7,000 ft., IX.25 (B. N. Chopra); 1 worker, Sinol Valley (F. S.); 1 male, Simla, W. Himalayas, 7-8,000 ft., IX-14 (Capt. Evans); 2 males, Baghi, Simla Hill States, 8,800 ft., 7-8.X.21 (S. W. Kemp); 2 males, Ramnee, British Garhwal, W. Himalayas, 20-X-07 (Mus. Coll.); 1 male, Ramnee, 21-X-07 (Mus. Coll.).

Bremus ignitus (Smith).

1 queen, Kuanshien, Szechuen, China, 3,000 ft., 5.IV-8.V.30 (D. C. Graham); 2 workers nr. Mupin, Szechuen, China, 2-8,000 ft., 28-VI-1929 (D. C. Graham); 2 workers, Ningyuenfu, China, alt. 6,000-6,200 ft., Aug. 2-4-28 (D. C. Graham); 1 worker, Yachow, Szechuen, China, alt. 2,300-2,500 ft., 27.28-VIII-30 (D. C. Graham); 1 worker, Yachow to Mupin, Szechuen, China, 2,000-5,000 ft., June 23-27-1929 (D. C. Graham); 1 worker, W. of Yachow, Szechuen, China, alt. 2,000-7,500 ft., June 14-18, 1922 (D. C. Graham); 2 workers, near Yachow, Szechuen, China, alt. 400-5,000 ft., 2 to 8-VII-30 (D. C. Graham); 4 workers, Suifu, Szechuen, China, 1928 (D. C. Graham); 2 workers, Yachow, Szechuen, China, alt. 2,500 ft., 14-VII-28 (D. C. Graham); 1 worker, Suifu, Szechuen, China, IV-V.24 (D. C. Graham); 1 worker, bet. Yachow and Da Shiang Lin Pass, Szechuen, China, 3,500 ft., Aug. 1923 (D. C. Graham); 1 worker, Tatsienlu, China-Tibet border, alt. 8-9,000 ft., 16.VIII.30 (D. C. Graham); All collected by D. C. Graham, 1 worker, Hangchow, 24.V. 1923 (Frison collection); 1 worker, Hangchow, 25.V. 1923 (Frison collection); 1 worker, Yokohama, 20-V-1906 (Brunetti-Indian Museum).

The original description of *ignitus* was based upon the female sex and no males have ever been definitely associated with this species. The characters of the female suggest it is a member of the subgenus *Bremus* (*s. s.*) and it is possible that *speciosus* Smith (*Bremus s. s.*), known only from the males, is the male of *ignitus*.

Dover (1922) mentions a specimen of *orientalis* Smith from "Yokohama." The worker of *ignitus* from Yokohama mentioned above is probably this specimen as *orientalis* is not known from Japan (Yokohama).

Bremus ignitus var. **cancellatus,** nov.

Worker.—Structurally similar to *B. ignitus* Smith (1869), a member of *Bremus s. s.* Differs in having some yellow pubescence upon the second abdominal tergites.

Holotype.—Worker, near Yachow, Szechuen, China, July 2-8, 1930, alt. 400-5,000 ft. *Paratypes.*—2 workers with same data as holotype; 1 worker, S. of Suifu, Szechuen, China, Aug. 1929; 1 worker, Suifu, Szechuen, China, 1928; 1 worker, Yachow to Mupin, Szechuen, China, June 23-27, 1929; 1 worker, nr. Mupin, Szechuen, China, 2-8,000 ft., June 28, 1929. All specimens collected by D. C. Graham.

Holotype and 3 paratypes deposited in the collection of the United States National Museum, 1 paratype in the collection of the Indian Museum and 2 paratypes in the collection of the author.

Differs from typical *ignitus* in having yellow pubescence upon second abdominal tergite and from *B. ignitus* var. *subcollaris* Skorikov (1914) in lack of yellow pubescence on prothorax and its presence upon second abdominal tergite. 1 paratypic worker has some yellow pubescence upon the first abdominal tergite.

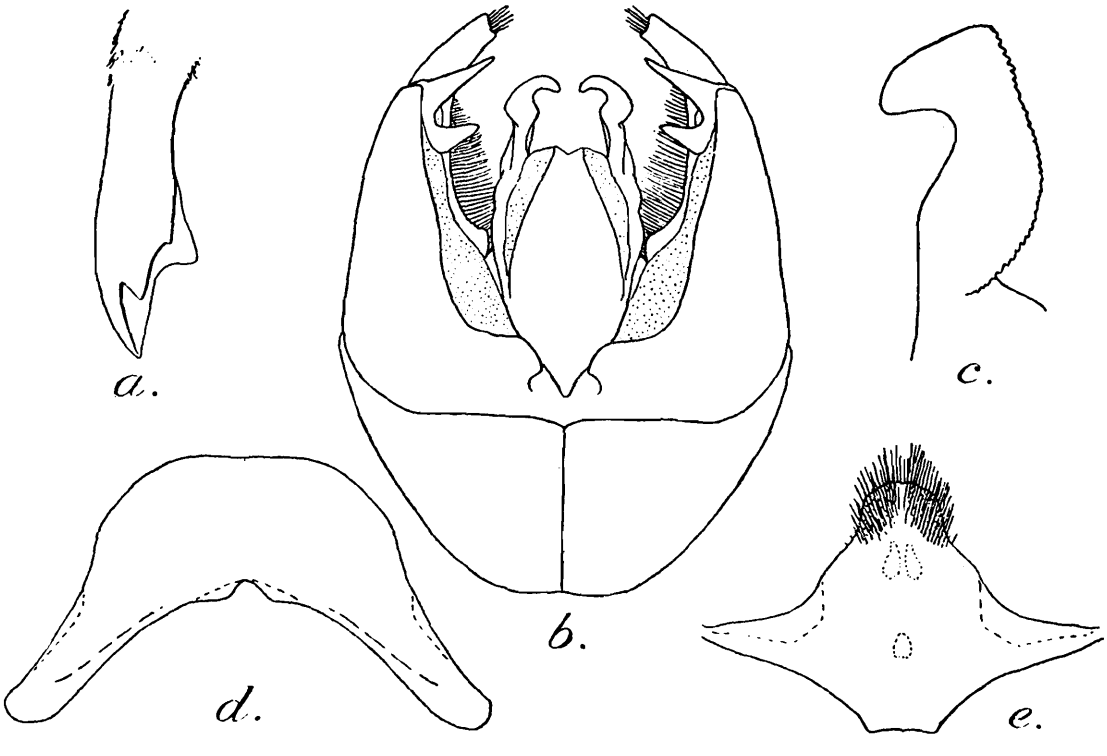
Subgenus **ALPIGENOBOMBUS** Skorikov (1914).

Bremus dentatus (Handl.).

1 queen, Kalimpong, Darjiling dist., E. Himalayas, alt. 600-4,500 ft., 24. IV-10.V.15 (F. H. Gravely); 1 worker, Kanaul, British Garhwal, W. Himalayas, 18-X-07 (Mus. Coll.); 1 worker, Tindharia, alt. 2,822 ft.; 1 worker, Ghumti, Darjiling dist., E. Himalayas, alt. 1,800-3,500 ft., VII. 11 (F. H. Gravely); 1 worker, Siliguri, N. Bengal, 18-20.VII-07 (Mus. Coll.); 1 worker, Suifu, Szechuen, China, April-May 1928 (D. C. Graham); 1 worker, Yachow, China, 1928 (D. C. Graham); 1 worker, bet. Yachow and Ningyuenfu, China, July 14-28.28, alt. 2,500-10,000 (D. C. Graham).

Bremus dentatus var. **concinnus,** nov.

Queen.—Structurally similar to *dentatus* Handlirsch which is a member of *Alpigenobombus* Skorikov (1914). Pubescence colored as follows: head and dorsum of thorax black; sides of thorax a whitish yellow; first, second and basal portion of third abdominal tergites yellow; remainder of third and basal portion of fourth abdominal tergite black; apical part of fourth as well as fifth and sixth abdominal tergites deep ferruginous; legs black. Wings very dark; mandibles many toothed, malar space much shorter than long, third antennal segment much longer than fourth and somewhat longer than fifth. Mesobasitarsus without a sharp spine-like projection.



TEXT-FIG. 5.—*Bremus dentatus* var. *concinnus*, nov. *a.* mandible of male showing four teeth; *b.* dorsal view of male genitalia; *c.* head of sagitta of male genitalia; *d.* outer spatha of male; *e.* inner spatha of male.

Worker.—Same as queen except black pubescence covers fourth abdominal tergite, black is more extensive on third tergite and sometimes occurs on extreme basal position of fifth abdominal tergite.

Male.—Agrees well in coloration with the worker. Mandibles (Fig. 5*a*) and genitalia (Fig. 5*b*) in general as for subgenus *Alpigenobombus*. Fifth antennal segment about as long as fourth and third together, fourth slightly longer than third. Genitalia (Fig. 5*b*) close to that of male of *rufocognatus* (Cockerell), but differs in that lower-inner angle of volsella does not have such a prominent projection. Outer and inner spatha as in figures 5*d* and 5*e*, respectively. Head of sagitta as in figure 5*c*.

This variety differs from the typical *dentatus* Handlirsch, which I consider a valid species, in having the sides of the thorax whitish yellow instead of black.

Holotype.—Queen, Chandragiri, Nepal (1422-15). *Allotype.*—Male, Nartiang, Khasi and Jaintia Hills district, Assam, 28-20.XI.30 (H. S. Rao). *Morphotype.*—Worker, same data as Allotype. *Paratypes.*—2 workers and 1 male, same data as Allotype ; 1 worker, Lamin, Assam (H. Rolle, American Mus. Nat. Hist.), formerly determined by Friese as " B. channicus " Holotype, allotype, morphotype and one paratype worker deposited in the collection of the Indian Museum. Two paratypic workers and 1 male deposited in the collection of the author and 1 worker in the collection of the American Museum of Natural History.

Bremus dentatus var. **surdus,** nov.

Queen.—Structurally similar to *B. dentatus* Handlirsch (1888), but differs in the thorax being brownish black and the fourth abdominal tergite almost entirely ferruginous. The first and second abdominal tergites are yellow with some brown at sides of second, third tergite black. Corbicular area dark reddish brown, fringes and hairs on legs black. Malar space short and mandibles many toothed as all members of the subgenus *Alpigenobombus.* Wings slightly violaceous.

Holotype.—Queen, near Tatsienlu, Szechuen, China, June 18-July 12, 1923, alt. 5,000-8,500 ft., collected by D. C. Graham. Deposited in the collection of the United States National Museum.

Bremus genalis (Friese).

1 queen, Darjiling, E. Himalayas, alt. 6,000-7,000 ft., 12.VI.14 (F. H. Gravely); 1 queen, Sureil Darjiling, (A. Alcock); 1 queen, Shillong; 1 worker Kurseong, E. Himalayas, alt. 6,000 ft., 15.VIII.09 (D'Abreu).

Bremus grahami var. **ordinatus,** nov.

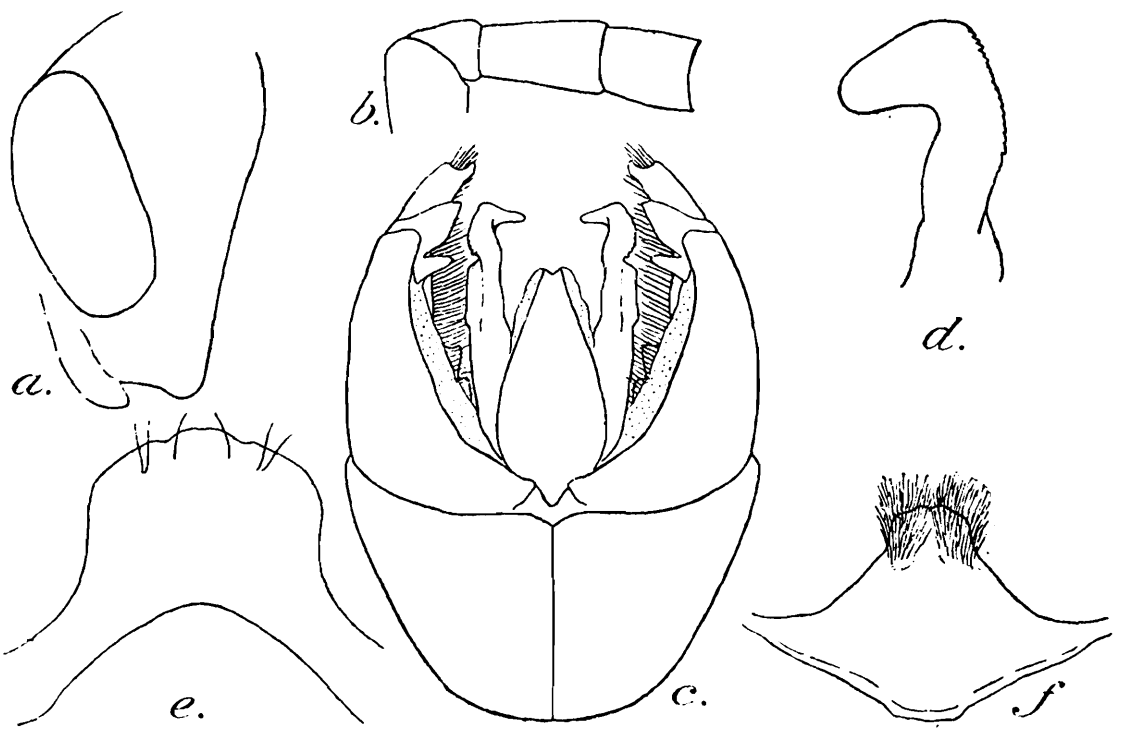
Male.—Pubescence colored as follows : face dull yellowish-grey, occiput brownish ; dorsum of thorax brownish with traces of a lighter longitudinal stripe, particularly noticeable on pronotum ; sides of thorax dull yellowish-white ; first abdominal tergite yellowish-white, second dominantly yellowish-white but with an admixture of black hairs ; third abdominal tergite black and fourth to seventh with ferruginous pubescence ; corbicular fringe with a tinge of ferruginous.

Mandibles about as for other members of the subgenus *Alpigenobombus.* Third antennal segment (Fig. 6*b*) much longer than fourth (remainder missing). Genitalia as in figure 6*c*. Outer and inner spathae as in figures 6*e* and 6*f* respectively. Head of sagitta of male genitalia as in Fig. 6*d*.

Holotype.—Male, N. side of Tonglu, alt., 8,000-10,000 ft. 26.IX.06 (I. H. Burkill). Deposited in the collection of the Indian Museum.

This species was recently described by the author (1933) on the basis of the workers. The male differs in having less contrasting colors, and particularly in having so much dull yellowish white pubescence on the second abdominal tergite. As stated in the original description of this species, *grahami* is very suggestive of *funerarius* var. *lateritus* (Friese)

in the female sex. As yet the male of *funerarius* has not been described and accordingly no comparison can be given with it.



TEXT-FIG. 6.—*Bremus grahami* var. *ordinatus*, nov. *a*. head of male from a side view; *b*. basal portion of antenna of male; *c*. dorsal view of genitalia of male; *d*. head of sagitta of male genitalia; *e*. outer spatha of male; *f*. inner spatha of male.

The male genitalia is sufficient to separate *grahami* from such related species as *dentatus*, *orichalceus*, *rufocognitus* and *sikhimi*. The most important difference is the shape of the squama which in *grahami* does not have its upper inner angle so sharply pointed.

Bremus orichalceus (Friese).

2 queens, Locha, Garhwal, W. Himalayas, alt. 5,000 ft., 17.IV.14 (Tytler); 1 worker, round about Mussoorie, Dehra Dun dist., U. Provs., 15-16.VI, 1-7. VII.30 (B. N. Chopra); 1 worker, Simla, W. Himalayas (jungle), alt. 6,000-7,000 ft., VIII-IX.25 (B. N. Chopra); 1 worker, Jabharket, on Mussoorie-Tehri Road, ca. 4 miles from Mussoorie, Dehra Dun dist., U. Provs., 20-25.VI.30 (B. N. Chopra); 1 worker, Kousanie, Kumaon, W. Himalayas, alt. 6,075 ft., 22.VII.14 (Tytler); 1 worker, Simla, W. Himalayas, alt. 8,000 ft., 6-VIII-18 (Brunetti); 1 worker, Dharampur, W. Himalayas, alt. 5,000 ft., 14.V.1913 (Phaku Ram); 1 male, Simla, W. Himalayas, alt. 7-8,000 ft., IX-14 (Capt. Evans).

It is possible that *orichalceus* may be but a color variety of *dentatus* Handlirsch. The structure of the male genitalia, as shown by the two new colour varieties described in this paper (*orichalceus* var. *conjunctus* and *dentatus* var. *concinnus*), are very similar and perhaps should be considered as identical. The presence of a transverse band of black pubescence on the middle of the dorsum of the abdomen is the only character known to me for the separation of *orichalceus* and *dentatus*, the latter having priority. At the present time it seems best to consider *orichalceus* and *dentatus* as two species.

Bremus orichalceus var. **conjunctus,** nov.

Male.—Mandibles similar to those of other members of the subgenus *Alpigenobombus.* Malar space short, not as long as width at articulation of mandibles. Antenna with fifth segment about as long as third and fourth together, fourth slightly shorter than third. Genitalia, as well as outer and inner spathae, very similar if not identical with those of *dentatus* var. *concinnus* (Figs. 6*c*, *d*, *e* and *f*).

Color of pubescence as follows : face, occiput, sides of head, dorsum and sides of thorax greyish-white ; first, second and most of third abdominal tergites yellow ; sides of third abdominal tergite partly black ; fourth, fifth, sixth and seventh abdominal tergites bright ferruginous ; legs with dark hairs tipped with greyish ; wings dark, slightly tinged with violaceous.

Worker.—Mandibles many toothed as in other members of the subgenus *Alpigenobombus.* Malar space shorter than width at articulation of mandibles. Antenna with third and fifth segments about the same length, fourth segment much shorter than either third or fifth. Labrum with tubercle-like areas widely separated ; shelf-like projection prominent and about one-third width of labrum, with anterior transverse margin sharp and straight. Clypeus slightly convex with numerous scattered punctures. Mesobasitarsus without a sharp spine-like projection.

Color of pubescence as follows : that on head dark tipped with greyish ; dorsum and sides of thorax dirty greyish-white ; first, second and most of third abdominal tergites pale yellow ; sides of third abdominal tergite with some black hairs ; fourth, fifth and sixth abdominal tergites with ferruginous pubescence ; legs with black hairs tipped with greyish. Corbicular space and clypeus with integument dark reddish-brown. Wings very dark, slightly violaceous.

Holotype.—Male, Mossy Nullah, below Barlowganj, ca. 3 miles from Mussoorie, Dehra Dun dist., U. Provs., 30. VI. 30, VII. 30 (B. N. Chopra). *Morphotype.*—Worker, Kousanie, Kumaon, W. Himalayas, alt. 6,075 ft., VII. 14 (Tytler). Deposited in the collection of the Indian Museum.

This variety may be separated from the typical *orichalceus* by the greyish-white dorsum and sides of the thorax. As already stated under *orichalceus*, this species may be but a color variety of *dentatus* Handlirsch. The genitalia of *orichalceus* var. *concinnus* are very similar and perhaps the species should be considered identical, *conjunctus* being but a color variety of *dentatus*.

Subgenus **RUFIPEDIBOMBUS** Skorikov (1922).

Bremus eximius (Smith).

1 queen, Darjiling, E. Himalayas, 26.V-VI.16 (F. H. Gravely) ; 1 queen, Upper Tenasserim ; 1 queen and 2 workers, no data ; 1 queen, Chitlong, Nepal (Ind. Mus.) ; 2 queens, Khasi Hills ; 1 queen, Moolai ; 2 queens, Shillong, Khasi Hills, Assam, 3-9.VII.30 (H. S. Rao) ; 1 worker, Darjiling dist., Singla, alt. 1,500 ft., 1913 (Lord Carmichael's collection) ; 1 worker, Darjiling ; Mong-wan Yunnan, W. China, 1909-10 (J. C. Brown) ; 1 queen and 5 workers, Upper Tenasserim ; 1 worker, Shillong (Godwin-Austin) ; 1 worker, N. Khasi Hills (Godwin-Austin) ; 1 male, Kurseong, E. Himalayas, alt. 4,700-5,000 ft., 20.VI. 10 (N. Annandale) ; a male, Darjiling, E. Himalayas (I. H. Burkill).

Bremus festivus (Smith).

3 queens, Uen Chuan, Szechuen, China, Aug. 7-14, 1924 ; 1 queen, Bet. Uen Chuan and Mowchow, alt. 4,500-5,500 ft., Aug. 5, 1924 ; 1 queen, Washan, Szechuen, China, July 23, 1925 ; 3 queens, Yachow, China, 1928 ; 1 queen, Da Shiang Lin Pass, China, Tibet Border, 4,960 ft., 23. VIII. 30 ; 2 queens, Dong Men Wei, 10 mi. W. Wei Chow-Szechuen, China, 5,600 ft. alt., 23. VIII. 1933 ; 1 queen, Wei Chow, 65 mi. N. W. Chengtu, Szechuen, China, 9,000-12,500 ft. alt., 15. VIII. 1933 ; all collected by D. C. Graham. 1 queen, Sides of the Deo-Gad stream and the Forests S. W. of Pinath, 7 miles from Kousanic (Almora dist.), Kumaon Hills, Sta. 62, I-VI-30 (H. S. Pruthi); 1 queen, Sarol Garden, Chamba, Punjab, Sta. 4, 20-V.27 (S. L. Hora) ; 1 queen, Naini Tal, May and June 1893 (Lucknow Mus.).

The male of this species has not been discovered but it is likely, judging from the females, that this beautiful black and white species belongs to this subgenus.

I have studied a worker of *B. melaleucus* Handlirsch, kindly loaned to me by the Natural History Museum, Wien, Austria, which is without doubt the type of this form. A study of this specimen has convinced me that *melaleucus* is merely a valid color variety of *festivus* Smith and differs in having hairs on the fourth abdominal tergite and on anterior and middle dorsal area of thorax dominantly black instead of greyish-white, the light colored hairs being very short and hence suppressed from view.

Subgenus **ORIENTALIBOMBUS** Richards (1929).

Bremus funerarius (Smith).

1 worker, Kalipokri, 10,000 ft., Aconit 26-1-06 (I. H. Burkill) ; 1 worker, Calcutta (Mus. Coll.).

Bremus funerarius var. **lateritius** (Friese).

1 worker, Yachow, Szechuen, China, alt. 2,200-5,000 ft., 21-24. VIII. 30 (D. C. Graham) ; 1 worker, bet. Fu Yao Lin Pass and Da Shiang Lin Pass, Szechuen, China, 7,500 ft., Aug. 1923 (D. C. Graham).

Bremus haemorrhoidalis (Smith).

1 queen ; 1 queen, Malwa Tal, Kumaon, W. Himalayas, 3,600 ft., 7.V.1911 (S. Kemp) ; 4 queens, Dharampur, Simla Hills, c. 5,000 ft., 6-8.V.07 (N. Annandale) ; 1 queen Almora, Kumaon, 5,500 ft., 26-VI-11 (C. Paiva) ; 4 queens, Kasauli, Simla Hills, c. 6,300 ft., 16-V-08 (N. Annandale) ; 1 queen, Kangra Valley, 4,500 ft., May, 1899 (Dudgeon) 1 queen, Naini Tal, Kumaon, c. 6,000 ft., 10-VI-09 (Mus. Coll.) ; 1 queen, Kangra Valley 4,500 ft., May 1899 (Dudgeon) ; 1 queen, Simla, W. Himalayas, alt. 7,000 ft., 12-13.V.1913 (N. Annandale) ; 1 queen, Bhim Tal, Kumaon, W. Himalayas, 4,450 ft., 2-10.V.1911 (S. Kemp) ; 5 workers, Bhim Tal, Kumaon Hills, ca. 4,450 ft., cultivated fields, 18.V.30 (H. S. Pruthi) ; 1 worker, Shahpur, Punjab (small rocky stream close to Däk Bungalow), 2,469 ft., 24.V.26 (S. L. Hora) ; 1 worker, Sarol Garden, Chamba, Punjab, 20.V.27 (S. L. Hora) ; 4 workers, and 1 male, United Provinces, Mussoorie ; 2 workers, Mussoorie, U. Provs. 2 workers, Monda, Nepal, 12-V-08 (R. H.) ; 3 workers, Dharampur, W. Himalayas, c. 5,000 ft., 14.V.1913 (Phaku Ram) ; 1 worker, Almora, Kumaon, 5,500 ft., 5-19-VIII-II (C. Paiva) ; 1 worker, Naini Tal, Kumaon, 6,400 ft. (N. Annandale) ; 1 worker, Mussoorie, U. Provs. alt. c. 7,000 ft. 12-VIII-5 (Brunetti) ; 1 worker, Kangra Valley, 4,500 ft., Aug. 1899 (Dudgeon); 1 worker, Mussoorie, U. Provs. alt. c. 7,000 ped, 20-24.VI-05 (Brunetti) ; 1 worker, Dhobie Khud, below Sunny View, ca. 3 miles from Mussoorie, Dehra Dun dist., U. Provs., 21-27.VI.30 (B. N. Chopra) ; 1 worker, Company Khud, below Landour Bazar, Mussoorie, Dehra Dun dist., U. Provs., 18.VI.30 (B. N. Chopra) ; 1 worker Round about Mussoorie, Dehra Dun dist., U. Provs., 15-16.VI-1-7.VII.30 (B. N. Chopra) ; 1 worker, Sioni, 10 miles n.w. of Ranikhet, sides of the stream below the Forest Rest House, 24.V.30 (H. S. Pruthi) ; 2 workers, Mossy

nullah, below Barlowganj, ca. 3 miles from Mussoorie, Dehra Dun dist., U. Provs.' Sta. 7, 30. VI-3. VII. 30 (B. N. Chopra); 1 worker, Naini Tal, Kumaon, c. 6,000 ft.' 7-VI-09 (Mus. Coll.); 1 male, Lobha, British Garhwal, W. Himalayas, 27-X-07 (Mus. Coll.); 1 male, Mussoorie, U. Provs.

Bremus haemorrhoidalis var. **albopleuralis** (Friese).

1 worker, Bhim Tal, Kumaon Hills, ca. 4,450 ft., cultivated fields, 18.V.30 (H. S. Pruthi); 1 worker, Bhim Tal, Kumaon, 4,500 ft., 22-27-IX-06 (N. Annandale); 1 worker, Bhim Tal, Kumaon, W. Himalayas, 4,450 ft., 10-12.V.1911 (S. Kemp); 1 worker, Almora, Kumaon, 5,500 ft., 23-VI-11 (C. Paiva); 1 worker, Almora, Kumaon, 5,500 ft., 20-21-VI-11 (C. Paiva); 1 worker, Katmandu, Nepal. (R. Hodgart).

Bremus metcalfi, sp. nov.

Queen.—Similar in morphological structures to the female of *Orientalibombus* as described and figured by Richards (1929). The pubescence is colored as follows: face, occipital orbits and occiput black; sides and dorsum of thorax a bright yellow, except for a few dark hairs near head and a narrow black band between wings; abdominal tergites one and two bright yellow, third black, fourth to apex bright ferruginous. Coxae, trochanters and bases of femora beneath with yellowish hairs; remainder of legs black; integument dark. Wings brown, without a distinct violaceous tinge.

Malar space long, about one and one-half times as long as width at articulation of mandibles, polished and practically impunctate. Clypeus with integument slightly reddish, somewhat convex, large punctures confined to outer apical angles and sides, disk polished and with very faint punctures. Tubercle-like areas on labrum well separated; labrum with shelf-like projection half as wide as width of labrum and its anterior edge nearly straight. Unpunctured area surrounding ocelli very extensive.

Antennae with third segment somewhat longer than the fourth and shorter than fourth and fifth together, fourth and fifth segments about of equal length. Mesobasitarsus without a pronounced spine-like projection.

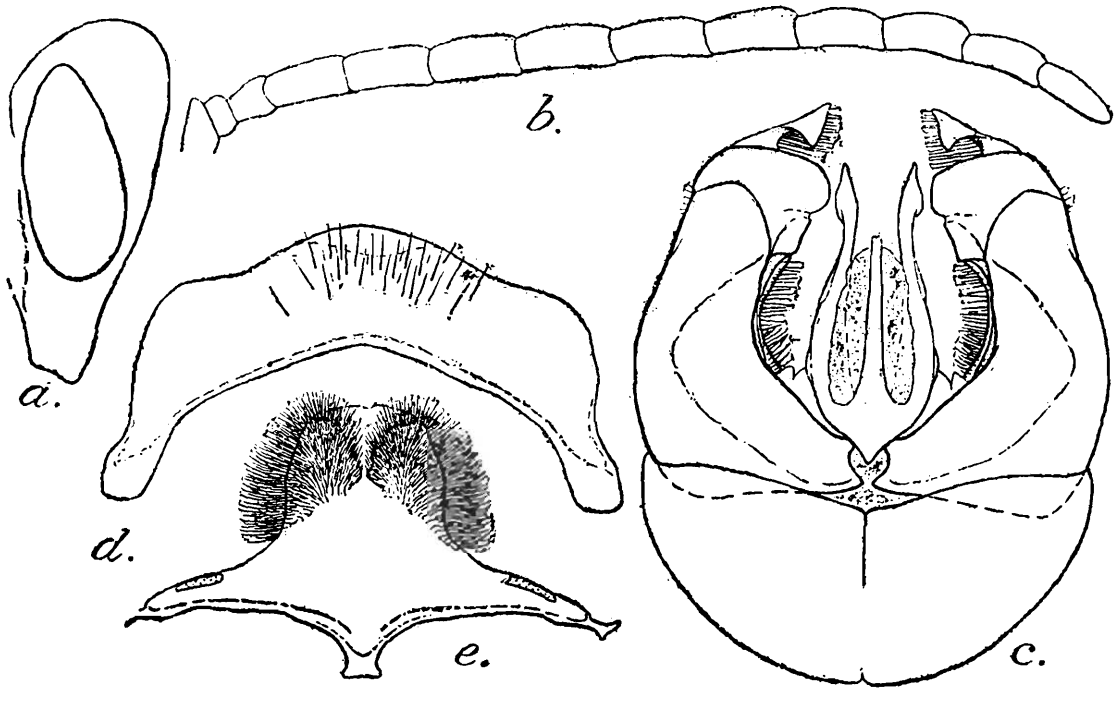
Length, 22 millimeters; spread of wings, 44 millimeters; width of abdomen at second segment, 9 millimeters.

Worker.—Very similar to queen in structure and in colors of pubescence. Differs in smaller size and in some specimens the black between the bases of the wings on the dorsum of the thorax is reduced to a small spot or even lacking.

Varying in size from 14 to 19 millimeters in length and other measurements in proportion.

Male.—Similar in most morphological structures to the male of *Orientalibombus* as described and figured by Richards (1929). The pubescence is colored as follows: face, occiput and occipital orbits with long dark hairs intermixed with shorter yellowish ones; sides and dorsum of thorax essentially bright yellow with some admixture of dark hairs particularly between the bases of the wings; abdominal tergites one and two bright yellow, third and most of fourth black, posterior margin of fourth and all remaining segments to apex are bright ferruginous. Coxae, trochanters and most of femora with long dense yellow

hairs, that on remaining segments mostly dark. Wings brownish, without a distinct violaceous tinge.



TEXT-FIG. 7.—*Bremus metcalfi*, sp. nov. *a*. head of male from a side view; *b*. antenna of male; *c*. dorsal view of genitalia of male; *d*. outer spatha of male; *e*. inner spatha of male.

Malar space (Fig. 7*a*) long, polished, impunctate, twice as long as width at articulation of mandibles. Mandibles two-toothed. Eyes normal. Unpunctured area around ocelli very extensive. Antennae (Fig. 7*b*) very elongate, segments arcuate, third segment very short and scarcely one-half as long as the fourth, fourth and fifth about equal in length.

Genitalia as in figure 7*c*. Inner and outer spathae as in figures 7*e* and 7*d*, respectively.

Length, 20 millimeters and other measurements in proportion.

Holotype.—Male, Suifu, Szechuen, China, XI-XII. 23. *Allotype.*—Queen, Suifu, Szechuen, China, alt. 1,000 ft., 11-1-22. *Morphotype.*—Worker, Mt. Omei, Szechuen, China, 25. VII. 1931 (Frison collection). *Paratypes.*—2 males, same data as holotype; 1 male and 3 workers, Suifu, Szechuen, China, Sept.-Nov. 28; 2 workers, Si Gi Pin, Mt. Omei, Szechuen, China, Aug. 5-17, 1925; 1 worker, Mt. Omei, China; 1 worker, same data as holotype; 1 worker, Suifu, Szechuen, China; 1 worker, Yachow, Szechuen, China, 2,000 ft., 1923; 4 workers, Szechuen, China, 1924; 1 worker, Shin Kai Si, Mt. Omei, Szechuen, China, 4,400 ft., Sept. 1-10, 1922 and 1 worker 8-1929; 1 worker, Suifu to Hongya, China, 1,000-1,400 ft. alt., June 15-21, 1919; 2 workers, Shin Kai Si, Mt. Omei, Szechuen, China, 4,400 ft., July-Aug., 1923; 2 workers, Kiating, China, 1,100 ft. alt., 6-29-24; 2 workers, Hua Sien Si, Mt. Omei, China, 7,000 ft. alt., 9-1-24; 1 worker, Tsae Keo, China, July, 1925; 1 worker, Suifu, Szechuen, China, 2,000 ft., 3-14-24; 3 workers, near Yachow, Szechuen, China, alt. 400-5,000 ft., July 2-8,

30; 1 worker, between Yachow and Kiating, Szechuen, China, 1,300-1,500 ft., July 2-4, 1930; 1 worker, Ningyuenfu, China, alt. 6,000-6,200 ft., Aug. 2-4, 1928; 2 workers, Mt. Omei, Szechuen, China, July 25, 1931 and July 29, 1929 (Frison collection). All collected by D. C. Graham except those indicated as in Frison collection.

Holotype, allotype and numerous paratypes deposited in the collection of the United States National Museum. Morphotype and several paratypes deposited in the collection of the author. Two paratypes deposited in the collection of the Indian Museum.

This striking and beautiful species can be readily distinguished in all castes from any other described species of the subgenus *Orientalibombus* on the basis of its color pattern. The male differs especially from all other known species of this subgenus in having the fourth and fifth antennal segments almost subequal in length. The color pattern of this new species resembles *trifasciatus* Smith, an *Agrobombus s. l.*, but may be readily separated from that species in the females by the lack of a prominent spine-like projection on the mesobasitarsus and in the males by marked differences in their genitalia.

I take pleasure in naming this new species for a former teacher, Professor C. L. Metcalf of the University of Illinois, because of his helpfulness and many kindnesses to the author.

Bremus montivolans (Richards).

1 queen, Inailong, N. Shan States, Burma, I.I.27 (H. S. Rao); 2 workers, Lashio, N. Shan States, Burma, ca. 2,700 ft., 10-15.XI.26 (H. S. Rao); 1 male, Namkham, N. Shan States, Burma, ca. 2,500 ft., 27-29-XI.26 (H. S. Rao); 1 male, Take-pum Mtn., Chinese frontier, N. E. Burma, alt. 4,000-5,000 ft., XI.1910 (C. W. Beebe).

Bremus orientalis var. **buccinatoris** (Smith).

2 queens and 1 worker, Kalimpong, Darjiling dist., E. Himalayas, 600-4,500 ft., 24. IV-10.V.15 (F. H. Gravely); 1 worker, Between Sukna and Siliguri, E. Himalayas, at light in carriage, VI.1930 (S. Ribeiro); 1 worker, Kurseong, E. Himalayas, alt. 4,500-5,000 ft., 22-VI-10 (N.Annandale); 1 worker, Sikkim, 3,800 ft., Sept. 1897 (Dudgeon Coll.); 1 worker, Sikkim (A. V. Knyvett); 6 workers, Tindharia, 2,822 ft.; 1 worker, Kurseong, E. Himalayas, 5,000 ft., 7-IX-09 (N. Annandale); 1 worker, Kurseong, E. Himalayas, 5,000 ft., 5-IX-09 (N. Annandale); 1 worker, Kurseong, E. Himalayas, 6,000 ft., 13-X-09 (D'Abreu); 1 worker, Kurseong, E.Himalayas, alt. 4,700-5,000 ft., 24-VI-10 (N.Annandale); 1 worker, Kurseong, E. Himalayas, 5,000 ft., 9-IX-09 (N. Annandale); 1 worker, Sikkim (Knyvett); 1 worker, Sikkim, 3,800 ft., Sept. 1897 (Dudgeon Coll.); 1 worker, Ghumti, Darjiling dist., E. Himalayas, c. 4,000 ft., VII.11 (F. H. Gravely); 1 worker, Sikkim (Dr. Stol); 1 queen and 1 worker, Darjiling dist., Singla, alt. 1,500 ft., April, 1913 (Lord Carmichael's Colln.); 2 workers, Darjiling, 6,000-7,000 ft., 3-VII-14 (Lord Carmichael's Colln.); 1 worker, Darjiling, 6,000-7,000 ft., 9-VII-14 (Lord Carmichael's Colln.).

Bremus orientalis var. **khasianus** (Richards).

1 queen, Nepal Valley, E. Himalayas, alt. 4,500-6,500 ft. (Manners-Smith); 2 workers and 3 males, Nartiang, Khasi and Jaintia Hills district, Assam, 28-29.XI.30 (H. S. Rao); 3 workers, Soondrijal, Nepal; 3 workers, Katmandu, Nepal; 1 worker, Chitlong, Nepal; 1 male, Suparitar, 35 miles S. W. of Khatmandu at entrance to Hills, 2,000 ft., 1-XII-07 (I. H. Burkill); 1 male, Dikrang Valley.

Subgenus **PRATOBOMBUS** Vogt (1911).

Bremus atrocinctus (Smith).

1 male, Sikkim, Tungloo, alt. c. 10,000 ft., July, 1912.

In addition to this record it seems opportune to include the following records of this species based upon specimens in the collection of the U. S. National Museum, Washington, D. C. and collected in China by D. C. Graham : 12 males, between Fu Yas Lin Pass and Da Shiang Lin Pass, Szechuen, China, 6,000-8,000 ft. alt., Aug., 1923 ; 19 males, Wen Chuan, Szechuen, China, Aug. 7-14, 1924 ; 13 males, near Mupin, Szechuen, China, July, 1929 ; 2 males, Gieh Yin Temple, Mt. Omei, China, Aug. 10, 1925 ; 2 males, Mt. Omei, Szechuen, China, 11,000 ft. alt., 1924 ; 1 male Shin Kaisi, Mt. Omei, Szechuen, China, 4,400 ft., Aug. 1922 ; 1 male, Yas-Gi, Szechuen, China, 4-8,000 ft., July 16, 1929 ; 6 males, near Tang-Gu, China-Tibet border, 15,600 ft. alt., Aug. 13-15, 1930 ; 3 males, Wa-Si-Geo, Szechuen, China, 5-6,000 ft., Aug. 18, 1930 ; 2 males, Suifu, Szechuen, China ; 1 male, Da Shiang Lin Pass, China-Tibet border, 4,060 ft., Aug. 23, 1930 ; 1 male, Mi-Chi-in, Yu Long Si, Tibet, 13-15,000 ft., Aug. 8-12, 1930 ; 4 males, Yachow, Szechuen, China, 2,200-5,000 ft., Aug. 21-25, 1930.

Bremus atrocinctus var. **terminalis** (Smith).

1 queen, Sikkim, Tungloo, alt. 10,000 ft., July, 1912 ; 1 queen and 2 workers, Dal, above Dharmsala, Punjab, alt. 5,500 ft., 31-V-26 (S. L. Hora) ; 7 workers, Sikkim 4 workers, Onari, Garhwal, W. Himalayas, 11,000 ft., 27-VI-14 (Tytler) ; 1 worker, Kousanie, Kumaon, W. Himalayas, 6,075 ft., VII-14 (Tytler) ; 1 worker, Painsar, Garhwal, W. Himalayas, above Lobha 7,500 ft., 20-IV-14 (Tytler) ; 1 worker, Shahpur, Punjab, small rocky stream close to Dak Bungalow, 2,469 ft., 24-V-26 (S. L. Hora) ; 2 workers, Kumaon Hills, sides of the Deo-Gad stream and the Forests S. W. of Pinath, 7 miles from Kousanie (Almora dist.), 1-VI-30 (H. S. Pruthi) ; 1 worker. Kangra Valley, 4,500 ft., June 1899 (Dudgeon).

In addition to the above records based upon material in the Indian Museum, it seems opportune to record the following records based upon material in the U. S. National Museum, Washington, D. C., all collected by D. C. Graham : 36 workers, 3 queens, 2 males, Uen Chuan, Szechuen, China, Aug. 7-14, 1924 ; 3 workers, 1 queen, 2 males, between Fu Yao Lin Pass and Da Shiang Lin Pass, from 6,800 to 8,000 ft., Aug. 1923 ; 86 workers, 26 queens, 1 male, near Mupin, Szechuen, China, 2-8,000 ft., June 27-July 27, 1929 ; 8 workers, Szechuen, China, July 9, 1929 ; 3 workers, 2 queens, Shin Kaisi, Mt. Omei, Szechuen, China, 2-6,000 ft., Sept. 1-10, 1922 ; 4 workers, 2 queens, Mt. Omei, Szechuen, China, Si Gi Pm, Aug., 1925 ; 1 worker, 2 queens, between Uen Chuan and Mowchow, China, 45-5,500 ft. ; Aug. 5, 1924 and Aug. 5, 1927, 1 worker, 1 queen between Yachow and Da Shiang Lin Pass, Szechuen, China, 6,000 ft., Aug. 1923 ; 1 queen, Wan Niens, China, alt. 6,000 ft. ; 32 workers, 2 queens, Yachow to Mupin, Szechuen, China, 2-5,000 ft. ; June 23-27, 1929, 1 worker, 1 queen, Suifu, Szechuen, China, Apr.-May, 1928 ; 8 workers, W. of Yachow, 2-7,500 ft., June 14-18, 1922, Szechuen, China ; 1 worker, W. Kuanshien, Junnan, China ; 1 worker, Mowchow, Szechuen, China, 14-4,500 ft. July 9, 1924, ; 2 workers, Washan, Szechuen, China, July 22-27, 1925, 55-11,000 ft. ; 1 worker, near Washan, Szechuen, China, July 20, 1925 ; 1 worker. Uen Chuan, Szechuen, China, 2,200 ft. July 7, 1924, ; 2 workers, between Mt. Omei and Mt. Wa, Szechuen, China, 2-8,000 ft. between July 24-Aug. 4, 1922 ; 7 workers, 3 queens, between Li To and Lu Ding Chiao, 4-9,000 ft., July 11-14, 1930, Szechuen, China ; 6 workers, 2 queens, 9 males, near Tang-Gu, China-Tibet Border, 14,000 ft., Aug. 3-6, 1930 ; 6 workers, 4 queens, Ningyuenfu, China, July 6-10,800 ft. 24-26-Aug. 2-4, 1928 ; 9 workers, 1 queen, Suifu, Szechuen, China, June 1-21, 1928, 10-1,500 ft. ; 1 queen, LuDing, Chiao, China-Tibet Border, 4-9,000 ft., July 12-14, 1930 ; 6 workers, 2 queens, 3 males, Yachow, Szechwan, China, May-June, 1928, and Aug. 21-25, 1930 ; 13 workers, 1 queen, DaShiang Lin Pass, China-Tibet Border, 4,960 ft., Aug. 23, 1930 ; 2 workers, 1 queen, Suifu, Szechuen, China ; 41 workers, 1 queen, near Tang-Gu, Tibet, 14,000 ft., Aug. 3-6, 1930 ; 16 workers, 1 male, Yu-Long-Si, 15,600 ft., Tibet ; July 31-Aug. 13, 1930 , 2 wrokers, Kuanshien, 3,000 ft., Apr. 5-May 8, 1930, Szechuen, China ; 7 workers, 4 males, Mi-Chi in Yu Long SiGge, 13-15,000 ft., Aug. 8-12, 1930, China-Tibet Border ; 2 workers, Tatsienlu, China-Tibet border, 8-900 ft., 4 workers, 1 queen, 3 males, Yachow. Szechwah, China, May-June, 1928 and Aug. 21-25, 1930 ; 1 worker, Wa-Si-Geo, Szechwan, China, 5-6,000 ft., Aug. 18, 1930 ; 1 worker, Ningyuenfu, China, between Yachow 2,500-10,000 ft. July 14-28, 1929, ; 1 worker, China, From U. S. N. M. Collection ; 1 male Ja-Ze Pass, China-Tibet Border, 16-17,150 ft., Aug. 13, 1930.

Bremus flavescens (Smith).

4 males, nr. Mupin, Szechuen, China, 2-8,000 ft., 28. VI. 1929; 3 males, Suifu, Szechuen, China, May 15-June 8, 1929; 7 males, S. of Suifu, Szechuen, China, April-June, 1929; 2 males, Yachow to Mupin, Szechuen, China, alt. 2,000-5,000 ft., June, 23-27, 1929; 1 male, near Kinting, Szechuen, Shin Kai Si, Mt. Omei, China, 4,400 ft. 1921; 1 male, W. of Yachow, Szechuen, China, 2,000-7,500 ft., June 14-18, 1922; 2 males, Chin Chi Shien, W. of Yachow, Szechuen, China, 45-600 ft., 10-11, VII. 1930; 1 male, Suifu, Szechuen, China, V.1924; all collected by D. C. Graham. 2 males, sides of the Deo-Gad stream and the Forests S. W. of Pinath, 7 miles from Kousanie (Almora dist.), I-VI.30 (H. S. Pruthi); 4 males, Naini Tal, May and June 1893 (Lucknow Mus.); 1 male, Naini Tal, 6-7,000 ft., Kumaon, 1908 (R. E. Lloyd); 1 male, Naini Tal, Kumaon, c. 6,000 ft., 10-VI-09 (Mus. Coll.).

The female has not as yet been reliably associated with the male.

Bremus mearnsi var. **bakeri** (Cockerell).

1 worker, Sureil, Darjiling (Major Alcock); 1 worker and 2 males, Lebong, Darjiling dist., E. Himalayas, 6,000-6,600 ft., 13-VI-14 (F. H. Gravely).

Bremus mearnsi var. **dilutus** Frison.

1 queen, Naini Tal, May and June 1893 (Lucknow Mus.); 1 worker, Bhowali, bed of a small hill stream near the Forest Rest House, 5,700 ft., 11.V.30 (H. S. Pruthi); 1 worker and 1 male, sides of the Geo-Gad stream and the Forests S. W. of Pinath, 7 miles from Kousanie (Almora dist.), Kumaon Hills, 1.VI.30 (H. S. Pruthi); 1 worker, Naini Tal, Kumaon, c. 6,000 ft., 10-VI-09 (Mus. Coll.); 1 male, Naini Tal, Kumaon, c. 6,000 ft., 7-VI-09 (Mus. Coll.).

Bremus mearnsi var. **geei** (Cockerell).

1 queen, Naini Tal, May and June 1893 (Lucknow Mus.); 1 worker, Monda, Nepal, 12.V.08 (R. Hodgart).

Bremus rotundiceps (Friese).

1 worker, Bhim Tal, Kumaon Hills, cultivated fields, ca. 4,450 ft., 18-V-30 (H. S. Pruthi).

Bremus rotundiceps var. **protensus,** nov.

Worker.—Structurally similar in most respects to other members of the subgenus *Pratobombus.* Malar space medium, about as long as width at articulation with mandibles. Labrum with tubercle-areas not widely separated, shelf-like projection with anterior margin rounded. Clypeus with centre of disk practically without large punctures. Antenna with third segment slightly longer than fifth, fifth much longer than fourth. Area between lateral ocelli and margin of compound eyes polished and with but few punctures.

Tibia and tarsus with integument dark reddish-brown. Mesobasitarsus without a sharp spine-like projection. Wings dark, with a slight violaceous tinge.

Pubescence colored as follows: head, thorax and legs black; first, second and most of basal and middle area of third abdominal tergites yellow; remainder of third and following segments ferruginous.

Holotype.—Worker, Bhim Tal, Kumaon Hills, ca. 4,450 ft., cultivated fields, 18-V-30 (H. S. Pruthi). *Paratypes.*—1 worker, Shahpur, Punjab, small rocky stream close to Dak Bungalow, 2,469 ft. alt., 13-V-26 (S. L. Hora) and 1 worker, Dharampur, W. Himalayas,

5,000 ft., 15-V-1913 (Phaku Ram). Holotype and one paratype deposited in the collection of the Indian Museum and one paratype in the collection of the author.

This new variety differs from typical *rotundiceps* Friese, according to my concept, by having black pubescence on the sides and dorsum of the thorax.

Bremus rotundiceps var. **cruentatus,** nov.

Worker.—Structurally the same as *rotundiceps* var. *protensus*. Differs in having black pubescence on sides of third and on most of fourth abdominal tergites.

Holotype.—Worker, Kalimpong, Darjiling dist., E. Himalayas, 19-24.V.30 (S. L. Hora). *Paratype.*—Worker, Sikhim (Bingham)—formerly determined by Friese as *channicus* var. *brevigenalis* and probably one of his typic specimens. Holotype in the collection of the Indian Museum and Paratype in the collection of the author.

This new variety differs from the true *rotundiceps* in having black pubescence on the sides and dorsum of the thorax and on some of the middle abdominal tergites. It differs from *rotundiceps* var. *protensus* in having black pubescence on most of the third and fourth abdominal tergites.

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INTERESSANTE UND NEUE SCHWIMMKÄFER DES INDISCHEN MUSEUMS IN CALCUTTA.

Von L. GSCHWENDTNE, *Linz a/D.*

Durch Vermittlung des Deutschen Entomologischen Museums in Berlin erhielt ich das gesamte, etwa 2·480 Stück umfässende Dytisciden —Material der Zoological Survey of India, Calcutta, zur Bearbeitung. Die Tiere stammen aus den entlegensten Gegenden British Indiens, besonders viele aus den nördlichen Grenzgebieten, den Tälern und Seen des Himalayas. Wie zu erwarten, befanden sich unter den Tieren, die meist sehr genaue Fundortangaben besassen, viele sehr wenig bekannte, teilweise bisher verschellone Dytiscidae und eine Anzahl ganz neuer Arten. Die Durchsicht des Materials liess auf Anwendung ziemlich moderner Sammeltechnik schliessen, da selbst von ganz winzigen Arten meist zahlreiche Stücke vorhanden waren, was besonders bei neuen Spezies beziehungsweise Variationen äusserst wertvoll empfunden wurde. Wenn auch gewisse Arten der nördlichen Grenzgebiete paläarktischen Einschlag verraten, so muss doch gesagt werden, dass die weitaus überwiegende Mehrzahl der Dytiscidae des Landes stark exotisch beeinflusst ist beziehungsweise rein exotisches Gepräge aufweist. Sehr beachtenswert ist der gelegentliche Nachweis von Arten, deren Verbreitung von Europa und Nordafrika über Kleinasien im Norden bis nach Turkestan und im Süden bis nach Indien reicht wie *z. B. Bidessus geminus* F und *thermalis* Germ., *Laccophilus minutus* L., *Hyphydrus pictus* Klg., *Coelambus confluens* F., *Gaurodytes biguttatus* Ol. und *conspersus* Marsh. etc., Arten die Guignot als *Eléments touraniens* bezeichnet. Nicht minder interessant ist andrerseits die Tatsache, dass es wiederum ein Genus gibt, das sich mit seinen Arten fast gänzlich auf Indien beschränkt: *Hyphoporus*, von dessen 16 Arten (14 bisher beschriebene *plus* 2 neue Arten, deren Beschreibung ich aber unterliess, da beide nur mit einem einzigen Stück in der Sendung vertreten waren) 12 bisher nur aus Indien bekannt worden sind, wobei es nicht ausgeschlossen ist, dass von den restlichen 4 Arten weitere 3 der angrenzenden Gebiete ebenfalls nach Indien herüberreichen. Dieser Nachweis verdient jedenfalls beachtet zu werden, da eine derartige Ausschliesslichkeit einer verhältnismässig artenreichen Gattung bei Dytiscidae sonst nur in der neuen Welt öfters vorkommt.

Im Folgenden bringe ich die Beschreibung der neuen Arten, die ich durch verschiedene Angaben über bisher wenig bekannte ergänze. Anhangsweise gebe ich eine Zusammenstellung von Arten, die bisher aus Indien noch nicht bekannt waren und sich unter dem Material des Museums befanden. Die neuen Arten habe ich hier ohne nähere Fundortangabe erwähnt, da sie im Text der Beschreibung ohnehin schon aufscheint.

Laccophilus kempi, sp. nov.

Eine in Form und Umfang an *Lacconectus* erinnernde Art, die eben dadurch und nicht zuletzt durch die eigenartige Färbung der Flügeldecken leicht zu erkennen ist.

Auffallend breit oval, hinten leicht zugespitzt, schwach gewölbt, Skutellarlappen wie bei *minutus* L.; Glanz der Oberseite infolge der ziemlich kräftigen Retikulation leicht getrübt; letztere besteht vor allem aus einer dichten Punktierung, die am Kopf äusserst fein, am Halsschild schon besser erkennbar, auf den Flügeldecken, besonders in der hinteren Hälfte neben den hier verworrenen Punktreihen deutlich hervortritt, die maschenförmige Retikulation ist am Kopf, Halsschild und auf den Flügeldecken in der weiteren Umgebung des Skutellarlappens doppelt, wobei hier die feinere fast kaum erkennbar, die gröbere aber kräftig ausgeprägt ist, nach aussen hin tritt zwischen beiden dann allmählich ein Ausgleich ein, wodurch die Retikulation einheitlich und einfach wird. Die ganze Unterseite ist äusserst dicht mikroskopisch schraffiert, die Abdominalsegmente überdies noch mit tief eingegrabenen schrägen Stricheln. Oberseite rötlichgelb, Halsschild vorne oft angedunkelt, Basis der Flügeldecken und die Naht ganz schmal gebräunt, vom zweiten Drittel an rostbraun, wobei der Seitenrand mit 1-2 Einbuchtungen heller bleibt, der rostbraune Teil ist vorne meist sehr gut abgegrenzt und gezackt, vor der Spitze mit einigen länglichen helleren Flecken, die aber meist ganz verwaschen sind. Unterseite rotbraun, erstes Abdominalsegment, Hinterbrust und die Innenlamellen der Hinterhüften heller, die fadenförmigen Fühler und Beine rötlichgelb.

3·7—4 mm.

Jor Pokri, 4,800 ft., Nr. Sitong, Darjiling, district E. Himalayas. 6-7-1918. 12 Exemplare, entdeckt von Herrn S. W. Kemp, nach dem ich die Art benenne.

Laccophilus solutus var. **indicus,** nov. var.

Es liegen mir acht aus verschiedenen Teilen Indiens stammende Tiere einer Art vor, die ich auf den mir unbekannten *solutus* Sharp beziehe, von dem sie aber in mehrfacher Hinsicht abweichen, weshalb ich sie bis zur endgiltigen Klärung des wirklichen Verwandtschaftsverhältnisses diesem als Variation unterordne.

Lang oval, in der Mitte am breitesten, nach vorne schwach, nach hinten viel stärker verengt, Skutellarlappen flach, glänzend, Retikulation doppelt, die gröberen Maschen auf den Flügeldecken nicht wesentlich kräftiger wie die feineren, gegen die Seiten und Spitze zu ausgegliechen. Prosternalfortsatz lang und schmal, Retikulation ziemlich kräftig, Stricheln der Abdominalsegmente dagegen zart. Ober-und Unterseite mehr oder weniger hell rötlichgelb, Flügeldecken mit Ausnahme des Seitenrandes und der Basis mehr oder weniger locker schwarzbraun gesprenkelt, sonst ungefleckt.

Penisrücken schmal, von der Seite gesehen säbelförmig gekrümmt, zugespitzt.

3·1—3·8 mm.

Von *solutus* Sharp durch geringere Grösse und viel schmälere Form unterschieden.

Ravi River, Lahore, Punjab, 13-12-1927 (3 Stück); Selai Kusi, Mangaldai, Assam, 8-1-1911 S. Kemp (4 Stück); Rajmahal, Bengal, 6-7-1909, Annandale (1 Stück).

Laccophilus apicicornis var. **nigritulus,** nov. var.

Die indischen Tiere bilden eine Variation, deren ganze Unterseite mit Ausnahme der gelben Fühler und Beine und des rötlichgelben Hinterrandes der letzten vier Abdominal-segmente schwarz ist.

10 Stück von Te-ring Gompa, 14,000 ft. Tibet (F. H. Stewart).

Desmopachria maculata Motsch.

Von dieser interessanten Art, die Régimbart in seiner *Revision des Dytiscidae de la Region Indo-Sino-Malaise* 1899, p. 231, irrtümlicherweise für einen *Hydrovatus* gehalten hat, liegen mir 5 von den Andaman-Inseln stammende Tiere vor. Die Bildung des Prosternalfortsatzes, der Fortsätze der Hinterhüften, die allgemeine Gestalt, die Form der Tarsen, Punktierung und Färbung der Oberseite verweisen die Art klar zu den Hyphydrinen. Eine Ausnahme bildet lediglich die Bildung des Clypeus, der nur ganz schwach gebogen ist und jede Spur einer Randung vermissen lässt, wodurch sich die Art an das Hyphydrinen Genus *Coelhydrus*, dessen Clypeus ebenfalls nicht gerandet ist, einigermassen anlehnt.

Das Vorkommen einer *Desmopachria* in Asien ist beachtenswert. Die bisher bekannten rund 30 Arten stammen alle aus Amerika, lediglich von einer Art, *Desm. variolosa* Reg. wird berichtet, dass sie in Tabak war, der aus Sumatra eingeführt worden ist (*vgl.* Régimbart: " Dytiscides trouves dans les Tabacs " in den *Ann. Soc. Ent. France* 1895, p. 322). Hiezu bemerkt allerdings Régimbart, dass er die Richtigkeit des Vorkommens bezweifle. Der nunmehr geglückte sichere Nachweis einer *Desmopachria*—Art den Andamanen lässt die Richtigkeit der Fundortangabe hinsichtlich der *variolosa* Régimbarts nun doch wahrscheinlich erscheinen.

Hyphydrus pictus var. **indicus,** nov. var.

Es liegt mir eine ganze Anzahl von Tieren vor, die zweifellos mit *pictus* Klg. grosse Ähnlichkeit haben und sich von diesem nur durch die hellere Färbung der Oberseite, besonders aber des Halsschildes unterscheiden. Auf letzterem ist lediglich der Vorder-und Hinterrand unbestimmt angedunkelt. Ein Weibchen hievon ist infolge sehr kräftiger Retikulierung der Oberseite vollkommen matt; dieses ♀ stammt aus Süd Indien (Palni Hills) aus einer Höhe von *ca.* 6,900 ft., gefangen von Herrn S. W. Kemp am 27. August 1922. Die übrigen Tiere dagegen aus Simla Hills (Kandaghat); die eine Fundstelle lag 3,500-4,000 ft., die andere 6,000-7,000 ft., hoch. Gefunden wurden diese Tiere von Herrn B. N. Chopra im August 1925.

Bidessus regimbarti, sp. nov.

Régimbart berichtet in seiner *Revision des Dytiscidæ de la region Indo-Sino-Malaise* p. 223 von einem *Bidessus thermalis* Germ. aus

Mandar, der sich von der europäischen Type durch geringere Grösse, schmälere und mehr parallele Gestalt und stärkere Punktierung wohl unterscheidet.

Von derartigen Tieren liegt mir nun neben typischen *signatellus* Klg. (*thermalis* Germ. ist ein synonym) eine grosse Zahl vor. Es kann gar kein Zweifel darüber bestehen, dass diese Tiere, die sich von letzteren gut unterscheiden, einer neuen Art angehören, was übrigens auch Régimbart schon vermutet hat. Die Tiere sind vor allem anderen ein wenig kürzer und breiter, seitlich stärker gerundet und hinten weniger zugespitzt. Kopf und Halsschild sind polyedrisch retikuliert, die Flügeldecken dagegen glatt, glänzend; Kopf spärlich und zart, Halsschild schon merklich stärker, die Flügeldecken grob und sogar ziemlich dicht, um ein mehrfaches kräftiger als bei *signatellus* punktiert, Behaarung besonders der Flügeldecken lang, weissgrau und ziemlich dicht; Basalstrichel des Halsschildes kräftig nach einwärts gekrümmt, auf den Flügeldecken gerade, meist schwächer und etwas kürzer, Nahtstreifen im Gegensatz zu *signatellus* schwach, stellenweise nur angedeutet, vorne meist ganz erloschen. Abdomen deutlich, Seiten der Hinterhüften unmerklich retikuliert, sonst glatt, die Punktierung der Hinterhüften wesentlich kräftiger wie bei der verglichenen Art.

Die Färbung ähnelt der dunkler *signatellus*, ist aber nur selten gut begrenzt, meist neigen die einzelnen Makeln zur Verbindung beziehungsweise Erweiterung, häufig ist die Zeichnung undeutlich oder verschwommen.

1·5—1·8 mm.

Lake Chilka at Balugaon und Chilka Survey Sta. 60. 7. März 1914 (among weeds) 63 Stück.

Coelambus parallelogrammus Ahr.

1 Stück aus Chinar Bagh Nullah (Kashmir, N. W. Himalayas, Sta. 2) beziehe ich auf diese Art. Die Binden der Flügeldecken heben sich von der Grundfärbung kaum ab, dagegen sind die Punktreihen an der Naht und an den Schultern vorne ganz deutlich ausgeprägt.

Hyphoporus kempi, sp. nov.

Eine Art aus der *elevatus*-Gruppe; von diesem selbst aber leicht zu unterscheiden durch die kürzere Form, lockerere Punktierung der Flügeldecken, der beim ♂ deutlichen Punktreihe und beim ♀ kräftigeren Retikulierung der Oberseite. Von dem ebenfalls ähnlichen *tonkinensis* Rég. durch bedeutendere Grösse, helle Unterseite und einfärbige männliche Tarsenglieder verschieden.

Kurz oval, gedrungen, Clypeus dick gerandet, Wulst in der Mitte verdünnt, Hinterecken des Halsschilds ganz kurz herabgebogen und kurz verrundet, Flügeldecken vor der Spitze leicht abgeschrägt und geschweift. Männchen glänzend, glatt, bloss hinter dem Clypeus schmal retikuliert, Weibchen dagegen matt, die ganze Oberseite deutlich retikuliert, Kopf ziemlich dicht, Halsschild merklich kräftiger, besonders an der Basis sehr kräftig punktiert, ohne dass sich aber hier die Punkte runzelförmig vereinigen würden, die Flügeldecken sind vorne deutlich

doppelt punktiert, hinten und gegen die Seiten zu ist die Punktierung dagegen ausgeglichen, nichtsdestoweniger aber auch hier noch kräftig und dicht, vorne ist auf der Scheibe bis gegen die Mitte zu eine dorsale Punktreihe gut erkennbar, die aber beim ♀ in der dichteren aber schwächeren Punktierung gänzlich verschwindet. Unterseite des ♂ glatt, des ♀ retikuliert, Hinterbrust, 1 und 2. Abdominalsegment sehr grob punktiert, Hinterhüften an den Seiten mit mehreren Riesenpunkten, Epipleuren kräftig und dicht punktiert. Oberseite rötlichgelb, Halsschild am Vorder-und Hinterrand schmal gebräunt, Flügeldecken an der Basis mit drei kleinen schwarzbraunen Makeln, eine an der Naht, die beiden nächsten daneben, Naht schmal schwarzbraun gesäumt, überdies mit vier mehrfach unterbrochenen Längsbinden, von denen die erste und dritte breiter wie die anderen sind. Unterseite, Fühler und Beine einfärbig rötlichgelb.

Die ersten drei Glieder der Vorder-und Mitteltarsen des ♂ leicht ereweitert. Penis in der Mitte stumpf geknickt, Spitzenhälfte ziemlich gleichbreit, Spitze unten mit kurzem Zähnchen.

$4\frac{1}{2}$—$4\frac{3}{4}$ mm.

Mangaldai, Assam (Partly dried River bed; Central tank) 4 ♂♂ entdeckt von Herrn S. W Kemp, dem zu Ehren ich die Art benenne; 1 ♀ aus Lucknow.

Hyphoporus musicus Klg.

Es liegen mir aus Nepal (Pharping) 4 Examplare vor, bei denen die Grundfarbe der Oberseite viel dunkler rötlichgelb ist als wie sonst, wodurch sich die ausserdem viel weniger markanten, breiteren und längeren Binden auf den Flügeldecken nur undeutlich abheben. Auch die Unterseite ist bei diesen Tieren viel dunkler. Im übrigen gleichen sie aber, was Gestalt und Punktierung betrifft, volkommen typischen Vertretern anderer Gegenden.

Lacconectus ovalis, sp. nov.

Eine mit *lividus* Rég. nah verwandte Art, die bei schwarzbrauner Oberseite auf den Flügeldecken zwei dicht geschlossen punktierte Längsreihen neben den lockeren, nur aus wenigen Punkten bestehenden übrigen Reihen aufweist.

Kürzer und breiter oval, hinten kaum stärker verengt als wie vorne, leicht depress; schwach glänzend, die ganze Oberseite, besonders Kopf und Halsschild kräftig retikuliert, Flügeldecken dicht punktuliert, mit zwei dicht geschlossenen, hinten aufgelockerten Punktreihen, eine weitere unregelmässigere Punktreihe zieht von den Schultern zur Spitze, zwischen diesen drei Reihen sind zwei weitere, durch einige kräftige Punkte angedeutet; Unterseite glänzend, kaum merklich retikuliert. Oberseite schwarz, Kopf rötlich, neben den Augen schwarzbraun, Halsschild mit breiten rötlichen Seiten, Schildchen rötlich durchscheinend, Flügeldecken häufig mit rötlicher subbasaler Doppelmakel an den Schultern, von wo sich nicht selten eine bräunlichrote wischartige Aufhellung bis zur Spitze erstreckt. Unterseite braun, Prosternum, die Seiten aller Abdominalsegmente sowie die Hinterränder des 3 bis 6.

Segmentes rötlich gesäumt, Fühler und Beine rötlich, Schienen und Tarsen der Mittel-und Hinterbeine ein wenig dunkler. Die vier Basalglieder der Vorder-und Mitteltarsen der ♂♂ deutlich erweitert.

4-4⅔ mm.

Upper Rotung, Abor Expedition (S. W. Kemp), 5-1-1912, in water at leaf base of plantain, 20 ft. from ground. 8 Stück.

Platambus fletcheri Zim.

Diese Art, die bisher nur aus Assam (Khasi Hills, Shillong) bekannt war, liegt mir nun in mehreren Stücken auch aus Punjab (small stream near Dhobie Ghat, Murree, alt. 7,242 ft.) und aus dem W. Himalayas (Kumaun, Malwa Tal, 3,600 ft.) vor.

Platambus lineatus Gschw.

Beschreibung nachzulesen in der KOLEOPT. RUNDSCHAU, Bd. 21 (Nr. 1 und 2, April 1935, p. 62). Genaue Fundortangabe: R. Brahmaputra, Kobo, 400 ft. Abor Expedition, 4-12-1911; Dihong R., below Pasighat, Abor Expedition, 16-12-1911 (S. W. Kemp). 21 Exemplare.

Platambus incrassatus Gschw.

Beschreibung ebenfalls in vorhin zitierter Zeitschrift p. 63 bereits erschienen. Fundort: Man Ton, Mongmit State, 4,200 ft. Ruby Mines dist. U. Burma. Feb.-April 1915 (F. Coggin Brown). 9 Exemplare.

Rhantus Lac.

Das unfangreiche, aus verschiedenen Gegenden Indiens stammende Material ermöglichte mir eine gründliche Überprüfung der durch ihre übergreifende Variabilität äusserst ähnlichen Arten der *punctatus*-Gruppe. Zu den von Régimbart in der " Revision des Dytiscidae de la region Indo-Sino-Malaise " erwähnten 3 Arten (*punctatus* Fourc., *sikkimensis* Rég. und *taprobanicus* Sharp) kommt eine neue Art, die ebenfalls mit *punctatus* grosse Ähnlichkeit hat und wahrscheinlich bisher als Variation desselben angesehen worden sein wird. Desgleichen müssen auch Stücke von *sikkimensis* für Variationen von *punctatus* gehalten worden sein, da von dieser Art, die im Lande sehr weit verbreitet ist, Régimbart nur 5 Exemplare seiner Beschreibung zugrunde legte. Auch *taprobanicus* befanden sich da und dort unter *Rh. punctatus*, was Zimmermann schon 1917 bei seiner Revision der Schwimmkäfer des Deutschen Entomologischen Museums in Berlin-Dahlem (*Arch.* f. *Naturgesch.* 1917/A, 12-Heft, p. 218) erwähnt.

Als wertvollstes Unterscheidungsmerkmal der einzelnen Arten erwies sich die Bildung der Parameren (siehe Abb. 2). Weniger konstant ist die Penisbildung, die manchmal geringfügige Abweichungen erkennen lässt. Die Form der männlichen Vorderklauen gestattet im allgemeinen ein sicheres Erkennen von *punctatus*-Tieren. Ebenfalls wertvoll erwies sich die Form der Scheitelmakel, ziemlich variabel dagegen die Retikulation, Färbung und Form. So zeigte sich beispielsweise, dass die von Régimbart für *sikkimensis* hervorgehobene Granulation (" petits

tubercules ") der Flügeldecken als eine Art monströse Bildung sowohl hier, wie auch bei *punctatus* und *taprobanicus* hin und wieder auftritt. Auch die Verdunkelung der Oberseite bis zur Unkenntlichkeit der Sprenkeln und Zeichnung erwies sich als nicht spezifisch für *sikkimensis*.

1 (2) Kleiner, 10-10·5 mm. kürzer, Flügeldecken hinten leicht verrundet, der schwarze Saum vor den Augen seitlich erweitert.
ovalis, sp. nov.

2 (1) Grösser und länger, 10·5-12·5 mm. Flügeldecken hinten meist zugespitzt, der schwarze Saum vor den Augen ganz schmal.

3 (4) Körper sehr schmal und parallel, hinten stark zugespitzt.
taprobanicus Sharp.

4 (3) Lang oval, in oder hinter der Mitte meist deutlich erweitert.

5 (6) Scheitelmakel hoch, oval, seitwärts kürzer, ohne Einkerbung in der Mitte.
sikkimensis Rég.

6 (5) Scheitelmakel niedrig und lang, zweilappig.
punctatus Fource.

Rhantus ovalis, sp. nov.

Lang oval, hinter der Mitte meist leicht erweitert, kaum zugespitzt, Halsschild sehr schwach gerundet, kräftig aber nur mässig dick gerandet, schwach gewölbt; stark glänzend, Kopf und Halsschild infolge der kräftigen engen Retikulation etwas matter, in den unregelmässigen Maschen 1-2 Punkte eingeschlossen, Flügeldecken merklich zarter und weitmaschiger retikuliert, in den Maschen ausser den üblichen Punkten mit feiner mikroskopischer Retikulation, die hinter der Mitte an Stärke allmählich zunimmt, ohne schliesslich ebenso kräftig zu werden wis die gröberen Maschen, die vor der Spitze wohl etwas enger aber kaum schwächer werden (im Gegensatz zu *punctatus*, bei dem sich gegen die Spitze zu in der Regel ein völliger Ausgleich zwischen beiden Retikulationen vollzieht). Die Punktreihen der Flügeldecken auffallend regelmässig und fast durchwegs aus vereinzelten kräftigen Punkten bestehend, wodurch sich die neue Art von *punctatus* sofort unterscheidet. Abdominalsegmente mit zarter Mikroretikulation, überdies mit zarten schrägen Stricheln, Hinterhüften mit kräftigen kurzen Runzeln und unregelmässigen queren furchenartigen Vertiefungen. Metasternalflügel ziemlich breit.

Kopf mit charakteristischer Makelzeichnung. Im Gegensatz zu den anderen Arten der Gruppe ist der Clypeus und nur ein ganz schmaler angrenzender Teil der Stirn hinter den Stirngrübchen rötlichgelb, der schwarze Saum vor den Augen daher breit, seitlich erweitert Scheitelmakel kleiner wie bei den anderen Arten, schwach dreilappig (siehe Abb. 1); Halsschild rötlichgelb mit mässig breiter, scharf begrenzter

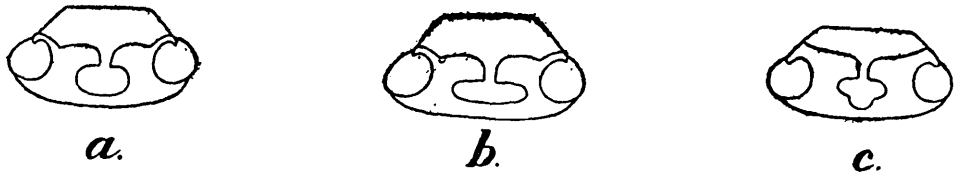


Abbildung 1.—Scheitelmakeln von (*a*) *Rhantus sikkimensis* Rég., (*b*) *R. taprobanicus* Sharp und *R. punctatus* Four., (*c*) *R. ovalis*, sp. nov.

Diskalmakel, Vorder-und Hinterrand davor und dahinter manchmal ganz schmal schwarzbraun gesäumt; Sprenkeln der Flügeldecken meist isoliert, Basis, Seitenrand und eine Nahtlinie schmal rötlichgelb, nicht

selten sind vorne noch zwei weitere Langslinien schwach angedeutet. Unterseite schwarz, Prosternum manchmal, Spitze der Hinterhüftenfortsätze in der Regel rötlich durchscheinend. Hinterrand des 3-5 Abdominalsegmentes rötlich gesäumt, Spitze des letzten rötlich ; Fühler und Vorderbeine rötlichgelb, Mittelbeine rötlichbraun, Hinterbeine schwarzbraun.

Die ersten drei Glieder der Vorder-und Mitteltarsen leicht erweitert, seitlich zusammengepresst, Klauen gleich lang und einfach. Analsegment in beiden Geschlechtern einfach. Penis und Parameren viel kürzer wie bei den anderen Arten, linke Paramere stark gebogen (siehe Abb. 2).

10-10·5 mm.

Senchal waterworks near Ghoom, 7,400 ft., Darjiling dist., E. Himalayas, 11·7·1918 (S. Kemp), 4 Stück.—Jorpokri near Darjiling, 7,500 ft. (F. D. la Touche), 5 Stück.—Pool on Tiger Hill, Darjiling, 8,300. ft., E. Himalayas, Juni 1918 (S. Kemp), 3 Stück.

Rhantus punctatus Fourc.

Es erübrigt sich, diese weithin verbreitete, bekannte Art zu beschreiben. Hervorheben möchte ich aber, dass die von Régimbart in seiner Beschreibung des *sikkimensis* erwähnte dunkle Färbung der Oberseite und Granulation der Flügeldecken mehrfach auch bei *punctatus*—Exemplaren aus den nördlichen Provinzen Indiens auftritt. Diese eigentümliche Beschaffenheit der Flügeldecken, die aussieht, als wären sie von zahllosen Bläschen bedeckt, ist übrigens durchaus keine seltene Bildung, da sie besonders bei *Cybister*—Arten individuell und verschieden stark ausgeprägt nicht selten beobachtet werden kann. Das eigenartige ist hier höchstens die Tatsache, dass die Granulation nur bei dunklen, fast schwarzbraunen Tieren auftritt, während hellere davor verschont bleiben. Diese Kombination, die ich bei allen 3 Arten (*punctatus, sikkimensis* und *taprobanicus*) immer wieder beobachten konnte, spricht deutlich für einen rein individuellen Charakter der Bildung (Mazeration ?).

Rhantus sikkimensis Rég.

Die Art erinnert so stark an *punctatus*, dass ihre Abtrennung an Hand der von Régimbart gemachten Angaben nur im männlichen Geschlechte mit Sicherheit möglich ist (die Klauen der Vordertarsen sind bei dieser Art vollkommen gleichartig, bei *punctatus* dagegen die äussere um etwa ein Drittel kürzer und mässig gebogen, die innere an der Basis auffallend verdickt, dann fast gerade). Ergänzend möchte ich deshalb erwähnen, dass bei *sikkimensis* im Gegensatz sowohl zu *punctatus*, wie *taprobanicus* die Scheitelmakel weder bandförmig noch zweilappig, sondern hoch oval ist, eine Bildung, die bei dieser Art regelmässig, bei *punctatus* dagegen nur in seltenen Fällen bei ganz hellen Stücken vorkommt (siehe Abb. 1). Im allgemeinen sind die Flügeldecken bei *sikkimensis* glänzender und die Mikroskulptur an der Spitze wesentlich schwächer, sodass sich die groben Maschen hier von ihr deutlich abheben. Die Parameren sind zur Spitze ganz allmählich verjüngt, der Penis ist, seitlich betrachtet, dünn stachelförmig, die Spitze von oben gesehen, nach rechts gewendet (siehe Abb. 2).

E. und W. Himalayas, N. Bengal (Siliguri).

Rhantus taprobanicus Sharp.

Der Penis dieser schmalen und parallelen, hinten stark zugespitzten Art mit schmaler bandförmiger Scheitelmakel ist kräftig stachelförmig mit kurzer, nach links gewendeter Spitze. Die Parameren sind lang, von der Mitte an zur Spitze fast gleich breit, mässig schmal (siehe Abb. 2). Oberseite stark glänzend, Retikulationsmaschen der Flügeldecken zart,

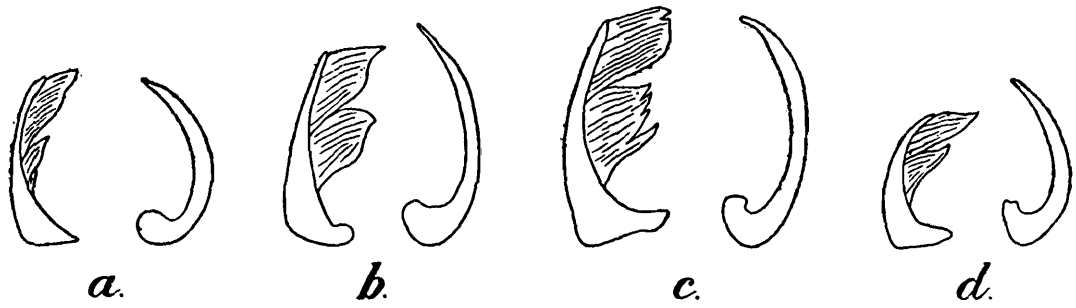


Abbildung 2.—Linke Parameren und Penis von (*a*) *Rhantus punctatus* Four., (*b*) *R. sikkimensis* Rég., (*c*) *R. taprobanicus* Sharp., (*d*) *R. ovalis*, sp. nov.

Mikroretikulation stark reduziert, an der Spitze viel schwächer als die gröberen Maschen.

E. und W Himalayas; Süd Indien (Kodaikanal); Bombay.

Zwei weitere, bisher sehr wenig bekannte *Rhantus*—Arten befanden sich ebenfalls unter dem Material:

Rhantus sexualis Zim.

Baghi. Simla Hill States. 8,800 ft. 7 Oktober 1921 (S. W Kemp) 1 Stück.—Kufri, 7,000 ft., Simla Hills, ponds. November 25 (B. N. Chopra) 2 Stück.—Phagu to Kufri, 8-9,000 ft., Simla Hills, 21 Mai 1916 (Annandale und Kemp) 1 Stück.—Painsur, Above Lohba, 8,000 ft., Garhwal, W Himalayas, 23 April 1914 (Tytler) 3 Stück.

Rhantus rugulosus Rég.

Von dieser Art, die Régimbart nur in einem einzigen beschädigten ♀ bekannt worden ist, liegen mir zwei Exemplare aus Berhampore, Court (Bengal) vor. Leider sind auch sie wieder ♀ ♀, weshalb ich über das männliche Geschlecht und damit über die definitive Gattungszugehörigkeit dieser hochinteressanten Art ebenfalls keine Entscheidungen treffen kann. Nichtsdestoweniger unterliegt es m. E. gar keinem Zweifel, das sie zu den Colymbetinen gehört und hier wieder wegen des grübchenförmig vertieften Metasternums zwischen den Mittelhüften am ehesten als eine *Rhantus*—Art zu betrachten ist. Alle anderen Merkmale, insbesondere das fast flache, breite und kurze Prosternum, der nicht gerandete Halsschild, die schwach gelappten Hintertarsen, vor allem aber die schwarze Färbung der Oberseite mit ihrem rötlichgelben Marginalsaum und die eigenartige Retikulation der Flügeldecken mit ihrer groben Punktierung würde zur Aufstellung eines eigenen Genus berechtigen, wenn nicht die erwähnten Besonderheiten im Genus *Rhantus* sich vereinzelt oder sogar gehäuft wiederfinden würden. Im besonderen verweise ich auf den afrikanischen *Rh. colymbetoides* Gschw., der in fast allen Merkmalen ein Seitenstück zu dieser Art bildet, sodass man beide mit

Recht in einem neuen subgenus vereinigen könnte. Da aber von beiden Arten bisher keine Männchen bekannt worden sind, möchte ich mit der Abtrennung derselben doch bis auf weiteres zuwarten.

Liste der gefundenen Arten, die bisher aus Britisch-Indien nicht bekannt waren :—

1. *Laccophilus minutus* L. (Nasratabad, Kashmir).
2. *Laccophilus elegans* Sharp (Calcutta).
3. *Laccophilus solutus* var. *indicus* Gschw.
4. *Laccophilus kempi* Gschw.
5. *Laccophilus apicicornis* var. *nigritulus* Gschw.
6. *Desmopachria maculata* Motch. (Andaman).
7. *Hyphydrus pictus* var. *indicus* Gschw.
8. *Bidessus regimbarti* Gschw.
9. *Bidessus geminus* F. (Kashmir, Simla Hills).
10. *Coelambus confluens* F. (Simla Hills).
11. *Coelambus parallelogrammus* Ahr.
12. *Hyphoporus kempi* Gschw.
13. *Copelatus feae* Reg. (Bangalore).
14. *Lacconectus ovalis* Gschw.
15. *Lacconectus lividus* Rég (Assam).
16. *Platambus lineatus* Gschw.
17. *Platambus incrassatus* Gschw.
18. *Rhantus ovalis* Gschw.
19. *Hydaticus pacificus* Aube (Sukna, E. Himalayas).
20. *Hydaticus nigritulus* Reg. (Yawnghwe).
21. *Sandracottus maculatus* Wehncke (between Upper and Lower Renging, Assam).

NOTES ON FISHES IN THE INDIAN MUSEUM.

XXV. On two new species of Cyprinid Fishes from Deolali, Nasik District, Bombay Presidency.

By Sunder Lal Hora, *D.Sc., F.R.S.E., F.A.S.B., and* Dev Dev Mukerji, *M.Sc., Zoological Survey of India, Calcutta.*

In 1932, the Zoological Survey of India received three specimens of *Rasbora* from Major R. W Hamilton Miller, I.M.S., of the District Laboratory, Colaba, Bombay, collected from a stream at Deolali in the Nasik District of the Bombay Presidency. The specimens though allied to *Rasbora rasbora* (Hamilton) differed from it in several respects and appeared to represent a form hitherto undescribed. A request was made to Major Miller for further specimens but he could not comply with the request. Through the kindness of Mr. S. H. Prater, however, we have now received a small collection of fish from Deolali obtained by Dr. A. G. Fraser. It not only contains 23 well preserved specimens of the new species of *Rasbora* but also 12 specimens of a new species of *Danio*. Other species represented in the collection are :—

1. *Barbus ticto* (Hamilton)	7 specimens.
2. *Parapsilorhynchus tentaculatus* (Annandale)	1 specimen.
3. *Barilius bendelesis* (Hamilton)	3 specimens.
4. *Barilius sp.* (Juv.)	3 specimens.
5. *Nemachilus denisonii* Day	1 specimen.

The two new species—*Rasbora labiosa* Mukerji and *Danio fraseri* Hora—are characterised by the fact that the lower lip is hypertrophied and forms a broad, loose membrane round the lower jaw. Without any biological observations in the field or the laboratory, it is difficult to assign any definite function to this structure, but attention may be directed to homologous structures found in certain tadpoles[1] of *Megophrys*, *Phyllobates*, *Microhyla* and *Phyllomedusa*. Among the functions assigned to hypertrophied lip in the tadpoles there is that of buoyancy, for the tadpoles are supposed to use it for hanging from the surface film. It is quite possible that the two new species, which are essentially surface fishes, also use their expanded lower lip for the mechanical process of suspending themselves from the surface film when the waters in their habitats become foul for the ordinary process of respiration. At our request Dr. Fraser has sent the following significant note on the localities in which he collected these species :—

" There is a tributary stream, which meanders through the Military area of the Deolali Cantonment and drains into the river ' Darna '[2]. All the fish were obtained

[1] Hora, *Phil. Trans. Roy. Soc. London* (B) CCXVIII, pp. 245-249, (1930).

[2] Darna is a tributary of the Godavari River. Annandale (*Rec. Ind. Mus.* XVI, pp. 109-161, 1919) in his account of the fauna of certain small streams in the Bombay Presidency made observations on collections made at Medha in the Satara District and at Khandalla in the Poona District. Both these places are far away from the Godavari drainage basin. The two new species would thus appear to have a somewhat localised distribution.

from this stream in pools, 3 to 4 feet deep, which have been formed in its course and the particular pools are located at a point some 400 yards from where it actually joins the river. This stream has no name, but it is locally known as the 'North Nallah'. It is a 'Nallah' in the true sense of the word, being deeply channelled and naturally formed by the annual rush of storm water drainage through it during the monsoon. Normally, it is fed from springs 2 to 3 miles west of the river Darna and so flows with water all the year round, but during the dry weather the flow is sluggish and drainage is very poor. The pools, in which the fish are found, are grown thickly with water weeds and the floor is covered with a silt deposit brought down from time to time. Green algae float upon its surface and excepting during the monsoon period, there is at other times of the year a fair degree of stagnation in the pools. The banks are grown with a variety of grasses."

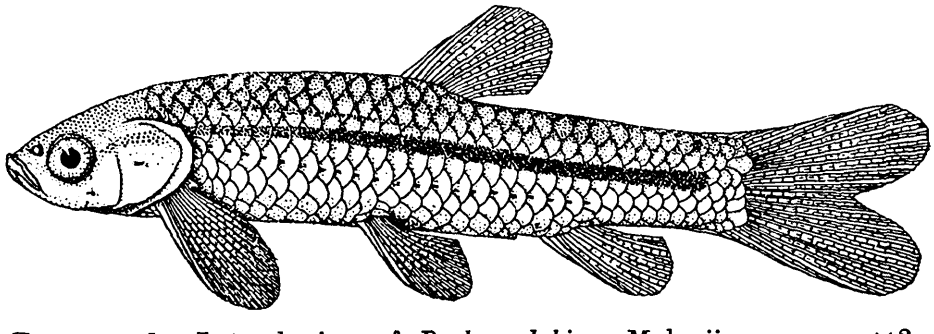
We are indebted to Dr. A. G. Fraser for the collection of the material and to Mr. S. H. Prater for the courtesy to allow us to study these interesting fishes. Mr. Prater has further allowed us to retain the type-specimens and several co-types for the collection of the Zoological Survey of India.

The two new species may be described as follows :—

Rasbora labiosa Mukerji, sp. nov.

D. 2/7 ; A. 2/5 ; P. 1/11 ; V. 1/8 ; C. 17 ; L. l. 30-32 ; L. tr. 7 ($5\frac{1}{2}/1\frac{1}{2}$).

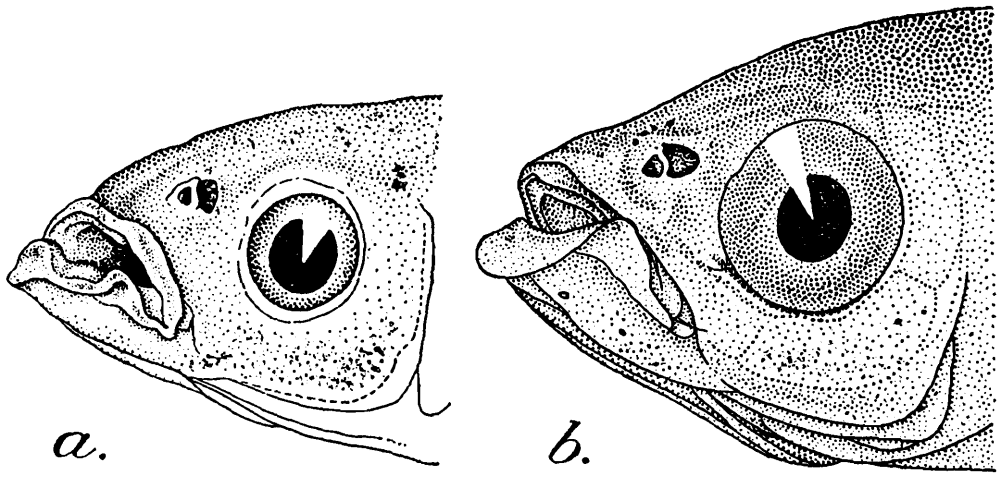
The dorsal profile of the body is moderately arched, while the ventral profile is more or less horizontal. The height of the body is contained a little over 4 times in the length excluding the caudal fin. The caudal peduncle is almost rectangular, being slightly longer than high. The head is small, somewhat blunt and a little higher than broad ; its length is contained about 3·8 times in the length of the body. The height of the head at occiput is contained nearly 1·4 times and the width from 1·6 to 1·8 times in its length. The eyes are large and prominent ; they are situated almost in the anterior half of the head. The diameter of the eye is contained 3·3 times in the length of the head. The interorbital space is wide and slightly convex ; its width is nearly equal to the diameter of the eye. The snout is short and blunt anteriorly ;



TEXT-FIG. 1.—Lateral view of *Rasbora labiosa* Mukerji, sp. nov. ×2.

its length is shorter than the orbital width and is contained 5 times in the length of the head. The mouth and the jaws are as in the genus. The lower lip shows a peculiar development. It is more fleshy and flabby than the upper one and projects beyond the jaw ; it is capable of being projected from the jaw and is partly deflected upwards over

the upper lip. It is provided with three distinct lobe-like structures (Text-fig. 2, *a*). The cleft of the mouth is oblique; its anterior end



Text-fig. 2.—Anterio-lateral view of *a*, *Rasbora labiosa* Mukerji, sp. nov. (×6) and *b*, *Danio* (*Danio*) *fraseri* Hora, sp. nov. (×5⅓) showing the nature of the hypertrophied lower lip.

is nearly in level with the upper border of the eyes, while the posterior end is almost in level with the anterior border of the eyes.

The body is covered with large and well developed scales. There are from 30 to 32 scales in a longitudinal series between the upper angle of the opercles and the base of the caudal fin. Before the dorsal fin there are 14 to 15 scales and 14 scales round the caudal peduncle. The lateral line is concave and incomplete; it extends as far as the posterior end of the anal. The number of perforated scales along the lateral line varies from 18 to 20. There are 5½ rows of scales between the lateral line and the base of the dorsal and 1½ rows between the lateral line and the base of the ventral on either side. The bases of the anal and the caudal are covered with scaly sheaths. There are small scaly appendages in the axils of the ventrals.

The insertion of the dorsal fin is slightly behind that of the ventrals and opposite to the 12th scale of the lateral line. It is considerably nearer the root of the caudal than the tip of the snout. Its height is a little less than the maximum depth of the body, but is almost equal to the depth of the body below it. Its anterior margin is faintly concave. The commencement of the anal is almost equidistant between the origin of the ventrals and the root of the caudal fin. Its outer margin is more or less rounded. When adpressed, it does not reach the root of the caudal. The pectoral fins are shorter than the length of the head and have rounded outer margin. They are separated from the base of the ventrals by a distance equalling a little less than half their own length. The ventrals are similar to the pectorals in shape, but are slightly smaller. They fall short of the vent which lies about two scales in advance of the insertion of the anal fin. The caudal fin is deeply forked with two more or less equal and rounded lobes. It is slightly longer than the head; its length is contained about 3·5 times in the length of the body excluding the caudal fin.

The specimens in alcohol are straw-coloured with a faint silvery sheen. The upper half of the body is somewhat darker than the lower. The margins of the scales in the upper half of the body, the top of the head and portions of the cheeks are sparsely infuscated with fine blackish dots. There is a broad black band along the middle of the body from the angle of the opercles to the root of the tail. Along the dorsum, there is a narrow black median line from the occiput to the base of the caudal fin.

Type-specimen.—F. 11970/1, *Zoological Survey of India* (*Ind. Mus.*), *Calcutta.*

Remarks.—*Rasbora labiosa* belongs to the group of species with incomplete lateral line and with 7 rows of scales between the dorsal and the ventral fins. It is closely allied to and occupies a place between *R. taytayensis* Herre[1] and *R. vagae* Rendahl[2], but can readily be distinguished from the former by the number of perforated scales along the lateral line and the colouration, while from the latter it differs chiefly in having much shorter pectoral fins. From all the known species, *R. labiosa* can at once be separated by the peculiar structure of the lower lip.

Measurements in millimetres.

Length of body without caudal	38·0	37·0
Height of body	9·0	9·0
Length of head	10·0	10·0
Breadth of head	6·0	5·5
Height of head at occiput	7·0	6·5
Length of snout	2·0	2·0
Diameter of eye	3·0	3·0
Interorbital width	3·0	3·0
Height of dorsal fin	8·0	8·0
Length of pectoral	8·0	8·0
Length of ventral	7·0	6·5
Length of anal	7·0	6·5
Length of caudal	11·0	10·5
Length of caudal peduncle	6·5	6·5
Least height of caudal peduncle.	5·0	5·0

Danio (Danio) fraseri Hora, sp. nov.

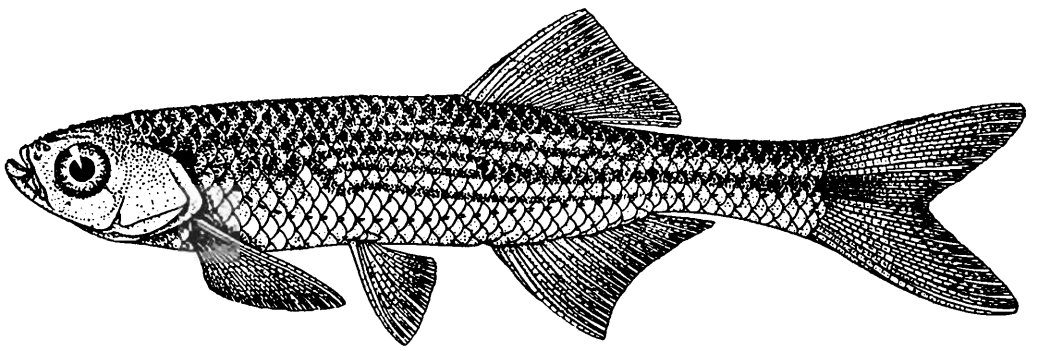
D. 2/11; A. 3/15; P. 1/12; V. 1/6; C. 19; L. l. 37-40; L. tr. 10 ($8\frac{1}{2}/1\frac{1}{2}$).

Danio fraseri is a long and slender species in which both the profiles are slightly arched. The body is greatly compressed and the head is pointed. The length of the head is contained from 5 to 5·3 times in the total length and from 3·7 to 4 times in the length without the caudal; the head is relatively longer in younger individuals. The height of the head at the occiput is contained from 1·3 to 1·4 times and the width from 1·9 to 2 times in its length. The eyes are large, lateral in position and situated almost in the anterior half of the head;

[1] Herre, *Phillipine Journ. Sci. Manila*, XXIV, pp. 264, 265, (1924); Hora & Mukerji, *Rec. Ind. Mus.*, XXXVI, pp. 357-359, text-fig. 7, (1934).

[2] Rendahl, *Arkiv, f. Zoologi*, XVIIIB, No. 13, p. 113, (1926).

the diameter of the eye is contained from 3 to 3·1 times in the length of the snout and from 1·1 to 1·3 times in the interorbital width. The interorbital space is slightly convex and in relation to the diameter of the eye it is broader in the younger individuals. The mouth is small and obliquely directed upwards; its cleft extends to below the anterior margin of the eye. The lower lip is hypertrophied and forms a broad, loose flap along the lower jaw (Text-fig. 2, *b*). In the preserved specimens it is reflected or contracted in various ways. The upper lip is of the normal type. There are two pairs of small barbels; the rostrals, which are shorter than half the diameter of the eye, are much longer than the maxillaries.



Text-fig. 3.—Lateral view of *Danio* (*Danio*) *fraseri* Hora, sp. nov., ×1⅓.

The body is almost rectangular anteriorly and in the region of the caudal peduncle it becomes much narrower; the depth of the body is contained from 5·1 to 6·8 times in the total length and from 3·8 to 5·1 times in the length without the caudal. The body and the caudal peduncle become relatively narrower with the growth of the fish. The least height of the caudal peduncle is contained from 1·3 to 2 times in its length. The body is covered with thin, closely adhering scales which cover the bases of the anal and caudal fins also. There are from 37-40 scales in a longitudinal row and about 10 in a transverse series between the commencement of the dorsal and that of the ventral fins. The number of predorsal scales is 16. The lateral line is complete and greatly curved; it ends slightly below the middle of the base of the dorsal fin.

The dorsal fin commences in advance of the anal and its insertion is almost equidistant between the posterior margin of the orbit and the base of the caudal fin. In smaller individuals the longest ray of the dorsal is shorter than the depth of the body whereas in larger specimens it is considerably greater. The free border of the dorsal fin is slightly concave or almost truncate. The pectoral fin is long and pointed; it extends considerably beyond the base of the ventral fin. The ventral fins reach the anal opening which is situated just before the commencement of the anal fin. The anal fin is similar to the dorsal but its free border is markedly concave. The caudal fin is much longer than the head; it is deeply forked, and the lower lobe is slightly better developed than the upper.

The colour pattern is more or less similar to that of *Danio aequipinnatus*. There are three or four dark longitudinal bands along the

middle of the body. The band in the middle is broader and is continued on the rays of the caudal fin. There is a black spot near the upper angle of the gill-opening. The dorsal surface is gray while the ventral surface is pale olivaceous. The proximal part of the dorsal fin is tinted gray. The free edges of the scales bear series of black dots.

Type-specimen.—F. 11791/1, *Zoological Survey of India* (*Ind. Mus.*), *Calcutta.*

Remarks.—Danio fraseri is distinguished from all the other species of the genus in having a hypertrophied lower lip. In other respects it is allied to *D. aequipinnatus*, but differs in having a much narrower body. In the new species there are only $1\frac{1}{2}$ rows of scales between the lateral line and the base of the ventral fin (*versus* $2\frac{1}{2}$ rows in *D. aequipinnatus*). The number of scales in a longitudinal series is also greater in *D. fraseri* than in *D. aequipinnatus* (37-40 *versus* 34-36). In their general facies the two species are markedly distinct.

Measurements in millimetres.

Total length including caudal	78·0	63·0	55·0
Length of caudal	20·0	14·2	14·0
Length of head	14·5	12·5	11·0
Height of head	10·3	9·6	8·2
Width of head	7·2	6·5	5·5
Length of snout	3·5	3·2	3·0
Diameter of eye	4·8	4·1	3·5
Interorbital width	5·6	5·3	4·6
Height of body	11·4	11·5	10·8
Longest ray of dorsal	12·6	8·8	8·6
Longest ray of anal	11·5	8·5	8·2
Length of pectoral	13·2	11·0	10·5
Length of ventral	9·5	7·6	6·8
Length of caudal peduncle	10·5	8·5	6·0
Least height of caudal peduncle	5·3	5·5	4·5

FISH OF THE NAGA HILLS, ASSAM.

By SUNDER LAL HORA, *D.Sc., F.R.S.E., F.A.S.B., and* DEV DEV MUKERJI, *M.Sc., Zoological Survey of India, Calcutta.*

(Plate VII)

INTRODUCTION.

In 1921, one[1] of us published an account of the " Fish and Fisheries of Manipur with some observations on those of Naga Hills " and recorded 17 species from streams with rocky beds in the northern watershed (Brahmaputra drainage) and 18 species from similar streams in the southern watershed (Chindwin drainage) of the Naga Hills. The lists included the 3 species mentioned by Day in the *Fauna of British India* from the Naga Hills and the two species described by Chaudhuri[2] from this area. Only 3 species, *viz.*, *Barbus hexastichus*, *Barilius barila* and *Danio aequipinnatus*, were known to be common to both the watersheds; this reduces the total of the species known from the Naga Hills to 32[3]. It may be noted here that 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 interest of the fish fauna of the Naga Hills lies in the fact that it contains representatives of the Assamese and the Burmese elements in almost equal proportions. To study this point in detail one of us requested Dr. J. H. Hutton, Deputy Commissioner of the Naga Hills, in 1927 to make a collection of fish during the course of one of his tours to an unfrequented part of the hills. Dr. Hutton agreed to this suggestion and procured a valuable collection for the Zoological Survey of India. Early this year Dr. B. Prashad and Dr. B. Chopra visited the Naga Hills to study certain zoogeographical problems and in the course of their investigations made an extensive collection of fishes.

The present paper deals mainly with these two collections.

Dr. Hutton made collections at the following places :—

Zhokami Tekhubami Mekruchu Mohumi	Brahmaputra drainage (Dayang Valley).
Purobami Sahunyu Melori Lepori Yisisu Laruri	Chindwin drainage (Tizu Valley).

[1] Hora, *Rec. Ind. Mus.* XXII, pp. 165-214, pls. ix-xii (1921).

[2] Chaudhuri, *Rec. Ind. Mus.* VII, p. 443, pl. xl, figs. 4, 4*a*, 4*b* and pl. xli, figs. 1, 1*a*, 1*b*; p. 441, pl. xl, figs. 1, 1*a*, 1*b* (1912).

[3] In 1921, Dr. Murray Stuart of the Geological Survey of India made a small collection of fish, comprising 11 species (Hora, *Rec. Ind. Mus.* XXII, p. 743, 1921) from the North-eastern border of Burma and the Naga Hills. As the exact localities of the species are not known, we have not included these forms in our treatment of the fish fauna of the Naga Hills. It may be remarked that 4 out of the 11 species, *viz.*, *Garra gotyla*, *Barbus chrysopterus*, *Barilius vagra* and *Ambassis nama*, are not represented in other collections from the Naga Hills.

Drs. Prashad and Chopra made collections at the following places :—

Kohima	Brahmaputra drainage.
Mao	
Chakabama	
Kekrima	
Emilomi	
Khezhabama	Chindwin drainage.
Phekrokejima	
Chepoketami	
Sakhai	
Sakhalu	

There are altogether 23 species in the two collections and of these 11, *i.e.*, *Amblyceps mangois*, *Exostoma labiatum*, *Barbus ticto*[1], *Crossochilus latius*, *Garra lissorhynchus*, *Garra kempi*, *Oreinus molesworthi*, *Psilorhynchus homaloptera*, sp. nov., *Nemachilus rupecola*, *N. subfusca*, and *Ophicephalus gachua*, are recorded from the Naga Hills for the first time. Though only one new species has been discovered in the collections under report, it has been possible to elucidate the precise specific limits of *Barbus hexagonolepis*, *Nemachilus manipurensis* and *N. subfusca*, while the geographical distribution of a number of species has been more precisely determined. For instance, *Exostoma labiatum*, *Barbus clavatus*, *B. hexagonolepis*, *Garra lissorhynchus*, *G. kempi*, *G. naganensis* and *Oreinus molesworthi*, which were hitherto known from the Brahmaputra drainage system, are now recorded from the Chindwin drainage system also. Species like *Brachydanio acuticephala* and *Nemachilus manipurensis*, which were known only from the Chindwin drainage system, have now been discovered in the Brahmaputra basin also.

44 species are now known from the Naga Hills. These species, together with their distribution as now known, are listed below :—

Serial Number.	Specific Name.	Brahmaputra Drainage System.	Chindwin Drainage System.	Widely distributed.
	BAGRIDAE.			
1	*Mystus bleekeri* (Day)	..	..	×
	SILURIDAE.			
2	*Ompok bimaculatus* (Bloch)	..	..	×
	AMBLYCEPIDAE.			
3	*Amblyceps mangois* (Hamilton)	..	..	×
	SISORIDAE.			
4	*Erethistes hara* (Hamilton)	..	..	×
5	*Erethistes elongata* Day	×	..	..
6	*Exostoma labiatum* (McClell.)	×	×	..

[1] *Barbus ticto* was obtained by one of us from the sluggish waters of the Manipur Valley, but it is recorded here from the Naga Hills.

Serial Number.	Specific Name.	Brahmaputra Drainage System.	Chindwin Drainage System.	Widely distributed.
	CYPRINIDAE.			
7	*Danio* (*Danio*) *dangila* (Hamilton)	..	..	×
8	*Danio* (*Danio*) *aequipinnatus* (McClell.)	..	..	×
9	*Danio* (*Danio*) *naganensis* Chaudhuri	..	×	..
10	*Danio* (*Brachydanio*) *acuticéphala* Hora	×	×	..
11	*Rasbora rasbora* (Hamilton)	..	..	×
12	*Barilius barila* (Hamilton)	..	..	×
13	*Barilius dogarsinghi* Hora	..	×	..
14	*Barilius bendelesis* var. *chedra* (Hamilton).	×†	..	..
15	*Barbus clavatus* McClell.	×	×	..
16	*Barbus tor* (Hamilton)	..	..	×
17	*Barbus hexagonolepis* McClell.	×	×	..
18	*Barbus conchonius* (Hamilton)	..	..	×
19	*Barbus oatesii* Boulenger	..	×	..
20	*Barbus ticto* (Hamilton)	..	..	×
21	*Crossochilus latius* (Hamilton)	..	..	×
22	*Garra rupeculus* (McClell.)	×	×	..
23	*Garra abhoyai* Hora	..	×	..
24	*Garra naganensis* Hora	×	×	..
25	*Garra kempi* Hora	×	×	..
26	*Garra lissorhynchus* (McClell.)	×	×	..
27	*Oreinus molesworthi* Chaudhuri	×	×	..
	PSILORHYNCHIDAE.			
28	*Psilorhynchus* sp. Hora	×	..	..
29	*Psilorhynchus homaloptera*, sp. nov.	×	..	..
	COBITIDAE.			
30	*Lepidocephalichthys berdmorei* (Blyth)	..	×*	..
31	*Lepidocephalichthys guntea* (Hamilton)	×†	..	..
32	*Acanthophthalmus pangia* (Hamilton)	×	×*	..
33	*Nemachilus manipurensis* Chaudhuri	×	×	..

* denotes that the species is found in Burma also.
† denotes that the species is found in other parts of India also.

Serial Number.	Specific Name.	Brahmaputra Drainage System.	Chindwin Drainage System.	Widely distributed.
	COBITIDAE—*contd.*			
34	*Nemachilus zonalternans* (Blyth)	..	×*	..
35	*Nemachilus sik maiensis* Hora	..	×	..
36	*Nemachilus kangjupkhulensis* Hora	..	×*	..
37	*Nemachilus prashadi* Hora.	..	×	..
38	*Nemachilus botia* (Hamilton)	..	..	×
39	*Nemachilus rupecola* (McClell.)	×†	..	..
40	*Nemachilus subfusca* (McClell.)	×	..	..
	MASTACEMBELIDAE.			
41	*Rhynchobdella dhanasorii* Hora	×	..	..
	NANDIDAE.			
42	*Badis badis* (Hamilton)	..	..	×
	OPHICEPHALIDAE.			
43	*Ophicephalus gachua* Hamilton	..	..	×
44	*Ophicephalus punctatus* Bloch.	..	..	×

* denotes that the species is found in Burma also.
† denotes that the species is found in other parts of India also.

Of the 44 species listed above, 16 are widely distributed in India and Burma; 11 are common to the Brahmaputra and the Chindwin drainage basins, though *Acanthophthalmus pangia* is found in Burma also; 8 species are found only in the Brahmaputra drainage of the Naga Hills, but of these *Nemachilus rupecola*, *Lepidocephalichthys guntea* and *Barilius bendelesis* are also found in other parts of India. Similarly, of the 9 species found only in the Chindwin drainage of the Naga Hills, *Nemachilus zonalternans*, *N. kangjupkhulensis*, *Lepidocephalichthys berdmorei* and *Barbus oatesii* are found in Burmese waters also.

Another point of zoogeographical interest is the similarity between the fish fauna of the Garo Hills, the Mishmi Hills, the Khasi Hills and the Naga Hills *inter se* and of these hills with that of the Eastern Himalayas. This is particularly true of the forms adapted to live in torrential streams, such as *Exostoma labiatum*, *Erethistes elongata*, *Garra kempi*, *G. lissorhynchus*, *Oreinus molesworthi*, *Nemachilus rupecola*, *N. subfusca*, etc. From a study of the Batrachian fauna of the Abor Hills, Annandale[1] concluded that " All the evidence at present available, therefore, supports the view that the fauna of the extreme eastern part of the

[1] Annandale, *Rec. Ind. Mus.* VIII, p. 36 (1912).

Himalayan foot-hills is not, at any rate so far as the frogs and toads are concerned, Himalayan in the sense in which the term has hitherto been understood, but allied rather to the fauna of Assam south of the Brahmaputra or even to that of Burma." Our studies on the distribution of fishes from these regions also lead us to similar conclusions.

The above list of species also shows that the fish fauna of the Naga Hills contains a great preponderance of the Ostariophysi, 40 out of a total of 44 species. Of these 40 species, 6 belong to the Siluroidea (1 Bagridae, 1 Siluridae, 1 Amblycepidae and 3 Sisoridae) and the remaining to the Cyprinoidea (21 Cyprinidae, 2 Psilorhynchidae and 11 Cobitidae). The remaining 4 species are distributed among the families Mastacembelidae, Nandidae and Ophicephalidae.

The 44 species known from the Naga Hills belong to 19 genera, all of which, with the possible exception of *Psilorhynchus*, are fairly widely distributed in India and Burma. It is thus seen that the Naga Hills—the watershed of the principal Burmese (Irrawaddy) and Assamese (Brahmaputra) drainage systems—have no endemic element so far as the genera of fishes are concerned. Among the species, however, there are 5, *viz.*, *Danio naganensis*, *Barilius dogarsinghi*, *Garra abhoyai*, *Nemachilus sikmaiensis* and *N. prashadi*, which are so far konwn only from the Chindwin drainage of the Naga Hills and 3, *Psilorhynchus* sp., *P. homaloptera* and *Rhynchobdella dhanasorii*, from the Brahmaputra drainage. *Danio* (*Brachydanio*) *acuticephala*, *Garra nanagensis* and *Nemachilus manipurensis* are also endemic in the Naga Hills, though they are found equally abundantly in both the watersheds. Thus 25 per cent. of the fish are endemic in the Naga Hills.

We have to thank Dr. J. H. Hutton for the very careful way in which his collection was preserved and labelled. To Drs. B. Prashad and B. Chopra we are grateful for devoting a considerable part of their time in the Naga Hills to the collection of fishes. Babu R. C. Bagchi has executed the drawings with his usual skill and care, and for this we are thankful to him.

Systematic description.

BAGRIDAE.

Mystus bleekeri (Day).

1921. *Macrones bleekeri*, Hora, *Rec. Ind. Mus.* XXII, p. 179.

1 specimen. Melori, Tizu River. J. H. Hutton, March 1927.

Mystus bleekeri is represented in Dr. Hutton's collection by a young specimen about 90 mm. in total length.

SILURIDAE.

Ompok bimaculatus (Bloch).

1921. *Callichrous bimaculatus*, Hora, *Rec. Ind. Mus.* XXII, p. 178.

1 specimen. Melori, Tizu River. J. H. Huttom, March 1927.

The only specimen of *Ompok bimaculatus* in Dr. Hutton's collection is about 142 mm. in total length.

AMBLYCEPIDAE.

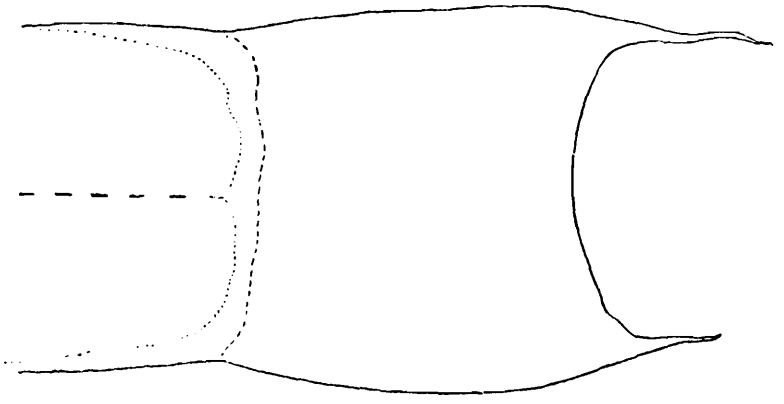
Amblyceps mangois (Hamilton).

1933. *Amblyceps mangois*, Hora, *Rec. Ind. Mus.* XXXV, p. 617.

1 specimen. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

17 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

One of us (Hora, *op. cit.*, pp. 607-621) has recently discussed the taxonomy and bionomics of the loach-like fishes of the genus *Amblyceps*. In most of the specimens under report the caudal fin is almost truncate



TEXT-FIG. 1.—Outline sketch of caudal fin of a specimen of *Amblyceps mangois* (Hamilton) from Lizho stream near Sakhai showing prolonged outer rays. × 3.

or slightly emarginate. In the example from the Lizho stream, however, the end rays of the caudal fin are produced into thread-like processes although the fin is not deeply emarginate as is usually the case with the Siamese examples.

The largest specimen is about 120 mm. in total length.

SISORIDAE.

Exostoma[1] **labiatum** (McClelland).

1923. *Glyptosternum labiatum*, Hora, *Rec. Ind. Mus.* XXV, p. 42, pl. i, fig. 2.

4 specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

4 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

2 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

15 specimens. Sakhalu, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

Exostoma labiatum has hitherto been known from the Mishmi and the Abor Hills in the Brahmaputra drainage basin. It is of interest to note that all the specimens recorded here were obtained from the Chindwin drainage basin.

The largest specimen is about 87 mm. in total length.

[1] One of us (Hora, *Rec. Ind. Mus.* XXV, p. 8, 1923) considered *Exostoma* Blyth to be a synonym of *Glyptothorax* Blyth as the type-species of the former—*E. berdmorei* Blyth—is indistinguishable from species included under *Glyptothorax*. The name is, however, used here in a loose but hitherto accepted sense, for the sake of convenience.

CYPRINIDAE.

Danio (Danio) aequipinnatus (McClelland).

1934. *Danio (Danio) aequipinnatus*, Hora & Mukerji, *Rec. Ind. Mus.* XXXVI, p. 131.

1 specimen. Mohumi village, sources of the Rengma River. J. H. Hutton, March 1927.

3 specimens. Chakhabama, Sidzu River. B. Prashad & B. Chopra, 17th February 1935.

Several specimens. Emilomi, Kéieki stream. B. Prashad & B. Chopra, 26th February 1935.

Danio aequipinnatus is a widely distributed species, though in the collections before us it is represented from 3 localities in the Brahmaputra basin.

The largest specimen is about 102 mm. in total length.

Danio (Danio) naganensis Chaudhuri.

1912. *Danio naganensis*, Chaudhuri, *Rec. Ind. Mus.* VII, p. 441, pl. xl, figs. 1, 1*a*, 1*b*.

1 specimen. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

12 specimens. Melori, Tizu River; Leori, Phodung River, a tributary of Tizu; Yisisu, Yazhiluwu River; a tributary of Tizu. J. H. Hutton, March 1927.

2 specimens. Laruri, Zhuzeti stream, a tributary of Titlo or Namtaleik. J. H. Hutton, March 1927.

4 specimens. Khezhabama (Chizami), Chiteri stream. B. Prashad & B. Chopra, 20th February 1935.

Numerous specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

Numerous specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

Danio naganensis was described by Chaudhuri from the Lungting River, Naga Hills, Manipur. The collections under report show that the species is very common and widely distributed in the Chindwin drainage of the Naga Hills. In most of the characters it is similar to *D. aequipinnatus*, but can be distinguished from it by its less deep body, one broad lateral band and eight divided rays in the dorsal fin. Moreover the eggs of *D. naganensis* are relatively much larger than those of *D. aequipinnatus*. From the distribution of the two species, as judged by the collections under report, it seems probable that *naganensis* replaces *aequipinnatus* in the Chindwin drainage of the Naga Hills.

The largest specimen is about 88 mm. in total length.

Danio (Brachydanio) acuticephala Hora.

1921. *Danio (Brachydanio) acuticephala*, Hora, *Rec. Ind. Mus.* XXII, p. 193.

8 specimens. Zhokami and Tekhubami, sources of the Dayang River. J. H. Hutton, March 1927.

3 specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

Brachydanio acuticephala was described from a very large number of specimens collected from the small streams and ponds of the Manipur Valley. Dr. J. H. Hutton obtained specimens from springs forming

the sources of the Dayang (Brahmaputra basin) and Tizu (Chindwin basin) Rivers.

In our[1] recent key to the species of the subgenus *Brachydanio, acuticephala* was included among the forms characterised by "Lateral line short, not extending beyond pectoral fin." We find, however, that the lateral line is totally absent in this species. The absence of barbels distinguishes it from the other species in which the lateral line is totally absent.

The largest specimen in Dr. Hutton's collection is about 35 mm. in total length.

Barilius barila (Hamilton).

1921. *Barilius barila*, Hora, *Rec. Ind. Mus.* XXII, p. 190.

2 specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

1 specimen. Chakabama, Sidzu River. B. Prashad & B. Chopra, 16th February 1935.

4 specimens. Sakhai, Lizho stream B. Prashad & B. Chopra, 23rd February 1935.

6 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 24th February 1935.

The specimens of *Barilius barila* in the collections under report show the morphological characteristics referred to by one of us (Hora, *op. cit.*) as adaptations to life in hill streams.

The largest specimen is about 148 mm. in total length.

Barbus clavatus McClelland.

1921. *Barbus clavatus*, Hora, *Rec. Ind. Mus.* XXII, p. 185, pl. ix, fig. 1.

4 specimens. Chipoketami, Tese-rü River. B. Prashad & B. Chopra, 22nd February 1935.

12 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd September 1935.

7 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd September 1935.

One of us discussed the systematic position of *Barbus clavatus* in 1921 and re-described the species from specimens collected in the Senapati stream (Barak River) at Kairong. The species had hitherto been found only in the Brahmaputra drainage system, but all the specimens under report were collected from the Tizu River or its tributary streams which ultimately drain into the Chindwin River. The specimens are well preserved and agree with the examples described from Kairong.

B. clavatus is readily distinguished by its large armed dorsal spine and by the black markings on the membranes in between the dorsal fin rays.

Attention may here be directed to the fact that one of us[2] described a variety of this species from the Myitkyina District, Upper Burma. The Burmese form is distinguished by its longer snout, shorter dorsal spine, lepidosis and colouration.

The largest specimen is about 200 mm. in total length.

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[1] Hora & Mukerji, *Rec. Ind. Mus.* XXXVI, pp. 130, 131 (1934).

[2] Mukerji, *Journ. Bombay Nat. Hist. Soc.* XXXVII, pp. 64-67, text-figs. 10, 11; pl. iii, fig. 1 (1934).

Barbus hexagonolepis McClelland.

1839. *Barbus hexagonolepis*, McClelland, *As. Res.* (Ind. Cyprinidae) XIX pp. 270, 336, pl. xli, fig. 3.
1878. *Barbus hexagonolepis*, Day, *Fish. Ind.*, p. 564, pl. cxxxvii, fig. 4.
1921. *Barbus hexastichus*, Hora (*nec* McClleland), *Rec. Ind. Mus.* XXII, p. 186.
1924. *Barbus hexastichus*, Hora (*nec* McClelland), *Rec. Ind. Mus.* XXVI, p. 27.

Several specimens (fry). Melori, Tizu River; Leori, Phodung River, a tributary of Tizu; Yisisu, Yazhiluwu River; a tributary of Tizu. J. H. Hutton, March 1927.

Several specimens (fry). Khazhabama (Chizami), Chiteri stream. B. Prashad & B. Chopra, 20th February 1935.

5 specimens. Chipoketami, Tese-rü River. B. Prashad & B. Chopra, 22nd February 1935.

7 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 24th February 1935.

Several specimens (fry). Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Barbus hexagonolepis appears to be the commonest species in the hills of Assam. According to Day "The character of the interrupted groove behind the lower lip at once distinguishes this species from B. *hexastichus*." It seems probable that the fry of both the species have black spots on either side before the base of the caudal fin. This juvenile character of the fry led one of us to refer specimens of *B. hexagonolepis* from the Naga Hills and the Garo Hills to *B. hexastichus*. A thorough examination of the specimens has shown that *B. hexagonolepsis* has a more slender body form, 28-30 scales along the lateral line and an interrupted groove behind the lower lip.

Barbus hexastichus is very closely related to *B. tor* (Hamilton). The races and varieties of the latter are not yet properly understood. It is difficult, therefore, to define the precise systematic position of *B. hexastichus*.

The largest specimen is about 300 mm. in total length.

Barbus ticto (Hamilton).

1921. *Barbus ticto*, Hora, *Rec. Ind. Mus.* XXII, p. 187.

1 specimen. Mohumi, sources of the Rengma River. J. H. Hutton, March 1927.

The only specimen of *Barbus ticto* in Dr. Hutton's collection is about 67 mm. in total length. Besides the usual spots on the sides of the tail, the distal half of the dorsal fin is grayish in colour.

Crossochilus latius (Hamilton).

1934. *Crossochilus latius*, Mukerji, *Journ. Bombay Nat. Hist. Soc.* XXXVII, p. 49, fig. 6.

1 specimen. Melori, Tizu River. J. H. Hutton, March 1927.

The specimen of *Crossochilus latius* conforms to the Siamese and Burmese form of the species as recently defined by one of us (Mukerji, *op. cit.*). This race differs from the *forma typica* from Northern Bengal in having 8 scales in a transverse series and 15 to 16 round the caudal peduncle. The form is depressed and slender and the head is relatively longer (4·3 to 4·8 times in the length of the body without the caudal as against 5 to 5·2 times in the typical form).

The specimen is about 120 mm. in total length.

Garra lissorhynchus (McClelland).

1921. *Garra lissorhynchus*, Hora, *Rec. Ind. Mus.* XXII, p. 662, pl. xxvi, figs. 2, 2*a*.

1 specimen. Zhokami and Tekhubami, source of the Dayang River. J. H. Hutton, March 1927.

2 specimens. Sakhai, Lizho stream B. Prashad & B. Chopra, 23rd February 1935.

5 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

In all the 8 specimens the dorsal and the caudal fins bear the characteristic markings of the female as described by one of us (Hora, *op. cit.*). In 5 examples the body cavity is full of ova in various stages of development, while in the remaining three there are only empty sac-like structures.

G. lissorhynchus has so far been known from the Khasi and Jaintia Hills which are situated in the Brahmaputra basin. The species is here recorded from the Chindwin basin for the first time.

In colour markings the female specimens of *G. lissorhynchus* resemble *G. abhoyai* Hora, but the two species differ in general facies and lepidosis.

The largest specimen is about 75 mm. in total length.

Garra kempi Hora.

1921. *Garra kempi*, Hora, *Rec. Ind. Mus.* XXII, p. 665, pl. xxvi, figs. 3, 3*a*.

8 specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

15 specimens. Melori, Tizu River; Leori, Phodung R., tributary of Tizu; Yisisu, Yazhiluwu R., tributary of Tizu. J. H. Hutton, March 1927.

3 specimens. Laruri, Zhuzeti stream, a tributary of the Titlo or Namtaleik. J. H. Hutton, March 1927.

Numerous specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

Garra kempi was originally described from a single specimen procured by Dr. S. W. Kemp from the Siyom River, below Damda in the Abor Hills. The waters from these hills drain into the Brahmaputra. The large number of specimens under report come from several small streams which join the Tizu River, a tributary of the Chindwin River.

The species is readily distinguished by the large size of its mental disc and by the fact that the anal opening is situated very far forwards, *i.e.*, almost midway between the commencement of the anal and that of the ventral fins.

The largest example is about 110 mm. in total length.

Garra naganensis Hora.

1921. *Garra naganensis*, Hora, *Rec. Ind. Mus.* XXII, p. 667, pl. xxv, figs. 2, 2*a*.

5 specimens. Zhokami and Tekhubami, sources of the Dayang River. J. H. Hutton, March 1927.

1 specimen. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

7 specimens. Melori, Tizu River; Leori, Phodung River, a tributary of the Tizu; Yisisu, Yazhiluwu River, tributary of Tizu. J. H. Hutton, March 1927.

1 specimen. Laruri, Zhuzet stream, a tributary of the Titlo or Namtaleik. J. H. Hutton, March 1927.

2 specimens. Stream at Mao. B. Prashad & B. Chopra, 14th February 1935.

17 specimens, Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

Numerous specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Garra naganensis was described from a single specimen collected at Kairong in the Senapati stream (Barak River) which drains into the Brahmaputra. The collections under report contain a large number of specimens of all sizes both from the Brahmaputra and the Chindwin drainage systems.

The species is distinguished from the preceding form by its small transversely oval mental disc and by the fact that the anal opening is situated much nearer the commencement of the anal fin than that of the ventral fins.

The largest specimen is about 130 mm. in total length.

Oreinus molesworthi Chaudhuri.

1913. *Oreinus molesworthi*, Chaudhuri, *Rec. Ind. Mus.* VIII, p. 247, pl. vii, fig. 2, 2*a*, 2*b*.

7 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

2 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 24th February 1935.

1 specimen. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Oreinus molesworthi was described from a single specimen obtained at Yembung in the Abor Hills. Since then it has been found in the Eastern Himalayas below Darjeeling[1]. The range of the species is here extended to the Chindwin drainage system for the first time.

The largest specimen is about 235 mm. in total length.

PSILORHYNCHIDAE.

Psilorhynchus homaloptera, sp. nov.

(Plate VII, figs. 1-6).

17 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February, 1935.

D. 2/7 ; A. 2/5 ; P. 7-8/9 ; V 2/7 ; C. 18 : L. l. 42-44 ; L. tr. 6-7 (3+3 or $3\frac{1}{2}+3\frac{1}{2}$).

In its depressed and flattened body, general facies and build *Psilorhynchus homaloptera* superficially resembles some of the highly specialised Homalopterid fishes. The dorsal profile is evenly arched ; it rises gently from the tip of the snout to the insertion of the dorsal fin, beyond which it slopes down gradually to the root of the caudal fin. The ventral profile is more or less horizontal or very slightly arched. The ventral surface of the head and the chest are flat and horizontal. The maximum depth of the body lies in front and below the dorsal fin. The caudal peduncle is short and fairly compressed ; its least height is contained from 1·4 to 1·7 times in its length.

[1] Hora, *Rec. Ind. Mus.* XXII, p. 734 (1921).

The head is greatly depressed, small and sub-triangular. The length of the head is contained from 5·1 to 5·6 times in the length of the body excluding the caudal fin. The height of the head at the occiput is equal to its length behind the nostrils. The snout is spatulate, smooth, obtusely pointed and has trenchant margins; it is considerably longer than the post-orbital part of the head, its length being contained about 2 times in the length of the head. The eyes are rather small, globular and dorso-lateral; they are situated almost entirely in the posterior half of the head. They are provided with free orbital margin and are not visible from the ventral surface. The diameter of the eye is contained from 3·6 to 4 times in the length of the head. The interorbital space is flat and much wider than the orbit. The gill openings are narrow; they extend from the lateral line as far down as the termination of the base of the pectoral fins. The nostrils are fairly large and situated much nearer the anterior margins of the eyes than the tip of the snout; they are separated by a conspicuous membranous flap. The internarial distance is almost equal to the length of the head behind the middle of the eyes.

The mouth is ventral and its opening is slightly arched; the width of the gape is equal to the length of the head behind the middle of the eyes. The upper jaw overhangs the vestibulum of the mouth. Both the upper and the lower jaws are provided with sharp rasping horny edges, bordered by thick, fleshy lips which are entire. The lips are not continuous at the angles of the mouth. The upper lip is narrow, somewhat tough and partly covered with the rostral fold. The lower lip, with its posterior superficial part, is in the form of a broad, thick flap which is free from the jaw. A fairly deep, distinct lateral furrow passes on either side from the post-labial groove to the sides of the snout, and marks off the mouth parts and the thick rostral fold. The rostral fold and the under surfaces of the chins are sparsely studded with minute tubercles, while the skin behind the lower lip is somewhat papillated.

The dorsal fin is in advance of the ventrals and its commencement is much nearer the tip of the snout than the root of the caudal; it is almost equidistant between the anterior margin of the eye and the commencement of the anal. The height of the fin is somewhat variable; it may be equal to or a little higher than the depth of the body below it. Its free margin is straight and oblique. The pectoral fins are pedunculate, broad, expanded and fan-shaped with a rounded free margin. They are horizontally placed, considerably longer than the head and are separated from the ventrals by a distance equal to one-third of their own length. The ventral fins are like the pectorals; they are somewhat shorter and have an oblique base, so that the fins on the two sides converge when folded back. They have a more or less truncate free margin, and they extend considerably beyond the anal opening which is situated nearer the tip of the ventrals than their origin. The anal fin is short and, like the dorsal, has a straight and oblique outer margin. It is about twice as long as its base and about one and half times longer than the height of the body above it. The caudal fin is lunate with unequal and angulate lobes, the lower lobe being slightly longer than the upper. It is considerably longer than the head and its own height.

The lateral line is feebly arched and runs along the middle of the body to that of the root of the caudal fin. The scales are fairly large, thin, and firmly adherent; they are arranged more or less regularly on the body. There are from 14 to 15 scales before the dorsal fin and 12 round the caudal peduncle. The number of perforated scales along the lateral line varies from 42 to 44. The number of scales in a transverse series between the bases of the dorsal and the ventral fins is also somewhat variable. Usually there are 7 rows, $3\frac{1}{2}$ rows being arranged between the base of the dorsal and the lateral line and $3\frac{1}{2}$ rows between the lateral line and the bases of the ventrals. In some specimens, there are only 6 rows, 3 rows above and 3 rows below the lateral line. The under surface of the body from the chest to the origin of the ventrals is perfectly smooth and devoid of scales.

The air bladder though still of the normal Cyprinid type has undergone considerable degeneration. In all essential features it is like that of *P. balitora* and *P. sucatio*, but is very much reduced. The anterior chamber is pea-shaped and somewhat flattened dorso-ventrally. The posterior chamber is very much smaller than the anterior chamber, but is more or less similar in shape. It has shifted from its original or normal position and is superimposed medially on the posterior part of the anterior chamber where it is partly tucked in a shallow invagination. The walls of both the chambers are thick and fibrous. The transverse processes of the second vertebra, on which the air-bladder rests, are considerably modified (pl. vii, fig. 5) so as to provide a bony covering for the anterior end of the bladder.

The basipterygium, like that of *P. balitora*, described and figured by one of us[1], has undergone complete ossification so as to form a shield-like structure, similar to that found in most Homalopterid fishes. It is slightly longer than broad, broadest at the zone of the ventral fin rays, and is destitute of well differentiated antero-medial or lateral horns. Anteriorly the basipterygum is broadly rounded. A fairly elevated, oblique and narrow ridge passes on either side on the dorsal surface of the basipterygium, almost parallel to the antero-lateral border. It extends as far as the anterior margin of the zone of the ventral fin rays and externally cuts off a fairly wide, elongated strip which is concave throughout, while internally these two longitudinal ridges, together with the postero-medial ridges meeting in the centre, enclose an obtusely triangular, broad space. This triangular enclosed area has a heart-shaped central, convex surface. The latero-posterior border of the basipterygium, *i.e.*, the zone of the ventral fin rays, is more or less flat and is provided with an antero-lateral and a postero-lateral angle. Near each antero-lateral angle are present two lateral foramina for connecting the basipterygium with the modified rib. This state of affair is very characteristic of *P. homaloptera*. In *P. balitora* and *P. sucatio* lateral foramina are altogether absent, while in Homalopterid fishes, when present, there is only a single foramen. The postero-medial horns are fairly developed and are widely separated by flat transverse processes. Above the base of each postero-lateral horn there is a short and angular sub-vertical process (pl. vii, fig. 4).

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[1] Mukerji, *Journ. Bombay Nat. Hist. Soc.* XXXVI, p. 826, fig. 2 (1933).

The structures of the pharyngeal bone and teeth (pl. vii, fig. 6) correspond almost entirely to those of *P. sucatio* described and figured by one of us[1]. The pharyngeal bones are roughly triangular in outline, and in a specimen, 80 mm. long, the length of their base is about 2 mm. The teeth are set close together on a broad apex; they are slender, almost of uniform length and thickness, hooked at the tip and arranged in a single row. Their approximate length is 0·6 mm.

The colouration in alcohol is uniformly pale olivaceous green, except for the ventral surface which is somewhat lighter. The head and the body are spattered all over with fine black dots. A fairly broad dusky lateral band passes, along the lateral line, from the angle of the operculum to the root of the caudal fin. In certain specimens a similar band passes dorsally from the occiput to the tail, while in others this band may break up, partly or entirely, into small irregular blotches. All the fins are more or less dusky.

Type-specimen.—F. 11792/1, in the collection of the *Zoological Survey of India* (*Ind. Mus.*), *Calcutta.*

Measurements in millimetres.

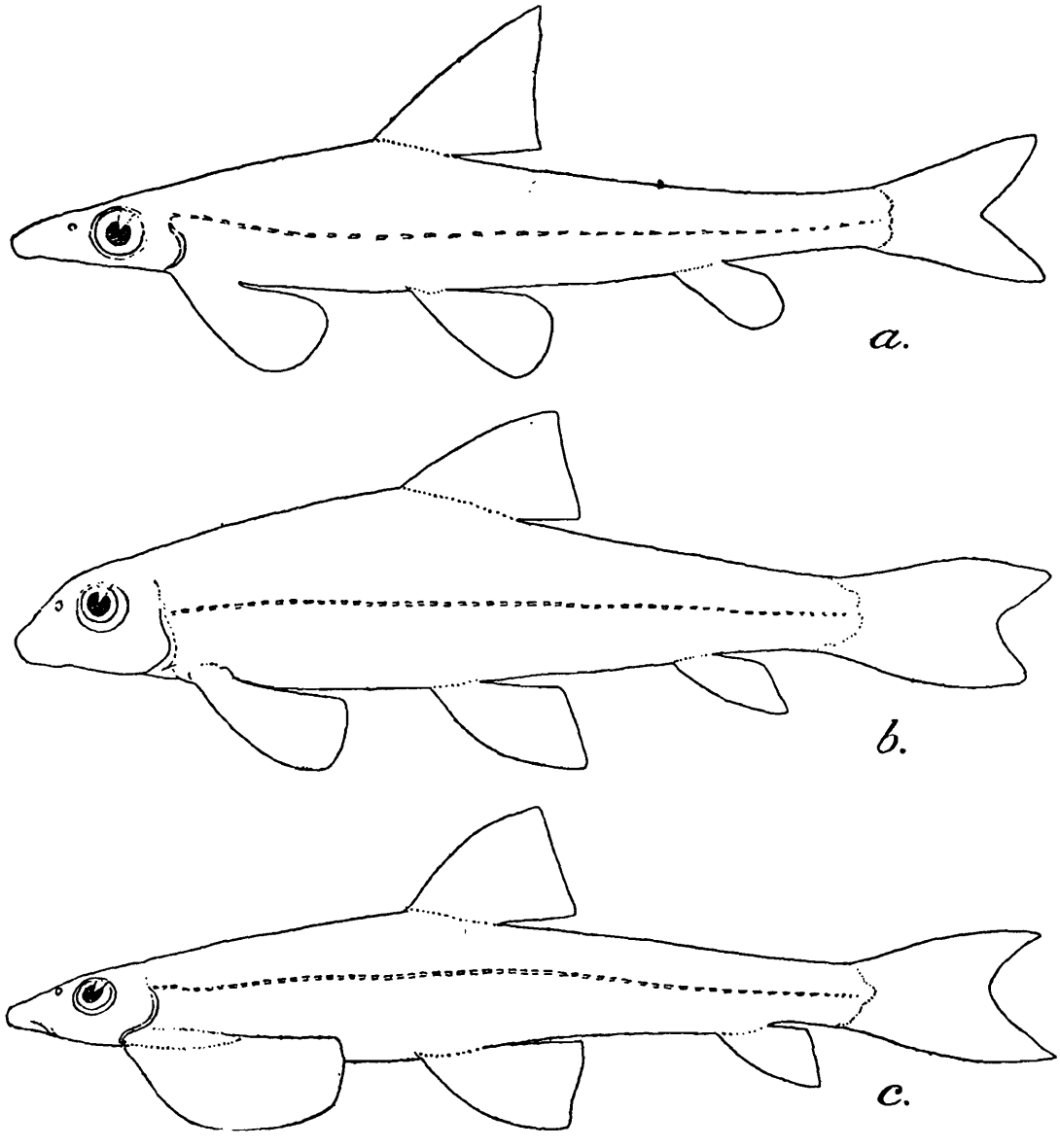
	Type.			
Length of body without caudal	64·0	59·0	57·0	56·0
Height of body	12·0	11·0	9·5	9·0
Length of head	12·0	11·0	11·0	10·0
Breadth of head	10·0	10·0	10·0	10·0
Height of head at occiput	7·5	7·0	7·0	6·5
Length of snout	6·0	5·5	5·5	5·0
Diameter of eye	3·0	3·0	3·0	2·5
Interorbital width	5·0	5·0	5·0	4·5
Height of dorsal fin	12·5	11·0	10·0	10·5
Length of pectoral fin	16·5	15·0	13·5	13·0
Height of anal fin	9·0	8·5	8·0	8·0
Length of caudal fin	14·0	13·0	12·5	12·5
Length of caudal peduncle	8·0	9·0	8·0	8·0
Least height of caudal peduncle	5·5	5·5	5·0	4·5

Remarks.—The systematic position of the genus *Psilorhynchus* has been elucidated only in recent years [2] and from a study of the abundant material of *P. sucatio* and *P. balitora* it has been shown that these fishes are sufficiently remarkable to constitute a separate family. They are distinguished by a peculiar type of mouth and lips; absence of barbels; single row of pharyngeal teeth; free, though greatly reduced air-bladder in the abdominal cavity; completely ossified, broad, plate-like basipterygium; and the presence of a number of unbranched rays in the pair fins. Though the new species described here has assumed the form of the most highly specialised Homalopterid fishes, it exhibits all the above characters in a marked degree. *P. homaloptera*, sp. nov. is not only abundantly distinct in general facies and build, but can also be distinguished by its small, dorso-lateral eyes and the larger number of

[1] Mukerji, *Journ. Bombay Hat. Hist. Soc.* XXXVI, p. 828, pl. i, fig. 5 (1933).

[2] Hora, *Rec. Ind. Mus.*, XXVII, pp. 457-460, text-fig. 3 (1925); Mukerji, *Journ. Bombay Nat. Hist. Soc.*, XXXVI, pp. 823-828 (1933).

undivided rays in the pectoral fins. The absence of scales along the entire ventral surface in front of the anal fin is another distinguishing feature of the species.



Text-fig. 2.—Lateral views of three Indian species of *Psilorhynchus* McClelland.

a. Psilorhynchus sucatio (Hamilton). × 1½.
b. Psilorhynchus balitora (Hamilton). × *ca.* 1⅘.
c. Psilorhynchus homaloptera, sp. nov. × 1½.

Our field-notes concerning the ecology of the Indian species of *Psilorhynchus* show that the differences in their form and structure can be correlated with differences in their habitats. *P. sucatio* has a shovel-like head, large lateral eyes, fairly complete lepidosis on the ventral surface behind the bases of the pectorals, a fewer number (4) of unbranched rays in the pectoral fins, and a spindle-shaped form. The species was found by us in larger streams at Siliguri where the bed was either muddy or where a large pool had formed. Specimens were also collected from pebbly beds, but they were not so common in such situations. *P. balitora* has a *Garra*-like appearance, somewhat smaller, dorso-lateral eyes which are not visible from the ventral surface, irregular lepidosis on the ventral surface behind the bases of the pectorals, larger

number (6) of unbranched rays in the pectoral fins and moderately elevated body. It lives in pebbly beds of small rapid-running streams at the base of hills. We collected a very large number of specimens from the Sevoke stream and the Mahanaddi river at the base of the Darjeeling Himalayas. The young specimens reported by one of us (Hora, *Rec. Ind. Mus.*, XIX, p. 211, 1920; *ibid.*, XXII, p. 182, pl. ix, figs. 6, 6*a*, 1921) from the Naga Hills were collected from a pool in the course of a torrential stream at Piphima and as they had not developed all the characters of the adult yet, they cannot throw much light on the adaptations undergone by the species [1]. *P. homaloptera* has a greatly depressed and flattened body, much smaller eyes, naked ventral surface, greatly reduced bladder and large number (8) of undivided rays in the pectoral fins, which are pedunculate. It was collected from the Keleki stream at Emilomi, but unfortunately we have no particulars of its precise habitat, though from an analogy with other torrential fishes, it can be safely assumed that the specimens must have been collected from rapids in the course of the stream.

From a close study of the build and habitat of *P. sucatio* it seems probable that the fish digs in sand or mud where it lives in burrows, though it is also capable of adhering to rocks as was observed by one of us by keeping the specimens in an aquarium. The modifications for digging purposes are (i) greatly flattened, elongated, shovel-like head and trenchant snout, (ii) small, ventral mouth, (iii) absence of barbels, (iv) lateral eyes, (v) a number of undivided rays in paired fins, (vi) position of the paired fins on the ventral surface, (vii) silvery peritoneal lining, and (viii) spindle-shaped body. The position of the paired fins on the ventral surface is rather significant. In all hill-stream fishes the paired fins are horizontal and spread outwards so as to enable the fish to have a greater surface for adhesion; their position on the ventral surface in *P. sucatio*, therefore, suggests that they are not normally used for adhesion in this species. If the fins were to project out at the sides, they will be a great hindrance at the time of burrowing. The lateral eyes are useful because no mud or sand can adhere to them. The undivided rays in the paired fins impart strength to the structures which are presumably used for burrowing. The shape of the head and body, the form and position of the mouth and the absence of barbels are all useful characters for a burrowing fish. The silvery or white peritoneal lining also suggests that the fish does not live in situations where it may be exposed to much light.

P. balitora shows modifications for life in rapid-running waters, though as its name indicates it may also be a sand-digger (*balitora* in Bengal means a sand-digger). Its form is more elevated, the snout is not so elongated and depressed, the eyes are dorso-lateral, the paired fins are horizontal and project beyond the contour of the body at the sides; the number of the undivided rays is increased from 4 to 6 and the peritoneal lining is grayish. In *P. homaloptera* the body is flattened and greatly depressed, the paired fins are pedunculate and spread

[1] It is likely that the young specimens from Piphima belong to our new species from Emilomi, but we leave this question open till specimens of intermediate sizes are discovered. The Piphima specimens are too young to warrant any conclusions.

outwards and the peritoneal lining is black showing that the fish lives on surfaces of rocks almost in direct sunlight. The eyes are small and dorsolateral.

The modifications undergone by these three species are of a progressive nature and it is remarkable to note that though the original modifications may have been induced by a burrowing habit, they have become accentuated when the same fishes took to life in swift currents. Attention may also be directed to the fact that similar modifications sometimes result in apparently different adaptations, but when the nature of modifications is analysed against the functions of the structures, then the real value of adaptations becomes evident. For instance, a strong pectoral fin is as useful for digging as for adhering to rocks and in both cases the result is achieved by the formation of a number of undivided rays. Bottom life is as natural for a burrowing species as for a species that adheres to rocks in a torrential stream, and the result is that in both cases the air-bladder is greatly reduced. One of us [1] has already directed attention to such cases of adaptations and explained their significance.

So far as can be ascertained, *Psilorhynchus* is restricted to India and Burma. The two species from China, *Psilorhynchus sinensis* Sauvage & Dabry de Thiersant (=*Hemimyzon sinensis*) and *P. fasciatus* Sauvage (=*Pseudogastromyzon fasciatus*), have been shown to be Homalopterid fishes [2]. The only other species described under this generic denomination is *Psilorhynchus aymonieri* Tirant [3] which has not yet been properly studied. The descriptions and figures of the species recently reprinted by Chevey [4] do not show its *Psilorhynchus* affinities, but it is difficult to assign any systematic position to it without examining the specimens.

COBITIDAE.

Nemachilus botia (Hamilton).

1921. *Nemachilus botia,* Hora, *Rec. Ind. Mus.*, XXII, p. 199.

1 specimen. Mekruchu stream, Dayang valley. J. H. Hutton, March 1927.

Nemachilus botia is represented by a single male specimen about 80 mm. in total length.

Nemachilus kangjupkhulensis Hora.

1921. *Nemachilus kangjupkhulensis,* Hora, *Rec. Ind. Mus.*, XXII, p. 202, pl. x, figs. 4, 4*a*.
1934. *Nemachilus kangjupkhulensis,* Mukerji, *Journ. Bombay Nat. Hist. Soc.*, XXXVII, p. 48.

1 specimen. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

15 specimens. Melori, Tizu River; Leori, Phodung River a tributary of Tizu; Yisisu, Yazhiluwu River, a tributary of Tizu. J. H. Hutton, March 1935.

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[1] Hora, *Phil. Trans. Roy. Soc. London* (B) CCXVIII, p. 264 (1930).
[2] Hora, *Mem. Ind. Mus.* XII, pp. 299, 314 (1932).
[3] Tirant, *Bull. Soc. Etudes Indochinoises* (1883).
[4] Chevey, *Oeuvre Ichtyologique de G. Tirant,* p. 35 (Saigon : 1929-1934).

16 specimens. Laruri, Zhuzeti stream, a tributary of Titlo or Namtaleik. J. H. Hutton, March 1927.

17 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

3 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 24th February 1935.

Nemachilus kangjupkhulensis was found to be widely distributed in the hill-streams of the Manipur Valley whence the waters drain into the Chindwin River. Mukerji recorded it from Burma and in the collections under report the species was collected from several streams of the Chindwin drainage only.

The largest specimen is about 72 mm. in total length.

Nemachilus manipurensis, Chaudhuri.

1912. *Nemachilus manipurensis*, Chaudhuri, *Rec. Ind. Mus.* VII, p. 443, pl. xl, figs. 4, 4*a*, 4*b* & pl. xli, figs. 1, 1*a*, 1*b*.

1921. *Nemachilus manipurensis*, Hora, *Rec. Ind. Mus.* XII, p. 199.

33 specimens. Zhokami and Tekhubami, sources of the Dayang River. J. H. Hutton, March 1927.

Numerous specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

3 specimens. Melori, Tizu River; Leori, Phodung River, a tributary of Tizu; Yisisu, Yazhiluwu River, a tributary of Tizu. J. H. Hutton, March 1927.

1 specimen. Stream at Kohima. B. Prashad & B. Chopra, 14th February 1935.

4 specimens. Chakabama, Sidzu River. B. Prashad & B. Chopra, 16th February 1935.

Numerous specimens. Paddy fields and irrigation channels, Kekrima. B. Prashad & B. Chopra, 18th February 1935.

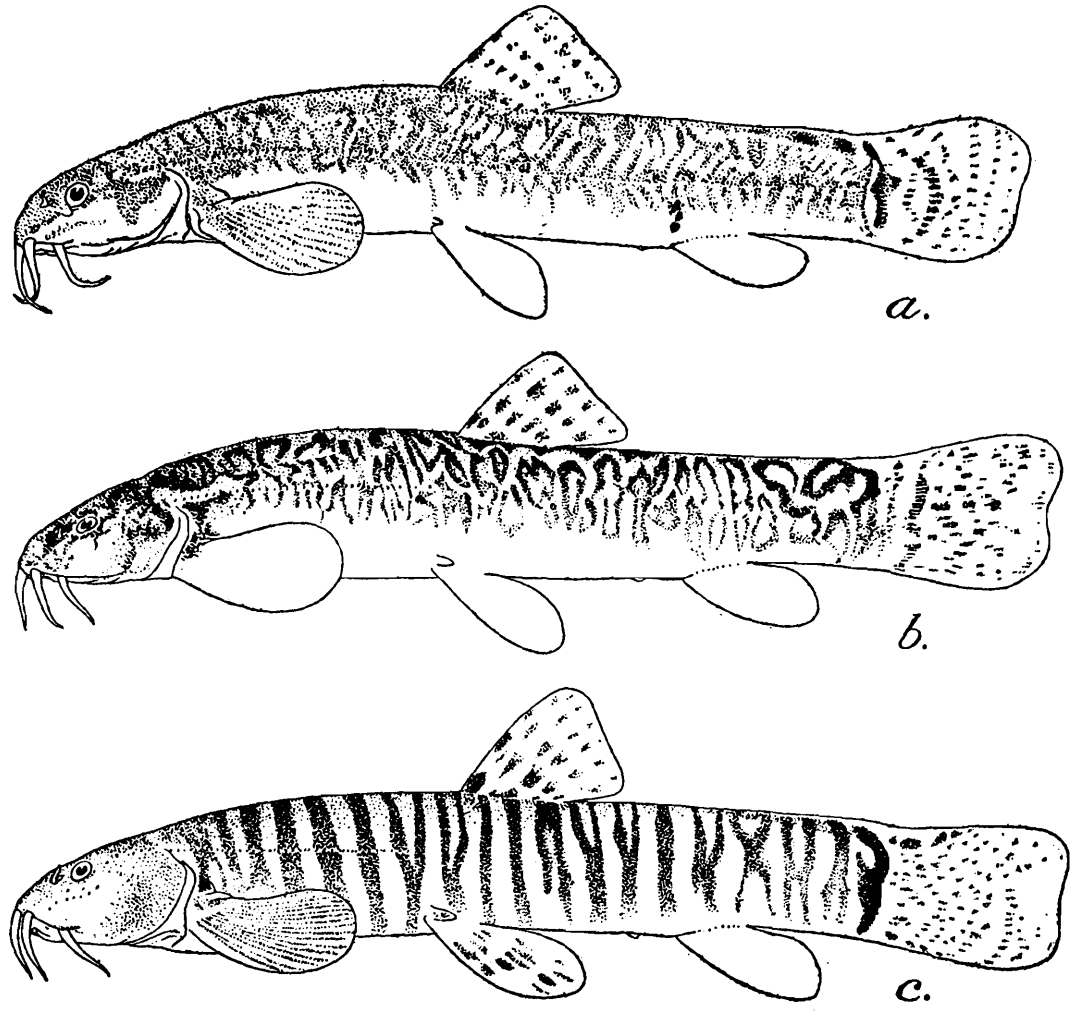
23 specimens. Sakhai, Lizho Stream. B. Prashad & B. Chopra, 23rd February 1935.

2 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

6 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Nemachilus manipurensis was described by Chaudhuri from three specimens collected in Manipur but later one of us reported on a large number of specimens from the Manipur Valley and remarked that "Except for slight variation in the colour of some specimens, they agree with Chaudhuri's description of the species" The collections now before us show that according to the colour variation the individuals of this species can be divided into two groups, *i.e.* (i) banded forms and (ii) mottled or plain forms. These differences refer to the colour of the body only, for in all specimens the dorsal and the caudal fins are marked with a large number of short, wavy bands. Correlated with the colour differences, there are certain morphological differences which are equally well marked. In the banded specimens the head and body are not greatly depressed and the ventral surface is only moderately flattened, whereas in the mottled specimens the head and body are greatly depressed and the ventral surface is flat and horizontal. When these characters are analysed against localities, it is seen that the banded and flattened specimens were invariably collected from rapids with pebbly beds, whereas the mottled specimens were collected in ponds, tanks or other stationary or sluggish pieces of water. It is significant that, with a few exceptions, the specimens collected in the Manipur Valley, where the

streams are rather sluggish, are of the mottled or plain type whereas those from the Naga Hills, where the streams are torrential, are mostly



Text-fig. 3.—Three colour variations of *Nemachilus manipurensis* Chaudhuri.

a. A specimen from Sakhai, Naga Hills. × 2.
b. A specimen from Purobami and Sahunyu, Naga Hills. × *ca*. 1½.
c. A specimen from Kekrima, Naga Hills. × *ca*. 1½.

Specimens with no markings on body from the Manipur Valley have already been figured by Chaudhuri (*Rec. Ind. Mus.* VII, pl. xl, fig. 4 and pl. xli, fig. 1, 1912).

banded. As the species is distributed over a considerable area and is found in different types of habitat conditions, it has undergone remarkable adaptative modifications.

Nemachilus manipurensis is similar to *N. multifasciatus* Day [1] in several respects, such as incomplete lateral line, barred dorsal and caudal fins and a large number of bands on the body, but differs in the form of the caudal fin (deeply emarginate in *multifasciatus* and truncate or slightly lobed in *manipurensis*) and colour pattern on the body (*manipurensis*, when banded, has uniformly narrow bands throughout whereas *multifasciatus* possesses few broad bands behind the dorsal and anteriorly the bands break up into narrower bands). These differences do not appear to be specific but until fresh material of Day's species becomes available it is desirable to treat these species as distinct.

The largest specimen is about 80 mm. in total length.

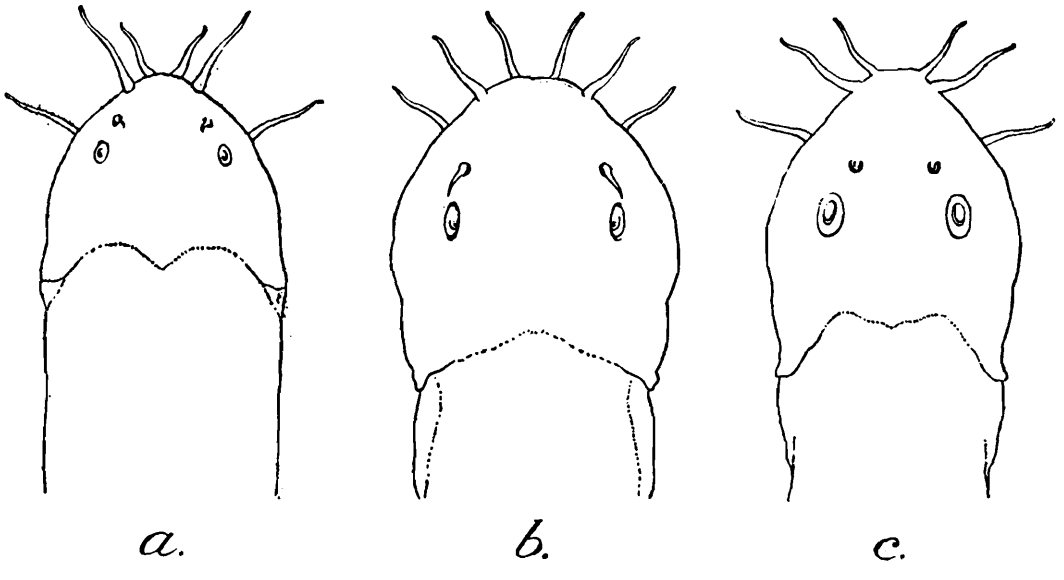
[1] Hora, *Rec. Ind. Mus.* XXXVII, p. 61 (1935).

Nemachilus rupecola (McClelland).

1839. *Schistura rupecula*, McClelland *Asiat. Res.* XIX (2) pp. 309, 441, pl. lvii, fig. 3.

21 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

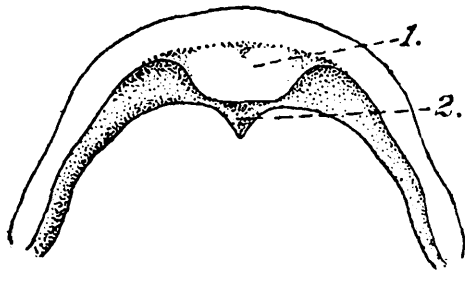
In their general build the specimens of *Nemachilus rupecola* from the Naga Hills agree with the form, *N. rupecola* var. *inglisi*, recently described by one of us [1] from the Eastern Himalayas, but differ from it in the absence of well-marked nasal appendages. It is probably an Assamese race of the Himalayan species but as the material before us is not in a good condition we refrain from giving it a separate name. In the typical



TEXT-FIG. 4.—Outline sketches of head of three geographical races of *Nemachilus rupecola* (McClelland).

a. A specimen from Simla Hills. × *ca.* 2.
b. A specimen from Darjeeling Himalayas. × *ca.* 2.
c. A specimen from Naga Hills. × *ca.* 2.

form from the Western Himalayas the head, especially in the region of the eyes, is not so broad as in the Darjeeling or Assamese forms. Moreover, the scales in the posterior region of the body in the typical form are well marked. The broadening of the head and the reduction of the scales in the case of the Darjeeling and Assamese forms show that the fish is better adapted to withstand the rush of torrents.



TEXT-FIG. 5.—Front view of jaws of a specimen of *Nemachilus rupecola* McClelland from Naga Hills. × 7½.

1 = beak-like process of upper jaw;
2 = emergination of lower jaw.

The jaws of *N. rupecola* are very characteristic. The upper jaw is produced into a beak-like process with a broad, truncate apex, while the lower jaw is deeply incised to receive this process. This condition is present in certain other species of the genus also but the characters are not well defined.

The largest specimen is about 102 mm. in total length.

[1] Hora, *Rec. Ind. Mus.* XXXVII, p. 58 (1935).

Nemachilus subfusca (McClelland).

1839. *Schistura subfusca*, McClelland, *As. Res.* (Ind. Cyprinidae) XIX, pp. 308, 443, pl. liii, fig. 5.

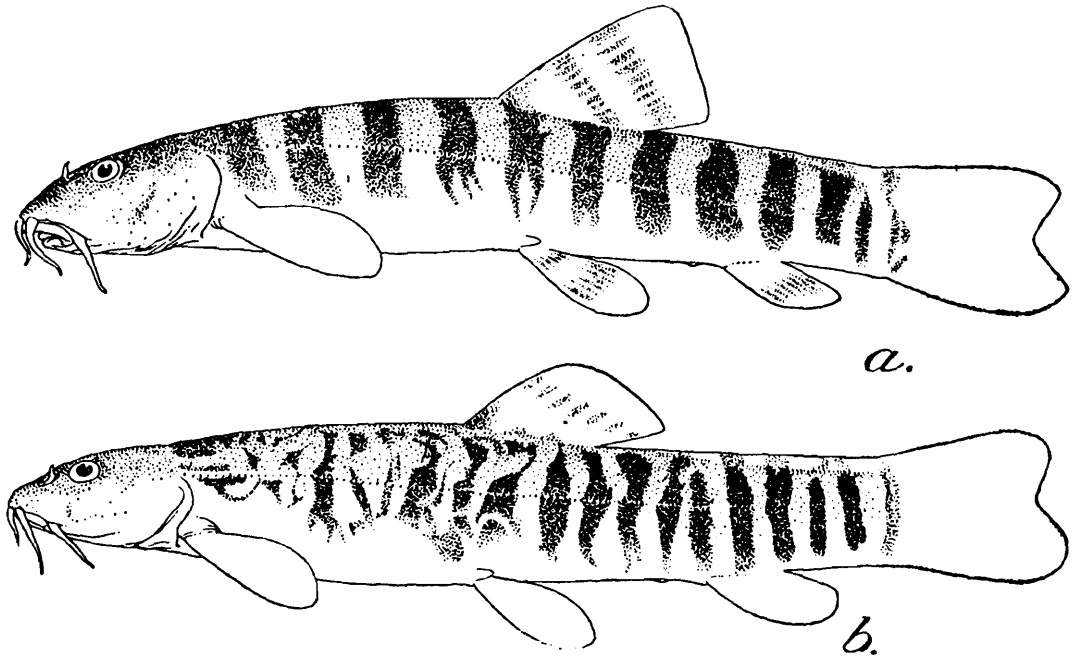
Several specimens. Mekruchu stream, etc., Dayang Valley. J. H. Hutton, March 1927.

Several specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Nemachilus subfusca was described by McClelland from " Upper Assam " and characterised as " Without spines; four cirri in front of the mouth, various regular zones encircling the body; eyes approximating to each other on either side of a narrow trenchant ridge like that of *Cobitis phoxocheila*; snout hard. Fin rays are,

D. 11 : P. 11 : V 7 : A. 7 : C. 17."

The above description is too meagre to establish the specific identity of *N. subfusca* and for this reason its specific limits have remained undetermined so far. One of us[1], from a study of the Eastern Himalayan species of the genus, regarded it as a synonym of *N. scaturigina* (McClell.) but the abundant material now before us shows that the Assamese form has to be regarded as a separate species. In *N. subfusca* the lateral line is complete or incomplete but it is fairly extensive (complete in *N. scaturigina*). The scales are feebly developed and in the anterior region of the body they are totally absent (scales well marked all over the body



Text-fig. 6.—Two colour variations of *Nemachilus subfusca* (McClelland) from Naga Hills.

a. A young specimen. × *ca.* 2. *b*. A mature specimen. × *ca.* 1½.

in *N. scaturigina*). In young specimens the colour-bands are more or less similar to those figured by McClelland whereas in older specimens

[1] Hora, *Rec. Ind. Mus.* XXXVII, p. 64 (1935).

the bands are broader and more numerous (incomplete bands in *N. scaturigina*). Specimens similar to those before us are present in an undetermined lot from the Khasi Hills and though McClelland has not mentioned any definite locality for his species, it is known that the originals of several of his Assamese species came from the Mishmi and the Khasi Hills. It is likely, therefore, that the specimens now before us represent McClelland's species.

Nemachilus subfusca may now be characterised as follows :—

D. 2/8 ; A. 2/5 ; P. 1/10 ; V. 1/6 ; C. 18.

Nemachilus subfusca is a gracefully built and moderately elongated species in which the upper profile is evenly arched up to the origin of the dorsal fin, beyond which it is almost straight or slopes slightly to the root of the caudal. The ventral profile is more or less horizontal in front of the ventral fins. The head is long, narrow and somewhat pointed anteriorly ; its length is contained from 4·2 to 5 times in the total length excluding the caudal and from 5 to 5·8 times including the caudal. The head is slightly wider than deep ; its width is contained from 1·2 to 1·4 times and the height at occiput from 1·5 to 1·8 times in its length. The snout is a little longer than the post-orbital part of the head. The eyes are dorso-lateral in position and are situated almost midway between the free margin of the operculum and the tip of the snout. They are not visible from the ventral surface. The diameter of the eye is contained from 4·5 to 6 times in the length of the head and from 1·5 to 2·7 times in the length of the snout. The interorbital space is moderately convex and slightly wider than the diameter of the eye. The mouth is small and semicircular ; its gape is equal to the length of the snout in front of the nostrils. The lips are fleshy and plain ; in preserved specimens they appear to be feebly corrugated. The lower lip is interrupted in the middle and deflected at the sides. The jaws are unequal, the lower one being considerably overhung by the upper. The lower jaw is sharp and shovel-like, being in some cases faintly incised in the middle. The upper jaw is produced into a short vertical, beak-like structure. The barbels are well-developed, all the three pairs are longer than the orbital width, the outer rostrals being the longest.

The body is sub-cylindrical in shape and somewhat elongated ; its depth is contained from 5·5 to 6·9 times in the total length without the caudal. The scales are feebly developed and are present only in the tail region. They appear to be totally absent in the anterior part and on the ventral surface of the body. Usually the lateral line is complete running along the middle of the body ; when incomplete, it is fairly extensive and extends as far as the anal fin. The caudal peduncle is considerably compressed, short and squarish ; it is slightly longer than high.

The dorsal fin commences in advance of the ventrals and its insertion is somewhat nearer to the root of the caudal fin than to the tip of the snout ; its posterior margin is obliquely truncate. The longest ray of the dorsal is in most specimens equal to or slightly shorter than the

depth of the body below it ; only rarely it is longer. The paired fins are short and horizontally placed ; they have rounded margin. The pectorals are nearly as long as the head behind the nostrils ; they are separated from the origin of the ventrals by a distance almost equal to their own length. The ventrals are shorter than the pectorals and do not extend as far as the anal opening, which is situated midway between the tip of the ventrals and the commencement of the anal, or a little nearer the latter. The anal fin is almost as high as the body above it ; it has, like the dorsal, a truncate outer margin. The caudal fin is shorter than the head ; it is emarginate with the lower lobe slightly more developed.

In spirit specimens the head and body are grayish to dusky above and pale olivaceous below. In adult specimens there are from 12 to 18 broad, dark, vertical bands which descend from the dorsal surface and extend almost to the ventral surface. These bands are very variable in regard to shape, size and position. They may be broader or narrower than or equal to the alternating bands of the ground colour. They may be straight, oblique or crescentic. Usually, these bands are more regular and prominent in the posterior half of the body, while anteriorly they may either break up into series of irregularly distributed blotches, or they may be obliterated altogether. In certain specimens, some of the bands are split into secondary bands. In the young and half grown specimens, the bands are less variable, narrower and fewer in number ; they are more regularly arranged and seldom exceed 14 in number. In all specimens the band at the root of the caudal fin is much darker than the others. There is a prominent black spot at the base of the anterior rays of the dorsal fin ; all the fin rays of the dorsal are dusky. The rest of the fins are diaphanous.

Measurements in millimetres.

Total length including caudal	82·0	70·0	64·0	51·0	45·0
Length of caudal	12·0	9·0	9·0	9·0	7·0
Length of head	14·0	12·0	12·0	10·0	9·0
Width of head	10·0	9·5	9·0	7·0	6·5
Height of head at occiput	9·0	8·0	7·0	5·5	5·5
Greatest depth of body	12·0	9·0	10·0	7·5	5·5
Length of snout.	6·5	6·0	5·0	4·5	3·0
Diameter of eye.	2·5	2·2	2·0	2·0	2·0
Interorbital distance	3·0	3·0	3·0	2·2	2·0
Length of caudal peduncle	9·5	9·0	8·0	5·0	5·0
Least height of caudal peduncle	8·2	8·0	7·0	4·5	4·0
Longest ray of dorsal	10·2	10·2	9·5	8·0	7·0
Length of pectoral	11·0	9·5	9·5	7·0	7·0
Length of ventral	9·5	9·0	8·5	7·0	6·0
Longest ray of anal	9·0	9·0	8·0	6·5	6·0
Distance between tip of snout and commencement of dorsal	36·0	31·0	29·0	24·0	19·5
Distance between commencement of pectoral and that of ventral	24·5	18·0	16·5	14·0	11·0
Distance between tip of snout and anal opening	52·0	45·0	40·0	31·5	27·0

OPHICEPHALIDAE.

Ophicephalus gachua Hamilton.

1934. *Ophicephalus gachua*, Hora & Mukerji, *Rec. Ind. Mus.* XXXVI, p. 135.

8 specimens. Zhokami and Tekhubami, sources of the Dayang River. J. H. Hutton, March 1927.

6 specimens. Purobani and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

7 specimens. Melori, Tizu River; Leori, Phodung River, a tributary of Tizu River; Yisusu, Yazhiluwu River, a tributary of Tizu River. J. H. Hutton, March 1927.

6 specimens. Kekrima. B. Prashad & B. Chopra, 17th February 1935.

4 specimens. Khazabama (Chizami), Chiteri stream. B. Prashad & B. Chopra, 20th February 1935.

16 specimens. Phikrokezema. B. Prashad & B. Chopra, 21st February 1935.

1 specimen. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Ophicephalus gachua is a widely distributed species of the genus and is represented in the collection from both the drainage basins of the Naga Hills. One of us[1] had referred specimens of this species collected in the Manipur Valley to *Ophicephalus harcourt-butleri* but we (*op. cit.*) have recently shown that the two species are synonymous.

The largest specimen under report is about 150 mm. in total length.

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[1] Hora, *Rec. Ind. Mus.* XXII, p. 208 (1921).

MGIPC—M—III-8-11—20-9-35—510.

EXPLANATION OF PLATE VII.

Psilorhynchus homaloptera, sp. nov.

FIG. 1.—Lateral view of type-specimen. × 2.

FIG. 2.—Dorsal surface of head and anterior part of body. × 2.

FIG. 3.—Ventral surface of head and anterior part of body. × 2.

FIG. 4.—Basipterygium from dorsal surface. × 7.

FIG. 5.—Air-bladder *in situ*. × 8.

FIG. 6.—Pharyngeal bone with teeth. × 30.

1. 2. 3. 4. 5. 6.

Psilorhynchus homaloptera, sp. nov.

P. Bagchi del.