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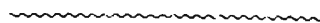
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Appendix.



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REVISION OF THE INDIAN GRÝLLÍDAE

By LUCIEN CHÓPARD.

The late Dr. Annandale, whose loss is a source of great grief to everyone who knew him, sent me a few years ago the whole of the Gryllid material of the Indian Museum. This was such an important collection that its study induced me to undertake the publication of a complete revision of the Gryllidae of India.

I have been obliged to defer this publication, as numerous other collections from different museums in Europe and in India, which have been sent to me since then, have brought such abundant material that it has been impossible for me up till now to complete the work for such a faunistic study as I proposed to carry out. The work of exact determination of the species previously known and the descriptions of those which are new to science has proved a very big task. The new species have proved to be more numerous than was expected and there is no doubt that a certain number still await discovery in the material which remains to be worked out. I have, therefore, decided to publish the descriptions of the new species as the first part of my Memoir on the Gryllidae of British India.

***Scapteriscus leptodactylus*, sp. nov.**

Type : 1 ♀, Damukdia, E. Bengal, 7-vi-08.¹

Size medium, rather slender. Head very narrow ; ocelli large, separated in front by a space scarcely equal to their own length. Pronotum strongly narrowing anteriorly, regularly ovoidal posteriorly ; anterior margin markedly concave ; disk yellowish, with a big brown spot occupying the whole of the median part.

Process of the anterior trochanter very long, narrow, with parallel margins ; the inferior one provided with spinuliform bristles all along its length. Anterior tibiae presenting an oval, completely uncovered drum ; claws long and widely apart ; claws of the tarsi also very long and narrow (fig. 1). Posterior tarsi with the 3rd joint very strongly enlarged, compressed, with subequal claws (fig. 2).

Elytra too badly damaged to show venation properly. Wings long. Length of body 27 mm. ; pronotum 8 mm.

This is the first species of the genus found in the Old World. It is rather close to *S. oxydactylus* Perty, in having very long and distant claws ; it also has some affinity with *S. borellii* Giglio-Tos and *S. mexicanus* Sauss. in the shape of the process of the trochanter, in having the tibial drum uncovered and the 3rd joint of the posterior tarsi enlarged, but the trochanter process being spinulose along the whole length of its inferior margin differentiates it from these two species.

¹ Except where otherwise stated the types are in the Indian Museum.

Tridactylus apicicornis, sp. nov.

Type: 1 ♀, Medha, alt. 2,200 ft., Yenna Valley, Satara Dist., 17-23-iv-12 (*F. H. Gravely*).

Bronze-black, shining. Head bronzed, finely alutaceous; forehead wide, eyes wide apart, their internal margins parallel. Palpi brown. Antennae rather slender, black, with the last joint yellow.

Pronotum wide, bronzed, alutaceous, with scattered small depressions, anterior margin straight, posterior regularly rounded; lateral lobes spotted with yellow. Abdomen with the tergites black, lined posteriorly with yellow; inferior face yellowish brown, subgenital plate similar to the preceding sternite. Cerci and anal appendages blackish.

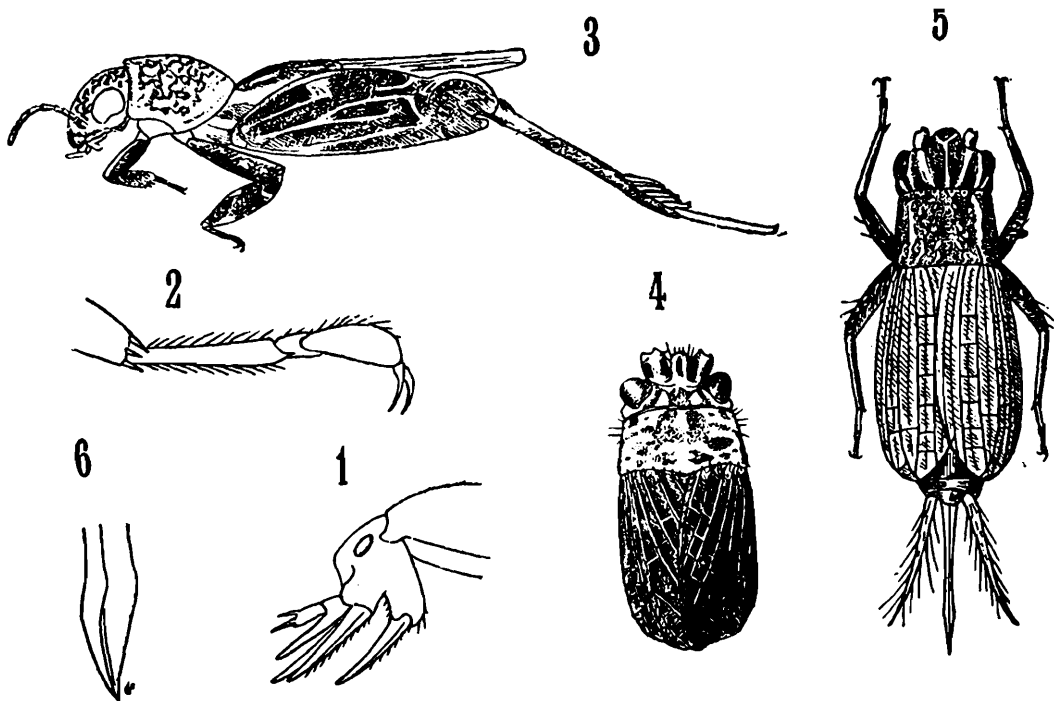


FIG. 1.—*Scapteriscus leptodactylus*, sp. nov., anterior tibia and tarsus; fig. 2. *id.*, posterior tarsus; fig. 3. *Tridactylus marmoratus*, sp. nov., lateral view; fig. 4. *Paranemobius vicinus*, sp. nov., head, pronotum and elytra of ♀; fig. 5. *Nemobius (?) strigipennis*, sp. nov., ♀; fig. 6. *Scottia minima*, sp. nov., apex of ovipositor.

Legs brown, adorned with yellow spots; intermediate tibiae as in *T. nigroaeneus*. Posterior femora with two yellow bands; tibiae with 3 internal and 4 external lamellae, inferior spurs very long; metatarsi very short, tuberculiform.

Length of body 5 mm.

This small species resembles *T. nigroaeneus* very much but differs from it in having a wider pronotum and the apex of the antennae yellow.

Tridactylus marmoratus, sp. nov.

Types: 1 ♂ 1 ♀, Yulaban, Naini Tal Dist., base of W. Himalayas, 22-iii-10.

Deep brown, adorned with yellowish stripes and markings (fig. 3). Head with rather narrow forehead, the ground colour yellowish with brown markings, forming on the occiput 2 spots and 2 longitudinal and

irregular bands extending up to the forehead ; facial shield with transverse brown markings ; clypeus with a brown transverse irregular stripe ; labrum brown. Maxillary palpi short, brown with yellow spots ; labial palpi yellowish. Antennae brown, rather short. Eyes with internal margin converging upwards, ocelli small, round.

Pronotum wide, marbled with brown and yellowish, anterior margin straight, posterior strongly and regularly rounded, disk feebly convex ; lateral lobes with inferior margin scarcely concave.

Abdomen brown above ; sternites in the male brown with posterior margin yellow, the last one rather widely rounded with wider yellow margin ; in the female abdomen yellow beneath with transverse brown band on the 7th and 8th sternites, 9th sternite conical. Cerci brown, with 2nd joint much shorter than 1st ; anal appendages as long as the cerci, yellowish above, brown beneath, slightly compressed.

Anterior legs, as in the genus, very short ; femora brown with a yellow stripe on the superior margin and a spot at apex of internal face. Intermediate femora lined with yellow above and beneath and spotted on the external face ; tibiae wide, as in *T. variegatus*, spotted with yellow. Posterior femora brown adorned with 4 fine longitudinal, yellow stripes, the middle one being furcate ; tibiae brownish with 3 internal and 4 external lamellae ; inferior spurs very long ; metatarsi tuberculiform.

Elytra short, adorned with yellow longitudinal spots. Wings variable in length.

Length of body ♂ 4 mm., ♀ 5 mm.

The general colouration is rather variable, some individuals presenting a much more abundant yellow colour, but the pattern is always the same.

***Ellipes indicus*, sp. nov.**

Type : 1 ♂, Kalimpong, Darjeeling Dist., alt. 600-4,500 ft., 24-iv—10-v-15 (*F. H. Gravely*).

General appearance as of a small *Tridactylus variegatus*. Black, shining, somewhat bronzed. Head wholly black, forehead wide, eyes wide apart. Antennae rather slender, a little rufous. Pronotum entirely black, finely alutaceous, sparsely punctate. Elytra black ; wings smoky with a white band along the superior margin of the folded part when at rest. Abdomen brownish, 9th sternite wide, subtruncate at apex. Cerci blackish ; anal appendages brownish.

Anterior legs yellowish rufous. Intermediate legs black, spotted with yellow ; tibiae fusiform. Posterior femora blackish, tibiae rufous yellow with a light ring near the base, their superior margins rather strongly denticulate, without laminae ; superior spurs short, inferior ones long, rufous ; metatarsi very small, tuberculiform.

Length of body 5 mm.

1 ♀, Gangtok, alt. 7,000 ft., Sikkim ; 27-vii-24, Major R. W. G. Hingston (Everest Exp.) ; British Museum.

♀. Entirely similar to the male, but larger. Subgenital plate longer than broad with posterior margin widely rounded ; 8th sternite completely hidden, deeply bilobed ; 9th sternite a little carinate with posterior margin subangular.

Length of body 6.5 mm.

This is an interesting small species belonging to a genus till now known exclusively from America.

***Paranemobius vicinus*, sp. nov.**

Types: 1 ♂, Parambikulam, Cochin State (Coll. Chopard); 1 ♀, Cochin State (all along the tramway, Western Ghats, October, 1914 (*F. H. Gravely*); Indian Museum.

Very close to *P. pictus* Sauss.; variegated with fine testaceous and black lines and spots as in that species; frontal rostrum narrower. Pronotum with posterior margin slightly angulate; lateral lobes ascending very little backwards, but weakly folded inwards, forming a small oblique keel running from the posterior margin to anterior angle. Legs shorter than in *P. pictus*, the posterior femora marked with rather wide blackish stripes which are transverse and not longitudinal as in *P. pictus*; posterior tibiae with rather shorter spines, the supero-internal apical spur not reaching the apex of metatarsus.

♂. Elytra extending to the posterior margin of 2nd abdominal tergite, without any speculum; the left elytron presenting 2 veins, the right one 3; both the longitudinal veins and transverse veinlets very much elevated; the areolae consequently resembling small cups. Subgenital plate rather long, slightly notched at apex, leaving space for a long process of the superior anal valve.

♀. Elytra as long as in male, overlapping in the median line; the internal margin of left elytron transparent, its apical margin a little truncate; dorsal field with veins standing out light against the dark background, 5 in number, a little oblique, discoidal vein furcate at apex (fig. 4), lateral field with 4 equidistant veins. Ovipositor very long as in *P. pictus*.

Length of body 10 mm.; post. fem. 8 mm.; elytra 4 mm., ovipositor 9.5 mm.

Although resembling *P. pictus* very much in general appearance, this species differs from it in certain important features, such as the disposition of the veins in the male elytra and the length of the elytra in the female.

***Nemobius* (?) *strigipennis*, sp. nov.**

Type: 1 ♀, Soom, alt. 4,000-5,000 ft., Darjeeling Dist., 14-vi-14 (*F. H. Gravely*).

♀ (fig. 5). Size small. Head brown, with forehead somewhat flattened, adorned with seven yellow stripes, extending on occiput and forehead, 2 behind each eye, 1 behind the antennal socket, 1 in the middle; face rufous. Maxillary palpi with first 3 joints brown, 4th nearly white, short, 5th long, triangular, whitish in its basal half, apex brownish.

Pronotum blackish brown, shining, adorned with small yellow stripes and spots; lateral lobes brown. Abdomen brown. Cerci stout, brownish. Ovipositor short, straight, with apical valves long, acute and very feebly denticulate.

Anterior and intermediate legs rather short ; femora brownish with a few light spots, bearing long bristles ; tibiae and tarsi testaceous ; anterior tibiae perforated at their outer side. Posterior legs wanting.

Elytra extending almost to the posterior extremity of abdomen, dark brown ; dorsal field presenting four longitudinal veins, separated by false veins as in certain *Trigonidiinae*, lateral field dark with four parallel veins.

Length of body 5.5 mm. ; ovipositor 3 mm.

This is a small species remarkable for the elytral venation which much resembles that of a *Trigonidium*, but I have for other reasons included it in the genus *Nemobius*.

***Scottia minima*, sp. nov.**

Type : 1 ♀, Mangaldai district, Assam-Bhutan Frontier, 25-xii-10 (*S. W Kemp*).

♀ (fig. 7). Apterous, small, rufous brown, with a silvery pubescence and very long black bristles. Head large, rounded, yellowish brown, with brown bands on the occiput ; frontal rostrum wide, presenting four rows of bristles. Palpi concolorous with 4th joint shorter than 3rd, 5th rather long, a little enlarged and darkened at apex. Antennae yellowish, indistinctly ringed with brown. Eyes large, hardly projecting ; ocelli arranged in a triangle.

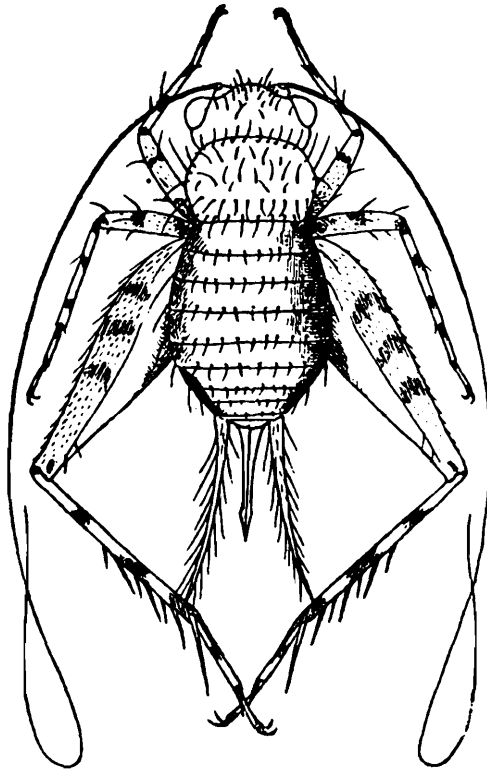


FIG. 7.—*Scottia minima*, sp. nov., ♀.

Pronotum transverse, with anterior and posterior margins straight ; disk convex, rufous, bearing numerous black bristles along the anterior and 2 rows along the posterior margin ; some others scattered chiefly in the anterior part ; lateral lobes rather high, mottled with brown, their inferior margin slightly ascending forwards, posterior angle almost a right-angle but rounded.

Abdomen with parallel margins, rufous, with sides black ; surface very pubescent near the apex with a row of bristles along the posterior margin of each tergite. Cerci long. Ovipositor short, straight, with apical valves rather large, almost wholly smooth, the superior margin of the superior ones scarcely denticulated (fig. 6).

Legs a little lighter than the body, very indistinctly ringed with brown. Anterior and intermediate femora compressed, rather thick ; tibiae shorter than the femora, presenting 3 rather obvious brown rings ; tarsi long, metatarsus a little longer than the other two joints together, base, apex and the 3rd joint brown. Anterior tibiae with a small oval drum at its external face. Posterior femora very much swollen, external face obliquely striated ; tibiae presenting 3 wide brown rings and bearing on each side 3 very long spines which are brown in the middle ; internal spurs very long, the inferior one about two-thirds of the superior which is as long as the metatarsus ; inferior and superior external spurs of the same length, rather short, the middle one twice as long, equalling scarcely half the length of the metatarsus. Metatarsus rather long, brown in middle, with long spurs, especially the internal one ; 3rd joint very long, brown at apex,

Length of body 4.5 mm. ; post. fem. 3.8 mm. ; ovipositor 2.5 mm.

This small species comes very close to *S. salticiformis* Bol. but has distinctly perforated anterior tibiae.

Brachytrypes birmanus, sp. nov.

Type : 1 ♀, Rangoon, Burma, (*J. Claine*, 1902) ; Museum de Paris.

In size equal to *B. orientalis* Burm., brown, very shining. Head as wide as pronotum, forehead with a rather strong, scarce, punctation.

Pronotum with anterior margin a little concave, posterior margin sinuate, sides straight, disk brown with two reddish brown impressed areas, lateral lobes almost entirely yellowish.

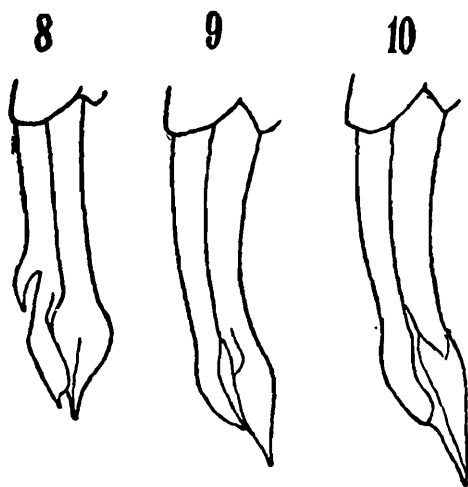


FIG. 8.—Ovipositor of *Brachytrypes birmanus*, sp. nov. ; fig. 9. *id.*, *B. orientalis* Burm. ; fig. 10. *id.*, *B. portentosus* Licht.

Legs slightly pubescent, posterior tibiae with five moderately strong spines on each margin.

Ovipositor very short, straight ; superior valves enlarged at apex and ending in a point, inferior ones deeply notched (fig. 8).

Elytra brown, shining, with very regular veins (3 free veins and 9 branches from the discoidal); transverse veinlets numerous, forming nearly square areolae. Wings caudate.

Length of body 25 mm.; post. fem. 15 mm.; elytra 19 mm.; ovipositor 3 mm.

In general appearance, the shape of the pronotum, which is not at all enlarged anteriorly, and the character of the posterior femora, which are slightly pubescent, this species is somewhat similar to *Gymnogryllus pulvillatus* Sauss., but the shape of its ovipositor shows it to be a true *Brachytrypes*. It is the same size as *B. orientalis* but differs from this species in its pronotum being narrower in front, in the head being smaller, and the ovipositor shorter and with different apical valves (figs. 8, 9).

***Gymnogryllus ruficeps*, sp. nov.**

Type: 1 ♀, Coromandel, alt. ca. 2,500 ft., 23-x-10.

Rather large, blackish brown with reddish head. Head globular, shining; forehead a little sloping; face reddish; the facial shield presenting a deep transverse furrow above the clypeus. Palpi and antennae brownish. Eyes rounded, only slightly projecting; ocelli in a straight line.

Pronotum brown, a little reddish in certain parts, shining, slightly enlarged in front; anterior margin concave, posterior margin sinuate; surface finely shagreened; lateral lobes brown. Abdomen blackish. Cerci brown. Ovipositor missing.

Legs light rufous, rather large. Posterior tibiae armed with five rather strong spines on each side, the two large internal spurs being equal in length.

Elytra brown, shining, dorsal field presenting 9 veins rather close and almost longitudinal, 3 free and ending on the internal margin, the 1st curved over the 2nd, the 4th from the humeral angle giving rise to the 5th, the others arising from the discoidal; veinlets rather numerous, forming a somewhat irregular reticulation especially near the discoidal vein. Wings short.

Length of body 18 mm.

This species resembles *G. erythrocephalus* very much, but is larger, with the posterior femora wholly rufous, the cerci brown at base and the elytral venation somewhat more irregular.

***Gryllus carmichaeli*, sp. nov.**

Types: 1 ♂, 1 ♀, Sukna, alt. ca. 1,000 ft., Darjeeling Dist.; *Carmichael* coll., May 1913.

Size medium. Head and pronotum blackish, contrasting with the testaceous elytra. Head round, almost black, having only a narrow yellow stripe along the eyes. Pronotum transverse, widening very slightly in its anterior third; anterior and posterior margins almost straight; disk weakly convex, a little pubescent, blackish; lateral lobes slightly ascending backwards, spotted with yellow near the anterior angle. Abdomen blackish, pubescent. Legs rufous brown; anterior

tibiae perforated with a large external tympanum and a very small internal one ; posterior tibiae armed with six spines on each side.

♂ (fig. 11). Elytra extending to the posterior extremity of abdomen, with a rather small, obliquely transverse, undivided speculum ; chords much curved, the 1st united to the speculum by 3 small veins, and to the diagonal by one vein a little beneath the middle ; 4 oblique veins, somewhat thickened at base, 1st broken, others only sinuate ; apical field short, with large areas ; lateral field blackish with 6 parallel veins, the mediastinal bearing two stems. Wings abortive.

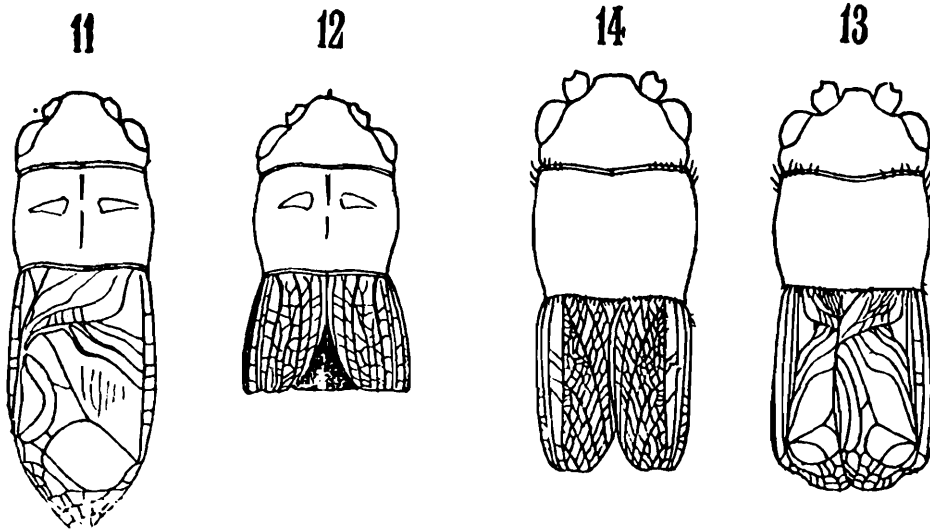


FIG. 11.—*Gryllus carmichaeli*, sp. nov., anterior part of body of ♂ ; fig. 12. *id.*, ♀ ; fig. 13. *Gryllus himalayanus*, sp. nov., anterior part of body of ♂ ; fig. 14. *id.*, ♀.

♀ (fig. 12). Elytra extending only to the posterior margin of 3rd abdominal tergite, widely rounded at apex, overlapping on the median line ; dorsal field with rather thick veins, forming two groups, one composed of the two discoidal veins, and the other of three parallel, slightly curved veins ; between these groups is an incomplete less visible vein ; reticulation rather wide and irregular ; lateral field black, with 6 veins, the mediastinal being furcate. Ovipositor long, with small, lanceolate apical valves.

Length of body ♂ 19 mm., ♀ 18 mm. ; pronot. 5 mm. ; post. fem. 14.5 mm. ; elytra ♂ 12 mm., ♀ 5.5 mm. ; ovipositor 15 mm.

This species seems to come near *G. quadrimaculatus* Sauss., but it is smaller with a quite different colouration ; the elytra of the male are also longer.

***Gryllus himalayanus*, sp. nov.**

Types : 1 ♂, Kurseong, alt. 5,000 ft., E. Himalayas, 9-VII-08 ; 1 ♀ Ghumti, alt. 1,000-3,500 ft., Darjeeling District, E. Himalayas July, 1911 (*F. H. Gravely*).

Rather large, black. Head black, shining, with a yellow spot around the ocelli, the lateral extending up to the eye. Pronotum slightly widening in front, black, with a golden rufous, silky pubescence ; lateral lobes dark brown with inferior margin slightly ascending backwards. Abdomen covered with a silky pubescence. Cerci long, rufous.

Legs rufous, hairy. Anterior tibiae presenting a large, oval, external tympanum and a very small internal one. Posterior femora rather

long ; tibiae bearing 6 spines on each margin ; inferior spurs of the same length ; the two big internal spurs long, especially the middle one, pubescent ; the middle external spur twice as long as the inferior one, superior one slender, like the last spine but a little longer ; metatarsi long, a little compressed, armed with 5-6 denticles above.

♂ (fig. 13). Elytra brown, extending a little beyond the middle of the abdomen, rounded at apex ; speculum small, nearly apical, somewhat oblique, divided in the middle ; apical field reduced to a few cells ; diagonal vein long, straight ; chords parallel, feebly curved ; five oblique veins, the first two of which are strongly sinuate, the others straight, somewhat confused ; anal vein slightly oblique, anal field short, reticulated ; lateral field presenting seven parallel, feebly curved veins and the furcate mediastinal vein.

♀ (fig. 14). Elytra a little shorter than in ♂, with parallel margins and truncated apex ; dorsal field presenting 3 almost straight veins and 3 branches of the discoidal ; reticulation close and rather irregular ; lateral field as in ♂. Ovipositor rather long, straight, with apical valves small and acute.

Length of body 18 mm. ; pronot. 5 mm. ; post. fem. 13.5 mm. ; post. tibiae 11 mm. ; post. tarsi 6.5 mm. ; elytra ♂ 7 mm., ♀ 5.5 mm. ; ovipositor 14 mm.

***Gryllus gravelyi*, sp. nov.**

Types : 1 ♂, 1 ♀, Forest Tramway, mile 10 to 14, Cochin State 28-x-14 (*F H. Gravely*).

♂ (fig. 15). Rather large, dark brown, body and legs very pubescent. Head chocolate-brown, with a yellow spot between the lateral ocelli and the eyes ; face brown.

Pronotum nearly squarish, with almost parallel margins ; disk slightly convex, uniformly brown, with a silky pubescence ; lateral lobes with inferior margin slightly ascending backwards, their inferior part a little lighter. Abdomen brown, with a fine silky pubescence.

Legs brown, the posterior ones long. Posterior femora a little reddish at base ; tibiae armed with 7 external and 6 internal spines ; metatarsi long, serrate on both superior margins.

Elytra extending only to the middle of abdomen, brown and shining ; speculum very much reduced, almost lost among the apical reticulation ; diagonal vein and chords almost straight, close to one another ; 2 oblique veins ; lateral field black, with seven regularly curved veins close together and the mediastinal vein bearing 2 stems.

♀ (fig. 16). Similar to the ♂, but lighter ; occiput showing traces of light bands. Elytra nearly as long as in ♂ ; dorsal field with very intricate venation ; veins, except those of the humeral margin, being lost amongst an abundant reticulation ; lateral field as in ♂, the mediastinal vein having a single branch only. Ovipositor straight, rather long and slender, with apical valves small, lanceolate.

Length of body 17 mm. ; pronot. 4.5 mm. ; post. fem. ♂ 14.5 mm., ♀ 15.5 mm. ; elytra ♂ 6 mm., ♀ 4.5 mm. ; ovipositor 16.5 mm.

G. gravelyi is allied to *G. himalayanus* Chop., but the ♂ has a different speculum and the ♀ has a much more confused venation of the elytra,

Gryllus flavovittatus, sp. nov.

Type : 1 ♀, Nilgiri Hills, alt. 3,500 ft., April, 1910 (*H. L. Andrewes*).

♀ (fig. 17). Rather large, brown, pubescent. Head rounded, shining, but finely pubescent; occiput and forehead dark brown, with a narrow yellow band along the internal margin of the eyes, extending to the lateral ocellus; a very narrow, scarcely visible, yellow line between the ocelli; face brown, shining; antennae and palpi brown.

Pronotum very slightly enlarged in front, with anterior and posterior margins nearly straight; disk pubescent, rufous brown, with a large, irregular, dark spot in middle; lateral lobes concolorous, with inferior margin slightly ascending backwards. Abdomen brown, very pubescent. Ovipositor rather long, straight, with apical valves small, acute.

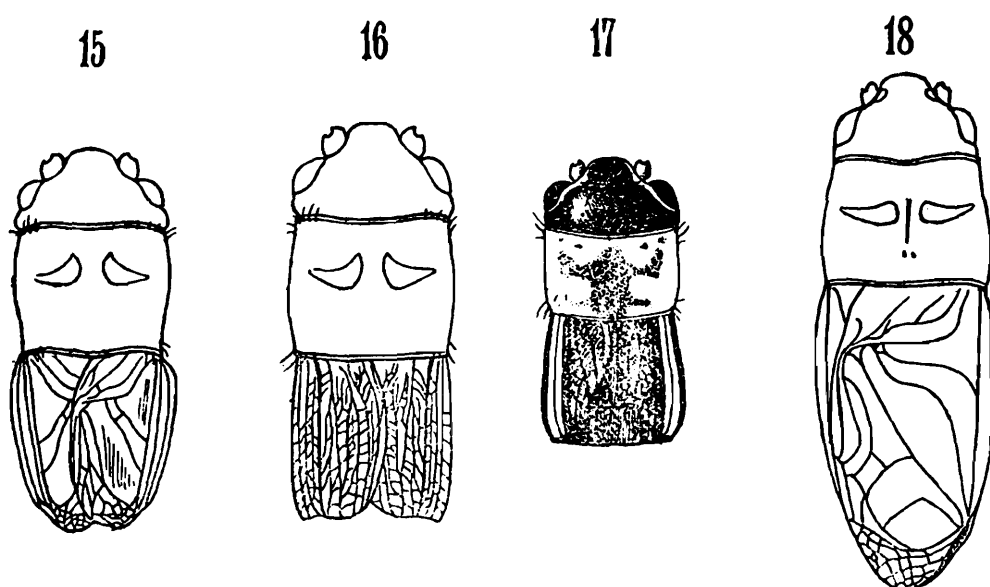


FIG. 15.—*Gryllus gravelyi*, sp. nov., anterior part of body of ♂; fig. 16. *id.*, ♀; fig. 17. *Gryllus flavovittatus*, sp. nov., anterior part of body of ♀; fig. 18. *Gryllopsis fuscus*, sp. nov., ♂.

Legs dark brown. Anterior tibiae bearing a large external tympanum and a small round internal one. Posterior femora rather short and thick; striated with brown at their external face; tibiae armed with 6 rather strong spines on each margin; spurs rather strong, pubescent, the superior internal one shorter than the middle one; matatarsi a little compressed, armed with 6 denticles on each side.

Elytra extending to the posterior margin of second abdominal tergite only, contiguous along the median line, with internal margin strongly oblique, almost black, with a very conspicuous yellow humeral band; dorsal field with four somewhat irregular, sinuate veins; transverse veinlets few and irregular; lateral field high, black, with 6 equidistant veins, mediastinal vein plain.

Length of body 18.5 mm.; pronot. 4 mm.; post. fem. 11 mm.; elytra 4.5 mm.

This species closely resembles *G. carmichaeli*, but it is more slender, elytra more obliquely truncated at their internal margin, with a yellow band, and the ovipositor is shorter.

***Gryllus pallidus*, sp. nov.**

Type : 1 ♂, Sevoke, alt. 1,000 ft., Darjeeling Dist., *Carmichael* coll., March, 1914.

♂ (fig. 19). Size and general shape similar to *Gryllodes sigillatus* Walk. Yellowish brown. Head rounded, presenting 5 indistinct brown bands on the forehead and occiput ; face yellow.

Pronotum a little wider than long ; anterior and posterior margins straight, disk mottled with brown, lateral lobes yellowish. Abdomen yellowish brown, the first four tergites presenting a pair of small round impressed areas on the median line.

Legs yellowish brown. Anterior tibiae perforated at their external face, but having only a depression on the internal one. Posterior femora rather thick and short ; tibiae armed with 6 external and 5 internal spines.

Elytra extending to the apex of third abdominal tergite, nearly transparent, somewhat darkened along the humeral vein and near the chords ; speculum small, quadrangular, divided by 2 veins, forming two cells ; 2 oblique veins ; diagonal long, very much inclined ; chords short, curved, the external one thick, the internal united to the mirror by two veinlets ; apical field very short, irregularly reticulated ; lateral field transparent, with 4 regular, longitudinal veins. Wings aborted.

Length of body 20 mm. ; pronot 3.5 mm. ; post. fem. 11.5 mm. ; elytra 7 mm.

This species is remarkable for its pale colouration and the elytra with the speculum divided into three cells.

***Gryllus castaneus*, sp. nov.**

Types : 1 ♂, 1 ♀, Bombay (*H. M. Lefroy*, 10-vi-04), Pusa Collection, British Museum.

Rather small ; uniformly chestnut brown. Head concolorous, without any markings ; forehead somewhat flattened ; frontal rostrum wide ; face short, the facial shield very convex, somewhat resembling that of *Mogoplistinae*. Palpi rufous, with joints 3, 4 and 5 subequal in length. Antennae brown.

Pronotum transverse, with anterior margin concave, posterior straight ; disk slightly convex, chestnut-brown, with the usual impressed areas a little lighter, covered with a rather abundant silky pubescence ; lateral lobes rather low, with inferior margin slightly ascending backwards. Abdomen brown. Cerci rufous. Ovipositor short, somewhat flattened and not very acute at apex.

Legs light rufous, rather short. Anterior tibiae perforated on either side. Posterior femora rather thick, uniformly rufous at their external face ; posterior tibiae short, presenting 5 internal and 6 external spines the two large internal spurs subequal in length ; metatarsi strongly denticulated.

Elytra extending to the apex of abdomen ; they are, in the male (fig. 20), translucent, smoky, darkened at apex ; speculum markedly transverse, divided much behind the middle ; 2 oblique veins ; apical

field short, presenting 4 veins and a regular reticulation. In the female (fig. 21), dorsal field presenting 4 rather irregular, parallel veins, the mediastinal one bearing 1 branch in the ♂, plain in the ♀. Wings caudate.

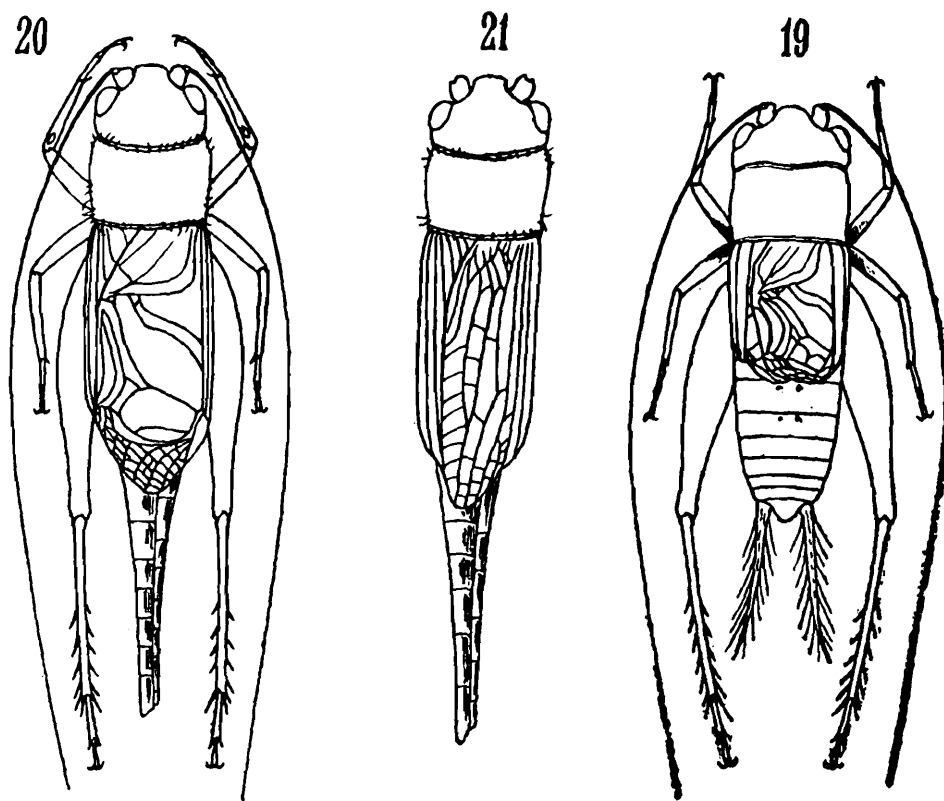


FIG. 19.—*Gryllus pallidus*, sp. nov., ♂ ; fig. 20. *Gryllus castaneus*, sp. nov., ♂ ; fig. 21. *id.*, ♀.

Length of body 12 mm. ; length with wings 19 mm. ; post. fem. 7 mm. ; ovipositor 4·5 mm. ; elytra 7·5 mm.

This small species is distinguishable by its uniform colouration, by the shape of the head, the elytral venation, and by the ovipositor being short and blunt at apex. It belongs to the *conspersus* group.

***Gryllus minimus*, sp. nov.**

Types : 1 ♂, 1 ♀, Sureil, alt. 5,000 ft., Darjeeling Dist., 11—31-x-17 (*N. Annandale and F. H. Gravely*).

Very small species, brown, mottled with fawn, like *G. chinensis*. Head brown, shining ; occiput adorned with 5 yellow lines ; cheeks and inferior part of face yellow ; without yellow stripe between eyes. Palpi brownish, 4th joint of maxillary palpi much shorter than 5th.

Pronotum mottled with yellow above, lateral lobes brown. Abdomen brown above, yellowish beneath.

Legs yellowish, marbled with brown bands and spots. Anterior tibiae perforated on both sides. Posterior femora rather thick ; tibiae armed with 5 spines on each superior margin.

♂. Elytra extending to the apex of abdomen ; anal vein with rounded angle ; speculum large, nearly as long as wide, anterior and external angles of 90°, posterior and internal angles rounded, undivided ; diagonal vein rather long, straight ; 4 oblique veins, parallel, slightly sinuate ;

apical field very short ; lateral field black in its superior part, whitish inferiorly, the plain mediastinal vein and 4 other veins feebly curved at base and converging a little towards the apex.

♀. Elytra covering scarcely half the abdomen, rounded at apex ; dorsal field with 6 veins rather close together, nearly longitudinal, slightly irregular and anastomosing ; lateral field coloured as in male, presenting 4 plain, equidistant veins. Ovipositor rather short, a little curved, with apical valves small, lanceolate, acute.

Length of body 8.5 mm. ; pronot. 2 mm. ; post. fem. 6.5 mm. ; elytra ♂ 5.5 mm. ; ♀ 3 mm. ; ovipositor 5 mm.

This species is distinguished by its very small size ; it closely resembles *G. clarellus* Sauss., but differs from it in the number of oblique veins and in having an undivided speculum.

I formerly separated from Saussure's old genus *Gryllodes* *G. parviceps* Walk. (type of the genus *Itaropsis* Chop.) and the species of the *pipiens* group (*Eugryllodes* Chop.). I now think it necessary to create the genus *Gryllopsis* for the species with large rounded head, nearly cylindrical body, elytra slightly shortened in the males, very short in the females. This genus *Gryllopsis* partly corresponds to the second and fifth groups of Saussure's *Gryllodes* ; the type is *G. hebraeus* Sauss.

***Gryllopsis pubescens*, sp. nov.**

Type : 1 ♀, Ghumti, alt. ca. 4,000 ft., Darjeeling Dist., E. Himalayas, July, 1911 (*F. H. Gravely*).

Size medium ; testaceous, varied with brown, thickly pubescent, Head as wide as pronotum, rounded, forehead slightly flattened ; occiput and forehead rather dark brown, the former adorned with 6 yellow stripes ; internal margin of eyes narrowly lined with yellow ; face yellowish, mottled with brown. Palpi with 4th joint shorter than 3rd and 5th. Antennae brown.

Pronotum slightly narrow both in front and behind, with anterior and posterior margins nearly straight ; disk a little convex, mottled with brown ; lateral lobes with inferior margin slightly ascending backwards, inferior part yellowish, the extreme margin and superior part dark brown. Abdomen nearly cylindrical, tergites mottled with brown along their posterior margin. Ovipositor rather long, straight, with apical valves narrow, acute.

Legs mottled with brown, tibiae feebly ringed. Posterior tibiae armed with 5 internal and 6 external spines, the 1st external being very short.

Elytra very short, widely separated from each other, internal margin very obliquely truncated ; dorsal field very much reduced, with 3 small veins ; lateral field larger, with 4 longitudinal veins.

Length of body 12 mm. ; pronot. 3.5 mm. ; post. fem. 10.5 mm. ; elytra 1.5 mm. ; ovipositor 10 mm.

This species comes very close to *G. terrestris* Sauss. (= *fuscopunctatus* Chop.) but its elytra are much shorter. A second specimen is much lighter than the type and has a somewhat longer ovipositor.

Gryllopsis fuscus, sp. nov.

Types : 1 ♂, 1 ♀, Parambikulam, alt. 1,700-3,200 ft., Cochin State, 16-24-ix-14 (*F. H. Gravely*).

Size medium ; dark brown with rufous legs. Head globular, shining, brown above ; face and ocelli yellow ; palpi light yellow. Pronotum transverse, slightly narrowing in front, anterior margin slightly concave, posterior straight ; disk rather convex, dark brown, with two triangular reddish brown impressed areas ; lateral lobes whitish with a silky pubescence, their inferior margin straight, black. Abdomen dark brown above, yellowish beneath. Cerci brown.

Legs reddish brown. Posterior femora rather strong, darkened at apex, with a pale, ill-defined, anteapical ring ; tibiae with 5 internal and 6 external spines.

♂ (fig. 18). Elytra extending to the apex of abdomen, dark brown, narrowing a little posteriorly ; speculum nearly as long as wide, with rounded angles, divided by an angular vein ; chords feebly curved, united to the mirror by a veinlet ; two diverging oblique veins ; apical field short, divided into small square areolae ; lateral field presenting the mediastinal vein with two stems and 6 parallel close-set veins. Wings short.

♀. Elytra extremely short, reduced to very small, lateral lobes, nerves hardly visible. Ovipositor short, straight, with apical valves furcate, the inferior being much shorter than the superior ones.

Length of body ♂ 14 mm., ♀ 16.5 mm. ; pronot. 3.5 mm. ; post. fem. ♂ 11.5 mm., ♀ 12 mm. ; elytra ♂ 9 mm., ♀ 0.6 mm. ; ovipositor 8.5 mm.

This species is very close to *G. rufoniger* Chop., but differs from it in having a more uniform colouration of the head and pronotum ; in *G. rufoniger*, moreover, the male elytron presents 3 oblique veins, those of the female being much longer. The ovipositor is shorter in *G. fuscus*, with the apical valves formed as in *G. virgulatus* Bol. This latter species also comes very close to *G. fuscus*, but it is smaller, the ♂ being somewhat depressed and the ♀ wholly apterous.

Cophogryllus ornatus, sp. nov.

Type : 1 ♀, Mungphu, alt, ca, 4,000 ft., Darjeeling Dist., 11—31-x-17 (*N. Annandale and F. H. Gravely*).

♀ (fig. 22). Small, apterous, dark brown, adorned with rufous spots. Head as wide as pronotum in front, brown, shining ; forehead a little sloping ; frontal rostrum narrow ; face rufous. Palpi yellowish ; 7th joint of maxillary palpi much shorter than 3rd, 5th large, triangular.

Pronotum shining, narrowing a little in front and behind, brown, variegated with rufous ; disk convex, with sides much rounded ; lateral lobes brown, with inferior margin slightly ascending backwards, anterior angle of about 90°, posterior one a little rounded. Mesonotum, metanotum and abdominal tergites brown, adorned with two large rufous spots. Cerci brown. Ovipositor rather short, straight, with apical valves a little curved, beak-like, the inferior being shorter than the superior.

Legs rather long, yellowish rufous. Anterior tibiae unperforated. Posterior femora rather thick, striated with brown on their external face ; tibiae rather short, armed with 3 spines on each margin ; tarsi long, especially the metatarsi.

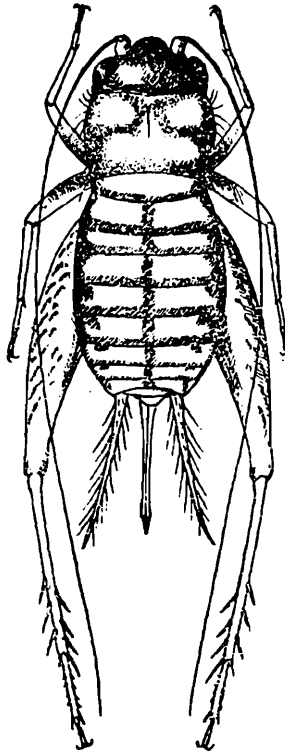


FIG. 22.—*Cophogryllus ornatus*, sp. nov., ♀.

Length of body 8·5 mm. ; post. fem. 6·5 mm. ; ovipositor 5 mm.

A second dry specimen of this species, much better preserved than the *type*, shows an abundant pubescence with fewer bristles, with the result that the pronotum is not so shining and the rufous spots are less conspicuous.

***Cophogryllus brunneus*, sp. nov.**

Type : 1 ♀, Siripur, Saran, Bihar, Aug., 1913 (*M. Mackenzie*).

Size small, brown, pubescent. Head as wide as pronotum, black, shining, without any ornament ; forehead slightly sloping ; frontal rostrum wide ; face brown. Antennae rufous. Ocelli very small.

Pronotum wide, rather markedly narrowing posteriorly ; anterior margin a little concave, posterior straight ; disk brown, pubescent, very slightly tinged with yellowish near the posterior margin ; lateral lobes black, with inferior margin very little ascending backwards. Abdomen rather narrow, strongly pubescent, brownish. Ovipositor short, straight, apical valves small and very acute.

Legs brownish. Posterior femora rather thick ; tibiae armed with 5 external and 4 internal spines ; metatarsi rather long, serrulate.

Length of body 10 mm. ; post fem. 7 mm. ; ovipositor 5·5 mm.

This small species has very much the same general shape as *Cophogryllus martini* Bol., but its head is wholly black above and the ovipositor is much shorter.

Cophogryllus angustus, sp. nov.

Type : 1 ♀, Singla, Darjeeling dist. (Coll. Chopard).

♀ (fig. 23). Size medium ; elongate, narrow ; uniformly blackish brown with rufous legs. Head rounded, shining ; frontal rostrum narrow. Palpi rufous ; 4th joint of the maxillary palps a little shorter than 3rd, 5th triangular, obliquely truncated at apex.

Pronotum longer than wide, slightly narrowing posteriorly ; anterior margin a little concave, posterior straight ; lateral lobes rather high, with posterior angle very much rounded. Mesonotum very short. Metanotum and abdomen blackish brown ; abdomen as wide as pronotum, with nearly parallel margins. Ovipositor rather long, slender, with very narrow, lanceolate apical valves.

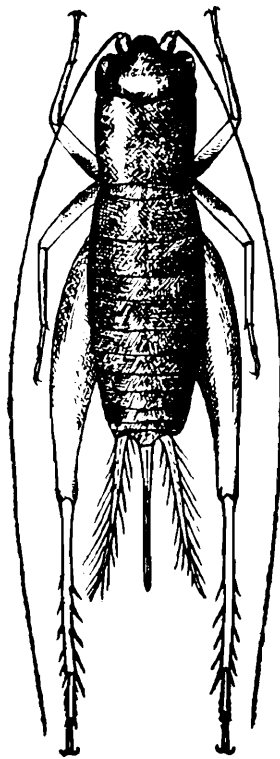


FIG. 23.—*Cophogryllus angustus*, sp. nov. ♀.

Legs rather long. Anterior tibiae unperforated ; anterior and intermediate tarsi short, the metatarsus equalling the 3rd joint. Posterior femora rather large, a little darker than the other legs ; tibiae much shorter than the femora, armed with 5 external and 4 internal spines ; metatarsi rather strong, pubescent, with 4 or 5 denticulations.

Length of body 13.5 mm. ; pronot. 3 mm. ; post. fem. 9 mm. ; post. tibiae 6 mm. ; ovipositor 7 mm.

Cophogryllus maindroni, sp. nov.

Type : 1 ♀, Cote de Malabar, Mahé (*M. Maindron*, 1902) ; Museum de Paris.

Rather large, entirely apterous ; shape and general appearance of a female *Gryllopsis*, but with a large head and pronotum widening rather strongly in front. Head globular, brown, shining ; occiput with indistinct short light bands ; cheeks spotted with yellow ; face rufous ; palpi

whitish, 4th joint equal to 3rd, 5th longer, feebly enlarged at apex. Antennae brown, slender. Eyes much flattened, their convexity not stronger than that of the head ; ocelli yellow.

Pronotum widening in front, with anterior and posterior margins nearly straight ; disk convex, brown ; lateral lobes with inferior margin slightly ascending backwards, their inferior part yellowish, especially in the anterior region, the extreme margin brown. Mesonotum, metanotum and abdomen brown above, yellowish beneath. Ovipositor rather long, very slender, with apical valves extremely narrow and acute.

Legs lighter than the body. Anterior and middle tibiae a little compressed, anterior tibiae without any perforation ; metatarsi a little longer than the other two joints together. Posterior femora thick, their external face somewhat rufous, unicolorous ; tibiae armed with 5 spines on each side ; spurs strong, the 2 large internal ones equal in length, the external middle one very long ; metatarsi compressed, rather long, armed with 5 internal and 7 external denticles.

Length of body 17 mm. ; pronot. 4 mm. ; width of pronot. anteriorly 5.1 mm., posteriorly 4.5 mm. ; post. fem. 12 mm. ; ovipositor 12.5 mm.

This species is distinguishable from other species of *Cophogryllus* by its large size, the pronotum widening in front, and by the very narrow apical valves of the ovipositor.

***Scapsipedus latithorax*, sp. nov.**

Type : 1 ♂, Pusa, Bihar ; (*H. M. Lefroy*, June, 1907), at light ; British Museum.

♂ (fig. 24). Small, blackish brown. Head large ; occiput and forehead convex, black, shining, without any marking ; face distinctly depressed ; mouth-parts somewhat lengthened, as in small individuals of *S. mandibularis* Sauss. ; palpi rufo-testaceous.

Pronotum distinctly transverse, with anterior and posterior margins straight ; disk feebly convex, blackish, pubescent ; lateral lobes slightly ascending backwards, tinged with yellow, their extreme inferior margin black. Abdomen brownish.

Legs rufo-testaceous, a little mottled with brown ; anterior tibiae perforated at their external face, the internal face being only depressed. Posterior femora thick, weakly striated with brown at their external face ; tibiae armed with 5 spines on each side.

Elytra extending to the apex of abdomen ; speculum lozenge-shaped ; divided beneath the middle by a curved vein ; 3 oblique veins ; diagonal vein very close to the first chord ; apical field short, widely reticulated ; lateral field darkened along the humeral vein, presenting 5 oblique, rather regular veins ; mediastinal vein bearing 2 branches. Wings caudate.

Length of body excluding wings 10 mm., including wings 18.5 mm. ; pronot. 2 mm. ; post. fem. 7.5 mm. ; elytra 7 mm.

This small species differs from the other species of the genus by its very wide pronotum, in the absence of markings on the head and by the elytral venation.

Scapsipedus parvus, sp. nov.

Types : 1 ♂, 1 ♀, Sitong ridge, alt. ca. 4,700 ft., Darjeeling dist., 22—28-x-17 (*N. Annandale and F. H. Gravelly*).

Very close to *S. mandibularis* Sauss., but smaller. Head presenting 6 narrow, yellow stripes on the occiput, and a yellow band uniting the lateral ocelli. Face rather strongly flattened, but the mandibles much less lengthened than in *S. mandibularis*, being nearly normal in shape.

Pronotum as in *S. mandibularis*.

Elytra of male extending to the apex of abdomen, with speculum wider than long, rounded posteriorly, divided about the middle by a curved vein; apical field very short; lateral field with regular parallel veins. Elytra of female scarcely extending to the middle of the abdomen, with longitudinal veins in the dorsal field; transverse veinlets numerous and forming a very irregular, lengthened reticulation.

Length of body 12.5 mm.; post. fem. 10 mm.; elytra ♂ 8 mm., ♀ 4.5 mm.; ovipositor 11.5 mm.

Scapsipedus ceylonicus, sp. nov.

Types : 1 ♂, Peradeniya, Ceylon, 14-v-10; 1 ♀, Latrigama, Ceylon, 28-xi-09.

Small, light brown. Head wide, rounded, adorned with 6 faintly visible light bands on the occiput, and a transverse narrow, yellow band between the antennae; face yellowish, facial shield a little darker with a yellow median band extending to the ocellus. In the male, the face is rather strongly flattened, the forehead is, however, only slightly projecting and the mandibles present a normal shape.

Pronotum slightly widening in front in both sexes; anterior margin a little concave, posterior straight; disk light rufous brown, dull; lateral lobes with superior part dark, inferior part very light, the distinction between the two parts very conspicuous.

Legs testaceous. Posterior tibiae armed with 5 internal and 6 external spines.

♂. Elytra extending to the apex of abdomen; speculum rather large, subquadrangular, divided much behind the middle; chords united to the speculum by a small vein coming near the angle; diagonal vein a little sinuate; 2 oblique veins; lateral field a little darker, presenting 6 very close and regular veins, and the mediastinal one having two branches more distant from each other. Wings short.

♀. Elytra extending to the middle of the abdomen only; dorsal field presenting 4 free veins and 2 branches from the discoidal; transverse veinlets numerous and irregular; lateral field with 6 regular veins, the mediastinal and the first one being furcate near the apex. Ovipositor broken.

Length of body ♂ 12.5 mm., ♀ 11.5 mm.; pronot. 2.5 mm.; elytra ♂ 7 mm., ♀ 4 mm.

S. ceylonicus is very close to *S. parvus* Chop., but with the head still less differentiated. The colouration and shape of the pronotum are characteristic of the species, and the elytra of the female are shorter than in the other species of the genus.

***Loxoblemmus latifrons*, sp. nov.**

Types : 2 ♀, Chiplun, Vashishti Valley, Ratnagiri dist. (*F. H. Gravely*, May, 1912) ; coll. Chopard and Indian Museum.

♀ (fig. 25). Rather small, testaceous, a little variegated with brown. Head wide ; occiput slightly convex, adorned with 3 wide rufous stripes ; frontal process short, very wide, a little angular at apex ; face (fig. 26) wholly flattened in its upper part, forming almost a triangle without any projecting angle, margins a little curled, disk slightly concave, and presenting a few transverse ridges. Mouth-parts very short ; palpi pale yellow. Antennae very slender, with 1st joint small, plain.

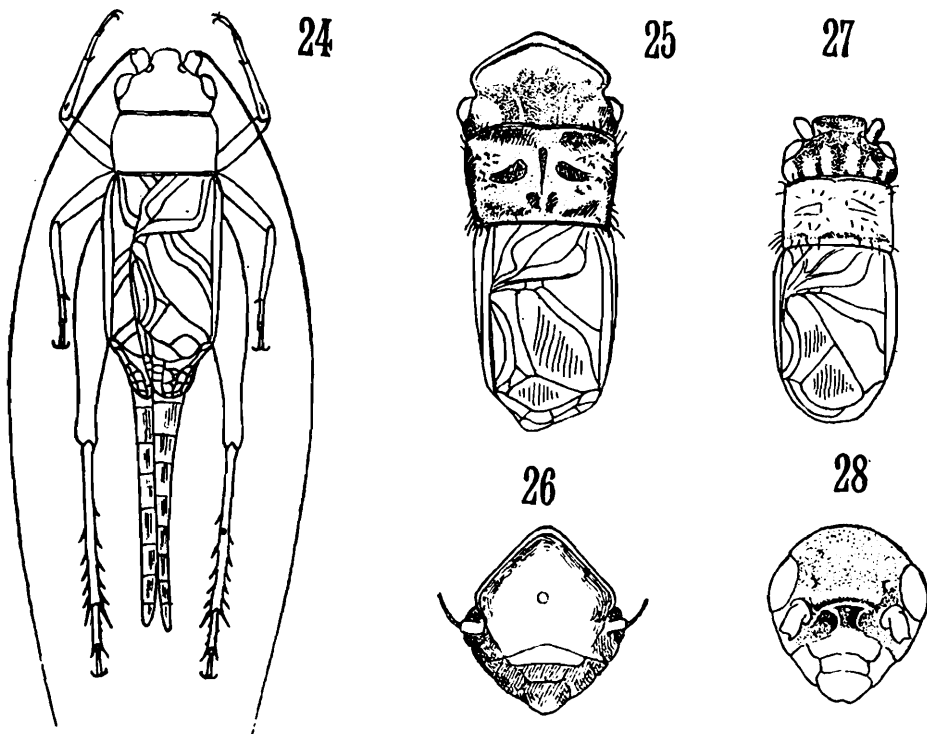


FIG. 24.—*Scapsipedus latithorax*, sp. nov., ♂ ; fig. 25. *Loxoblemmus latifrons*, sp. nov., anterior part of body of ♂ ; fig. 26. *id.*, facial shield seen from in front ; fig. 27. *Loxoblemmus cavifrons*, sp. nov., anterior part of body of ♂ ; fig. 28. *id.*, frontal view of head.

Pronotum wide, with anterior and posterior margins straight ; disk a little mottled with brown ; lateral lobes very pale, except their superior part, which is brown. Abdomen brown above, yellowish beneath.

Legs rather short, testaceous. Anterior tibiae perforated by a large external tympanum. Posterior tibiae armed with 4 or 5 spines on each margin, the 1st being very small ; spurs rather strong, the two large internal ones equal in length ; metatarsus rather short, with 5 internal and 7 external strong denticles.

Elytra extending to the apex of abdomen, brownish. Speculum very small, distinctly transverse ; diagonal vein long, almost straight ; chords slightly curved, the internal united with the mirror by a veinlet ; 2 oblique veins, the 1st a little sinuate, the 2nd straight ; apical field very short ; lateral field blackish along the edge, becoming almost transparent beneath, presenting 3 straight, equidistant veins.

Length of body 9.5 mm. ; pronot. 2.5 mm. ; post. fem. 7 mm. ; elytra 5 mm.

This is a small species, easily recognizable by the shape of the frontal process and by the elytral mirror.

***Loxoblemmus cavifrons*, sp. nov.**

Type : 1 ♂, Pondicherry (*M. Maindron*, 1881) ; Museum de Paris.

♂ (fig. 27). Small, rufo-testaceous. Head rather large, globular, shining ; occiput presenting 5 light lines ; forehead entirely dark brown, frontal rostrum very wide, truncated and feebly concave at apex ; face brown, except the clypeus and the bottom of facial shield, which are yellowish ; shield axe-shaped (fig. 28) and forming a rather deep hollow. Palpi yellow, 4th joint of maxillary palps shorter than 3rd.

Pronotum wide, with anterior and posterior margins straight, sides parallel ; disk rufo-testaceous, with posterior margin slightly darkened ; lateral lobes very pale, their inferior margin straight. Abdomen yellowish.

Legs yellowish. Anterior tibiae perforated at their external face only. Posterior legs wanting.

Elytra extending to the apex of abdomen, nearly transparent, darkened at both base and apex ; anal field small, the anal vein highly curved ; speculum rather large, almost square ; diagonal vein long, straight ; chords slightly curved, very distant from the diagonal ; 2 oblique veins, slightly diverging, the longer one very sinuous ; apical field extremely short.

Length of body 8.5 mm.

Loxoblemmus cavifrons is a very small species distinguished by the shape of the frontal rostrum and of the facial shield.

***Landreva semialata*, sp. nov.**

Type : 1 ♀, Talewadi near Castle Rock, N. Kanara Dist., 3-x-16 (*S. Kemp*).

♀ (fig. 29). Size rather large, rufous brown. Head shining, without any ornamentation ; palpi whitish.

Pronotum widening a little anteriorly, with anterior margin rather strongly concave, posterior straight ; disk uniformly brown ; lateral lobes with inferior margin slightly ascending backwards, black, anterior angle yellowish, covered with a whitish pubescence. Abdomen brownish, pubescent, with small black spots along the posterior margin of the tergites. Ovipositor straight, long, with apical valves narrow and equal in length, as in species of the genus *Gryllus*.

Legs lighter than the body, a little mottled with brown ; anterior tibiae perforated at their external face only. Posterior legs wanting.

Elytra extending no farther than the 1st abdominal tergite, but touching each other along the median line ; dorsal field very obliquely truncated at apex, the internal margin short, much rounded ; 5 longitudinal nerves, faintly visible, and united by a very irregular reticulation ;

humeral band light-coloured ; lateral field rather high, with 5 regularly distant, parallel veins, the mediastinal one furcate near the apex.

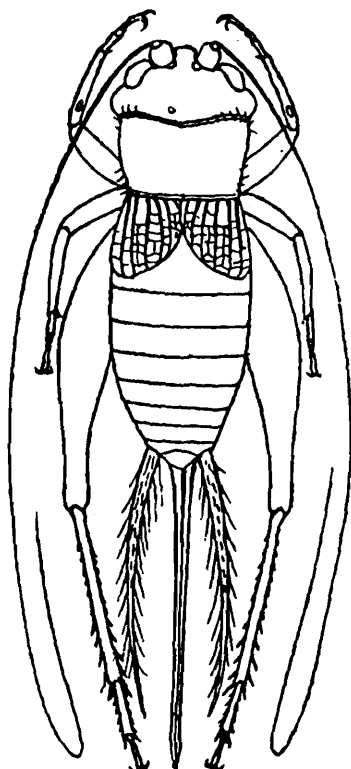


FIG. 29.—*Landreva semialata*, sp. nov., ♀.

Length of body 19 mm. ; pronot. 4·5 mm. ; elytra 3 mm. ; ovipositor 14 mm.

***Myrmecophila albicincta* Chop. var. *concolor*, nov.**

Type : 1 ♂, Matiana, alt. 8,000 ft., Simla Hills, 28—30-iv-07 (*N. Annandale*).

Size and shape of *M. albicincta* but without any light band on the mesonotum ; 10th abdominal tergite rather strongly notched, forming two small tubercles bearing a few bristles. Armature of the legs exactly as in *albicincta* but metatarsus a little thicker, bearing 3 spinelets.

Length of body 3 mm.

This form is perhaps a distinct species, but the males alone are very difficult to separate in this group.

***Myrmegryllus*, gen. nov.**

General shape and habit of *Myrmecophila* ; forehead pubescent ; inferior margin of posterior femora bearing small tubercles ; tibial spines and spurs as well as posterior metatarsi and their spurs provided with a very long pubescence.

***Myrmegryllus pilipes*, sp. nov.**

Type : 1 ♂, Peradeniya, Ceylon, 16-v-10.

Small, dark brown. Frontal rostrum rather narrow, its sides angulate, with a rather long pubescence. Maxillary palpi with 4th joint very

short and dilated at apex, 5th large, elongate and triangular. Antennae rather thick, brown, with a short pubescence. Eyes small.

Pronotum wide, with anterior margin almost straight. Abdomen dark brown, a little lighter towards the apex, 10th tergite with much projecting angles; superior anal valve triangular, small; subgenital plate a little notched at apex. Cerci rather long, not very thick, showing 11 distinct joints.

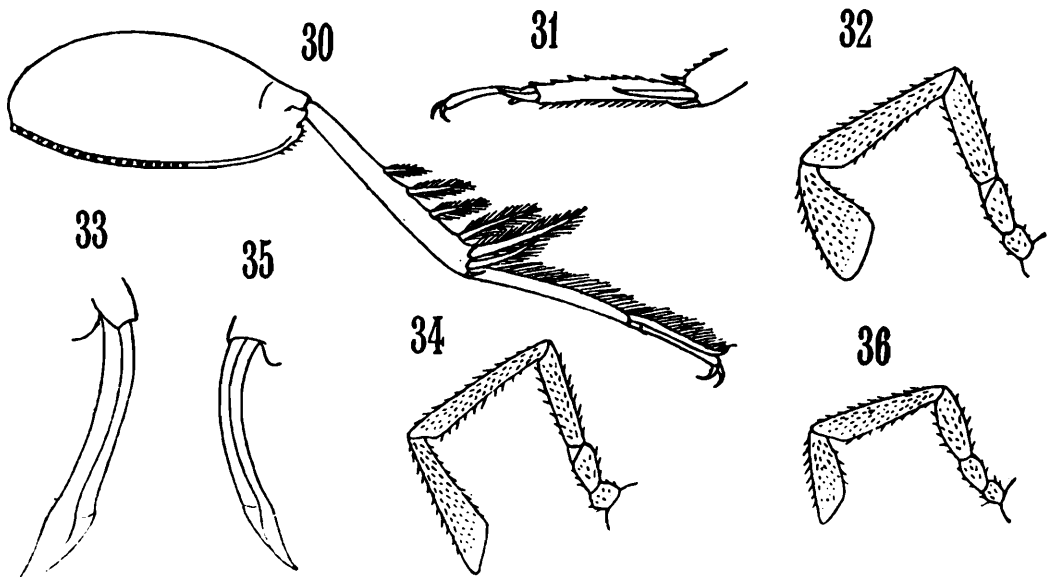


FIG. 30.—*Myrmegryllus pilipes*, sp. nov., external face of posterior leg; fig. 31. *Cryptoptilum indicum*, sp. nov., apex of posterior tibia and tarsus; fig. 32. *Cryptoptilum maindroni*, sp. nov., maxillary palpus; fig. 33. *id.*, ovipositor; fig. 34. *Ornebius ceylonicus*, sp. nov., maxillary palpus; fig. 35. *id.*, ovipositor; fig. 36. *Ornebius henryi* Chop., maxillary palpus.

Legs a little lighter than the body; anterior and intermediate ones rather long and slender, tarsi very long, about three-fourths of the length of the tibiae. Posterior femora (fig. 30) relatively slightly swollen, their inferior margin slightly convex, presenting a row of about 15 small rounded tubercles. Tibial spines and spurs very hairy (fig. 30); 4 internal spines, 1st a little shorter than the 2nd, the latter equal to the 3rd, 4th very long; only one rather long external spine; superior spurs very long, intermediate ones about half as long, inferior ones very short; tarsi long, the metatarsus presenting 2 small spines above on the median line, its superior margins also provided with a very long and thick pubescence; metatarsal spurs very long, equal in length, extending to the apex of 3rd joint and provided with the same long pubescence.

Length of body 3.2 mm.

***Cryptoptilum indicum*, sp. nov.**

Type: 1 ♂, Trichur, Cochin State, 1-x-14 (*F H. Gravely*).

♂ (fig. 37). Rufous brown. Head as wide as pronotum; occiput convex; forehead sloping, frontal rostrum short and wide, undivided, rounded at apex; face short, the facial protuberance feebly projecting, presenting two small impressions. Palpi dark brown; maxillary palpi with 4th joint longer than 3rd, 5th scarcely equal to 4th, feebly enlarged at apex, with superior and inferior margins nearly straight. Antennae extremely slender. Eyes small.

Pronotum wide in front, rather strongly expanded posteriorly, with lateral margins somewhat convex. Abdomen brown, a little depressed ; subgenital plate wide, rounded.

Legs short, covered with brown scales. Anterior tibiae perforated on their internal face ; metatarsi thick, 3rd joint of the tarsi long. Posterior femora short, rather thick ; tibiae flattened above, with serrulate margins ; internal spurs rather long, specially the middle one ; external spurs much shorter than the internal, but still relatively long, the middle one longer than the other two ; metatarsi rather strong, with superior margins serrulate ; 3rd joint very slender (fig. 31).

Elytra wholly concealed by the pronotum.

Length of body 8 mm. ; pronot. 4 mm. ; post. fem. 5.5 mm.

This species of *Cryptoptilum* differs from the American species of the genus in the shape of the pronotum.

***Cryptoptilum maindroni*, sp. nov.**

Types : 1 ♂, 1 ♀, Coonoor, Nilgiri hills (*M. Maindron*, 1902); Museum de Paris.

♂ (fig. 38). Rather small ; dark brown, with grey and brown scales. Head as wide as the anterior margin of pronotum ; forehead sloping, with two small impressions near the base of the rostrum ; rostrum very wide, rounded, presenting an inconspicuous median ridge ; facial protuberance rather strongly projecting. Palpi brown (fig. 32) ; 4th joint of maxillary palpi much longer than 3rd and 5th, the 5th relatively short and wide, triangular. Antennae very slender, yellowish, with a

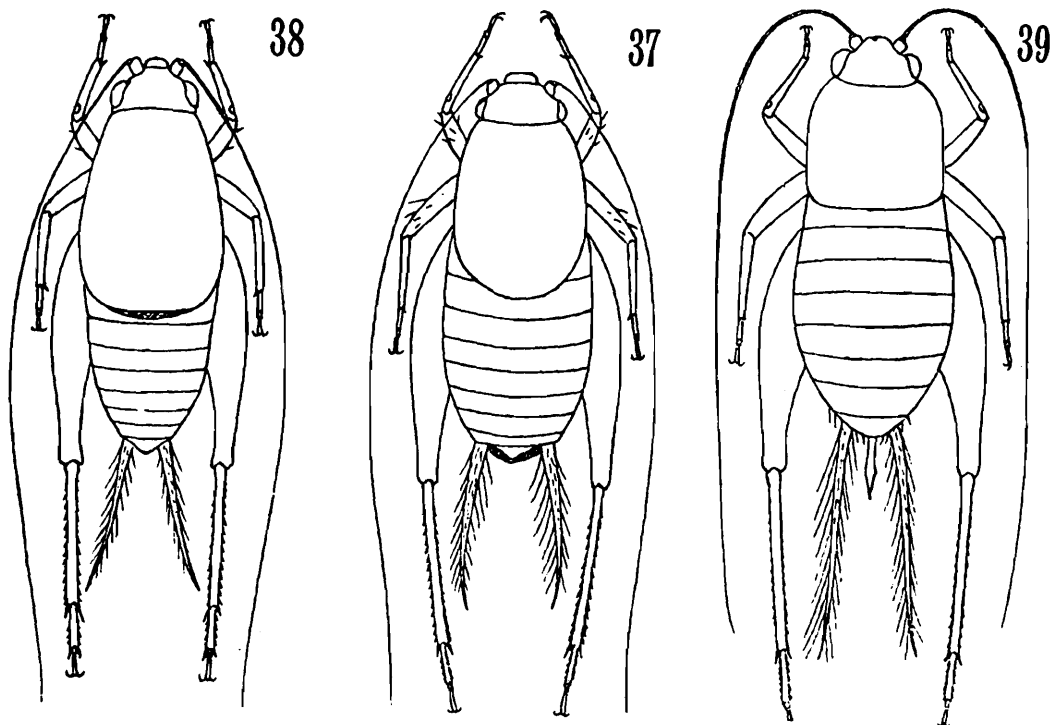


FIG. 37.—*Cryptoptilum indicum*, sp. nov., ♂ ; fig. 38. *Cryptoptilum maindroni*, sp. nov., ♂ ; fig. 39. *Ornebius ceylonicus*, sp. nov., ♀.

few brown rings. Eyes small, rounded ; lateral ocelli visible near the antennal sockets but exceedingly small.

Pronotum narrowing slightly in front, produced backwards, but its posterior margin nearly straight; disk slightly convex, brown. Abdomen a little depressed, brown; last tergite large, triangular; subgenital plate very wide; anal valves without any process. Cerci rather long, slender.

Legs short; anterior and middle tibiae with a small ring of yellowish scales; anterior tibiae bearing a small, round tympanum near their base; tarsi short, the metatarsus equalling the other two joints. Posterior femora rather long, not very thick; tibiae slightly compressed, with two small yellowish rings near the base, their superior margins serrated; external spurs short, internal ones a little longer, the middle spur on each side the longest; metatarsi compressed, yellowish at base, serrated, 3rd joint short, slender.

Elytra very short, visible only behind the median part of the posterior margin of pronotum.

♀. Head and legs as in male. Pronotum longer than wide, with anterior and posterior margins nearly straight, sides a little convex. Ovipositor short, a little curved, with apical valves rather long, lanceolate and acute (fig. 33).

Length of body ♂ 7 mm., ♀ 8 mm.; pronot. ♂ 3.5 mm., ♀ 2.5 mm.; post. fem. ♂ 5 mm., ♀ 5.5 mm.; ovipositor 3.5 mm.

The male of this species is recognisable by the shape of the pronotum; the female looks very much like *O. ceylonicus* Chop., but is readily distinguished by the shape of the palpi which are more similar to *C. henryi* Chop., also from Ceylon (fig. 36).

***Crnebius ceylonicus*, sp. nov.**

Type: 1 ♀, Kandy, Ceylon, 12-vi-10.

♀ (fig. 39). Size medium. Very dark brown; abdomen and legs covered with scales. Head as wide as pronotum in front, with forehead a little flattened, sloping; rostrum wide but very short; frontal protuberance rounded, rather projecting, presenting a scarcely visible smooth median ridge. Maxillary palpi (fig. 34) light, especially the last two joints, 4th joint longer than 3rd and 5th, the last one triangular, slightly widening at apex. Antennae very slender, yellowish, with a few brown, somewhat nodular joints. Eyes large, rounded; ocelli very small, the anterior one not perceptible.

Pronotum as long as wide, very slightly narrowing in front, anterior margin a little concave, posterior straight; disk weakly convex, brown, shining; lateral lobes very little raised, with inferior margin a little notched, angles very much rounded.

Abdomen brown, a little enlarged in the middle; subgenital plate very short, rounded. Cerci rufous. Ovipositor very short, a little curved near the base, with apical valves very large, smooth and lanceolate (fig. 35).

Legs short, with brown scales. Anterior tibiae perforated with a small round tympanum on the internal face. Posterior femora rather strong, swollen; tibiae short, a little curved, provided with minute denticles on their superior margins; internal spurs long, especially the

middle one, inferior decidedly longer than the superior (which is somewhat reflected to the superior margin); external spurs shorter than the internal, but presenting the same proportions; metatarsi rather long, their superior margin armed with 7 or 8 denticles.

Length of body 7 mm.; pronot. 2.5 mm.; ovipositor 3 mm.

This species looks very much like *O. leucopygus* Chop., but is smaller, with narrower frontal protuberance and with the ovipositor a little longer and not so straight. Both these species have the appearance of a *Mogoplistes*.

***Pseudendacustes*, gen. nov.**

Close to *Endacusta* Br. and *Parendacustes* Chop. Head with frontal rostrum very narrow; lateral lobes of pronotum triangular, with inferior margin ascending backwards; anterior femora presenting a small internal tympanum; posterior tibiae with medio-external spur longer than the other two, supero- and medio-external spurs equal in length. Elytra covering about three-fourths of the abdomen in both sexes; ♂ without any very distinct speculum, numerous oblique veins; ♀ with longitudinal veins.

***Pseudendacustes gravelyi*, sp. nov.**

Types: 1 ♂, 1 ♀, Forest tramway, miles 10 to 14, Cochin State. 29-ix-14 (*F. H. Gravely*).

♀ (fig. 40). Rather small, rufous, shining. Head a little wider than the pronotum in front, rufous; forehead much excavated, frontal rostrum very narrow, presenting a furrow, the edges of which converge forwards; a few long bristles at apex; face rufous, elongate. Maxillary palpi rather slender, a little darkened, with 4th joint a little shorter than 5th and equalling 3rd. Eyes large, projecting, rounded; ocelli small, the anterior one at the extreme apex of the rostrum, but visible from above, lateral ones at base of rostrum, very close owing to the narrowness of the rostrum. Antennae rufous at base, brown distally.

Pronotum dark brown, adorned with two rufous stripes on each side; anterior margin slightly convex, posterior slightly concave; disk shining, somewhat embossed; lateral lobes triangular, with inferior margin strongly ascending backwards; anterior angle a little rufous.

Abdomen brownish. Cerci long. Ovipositor broken.

Legs a little lighter than the body, rather long, provided with short and strong bristles. Anterior tibiae slender, having on their internal face a depression and a small tympanum; tarsi very long and slender, the metatarsus a little darkened, in length equalling the other joints together, armed beneath with spiniform bristles. Posterior femora rather large, with filiform apical part very much reduced; tibiae armed with 4 external and 3 internal rather short spines, denticulated up to the base; middle external spur twice as long as the inferior, which is a little longer than the superior; infero-internal spur short, middle and superior ones long and equal in length; metatarsi darkened except at base, armed above with a row of 5 to 6 denticles.

Elytra brown, shining, extending to three-fourths the length of the abdomen (this is much retracted), with projecting veins; dorsal field

with 5 longitudinal, somewhat diverging veins, transverse veinlets fairly numerous, feebly visible, irregular ; lateral field with 3 longitudinal, plain veins.

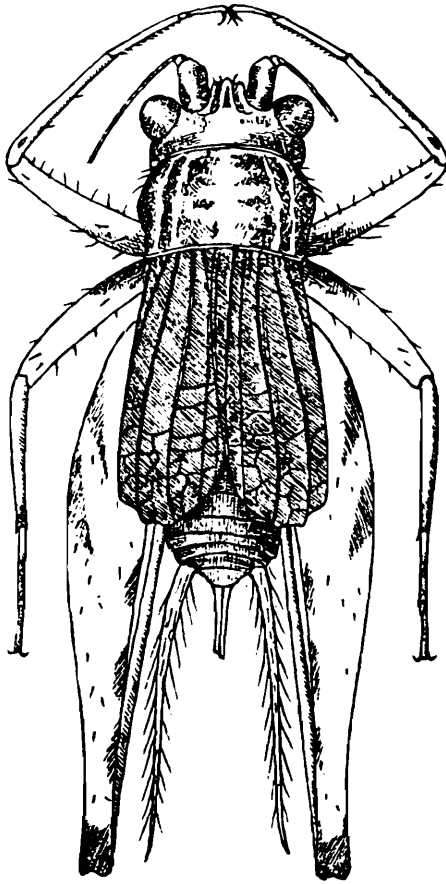


FIG. 40.—*Pseudendacustes gravelyi*, sp. nov., ♀.

♂ (fig. 41). Similar to the female. Abdomen a little mottled with brown ; subgenital plate elongate, slightly truncated at apex. Elytra extending but little beyond the middle of abdomen, truncated at apex, presenting a blackish spot in the axillar field, and a second, larger one, occupying the greater part of the disk ; dorsal field presenting no well defined speculum ; 6 rather neat oblique veins and a 7th less visible ; diagonal and 2 chords rather badly defined ; lateral field blackish, with 3 parallel veins.

Length of body ♀ (abdomen retracted) 8.5 mm., ♂ 10 mm. ; pronot. ♀ 2 mm., ♂ 2.3 mm. ; post. fem. 9 mm. ; elytra ♀ 4.5 mm., ♂ 4 mm.

***Speluncacris* (?) *annandalei*, sp. nov.**

Type : 1 ♀, Sureil, alt. 5,000 ft., Darjeeling dist., E. Himalayas, 11—31-x-17 (*N. Annandale and F. H. Gravelly*).

♀ (fig. 42). Size medium, apterous, rufous brown varied with dark brown. Head narrower than pronotum in front ; occiput and forehead weakly convex, brown, with 5 narrow light stripes ; frontal rostrum narrower than the 1st joint of antennae, rounded ; face shining, rufous, with a pale band in the middle. Palpi brown, rather long ; 4th joint of maxillary palpi a little longer than 3rd, 5th equal to 4th, rather

strongly dilated at apex, with superior margin concave. Antennae rather thick, profusely ringed with light brown and yellow. Eyes rounded, slightly projecting; ocelli very small, the anterior one in a small depression nearly at apex of rostrum.

Pronotum widening considerably a little before the middle, with anterior and posterior margins nearly straight; disk convex, a little embossed, dark brown with rufous markings; lateral lobes with inferior margin strongly rounded, especially in the posterior region, but not quite triangular in shape. The other two thoracic segments and abdominal tergites brown with a golden pubescence, adorned with a light median band most conspicuous on the anterior segments. Cerci rather long, brown. Ovipositor long, straight, with apical valves small, acute at apex.

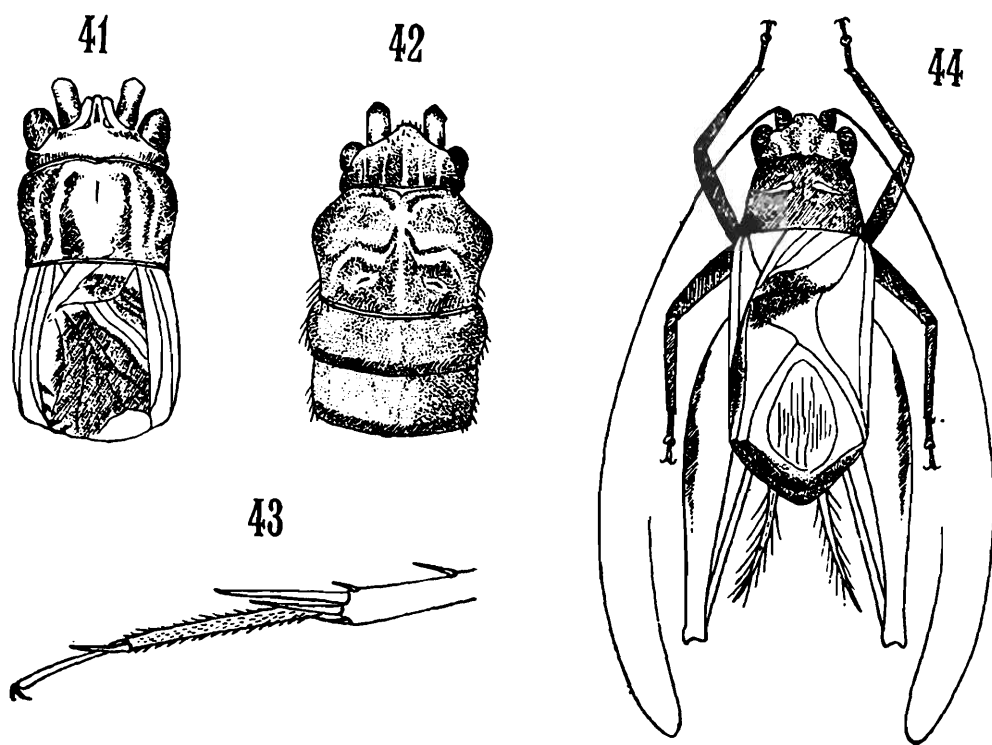


FIG. 41.—*Pseudendacustes graveleyi*, sp. nov., head, pronotum and elytra of ♂; fig. 42. *Speluncacris* (?) *annandalei*, sp. nov., anterior part of body of ♀; fig. 43. *id.*, apex of posterior tibia and tarsus; fig. 44. *Paratrigonidium unifasciatum*, sp. nov., ♂.

Legs ringed with brown; anterior tibiae not perforated. Posterior femora rather thick, obliquely striated at their external face, filiform at apex; tibiae serrated and armed with 4 spines on each side, the last much shorter than the others and the external ones longer than the internal; internal spurs much longer than the external, the superior one being the longest on each side, the internal extending to about the middle of the metatarsus; metatarsus long, slender, bearing above a few weak denticles on its upper surface (fig. 43).

Length of body 11 mm.; pronot. 3 mm.; width of pronot. 3.5 mm.; post. fem. 10 mm.; post. tib. 11 mm.; ovipositor 9.5 mm.

The male being unknown, it is difficult to be certain as to whether this species really belongs to the genus *Speluncacris*; it is remarkable for its small head and wide pronotum.

Paratrigonidium unifasciatum, sp. nov.

Type: 1 ♂, Soom, alt. 4,000-5,000 ft., Darjeeling dist., 14-vi-14
(*F. H. Gravely*).

♂ (fig. 44). Head brown, with three somewhat indefinite light bands on occiput. Antennae yellow, with two first joints brown. Palpi testaceous, with 4th joint short, 5th large, triangular, lengthened. Eyes rounded.

Pronotum wide, uniformly blackish brown, with anterior margin rather convex, posterior straight. Abdomen brown. Cerci yellowish.

Anterior and intermediate legs long, blackish brown. Posterior legs testaceous; femora presenting a wide, longitudinal brown band. Anterior tibiae perforated at their external face only.

Elytra with parallel margins, transparent, except for three smoky spots, one at base of the anal field, a second on the chords and the third at apex of the elytron; speculum large; diagonal vein short, sinuate; lateral field brown, with 3 veins, the superior of which is straight, the other two sinuate. Wings very short.

Length of body 5.5 mm.

Metioche pallidinervis, sp. nov.

Type: 1 ♂, Talewadi near Castle Rock, N. Kanara dist., 8-x-16
(*S. W. Kemp*).

♂ (fig. 45). Rather large for the genus, blackish, with elytral veins light yellow standing out against the dark background. Head rufous, with a brown spot on occiput; frontal rostrum brown; face rufous yellow,

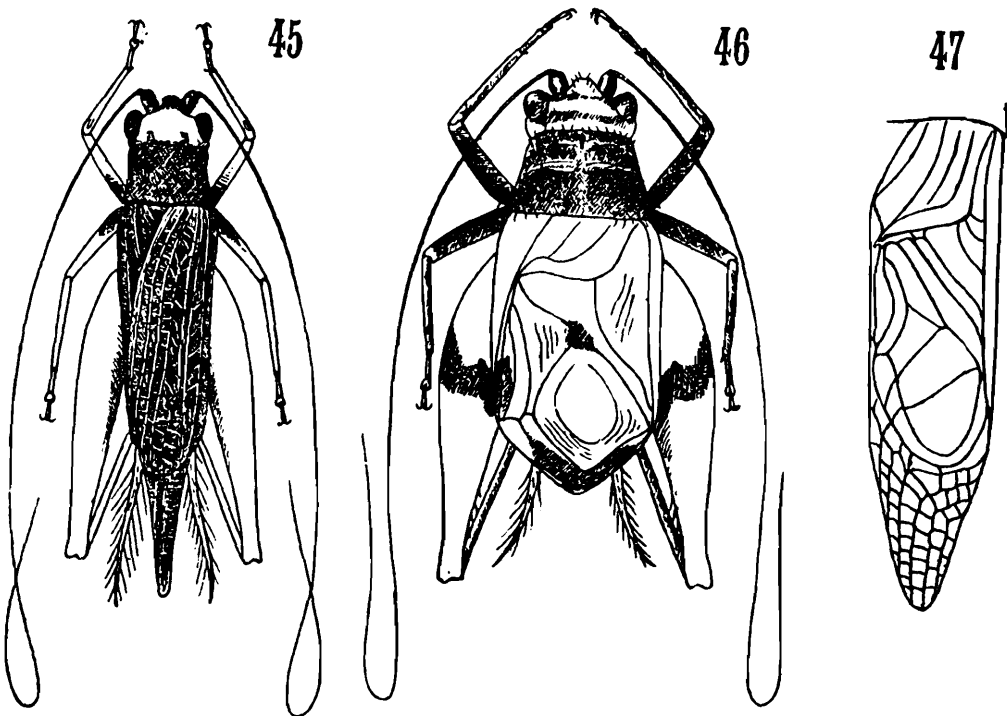


FIG. 45.—*Metioche pallidinervis*, sp. nov., ♂; fig. 46. *Anaxipha nigrithorax*, sp. nov., ♂, fig. 47. Right elytron of *Madasumma graveleyi*, sp. nov.

shining. Palpi yellowish; 4th joint of maxillary palpi shorter than 3rd, 5th a little longer than 4th, widening slightly at apex. Antennae

brownish, with first two joints and a few rings draker. Eyes rather large, rounded.

Pronotum nearly black, with only the extreme margin of lateral lobes yellowish; anterior margin a little convex, posterior one weakly sinuate. Abdomen blackish, except for a yellow stripe on each side. Cerci black. Subgenital plate with a small yellow point in the middle of posterior margin.

Legs yellow. Anterior tibiae perforated on their internal face only. Posterior tibiae with brown spines.

Elytra black with yellow veins, except in the covered part of the left elytron which is wholly black; dorsal field presenting 3 rather regular longitudinal veins and the discoidal one bearing two irregular branches; transverse veinlets rather close, regular between the free veins, irregular between the discoidal and its branches; lateral field black, rather pubescent, with 2 long straight veins, and 2 short curved ones. Wings rather long, blackish, iridescent.

Length of body 7 mm.; length including wings 10.5 mm.; post. fem. 7 mm.; elytra 6 mm.

This species is well characterized by its colour and by its general shape which is rather like that of an *Amusurgus*, but with more regular elytral veins than in that genus. The colouration and general aspect somewhat remind one of a *Nisitira*.

***Anaxipha nigrithorax*, sp. nov.**

Type : 1 ♂, Eppukadu, alt. 2,300 ft., Nilgiri Hills (*H.L. Andrewes*).

♂ (fig. 46). Size medium; testaceous brown, adorned with blackish brown spots and bands. Head wide; forehead short, convex, adorned with a transverse brown band; face blackish, shining. Palpi long, testaceous, the 5th joint triangular, elongate, darkened. Antennae yellowish with two first joints black. Eyes large, rounded.

Pronotum slightly narrowing in front, wholly black, with a whitish pubescence and scattered long black bristles; lateral lobes rounded anteriorly. Abdomen black; subgenital plate narrowing posteriorly. Cerci yellowish.

Anterior and intermediate femora black, except the apex, which is light; tibiae greyish, the anterior perforated only on their external face; tarsi rather long, greyish. Posterior femora stout and rather short, testaceous, adorned with two bands, a wide brown band, commencing from base, extending a little on the external face and coming back widening to the internal margin, and a second narrower brown band along the inferior margin of the external face, extending from about the anterior fourth to the apical third. Posterior tibiae greyish, with long spines.

Elytra smoky, with brown spots at apex, along the internal margin and in the anterior angle of speculum, which is large and wide; diagonal vein very short, sinuate; chords almost straight; lateral field brown, with 4 veins, the 1st straight and diverging, 2nd a little sinuate, 3rd very short, incomplete, and 4th strongly sinuate. Wings abortive.

Length of body 6.5 mm.; post. fem. 5 mm.

A. nigrithorax comes very close to *A. musicus* Sauss., but differs from it in having the anterior legs almost entirely black, posterior femora with only two brown stripes, and pronotum wholly black.

***Dionymus carmichaeli*, sp. nov.**

Types: 1 ♂, 1 ♀, Darjeeling dist., alt. 1,000-3,000 ft., *Carmichael* coll., May-June, 1912.

Size same as that of *D. marmoratus* Haan; colour testaceous brown. Head small, shining, rufous brown with indistinct light bands on the occiput; frontal rostrum rather wide, truncate at apex. Palpi testaceous; last joint of the maxillary palpi brown, 4th joint a little shorter than 3rd, 5th slightly enlarged at apex. Eyes rounded, slightly projecting; ocelli yellow, rather large.

Pronotum somewhat narrowing in front, anterior margin weakly concave, posterior margin a little sinuate; disk rufous, almost flat; lateral lobes lighter in the inferior part; inferior margin straight; anterior angle of 90°, but slightly rounded, posterior angle rounded.

Abdomen brownish; subgenital plate of the ♂ long, narrow.

Legs rufous. Anterior and intermediate femora slightly marbled with brown and presenting a brown ring, not very distinct, towards the apex; anterior tibiae a little swollen at base, presenting an oval external tympanum, the internal one being reduced to an undulated slit; tarsi rather long, the metatarsus equalling the 3rd joint in length. Posterior femora feebly swollen, with a brown ring near the apex; tibiae brown, denticulated at base and armed with 4 spines on each superior margin; infero-internal spur short, middle and superior ones rather long, especially the former; inferior and superior external spurs short, the intermediate one much longer; metatarsi long, armed with 6 or 7 denticles on each side.

♂. Elytra long and rather wide; anal vein a little sinuate, strongly angulate; speculum transverse, divided in the middle; diagonal vein rather long, a little curved; chords parallel, feebly convex; 5 somewhat irregular oblique veins; apical area long and rounded, with 7 sectors, of which the 6th is furcate; lateral field presenting 4 veins and the mediastinal, the latter having 7 branches, the first 3 or 4 being somewhat broken. Wings rather long.

♀. Elytra brown, presenting in the dorsal field 8 oblique and rather regularly distant sectors; transverse veinlets forming rather regular, long areae; lateral field not so overlapping as in ♂, the mediastinal vein bearing 3 branches. Free veins 4 in number, longitudinal, rather regular. Ovipositor almost straight, with apical valves small, lanceolate, separated by a small depression.

Length of body 17 mm.; length including wings 25 mm.; pronot. 2.5 mm.; post. fem. 9 mm. elytra 15 mm.; ovipositor 11 mm.

This species has much the same general form as *D. marmoratus*, but differs from it in its more rufous, uniform colouration, its shorter legs and the medio-internal spur of the posterior tibiae being not so long; in the ♂ the elytral venation is very different, while in the ♀ the transverse veinlets are more numerous.

***Madasumma maindroni*, sp. nov.**

Type : 1 ♂, Cote de Malabar, Mahé (*M. Maindron*, 1902) ; Museum de Paris.

♂ (fig. 48). Size medium ; yellowish varied with blackish brown. Head rather small, but still a little wider than the pronotum in front ; forehead flattened ; rostrum narrow, truncated at apex, with margins straight, much converging ; face brownish, facial shield very narrow between the antennae, presenting two yellowish callosities, almost in contact on the median line. Palpi testaceous, pubescent ; 4th joint of the maxillary palpi much shorter than 3rd, 5th rather large, feebly dilated at apex, with superior margin convex. Antennae yellowish, with 1st joint brownish. Eyes large, rounded ; ocelli rather large, the anterior one in a very small depression.

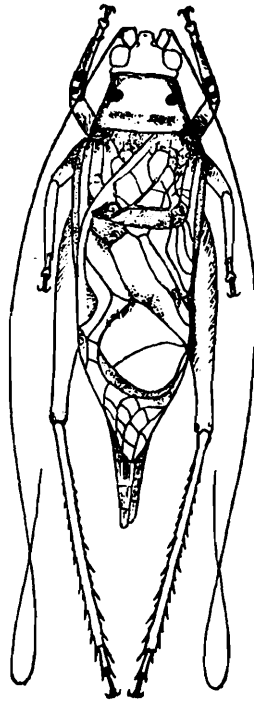


FIG. 48.—*Madasumma maindroni*, sp. nov., ♂.

Pronotum markedly widening posteriorly, the insertion of lateral lobes nearly angular ; anterior margin slightly concave, posterior straight ; disk slightly raised along the posterior margin, nearly flat in front, rufous, with two lateral brown bands in which are included the two impressed areas which are much more lateral than usual ; lateral lobes yellow. Abdomen yellowish ; subgenital plate rather long, subacute at apex. Genitalia very short, truncated at apex (in very bad state).

Legs yellowish. Anterior tibiae subquadrate, very strongly swollen at base, their superior face brown with a small yellowish callosity above the swollen part ; external tympanum rather large, oval, internal one very hollow under the swollen margin ; metatarsi very short and thick, 3rd joint very slender ; middle tibiae a little thick and compressed ; tarsi as the anterior ones. Posterior femora feebly swollen, uniformly rufous yellow ; tibiae with 5 spines on each side ; metatarsi rather short thick.

Elytra rather wide, translucent in the dorsal field, but presenting brown spots along the anal vein, around the mirror, on the chords and along the humeral band; speculum large, nearly square, divided in the middle; chords almost angular; diagonal short, sending a branch to the 1st oblique vein; anal and axillary veins very strong, anal field widely reticulated; 6 oblique veins, 2 of which are long and somewhat irregular, the others shorter and parallel; apical field short and reticulated in large areas; lateral field yellow, the mediastinal vein bearing 8 branches. Wings a little longer than the elytra.

Length of body 13 mm.; length with wings 18.5 mm.; pronot. 2 mm.; post. fem. 8.5 mm.; elytra 12.5 mm.

***Madasumma bimaculata*, sp. nov.**

Type: 1 ♂, Bhoutan, Pedong (ex *R. Oberthür*, 1897); Museum de Paris.

♂ (fig. 49). Size medium, rather elongate; testaceous, more or less greenish on the sides. Head small, a little flattened; frontal rostrum very narrow, with a rather deep depression in which the anterior ocellus is located. Face short, yellowish. Palpi brownish, testaceous; 4th joint of maxillary palpi much shorter than 3rd, 5th also rather short, wide, triangular. Antennae brown, rather thick, their base nearly black. Eyes rather small, rounded.

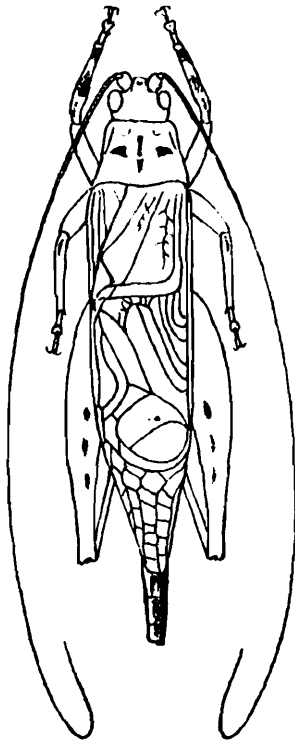


FIG. 49.—*Madasumma bimaculata*, sp. nov., ♂.

Pronotum flat above, the limit of lateral lobes subangular; anterior margin straight, posterior one a little convex; lateral lobes not very high, with inferior margin ascending very little forwards; disk greenish, with a brown median line and two blackish triangular impressions; lateral lobes also greenish, but with extreme margin brown, the limit between the disk and the lobes forming a somewhat callous yellow band; the band lined with black beneath.

Abdomen testaceous ; superior anal valve triangular, rounded at apex, black ; genitalia (figs. 50 and 51) rather short, presenting two lateral lobes, notched at apex, and two median pieces, ascending between the lobes and ending in a very sharp point.

Legs short, pubescent. Anterior tibiae rather strongly swollen, testaceous brown, with a blackish spot on the swollen part extending to the base, the apex equally blackish ; external tympanum nearly square, internal one narrow, almost slit-like. Posterior femora narrow, adorned with 3 black spots above ; tibiae armed with 5 external and 6 internal spines ; external spurs very short, internal spurs a little longer, especially the superior one ; metatarsi short, thick, 3rd joint very long and slender.

Elytra rather narrow, very long, brownish, with a greenish humeral band ; anal field very large, with 3 strong axillary veins ; anal vein broken at a right angle ; speculum rather small, nearly round ; diagonal vein rather short ; 6 nearly regular oblique veins ; apical field with very distant veins and a very wide reticulation ; mediastinal vein with 10 branches. Wings a little longer than the elytra.

Length of body 17.5 mm. ; length including wings 25 mm. ; pronot. 3 mm. ; elytra 19 mm. ; post. fem. 10.5 mm.

This species is very remarkable for its colouration and is distinguished by the proportion of the length of elytra to the anterior part of the body.

***Madasumma gravellyi*, sp. nov.**

Type : 1 ♂, Kalimpong, Darjeeling dist., E. Himalayas, 24-iv—10-v-15 (*F. H. Gravelly*).

Size rather large, shape elongate ; testaceous brown with a yellowish stripe along the elytral edge. Head somewhat mottled with brown ; frontal rostrum as wide as 1st joint of antennae, flat, not at all furrowed above ; ocelli small ; face and palpi yellowish, the 5th joint of maxillary palpi slightly enlarged at apex.

Pronotum mottled with brown ; disk a little darker than the lateral lobes ; anterior margin slightly concave, posterior sinuate.

Abdomen yellowish brown with a median dark longitudinal band beneath. Cerci yellowish. Superior anal valve wide, rounded at apex. Subgenital plate rather long, triangular. Genitalia (fig. 52) very large, composed of two large lateral valves, curved upwards, and a very long acute median process, carrying at its base two small hooks directed upwards.

Legs mottled with brown ; anterior tibiae slightly swollen at base, the internal tympanum almost slit-like. Posterior legs wanting.

Elytra long (fig. 47), rather narrow, with speculum longer than wide ; diagonal vein short ; 5 oblique veins, of which 2 are long and parallel, and 3 short and curved, forming two widely separate groups ; apical field long with regular nervation ; mediastinal vein with 12 stalks. Wings a little longer than the elytra.

Length of body 22 mm. ; length including wings 27.5 mm. ; elytra 17 mm.

This species belongs to the *marginipennis* group, but the abdominal end is very characteristic.

***Madasumma darjilingensis*, sp. nov.**

Type: 1 ♂, Pashok, Darjeeling dist., E. Himalayas, Oct., 1917
(*F. H. Gravely*).

Rufous brown, with a yellow stripe on the lateral lobes of pronotum and on the margin of elytra; feebly pubescent. Head with frontal rostrum flat, narrowing in front, its margins slightly projecting. Ocelli rather large, especially the lateral ones, the anterior one located almost at base of rostrum. Maxillary palpi testaceous, with 4th joint short, 5th rather long and very little enlarged at apex. Antennae uniformly rufous.

Pronotum with anterior margin straight, posterior margin very little sinuate, disk almost flat, slightly darkened and mottled with brown; lateral lobes yellowish.

Abdomen yellowish. Cerci slender, yellowish, a little darkened near the apex. Posterior abdominal region much differentiated, posterior margin of 9th tergite thick and feebly notched, 10th tergite widely notched (fig. 53), forming two triangular lobes; superior anal valve large, with thick margins, a little notched in the middle, its angles rounded; genitalia large (fig. 54), formed of a superior large, bifid piece, dentate at base and directed upwards at apex, and two inferior hooks projecting laterally; subgenital plate rather long, narrowing posteriorly but with apex rounded.

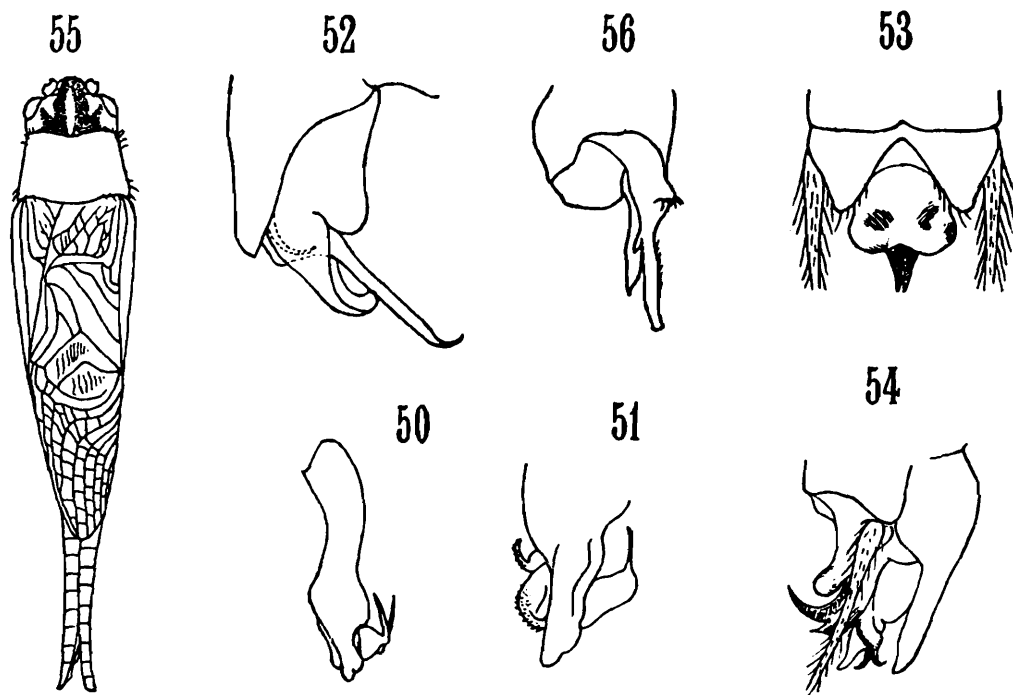


FIG. 50.—*Madasumma bimaculata*, sp. nov., genitalia of ♂, lateral view; fig. 51. apical part of the same, magnified; fig. 52. *Madasumma gravelyi*, sp. nov., genitalia of ♂, lateral view; fig. 53. *Madasumma darjilingensis*, sp. nov., apex of abdomen of ♂, dorsal view; fig. 54. lateral view of the same; fig. 55. *Mnesibulus andrewesi*, sp. nov., ♂; fig. 56. *id.*, lateral view of genitalia.

Legs hairy, rufous, a little mottled with brown. Anterior tibiae rather thick, flattened above, a little dilated at base; internal tympanum

in the form of a wide slit, external one oval. Posterior tibiae armed with 5 spines on each margin; metatarsus short, thick, armed with 3 external and 1 internal denticle.

Elytra rather wide, pubescent, with a yellowish humeral band, but without a spot of the same colour; axillary field with 3 very distinct veins, 2 of which are oblique and the 3rd strongly elbowed; anal vein broken at right angle; speculum slightly longer than wide, divided a little before the middle; chords feebly curved; 7 oblique veins, almost equidistant, 3 of which are almost straight, the other 4 short and curved; apical field rather short, presenting 4 sectors, reticulated in large areolae. Wings a little longer than the elytra.

Length of body 25 mm.; pronot. 3.5 mm.; post. fem. 13 mm.; elytra 18.5 mm.

This species is very close to *M. greeni* Chop. from Ceylon; it differs from it in the absence of a yellow spot on the elytra, in the speculum being placed a little more posteriorly, so that the diagonal vein and the chords are longer and the apical field shorter, and lastly and chiefly in the posterior abdominal region which is very different in the two species.

***Mnesibulus fuscipennis*, sp. nov.**

Type: 1 ♀, Chalakudi, Cochin State, 14—30-ix-14 (*F. H. Gravely*).

Size medium; colouration more uniform than in the other species of the genus. Head reddish brown; frontal rostrum a little narrower than the 1st joint of antennae, feebly rounded at apex and slightly furrowed above; face dark brown; cheeks and palpi much lighter, reddish yellow; maxillary palpi with 4th joint very short, 5th a little longer than the 3rd and of the shape of an almost equilateral triangle. Antennae yellowish brown.

Pronotum narrowing a little anteriorly, with anterior margin straight, posterior subangulate; disk nearly flat but slightly raised posteriorly, reddish brown with two irregular dark bands on the sides; lateral lobes lighter, with inferior margin rounded.

Abdomen brown above, yellowish beneath. Cerci long, yellowish. Ovipositor as long as the cerci, straight, with apical valves small, black, forming a small rounded mass, granulose in its apical half only, and ending in two obtuse teeth.

Legs uniformly reddish brown; anterior tibiae a little darkened, strongly swollen at base, fusiform, with external tympanum oval, internal one hollow and almost quadrangular. Posterior tibiae bearing 5 spines on each superior margin; spurs short, especially the external ones.

Elytra rather narrow, rather dark brown with a darker spot at base and a blackish stripe on the shoulder, a blackish spot a little before the middle of the edge and a few small light spots along this same edge; dorsal field with 10 veins, rather oblique, regular, except the 4th and 5th which are more distant than the others; first three veins free, the others emerging from the discoidal; transverse veinlets rather regular, forming nearly square areolae; lateral field lighter than the dorsal field; mediastinal vein bearing 6 branches. Wings extending much beyond the elytra.

Length of body 13 mm. ; length including wings 20·5 mm. ; post. fem. 8 mm. ; elytra 14 mm. ; ovipositor 7 mm.

Mnesibulus andrewesi, sp. nov.

Type : 1 ♂, Nilgiri Hills, alt. 5,500 ft., April, 1910 (*H.L. Andrewes*).

♂ (fig. 55). Size medium ; testaceous brown. Head rounded, a little wider than the pronotum, presenting a wide brown band, extending from occiput to the apex of frontal rostrum and divided in the middle by a very slender light line ; rostrum wide, a little rounded at apex ; face yellowish, short. Palpi testaceous ; 4th joint of maxillary palpi a little shorter than 3rd, 5th triangular, very obliquely truncated at apex. Antennae slender, rufous. Eyes rounded ; ocelli rather large, yellow.

Pronotum feebly transverse, very slightly narrowing anteriorly, with anterior margin slightly concave, posterior sinuate ; disk rufous brown ; lateral lobes lighter, with inferior margin nearly straight. Abdomen testaceous. Cerci very long. Genitalia very long, almost tubular, the superior part longer than the inferior (fig. 56).

Anterior and intermediate legs rufous. Anterior tibiae strongly swollen, with an external oval tympanum opening above the swollen part ; internal tympanum quite slit-like. Posterior legs wanting.

Elytra rather narrow, testaceous ; speculum nearly rounded, with inferior margin interrupted a little before the external angle ; diagonal vein short ; chords feebly curved, united with the mirror by two veinlets ; anal vein broken at right angle ; anal field with somewhat reticulated veins ; 4 oblique veins, 2 of which are long and slightly diverging, and 2 short ; apical field long, with 6 nearly longitudinal, regular sectors ; transverse veinlets numerous, forming almost square areolae. Wings very caudate.

Length of body 14 mm. ; length including wings 20·5 mm. ; pronot. 2·2 mm. ; elytra 12 mm.

NOTES ON FISHES IN THE INDIAN MUSEUM.

XV.—NOTES ON BURMESE FISHES.

By SUNDER LAL HORA, D.Sc., F.L.S., F.Z.S., Assistant Superintendent,
Zoological Survey of India, Calcutta.

Recently I had an opportunity of determining several small lots of fish from different parts of Burma for the Director, Harcourt Butler Institute of Public Health, Burma. Among these I found examples of *Barbus* (*Puntius*) *binotatus* (C.V.), *Ctenogobius alcocki* (Annandale) and of a new species of the subgenus *Brachydanio*. Of the last species several specimens were also collected by Dr. H. S. Rao in the Northern Shan States. In this paper I propose to write notes on these forms and to include the description of another new species of *Brachydanio* collected by Dr. B. N. Chopra in the Myitkyina District, Upper Burma.

***Ctenogobius alcocki* (Annandale).**

1906. *Gobius alcocki*, Annandale, *Journ. As. Soc. Bengal* (n. s.) II, p. 201, fig. 1.
1923. *Ctenogobius alcocki*, Hora, *Mem. Ind. Mus.* V, p. 774.

Ctenogobius alcocki has hitherto been recorded from Port Canning, Calcutta and the Chilka Lake. Dr. B. N. Chopra and I collected several specimens of this species in a small tidal channel beyond the sacred temple at Puri. I have here to record its occurrence at Rangoon. The species was collected in a tank full of vegetation and situated to the west of the Harcourt Butler Institute of Public Health, Burma.

***Barbus* (*Puntius*) *binotatus* (C.V.).**

1878. *Barbus goniosoma*, Day, *Fish. India*, p. 562, pl. cxxxvii, fig. 2.
1916. *Puntius binotatus*, Weber and Beaufort, *Fish. Indo-Austral. Archipel* III, p. 186, fig. 74.

Barbus (*Puntius*) *binotatus* exhibits considerable individual variation both as regards the form of its body and its colouration. According to Weber and Beaufort this species is only found in "Sumatra, Nias, Java, Bali, Lombok, Borneo, Banka, Biliton, Singapore, Malacca, Philippines," for they did not recognize that the form described by Day as *Barbus goniosoma* from Mergui was synonymous with *B. binotatus*. I have examined two of Day's original specimens from Mergui and a number of half-grown examples from Kambanta, Tavoy district, and find that they agree with Weber and Beaufort's description of *Puntius binotatus* in every essential detail. In certain examples from Tavoy there is an indication of a black spot at the base of the anterior dorsal ray and another still more indistinct spot at the base of the caudal. The colouration is silvery except for the tips of the dorsal, anal and caudal fins which are grayish.

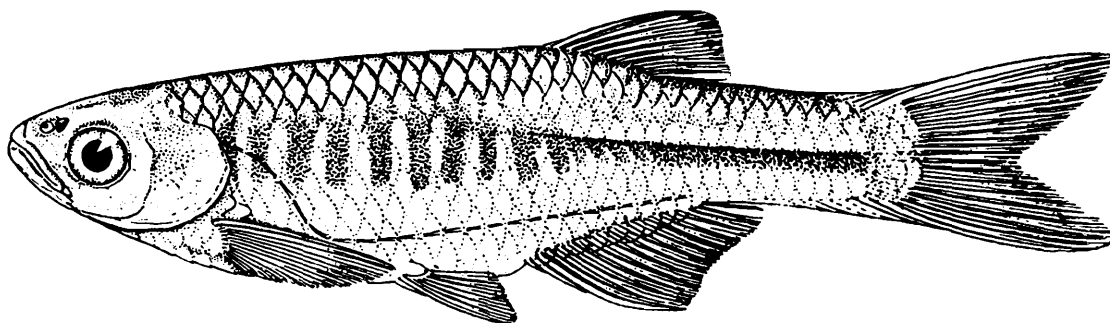
For convenience of reference I give below measurements in millimetres of some of these examples :—

	Mergui.		Tavoy.	
Total length without caudal	95.5	96.0	75.3	62.0
Length of head	26.1	25.3	21.7	18.3
Depth of body	35.2	37.0	26.5	21.2
Length of snout	7.6	7.9	5.7	5.6
Diameter of eye	8.2	7.8	6.2	6.0
Interorbital width	10.5	9.5	7.8	6.5
Longest ray of dorsal	23.0	24.0	16.7	15.5
Longest ray of anal	14.5	14.3	11.5	10.6
Length of pectoral	20.5	20.0	15.8	15.0
Length of ventral	18.0	18.5	14.0	13.3

Danio (Brachydanio) shanensis, sp. nov.

D. 2/7 ; A. 3/10-12 ; P. 13 ; V. 8 ; C. 18.

Danio (Brachydanio) shanensis is a small species in which the dorsal profile rises gently from the tip of the snout to the commencement of the dorsal fin, beyond which it slopes down to the base of the caudal.



TEXT-FIG. 1.—Lateral view of *Danio (Brachydanio) shanensis*, sp. nov. $\times 3$.

The ventral profile is arched, except in the region of the caudal peduncle, where it runs parallel to the dorsal profile. The body is greatly compressed from side to side and the head is somewhat pointed. The length of the head is contained 3.8 to 4 times and the depth of the body 3.3 to 3.7 times in the total length without the caudal. The diameter of the eye is contained 3 to 3.5 times in the length of the head ; it is almost equal to the length of the snout and is contained about 1.5 times in the interorbital width. The barbels are generally absent but in some specimens a pair of short, stumpy barbels are present at the corners of the mouth. The mouth is obliquely directed upwards and is of moderate width. There are 10 short, stout and rather widely set gill-rakers. The commencement of the dorsal is slightly behind that of the anal and its longest ray is equal to the head without the snout ; it has 2 spines and 7 branched rays, the last being split to the base. The anal fin contains 3 spines and 10-12 branched rays, the last being split to the base. The pectoral is shorter than the head and just reaches the ventral, which does not extend to the base of the anal. Both the paired fins are provided with short appendages at their bases. The caudal fin is deeply emarginate and is longer than the head. The scales are very thin and are hardly distinguishable in young specimens. There

are 34 scales in a longitudinal row and there are 8 rows in a transverse series. The scales are marked with longitudinal lines. The bases of the anal and the caudal fins are covered with thin scales. There are 17 predorsal scales. The least height of the caudal peduncle is contained 1.6 to 1.9 times in its length ; there are 10 scales round the caudal peduncle. The lateral line is incomplete. From the upper angle of the gill-cover it turns abruptly downwards and is then continued in the lower half of the body for a considerable distance, but it never reaches the base of the caudal fin.

The colouration is very characteristic of the species. It possesses a broad, lateral band of a dark colour which becomes narrower posteriorly. With age it is broken up into a number of vertical bars anteriorly and the intervening spaces between these become silvery. There is a black streak along the back and the edges of the scales in the upper half are covered with black dots. The general colouration is pale olivaceous. The fins are diaphanous. In very young specimens the colouring is silvery all over.

Type-specimen :—F 10814/1, *Zoological Survey of India (Ind. Mus.)*.

The species seems to be quite common in the Northern Shan States. Dr. H. S. Rao collected a large number of specimens in rice fields, in pools and ditches in the bed of hill streams at Namkhan, Kutkai, Lashio and Hsipaw.

Measurements in millimetres.

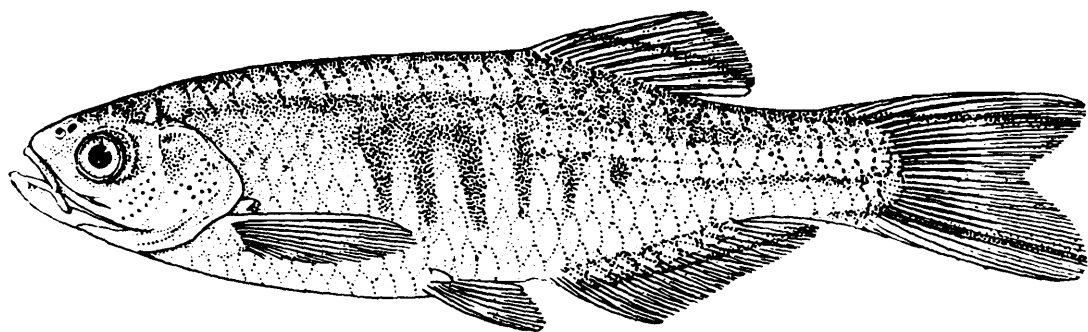
Total length without caudal	.	.	.	30.0	33.0	38.0
Length of head	.	.	.	7.4	8.0	10.0
Height of body	.	.	.	8.2	8.8	11.5
Length of snout	.	.	.	2.2	2.3	3.3
Diameter of eye	.	.	.	2.2	2.4	3.0
Interorbital width	.	.	.	3.4	3.4	4.4
Length of pectoral	.	.	.	6.2	6.8	8.1
Length of ventral	.	.	.	4.0	4.8	5.7
Length of caudal peduncle	.	.	.	6.8	7.7	8.0
Least height of caudal peduncle	.	.	.	3.5	4.2	5.0

Danio (Brachydanio) choprae, sp. nov.

D. 2/7 ; A. 3/12-13 ; P. 13 ; V 7 ; C. 20.

Danio (Brachydanio) choprae is a small species not more than 30 mm. in length. Both the dorsal and the ventral profiles are slightly arched. The body is compressed from side to side and the head is somewhat pointed. The length of the head is contained from 4 to 4.2 times and the depth of the body 3.2 to 3.5 times in the total length without the caudal. The diameter of the eye is very variable ; it is contained from 2.5 to 3.5 times in the length of the head. The snout is considerably shorter than the diameter of the eye, which is contained from 1.3 to 1.5 times in the interorbital width. There are two pairs of well-developed barbels. The rostral barbel originates just in front of the nares and for the greater part of its length lies in a groove ; it is almost as long as the diameter of the eye. The maxillary barbel is much longer than the eye. The mouth is obliquely directed upwards and is of moderate

width. The gill-rakers are short and widely set. The commencement of the dorsal is opposite that of the anal ; its longest ray is considerably shorter than the head ; it contains 2 spines and 7 branched rays. The anal fin contains 3 spines and 12 to 13 branched rays. The pectoral is slightly shorter than the head and just touches the base of the ventral, which is separated from the anal by a short distance. There is a short fleshy appendage at the base of the pectoral and a scaly appendage at the base of the ventral. The caudal fin is emarginate and longer than the head. The scales are thin and hardly visible in young specimens. There are 33 scales in a longitudinal row and there are 7 rows transversely arranged on the body. The base of the anal fin is covered with scales. There are 15 predorsal scales. The minimum height of the caudal peduncle is contained 1·3 to 1·7 times in its length ; there are 10 scales round the caudal peduncle. The lateral line is absent.



TEXT-FIG. 2.—Lateral view of *Danio (Brachydanio) choprae*, sp. nov. $\times 3\frac{1}{2}$.

Danio choprae has a very characteristic colouration. It is pale olivaceous, the upper surface being much darker than the lower. Anteriorly there are several dark, broad, vertical bars which grow shorter in length as they recede backwards till they are reduced to mere dots, and in continuation of these there is a dark longitudinal stripe to the base of the caudal. There are two indistinct longitudinal bands in the upper half of the body and a black streak along the back. Both the dorsal and the anal fins are provided with longitudinal bands across their rays. Each lobe of the caudal fin possesses a longitudinal black band. The fins are, otherwise, quite transparent.

Type-specimen :—F 10811/1, *Zoological Survey of India (Ind. Mus.)*.

Several specimens of this new species were collected by Dr. B. N. Chopra in small rocky streams about Kamaing and Namma in the Myitkyina District, Upper Burma.

Measurements in millimetres.

Total length without caudal	20·5	20·5	21·0
Length of head	5·0	5·1	5·0
Height of body	5·7	6·0	6·4
Length of snout	1·6	1·6	1·6
Diameter of eye	2·0	2·0	1·8
Interorbital width	2·8	2·7	2·8
Length of pectoral	4·7	5·0	4·5
Length of ventral	3·0	3·0	3·0
Length of caudal peduncle	4·0	4·0	4·0
Least height of caudal peduncle	2·4	3·0	2·8

NOTES ON FISHES IN THE INDIAN MUSEUM.

XVI.—ON FISHES OF THE GENUS *ESOMUS* SWAINSON.

By SUNDER LAL HORA, D.Sc., F.L.S., F.Z.S., Assistant Superintendent
and D. D. MUKERJI, M.Sc., Assistant, Zoological Survey of India,
Calcutta.

While identifying a small collection of fish from Rangoon one of us found an interesting variety of the composite species, *Esomus danricu* (Ham. Buch.). On going through the literature and after consulting Ahl's¹ recent revision of the genus *Esomus* we decided to define, as far as possible, from the extensive material preserved in the Indian Museum collection, the specific limits of the various Indian species of this genus and to add notes on the Extra-Indian species as far as practicable. Efforts have also been made to get fresh material from different places in India, Burma and Ceylon and from other countries. Besides the fresh material collected from the neighbourhood of Calcutta, we have received collections from Professor F. G. Meggitt of the Rangoon University, Mr. E. A. D'Abreu, Curator of the Central Museum at Nagpur, Professor George Matthai of the Punjab University, Dr. D. R. Bhattacharya of the Allahabad University, Mr. C. R. Narayan Rao of the Mysore University, Dr. B. Sundara Raj, Director of Madras Fisheries, Dr. Joseph Pearson, Director of the Colombo Museum, and Dr. H. M. Smith, Director of the Department of Fisheries, Siam. To all these gentlemen we offer our sincere thanks for the valuable help they have rendered us by sending the material.

Genus *Esomus* Swainson.

1839. *Esomus*, Swainson, *Natural History, Fishes* II, p. 285.

1842. *Nuria*, Cuvier and Valenciennes, *Hist. Nat. Poiss.* XVI, p. 238.

Esomus is a genus of small Cyprinid Fishes (sub-family Rasborinae) in which the body is elongated and strongly compressed from side to side. The dorsal profile is more or less straight. The mouth-opening is small and obliquely directed upwards. There are two pairs of barbels at the corners of the mouth, the anterior pair or the so-called rostral barbels are short, while the maxillary barbels are long and may extend as far back as the base of the anal fin. The dorsal is situated almost above the anal fin ; it is short with six branched rays. The anal is usually short with five branched rays. The lateral line, when present, is strongly arched anteriorly and runs in the lower half of the caudal peduncle. The scales are of moderate size. The gill-openings are large and the gill-rakers are short. The pharyngeal teeth are arranged in a single row, 5—5.

Distribution.—British India, Ceylon, Nicobars, Malay Peninsula, Malay Archipelago and French Indo-China.

¹ Ahl, *Mitt. Zool. Mus. Berlin*, XI, pp. 38-43 (1923).

As is evident from the following account there has been great confusion regarding the Indian species of this genus, for which the inadequate descriptions and poor illustrations of the earlier authors are mainly responsible. Moreover, many of the species exhibit considerable individual variability, and the lack of sufficient material from all parts of the country resulted in the authors' considering individual variations as distinct species. After a careful study of a large number of specimens from different parts of India we are able to recognise only five species from within the limits of British India. These species may be distinguished with the help of the following key :—

- I. Lateral line complete or nearly so, extending to at least the base of the anal fin.
 - A. Black spot above the base of pectoral; (sides without black, broad lateral bands, depth of body proportionately greater, being contained 2·9 to 4 times in the length without the caudal) .. *E. altus* (Blyth).
 - B. No black spot above the base of pectoral; (depth of body proportionately shorter, being contained 3·7 to 4·5 times in the length without the caudal).
 - i. Sides with black, broad, lateral bands, predorsal scales 19 to 20 *E. thermoicos* (C. V.)
 - ii. Sides without black, broad, lateral bands, predorsal scales 17 *E. barbatus* (Jerdon).
- II. Lateral line absent or nearly so, piercing only 4 to 6 scales anteriorly.
 - A. A well-defined precaudal spot; sides without lateral bands; 12 scales round caudal peduncle .. *E. ahli*, sp. nov.
 - B. No precaudal spot; sides with broad, lateral bands; 14 scales round caudal peduncle *E. danricus* (H. B.).

Besides the species enumerated above we have examined specimens of *E. metallicus* Ahl¹, and we take this opportunity to add a short note on the species in this paper. Attention is also drawn to a species described from Indo-China.² Of *E. malayensis* and *E. caudiocellatus* recently described by Ahl (*op. cit.*) we have not seen any specimens and are, therefore, unable to make any remarks on them. It seems probable, however, that the form recorded by Karoli³ as *Nuria danrica* from Singapore is one of Ahl's species from that region, but it is difficult to be certain without authentic material.

***Esomus altus* (Blyth).**

- 1860. *Nuria alta*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 162.
- 1868. *Nuria alta*, Günther, *Cat. Fish, Brit. Mus.* VII, p. 201.
- 1869. *Nuria alta*, Day, *Proc. Zool. Soc. London*, p. 558.
- 1878. *Nuria danrica* var. *alta*, Day, *Fish. India*, p. 583, pl. cxlv, fig. 8.
- 1885. *Nuria danrica*, Vinciguerra, *Ann. Mus. Civ. Genova* (2) II, p. 93.
- 1889. *Nuria danrica* var. *alta*, Day, *Faun. Brit. Ind. Fish.* I, p. 234, fig. 106.
- 1890. *Nuria danrica*, Vinciguerra, *Ann. Mus. Civ. Genova* (2) IX, p. 173.
- 1910. *Nuria danrica* var. *alta*, Jenkins, *Rec. Ind. Mus.* V, p. 138.
- 1923. *Esomus altus*, Ahl, *Mitt. Zool. Mus. Berlin* XI, p. 39.

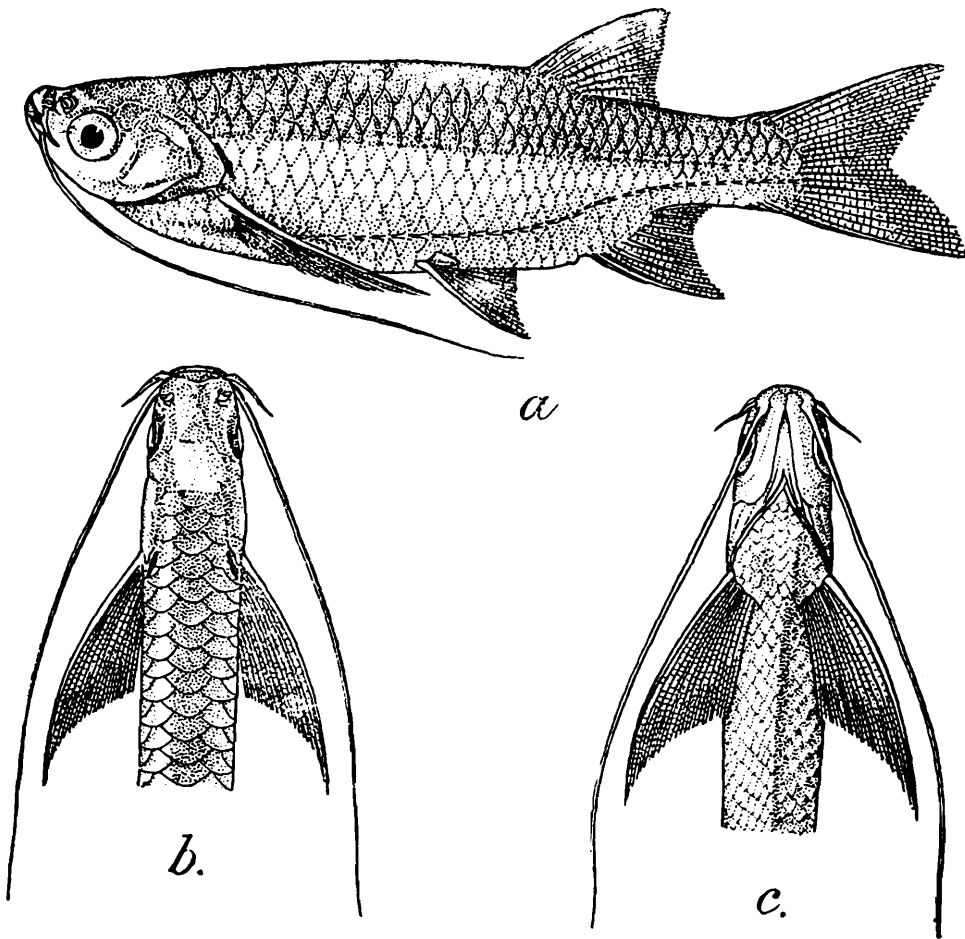
Esomus altus is a Burmese species and can be readily distinguished by the possession of a complete lateral line and the characteristic black

¹ Ahl, *Mitt. Zool. Mus. Berlin*, XI, p. 42 (1923).

² Lunel, *Mem. Soc. Phys. Hist. Nat. Genève*, XXVII, pp. 296-299, pl.—, fig. 2 (1881).

³ Karoli, *Természettudományi Füzetek Budapest*, V, p. 180 (1881).

mark above the base of the pectoral. The absence of a broad, black lateral band is also a good diagnostic character. Day in 1878 recognised it only as a variety of *E. danrica* on account of the greater height of its body which, according to him, is $4\frac{1}{2}$ instead of $5\frac{1}{2}$ in the length, and "on its anal fin being a little lower" According to Blyth's original description the height of the body is about one-fourth of the total length. A rigid observance of this diagnostic character is responsible for a certain amount of confusion as is evident from Vinciguerra's remarks in the works cited above. We have taken measurements of 19 examples and find a great deal of individual variability; the height of the body is



TEXT-FIG. 1.—*Esomus altus* (Blyth).

- a. Lateral view $\times 1\frac{1}{8}$; b. Dorsal view of head and anterior part of body $\times 1\frac{1}{8}$;
c. Ventral view of head and anterior part of body $\times 1\frac{1}{8}$

contained from 2.9 to 4 times in the length without the caudal. The type-specimen is, however, very remarkable in this respect, for only in this specimen is the height of the body 2.9 times in the length without the caudal. The length of the head is about one-fourth of the body length, though the proportion varies from 3.7 to 5.1. The diameter of the eye is contained from 3 to 3.7 times in the length of the head. The snout is usually shorter than or equal to the diameter of the eye, but in exceptional cases it may be slightly longer. The caudal peduncle is 1.5 times its least height and is encircled by 14 scales. There are 31 to 33 scales in a longitudinal series and they are arranged on the body in 7 transverse rows. The number of predorsal scales varies from 16 to 19.

None of the pectoral fin-rays are produced beyond the membrane; the pectoral reaches the base of the ventral. The maxillary barbels vary as regards their length, usually they extend as far as the base of the ventral, but in certain cases they reach the end of the anal fin. The lateral line is complete; it is sometimes interrupted above the base of the anal fin (see Day's figures of the species).

The colouration according to Blyth is as follows:—"ruddy, with a broad yellow lateral band surmounted by a nearly obsolete black streak: gill-covers silvery; and a black spot above the base of the pectorals: fins pale and yellowish, more or less tinged with dusky in the young"

Esomus altus was originally described from Tenasserim, but it seems to be fairly common even in northern Burma. The late Dr. N. Annandale purchased a fine series of specimens from the Mandalay market. There are altogether 38 examples of this species in the Indian Museum. The following table gives the localities of these specimens:—

832 Cat.	Tenasserim (Type)	Maj. Berdmore	2
2451	Moulmein	F. Day	1
824 Cat.	Pegu . .	F. Day	6
825 Cat.	Prome . .	F. Day . .	5
822 Cat.	Mandalay	Maj. Haden	2
823 Cat.	" . .	F. Day . .	1
1764, 1768, 1771, 1773-6, 1779-80, 1785-6, 1788, 1791-4.	" }	N. Annandale	16
828 Cat.		No locality	2
F $\frac{10775}{1}$	Chaungwa, Myitkyna Dist.	B. N. Chopra	3

In our opinion Vinciguerra's examples of "*Nuria danrica*" from Rangoon and Bassein are probably to be referred to this species.

Measurements in millimetres.

	Chaungwa			Pegu		Mandalay		Tenasserim	Moulmein	Prome	
Total length without caudal	66	71	73	50.5	65	78	81	80	87	64.5	76
Length of head	16	17	17	13.5	15	17	18	19.5	19	15.5	78
Height of body	18.5	20	21	14	18.5	22	24	27	24	17	19
Diameter of eye	5	5	5	4	4.5	4.5	5	5.5	5	4.5	5
Interorbital width	7	8	8	4.5	5	5.5	6	6.5	7	5.5	6
Length of snout	4	4	4	3.5	4	5	5	4.5	5.5	4.5	5
Length of caudal peduncle	9.5	12	11	10	12	14	16	14	15	12.5	14.5
Least height of caudal peduncle	8	8	8.5	6	8	9	10	11	10.5	8	9.5

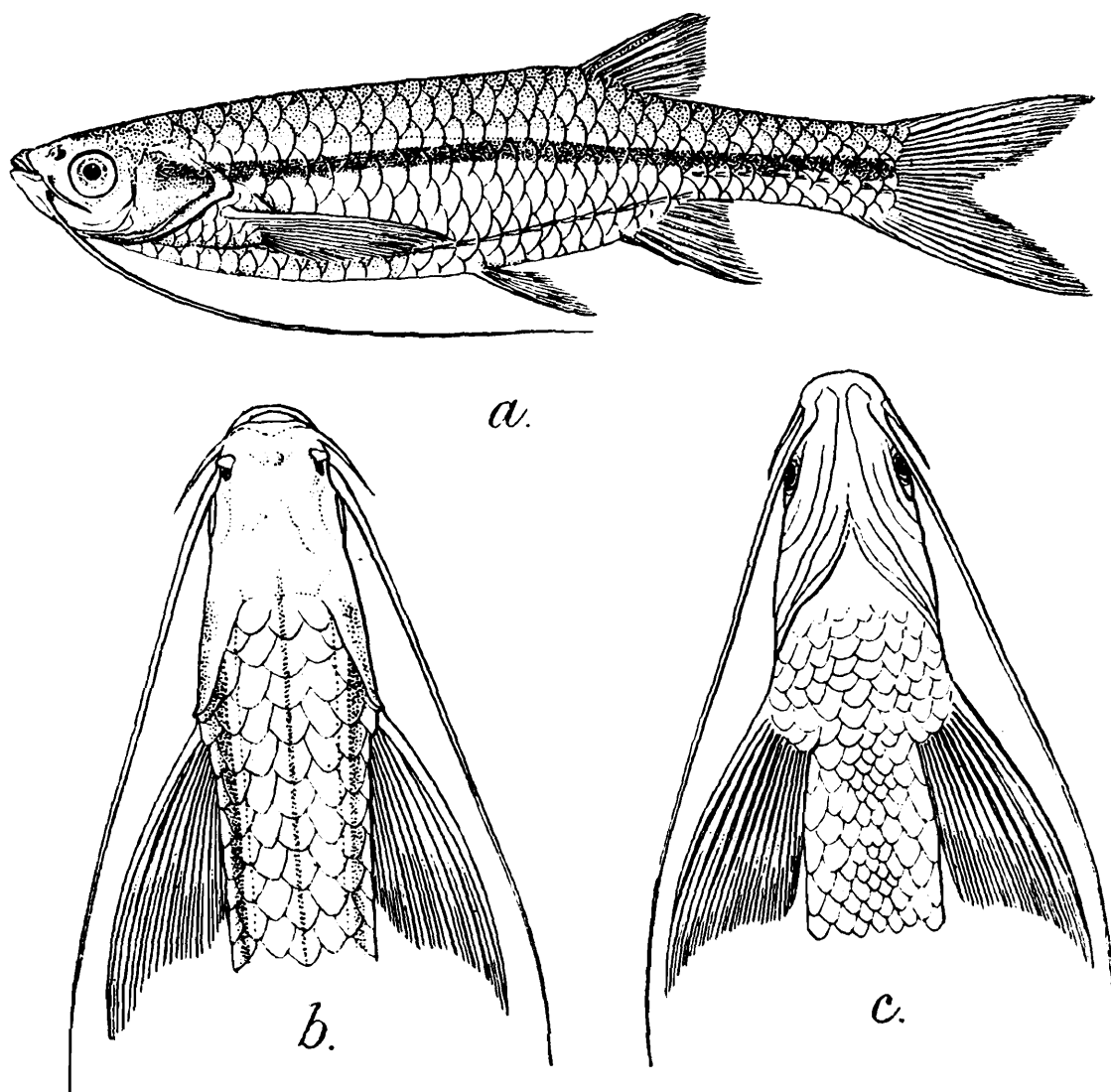
***Esomus thermoicos* (Cuv. & Val.).**

1842. *Nuria thermoicos*, Cuvier and Valenciennes, *Hist. Nat. Poiss.* XVI, p. 238, pl. 472.

1868. *Nuria danrica* (in part), Günther, *Cat. Fish. Brit. Mus.* VII, p. 200,

1923. *Esomus thermoicos*, Ahl, *Mitt. Zool. Mus. Berlin* XI, p. 40,

Through the kindness of Dr. Joseph Pearson, the Director of the Colombo Museum, we have received 5 specimens of an *Esomus* collected from different localities in Ceylon. He informs us that, "Mr. P. E. P. Deraniyagala of this department has collected several specimens from different parts of Ceylon, but he has been able to distinguish only one variety" In this form the lateral line is more or less complete, but Dünker¹ has recorded from Ceylon "*Nuria danrica* Buch. var. *mala-barica* Day", a form in which the lateral line is absent. We are unable



TEXT-FIG. 2.—*Esomus thermoicos* (Cuv. & Val.).

a. Lateral view $\times 1\frac{1}{2}$; b. Dorsal view of head and anterior part of body $\times 1\frac{1}{2}$;
c. Ventral view of head and anterior part of body $\times 1\frac{1}{2}$.

to comment on this record in the absence of authentic material, but it may safely be presumed that the commonest species of the genus in Ceylon is *E. thermoicos*. This species is characterized as follows:—

D. $\frac{2}{6}$; A. $\frac{3}{5}$.

Esomus thermoicos is a well built species in which the length of the head is nearly equal to the depth of the body and is contained from 3.8 to 4.5 times in the total length without the caudal, but the length of the head and the depth of the body become proportionately smaller

¹ Dünker, *Mitt. Zool. Mus. Berlin* XXIX, p. 266 (1912).

with age. The diameter of the eye is contained from 3.2 to 3.8 times in the length of the head. The snout is equal to or slightly shorter than the diameter of the eye. The interorbital region is flat and its width is 1.5 times the diameter of the eye. The maxillary barbels reach the end of the pectoral fin or extend slightly beyond it. The lateral line is well marked and more or less complete; it is interrupted above the base of the anal fin in certain examples. There are 19 or 20 predorsal scales. The pectoral rays are not drawn out and, except in young individuals, do not reach the ventrals, which are separated from the anal by a considerable distance. The caudal peduncle is slightly shorter than the head and is twice its minimum height; it is encircled by 14 scales. There are 32 to 34 scales along the lateral line and there are 7 transverse rows of scales on the body.

The upper half of the fish is darker in colour. There is a broad, black lateral band between the eye and the base of the caudal, and a black streak along the dorsal surface.

Esomus thermoicos is found in Ceylon. It was originally described from the hot springs at Kanniya. Mr. P. E. P. Deraniyagala of the Colombo Museum informs us "that no *Esomus danrica* is to be found within the radius of 300 yards of the hot springs at Kanniya, judging from two collections of fishes from these springs. Other fishes also said to be found in these springs are absent, including the famous (*Barbus*) *Puntius thermalis* "

Measurements in millimetres.

Total length without caudal	.	37	40	56	56	72.5
Length of head	.	9.5	10	13	12.5	16
Height of body	.	10	10.5	14	13	17
Diameter of eye		2.5	3	4	3.5	4.2
Interorbital width	.	4	4	5	5.5	6.8
Length of snout		2.5	2.5	3	3	4
Length of caudal peduncle		8	9.5	13	12	13
Least height of caudal peduncle		3.5	4	6.5	5.5	7.5

Esomus barbatus (Jerdon).

1849. *Leuciscus barbatus*, Jerdon, *Madras Journ. Litt. Sci.* XV, p. 322.
 1865. *Esomus thermoicos*, Kner, *Novara-Exped.-Zool. Fische.*, p. 363.
 1867. *Esomus* (*Nuria*) *maderaspatensis*, Day, *Proc. Zool. Soc. London*, p. 300.
 1868. *Nuria danrica* (in part), Günther, *Cat. Fish. Brit. Mus.* VII, p. 200.
 1878. *Nuria danrica* (in part), Day, *Fish. India*, p. 583.
 1889. *Nuria danrica* (in part), Day, *Faun. Brit. Ind. Fish.* I, p. 334.
 1916. *Nuria danrica*, Sundara Raj, *Rec. Ind. Mus.* XII, p. 259.
 1916. *Esomus danrica*, Weber and Beaufort, *Fish. Indo-Austral. Archipel.* III, p. 83, fig. 30.
 1923. *Esomus maderaspatensis*, Ahl, *Mitt. Zool. Mus. Berlin* XI, p. 40.
 1927. *Nuria danrica*, Narayan Rao and Seshachar, *Half-yearly Journ. Mysore University* I, No. 2, p. 16.

Through the kindness of Dr. B. Sundara Raj and Mr. C. R. Narayan Rao we have received a large number of specimens of *Esomus barbatus* from different localities in South India. The species is closely allied to *E. thermoicos* from Ceylon, but can be readily distinguished by its characteristic colouration and by the possession of 17 predorsal scales.

D. 2/6; A. 3/5.

The length of the head is contained from 4.1 to 4.5 times and the depth of the body from 4 to 4.4 times in the total length without the caudal. The head becomes proportionately shorter with age. The diameter of the eye is contained from 3.4 to 4.2 times in the length of the head. The snout is equal to or slightly longer than the diameter of the eye. The interorbital width is somewhat greater than the diameter of the eye. The maxillary barbels usually extend up to the middle of the pectoral, but they may be slightly longer or shorter. The lateral line is complete and well defined. There are 30 to 32 scales along the lateral line and 7 transverse rows on the body. There are 17 predorsal scales. The pectoral rays are slightly produced in young individuals only. Except in young specimens the pectorals do not reach the ventrals and the latter do not extend to the anal. The caudal peduncle is slightly shorter than the head in young individuals, but in full grown specimens it is slightly longer; its least height is about half of its length. There are 14 scales round the caudal peduncle.

In *Esomus barbatus* the body is silvery white, darkish above and lighter below. On the sides there are broad but indistinct silvery bands with a streak of a darker colour running along the middle of the body and becoming quite prominent behind the ventral fin. The fins are diaphanous.

The species is quite common in South India, and is represented in the Indian Museum collection from the following localities :—

2591	Madras	F. Day	1
F $\frac{10796}{1}$	. Mopad, Nellore Dist., Madras	Madras Fisheries	19
F $\frac{10797}{1}$	. Verkaipudie, Nellore Dist., Madras	Ditto	106
F $\frac{10798}{1}$	. Porpandal, Chenglepet Dist., Madras	Ditto	72
F $\frac{10799}{1}$	. Mysore	C. R. Narayan Rao	2

Measurements in millimetres.

	Verkaipudie				Mopad			
Total length without caudal	50.5	55	58	60.5	67	71	77	87
Length of head . . .	12	13	14	14	15	16	17.5	19
Height of body	12	13	14	13.7	15.2	17	19	21
Diameter of eye	3.5	3.5	4	3.5	4	4.2	4.5	4.5
Interorbital width	3.7	3.7	4.5	4	5	5	6	6.7
Length of snout	3.2	4	4	4	4.2	4.7	5.2	5.7
Length of caudal peduncle	11	12.5	13	13.7	16	16.5	16.5	20
Least height of caudal peduncle.	6	6.5	6.7	7	7.5	7.7	8.5	9.5

***Esomus ahli*, sp. nov.**

1869. *Nuria malabarica* (in part), Day, *Proc. Zool. Soc. London*, p. 559.

1878. *Nuria danrica* var. *malabarica* (in part), Day, *Fish. India*, p. 583.

1889. *Nuria danrica* (in part) Day, *Faun. Brit. Ind. Fish.* I, p. 334.

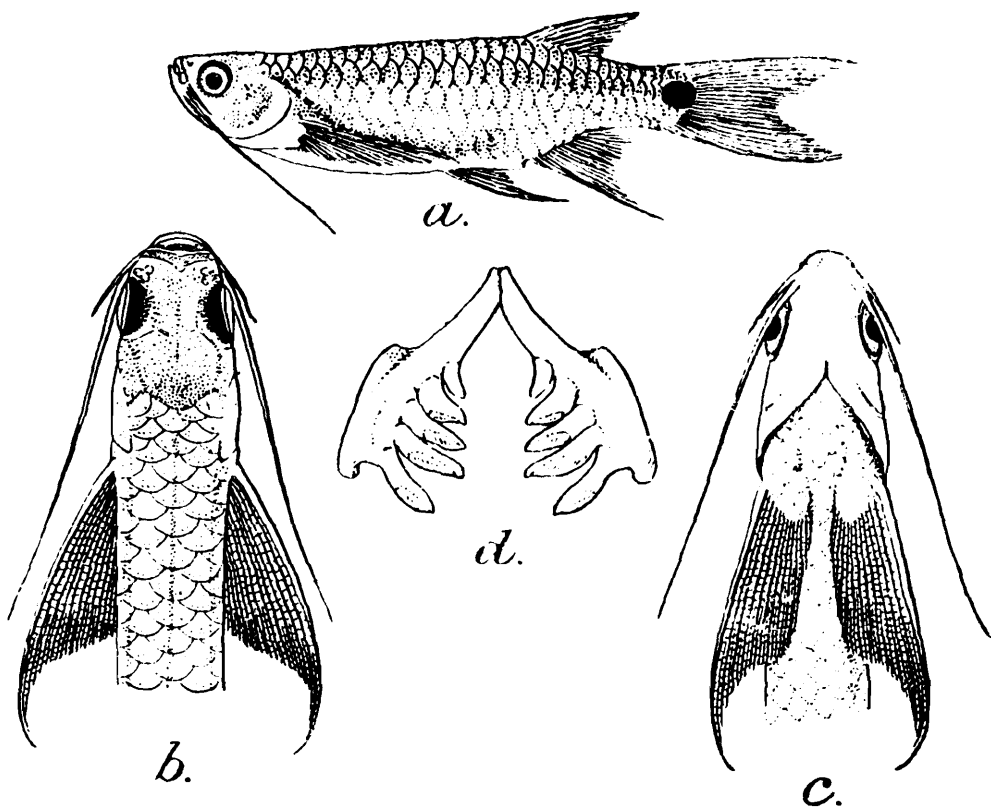
1923. *Esomus malabaricus*, Ahl (nec Day), *Mitt. Zool. Mus. Berlin* XI, p. 42.

The absence of the lateral line has been considered to be the chief characteristic of Day's *Esomus malabaricus*, and it was probably this

assumption that led Day in 1869 to confuse the Irrawaddi specimens with the Malabar examples without the lateral line. From an examination of a large series of specimens from India and Burma we have come to the conclusion that the Burmese form described as *malabaricus* by Ahl is quite distinct from Day's *malabaricus* from Trichur. We consider the former to be a hitherto undescribed form and have great pleasure in associating it with the name of Dr. Ernst Ahl. *Esomus ahli* may be described as follows :—

D. 2/6 ; A. 3/5 ; P. 13 ; V 7 ; C. 20.

Esomus ahli is a small species which does not grow to more than 2·5 inches in length. The head is contained from 4·1 to 4·4 times and the depth of the body from 3·7 to 4 times in the total length without the caudal. The head is proportionately longer and the body is deeper in



TEXT-FIG. 3.—*Esomus ahli*, sp. nov.

a. Lateral view $\times 2$; b. Dorsal view of head and anterior part of body $\times 3$; c. Ventral view of head and anterior part of body $\times 3$; d. Pharyngeal bones with teeth $\times 12$.

young individuals. The diameter of the eye is about one-third the length of the head. The interorbital width and the snout are considerably shorter than the diameter of the eye. The maxillary barbels are very variable. In some they extend up to the middle of the pectoral fin only, while in certain other specimens they reach beyond the base of the anal fin. The dorsal fin commences opposite the 18th longitudinal scale and there are 15 to 16 predorsal scales. The lateral line pierces from 4 to 6 scales only. There are 27 to 28 scales in a longitudinal series and they are arranged on the body in 6 transverse rows. The pectoral fin is long and reaches the base of the ventral which extends to the base of the anal fin. The outermost rays of the paired fins and the third spine of the anal fin are greatly drawn out. In the Moulmein

examples this condition is better marked than in those from Rangoon. The least height of the caudal peduncle is contained from 1.5 to 2 times in its length. There are 12 scales round the caudal peduncle.

The colouration in spirit is silvery with a well marked black pre-caudal spot.

Type-specimen :—F 10794/1, *Zoological Survey of India (Ind. Mus.)*.

Esomus ahli is found in pools and ditches and has so far been recorded from Rangoon, Moulmein and Akyab in Burma. The following table gives the exact localities of the specimens in the Indian Museum collection :—

F $\frac{10794}{1}$	Rangoon (Type-series)	F. G. Meggitt	.	11
829 Cat.	Rangoon . .	F. Day . .	.	2
F $\frac{6344.5}{1}$	. Rangoon	S. A. Harris	.	2
F $\frac{7448.72}{1}$	. Outside Farm caves near Moulmein	F. H. Gravely		25
F $\frac{10795}{1}$	. Akyab	E. S. Feegrade	.	1
F $\frac{10810}{1}$	. Lashio, N. Shan States, Burma	Director, Harcourt Butler Institute of Public Health		4

Measurements in millimetres.

	Moulmein.				Rangoon.			
Total length without caudal	29	31.5	33	35	28	30	31.5	45
Length of head	7	7.5	7.5	8	6.5	7	7	9.5
Height of body	7.5	8.5	8.5	8.7	7	8	9	12
Diameter of eye	2.5	2.5	2.5	2.5	2	2	2	2.5
Interorbital width	2	2	2	2	2.5	3	2	2.5
Length of snout	2	2	2	2	1.5	2	2	2
Length of caudal peduncle	6	6	6	6.5	6	6.5	6	8
Least height of caudal peduncle.	3.2	3.7	4	4	3.5	4	3.5	5

***Esomus danricus* (Ham. Buch.)**

1822. *Cyprinus danrica*, *C. jogia*, *C. sutiha*, Hamilton Buchanan, *Fish. Ganges* pp. 325-327, 390, 391, pl. xvi, fig. 88.
 1839. *Perilampus recurvirostris*, *P. macrouru*, *P. thermophilus*, McClelland, *As. Res.* (Ind. Cyprinidae), XIX, pp. 290, 291, 398, 399; pl. xlv, figs. 2B, 3B, pl. liv, fig. 19.
 1839. *Esomus vittatus*, Swainson, *Nat. Hist. Fish.* II, p. 285.
 1842. *Nuria thermophylos*, Cuvier and Valenciennes, *Hist. Nat. Poiss.* XVI, p. 240.
 1853. *Nuria danrica*, Bleeker, *Verh. Bat. Gen.* XXV, p. 130.
 1863. *Esomus danrica*, Bleeker, *Atl. Ichthyol.* III, p. 32.
 1867. *Esomus malabaricus*, Day, *Proc. Zool. Soc. London*, p. 299.
 1868. *Nuria danrica* (in part), Günther, *Cat. Fish. Brit. Mus.* VII, p. 200.
 1869. *Nuria malabarica* (in part), Day, *Proc. Zool. Soc. London*, p. 559.
 1878. *Nuria danrica* (in part), Day, *Fish. India*, p. 583, pl. cxlv, fig. 7.

1889. *Nuria danrica* (in part), Day, *Faun. Brit. Ind. Fish.* I, p. 334.
 1907. *Nuria danrica*, Annandale, *Rec. Ind. Mus.* I, p. 41.
 1909. *Nuria danrica*, Jenkins, *Rec. Ind. Mus.* III, p. 287.
 1912. *Nuria danrica* var. *malabarica*, Dunker, *Mitt. Zool. Mus. Berlin* XXIX, p. 266.
 1912. *Nuria danrica* var. *grahami*, Chaudhuri, *Rec. Ind. Mus.* VII, p. 44, pl. xxix, fig. 3.
 1913. *Nuria danrica*, Chaudhuri, *Rec. Ind. Mus.* VIII, p. 253.
 1915. *Nuria danrica*, Southwell, *Rec. Ind. Mus.* XI, p. 315.
 1915. *Nuria danrica* var. *grahami*, *id.*, *ibid.*, XI, p. 315.
 1923. *Esomus thermophylus*, *E. sutiha*, *E. jogia*, *E. danricus*, *E. lineatus*, Ahl, *Mitt. Zool. Mus. Berlin* XI, pp. 40-42.

Esomus danricus is the most widely distributed Indian species of the genus, and we have examined a very large series of specimens from all parts. The species exhibits a great range of individual variability, especially as regards the length of the maxillary barbels, the structure of the paired fins and the composition of the lateral band on the body. From a very careful study of the extensive material at our disposal we are led to conclude that the various forms described from Bengal, Assam, the United Provinces and Orissa are synonymous with one another. We have also included Day's *malabaricus* in the above synonymy, but not without some hesitation. The specimens identified by Day as *E. malabaricus* are not in a good state of preservation, but as far as can be judged from these specimens they do not differ materially from the common Bengal species. Dunker's *Nuria danrica* var. *malabarica* from Ceylon probably belongs to this species, but we cannot express a definite opinion without examination of authentic material. In view of the great confusion that has hitherto prevailed about *Esomus danricus* we propose to give below a short description of the species:—

The length of the head is contained from 3.5 to 5 times and the depth of the body from 3.3 to 4.8 times in the total length without the caudal. The diameter of the eye is contained from 3 to 4 times in the length of the head. The interorbital width is usually slightly greater than the diameter of the eye, but in some examples it is equal to or even shorter. The snout is invariably shorter than the diameter of the eye. The length of the maxillary barbels is variable; usually they extend to the middle of the pectorals but may reach their base or extend even a little further. There are 16 to 17 predorsal scales. The lateral line pierces from 4 to 6 scales only anteriorly. There are 27 to 30 scales in a longitudinal series and these are arranged on the body in 6 transverse rows. The pectoral reaches the base of the ventral, which extends to the base of the anal. The outer rays of the paired fins usually extend for a considerable distance beyond the fin membrane, but their length varies considerably. The minimum height of the caudal peduncle is contained from 1.2 to 2 times in its length. There are 14 scales round the caudal peduncle.

There is a broad lateral band of a black colour extending from behind the eye to the base of the caudal fin. This band is very variable, and in certain examples is represented as a silvery band only. The body is silvery, the upper half being slightly darker.

Esomus danricus is very common in the ponds and ditches of Bengal, Bihar, Orissa, Assam, United Provinces, Central Provinces and the

Punjab. It is also found in South India. In the Indian Museum collection the species is represented from the following localities :—

$F \frac{10776}{1}$	. Madhopur, Punjab . . .	Punjab Fisheries .	3
$F \frac{10786}{1}$	. Punjab . . .	„ „	3
$F \frac{10777}{1}$	. Chawas Nallah, Punjab .	G. C. Howell	3
$F \frac{10778}{1}$	. Lahore, Punjab . . .	George Matthai	4
$F \frac{10782}{1}$	. Puranapokra, Kon, Mirzapur, U. P. . . .	Mrs. Johnston	2
$F \frac{6208-11}{1}$	Hazratgunge, Lucknow, U.P.	S. W. Kemp	4
$F \frac{10781}{1}$	. Agra, U. P.	Zool. Dept., Allahabad University .	3
$F \frac{7701}{1}$	. Kalinaddi, Meerut, U. P. (Type of var. <i>grahami</i>)	Capt. J. D. Graham	1
$F \frac{7283}{1}$	. Delhi, U. P. . . .	Mus. Coll.	1
$F \frac{6143}{1}$	. „ „ .	Malaria Officer, Lahore	1
$F \frac{7714}{1}$	Bhagmati R., Champaran Dist., Bihar	M. Mackenzie	1
$F \frac{7685}{1}$	Ditto . . .	„ „	1
$F \frac{10791}{1}$	. Gandak R., Siripur, Saran Dist. . . .	„ „	1
$F \frac{3759}{1}, F \frac{3763}{1}$	} Siripur, Saran Dist.	„ „	9
$F \frac{4211-12}{1},$			
$F \frac{5366-70}{1}$			
$F \frac{10779}{1}$	. Nerbudda R., Mandla Dist C. P.	E. A. D'Abreu	1
$F \frac{10780}{1}$	. Carlsingon Panchmarhy, C. P.	?	1
$F \frac{10783}{1}$	. Nawegaon Lake, Bhandara Dist., C. P..	E. A. D'Abreu	5
$F \frac{10788}{1}$	. Champadanga, near Calcutta	R. Hodgart	21
$F \frac{10789}{1}$	. Khardah, 24-Pergs. Dist., Bengal . . .	D. D. Mukerji	20

F $\frac{6756-62}{1}$	Gatigarh, Hughly Dist., Bengal	A. Rahman	7
F $\frac{6592-6601}{1}$	Khanpur, Hughly Dist., Bengal	" "	10
F $\frac{4886}{1}$, F $\frac{4889}{1}$	Berhampur Court, Bengal	S. W. Kemp	2
F $\frac{1468-73}{1}$	Port Canning, L. Bengal	N. Annandale	6
13918-13930	Jessore Bheels, E. Bengal	Wood-Mason & Alcock	13
F $\frac{6374}{1}$, F $\frac{6377-88}{1}$	} Khulna, E. Bengal	J. Caunter	13
F $\frac{2027}{1}$	Manbhum	A. K. Hallows	1
F $\frac{10790}{1}$	Amlabad, near Jharia, Manbhum Dist.	D. D. Mukerji	20
827 (Cat.)	Calcutta Bazaar	F. Day	12
F $\frac{7118-22}{1}$	Nomati, Darrang Dist., Assam	S. W. Kemp	5
F $\frac{7135-38}{1}$	Ditto	" " "	4
F $\frac{10793}{1}$	Between Chittagong and Sultan Bagu Bastan	N. Annandale & S. W. Kemp	2
F $\frac{10792}{1}$	Drummondgunge Tank (Daman)	?	2
F $\frac{7745}{1}$	Dibrugarh, N. E. Assam	S. W. Kemp	1
F $\frac{7173}{1}$	Sur Lake, Puri, Orissa	N. Annandale	1
F $\frac{10784}{1}$	Nellore Dist., Madras	" "	1
F $\frac{10785}{1}$	Colair Lake, Kistna Dist.	" "	2
2450	?	F. Day	1
830 (Cat.)	?	?	1
F $\frac{9922}{1}$	?	R. B. Seymour Sewell	3
F $\frac{10787}{1}$	?	?	8

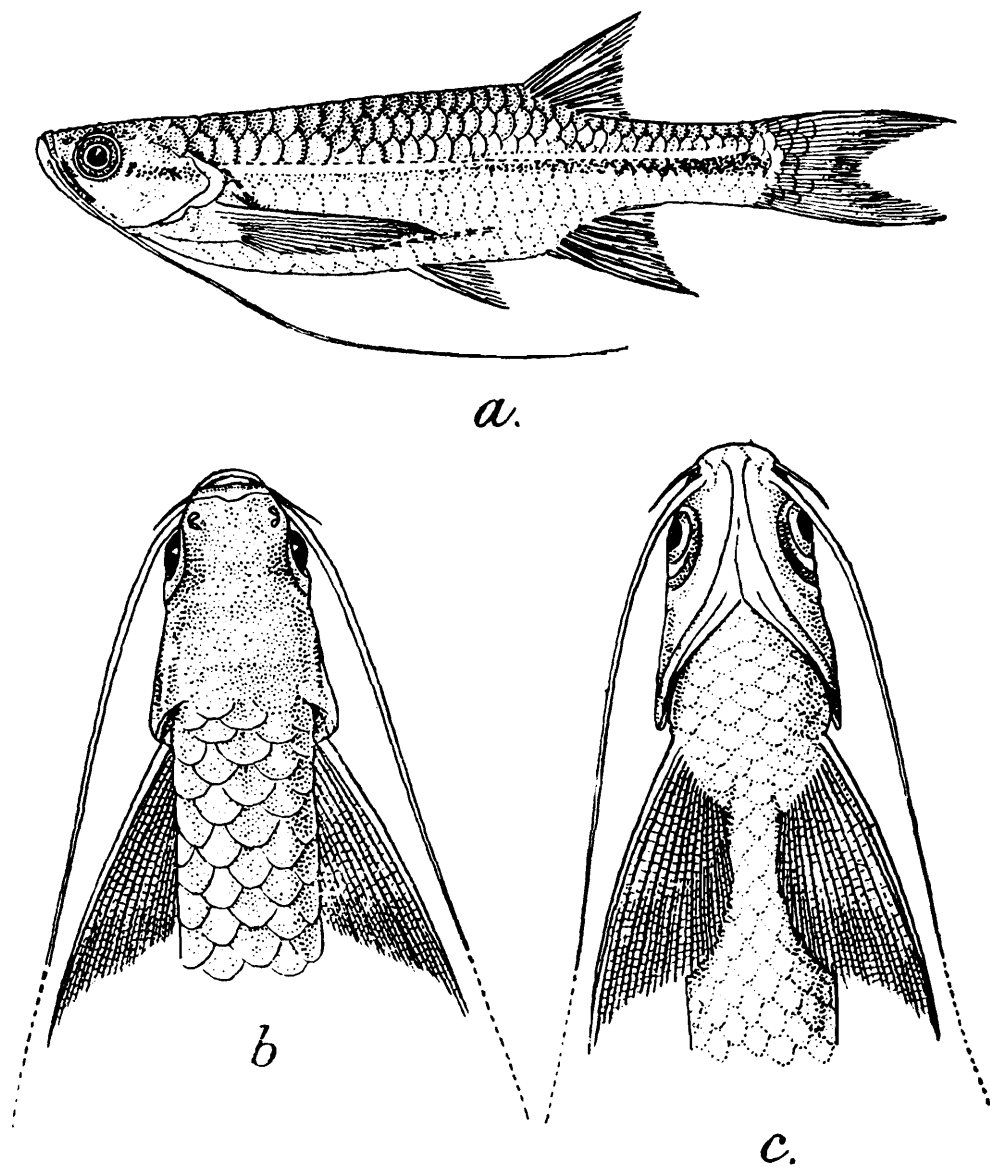
Measurements in millimetres.

	Punjab.			United Provinces.			Bihar.			Central Provinces.			Bengal.			Assam.			Orissa.	Madras.
Total length without caudal.	44	50	52·5	25	29	30	35	38	42	30	32	36	37	41	45	26	35	39	33	43
Length of head	11	12·5	12·5	7	7·5	7·5	9	10	10	7·5	7·5	7·5	9	10	9·5	7	9	9·5	8	8·5
Height of body	11	13	13	5·75	6·5	6·5	9	9·5	10	7·5	7·5	7·5	9	10	10·5	7	9	10	8·5	11
Diameter of eye	3·5	3·5	3·5	2	2·5	2·25	2·75	3	3	2	2	2	3	3	3	2	3	3	2·25	3
Interorbital width	5	5	5	3	3·25	3·25	4	4	4	2	2	2	2	2	2·5	3	3·5	4	2	3
Length of snout	3	3·5	3·5	2	2	2	2·25	2·5	2·5	2	2	2	2	2	2·5	1·75	2	2	2	2·5
Length of caudal peduncle.	9	10	10	5	5·75	6	7	8	8	6	6·5	7	7	9	9	5·75	6·25	7	6·5	8
Least height of caudal peduncle.	5	6	6	2·5	3	3	3·5	4	4	3·5	3·5	4	4·5	5	5	3	4	5	4	5

***Esomus metallicus* Ahl.**

1923. *Esomus metallicus*, Ahl, Mitt. Zool. Mus. Berlin XI, p. 42.

Through the kindness of Dr. H. M. Smith, Director, Department of Fisheries, Siam, we have received a number of specimens of the genus *Esomus* from Nontaburi in Central Siam and from Nong-Khor in the south-eastern part of Siam. Though these examples differ in certain respects from Ahl's description of *E. metallicus*, we have little doubt that they belong to the same species. The species was described from seven specimens collected at Petchaburi.



TEXT-FIG. 4.—*Esomus metallicus* Ahl.

a. Lateral view $\times 2$; b. Dorsal view of head and anterior part of body $\times 3$;
c. Ventral view of head and anterior part of body $\times 3$.

The lateral line in all the specimens examined by us does not extend to the anal fin; in some cases it does not even reach the base of the ventral. The maxillary barbels vary considerably as regards their length, generally they reach the base of the anal fin or extend beyond it, but in some specimens they do not extend beyond the base of the ventral.

Usually there is a distinct lateral band commencing from behind the eye and extending to the base of the caudal fin. In some specimens

it becomes indistinct in the anterior half of the body, but is prominent in the tail region.

Esomus metallicus is distinguished by its long maxillary barbels, by the presence of the lateral line at least to the base of the ventral and by its characteristic colouration.

Specimens from the following localities are represented in the Indian Museum collection :—

F $\frac{10800}{1}$	Nontaburi, Central Siam	.	H. M. Smith	.	.	8
F $\frac{10801}{1}$	Nong-Khor, South-east Siam	„	„	„	.	19

Measurements in millimetres.

	Nontaburi				Nong-Khor.			
	37.5	39	40	46	31	34	35	38
Length without caudal . . .	37.5	39	40	46	31	34	35	38
Length of head . . .	8.5	9	9	10	9	8.2	8.5	9
Height of body . . .	9	10	10.5	13	9.5	9	9	11
Diameter of eye . . .	3	3	3	3	3	2.5	2.5	2.8
Interorbital width . . .	3.5	4	3.5	4.5	3	3	3	3
Length of snout . . .	2	2	2	2.5	2.2	2.2	2.2	2.3
Length of caudal peduncle . .	9	9	9.5	10	7.5	7	7.5	8
Least height of caudal peduncle	4	4.5	5	5.5	4.2	4	4	4.5

The form of the fish as shown in the figure is the result of preservation. The figure of the head region shows a prominence in the middle of the lower jaw. Such prominence is absent in *Esomus*. We are unable to add anything further about this form and only include it here for convenience of reference.

ZUR KENNTNIS DER MIKROFAUNA VON BRITISCH INDIEN.

II. HYDRACARINA.

Von DR. C. WALTER, Zoologische Anstalt der Universität, Basel.

Allem Anscheine nach wird in den kommenden Jahren die Wassermilbenfauna Indiens das Interesse der Forscher mehr beanspruchen als dies bis heute der Fall gewesen ist. Es dürfte deshalb nicht unangebracht sein, der Beschreibung einer Anzahl neuer Hydracarinien aus Vorder-Indien, die mir Herr Dr. P. A. Chappuis freundlichst zur Bearbeitung zugestellt hat, eine Zusammenstellung der Literatur und der bis jetzt im indo-australischen Faunengebiete nachgewiesenen Arten vorausgehen zu lassen.

LITERATUR.

CANESTRINI, G. Acari nuovi o poco noti.

1884. *Atti R. Istit. Ven. sc.*, T. 2, ser. 6, p. 719.

Für Queensland wird die an einem Wasserkäfer schmarotzende Larve von *Hydrarachna odontognatha* Can. beschrieben.

DADAY, E. Microscopische Süßwassertiere aus Ceylon.

1898. *Term. Füzetek*, Vol. 21, Anhangsheft, pp. 85-116, fig. 41-55.

<i>Atax nodosus</i>	=	<i>Neumania nodosa</i> (Daday).
<i>Atax singalensis</i>	=	<i>Unionicola singalensis</i> (Daday).
<i>Curvipes conglobatus</i>	=	<i>Piona conglobata</i> (C. L. Koch) ??.
<i>Curvipes Horvathi</i>	=	<i>Piona horvathi</i> (Daday).
<i>Frontipoda picta</i>	=	<i>Oxus pictus</i> (Daday).
<i>Frontipoda ceylonica</i>	=	<i>Oxus ceylonicus</i> (Daday).
<i>Arrenurus singalensis</i>	=	<i>Arrhenurus singalensis</i> Daday.
„ <i>Madaasszi</i>	=	„ <i>madaraszi</i> Daday.
„ <i>ceylonicus</i>	=	„ <i>ceylonicus</i> Daday.
„ <i>rostratus</i>	=	„ <i>rostratus</i> Daday.
„ <i>orientalis</i>	=	„ <i>orientalis</i> Daday.
„ <i>congener</i>	=	„ <i>congener</i> Daday.
<i>Hydryphantes silvestrii</i>	=	<i>Eupatra silvestrii</i> (Daday).
<i>Hydrachna dilatata</i>	=	<i>Hydrarachna dilatata</i> Daday.

Als *Curvipes conglobatus* bezeichnete Daday eine Larve aus den Sümpfen von Madatugama, obwohl Imagines dieser Art weder auf Ceylon noch im übrigen Faunengebiete nachgewiesen worden sind. Die Richtigkeit dieser Bestimmung ist daher stark zu bezweifeln. Auch scheint das als Männchen von *C. horvathi* beschriebene Exemplar einer andern Art anzugehören. Es unterscheidet sich vom Weibchen durch eine Reihe von Merkmalen (Palpus, Bau und Borstenbesatz der Beine, Krallen, Zahl der Genitalnäpfe u. a. m.), so dass meiner Ansicht nach die beiden Individuen nicht die Geschlechtstiere ein und derselben Art sein können.

KOENIKE, F. Eine unbekannte Eylais-Form nebst einer Notiz zur Synonymie einer verwandten Art.

Ergebnisse einer Reise nach dem Pacific (SCHAUINSLAND 1896-1897).

1900. *Zool. Jahrb. Syst.*, Vol. 23, pp. 125-132, fig. 1-7.

Eylais schauinslandi Koen. Lagune auf d'Urville-Insel in der Cookstrasse (Neuseeland).

DADAY, E. Mikroskopische Süsswassertiere aus Deutsch-Neu-Guinea.

1901. *Term. Füzetek*, Vol. 24, pp. 1-56, pl. 1-3.

Atax multiporus = *Neumania (Lemienia) multipora* (Daday).

Curvipes piersigi = *Piona piersigi* (Daday).

Arrhenurus koenikei = *Arrhenurus koenikei* Daday.

PIERSIG, R. Beiträge zur Kenntniss der Hydrachnidenfauna des Bismarck-Archipels.

1904. *Arch. f. Naturgesch.*, Vol. 1, pp. 1-34, pl. 2-5 (s. auch : PIERSIG, R., In- und ausländische Hydrachniden. 1898. *Zool. Anz.*, Vol. 21, pp. 568-575).

Arrhenurus dahli Piersig.

„ *laticodulus* Piersig.

„ *latipetiolatus* Piersig.

„ *altipetiolatus* Piersig.

„ *bicornutus* Piersig.

„ *lohmanni* Piersig.

„ *quadricaudatus* Piersig.

„ *matupitensis* Piersig.

„ *quadricornutus* Piersig.

Oxus dahli Piersig.

OUDEMANS, A. C. In *Nova Guinea. Résultats de l'expédition Scientifique Néerlandaise à la Nouvelle Guinée.* Acari.

1906. Vol. 5, pp. 101-162, pl. 3, fig. 88-93. (s. auch : OUDEMANS, A. C. in *Entomologische Berichten*, 1905, No. 23, p. 223).

Der Verfasser beschreibt als *Limnesia jamurensis* eine auf *Mansonia unicolor* Theob. festsitzende Larve aus der Umgebung des Jamur-Sees. Wie die Figuren zeigen, handelt es sich nicht mehr um eine Larve, sondern um ein Nymphophanstadium, und dann gehört die Art ganz bestimmt nicht in das Genus *Limnesia*. Die Gattung genauer zu bestimmen, ist jedoch nicht möglich.

PIERSIG, R. Ueber Süsswasser-Acarinen von Hinterindien, Sumatra, Java und den Sandwich-Inseln. (Reise von Dr. Walter Volz).

1906. *Zool. Jahrb. Syst.*, Vol. 23, pp. 321-394, pl. 13-21. (Ausgegeben : 11. Mai 1906).

JAVA : *Atax affinis* = *Unionicola affinis* (Piersig).

Piona pseudouncata Piersig.

Limnesia lembangensis Piersig.

Amasis minimus = *Sigthoria minima* (Piersig).

Arrhenurus aculeatifrons Piersig.

„ *gibberifrons* Piersig.

Diplodontus despiciens var. *monticolus* Piersig.

SUMATRA : *Neumania volzi* Piersig.

„ *ambigua* Piersig.

Piona multipora Piersig.

„ *bipunctata* Piersig.

Arrhenurus pseudoaffinis Piersig.
 „ *belaniensis* Piersig.
 „ *bicornicodulus* Piersig.
 „ *palembangensis* Piersig.
 „ *gracilipes* Piersig.

Eupatra rotunda Piersig.

Eylais pseudorimosa Piersig.

SIAM : *Ecpolopsis multiscutata* = *Koenikea multiscutata* (Piersig).

Piona pachyderma Piersig.

Brachypodopsis coerulea = *Axonopsis coerulea* (Piersig).

Hydrachna semiscutata = *Hydrarachna semiscutata* Piersig.

„ *volzi* = „ *volzi* Piersig.

KOENIKE, F. Hydrachniden aus Java.

1906. *Jahrb. Hamburg. Wiss. Anst.*, Vol. 23, 2. Beiheft, pp. 105-137, pl. 1-2. (Ausgegeben : 25. Oktober 1906).

Von den in dieser Arbeit als neu beschriebenen Arten lassen sich zwei ganz bestimmt auf PIERSIGSche Formen beziehen, deren Diagnosen wenige Monate früher erschienen sind. *Neumania megalommata* Koen. ist ein Synonym von *N. ambigua* Piersig, *Limnesia gentilis* Koen. ein solches von *L. lembangensis* Piersig. Sehr wahrscheinlich sind auch *Unionicola pudenda* (Koen.) und *U. affinis* (Piersig) Namen für die gleiche Art, trotzdem die Diagnosen einige Verschiedenheiten enthalten.

Atax necessarius = *Unionicola necessaria* (Koen.).

Atax pudendus = ?*Unionicola affinis* (Piersig).

Neumania megalommata = *Neumania ambigua* Piersig.

„ *pilosa* Koenike.

„ *falcipes* Koenike = *N (Lemienia) falcipes* (Koen.)

Hygrobatas falcipalpis Koenike.

Limnesia gentilis = *Limnesia lembangensis* Piersig.

Diplodontus tenuipes Koenike.

Arrhenurus kraepelini Koenike.

Hydrachna sp.

Bei letzterer Form handelt es sich um Nymphophanstadien einer *Hydrarachna*-Art, die an einer Wasserkäferlarve (*Dytiscus*-Larve ?) befestigt waren.

RAINBOW, W. J. A Synopsis of Australian Acarina.

1906. *Rec. Austr. Museum*, Vol. 6, pp. 145-193, fig. 36-37.

Die Diagnosen der beiden als neu beschriebenen Arten.

Eylais macchullochi.

Atax cumberlandensis = *Unionicola cumberlandensis* (Rainbow).

sind leider so allgemein gehalten, dass ein sicheres Erkennen wenigstens der ersteren fast ausgeschlossen erscheint.

APSTEIN, C. Das Plankton des Colombo-Sees auf Ceylon.

1907. *Zool. Jahrb. Syst.*, Vol. 25, p. 233.

Der Verfasser erwähnt das Auftreten von Hydracarin im Plankton und auf dem Boden des Colombo-Sees; diese Arten sollten von F. KOENIKE bestimmt werden, doch ist mir aus der Literatur keine diesbezügliche Angabe bekannt. Auf p. 238 werden nach DADAY citiert :

Atax nodosus = *Neumania nodosa* (Daday).

und zwei weitere, nicht näher bestimmte Formen,

DADAY, E. Entomostraca et Hydrachnidae e Tibet.

1908. *Rec. Ind. Mus.*, Vol. 2, pp. 323-341, fig. 9.

Eylais tibetana Daday.

LOHMANN, H. Marine Hydrachnidae und Halacaridae.

1909. *Fauna Südwest-Australiens*, Vol. 2, pp. 151-152, fig. 1.

Pontarachna denhami = *Litarachna denhami* (Lohmann).

LOHMANN, H. Eine Pontarachna von Formosa (*Pontarachna formosae* n. sp.).

1909. *Zool. Anz.*, Vol. 34, pp. 300-302, fig. a-e.

APSTEIN, C. Das Plankton des Gregory-Sees auf Ceylon.

1910. *Zool. Jahrb. Syst.*, Vol. 29, p. 674.

Nach F KOENIKE soll nicht nur in diesem See, sondern auch im Colombo-See im Plankton auftreten :

Piona longicornis var. *imminuta* Piersig.

WALTER, C. Hydracarina der Aru-Inseln.

1911. *Abh. Senckenberg Naturf. Ges.*, Vol. 34, pp. 209-222, pl. 7-8.

Hydrarachna mertonii Walter.

Mamersa rouxi Walter.

Arrhenurus dahli Piersig.

„ *quadricornutus* Piersig.

„ *pulcher* Walter.

„ *alatus* Walter.

„ *angustiscutatus* Walter.

Encentrifophorus chelatus Walter.

Piona bipunctata Piersig.

KOENIKE, F. Neue und neubenannte Wassermilben.

1914. *Abh. Nat. Ver. Bremen*, Vol. 22, pp. 397-398, fig. 13-14, (s. auch :

KOENIKE, F Ueber einige Arten der Wassermilbenfamilie der Hygrobatiden. 1918. *Abh. Nat. Ver. Bremen*, Vol. 24, p. 528).

Aus den Kiemen einer *Unio nepeanensis* Less. aus Australien wird beschrieben :

Unionicola cirrosa Koenike.

WALTER, C. Les Hydracariens de la Nouvelle-Calédonie.

1915. In : F. Sarasin und J. Roux, *Nova Caledonia*, *Zool.* Vol. 2, pp. 97-122, pl. 4-6.

Eylais incerta Walter.

Oxus orientalis Walter.

Unionicola longiseta Walter.

„ *crassipalpis* Walter.

Encentrifophorus sarasini Walter.

Neumania neo-caledonica Walter.

Piona diversa Walter.

Arrhenurus dahli Piersig.

„ *depressus* Walter.

„ *multicornutus* Walter.

„ *rouxi* Walter.

HASWELL, W. A. *Astacocroton*, a new type of Acarid.

1922. *Proc. Linn. Soc. New South Wales*. Vol. 47, pp. 329-343, pl. 36-37.

WALTER, C. Hydrobiologische Beiträge aus China. Hydracarina.

1923. *Internat. Revue Hydrobiol.*, Vol. 11, pp. 193-201, pl. 11.

Aus einem Lotosteiche aus der Umgebung von Kanton werden aufgeführt :

Koenikea multiscutata (Piersig).

Arrhenurus aculeatifrons Piersig.

„ *palembangensis* Piersig.

„ *weigoldi* Walter.

VIETS, K. Ueber einige Hydracarinen von den Molukken.

1923. *Zool. Anz.*, Vol. 57, pp. 188-191, fig. 1-4.

BURU : *Limnesia buruensis* Viets.

Arrhenurus dahli Piersig.

„ *altipetiolatus* Piersig.

„ *bicornutus* Piersig.

„ *lohmanni* Piersig.

„ *matupitensis* Piersig.

„ *toxopeusi* Viets.

VIETS, K. A Note on Indian Water-Mites.

1926. *Rec. Ind. Mus.*, Vol. 28, pp. 171-172.

VIETS, K. Indische Wassermilben.

1926. *Zool. Jahrb. Syst.*, Vol. 52, pp. 369-394, fig. 1-34.

BENGAL : *Eylais degenerata* var. *asiatica* Viets.

Hydrarachna trilobata Viets.

„ sp.

Diplodontus despiciens (O. F. Müller).

Hygrobates falcipalpis Koenike.

Unionicola diversipes Viets.

„ *scutigera* Viets.

Arrhenurus pseudoaffinis Piersig.

BURMA : *Unionicola diversipes* Viets.

Arrhenurus hamiger Viets.

UNITED PROVINCES : *Eylais degenerata* var. *asiatica* Viets.

„ *rimosoides* Viets.

Limnesia gentilis var. *indica* Viets = *L. lembangensis indica* (Viets).

Neumania volzi var. *indica* Viets = *N. indica* (Viets).

? *Encentrifidophorus chelatus* Walter.

Arrhenurus congener Daday.

SIAM : *Hygrobates falcipalpis* Koenike.

Arrhenurus sp.

ANDAMANS : *Arrhenurus pseudoaffinis* Piersig.

Limnesia gentilis Koenike ist als Synonym von *L. lembangensis* Piersig erkannt worden. VIETS' Varietät *indica* ist daher auf letztere zu beziehen. Meiner Ansicht nach hat *Neumania volzi* var. *indica* mit *N. volzi* Piersig nichts zu tun, weshalb es richtiger sein dürfte, sie als besondere Art, *N. indica* (Viets) zu betrachten.

VIETS, K. Fauna Sumatrensis. Hydracarina.

1926. *Entomol. Mitteil.*, Vol. 15, pp. 101-102, fig. 1-3.

Eylais degenerata var. *sumatrensis* Viets.

Eupatra rotunda Piersig.

Arrhenurus kraepelini Koenike.

VIETS, K. *Atractides spongicolus* n. sp., eine Hydracarine aus einem Süßwasserschwamm von Celebes.

1927. Zool. Anz., Vol. 71, pp. 109-112, fig. 1-5.

WALTER, C. Hydracarin von den Philippinen.

Im Druck.

LUZON : *Limnesia bakeri* Walter.

Neumania ambigua Piersig.

„ *flagellata* Walter.

Von den mir zur Bearbeitung überwiesenen Proben stammt die eine aus einem Sumpfgewässer bei Calicut. Sie erwies sich als ausserordentlich reichhaltig, enthielt sie doch 153 Individuen in 18 verschiedenen Spezies. Die Probe kommt aus den Sammlungen des Imperial Bureau of Fisheries, Madras.

Eylais rimosoides Viets.

Diplodontus despiciens var. *monticolus* Piersig.

Nilotonia indica n. sp.

Limnesia lembangensis Piersig.

Oxus orientalis Walter.

Unionicola crassipes (O. F. Müller).

Neumania ambigua Piersig.

„ *volzi* Piersig.

„ *longipes* n. sp.

„ *pilosa* Koen.

Piona pseudouncata Piersig.

Axonopsis latifrons n. sp.

Arrhenurus aculeatifrons Piersig.

„ *bicornicodulus* Piersig.

„ *micropetiolatus* n. sp.

„ *palembangensis* Piersig.

„ *pseudobruzelii* n. sp.

„ *belaniensis* Piersig.

Die drei folgenden, von Dr. HORA gesammelten Proben, sind die ersten aus Bachläufen Vorder-Indiens. Die darin enthaltenen Formen zeigen grosse Verwandtschaft mit den Torrenticolen des palaearctischen Gebietes, und es ist wohl anzunehmen, dass sie ihm ursprünglich auch entstammen. Dafür spricht auch die Lage der Gewässer am Südhange des Himalaja. Die Tiere lebten im Moos.

Bhagsu-nath, Upper Dharamsala, Kangra Valley, Punjab, 4. Juni 1926.

Lebertia (Ps.) *orientalis* n. sp.

Testudacarus tripeltatus n. g., n. sp.

Aturus scutelliferus n. sp.

Tilok-nath, Kangra Valley, Punjab, 25. Mai 1926.

Megapus minutus n. sp.

Atractides angulatus n. sp.

Near Milestone 16½ from Darjiling (Teesta-Darjiling Road), 21. December 1926.

LISTE DER IM INDO-AUSTRALISCHEN FAUNENGEBIETE NACHGEWIESENEN HYDRACARINEN.

	Tibet.	Punjab.	Darjiling.	United Provinces.	Bengal.	Burma.	Siam.	Kanton.	Formosa.	Calicut.	Ceylon.	Andamans.	Sumatra.	Java.	Luzon.	Buru.	Celebes.	Aru.	Neu-Guinea.	Bismarck-Archipel	Neu-Caledonien.	Australien.	Neu-Seeland.
1. <i>Hydrovolzia infringata</i> Walter																							
2. <i>Eylais tibetana</i> Daday																							
3. „ <i>degenerata sumatrensis</i> Viets																							
4. „ „ <i>asiatica</i> Viets																							
5. „ <i>pseudorimosa</i> Piersig																							
6. „ <i>incerta</i> Walter																							
7. „ <i>rimosoides</i> Viets																							
8. „ <i>schauinslandi</i> Koenike																							
9. „ <i>macchulochi</i> Rainbow																							
10. <i>Hydrarachna volzi</i> Piersig																							
11. „ sp. Viets																							
12. „ <i>dilatata</i> Daday																							
13. „ <i>trilobata</i> Viets																							
14. „ <i>mertoni</i> Walter																							
15. „ <i>semiscutata</i> Piersig																							
16. „ <i>odontognatha</i> Can.																							
17. „ sp. Koenike																							
18. <i>Eupatra silvestrii</i> (Daday)																							
19. „ <i>rotunda</i> Piersig																							
20. <i>Mamersa rouxi</i> Walter																							
21. <i>Diplodontus despiciens</i> (O. F. Müller)																							
22. „ „ <i>monticolus</i> Piersig.																							
23. „ <i>tenuipes</i> Koenike																							
24. <i>Nilotonia indica</i> Walter																							
25. <i>Sigthoria minima</i> (Piersig)																							

53.	„	<i>scutigera</i> Viets	.	.
54.	„	<i>cumberlandensis</i> (Rainbow)	.	.
55.	„	<i>diversipes</i> Viets	.	.
56.	<i>Encentridophorus</i>	<i>chelatus</i> Walter	.	.
57.	„	<i>sarasini</i> Walter	.	.
58.	<i>Neumania</i>	<i>indica</i> (Viets)	.	.
59.	„	<i>longipes</i> Walter	.	.
60.	„	<i>ambigua</i> Piersig	.	.
61.	„	<i>volzi</i> Piersig	.	.
62.	„	<i>neo-caledonica</i> Walter	.	.
63.	„	<i>nodosa</i> (Daday)	.	.
64.	„	<i>pilosa</i> Koenike	.	.
65.	„	<i>flagellata</i> Walter	.	.
66.	<i>N. (Lemienia)</i>	<i>multi-pora</i> (Daday)	.	.
67.	„	<i>falcipes</i> Koenike	.	.
68.	<i>Koenikea</i>	<i>multiscutata</i> (Piersig)	.	.
69.	<i>Piona</i>	<i>coccinea</i> var. <i>imminuta</i> Piersig	.	.
70.	„	<i>pseudouncata</i> Piersig	.	.
71.	„	<i>piersigi</i> (Daday)	.	.
72.	„	<i>pachyderma</i> Piersig	.	.
73.	„	<i>belaniensis</i> Piersig	.	.
74.	„	<i>diversa</i> Walter	.	.
75.	„	<i>horvathi</i> (Daday)	.	.
76.	„	<i>multi-pora</i> Piersig	.	.
77.	„	<i>bipunctata</i> Piersig	.	.
78.	„	<i>conglobata</i> (O. F. Müller) ?	.	.
79.	<i>Axonopsis</i>	<i>coerulea</i> (Piersig)	.	.
80.	„	<i>latifrons</i> Walter	.	.
81.	<i>Aturus</i>	<i>scutelliferus</i> Walter	.	.
82.	<i>Arrhenurus</i>	<i>dahli</i> Piersig	.	.
83.	„	<i>koenikei</i> Daday	.	.
84.	„	<i>depressus</i> Walter	.	.
85.	„	<i>aculeatifrons</i> Piersig	.	.
86.	„	<i>orientalis</i> Daday	.	.
87.	„	<i>altipetiolatus</i> Piersig	.	.
88.	„	<i>latipetiolatus</i> Piersig	.	.
89.	„	<i>alatus</i> Walter	.	.
90.	„	<i>pseudoaffinis</i> Piersig	.	.

	Tibet.	Punjab.	Darjiling.	United Provinces.	Bengal.	Burma.	Siam.	Kanton.	Formosa.	Calicut.	Ceylon.	Andamans.	Sumatra.	Java.	Luzon.	Buru.	Celebes.	Aru.	Neu-Guinea.	Bismarck-Arckipel	Neu-Caledonien.	Australien.	Neu-Seeland.
<i>Arrhenurus rouxi</i> Walter . . .																							
„ <i>laticodulus</i> Piersig . . .																							
„ <i>bicornutus</i> Piersig . . .																							
„ <i>lohmanni</i> Piersig . . .																							
„ <i>kraepelini</i> Koenike . . .																							
„ <i>madaraszi</i> Daday . . .																							
„ <i>bicornicodulus</i> Piersig . . .																							
„ <i>gibberifrons</i> Piersig . . .																							
„ <i>pulcher</i> Walter . . .																							
„ <i>micropetiolatus</i> Walter . . .																							
„ <i>angustiscutatus</i> Walter . . .																							
„ <i>belaniensis</i> Piersig . . .																							
„ <i>ceylonicus</i> Daday . . .																							
„ <i>congener</i> Daday . . .																							
„ <i>gracilipes</i> Piersig . . .																							
„ <i>hamiger</i> Viets . . .																							
„ <i>matupitensis</i> Piersig . . .																							
„ <i>multicornutus</i> Walter . . .																							
„ <i>palembangensis</i> Piersig . . .																							
„ <i>pseudobruzeli</i> Walter . . .																							
„ <i>quadricaudatus</i> Piersig . . .																							
„ <i>quadricornutus</i> Piersig . . .																							
„ <i>rostratus</i> Daday . . .																							
„ <i>singalensis</i> Daday . . .																							
„ <i>toxopeusi</i> Viets . . .																							
„ <i>weigoldi</i> Walter . . .																							
„ sp. Viets . . .																							

BESCHREIBUNG DER ARTEN.

1. *Hydrovolzia infrigata* n. sp.*Weibchen* :

Der Körper ist 0,585 mm lang, 0,390 mm breit. In Gestalt und Färbung weicht diese Art nicht von den beiden europäischen ab. Immerhin ist der Körper stärker gewölbt.

Die Doppelaugen sind randständig, Abstand der grossen Linsen voneinander 105μ . Sie liegen jederseits am Aussenrand der beiden frontalen, vorn gerundeten Vorsprünge, auf denen die beiden antenniformen Borsten sitzen. Der zwischen diesen Vorsprüngen liegende Ausschnitt ist tief, halbkreisförmig, und wird von oben her durch Chitinmassen des Praedorsalschildes zugedeckt. Antenniforme Borsten ziemlich kräftig, gefiedert, rückwärts gebogen, 65μ voneinander entfernt. Hinter jedem Doppelauge steht eine lange und feine Borste (fig. 1).

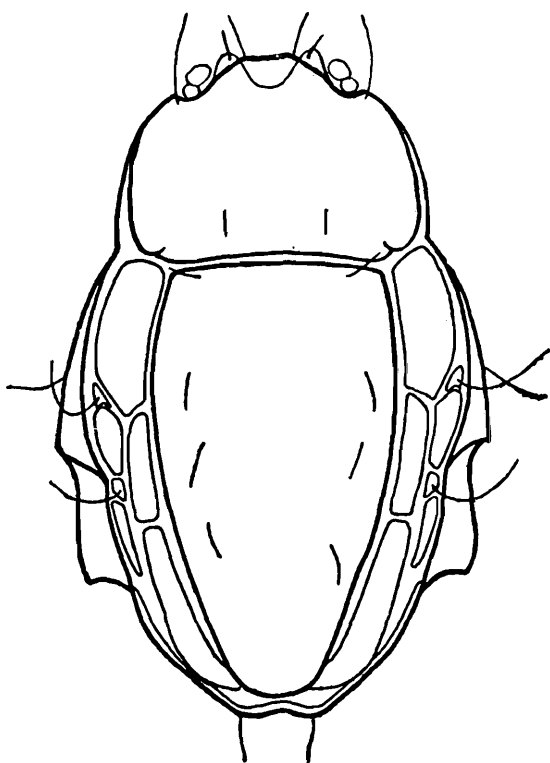


FIG. 1.—*Hydrovolzia infrigata* n. sp. ♀. Dorsalansicht.

Praedorsalschild 180μ lang, 265μ breit, relativ länger als bei den Vergleichsarten. Hinterrand leicht concav ausgeschweift, Seitenränder viel weniger gebogen als bei *H. placophora* (Monti), Vorderrand mit zwei sehr feinen Haaren zwischen den Vorsprüngen der antenniformen Borsten. Vor der Mitte des Hinterrandes liegen einige grosse Porendurchbrüche und zwei feine Haare.

Postdorsalplatte 415μ lang, mit gerade verlaufendem Vorderrand, maximale Breite im vorderen Drittel 220μ . Von dieser Stelle an verjüngt sich die Platte gleichmässig nach hinten und schliesst abgerundet ab. Die Porendurchbrüche alle von gleicher Grösse. Längs der Seitenränder sind jederseits vier Borsten verteilt. Zwischen der Vorderpartie der Postdorsalplatte und der 3. Epimere liegt ein 150μ langes Schildchen, an welches sich nach hinten zwei parallele Reihen schmaler Chitinbänder anschliessen. Die innere Reihe besteht aus einem vordern, 105μ langen, und einem hintern, 185μ langen Streifen, der sich in seiner

hintern Hälfte etwas verbreitert und unter das Postdorsalschild greift. Das Ende der letztern erscheint daher erhaben. Die äussere Reihe weist zunächst ein dreieckiges, mit Drüsenmündung versehenes Plättchen auf. Nach hinten folgen ein Drüsenschildchen, dann ein schmal dreieckiges Plättchen, dessen Hinterende etwa bis zur Einlenkungsstelle des 4. Beines reicht. Die Haut ist zwischen den einzelnen Chitinerhärtungen längsliniert.

Maxillarorgan in der Gestalt demjenigen der europäischen Arten ähnlich, doch kleiner, nur 185μ lang, 135μ breit. Rostrum 80μ lang, basal 70μ breit. Die grösste Breite des Organes befindet sich an der Einlenkungsstelle der Palpen. Der Hinterrand der Ventralwandung ist leicht vorgebogen. Mandibelmasse: Länge 153μ , Höhe 33μ , Länge der Klaue 41μ , der Grube 62μ . Vor der spitz endigenden Klaue ein gefranstes Mandibelhäutchen. Proximalende der Mandibel nicht gerundet, sondern mit umgebogener Spitze versehen.

Palpen (fig. 2) dünner als die Vorderbeine. Die Streckseitenlängen der einzelnen Glieder betragen: 1. 13, 2. 65, 3. 49, 4. 70, 5. 36μ . Grund-

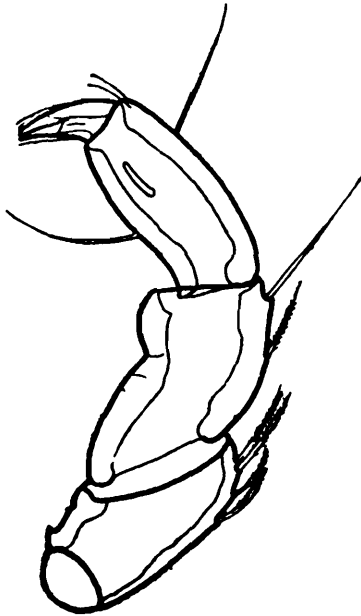


FIG. 2.—*Hydrovolzia infringata* n. sp. ♀. Palpus.

glied ohne Borste. Beim 2. Gliede beträgt die Länge der Beugeseite nur $\frac{1}{4}$ bis $\frac{1}{3}$ der Dorsalseite, an deren Distalende 2-4 kurze Borsten stehen. 3. Glied mit eigenartiger Einknickung der Beugeseite, welche letztere länger (60μ) als die Streckseite. Beugeseite des 4. Gliedes in der Mitte etwas aufgebaucht, dort eine lange gebogene Borste tragend. Innenseite fast in der Mitte mit starkem Dorn, Streckseite in der distalen Hälfte mit verlängerter Borste. Endglied in drei oder vier einander anliegende Klauen auslaufend. Chitin der Glieder sehr dickwandig.

Die beiden ersten Epimeren median in ihrer hinteren Partie eine Strecke parallel zu einander verlaufend. Aussenrand der 2. Platte freistehend, der Bauchfläche nicht direkt aufliegend, am Hinterrand mit breitem Chitinsaum versehen. Länge der beiden vorderen Epimerengruppen 195μ , der beiden hinteren Platten zusammen $0,295$ mm, wovon auf die 3. Epimere allein 200μ entfallen. Letztere ist der 4. Platte schief angesetzt; ihr Innenrand misst 170μ (fig. 3).

3. 400, 4. 455 μ . Schwimmhaare sind keine vorhanden, doch tragen einzelne Glieder hie und da feine, verlängerte Borsten. Auf der Strecksei-

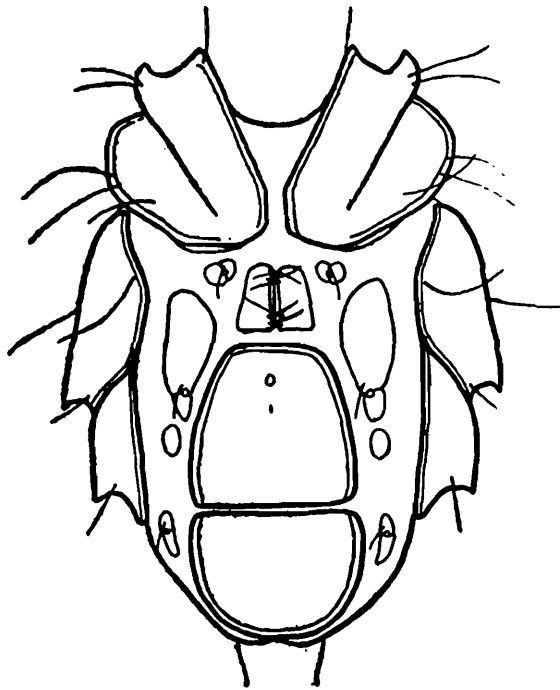


FIG. 3.—*Hydrovolzia infrigata* n. sp. ♀. Ventralansicht.

te der Glieder und periarticulär kurze, kräftige Dornen, die meisten mit gesägten Rändern. Auf dem Grundgliede der beiden vordern Beinpaare stehen dorsal je 2 gefiederte Säbelborsten. Die Krallenscheiden der Vorderbeine tragen nur glatte, etwas verlängerte Haarborsten und je einen kurzen Dorn. Tiefgefiederte Borsten finden sich dagegen auf der Krallenscheide des 3. und 4. Fusses; auf ersterem zählt man 3-4, auf letzterem nur zwei.

Die zwischen den Epimeren gelegene Partie der Ventralseite (fig. 3) trägt median zu vorderst das Genitalorgan. Es besteht aus zwei Klappen, die zusammen eine 65 μ lange und hinten 90 μ breite trapezförmige Figur bilden. Längs deren Innenränder finden sich jederseits vier Haarborsten, 2 vorn, 2 hinten. Genitalnäpfe sind keine vorhanden, auch die hellen Höfe unter den Klappen fanden sich nicht vor.

Hinter dem Genitalhofe liegt die grosse Analplatte von ähnlicher Form wie diejenige von *H. placophora* ist länger als die hinter ihr liegende Postanalplatte (160 μ : 125 μ), aber weniger breit als sie (155 μ : 165 μ). Der Excretionsporus liegt weit vorn. Jederseits dieser Platten liegen verschiedene Chitinerhärtungen: zuvorderst eine Drüsenpore, dann ein grösseres Plättchen von dreieckiger Form mit einem Drüsenporus in der hintern Ecke, weiter nach hinten ein rundlicher Fleck und endlich eine weitere Drüsenmündung auf länglichem Plättchen.

Fundort: Near Milestone 16½ from Darjiling (Teesta-Darjiling-Road), 21. Dezember 1926. Im Moos 2 eiertragende Weibchen. Dr. Hora leg.

2. *Eylais rimosoides* Viets.

Die Augenbrille des einzigen Weibchens stimmt in den Massen mit derjenigen des Typus überein. Die vordere Ausbuchtung der Augenbrücke zwischen den beiden die Sinnesborsten tragenden Vorsprüngen wird aber vom Muskelansatzzapfen ganz ausgefüllt, dessen Vorderrand

auf die Höhe des Vorderrandes der Augenkapseln zu liegen kommt. Der hinter der Brücke liegende Ausschnitt wird durch angelagerte Chitinbänder verengt. Der Palpus ist im 4. und 5. Gliede etwas verkürzt. Diese messen bzw. 360 und 170 μ , statt 420 und 225 μ , und auch Maxillarorgan und Mandibel weisen eine Verkürzung auf, 645 μ statt 745 μ .

Nymphe: In der Augenbrille zeigt sie die von VILTS für die Imago gezeichneten Verhältnisse, doch ist die Brücke verhältnismässig schmaler. Breite der Brille 0,260 mm, Länge einer Augenkapsel 0,175 mm. Das Maxillarorgan misst in der Länge wie die Mandibel 0,390 mm. Streckseitenlängen der einzelnen Palpenglieder: 1. 75, 2. 115, 3. 115, 4. 200, 5. 120 μ . Der Vorsprung des 3. Gliedes ist mit nur 5-6 Borsten besetzt. Die Innenfläche des 4. Gliedes trägt 3 Schwertborsten und distal 3 Fiederborsten.

Fundort: Sumpfgewässer bei Calicut. 1 Weibchen mit Eiern und 1 Nymphe.

3. *Diplodontus despiciens* var. *monticolus* Piersig.

Nur unter gewissen Vorbehalten möchte ich die beiden vorliegenden Weibchen auf diese Form beziehen. PIERSIG'S Diagnose (1906) ist recht knapp gehalten und schweigt sich über wichtige Merkmale aus. Die Typenexemplare konnten in der Sammlung nicht aufgefunden werden.

Beide Individuen sind wenig über 1 mm. lang. Die Haut trägt rundliche stumpfe Papillen, deren basaler Durchmesser ca 7 μ beträgt. Streckseitenlängen der Palpenglieder: 1. 44, 2. 73, 3. 54, 4. 175, 5. 78 μ . Nach PIERSIG soll das Verhältnis des 2. zum 3. Gliede 2:1 betragen; doch wird nicht gesagt, wie diese Zahlen erhalten worden sind. Auf Fig. 14, pl. 13 (PIERSIG 1906) zeigen die beiden Glieder dieses Verhältnis nur in der Mitte der Flachseiten. Dagegen scheint mir die Bewehrung der Innenseite des 2. Gliedes sehr typisch zu sein. Die drei Fiederborsten sind jedenfalls kräftiger entwickelt als bei der europäischen Art. Die am meisten streckseitenwärts verlagerte zeigt meist deutliche Fiederung beider Ränder. Die gebogene mittlere weist auf ihrer Beugeseite deutliche Fiederung auf, auf der Streckseite dagegen nur distal; weiter proximalwärts lassen sich nur unregelmässig stehende Einzelfiedern erkennen. Die der Beugeseite des Gliedes genäherte Borste zeigt nur auf der dem Palpengrunde zugekehrten Seite deutliche Fiedern; diese sind aber sehr lang. Die andere Seite ist entweder nicht oder nur distal gefiedert.

Der Mundkegel zeigt eine andere als die von PIERSIG für das Männchen auf Fig. 13 dargestellte Form, ist vorn weniger spitz und seine Seitenränder verlaufen fast bis zur Einlenkungsstelle der Palpen parallel zueinander. Das Rostrum ist weniger breit.

Das Camerostom erscheint weniger weit als bei den Individuen von PIERSIG. Die transversalen Fortsätze am Hinterende der 1. Epimere sind eben kürzer, sodass die Medialränder dieser beiden Platten näher beieinander liegen. Hinter der Einlenkungsstelle des 4. Beines ein kurzer Fortsatz am Plattenrande, der von PIERSIG nicht gezeichnet

Der Genitalhof weist eine Länge von 0,210 mm auf. Die beiden Napfplatten gleichen denjenigen der europäischen Form. Der napffreie Saum längs des Medialrandes einer jeden Platte ist weniger breit und von einer geringeren Anzahl von Haaren besetzt, als dies in Fig. 13 von PIERSIG dargestellt worden ist.

Fundort : Sumpfgewässer bei Calicut. 2 Weibchen.

4. *Nilotonia indica* n. sp.

Nymphe :

Gewisse Merkmale berechtigen zur Annahme, dass es sich nicht um die Nymphe von *N. loricata* (Nordensk.), sondern um eine von ihr spezifisch verschiedenen Form handelt.

Länge 0,645 mm, Breite 0,510 mm. Umriss oval, Stirnrand zwischen den kurzen, 190 μ voneinander entfernten antenniformen Borsten vorgewölbt. Haut mit deutlichen leistenförmigen Erhebungen dicht bedeckt; deren Länge verschieden ist. Die oberen Hautschichten erinnern an diejenigen gewisser *Pseudo-Lebertien*, hauptsächlich *L. zschokkei* Koen. Der Rücken trägt die gleiche Anzahl von Drüsenmündungen wie bei *N. loricata*. Die Drüsenringe messen 21-26 μ im Durchmesser. Vordere Rückenhälfte trägt ein Paar kleiner rundlicher Plättchen, deren Innenrand, abweichend von der Vergleichsart, mit einer Borste ausgerüstet ist. Auf dem Hinterrücken eine grössere Platte, 150 μ lang, 140 μ breit, porös. Die beiden Augen jeder Seite sind voneinander getrennt, vordere Linse rundlich, die hintere länglich.

Das Maxillarorgan in der Ventralwand — hinterer Fortsatz nicht inbegriffen — 150 μ lang. Es ist gedrungener als dasjenige der Vergleichsart. Rüssel viel weniger stark ausgezogen, an der Spitze gestutzt. Aufbauchung der Ventralwandung schwächer, gleichmässiger gerundet, ohne deutliche Einsattelung hinter derselben. Hinterrand der Seiten-

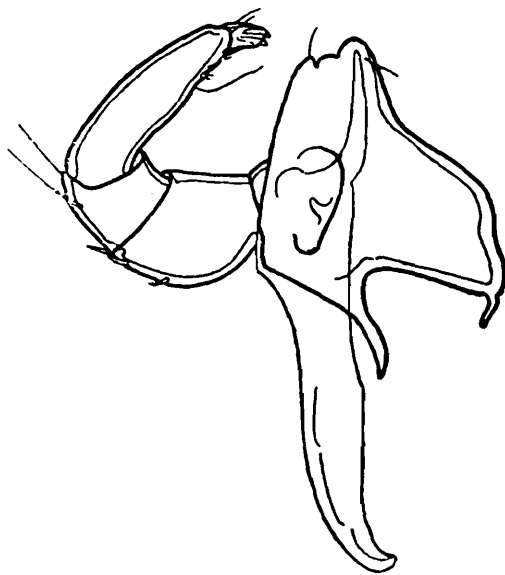


FIG. 4.—*Nilotonia indica* n. sp. Nymphe. Maxillarorgan und Palpus.

wand kaum schief gerichtet, fast senkrecht auf der Ventralwand stehend. Beide Fortsatzpaare viel kürzer. Mandibel mit relativ kürzerem Klauenglied als bei der Vergleichsart; Totallänge 0,260 mm, Klauenlänge 86 μ .

Die Streckseiten der Palpenglieder messen :

	1. 26,	2. 86,	3. 50,	4. 101,	5. 26 μ ,
die Gliedhöhen :	41	55	49	31	15 μ .

Das Chitin ist stark porös, wie übrigens auch dasjenige des Maxillarorganes. Die Poren sind in Gruppen angeordnet. Die Beborstung der Palpenglieder ist derjenigen der Vergleichsart wohl sehr ähnlich. 2. Glied ohne Beugeseitenborste. Am distalen Ende der Aussenwand des 4. Gliedes ein kleiner mit Borste versehener Vorsprung (fig. 4).

Epimeren (fig. 5) nicht über den Stirnrand vorspringend, 0,345 mm lang, 0,525 mm breit, unter Einbezug der äusseren Erweiterungen der 4.

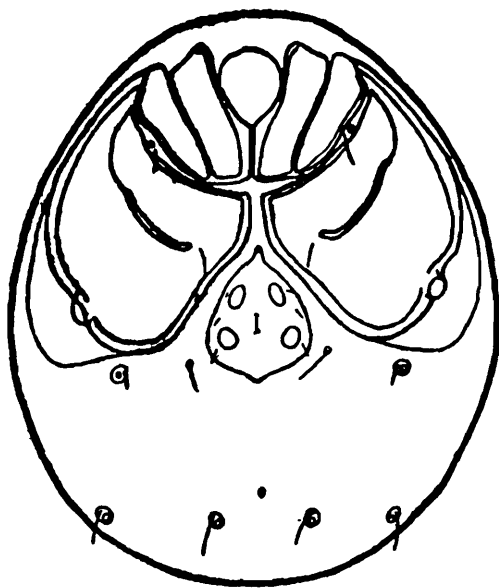


FIG. 5.—*Nilotonia indica* n. sp. Nympe. Ventralansicht.

Epimeren, die bis an den Körpertrand reichen. Maxillarbucht relativ tiefer als bei der Vergleichsart, ihr Hinterende hinter der Mitte der 1. Epimeren liegend, 90 μ tief, das verbleibende hintere Stück der 1. Epimeren noch 67 μ betragend. Suture zwischen 3. und 4. Epimere nicht bis an den Medialrand reichend, vor dem Haar auf der Platte nach vorn umbiegend, ähnlich wie bei *Dartia*. Hinterrand der 4. Epimere mit schmalen Saum, der weder das Einzelhaar neben dem Genitalhofe, noch die Postepimeraldrüse erreicht. Oberfläche der Hüftplatten von zahlreichen, in Gruppen angeordneten Poren durchbrochen.

Beinlängen : 1. 460, 2. 575, 3. 590, 4. 665 μ . Glieder dickwandig. Borsten wenig zahlreich : an den ventralen Gliedenden meist 2 kräftige, breite, gefiederte Schwertborsten, auf den Streckseiten meist kurze Dornen. Schwimmborsten : eine verkürzte auf dem 4. Gliede des 2. Beines, 1 normale auf dem 4. Gl., 3 auf dem 5. Gl. des 3. Beines, 3-4 auf dem 4., 3 auf dem 5. Gliede des Hinterfusses. Endglied des letzteren mit 5-6 über die Gliedlänge verteilte Borsten, kurz vor der Spitze ein etwas verlängertes Haar. Das Gliedende trägt 2 kurze Börstchen. Krallen der 3 Vorderbeine aus kräftigem Hauptzahn bestehend, dem aussen eine gekrümmte Borste, innen ein kurzer, absteigender Zahn angegliedert ist. Eine Zähnelung hinter demselben durch 2-3 winzige Höckerchen kaum angedeutet.

Genitalorgan (fig. 5) ganz in der Bucht liegend, aus einer porösen

Vorderende in eine Spitze ausgezogen ist. Hinterrand leicht vorgewölbt. Die vordern Näpfe etwas länglicher als die beiden hintern. Längs der beiden Seitenränder je 3 kurze Haare. Plattenlänge incl. Fortsatz 150μ , Breite 127μ .

Excretionsporus ohne Chitinring, ca 130μ hinter der Genitalplatte.

Fundort: Sumpfgewässer bei Calicut. 1 Nympe.

5. *Limnesia lembangensis* Piersig.

Syn. *L. gentilis* Koenike.

Diese Art ist gewiss eine der verbreitetsten Indiens. Die relativ zahlreichen Individuen, die untersucht werden konnten, zeigen nicht selten Abweichungen vom Typus. PIERSIGS *L. lembangensis* kann ich nicht als blosse Varietät von *L. gentilis* Koenike anerkennen, wie VIETS (1926) dies tut, sondern es ist letztere nichts anderes als ein Synonym der ersteren. Das Merkmal der stark genäherten 1. und 2. Genitalnäpfe konnte bei verschiedenen Individuen teils nur auf der einen Genitalplatte, teils auch beidseitig nachgewiesen werden. Die Mehrzahl der Individuen zeigt aber zwischen den beiden Näpfen eine Distanz, die grösser als der Napfdurchmesser ist. Dem welligen Napfrande ist kein systematischer Wert beizumessen. Es ist dies nichts anderes als eine durch die Conservierung bedingte Deformierung, die bei den einzelnen Exemplaren in recht verschiedenem Grade zu beobachten ist. Die Grösse der einzelnen Näpfe ist sehr variabel. Die Zahl der kurzen Borsten am Endgliede des Hinterbeines schwankt zwischen 3 und 5, beträgt aber meistens 4.

Nympe.

Länge 0,500 mm. Vordere Epimeren hinter dem Maxillarorgane noch nicht verwachsen; wohl aber senden sie an ihrem Hinterende medianwärts gerichtete Fortsätze aus. Palpen ohne Zahn am 2. Gliede. Streckseitenlängen der einzelnen Palpenartikel: 1. 10, 2. 72, 3. 41, 4. 96, 5. 28μ . Genitalplatte bedeutend breiter als lang, $91:49\mu$, viernäpfig, mit geringer Einbuchtung des Vorder- und Hinterrandes. Schwimmhaare ganz vereinzelt auftretend. Das Endglied des Hinterbeines mit einer einzigen, fast gliedlangen Borste kurz vor dem Gliedende.

Fundort: Sumpfgewässer bei Calicut. 12 ♂, 8 ♀, 1 Nympe. 2 der Männchen noch ganz jung, erst geschlüpft, die meisten anderen noch nicht voll erwachsen. Von den Weibchen trug ein einziges Eier. Der 1,05 mm lange Körper war mit zahlreichen Eiern von 165μ Durchmesser angefüllt.

6 *Lebertia* (Ps.) *orientalis* n. sp.

Nympe:

Diese Art gleicht im Palpenbau unseren beiden einheimischen Formen *L. zschokkei* und *L. oculata*, in den übrigen Verhältnissen aber *L. lineata*.

Der Körper des noch nicht erwachsenen Tieres misst in der Länge 0,315 mm, in der Breite 0,270 mm. Haut ca 8μ dick, Epidermis liniert. Die einzelnen Linien sind nicht gerade, teils sehr kurz, teils relativ lang. In der Medialpartie des Rückens, hinter den Augen, eine engbegrenzte Zone von netzförmiger Struktur, Antenniforme Borsten

kräftig, nach hinten gebogen, 50μ voneinander entfernt. Ventral sind die einzelnen Linienzüge länger als auf dem Rücken, und da es sich um eine noch jugendliche Nymphe handelt, auch viel dichter. Um den Excretionsporus und hinter den Analdrüsen verlaufen sie ringförmig.

Das Maxillarorgan wurde bei der Exstirpation zerstört. Pharynx sich hinten glockenförmig erweiternd, mit grösster Breite über dem Chitinwulst am Hinterrande (40μ).

Länge der Palpenglieder auf der Streckseite: 1. 15, 2. 52, 3. 49, 4. 62, 5. 26μ . 2. Glied (fig. 6) mit leichter Concavität der Beugeseite, starker Biegung der Dorsalseite, die in der Mitte eine gefiederte Borste,

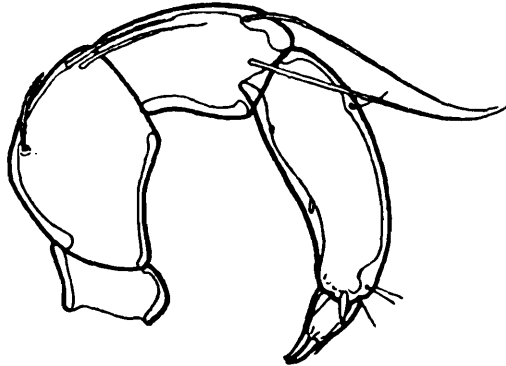


FIG. 6.—*Lebertia (Ps.) orientalis* n. sp. Nympe. Palpus.

distal eine innere lange und eine äussere etwas kürzere Borste trägt. 3. Glied mit den beiden charakteristischen Langborsten, von denen die der Streckseite weiter vom Distalende entfernt als die auf der Mittellinie der inneren Flachseite sich befindende. 4. Glied mit deutlicher Abkrümmung des distalen Drittels, an dieser Stelle der Beugeseite das distale Tasthaar tragend, das proximale unweit des basalen Endes. Chitinstift lang und spitz.

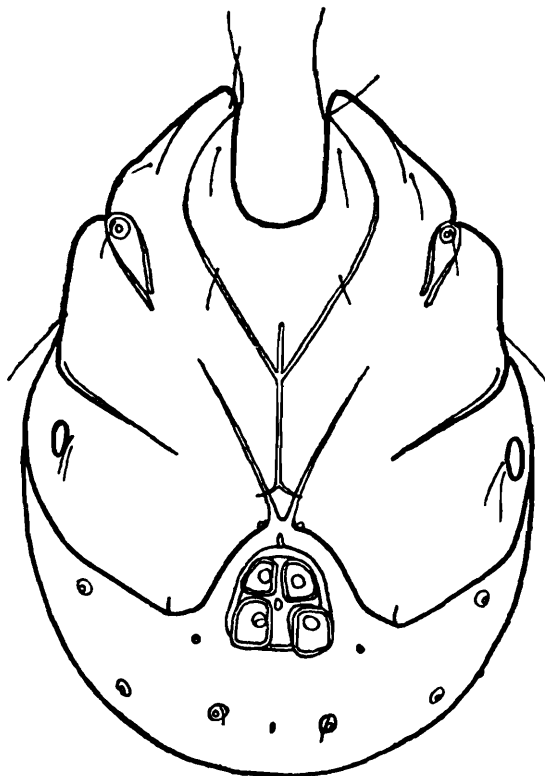


FIG. 7.—*Lebertia (Ps.) orientalis* n. sp. Nympe. Ventralansicht.

Die Epimeren (fig. 7) 315μ lang, bei diesem Individuum den grössten

deutet. Vorderspitzen der 1. Epimeren kurz und stumpf. Hinterende der Vorderepimeren etwa in der Mitte des Abstandes zwischen Maxillar- und Genitalbucht gelegen. Hinterrand der 4. Platte gerade, parallel verlaufend zu der Sutur zwischen 3. und 4. Platte. Hinterende der 2. Epimeren spitz.

Beine im Vergleiche zur Körperlänge noch sehr lang. Sie messen: 1. 340, 2. 395, 3. 475, 4. 600 μ , sind dünn und wenig beborstet.

Der die 4 Näpfe umschliessende Chitinring ist hinten breiter als vorn, daher die beiden vorderen Näpfe auch kleiner als die hintern. Er trägt vorn einen sehr schwachen medianen Fortsatz und wenige Härchen.

Excretionsporus ohne Chitinumfassung.

Fundort: Bhagsu-nath, Upper Dharamsala, Kangra Valley, Punjab, 4. Juni 1926. 1 Nympe. Dr. Hora leg.

7 *Oxus orientalis* Walter.

Fundort: Sumpfgewässer bei Calicut. 1 ♀.

Testudacarus n. g.

Sehr nahe mit *Atractides* C. L. Koch verwandt.

Rücken und Ventralfläche gepanzert. Mediane Rückenplatte von einem Kranze von Schildern umgeben, von denen die drei vorderen am grössten sind. Ein Paar Hautdrüsenmündungen auf der Mittelplatte, die übrigen auf den Teilschildern. Maxillarorgan mit Rostrum, dieses sowie die Palpen ähnlich gebaut wie bei *Atractides*. Epimeren zu einer Platte verschmolzen, die 4. Platte durch deutliche Nähte vom übrigen Panzer abgetrennt. Insertion des Hinterbeines auf der Aussensutur der 4. Epimere. 1. Epimeren median verschmolzen, wie bei der verwandten Gattung vorspringend. 2. und 3. Epimere miteinander verwachsen. Beine ohne Schwimahaare. Genitalorgan vorn und seitlich von den Epimeren und hinten vom Ventralpanzer umschlossen. Genitalöffnung von zwei aussen beweglich eingelenkten Klappen verdeckt, unter deren Innenränder drei Napfpaare liegen.

8. *Testudacarus tripeltatus* n. sp.

Weibchen:

Länge Stirnrand-Körperhinterrand 0,885 mm, mit den vorspringenden Epimeren 1,065 mm, Breite 0,720 mm. Umriss des Rumpfes elliptisch. Färbung des Chitins gelb, Augenpigment schwarz-braun. Gegenseitiger Abstand der grossen über den Stirnrand vorspringenden Augenlinsen 0,240 mm, der schwachen, auf besondern Höckern stehenden antenniformen Borsten 0,180 mm.

Rücken (fig. 8) mit grossem ovalem Schild von 690 μ Länge und 525 μ Breite. Das Chitin des Vorderrandes ist viel weniger dick als die übrigen Panzerteile; dieser greift etwas über den Hinterrand der drei vorderen Teilschilder. Vor der Plattenmitte, ausserhalb der beiden wie bei *Atractides* vorhandenen "Rückenflecken" je eine Drüsenmündung mit feinem Haar. Am Vorderrand der Rückenplatte drei grössere Teilschilder, ein medianes und zwei laterale; die beiden letzteren tragen am Vorderrande je eine Drüsenmündung und zwei Haare. Die Seiten

und das Hinterende der Hauptplatte werden von einem Kranze von 7 Paaren ungleich grosser Schilder umfasst, von denen die 4 kleineren

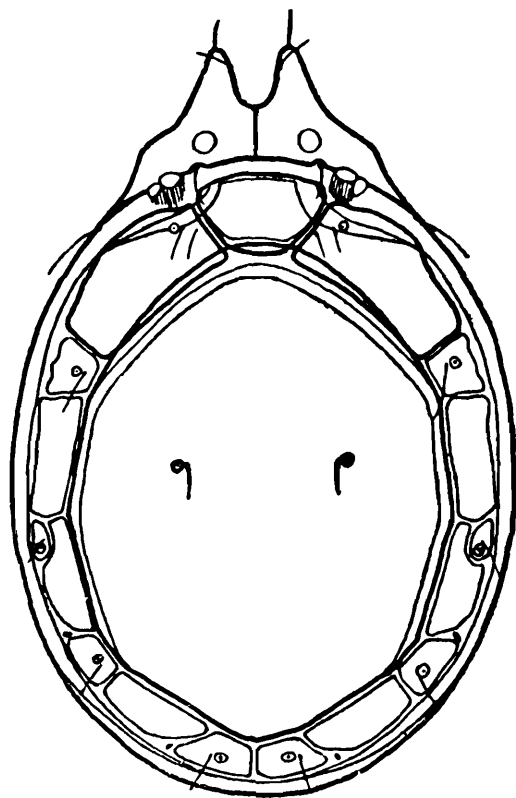


FIG. 8.—*Testudacarus tripeltatus* n. g., n. sp. ♀. Dorsalansicht.

mit je einer Drüsenmündungspore und einem Haare ausgestattet sind. Die drei übrigen Paare haben längliche Form. Diese Schilder wie die mediane Platte sind alle feinporös. Mit Ausnahme der drei vorderen werden alle Teilschildchen mehr oder weniger von der mit feinen und langen Linien versehenen Epidermis überdeckt, erscheinen also ganz oder teilweise als subcutane Gebilde. Der Ventralpanzer greift nicht auf die Dorsalfläche über.

Maxillarorgan mit Pharynx 220 μ lang, an der Einlenkungsstelle der Palpen 90 μ breit. Rostrum im Vergleiche zu verschiedenen *Atractides*-Arten kurz, conisch, an der Basis 60 μ breit, während die Länge 50 μ beträgt. Ueber den genauen Verlauf des Hinterrandes der Ventralwandung können keine Angaben gemacht werden. Pharynx hinten vorspringend, sein Ende stark erweitert, mit nach oben umgebogenen Seiten- und Hinterrand. Ventralwand hinter dem Rostrum stark vorgewölbt. Obere Fortsätze kurz, breit, hinten nicht divergierend. Seitenwandung nach oben eckig übergreifend, die hintere Partie der Einlenkungsgrube der Palpen teilweise überdeckend. Pharynxöffnung langgestreckt, schmal.

Totallänge der Mandibel 225 μ . Sie ist säbelartig gebogen. Mandibelgrube 100 μ lang, Klauenglied 45 μ . Letzteres ist schwach, leicht gekrümmt, mit Reihen feiner Zähnchen sowohl auf der Streckseiten als auch auf der Beugeseitenkante.

Palpus (fig. 9) klein und schwach, die Dicke der Glieder der benachbarten Beine bei weitem nicht erreichend. Streckseitenlänge der einzelnen Glieder :

	1. 31,	2. 65,	3. 49,	4. 57,	5. 21 μ ,
Beugeseitenlänge :	15	44	36	49 μ	

Grundglied mit vorgewölbter Beugeseite, dorsal 1 starken Dorn tragend. Beugeseite des 2. und 3. Gliedes mit concaver Beugeseite, an deren distalem Ende je ein gerader, kräftiger, gefiederter Dorn. Streckseite des 2. Gliedes mit ca 6 kräftigen, gefiederten Dornen ausgerüstet,

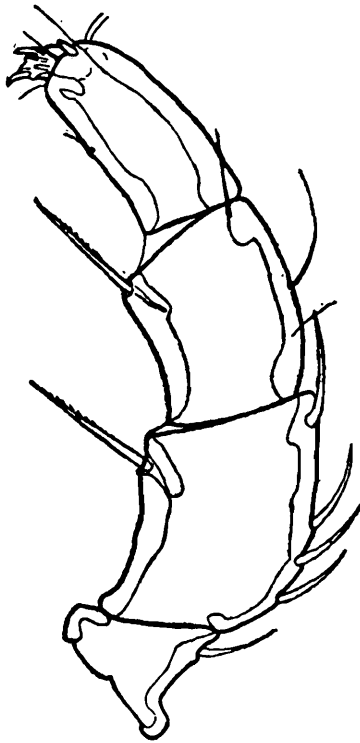


FIG. 9.—*Testudacarus tripeltatus* n. g., n. sp. ♀. Palpus.

diejenige des 3. Gliedes mit 2 medianen und einer distalen Borste. Beugeseitenhaare des 4. Gliedes nebeneinander. Innenseite distal mit kurzem, breitem Chitinzahn und einzelnen feinen Haaren. Endglied sehr kurz, mit verlängerter Klaue am Ende der Beugeseite und kürzerer

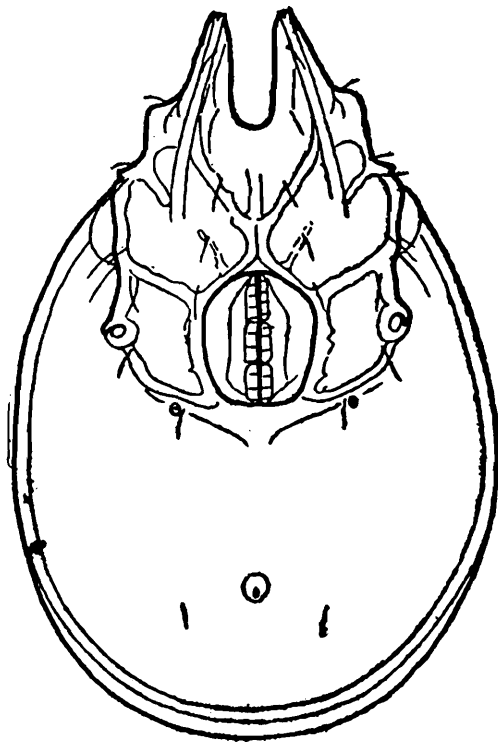


FIG. 10.—*Testudacarus tripeltatus* n. g., n. sp. ♀. Ventralsansicht.

dorsalwärts. Eine 3. Klaue findet sich auf dem einen der beiden Palpen zwischen diesen beiden.

Epimeralgebiet (fig. 10) weit nach vorn vorspringend. Die Spitze der 1. Epimere trägt die Ausführöffnung einer Drüse von ähnlicher Lage wie die glandulae globulosae der *Lebertia*-Arten und sehr langem Ausführgang. Die beiden 1. Epimeren hinter dem Camerostom verwachsen, 2. Epimeren mit kurzer gemeinsamer Naht vor dem Genitalorgan, von den 3. Epimeren nur durch eine kurze Aussennaht abgetrennt. Von der hintern Aussenecke der 3. Platte läuft eine etwas erhabene, nicht sehr deutliche Naht im Bogen nach dem vorderen Körperrande. 4. Epimere aussen und hinten durch Suturen vom Ventralpanzer abgetrennt; die Aussennaht enthält die Einlenkungsstelle des 4. Beines und überdeckt die Einlenkungsgrube z. T. mit einem abgerundeten Fortsatz. Die 4. Epimere überragt das Genitalorgan nach hinten nicht. An deren Hinterrande eine Drüsenmündung. Das ganze Epimeralgebiet wird durch stark hervortretende Suturen vom übrigen Ventralpanzer geschieden, ist kräftig chitinisiert.

Beine stark; ihre Länge beträgt: 1. 0,510, 2. 0,585, 3. 0,660, 4. 1,0 mm; sie tragen kurze, meist schwach gefiederte Borsten und Dornen, die hauptsächlich die Streckseite der Glieder und deren oft mit Gelenkscheiden versehene Distalränder besetzt halten. Kralle mit Innenzahn und Krallenblatt.

Genitalorgan (fig. 10) 250 μ lang, im vorderen Drittel 180 μ breit, hinten etwas schmaler, breiterundet abschliessend. Vor den beiden Platten ist ein mit den benachbarten Epimeralplatten verwachsener Stützkörper erkennbar. Innerer Klappenrand mit ca 12 feinen Haaren besetzt, unter ihm liegen nur 3, nicht 6 Näpfe wie bei *Atractides*; sie sind langgestreckt, alle etwa von gleicher Länge.

Excretionsporus von porenlosem Hof umfasst, vom Genitalhofe etwas weiter entfernt als vom hintern Körperrand.

Fundort: Bhagsu-nath, Upper Dharamsala, Kangra Valley, Punjab, 4. Juni 1926, 1 Weibchen. Dr. Hora leg.

9. *Atractides angulatus* n. sp.

Weibchen:

Die Körperlänge beträgt 0,615 mm ohne die vorstehenden Epimeren, mit denselben 0,720 mm, Breite 0,480 mm. Umriss elliptisch, durch

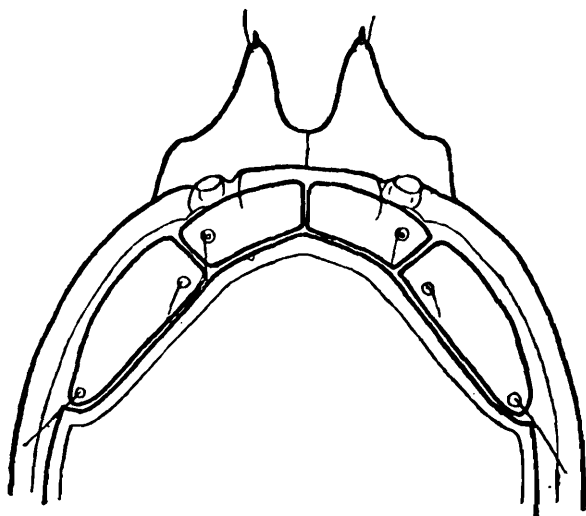


FIG. 11.—*Atractides angulatus* n. sp. ♀. Vorderpartie des Rückens.

den Ventralpanzer bedingt, der mit seinen Rändern leicht dorsalwärts

misst in der Länge zusammen mit den vordern Teilschildern 585μ , in der Breite 405μ , sodass eine relativ breite Randzone freibleibt, in der die feinlinierte Haut sichtbar wird. Die 4 Teilschilder (fig. 11) sind alle frei, die beiden medianen kleiner als die lateralen (am Innenrande gemessene Länge derselben 90 und 165μ). Letztere sind auch breiter, 60μ , als die medianen, 45μ . Die Schulterecken des 525μ langen Hauptschildes umfassen die Lateralschilder an deren Hinterende nur schwach. Abweichend von der nächstverwandten Art, *A. microstomus* (Koenike), bleiben die beiden Drüsenpaare der Hauptplatte den Seitenrändern genähert. Seitwärts und hinten weist sie eine Randzone von dichter Porosität auf.

Maxillarorgan mit sehr kurzem Rüssel, 40μ bei einer Totallänge von 180μ (Pharynx inbegriffen). Höhe 105μ . Obere Fortsätze lang und kräftig entwickelt. Pharynx hinten pfeifenkopfförmig erweitert. Mandibellänge 210μ .

Die sehr kurzen und gedrunghenen Palpen (fig. 12) weisen folgende Streckseitenlängen ihrer Glieder auf: 1. 23 , 2. 49 , 3. 36 , 4. 41 , 5. 15μ .

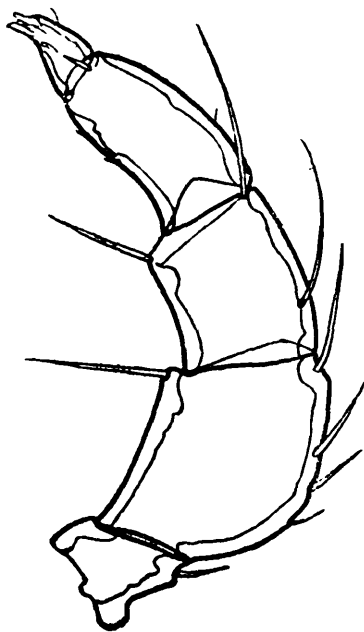


FIG. 12.—*Atractides angulatus* n. sp. ♀. Palpus.

Grundglied mit kurzer Distalborste. Beugeseite des 2. und 3. Gliedes ohne Zapfenbildung, am distalen Ende je eine steife Borste tragend. Streckseite des 2. Gliedes mit 5 kürzeren Borsten ausgerüstet, diejenige des 3. Gliedes trägt 3 feine, verlängerte Borsten, 2 proximal, eine distal. 3. Glied mit distalen Gelenkscheiden von dreieckiger Form an beiden Flachseiten. 4. Glied etwas verjüngt, sehr schwache Beugeseitenborsten tragend, sowohl innen als auch aussen am Ende einen kurzen Chitinstift aufweisend. Endglied mit zwei Klauen.

Epimeren nach vorn vorragend (fig. 13). Die Maxillarbucht ist sehr lang, 175μ , und 55μ breit, hinten fast eckig ausgeschnitten. Medialnaht der 2. Epimeren sehr kurz. Maxillarbucht von der Genitalbucht 150μ entfernt.

Die schwachen Beine haben geringen Borstenbesatz. Beinlängen: 1. 390 , 2. 440 , 3. 540 , 4. 750μ .

Genitalorgan verkehrt-oval, hinten breiter als bei der Vergleichsart. Es misst in der Länge 185μ , in der Breite im vorderen Drittel

160 μ . Innenrand mit etwa 7 Härchen besetzt, Aussenrand ebenso. Es sind 6 Napfpaare vorhanden.

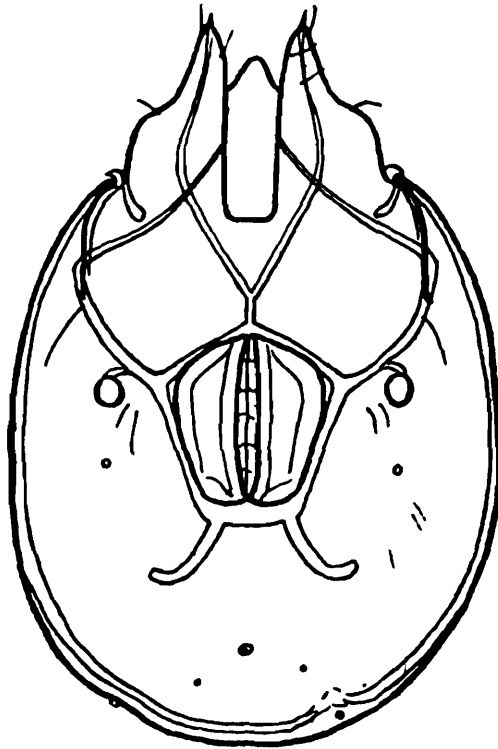


FIG. 13.—*Atractides angulatus* n. sp. ♀. Ventralansicht.

Excretionsporus vom Hinterrande des Körpers deutlich abgerückt (75 μ).

Nymphe :

Der Körper misst in der Länge 0,400 mm, in der Breite 0,305 mm. Mit den vorstehenden Epimeren erreicht die Länge 0,470 mm. Umriss

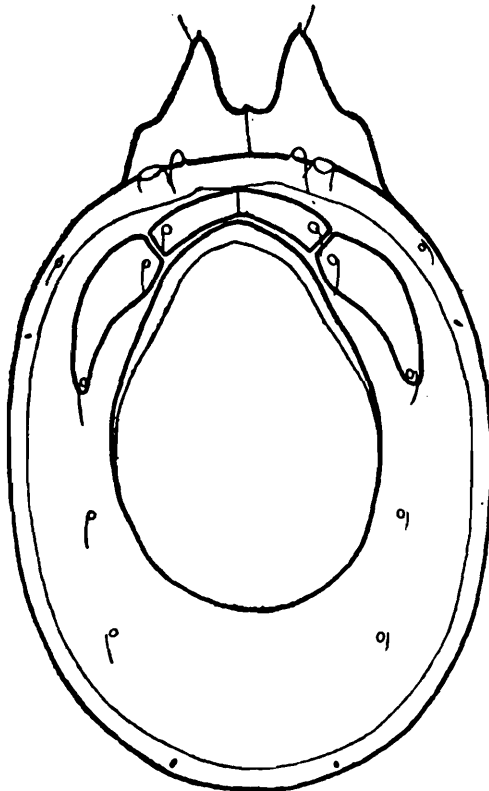


FIG. 14.—*Atractides angulatus* n. sp. Nymphe. Dorsalansicht.

elliptisch. Haut dick (8 μ) und mit deutlichen langen Linien überzogen. Auf dem Rücken (fig. 14) findet sich ein grosser Medianschild von ovaler

Form, 220μ lang, 160μ breit. Dessen Vorder- und die Seitenränder porenlos. Vor dieser Platte 4 Teilschilder, die beiden medianen rechteckig, die beiden lateralen dreieckig, leicht gebogen, länger als die medianen. Drüsenporen wie bei der Imago angeordnet.

Maxillarorgan kurzrüsselig, 100μ lang bis zum Hinterende des Pharynx; dieser allein kommt unter die 1. Epimeren zu liegen; hinten schliesst er spitzbogig ab. Der ganze Vorderteil des Maxillarorgans liegt unbedeckt in der 90μ langen, schmalen, hinten fast eckigen Maxillarbucht. Palpen kurz, gedrungen, etwas weniger Borsten als beim Weibchen aufweisend.

Hinter der Maxillarbucht verschmelzen die 1. Epimeren (fig. 15). Die 2. weisen eine mediane, wohl nicht sehr stark entwickelte Suture

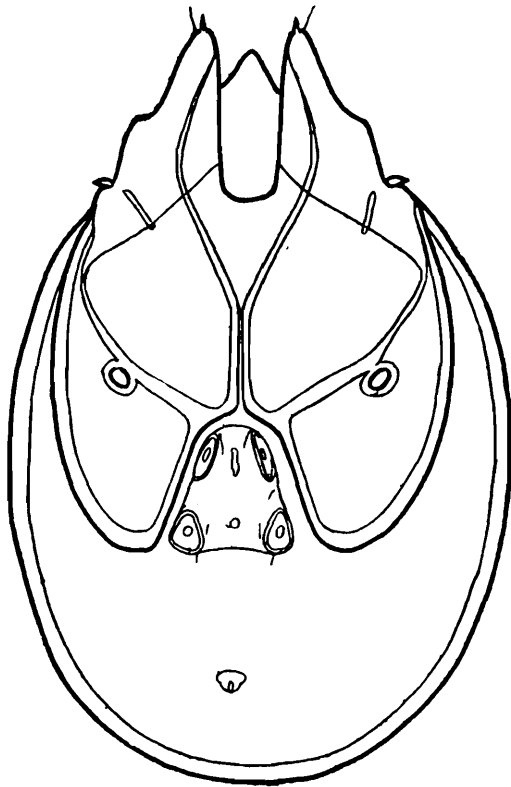


FIG. 15.—*Atractides angulatus* n. sp. Nympe. Ventralansicht.

auf, die 180μ lang ist. 4. Epimeren hinten bogig abschliessend, das Genitalorgan nach rückwärts nicht überragend. Alle Epimeren deutlich porös.

Beinlängen : 1. 218, 2. 226, 3. 255, 4. 390μ .

Hinterrand der ganz in der Genitalbucht gelegenen Napfplatte etwas ausgeschweift. Von den 4 voneinander getrennten Näpfen liegen 2 von länglicher Form längs der Vorderpartie der Seitenränder, die 2 andern von rundlicher Form in den hinteren Ecken. Die 75μ lange und hinten ebenso breite Platte trägt ausserdem einige feine Haare und in der Medianen zwei etwas verdickte Stellen des Chitins.

Excretionsporus vom Hinterrande des Körpers abgerückt.

Fundorte : Tilok-nath, Kangra Valley, Punjab, 25. Mai 1926, 1 ♀ und eine Nympe. Near Milestone $16\frac{1}{2}$ from Darjiling (Teesta- Darjiling-Road), 21. Dezember 1926, 3 ♀. Dr. Hora leg.

10. *Megapus minutus* n. sp.*Weibchen* :

Diese neue Art zeigt grosse Verwandtschaft mit dem europäischen *M. polyporus* Viets.

Die Länge des reifen Weibchens beträgt 0,435 mm (ohne die vorspringenden Epimeren, 0,465 mm mit denselben); Breite 0,360 mm. Die Art ist also bedeutend kleiner als die Vergleichsform. Umriss (Fig. 16)

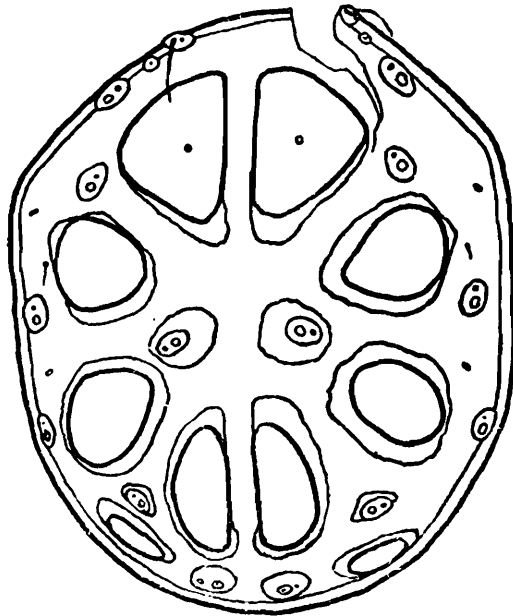


FIG. 16.—*Megapus minutus* n. sp. ♀. Dorsalansicht.

elliptisch, mit stark abgeschrägten vorderen Seitenrändern. Stirnrand zwischen den 95 μ voneinander entfernten, rückwärts gerichteten antenniformen Borsten nur wenig vorgewölbt. Augenabstand 110 μ . Haut bis 10 μ dick, feinliniert, wie die Vergleichsart eine Menge von Platten tragend, die ähnliche Gruppierung aufweisen. Sie sind porös und teilweise von porenlosen Rändern eingefasst. Das vordere Paar verwächst nicht mit der Pore beim Aussenrande. Am Hinterende des Rückens liegt nicht eine unpaare Platte, sondern ein Schilderpaar, das dem Hinterrande näher zu liegen kommt; auch sind die schief hinter ihnen gelagerten Plättchen relativ grösser als bei *M. polyporus* Viets.

Maxillarorgan nur 100 μ lang, mit schwachem, auf der Ventralwandung entspringendem Rüssel, der sehr dünn und etwas schief nach vorn gerichtet ist. Seine Länge beträgt 18 μ . Palpengruben ganz vorn gelegen. Obere Fortsätze schlank, spitz endigend, fast senkrecht aufsteigend.

Die Längen der Streckseiten der einzelnen Palpenglieder (fig. 17) sind folgende: 1. 28, 2. 60, 3. 44, 4. 75, 5. 41 μ . Beugeseite des Grundgliedes stark verkürzt, etwas vorgewölbt, Streckseite mit distalem Dorn. Die Beugeseite des 2. Gliedes trägt distal einen spitzen, kegelförmigen, kräftig chitinierten und schief nach vorn weisenden Zapfen. Dorsal stehen 6 Borsten, gegen die Aussenseite 2 mittlere und eine distale, gegen die Innenseite eine mittlere und zwei distale. Streckseite des 3. Gliedes mit 2 mittleren und 2 distalen Borsten. 4. Glied gebogen, distal verjüngt, Beugeseitenhaare vor der Mitte inseriert, das proximale verlängert und auf kleinem Höcker stehend. Neben ihm, gegen die Innenfläche zu, eine kräftige Schwertborste mit abgerun-

deter Spitze. Streckseite mit einzelnen feinen Härchen in der Nähe des distalen Endes. Endglied schlank, leicht gebogen, in 3 Klauen auslaufend.

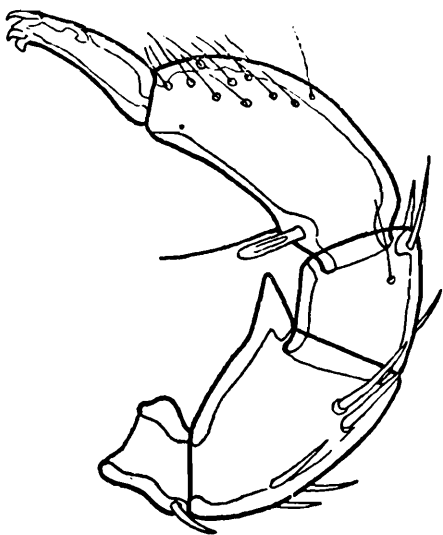


FIG. 17.—*Megapus minutus* n. sp. ♀. Palpus.

Epimeren (fig. 18) denjenigen der Vergleichsart ähnlich. Die Spitzen der vorderen Platten ragen etwas über den Stirnrand vor. Die 1.

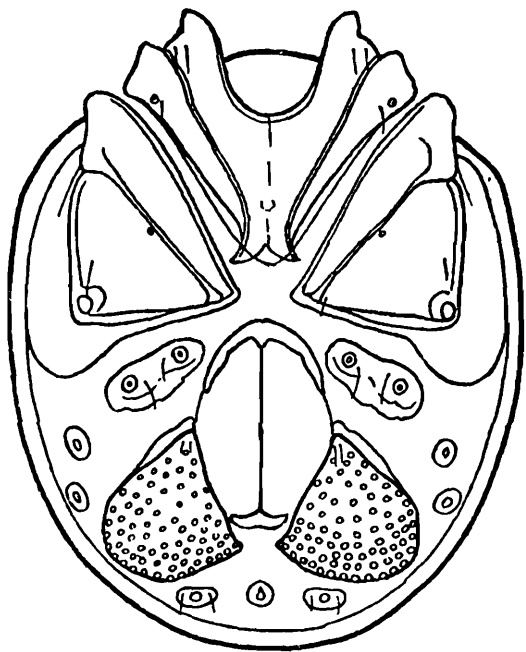


FIG. 18.—*Megapus minutus* n. sp. ♀. Ventralansicht.

Epimeren messen in der Länge 255μ , sie verwachsen hinter dem Maxillarorgan und bilden eine Naht von 125μ Länge, während das Camerostom nur 75μ tief ist. Bei der Vergleichsart sind beide etwa von gleicher Länge. Hinterende der Vordergruppe jederseits in einen nach aussen gerichteten Fortsatz auslaufend. 3 Epimere in ihrer medianen Partie relativ breiter als bei der Vergleichsart, neben der Innenecke der 4. Epimere noch 20μ breit. Letztere dreieckig, am Aussenrande mitsamt der 3. Epimere von flügelartiger Verbreiterung umfasst.

Beine kurz, ohne Schwimmhaare. Längen: 1. 360, 2. 295, 3. 330, 4. 540μ . Am Distalende und auf der Streckseite der Glieder nur kurze Borsten. Vorderbein ähnlich wie bei der Vergleichsart umgestaltet.

Das 5. Glied (fig. 19) misst 96μ , ist cylindrisch und, abgesehen von

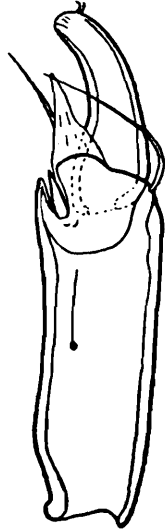


FIG. 19.—*Megapus minutus* n. sp. ♀. Endglieder des Vorderbeines.

einer Einschnürung am Grunde, in seiner ganzen Länge von fast gleicher Dicke. Distalende scheidenartig über das Gelenk hinaus verlängert, am stärksten auf der Beugeseite, wo der Rand 2-3 runde Einschnitte aufweist. Die beiden Distalborsten nicht in einer Grube der Beugeseite befestigt, sondern innerhalb der Gelenkscheiden beugeseitenwärts entspringend. Die kürzere blattartig verbreitert, sich dann plötzlich verschmälernd und spitz auslaufend. Die andere ist weniger breit, etwa von der Länge des Endgliedes, in ihrer distalen Hälfte peitschenartig gebogen und fein. Auf der Aussenwandung der Gelenkscheide sitzt die bekannte Krummborste. Endglied 52μ lang, distalwärts stark verjüngt und gebogen; es trägt 2 feine, fast verkümmerte Krallen. Die Kralle der drei hintern Beine besteht aus einem spitzen Hauptzahn, einem langen, dünnen Aussenzahn und einem etwas kräftigeren, aber kürzeren Innenzahn. Blattartige Verbreiterung des Krallenstieles nur schwach.

Das Genitalorgan (fig. 18) zeichnet sich von dem der Vergleichsart durch eine noch grössere Zahl von Genitalnäpfen aus. Auf jeder der beiden zungenförmigen, schief nach aussen und hinten gerichteten Platten sitzen über 50. Die Platten längs der Genitalspalte 100μ breit, in natürlicher Wölbung 100μ lang. Die 145μ lange Spalte vorn von grossem, halbmondförmigem Stützkörper begrenzt; hinterer Stützkörper viel kleiner.

Excretionsporus etwa auf der die Hinterenden der Genitalplatten verbindenden Linie gelegen, jederseits eine Analdrüsenmündung auf Chitinplättchen, das ausserdem 2 Haare trägt.

Fundort: Tilok-nath, Kangra Valley, Punjab, 25. Mai 1926, 1 ♀, mit drei Eiern von 165μ Durchmesser. Dr. Hora leg.

11. *Unionicola crassipes* (O. F. Müller).

Alle erbeuteten Exemplare waren ausserordentlich klein; die ♂ massen durchschnittlich 0,6 mm, die ♀, von denen kein einziges eiertragend war, 0,65 mm. In den Artmerkmalen stimmen sie aber mit den europäischen Individuen vollkommen überein.

Fundort: Sumpfgewässer bei Calicut. 21 ♂, 40 ♀.

12. *Neumania ambigua* Piersig.Syn. *N. megalommata* Koenike.

Die beiden untersuchten Männchen stimmen ganz mit der Beschreibung überein, die KOENIKE (1906) von *N. megalommata* gibt. Anlässlich der Bestimmung eines Weibchens von den Philippinen habe ich bereits darauf hingewiesen, dass die Identität dieser Art mit *N. ambigua* sehr wahrscheinlich sei. Nachdem mir nun auch das Männchen bekannt geworden, bestehen für mich keinerlei Zweifel mehr.

Der Beschreibung ist noch beizufügen, dass die Haut sehr feine Chitinspitzchen trägt. Die Palpenglieder messen auf der Streckseite: 1. 23, 2. 78, 3. 47, 4. 83, 5. 31 μ , was einer totalen Länge der Palpen streckseite von 262 μ entspricht; misst man aber die Palpenglieder in der Mitte der Flachseiten, so ergibt sich eine Länge von 208 μ , was KOENIKES Angabe gleichkommt. Die beiden kräftigen Borsten am Distalende des 3. Gliedes finden sich in der Tat auch bei dieser Art, die der Streckseite ist kürzer und misst etwa $\frac{2}{3}$ derjenigen auf der Aussenseite. KOENIKE zeichnet sie in seiner Fig. 8 beide zu kurz. Typisch sind wohl in erster Linie die schwachen und relativ kurzen Borsten am Distalende des 2. Gliedes.

Die Epimeren sind einander weniger genähert als beim Typus. Uebrigens dürfte KOENIKES Aeusserung, dass sich die beiden hinteren Gruppen auf der Innenseite in einem Flächenfortsatze berühren, welcher der 3. und 4. Platte auf der ganzen Strecke saumartig anhänge (Fig. 6), nicht den Tatsachen entsprechen. In diesen saumartigen "Fortsätzen" sind eben Muskelbänder zu erkennen, die nach vorn dem Maxillarorgane zuziehen. Die eigentlichen Epimeralplatten werden also durch einen grösseren Abstand voneinander geschieden, als es KOENIKE annimmt. Dieser beträgt bei den vorliegenden Exemplaren 60 bzw. 65 μ .

Die Beborstung der Beine ist typisch. Endglied des Hinterbeines normal, distal leicht gebogen. Die wichtigsten Merkmale des Borstenbesatzes sind folgende:

1. Bein: 3. Glied: 1 kräftige und 1 sehr kurze gerillte Borste,
 4. ,, : 1 Paar ungleich langer gerillter Borsten, 2 Dornen,
 von denen der eine ganz distal,
 5. ,, : 2 Paare Rillborsten, ganz distal 1 kurzer Dorn.
2. Bein: 3. Glied: 1 schwache gerillte, weiter distal eine ebenfalls
 schwache, etwas längere, scheinbar aber nicht
 gerillte Borste.
 4. und 5. Glied wie 1. Bein.
3. Bein: 3. Glied: 2 mittellange glatte Schwertborsten,
 4. und 5. Glied: je 3 mittellange glatte Schwertborsten, auf
 letzterem 4 distalwärts an Länge zunehmende
 Dolchborsten, die letzte deutlich kurz gefiedert.
4. Bein: 4. Glied: Beugeseite mit 4, 5. Glied mit 6 kurzen und
 kurzgefiederten Dolchborsten.

Schwimmborsten treten vereinzelt auf auf dem 4. und 5. Gliede des 2. Beines und auf dem 3. Gliede der beiden Hinterbeine. Auf dem 4. und 5. Gliede der beiden Hinterbeine zählt man je 3-4 Schwimphaare

Jederseits der Genitalspalte (fig. 20) finden sich 9 Näpfe. Dem äussern Plattenrande folgen feine Borsten. Bei den vorliegenden

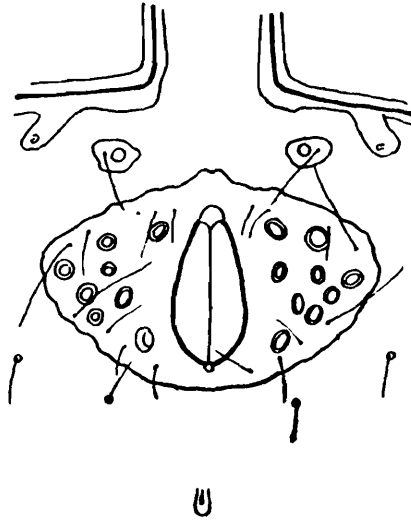


FIG. 20.—*Neumania ambigua* Piersig. ♂. Genitalorgan.

Individuen wird vorn die Genitalöffnung durch einen schmalen Saum umfasst. Hinter dem Genitalorgane liegen in der weichen Haut 4 Einzelhaare in einer Querreihe.

Excretionsporus nicht von Chitinring umgeben.

Fundort : Sumpfgewässer bei Calicut. 2 ♂.

13. *Neumania volzi* Piersig.

Der Beschreibung dieser Art durch PIERSIG (1906) lagen zweifellos unreife Weibchen zu Grunde. Verschiedene in der PIERSIGSchen Sammlung enthaltene und als *N. volzi* bezeichnete Exemplare weisen in Einzelheiten Abweichungen von der Diagnose auf, die unter Beifügung weiterer Details corrigiert werden sollen. Die indischen Individuen stimmen sehr gut mit den von VOLZ gesammelten überein.

Weibchen :

Körperlänge bis 1,3 mm. Auch in der PIERSIGSchen Sammlung enthaltene Exemplare erreichen 1,125 mm. Deren Körpergestalt ist dann nicht mehr verkehrt-oval, sondern entschieden oval. PIERSIGS Fig. 16 wurde jedenfalls nach einem noch jugendlichen Weibchen angefertigt. Die Körperfarbe dürfte bei erwachsenen Individuen eher als dunkelbraun zu bezeichnen sein. Haut mit ausserordentlich feiner, schwer wahrnehmbarer Liniatur. Auf der unbenetzten Haut sind kleine Chitinkörnchen zu sehen. Ausser den leicht über die Unterlage hervorstehenden Steissdrüsen finden sich zwei weitere erhöhte Drüsenmündungen auf der hintern Dorsalfläche.

Der Palpus ist in Fig. 22, T. 14 (PIERSIG 1906), teils ungenau, teils unrichtig wiedergegeben. So sind die Endborsten der Dorsalseite des 3. Gliedes viel zu kurz gezeichnet. Die Höcker der Tasthaare des 4. Gliedes und der Zapfen am Gliedende sind in Wirklichkeit viel deutlicher. und der Aussenseite des 4. Gliedes fehlt in der Figur ein

distales über die Spitze des Endgliedes hinausragendes feines Haar. Die Streckseitenlängen der Palpenglieder betragen:

1. ♀, PIERSIGSche Sammlung:	1. 41,	2. 124,	3. 75,	4. 127,	5. 44 μ ,
2. ♀, „ „ :	36	111	72	127	44 μ ,
3. ♀, Calicut :	36	119	70	119	41 μ .

Es übertrifft also das 4. Glied das 2. nicht immer an Länge.

Die Epimeren tragen ein wichtiges Merkmal, das PIERSIG in keiner Weise erwähnt: der Einlenkungsfortsatz des 3. Beines zeigt stark gebogenen Aussenrand und kurzen Hinterrand, sodass eine stumpfe Ecke entsteht, der Einlenkungsfortsatz des 4. Beines stellt aber einen kräftigen, 20-25 μ langen, schräg nach hinten und aussen gerichteten Stachel dar. Die Beinlängen betragen: 1. 1,2, 2. 1,245, 3. 1,125, 4. 1,44 mm.

Die von PIERSIG angegebene Länge der Genitalöffnung (160 μ) ist viel zu kurz und hat höchstens für jugendliche Weibchen Geltung. Sie misst an Exemplaren, die ihre natürliche Wölbung der Ventralseite noch besitzen, 195 μ , bei Individuen aus der PIERSIGSchen Sammlung sogar 210 μ . Vor der vorderen Innenecke jeder Napfplatte, die auch weniger als 28 Nöpfe tragen kann, stehen 3-4 Haare in der weichen Körperhaut, nicht nur 2, wie PIERSIG dies zeichnet. Die Entfernung der Napfplatten vom vorderen Stützkörper ist bei reifen Weibchen grösser als es PIERSIG in Fig. 23 darstellt. Excretionsporus von Chitinring umfasst.

Männchen:

Länge des Körpers 0,750 mm. In den meisten Merkmalen Uebereinstimmung mit dem Weibchen. Die Palpen sind etwas kürzer und gedrungener: Streckseitenlängen der Glieder: 1. 28, 2. 85, 3. 52, 4. 87, 5. 36 μ . Einlenkungsfortsätze an den 3. und 4. Epimeren mit denselben Merkmalen wie beim Weibchen. An den 1. and 2. Beinen fehlt auf dem 5. Gliede das distale Paar langer, gerillter Borsten; an ihrer Stelle findet sich ein Paar kurzer, steifer Borsten.

Genitalhof (fig. 21) aus einer breitelliptischen Platte bestehend von 153 μ Länge und 170 μ Breite. Genitalspalte gross, 117 μ lang. Vorder-

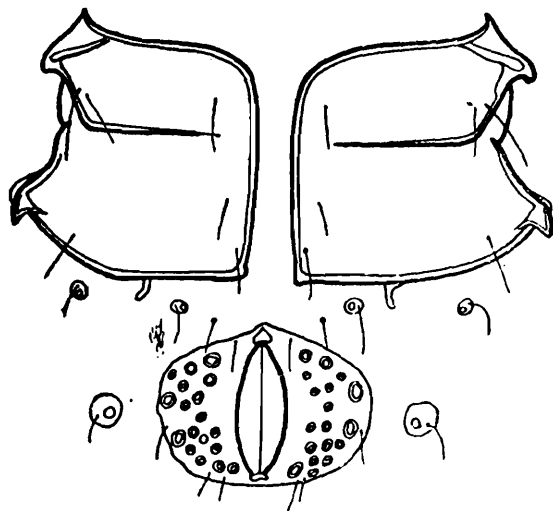


FIG. 21.—*Neumania volzi* Piersig. ♂. Hintere Epimerengruppen und Genitalorgan.

rand der Genitalplatte median einen schwachen Vorsprung bildend. Jederseits 18 Nöpfe von ungleicher Grösse, je ein Haar am Vorder-

und eines am Seitenrande, 2 am Hinterrand. Jederseits zwischen Genitalhof und Epimeralgebiet 2 Haare in der weichen Haut. Excretionsporus inmitten eines Chitinringes.

Nymphe :

Körperlänge 0,570 mm, Breite 0,420 mm. Umriss elliptisch. Die Augen liegen am seitlichen Vorderrande, ihre grosse Linse ist verkehrt-oval, 30μ lang, die kleine elliptisch, mit einem grössten Durchmesser von nur 15μ . Die dünne Haut trägt einen relativ dichten Besatz feinsten Chitinkörnchen. Steissdrüsen und ein Paar Drüsenmündungen am Hinterende der Dorsalfäche leicht erhöht.

Streckseitenlängen der Palpenglieder : 1. 15, 2. 60, 3. 40, 4. 73, 5. 21μ . Von denjenigen der *N. pilosa* Nymphe unterscheiden sich die Palpen schon durch die Längenverhältnisse. Dorsalseite des 2. Gliedes mit einer vom Gliedende abgerückten Borste und einer anderen, kürzeren, an der distalen Aussenseite. 3. Glied mit 2 nicht besonders kräftigen Bortsten, die eine in der Mitte der Aussenfläche, aber der Streckseite etwas näher als der Beugeseite, die andere dorsal distal. Das 4. Glied weist eine deutliche Biegung auf, die beiden sehr feinen Tasthaare etwa in der Mitte der Beugeseite und nicht auf Höckern inseriert, ihre gegenseitige Stellung auf beiden Palpen nicht ganz dieselbe. Chitinzahn am Distalende kaum angedeutet ; dort fehlt auch das feine Haar der Aussenseite. Endglied gedrungen, in seiner Mitte am wenigsten hoch, mit stark eingebuchteter Beugeseite, in 3 deutliche Klauen auslaufend.

Epimeren 285μ lang, im 4. Paar 345μ breit. Oberfläche netzartig gefeldert. Epidesmen der vorderen Paare kurz, nur unter die 3. Platten reichend. Aussenecken der 3. und 4. Epimeren ohne besondere Auszeichnung. Ränder und Suturen schwach chitiniert.

Beinlängen : 1. 630, 2. 620, 3. 580, 4. 630μ . Die beiden ersten Beine jeder Seite deutlich verdickt, ihre Endglieder leicht gebogen. Krallen der beiden letzten Beine schwächer als die der vordern und weniger gebogen, 25μ lang. Borstenbesatz reduziert. Die distalen Fiederborsten der Beugeseite des 5. Gliedes am 3. Bein und der 3.-5. Glieder am letzten mit 6-8 ziemlich feinen Fiedern jederseits. Die

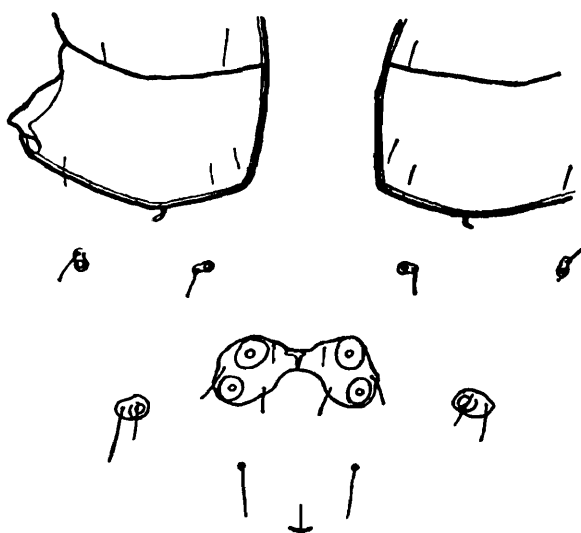


FIG. 22.—*Neumania volzi* Piersig. Nymphe. Hintere Epimeren und Genitalorgan.

weiter proximalwärts stehenden Fiederborsten (höchstens 2-3 Stück) sind alle kürzer und ebenfalls deutlich, wenn auch sehr fein gefiedert.

Endglied des 4. Beines mit 2 Beugeseitendornen. Auf den Hinterbeinen 1-3 Schwimphaare auf dem 3.-5. Gliede.

Genitalorgan (fig. 22) auf sehr dünnchitinisierter Platte, die derjenigen gewisser *Limnesia*-Arten gleicht. Von den 4 Näpfen sind die beiden vordern grösser und liegen näher beieinander als die beiden hintern. Die Näpfe werden von 3 Paaren von Haaren umstellt.

Excretionsporus mit schwachem hintern Stützkörper.

Fundort: Sumpfgewässer bei Calicut. 7 ♂, 23 ♀, teils noch nicht erwachsen, teils eiertragend, 1 Nymphe.

14. *Neumania longipes* n. sp.

Diese Art ist am nächsten mit derjenigen Form verwandt, die VIETS (1926) als Varietät *indica* zu *N. volzi* gestellt hat. Beide zeichnen sich durch Abwesenheit von Genitalplatten aus. Solche sind aber bei *N. volzi* vorhanden; dieses Merkmal erscheint mir wichtig genug, um der VIETSSchen Form Artstellung einzuräumen, trotz verschiedener Uebereinstimmungen mit *N. volzi*. Ich bezeichne sie daher als *N. indica* (Viets). In welchem Verwandtschaftsgrade nun *N. indica* und *N. longipes* zu einander stehen, lässt sich vorläufig nicht sagen, da VIETS' Beschreibung über verschiedene Einzelheiten nicht restlos Auskunft gibt. Ich bin nicht der Ansicht, dass es sich in diesen beiden Formen um die gleiche Art handelt, wohl aber ist nicht ausgeschlossen, dass *N. longipes* eine Varietät von *N. indica* darstellt.

Weibchen:

Länge und Breite der drei Individuen: 0.990/0,750 mm, 1,050/0,825 mm, 1,170/0,900 mm. *N. indica* mit 0,560/0,420 mm also nur von etwa halber Grösse. (Die nachfolgenden Masse beziehen sich auf das grösste der untersuchten Individuen.)

Die Haut trägt eine äusserst feine Linierung. Eine sehr dichte und feine Körnelung, die sich hauptsächlich auf der Dorsalseite findet, konnte nur bei unbenetzter Haut unzweideutig beobachtet werden.

Bei keinem der Individuen ragen, wie bei *N. indica*, die Steissdrüsen als niedere Kegel über den seitlichen Hinterrand hervor. Sie liegen vom Rande deutlich abgerückt. Ein zweites Paar auf höckerartigen Erhöhungen ausmündende Drüsen liegt dorsal, ebenfalls in der Nähe des seitlichen Hinterrandes. Die übrigen Drüsenporen liegen flach und besitzen nur schwache Chitinringe, an die das Haarplättchen deutlich angesetzt ist.

Maxillarorgan am Tiere gemessen mit Fortsatz 185μ , Mandibel 187μ lang. Beide Organe bei *N. indica* kürzer, 150 bzw. 155μ messend, während die Mandibelklaue bei beiden Formen 75μ hat. Auch die Palpenglieder sind länger als bei der Vergleichsart: 1. 47, 2. 143, 3. 80, 4. 138, 5. 49μ . Dagegen ist die Beborstung (fig. 23) sehr ähnlich. Die in der Mitte des inneren Distalrandes des 2. Gliedes sitzende Borste ist jedoch länger und kräftiger als es die Fig. 22 (VIETS 1926) für die Vergleichsart zeigt, und das 2. Glied ist etwas länger als das 4., während bei der VIETSSchen Form das umgekehrte Verhältnis zutrifft,

Hinterrand der 2. Epimere (fig. 24) nicht gerade wie bei *N indica*, sondern stumpfwinklig gebrochen. Sutura zwischen der 3. und der

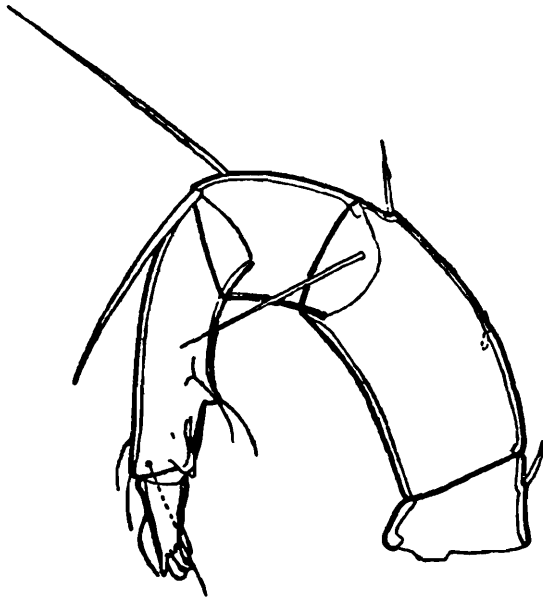


FIG. 23.—*Neumania longipes* n. sp. ♀. Palpus.

4. Epimere bis an den Medialrand sich erstreckend. Letzte Platte aussen viel weniger verschmälert als bei der Vergleichsart. Aussenecke

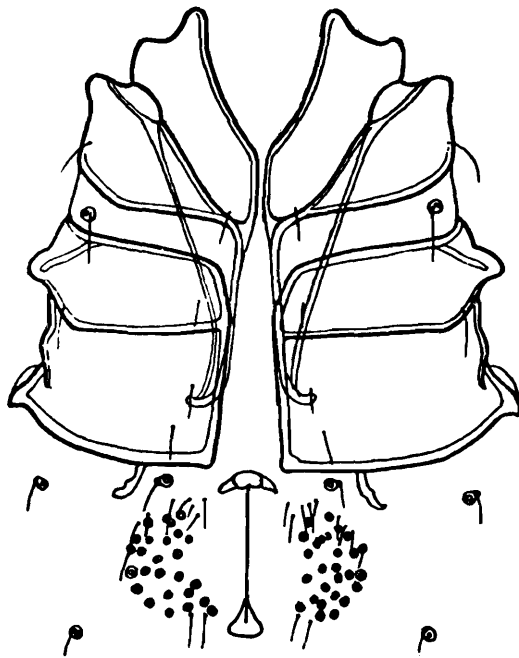


FIG. 24.—*Neumania longipes* n. sp. ♀. Epimeren und Genitalorgan.

der 3. Epimere abgerundet, die der 4. in einen kurzen, breiten, stumpfen, schief nach aussen und hinten gerichteten Fortsatz auslaufend. Fortsatz am Hinterrande der letzten Platte kräftiger entwickelt als bei der Vergleichsform. Oberfläche der Epimeren fein netzartig gefeldert, dicht und feinporig.

Beine sehr kräftig entwickelt, besonders die beiden Vorderpaare mit ihren verdickten 2.-4. Gliedern. Höckerborsten auf dem 2.-4. Gliede des 1. Beines wie bei der Vergleichsart; auf dem 5. Gliede sind es aber 3 Paare, wovon das 3. ganz distal steht, die äussere der beiden Borsten aber verkürzt ist. Auf dem 2. und 3. Gliede des 2. Beines findet sich je nur 1 (statt je 2) kurze Höckerborste, auf dem

4. Gliede zählt man 4, auf dem 5. Gliede 6. Die Zahl der Kurzborsten dieser beiden Beine ist im Vergleiche zu *N volzi* deutlich erhöht; sie sitzen hauptsächlich an den Gliedenden und auf den Streckseiten. Eine Erhöhung der Borstenzahl auf dem 3. und 4. Beine ist für alle Borstenarten zu verzeichnen; die mittellangen Schwertborsten der Gliedinnenseiten treten oft in doppelter Anzahl derjenigen von *N volzi* auf. Die Fiederborste am Distalende des 5. Gliedes, 3. Bein, und des 3.-5. Gliedes, 4. Bein, unterscheiden sich von denjenigen von *N volzi* dadurch, dass sie jederseits des Fiederschaftes nur 1-3 grobe Zacken aufweisen. Es scheinen also allerlei Unterschiede im Borstenbesatz der Beine vorhanden zu sein; denn VIETS hebt deutlich hervor, dass der Haarbesatz von *N indica* nahezu mit demjenigen von *N volzi* übereinstimmt. Die Längen der Beine sind sehr beträchtlich: 1. 1,530, 2. 1,545, 3. 1,440, 4. 1,650 mm. Alle Beine sind bedeutend länger als der Körper, länger auch als bei *N volzi*. Die Krallen sind einzinkig, wenig gebogen.

Das Genitalorgan (fig. 24) ist demjenigen von *N indica* sehr ähnlich. Die Genitalnäpfe liegen in der weichen Körperhaut, jederseits der Spalte 25-26 (bei einem anderen Individuum bis 35 Näpfe, während *N indica* nur 18 besitzt), und zwischen ihnen erkennt man die feinlinierte Epidermis. Wohl infolge der Abwesenheit der Platten sind die Näpfe sehr dickwandig, ihr Lumen ausserordentlich eng. Am Rande des Napfgebietes hinten und aussen einzelne feine auf rundlichen Plättchen eingefügte Härchen, vorn eine Reihe von 4-5 solcher und weiter gegen den vorderen Stützkörper zu ein Einzelhaar. Genitalspalte reichlich 200 μ lang, also kürzer als bei der Vergleichsart. Vorderer Stützkörper ankerförmig, hinterer etwas flächig verbreitert.

Excretionsporus am Hinterrande des Körpers gelegen und mit hinterem Stützkörper versehen.

Fundort: Sumpfgewässer bei Calicut. 3 ♀.

15. *Neumania pilosa* Koen.

Nymphe:

Hautmerkmal der 510 μ langen und 375 μ breiten Nymphe wie bei der Imago. Streckseitenlängen der Palpenglieder: 1. 18, 2. 58, 3. 31,

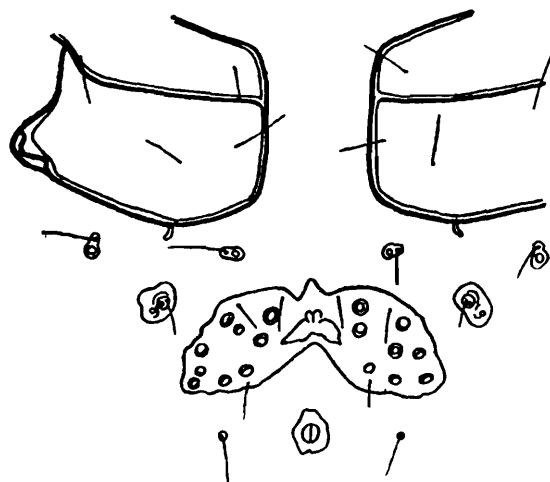


FIG. 25.—*Neumania pilosa* Koen. Nympha. Hintere Epimeren und Genitalorgan.

4. 49, 5. 26 μ . 1. Glied ohne Borste. Streckseite des 2. mit fast distaler kurzer Borste und einer andern am Distalende der Innenfläche,

Die distale Streckseitenborste des 3. Gliedes stark verkürzt, die auf der Aussenfläche sehr kräftig. Am 4. Gliede sind die beiden Einlenkungshöcker der beiden Tasthaare kaum entwickelt, der distale Chitinzahn aber deutlich erkennbar. Epimeren 270μ lang, ohne Hakenfortsatz an den Aussenecken der hintern Epimeren. Beinlängen: 1. 595, 2. 595, 3. 520, 4. 610μ . Die Zahl der Borsten stark reduziert. Fiederborste am Distalende des 5. Gliedes am 3. Bein und am 3.-5. Gliede des 4. Beines ziemlich grob gefiedert, die Fiederung der übrigen Beugeseitenborsten kaum erkennbar. Genitalhof (fig. 25) aus zwei median miteinander verwachsenden flügelartigen Platten bestehend, von denen jede 8-9 Näpfe und einzelne Härchen trägt. Die Näpfe liegen nicht dicht beieinander. Plattenrand unscharf, nicht verdickt. Excretionsporus wie bei der Imago von Chitinring umgeben.

Fundort: Sumpfgewässer bei Calicut. 1 Nymphe.

16. *Piona pseudouncata* Piersig.

Weibchen:

Von dieser Art liegt ein eiertragendes Weibchen vor, dessen Körperlänge 1,6 mm. beträgt.

Die Haut ist nicht völlig glatt, wie PIERSIG (1906) dies behauptet, sondern trägt, wenn auch schwer sichtbar, ein System feinsten Linien.

Maxillarorgan 265μ , Mandibel 330μ lang, letztere mit deutlichem eckige Knine, das ausserdem vom ausgezogenen Hinterteil abgesetzt ist. Klaue kräftig, 90μ lang, am Grunde stark umgebogen, in seinem weiteren Verlaufe fast gerade, beidseitig gerillt, an der Beugeseite mit einer Reihe sehr kleiner Zähne.

Streckseitenlängen der Palpenglieder: 1. 55, 2. 250, 3. 110, 4. 260, 5. 130μ . Der Palpus stimmt mit der von PIERSIG gegebenen Fig. 48 gut überein, wenn auch beim weiblichen Taster die Beugeseite des 2. Gliedes kaum merklich vorgewölbt ist.

Epimeren 0,675 mm lang. Die beiden vorderen Platten zeigen an ihrem Medialrande einen sie verbreiternden Saum. Hintere Platten Gruppen 165μ voneinander entfernt. 4. Epimeren mit kräftig vorspringender Hinterrandsecke, an die sich ausserdem subcutan ein ebenfalls nach hinten gerichteter stumpfer Fortsatz anlegt.

Beinlängen: 1. 1,110, 2. 1,215, 3. 1,245, 4. 1,365 mm. Das 1. Bein ist in PIERSIG'S Fig. 49 gut dargestellt. Zahl der Schwimmborsten am 4. und 5. Gliede des 3. Beines 6 bzw. 8, auf den gleichen Gliedern des Hinterbeines 8 bzw. 10. Endglied mit vier Borsten auf der Innenfläche und stark verkürzter Kralle.

Genitalhof mit dem vordern ankerförmigen und dünnen Stützkörper auf der Höhe der hinteren Ecken der beiden Medialränder der 4. Epimeren. Genitalspalte 310μ lang. Jederseits des hintern Stützkörpers eine zungenförmige Platte, 150μ lang, 125μ breit. Auf jeder Platte 2 grössere Näpfe (Durchmesser bis 30μ), der vordere alleinstehend, der hintere umstellt von 11-13 Näpfen. Napfzahl also etwas geringer als beim Männchen, das von PIERSIG beschrieben worden ist. Auf der dem Stützkörper zugekehrten Ecke einige kurze Härchen (gewöhnlich 3), ein weiteres Härchen beim vorderen Napfe und 2 vor demselben in der weichen Haut.

Excretionsporus etwa 200μ hinter dem Genitalhof, umgeben von einem Chitinring.

Fundort: Sumpfgewässer bei Calicut. 1 ♀, 35 Eier von 195μ tragend.

17. *Axonopsis latifrons* n. sp.

Diese Art steht *A. coerulea* (Piersig) sehr nahe, unterscheidet sich aber von dieser Form in erster Linie durch die gedrungene Gestalt, im männlichen Geschlechte auch durch die abweichende Lage des Genitalorganes. Sie ist auch in der PIERSIGSchen Sammlung enthalten, von PIERSIG jedoch nicht als besondere Art erkannt, sondern mit ersterer vermengt worden.

Weibchen:

Länge des Körpers $0,380$ mm, Breite $0,360$ mm, also kürzer aber breiter als *A. coerulea*. Umriss breit verkehrt-oval. Stirnrand auf eine Länge von 130μ gerade abgestutzt. Antenniforme Borsten sehr fein, 78μ voneinander entfernt. Die Körperfärbung dürfte grünlich sein. Augen schwarz pigmentiert, ca 100μ voneinander abstehend.

Rückenbogenfurche unvollständig, da vorn der Rückenpanzer mit dem Ventralpanzer verwächst und die Stirnkante bildet. Oberfläche des Chitins leicht wabig, in jeder Vertiefung einige Poren aufweisend. Haare und Drüsenmündungen anders gruppiert als bei der Vergleichsform: vorn auf dem Rückenpanzer 1 Paar feiner Haare hinter den Augen, etwas weiter hinten 2 Paare fast in einer Querlinie liegende Drüsenmündungen, das äussere Paar fast am Plattenrande. Weiter rückwärts noch 2 weitere Paare von Haaren, das hinterste kurz vor dem Plattenende. In der Rückenfurche erkennt man die feinlinierte Haut. Der Excretionsporus liegt median am Plattenhinterrande.

Das Maxillarorgan misst bis zum Ende des Doppelfortsatzes 100μ ; dessen Ventralwandung bis zum Grunde der Maxillarbucht 78μ . Mundöffnung in der Mitte der Ventralwandung. Die Palpenglieder messen auf der Streckseite; 1. 26, 2. 47, 3. 26, 4. 61, 5. 26μ , stimmen also in dieser Beziehung mit denjenigen der Vergleichsart überein. Die feinen Haare am 2. und 3. Gliede sind ebenso fein wie bei dieser,



FIG. 26.—*Axonopsis latifrons* n. sp. ♀. Palpus.

aber etwas länger, auch das in der Mitte der Streckseite des 3. Gliedes stehende (fig. 26). Tastborsten der Beugeseite des 4. Gliedes abweichend in der Dreizahl, eine am Innenrand etwas distalwärts der Mitte eingelenkt, die beiden anderen am Aussenrand, hintereinander, jede

auf einem zahnartigen Höcker stehend. Distalhälfte der Beugeseite deutlich abgeflacht. Innenende neben der Einlenkungsstelle des 5. Gliedes höckerig vortretend. Chitin der Palpenglieder feinporös.

Epimeren (fig. 27) ganz mit dem Ventralpanzer verwachsend, der Vergleichsart sehr ähnlich. Die Spitzen der 1. Epimeren ragen nicht

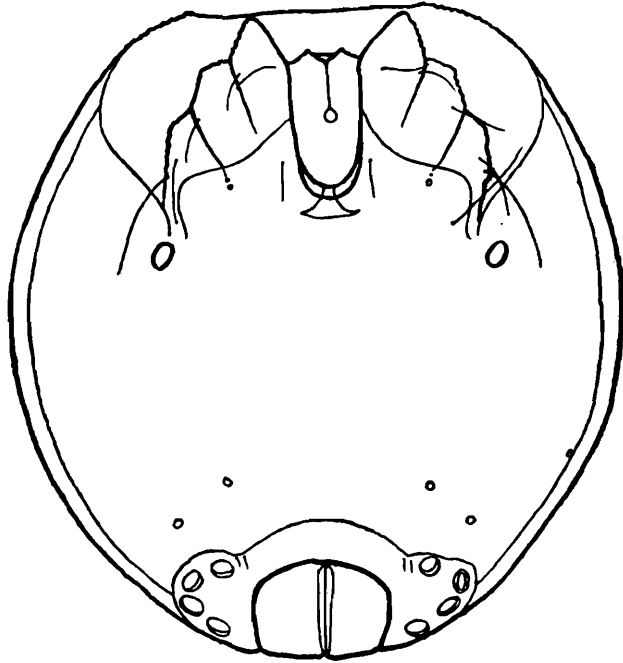


FIG. 27.—*Axonopsis latifrons* n. sp. ♀. Ventralansicht.

über den Stirnrand hervor. Ränder der 1.-3. Epimere aussen zackig. Maxillarbucht etwas tiefer als bei *A. coerulea*, 105μ statt 90μ .

Längen der Beine: 1. 260, 2. 280, 3. 320, 4. 390μ , in Wirklichkeit also kürzer als bei der Vergleichsart, relativ aber von fast gleicher Länge. Sie sind schwach, Glieder distal kaum verbreitert. Borstenzahl gering: am Distalende der mittleren Glieder sitzen einige verlängerte und auch dornartige Borsten, auf der Innenfläche der beiden letzten Glieder des Hinterbeines in Reihen geordnete kurze Borsten. Schwimmhaare wenig zahlreich: 2 auf Glied 5 des 2. Beines, je 2-4 auf dem 4. und 5. Gliede des 3. und 4. Beines. Krallen mit sehr schwachem innerem Nebenzahn.

Genitalhof (fig. 27) ganz am Hinterende des Körpers gelegen, sogar leicht dorsal übergreifend, bei der Vergleichsart dagegen etwas vom Körperende abstehend; Länge 50μ , Breite 83μ , Lefzen chitiniert, deutlich porös. Die 4 Näpfe ähnlich gelagert wie bei *A. coerulea*, der hinterste aber ganz am Hinterrande gelegen; alle Näpfe von gleicher Grösse.

Männchen:

$0,350$ mm lang, $0,330$ mm breit, relativ breiter als das Weibchen, Umriss daher rundlicher erscheinend (fig. 28). Stirnrand ganz seicht eingebogen, 117μ lang. Excretionsporus weiter nach hinten verlagert als im weiblichen Geschlechte, am Hinterrande der Dorsalplatte halbkreisförmig vorstehend.

Palpus dem weiblichen sehr ähnlich; in den Gliedlängen nur geringe Unterschiede: 1. 26, 2. 44, 3. 26, 4. 57, 5. 26μ . 4. Glied auf der Beugeseite weniger stark aufgetrieben.

Beinlängen: 1. 230, 2. 278, 3. 310, 4. 380 μ .

Genitalorgan (fig. 28) ganz am Hinterrande des Körpers liegend, etwas dorsalwärts übergreifend. Genitalspalte ganz terminal, Lefzen

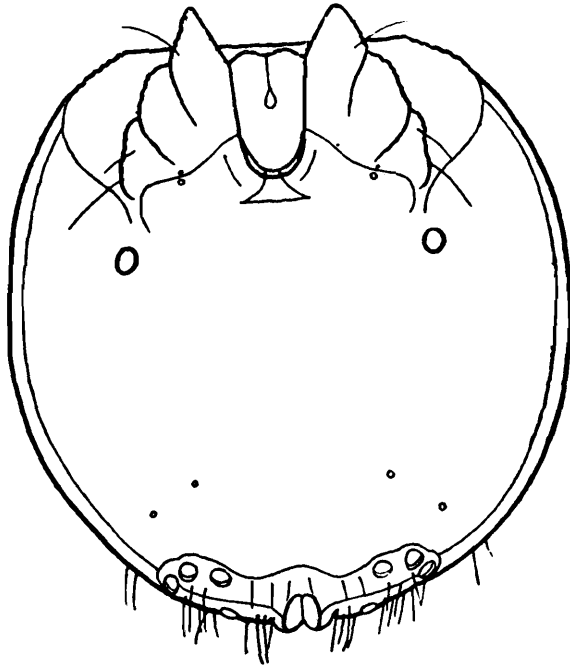


FIG. 28.—*Axonopsis latifrons* n. sp. ♂. Ventralansicht.

am Hinterrande leicht vorstehend, 25 μ breit. Drei der Näpfe auf der Ventralseite im Bogen angeordnet, der 4. terminal gelegen, sein Hinterrand von der Ventralfläche her eben noch sichtbar; er liegt den Lefzen näher als dem äussersten der 3 Näpfe der Ventralseite. Längs des Körperrandes eine Reihe feiner Haare zwischen den Aussennäpfen jeder Seite. Alle Näpfe von gleicher Grösse.

Fundort: Sumpfgewässer bei Calicut. 7 ♂, 1 ♀.

18. *Aturus scutelliferus* n. sp.

Männchen:

Die Länge des Körpers beträgt 0,330 mm, Breite 0,285 mm. Gestalt rundlich-viereckig. Stirnrand vorgebogen, median mit kleiner Kerbe zwischen den etwas vorstehenden Höckern der antenniformen Borsten. Letztere sind fein, gerade, 70 μ voneinander entfernt. Abstand der schwarz pigmentierten Augen voneinander 85 μ . Rand des Körperpanzers in der Schultergegend zackig. Färbung braun.

Dorsalpanzer (fig. 29) vorn und auf den Seiten durch eine Furche von den nach oben übergreifenden Rändern des Ventralpanzers abgetrennt, in seiner vorderen Hälfte convex, hinten muldenartig vertieft. Auf dem Abfall zur Mulde zwei kräftig hervortretende Drüsenhöcker, vor jedem derselben ein fast bis an seine Basis gespaltenes Borstengebilde, dessen einer Teil blattartig breit ist und spitz endigt, der andere länger, schmaler und spitzer ist. Innen neben dieser gespaltenen Borste eine Drüsenmündung. Das Chitin der Mulde nur undeutlich porös; 2 Gruppen von Porendurchbrüchen liegen am hinteren Seitenrande, schief hinter einer von feinem Haar begleiteter Drüsenpore. Excretionsporus auf einem Schildchen gelegen, das vorn und seitlich scharf abgegrenzt, vorn gerundet ist und sich nach hinten etwas verbeitert; hinter demselben, jederseits des Spaltgrundes ansetzend, eine

Reihe feinsten, nach vorn gerichteter Haare. Am Aussenende dieser Reihe ein am Grunde verdicktes Borstengebilde mit einseitigem Besatz

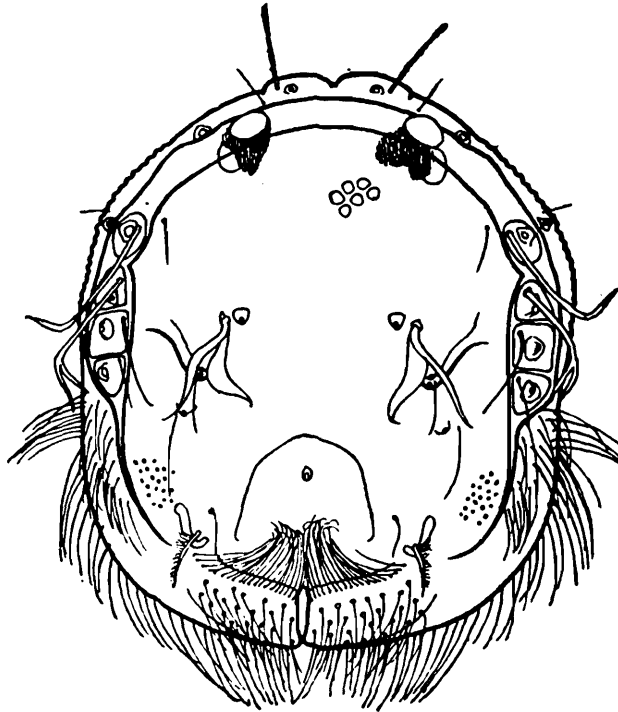


FIG. 29.—*Aturus scutelliferus* n. sp. ♂. Dorsalansicht.

feiner, gegen die Spitze an Länge abnehmende Fiedern. Bei dieser Borste ein Einzelhaar.

In der Furche liegen jederseits vier Drüsenmündungsplättchen hintereinander, das 1. mit einer langen, starken, am Ende gebogenen Borste; des 2. trägt eine kräftige Gabelborste, während die beiden hinteren nur mit einfachen Haaren besetzt sind. Längs des Körperhinterrandes stehen Reihen mittellanger Borsten ohne zwiebelartig verdickten Grund. Reich beborstet sind auch die dorsal übergreifenden Partien des Ventralpanzers hinter den 4 Drüsenmündungen in der Furche und die Stellen zu beiden Seiten des hinteren Spaltes, dessen Ecken mit je 2 blasenförmigen Gebilden versehen sind (fig. 32).

Maxillarorgan kräftig chitiniert, besonders dessen Ventralwand, die an ihrem Hinterende in einen schräg aufwärts weisenden Fortsatz ausgeht. Länge des Maxillarorganes 86μ , der Mandibel 100μ . Letz-

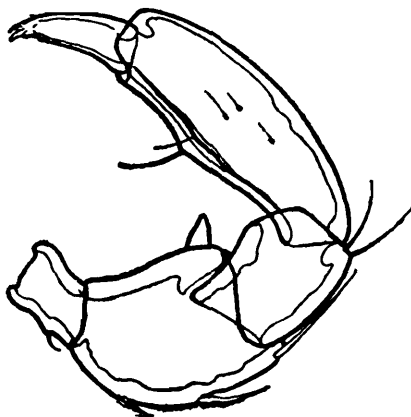


FIG. 30.—*Aturus scutelliferus* n. sp. ♂. Palpus.

tere mit spitzem Ende hinter der 39μ langen Grube. Klaue schwach. Streckseitenlängen der Palpenglieder: 1. 21, 2. 52, 3. 39, 4. 78, 5. 34μ .

Auf der Dorsalseite des Grundgliedes (fig. 30) 1 kurze Borste, des 2. 6, des 3. 2 Borsten. Distaler Rand der Beugeseite des 2. Gliedes aussen in einen scharfen Zahn ausgezogen. Beugeseite des vorletzten Gliedes in der Mitte nur schwach aufgetrieben, dort nebeneinander die beiden Tastborsten tragend, die äussere kräftig und auf einer zum Distalende laufenden Längsleiste inseriert, die andere haardünn. Endglied in 2 Klauen auslaufend.

Epimeren mit dem Ventralpanzer verwachsen. Die gezähnten Spitzen der 1. Epimeren ragen über den Frontalrand hinaus.

Beinlängen: 1. 415, 2. 470, 3. 550, 4. 590 μ . Die drei vorderen Beine ungefähr von gleicher Dicke, mit wenig zahlreichen, schwachen und kurzen Borsten besetzt. Einige verlängerte Borsten distal auf dem 2. und 3. Gliede besonders der beiden ersten Beine und auf der Beugeseite des 5. Gliedes des 3., wo in einer Reihe 11 Borsten von halber Gliedlänge zu zählen sind. Auf der Mitte der Aussenseite desselben Gliedes 4-5 längere, etwas kräftigere Borsten mit feiner Spitze und distal 2 kurze. 4. Bein am dicksten, dessen 2. Glied auf der distalen Beugeseite mit breitem, blattartigem, abgerundetem Fortsatz, der $\frac{2}{3}$ der Länge des folgenden Gliedes erreicht. Das 95 μ lange 4. Glied (fig. 31) verbreitert sich distal und trägt dort 2 breite, blattartige Gebilde,



FIG. 31.—*Aturus scutelliferus* n. sp. ♂. 4. und 5. Hinterbeinglied.

vor diesen 3 weniger breite lange Borsten. Etwa in der Gliedmitte stehen 2 lange verbreiterte Borsten, distal, längs des Innenrandes 2 lange gegabelte, deren kurzer Ast etwas verbreitert, der längere dünn ist, und endlich eine etwas kürzere, peitschenartig gebogene Borste mit feingesägter seitlicher Verbreiterung. 5. Glied 165 μ lang, schwach gebogen, doch in seiner ganzen Länge von gleicher Dicke, am Grunde 5 Borsten tragend, von denen 4 feingesägte seitliche Erweiterungen aufweisen, während die 5. gabelig endigt. Weiter distalwärts eine Reihe von 5 an Länge zunehmenden, in einen kurzen breiteren und

einen längeren, spitz ausgezogenen Ast endigenden Borsten. Am Distalende eine geisselartig gebogene, ein fadenförmiges Anhängsel tragende und 6 einfache Borsten. Kralle des Hinterbeines stärker als diejenige der vordern Paare, wie diese mit Innen- und Aussenzahn ausgerüstet; Krallenstiel nicht besonders stark verbreitert.

Genitalnäpfe (fig. 32) jederseits der Hinterrandsspalte in einer Anzahl von 14-15 Stück, die drei innern längs der Spalte gelegen, die übrigen

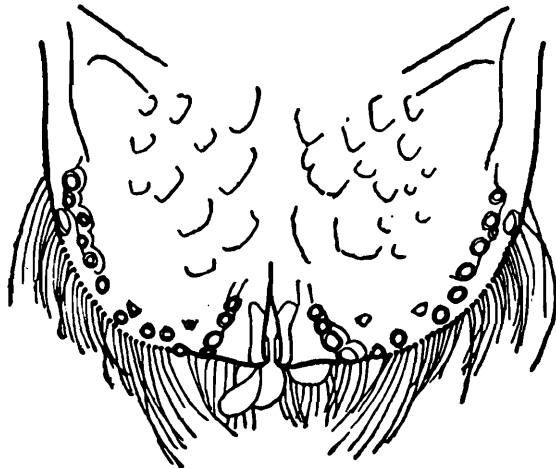


FIG. 32.—*Aturus scutelliferus* n. sp. ♂. Hinterende der Ventralfläche.

am Körperande. Der äusserste Napf jederseits ist der grösste. Er liegt ganz am seitlichen Körperande, ein Stück weit hinter der Einlenkungsstelle des 4. Beines.

Nymphe:

Länge 220 μ , Breite 205 μ . Das vorliegende Exemplar ist jedenfalls noch nicht voll entwickelt. Stirnrand mit zwei deutlich vorspringenden, die antenniformen Borsten tragenden Höckern. Körperhaut 10 μ dick, Oberfläche grob verworren liniert. Vorderrücken mit 2 länglich-runden Platten, deren Innenränder aber parallel zueinander verlaufen. Plattenoberfläche wabig; Länge 62 μ , Breite 41 μ . Dahinter ein Paar Schilder

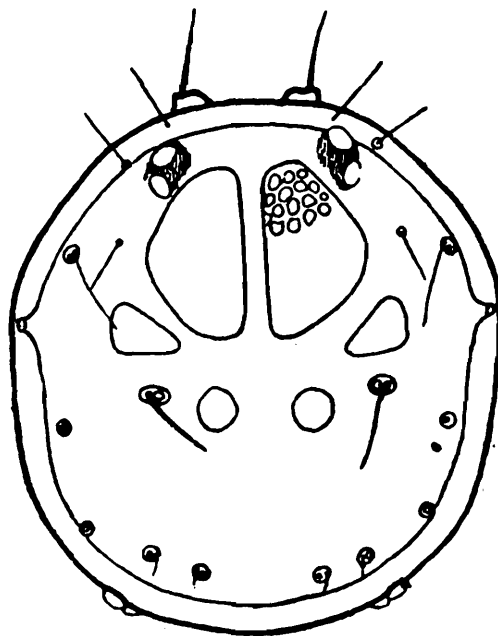


FIG. 33.—*Aturus scutelliferus* n. sp. Nymphe. Dorsalansicht.

von dreieckiger Form und ein Paar rundlicher. Ausserdem trägt der Rücken eine Anzahl von Drüsenporen; s. Fig. 33.

Maxillarorgan 57μ lang, wie auch die Palpen ohne besondere Merkmale.

Die beiden ersten Epimeren verwachsen nicht miteinander; ihre Medialränder verlaufen parallel zueinander. Medialrand der 4. Platte bogig, Hinterrand querliegend. Oberfläche der Hüftplatten grobwabig.

Beine nach hinten an Dicke abnehmend. Die Längen betragen: 1. 230, 2. 240, 3. 265, 4. 315μ .

Genitalplatten klein, jede 2 Näpfe tragend, ganz am Hinterrande des Körpers gelegen, teilweise von der Dorsalseite sichtbar (noch nicht erwachsene Nymphe).

Excretionsporus fast hinterrandständig.

Fundort: Bhagsu-nath, Upper Dharamsala, Kangra Valley, Punjab. 4. Juni 1926, 1 ♂, 1 Nymphe. Dr. Hora leg.

19. *Arrhenurus aculeatifrons* Piersig.

Fundort: Sumpfgewässer bei Calicut. 5 ♂, 5 ♀. Die untersuchten Individuen sind alle grösser als der Typus. Die Männchen messen in der Körperlänge 0,9-0,975 mm, die Weibchen 0,795-0,825 mm.

20. *Arrhenurus belaniensis* Piersig.

Männchen:

Körper 0,675 mm lang, 0,500 mm breit, im Umriss birnförmig (fig. 34). Stirnpartie vorspringend, die 115μ voneinander entfernten Augen

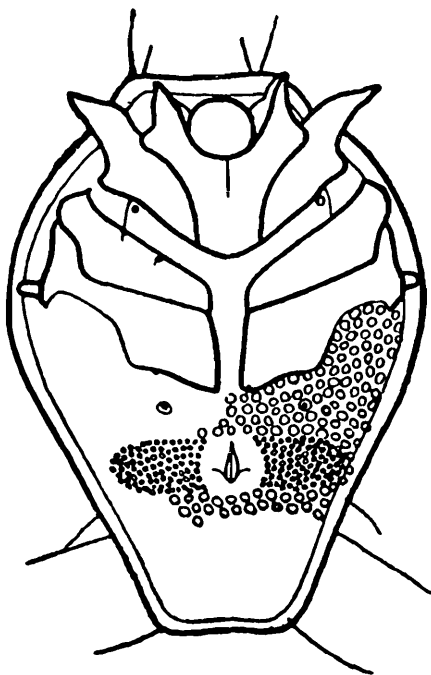


FIG. 34.—*Arrhenurus belaniensis* Piersig. ♂. Ventralansicht.

tragend; diese sind schwarz pigmentiert. Stirnrand gerade; antenniforme Borsten fein, gerade, 120μ voneinander abstehend. Nach hinten läuft der Körper ohne besondere Abgrenzung in den immer schmaler werdenden Anhang aus, dessen Hinterrand gerade abgeschnitten ist und 165μ misst. Rücken vorn stark gewölbt, den rundlichen, 220μ langen und 245μ breiten Dorsalpanzer tragend, der vom Stirnrande 100μ absteht. Hinterrand desselben weniger stark gebogen als der

Vorderrand. Nennenswerte Höckerbildungen sind keine vorhanden. Anhang fast flach, mit 3 Paaren langer Haare, sonst ohne Auszeichnungen.

Maxillarorgan 115μ lang, (der über den Hinterrand vorspringende Pharynx nicht inbegriffen), 90μ breit. Mandibellänge 105μ . Streckseitenlängen der einzelnen Palpenglieder: 1. 18, 2. 60, 3. 28, 4. 49, 5. 37μ . Das Grundglied (fig. 35) scheint borstenlos zu sein. 2. Glied auf der

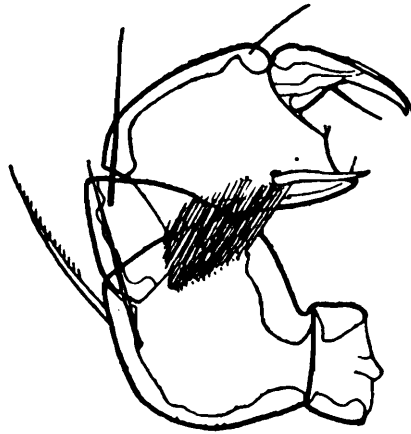


FIG. 35.—*Arrhenurus belaniensis* Piersig. ♂. Palpus

Streckseite ausserordentlich stark gebogen, ventral aber sehr verkürzt, sodass die proximale und die distale Gelenkfläche fast senkrecht zueinander gerichtet sind. Dorsal eine steife Borste, die das nachfolgende Glied an Länge übertrifft. Innenfläche stark aufgebaucht; distale Glieddicke 52μ . Dieser Vorsprung trägt ein sehr dichtes Büschel feiner, bis 25μ langer Borsten. Eine starke Borste steht schief hinter diesem Haarpolster, der Aussenseite genähert. 3. Glied innen mit feinem Haar, aussen mit langer Borste. Flächenfortsatz des 4. Gliedes mit spitz ausgezogener Beugeseitenecke, hinter der das eine Tasthärchen steht, während das andere sich auf einer schwachen mittleren Vorwölbung des Distalrandes befindet. Die Borste auf der Abflachung in der Nähe der Beugeseite, an der Basis dick, Spitze scharf. Von der Seite gesehen läuft das Endglied in eine einzige lange und spitze Klaue aus.

Die Vorderrandspitze der 2. Epimere (fig. 34) ist ausserordentlich stark ausgezogen, 100μ lang, und ragt über den Stirnrand hinaus. 3. Epimere schmal, die 4. aussen stark verschmälert. Ihr Hinterrand hinter der Einlenkungsstelle des 4. Beines eine tiefe Einbuchtung aufweisend, die von Panzerporen ausgefüllt wird; die Abgrenzung zwischen Epimere und Ventralpanzer nur noch undeutlich ausgebildet. Zwischenraum zwischen den hinteren Epimerengruppen schmal.

Beinlängen: 1. 450, 2. 635, 3. 600, 4. 620μ ; das 2. Bein übertrifft also alle andern an Länge. 4. Bein ohne Sporn. Nicht zahlreiche Schwimmhaare finden sich auf dem 3.-5. Gliede. des 3 und 4. Beines, vereinzelte auch schon auf dem 2. Beine.

Genitalorgan (fig. 34) an der Basis des Anhanges gelegen. Die längliche Spalte liegt inmitten eines porenlosen Feldes von 80μ Breite. Napfplatten nicht deutlich vom Ventralpanzer abgesetzt, zahlreiche kleine Näpfe tragend. Sie sind transversal gerichtet, an ihrem dicht am Seitenrande des Körpers liegenden Ende abgerundet und für ein *Arrhenurus*-Männchen relativ sehr breit.

Weibchen:

Körper 0,960 mm lang, 0,855 mm breit. Umriss breitoval (fig. 36), Hinterrand mit breiter Rundung, Stirnrand leicht vorgewölbt. Gegenseitige Entfernung der antenniformen Borsten 225μ , der Augen 275μ . Rückenpanzer vom Stirnrande 165μ abstehend, langelliptisch, hinten mit dem Ventralpanzer verwachsen.

Palpus etwas weniger gedrunken als beim Männchen, aber mit diesem in den wichtigen Merkmalen übereinstimmend. Streckseitenlängen der einzelnen Glieder: 1. 18, 2. 75, 3. 41, 4. 62, 5. 45μ .

Epimerenspitzen nicht an den Frontalrand heranreichend, die der 2. Platte bei weitem nicht so stark ausgezogen wie beim Männchen, aber etwas breiter als die der 1. Platte; Abstand der beiden hinteren Plattengruppen vorn grösser als hinten, wo er noch 75μ beträgt. Aeusserer

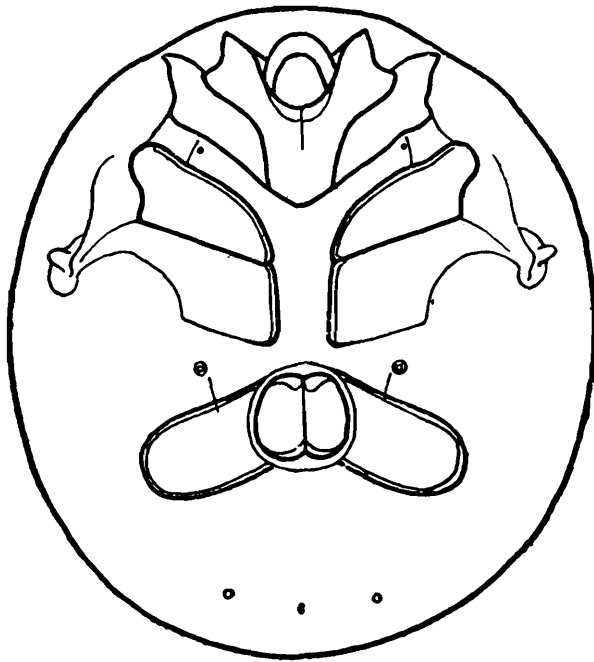


FIG. 36.—*Arrhenurus belaniensis* Piersig. ♀. Ventralansicht.

Hinterrand der 4. Epimere wie beim Männchen stark ausgeschweift und nur undeutlich sichtbar (fig. 36).

Beinlängen: 1. 725, 2. 780, 3. 725, 4. 800μ , letzteres also länger als die anderen.

Genitalorgan (fig. 36) nahe bei den Epimeren gelegen. Die breitelliptische Lefzenpartie misst in der Länge 130μ , in der Breite 145μ . Porenflecken nicht vorhanden. Napfplatten wenig schief nach hinten und aussen gerichtet, ihre Breite entspricht der Lefzenlänge, ihr Ende ist abgerundet. Sie tragen zahlreiche kleine Näpfe. Totalbreite des Genitalorganes 465μ .

Excretionsporus nicht weit vom Hinterrande des Körpers entfernt.

Fundort: Sumpfgewässer bei Calicut. 1 ♂, 1 ♀.

21. *Arrhenurus bicornicodulus* Piersig.

Ich halte zwei *Arrhenurus*-Weibchen für das bisher noch nicht bekannte weibliche Geschlechtstier dieser Art.

Weibchen :

Körperlänge 0,990 mm, Breite 0,855 mm. Im Umriss (fig. 37) ist der vordere Körperteil dem männlichen sehr ähnlich. Er vers-

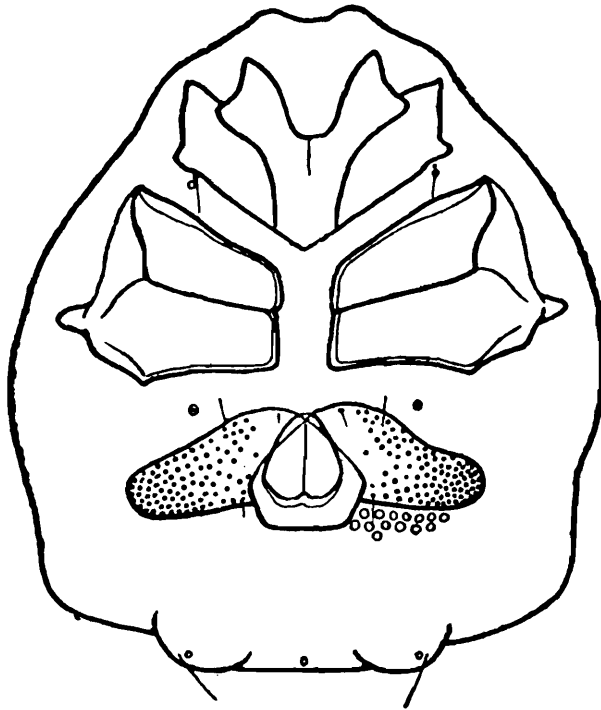


FIG. 37.—*Arrhenurus bicornicodulus* Piersig. ♀. Ventralansicht.

chmälert sich stark nach vorn, Stirnrand zwischen zwei höckerartigen Vorsprüngen eingebuchtet. Grösste Körperbreite über der Einlenkungsstelle des 4. Beinpaares. Nach hinten ist die Verschmälerung nur gering. Beim Uebergang in den Hinterrand werden zwei abgerundete Ecken gebildet. Mittelpartie des Hinterrandes in einer Ausdehnung von ca 450 μ kräftig vorspringend, jederseits von gerundetem Höcker begrenzt.

Rückenplatte vorn breit gerundet, vom Stirnrand 240 μ abstehend. Ihre grösste Breite liegt weit hinten und beträgt 510 μ . Hinterrand nicht ausgebildet, da Verwachsung mit dem übrigen Panzer eintritt. Umriss langoval. An der Stelle der grössten Körperbreite findet sich jederseits ausserhalb des Rückenbogens eine gerundete Kuppe, was auch beim Männchen der Fall ist.

Abstand der schwarz pigmentierten Augen voneinander 255 μ , ihre Entfernung vom Stirnrand 75 μ .

Maxillarorgan ohne vorspringenden Pharynx 150 μ lang, 125 μ breit. Die Masse, die PIERSIG (1906, p. 367) für das männliche Organ angibt (Länge 560 μ , Höhe 528 μ) können nicht richtig sein. Hinterpartie der Ventralwandung sehr breit, 60 μ messend. Mandibel 170 μ lang. Streckseitenlängen der einzelnen Palpenglieder: 1. 28, 2. 73, 3. 44, 4. 83, 5. 49 μ . Die Glieder stimmen in Form und Ausrüstung (fig. 38) mit denjenigen des Männchens überein. Besonders charakteristisch dürften die drei kurzen Borsten auf der Innenfläche des 2. Gliedes sein. Auf der Innenseite des 3. Artikels steht nicht, wie PIERSIG angibt, eine Schwertborste, sondern ein langes, feines Haar.

Die Vorderenden der Epimeren (fig. 37) weniger spitz als beim Männchen. 4. Epimeren 75 μ voneinander entfernt, ihr Hinterrand deutlich ausgebildet. Die "panzerporenartigen Gebilde" und "Inselbildungen,"

von denen PIERSIG spricht, sind wohl nichts anderes, als Muskelansatzstellen auf der Unterseite der Epimeren.

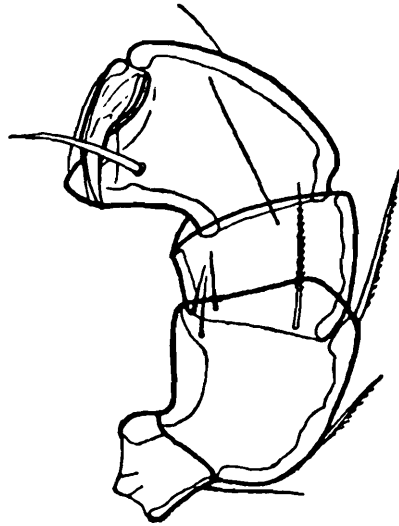


FIG. 38.—*Arrhenurus bicornicodulus* Piersig. ♀. Palpus.

Beinlängen : 1. 685, 2. 800, 3. 755, 4. 930 μ .

Lefzenfeld des Genitalorganes (fig. 37) nach vorn sich zuspitzend, hinten am breitesten, dort und auch seitlich von gebogenen Rändern begrenzt. Länge der Lefzenpartie 115 μ , Breite 125 μ ; Chitinflecken sind nicht vorhanden. Hinterrand sehr stark verdickt, wulstartig vorstehend. Genitalplatten transversal gerichtet, an der Ansatzstelle sehr breit, nach aussen sich verschmälernd und abgerundet abschliessend. Grösste Breite einer Napfplatte 175 μ , Spannweite des ganzen Organes 550 μ . Näpfe viel kleiner als die Panzerporen, längs der Lefzen viel weniger dichtstehend als weiter aussen. Drüsenpore hinter den Epimeren leicht erhöht.

Excretionsporus am Hinterrande zwischen den beiden Kuppen gelegen.

Beim Männchen haben die Genitalplatten ähnlichen Verlauf wie diejenigen des Weibchens, wie an den in der PIERSIGSchen Sammlung enthaltenen Stücken nachgewiesen werden konnte. PIERSIGS Figur 72, pl. 18 (1906) gibt die Verhältnisse insofern nicht richtig wieder, als median der Vorderrand der Napfplatten weiter nach vorn bogig vorspringt, die Genitalspalte auch weiter nach vorn zu liegen kommt.

Fundort : Sumpfgewässer bei Calicut. 2 ♀.

22. *Arrhenurus micropetiolatus* n. sp.

Männchen :

Diese Form zeigt verwandtschaftliche Beziehungen zu *A. pulcher* Walter, unterscheidet sich aber von ihm besonders in der Gestaltung des Anhanges.

Die Körpergrösse misst 0,800 mm, die Breite 0,705 mm. Stirnrand mit flacher Einbuchtung zwischen den antennenformen Borsten, die 225 μ voneinander entfernt sind, tragenden Stirnhöckern. Augen schwarz pigmentiert, 270 μ voneinander abstehend. Seitenrand im Gebiete der Augen mit flacher Einbuchtung. Anhang (fig. 39) sehr kurz, nur undeutlich vom Körper abgesetzt. Eckfortsätze in den Spitzen 585 μ voneinander entfernt. Am Körperende eine steil abfallende

Mulde, deren Hinterrand von zwei auf der Ventralseite entspringenden Höckern gebildet wird, die in ihren Spitzen einen Abstand von 375μ

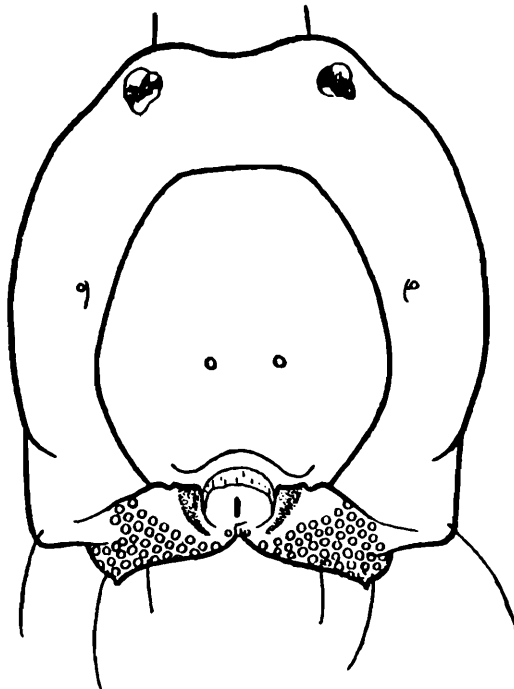


FIG. 39.—*Arrhenurus micropetiolatus* n. sp. ♂. Dorsalansicht.

aufweisen. Zwischen ihnen ist der Rand flach ausgeschnitten und median spitzwinklig bis spaltartig gestaltet. Rückenbogen vom Stirnrande 180μ entfernt, Breite der dorsalen Platte 450μ . Mittelpartie der Anhangsmulde eine rundliche Vertiefung bildend, die oben und seitlich von einem Hautsaum umfasst wird und die in ihrer Mitte einen sehr kurzen (35μ) Petiolus trägt. Sie ist jederseits von einem niedrigen dicht und feinporösen Wall begrenzt, der nach hinten an Breite abnimmt, und an den sich nach aussen hin eine porenlose Partie anschliesst. Rückenfläche ausserhalb des Rückenbogens, etwa über der 3. Epimere, jederseits einen niedrigen Höcker mit Drüsenpore.

Maxillarorgan 145μ lang, vorn 105μ breit, 110μ hoch. Mundöffnung am Vorderrande eines 75μ hohen Vorsprunges, jederseits von einem aus farblosem Chitin bestehenden Zahn flankiert, an dessen Grunde die beiden Borsten stehen. Die beiden 20μ langen Zähne liegen in der

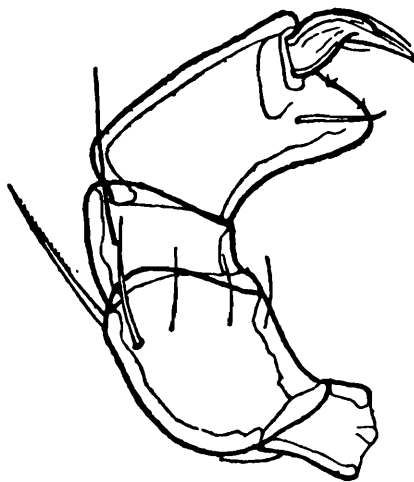


FIG. 40.—*Arrhenurus micropetiolatus* n. sp. ♂. Palpus.

Verlängerung der Ventralwandung nach vorn. Die Palpen sitzen am Hinterende des Vorsprunges. Mandibel 148μ lang,

Die Palpenglieder (fig. 40) messen auf ihrer Streckseite: 1. 39, 2. 73, 3. 44, 4. 86, 5. 44 μ . Grundglied mit stark gebogener, feiner Borste. Die Dorsalseite des 2. Gliedes trägt eine mittlere und eine distale Borste, die Innenfläche nahe beim Distalrande 3 feine Borsten und eine längere gegen die Streckseite zu. 3. Glied mit langer Innen- und Aussenseitenborste. 4. Glied mit kräftiger basaler Biegung. Ecke des Flächenfortsatzes abgerundet, deren Borste kurz.

Die Epimerenspitzen erreichen den Stirnrand nicht. Die vordere Gruppe schliesst hinten gerundet ab. 3. und 4. Epimere median von fast gleicher Breite, Hinterrand der letzteren transversal, fast gerade. Abstand der beiden hintern Gruppen voneinander 80 μ am Hinterende, vorn etwas weniger.

Beinlängen: 1. 755, 2. 850, 3. 875, 4. 1010 μ . 4. Glied des Hinterbeines mit kurzem Sporn, der 8 über seine ganze Länge verteilte mittellange Borsten trägt.

Genitalspalte langgestreckt. Ihr Hinterende erreicht fast den medianen Ausschnitt des Hinterrandes, vor den noch der Excretionsporus zu liegen kommt; letzterer wird aber nur bei Kopfstellung des Tieres deutlich sichtbar. Das ganze Genitalorgan bildet einen kräftigen, nach hinten vorgebogenen Wulst, der z. T. seitlich die beiden kuppelartigen Erhebungen hinter den Epimeren noch umfasst. Napfplatten in ihrem mittleren Teile relativ breit, sich nach den Seiten hin aber rasch verschmälernd.

Weibchen:

Länge 1,080 mm, Breite 0,960 mm. Der Körperumriss (fig. 41) gleicht demjenigen von *A. pseudoaffinis* Piersig; die Einsenkung des

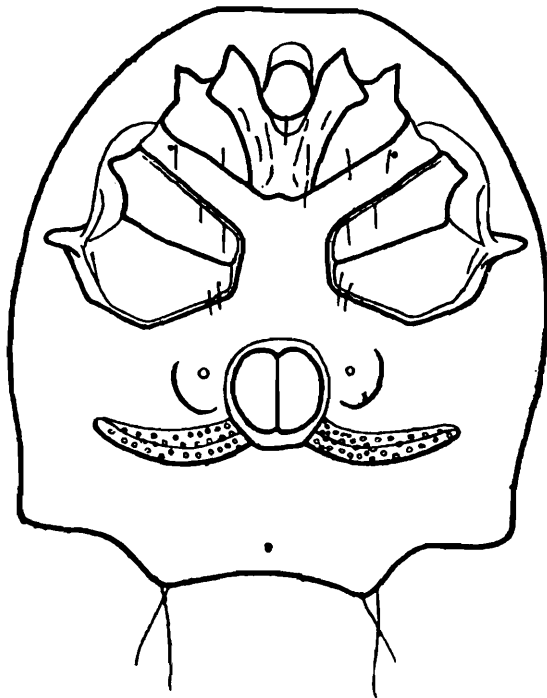


FIG. 41.—*Arrhenurus micropetiolatus* n. sp. ♀. Ventralansicht.

Stirnrandes ist aber kaum angedeutet, die Eckfortsätze stehen weniger vor, und zwischen den beiden am Hinterrand vorspringenden Höckern liegt eine etwas tiefere Einbiegung. Rückenpanzer langoval, 765 μ lang, 615 μ breit, vom Stirnrande doppelt so weit (180 μ) als vom Hin-

terrante abstehehd. Ueber den 3. Epimeren jederseits eine schwache kuppelartige Erhöhung.

Maxillarorgan 155μ lang, 111μ hoch, vorn 123μ breit. Mandibel 158μ lang. Länge der Palpenglieder: 1. 39, 2. 75, 3. 49, 4. 96, 5. 47μ . Alle diese Organe wie beim Männchen gebaut.

Epimeralgebiet klein. Abstand der hintern Gruppen voneinander 150μ an den Hinterecken, vorn etwas weniger. Medialrand der 3. Platte so lang wie derjenige der 4. Diese verbreitert sich von 65μ am Medialrande auf 175μ in ihrer Mitte.

Die dünnen Beine weisen folgende Längen auf: 1. 715, 2. 875, 3. 915, 4. 1000μ .

Genitalgebiet (fig. 41) sehr typisch durch die erhöhte Lage der Lefzen. Jederseits derselben eine kuppelartige Erhöhung, auf welcher die beiden sonst direkt hinter den Epimeren liegenden Drüsenmündungen sich befinden. Dadurch werden die Napfplatten weit nach hinten verschoben. Sie setzen am Hinterrande der Lefzen an, sind sehr schmal, innen etwas breiter als aussen, und ziehen sich in flachem, nach vorn offenem Bogen seitwärts. Ihr Hinterrand tritt sehr stark hervor, ist auch kräftig chitiniert, was durch eine ihm parallel verlaufende Linie angezeigt wird. Die Abgrenzung des Vorderrandes vom Ventralpanzer ist dagegen viel weniger deutlich. Die Näpfe sind sehr klein. Lefzenpartie breitoval, 155μ lang, 180μ breit, hinten und seitlich von wulstartig verdicktem Chitinrande umfasst, keine Flecken tragend.

Excretionsporus nahe am Körperhinterrand gelegen.

Fundort: Sumpfgewässer bei Calicut. 2 ♂, wovon eines noch nicht ausgewachsen, 1 ♀.

23. *Arrhenurus palembangensis* Piersig.¹

Das einzige Exemplar, ein noch nicht reifes Weibchen, ist kleiner als der Typus, 780μ lang, 675μ breit. PIERSIGS Exemplar war dagegen eiertragend (21 Eier von 150μ Durchmesser). Der Beschreibung PIERSIGS (1906) ist beizufügen, dass die Rückenplatte hinten mit dem übrigen Panzer verwachsen kann, was bei beiden untersuchten Weibchen der Fall ist.

Streckseitenlängen der Palpenglieder: 1. 26, 2. 59, 3. 36, 4. 80, 5. 46μ . Distalende des 4. Gliedes 50μ breit. Die drei Borsten der Innenfläche des 2. Gliedes etwas stärker und länger als beim Typus.

In geschlossenem Zustande sind die Ausschnitte des seitlichen Lefzenrandes (PIERSIG, 1906, Fig. 99 und 103) kaum sichtbar. Sie werden nur deutlich erkennbar bei nach innen umgeschlagenen Lefzen und hervorgerufen durch die grossen, leicht erhabenen porösen Flecken auf den Lefzen, die eine noch grössere Ausdehnung haben als bei *A. bruzelii* Koenike.

Fundort: Sumpfgewässer bei Calicut. 1 ♀.

¹ Zwei eiertragende Weibchen dieser Art verdanke ich meinem Freunde, Herrn Dr. R. MENZEL, der sie in der Umgebung von Buitenzorg erbeutet hat. Damit ist diese Form auch für Java festgestellt.

24. *Arrhenurus pseudobruzellii* n. sp.*Weibchen :*

Die nächstverwandten Formen sind *A. bruzellii* Koenike, *A. congener* Daday, *A. weigoldi* Walter und *A. pseudoaffinis* Piersig.

Länge 1,2 mm, Breite 1,020 mm. Der Umriss (fig. 42) ist etwa derselbe wie bei *A. bruzellii*, erscheint aber im ganzen plumper. Stirn-

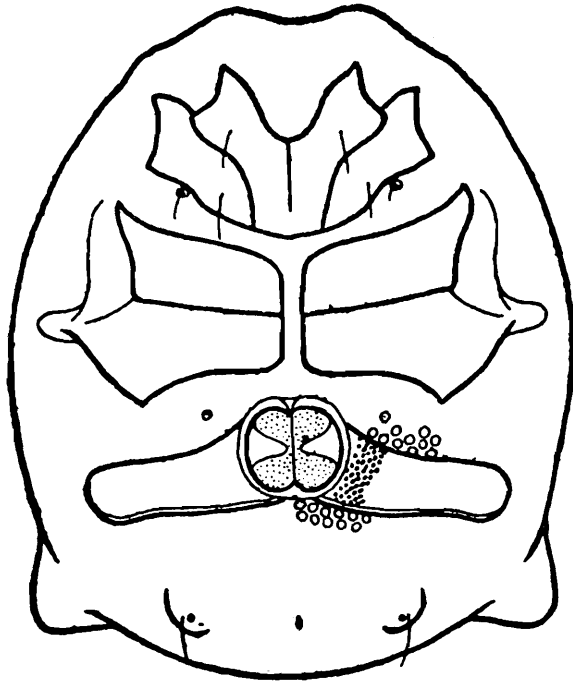


FIG. 42.—*Arrhenurus pseudobruzellii* n. sp. ♀. Ventralansicht.

rand mit wenig tiefer Einbuchtung. Seitenrand im Gebiete der 375 μ voneinander entfernten Augen leicht vorspringend. Eckfortsätze hinten schief seitwärts gerichtet, der Hinterrand zwischen ihnen breit vorgewölbt. Rückenbogen verkehrt-oval, zwischen den zwei kuppelförmigen Erhöhungen am vorderen Seitenrande eingedrückt. Entfernung vom

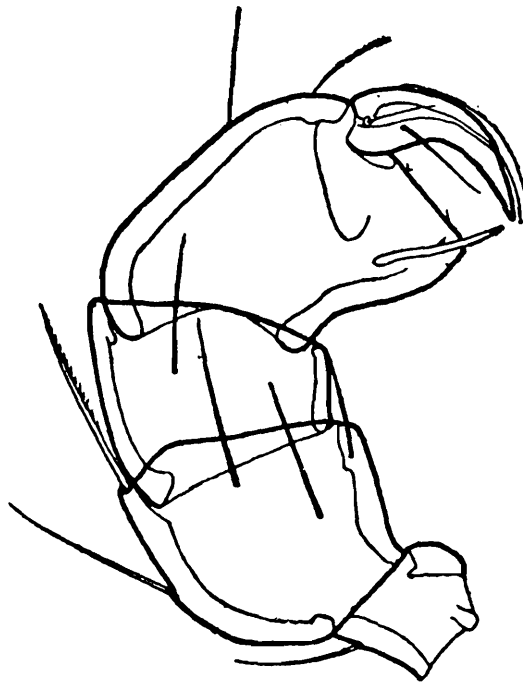


FIG. 43.—*Arrhenurus pseudobruzellii* n. sp. ♀. Palpus.

Stirnrande 345 μ , vom Hinterrande nur 90 μ . Grösste Breite der Dorsalplatte 645 μ .

Maxillarorgan 165μ lang, vorn 130μ breit. Mandibellänge 195μ ; die Klauenspitze zeigt schief aufwärts, und am Hinterende der Streckseite befindet sich ein scharf ausgeprägter knieförmiger Vorsprung. Die Palpenglieder messen dorsal: 1. 34, 2. 85, 3. 70, 4. 106, 5. 65μ . Der kräftig gebaute Palpus gleicht hinsichtlich des Borstenbesatzes demjenigen der Vergleichsart. 2. Glied (fig. 43) mit 2 feinen Borsten in der Nähe des Beugeseitenrandes und einer kräftigen in der Mitte beim Distalrande der Innenseite, 2 steifen, gefiederten, auf der Streckseite. 4. Glied in der Form besonders an dasjenige von *A. congener* Daday erinnernd.

Epimeren (fig. 42) weit vom Frontalrande abstehend. Mediane Länge der 3. Platte derjenigen der 4. fast gleichkommend. Hinterrand der vordern Epimerengruppe fast bogig. Die beiden hintern Gruppen median durch einen nur 40μ betragenden Abstand geschieden, dadurch deutlich von den drei anderen Arten abweichend, sich aber am meisten *A. bruzelii* nähernd. Hinterrand der 4. Platte weniger flach ausgerandet als bei *A. congener*.

Beinlängen: 1. 780, 2. 855, 3. 855, 4. 1100μ .

Genitalorgan (fig. 42) nahe an die Epimeren gerückt. Lefzenpartie fast kreisrund, 143μ lang, 156μ breit. Lefzenflecke wie bei *A. bruzelii*. Napfplatten sich weit seitwärts erstreckend, das ganze Organ 750μ breit. Mittlere Breite der Napfplatten 120μ , an der Ansatzstelle etwas breiter, die Lefzen aber am Vorderrande nicht umfassend. Aussenende gerundet, ganz schwach abgebogen. Hinterrand dadurch leicht wellig. Platten mit dichtem Besatz kleiner Näpfe.

In der Nähe des Hinterrandes zwei niedrige kuppenartige Vorwölbungen, zwischen denen der Excretionsporus gelegen ist.

Fundort: Sumpfgewässer bei Calicut. 1 ♀.

REPORT ON SOME DEEP-SEA SPONGES FROM THE INDIAN
MUSEUM COLLECTED BY THE R. I. M. S.
"INVESTIGATOR."

PART II. TETRAXONIDA (CONCLUDED) AND EUCERATOSA.

By M. BURTON, *M.Sc.*, Assistant in the Department of Zoology, British Museum.

(Plates I, II.)

Discodermia gorgonoides, sp. n.

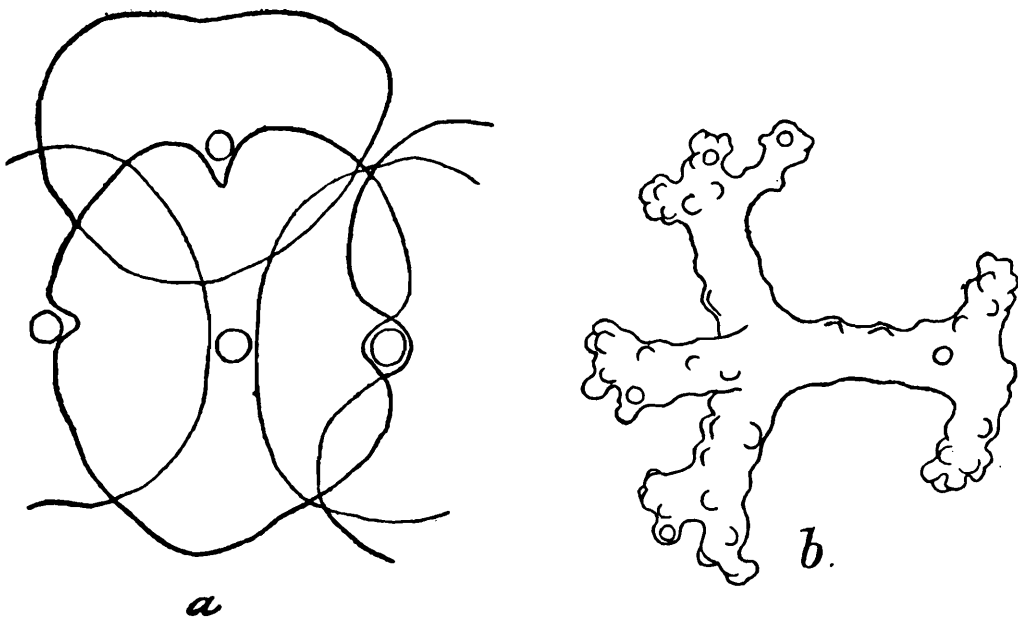
The species is represented by a fragment of what may have been a branching sponge with rounded branches about 2 mm. in diameter. The surface bears a number of small conical protuberances arranged almost in a spiral. No definite oscules are visible. Colour, in spirit, yellow.

The skeleton consists of tetracrepid desmas through which run bundles of oxea which do not pierce the ectosome but stop short just below the surface.

Spicules.—(1) *Oxea*, long, slender, measuring about $\cdot 33$ by $\cdot 005$ mm.

(2) *Desmas*, tetracrepid, each epactine being roughly $\cdot 1$ mm. long and usually smooth for the greater part of their length but become highly tuberculate towards the ends (text-fig. 1*b*).

(3) *Discotriaenes*, of the usual form. Dimensions.—Diameter of cladome, $\cdot 18$ mm., length of rhabdome, $\cdot 09$ mm. These spicules form a layer at the surface where they are arranged in such a close manner



TEXT-FIG. 1.—*Discodermia gorgonoides*, sp. n.

a. Discotriaenes, $\times 200$; *b.* Desma, $\times 200$.

that the edges of individual spicules overlap. Many of them have one or more notches in the edge of the disc whose presence is due to a

mechanical hindrance during development from the shafts of adjacent discotriaenes (text-fig. 1a).

(4) *Microstrongyles*, with slightly roughened surface, about .009 mm. long.

The species differs in its cylindrical, possibly branching habit from all other species of the genus, except *D. vermicularis* Döderlein (1884) and *D. ramifera* Topsent (1892D) from which it differs in the absence of microxea.

Lendenfeld (1906, p. 344) suggests that the true distinction between *Discodermia* and *Theonella* should rest rather on the presence or absence of the microxea than on the form of the dermal triaenes, an opinion with which I cannot agree.

Registered No., locality, etc.—P. $\frac{281}{1}$ (XLVI, 6), 8 miles W. of Interview I. Andamans, 45-270 faths.

***Taprobane herdmani* Dendy (1905, 1921B).**

Previously recorded from Ceylon and the western Indian Ocean, this species is represented by two dried specimens, both regularly infundibuliform and of a light brown colour. The larger is 9 cms. high and 13 cms. across the mouth of the funnel. The smaller is 2 cms. high and the same across the mouth. The thickness of the walls is 1 cm. and .5 cm. in the two specimens respectively.

In spiculation the agreement with the holotype is very close and the specimens differ from it only in the more regular external form. Dendy's (1921B) specimens, while agreeing more closely with the holotype in external form, have larger sigmata, .013 by .0024 mm. as against .010 by .001 mm.

Previously known distribution.—Ceylon ; Indian Ocean.

Registered Nos., localities, etc.—P. $\frac{282}{1}$ (XXXIII), P. $\frac{283}{1}$ (XXXIV), Mergui Archipelago, 13° 4' 30" N., 96° 44' E., 65 faths. Collected, 17th April 1913.

***Petromica massalis* Dendy (1905, 1921B).**

A single massive specimen, brown in colour, 1 cm. high and 1.5 cm. across the base.

The monaxon spicules are very sparse and much more slender than is usual but otherwise the sponge agrees closely with the holotype.

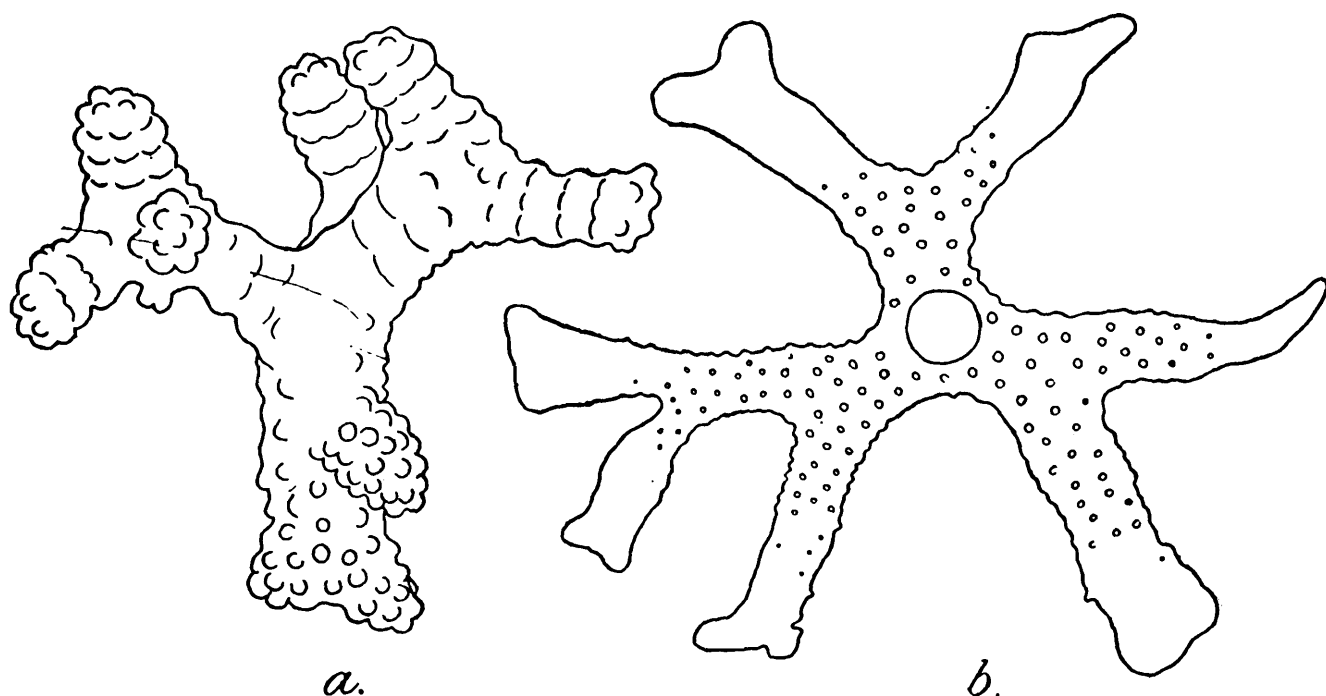
Previously known distribution.—Ceylon ; Indian Ocean.

Registered No., locality, etc.—P. $\frac{284}{1}$ (XLVI, 5), 8 miles W. of Interview I. Andamans, 45-270 faths.

***Theonella cupola*, sp. n.**

The two examples of this species are similar in external form : they are massive with a convex upper surface and resting on a circular base about 2 cms. in diameter. The larger is 8 mm. high. The surface is smooth with a depression placed excentrically on the upper surface containing the single oscule. The latter is 1 mm. in diameter and is surrounded by a thin membranous margin resembling a velum. Just

beneath the opening of the oscule is a cavernous chamber receiving the openings of the numerous exhalant canals, while similar canals can be



TEXT-FIG. 2.—*Theonella cupola*, sp. n.
a. Desma, $\times 200$; b. Phyllotriaene, $\times 200$.

seen through the transparent ectosome running parallel to it. The pores are distributed generally between the cladi of the surface phyllotriaenes and are about $\cdot 05$ mm. in diameter. The colour, in spirit, is greyish yellow.

The skeleton is typical, consisting of closely-locking desmas roofed over at the surface by a layer of phyllotriaenes, with the short shafts of the latter directed towards the interior of the sponge. At the surface, also, are bundles of about 6 slender monactinal megascleres which protrude beyond the ectosome, while similar bundles are found associated with the desmas of the main skeleton. These are, for the most part, oxea but they appear to vary somewhat in shape, sometimes the ends are blunted (*i.e.*, strongylote), sometimes swollen (*i.e.*, amphitylote). The development of the phyllotriaenes takes place *in situ*.

The only other spicule is a microrhabd abundantly associated with the ectosome, around the pores, and with the linings of the canals.

Spicules.—(1) *Oxea*, straight or curved, variously modified to form strongyla or amphitylota measuring $\cdot 44$ by $\cdot 005$ mm.

(2) *Phyllotriaenes* with short conical shafts bearing cladomes composed of three dorso-ventrally flattened dichotomous cladi. The outer surface of these spicules is covered with small tubercles. Total diameter of cladome, $\cdot 495$ mm., shaft, $\cdot 176$ mm. long (text-fig. 2b).

(3) *Desmas*, tetracrepid, massive, usually covered with numerous rounded tubercles. Total length about $\cdot 385$ mm. Average thickness of epactines $\cdot 077$ mm. (text-fig. 2a).

(4) *Microrhabds* with well-developed spines, variable in size, measuring on an average $\cdot 019$ by $\cdot 005$ mm.

The species makes a near approach to *T. lacerata* Lendf. from Sumatra but differs in the smaller details of the spiculation.

Registered No., locality, etc.—P. $\frac{285}{1}$ (XL, I), Laccadive Is., 1 mile off Kiltan I., 20-30 fms.

***Azorica pfeifferae* Carter (1873D, 1876D).**

Azorica marginata, Sollas, 1888A, p. 323, pl. xxxv, figs. 14-22. (For further synonymy vide Lendenfeld 1903B and Topsent 1904A).

Two fragmentary specimens, almost identical with the holotype in external form and colour, present certain differences in the skeleton which lead me to regard *A. marginata* as a synonym of this species.

Sollas (*l.c.*, p. 324) says of *A. marginata*, "They might easily be mistaken for a young specimen of *Azorica pfeifferae*; the characters of the desma suffice to distinguish it." Apparently the characters referred to are the dense tuberculations and their bifid nature. In view of the possession by the present forms of these characteristics and of their strong affinity with *A. pfeifferae* on the other hand, I do not feel inclined to accept such small details as evidence of the existence of two distinct species.

Previously known distribution.—North Atlantic; West Indies; Indian Ocean; Indo-Pacific.

Registered Nos., localities, etc.—P. $\frac{286}{1}$ (XIII), "Investigator" Stn. 220, Andaman Sea, Lat. 13° 16' 30" N., Long. 93° 8' E., 79 faths; P. $\frac{287}{1}$ (XXXII, 3), "Investigator" Stn. 535, Mergui Archipelago, Lat. 13° 4' 30" N., Long. 96° 44' E., 65 faths.

***Siphonidiella*, gen. nov.**

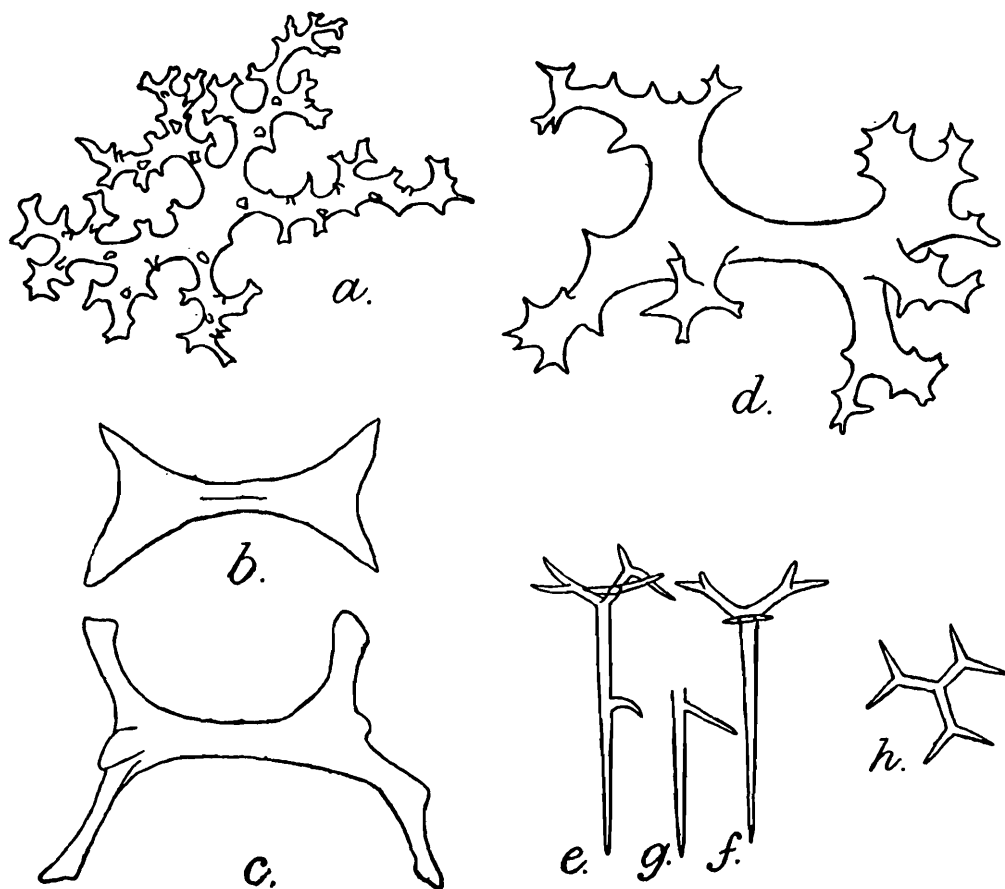
Rhabdosa in which the ectosomal spicule is a desma highly branched in a plane parallel to the surface. The choanosomal desmas are mono-crepid. There are no microscleres. The only other spicule present is a small dichotriaene occurring in the choanosome, apparently scattered promiscuously and without any definite arrangement.

This genus is most nearly related to *Siphonidium* Schmidt from which it differs chiefly in the possession of a triaene in the place of a rhabdus as the third category of spicules. Possibly it may be found necessary later on to merge the genera, but on the other hand it is possible that the present genus does not belong to the Rhabdosa at all. The presence of a triaene in the spiculation does suggest an affinity with the Tetracnididae but I feel fairly confident that the desmas are mono-crepid and not tetracrepid.

***Siphonidiella dendyi*, sp. n.**

The single specimen is a hard stony sponge consisting of a main irregularly cylindrical portion, about 4 cms. long and 2 cms. in diameter, from the apex of which are given off three small lobes. The whole presumably grew erect with the small lobes uppermost, since the oscular processes are given off evenly all round the specimen and not confined to any one side or pointing in any one direction. The colour varies, in different parts of the sponge, from greyish brown to brownish-yellow. The surface is perfectly smooth but uneven and there is a definite ecto-

somal layer with a special dermal skeleton. With a hand-lens the sub-dermal canals appear as dark meandrine lines beneath the surface. The oscules are situated at the ends of small papillate processes distributed over the general surface. There are roughly about 25 of these



TEXT-FIG. 3.—*Siphonidiella dendyi*, sp. n.

a. Ectosomal desma ; b, c, d. Choanosomal desma in various stages of development ; e, f, g. Dichotriaenes, e and g with lateral spurs ; h. Cladome of dichotriaene. All $\times 200$.

processes in all. Most of them show signs of having been damaged but a typical example is cylindrical, about 3 mm. high and the same in diameter. The diameter does not vary much from the base to the apex. Each process appears to contain one or more exhalant canals which empty their contents to the exterior through a single osculum.

The skeleton consists of very tightly-locking desmas divided into two distinct categories characterised by their position in the sponge and the form and size of the desma. These form the entire skeleton except for the presence of small dichotriaenes which may be seen scattered indiscriminately in the choanosome. The presence of the tetract spicules in a sponge whose only other spicules are, apparently, monocrepid rather obscures the affinities of the genus to which it belongs.

Spicules.—(1) *Ectosomal desmas*. These are so like those of *Siphonidium capitatum* Sollas (1888A) that I cannot do better than quote that author's very able description of them. "A broad undulating epirhabd, giving off branches from the convex sides of the curves, and bifurcating at the ends ; the cladi subdivide and give off lateral branches, and all the branches terminate finally in twig-like processes. The desma is depressed and ramified in a plane parallel to the surface, and the engies between the branches are mostly well rounded off ; the twig-like endings

of one desma are overlapped by those of its neighbours, and thus a close-meshed superficial network is produced without actual zygois." When viewed from above the dermal skeleton has the same appearance as that figured by Lendenfeld (1906, Pl. XLV, fig. 13) for *Plakidium acutum*. The actual extent of the desma is roughly $\cdot 210$ by $\cdot 150$ mm. (text-fig. 3a).

(2) *Choanosomal desmas*: monocrepid, with a peculiar thorny or spiny appearance. The shape can be best appreciated by reference to the figure (text-fig. 3 b, c, d). The size is very variable but a single desma is roughly $\cdot 200$ by $\cdot 130$ mm. in extent.

(3) *Dichotriaenes*.—These do not appear to be localised in any particular part of the sponge but occur scattered throughout all the tissues. They are variable in size. The cladome may vary from $\cdot 072$ to $\cdot 132$ mm. in total diameter, while the shaft varies in length from $\cdot 050$ to $\cdot 150$ mm., and in thickness from $\cdot 005$ to $\cdot 013$ mm. Very frequently, in about 50 per cent. of cases, a spur may be noted protruding at various angles from the shaft about halfway down (text-fig. 3 e-g).

Registered No., locality, etc.—P. $\frac{288}{1}$ (XXXII, 2), "Investigator" Stn. 535, Mergui Archipelago, Lat. $13^{\circ} 4' 30''$ N., Long. $96^{\circ} 44'$ E., 65 faths.

Gellius flagellifer Ridley and Dendy (1886, 1887).

(For synonymy and distribution *vide* Dendy 1924A.)

I assign two specimens to this species, not without some hesitation. They are sub-spherical, of a loose and cavernous texture, with a single oscule at the apex. The colour in both is a very pale yellow. The disposition of the various spicules in the skeleton approximates very closely to that in the type. The characteristic flagellate sigmata are fairly rare and measure from $\cdot 08$ to $\cdot 09$ mm. The second type of sigmata are, on an average, $\cdot 06$ mm. long. The oxea in P. $\frac{289}{1}$ (XVI) measure $\cdot 36$ by $\cdot 014$ mm., in P. $\frac{290}{1}$ (XVII) $\cdot 28$ by $\cdot 012$ mm.

Previously known distribution.—Almost cosmopolitan.

Registered Nos., localities, etc.—P. $\frac{289}{1}$ (XVI), "Investigator" Stn. 234, Andaman Sea, $13^{\circ} 15' 30''$ N., $93^{\circ} 23'$ E., 498 faths; P. $\frac{290}{1}$ (XVII), "Investigator" Stn. 236, Andaman Sea, $13^{\circ} 59'$ N., 93° E., 172-303 faths.

Gellius canaliculata (Dendy).

Gellius ang latus (Bwk.) var. *canaliculata* Dendy (1905.)

There is a single specimen agreeing with the type in all respects, but for the slight differences in size of the spicules. These are, in the present specimen:—Oxea, 168 by $\cdot 006$ mm., sigmata, $\cdot 028$ mm. long, toxa, $\cdot 053$ mm. long.

On comparing the Kurrachee (Karachi) and Torres Strait specimens mentioned by Ridley (*l. c.*), I find that they agree with the present species in all respects except that in one of them there are no toxa. It is curious that Ridley should have missed this form of spicule, but

it is present in abundance in the Torres Strait sponge and sparingly present in one of the Kurrachee (Karachi) specimens.

Previously known distribution.—Kurrachee (Karachi); Torres Strait (Ridley); Ceylon (Dendy).

Registered No., locality, etc.—P. $\frac{291}{1}$ (XXVIII), "Investigator" Stn. 385, Arabian Sea, 16° 40' N., 71° 53' E., 630 faths.

Gellius megastoma, sp. n.

(Pl. I, fig. 1.)

The single specimen is composed of two sub-spherical lobes almost completely fused together, the whole standing about 1.25 cm. high on a base 2 cms. by 1.5 cm. At the apex of each lobe is a single large oscule leading into a deep cloacal tube running vertically downwards to the base of the sponge. The diameters of the oscules are 4 and 5 mm. respectively. The colour, in spirit, is a greenish-yellow. The surface is glabrous but slightly uneven. The very delicate, transparent dermal membrane appears to be supported by an inconspicuous dermal skeleton composed of an irregular network of bands of spicules. Whether this is actually a special dermal skeleton or only the outermost portion of the main skeleton it is very difficult to determine accurately. Beneath this are numerous conspicuous sub-dermal cavities, the whole imparting a finely reticulate appearance to the surface. The pores are inconspicuous but probably overlie the sub-dermal cavities. The sponge is soft and friable.

The main skeleton is composed of oxea lying in a very irregular manner throughout the choanosome, sometimes associated in ill-defined bands but often merely grouped together in a most sporadic fashion so that the arrangement may be said to be irregularly Halichondrioid. A special dermal skeleton is present (*vide supra*).

Spicules.—(1) *Oxea*, usually slightly curved, with obtusely pointed ends, often incipiently strongylote, measuring .504 by .024 mm.

(2) *Sigmata*, of the usual type, .02 mm. long.

The large size of the oxea forms, together with the unusual size of the oscules and the external form, the outstanding features of the species. In the size of the megascleres it resembles such species as *G. glacialis*, *G. calyx* and *G. carduus* of Ridley and Dendy, but differs from them all in the external appearance. Like *G. ridleyi* externally, it differs from that species in the size of the spicules.

Registered No., locality, etc.—P. $\frac{292}{1}$ (XLVII, 2), Andamans, 130-290 faths.

Sigmaxynissa fibulata (Ridley).

Gelliodes fibulatus, Ridley, 1884B.

Gelliodes fibulatus, Ridley and Dendy, 1887.

Gelliodes fibulatus, Lendenfeld, 1887E.

Gelliodes fibulatus, Hentschel, 1912A.

Non Gelliodes fibulatus, Babic, 1921, 1922.

Two perfectly typical specimens are present. The spicules in P. $\frac{293}{1}$ (II) are like those of the 'Challenger' specimen in size, *viz.* :—oxea,

173 by .008 mm., sigmata, .014 mm. long. In P. $\frac{294}{1}$ (LV. I.) the oxea are slightly longer but the sigmata are only .011 mm. long.

Previously known distribution.—Torres Strait (Ridley, Ridley and Dendy, Lendenfeld); Arafura Sea (Hentschel).

Registered Nos., localities, etc.—P. $\frac{293}{1}$ (II), "Investigator" Stn. 10, 7½ miles E. of N. Cinque I., Andamans, 490 faths; P. $\frac{294}{1}$ (LV, 1), "Investigator" Sta. 10 C, off Cinque I., Andamans, 120-170 faths.

Protoschmidtia expansa Thiele (1903B).

A few small fragments of this species are present which are sufficiently like the paratype possessed by the British Museum as to admit no doubt as to their identity with Thiele's species. They are yellowish crusts of a stony, *Petrosia*-like texture. The skeleton is composed of a dense almost Halichondrioid network of oxea. There is no special dermal skeleton and the surface is minutely hispid to the touch. The oxea are slightly thicker than those of the holotype but of the same length.

Previously known distribution.—Ternate (Thiele).

Registered No., locality, etc.—P. $\frac{296}{1}$ (LXI), 16° 44' 45" N., 93° 34' 30" E., 1300 faths.

Protoschmidtia cerebrum, sp. n.

(Pl. I, fig. 2.)

The seven fragmentary representatives of this species are all subspherical with the exception of P. $\frac{296}{1}$ (XLVI, 1c. d.) which is irregularly cylindrical. There is otherwise little variation in the salient features as we pass from one sponge to another, except for the usual small differences in spicule dimensions. The holotype, P. $\frac{297}{1}$ (LII, a), is irregularly subspherical with four comparatively large oscules, about 1.5 mm. in diameter, at various points on the surface. The surface itself is minutely hispid where the spicules from the underlying skeleton project through the delicate dermal membrane. Beneath the dermal membrane are a large number of conspicuous sub-cortical cavities which can be clearly seen through the transparent ectosome. Frequently these cavities coalesce giving the maendrine appearance which suggested the specific name. The pores are apparently situated immediately above the sub-dermal cavities but they are so inconspicuous as to render their exact determination difficult. The oscules lead into deep cloacal tubes, running vertically downwards to the base of the sponge, which receive the openings of the exhalant canals. The colour, in spirit, is pale yellow.

The skeleton consists of stongyla only. These are arranged in a manner usually spoken of as *Petrosia*-like, that is, they build up a very close-meshed network of polyspicular fibres in which the spicules are arranged in a Halichondrioid manner which gives the sponge a hard, stony texture. There is no special dermal skeleton.

Spicules.—The only spicule is the strongyle, straight or slightly curved with evenly rounded ends, .264 mm. long by .016 mm. thick.

I have placed this species in the genus *Protoschmidtia* on account of its similarity, so far as the skeleton arrangement goes at all events, to the preceding species, *P. expansa*. Nevertheless, I do not feel content with the determination. According to Czerniawski (1878), its author, the genus occupies a position intermediate between *Reniera grossa* and *R. palmata*. We have no satisfactory description of either of these two species, neither does the bare statement that the genus *Protoschmidtia* is intermediate between these two species give us any indication as to the manner in which it agrees with or differs from either or both. In other words, we are left to give our own interpretation as to the characters of the genus. Since both *Amorphina* and *Reniera* are in an equally confused state, the position becomes rather difficult. In his preliminary sorting of the collection, Dendy had labelled this specimen "*Petrosia*." The only resemblance it bears to that genus is its hard texture. It has neither the special dermal skeleton nor the two sorts of oxea and two of strongyles of the type-species *P. dura*. The structure of the skeleton is not that of a typical *Reniera*, neither does it possess the special dermal skeleton of the genus *Amorphina*. Until the true characters of the various genera of the Renierinae have been established I feel that the only course is to place the species in its present genus for the reason already mentioned as a provisional measure.

Registered Nos., localities, etc.—*P.* $\frac{296}{1}$ (XLVI, 1 c, d), 8 miles W. of Interview I., Andamans, 45-270 faths.; *P.* $\frac{297}{1}$ (LII, a), Andamans, 271 faths.; *P.* $\frac{298}{1}$ (LV), "Investigator" Sta. 10 C, off Cinque I., Andamans, 120-170 faths.

***Calyx clavata*, sp. n.**

The single broken specimen consists, at the moment, of two portions. The larger is subcylindrical, about 15 mm. long and 2.5 mm. in diameter, the second, 10 mm. long and 1.5 mm. thick. It is difficult to suggest the habit of the sponge except with great uncertainty but it was either ramose and repent or erect, clavate and slightly stipitate. The latter is the more probable. Colour, yellowish-white, in spirit; surface smooth. Oscules are visible on the larger fragment where they occupy a more or less lateral position. They are about 1 mm. in diameter with the margins level with the general surface of the sponge. The pores are about .06 mm. in diameter and scattered evenly over the whole of the surface. Beneath the transparent dermal membrane the underlying skeleton may be seen with the naked eye to be composed of stout anastomosing bands of spiculo-fibre whose general course is in a direction from one end of the sponge to the other. These fibres give a distinctly reticulate appearance to the sponge.

The skeleton consists of two distinct parts, a dermal and a main skeleton. The main skeleton consists of a more or less confused reticulation of oxea lying in the choanosome with little or no order, but running through this mass are stout multispicular bands of oxea cemented together with a small amount of spongin. In some places these bands are so diffuse as to be barely distinguishable from the irregular reticulation in which they are embedded but in others they stand out conspi-

cuously. They follow no apparent course or direction but anastomose freely and beneath the surface they appear to pursue a course more or less parallel to the long axis of the sponge, giving the surface the reticulate appearance already noted. The dermal skeleton consists of a very delicate but quite distinct layer of oxea lying in the ectosome parallel to the general surface of the body. The meshes of the network are always triangular and unispicular, the sides being one spicule's length. This regular triangular pattern is broken only at those points where pores pierce the ectosome, when the mesh may be quadrangular or pentagonal. The ends of the spicules are cemented together at the ends by a small but distinct quantity of spongin.

Spicules.—*Oxea*, smooth, straight or slightly curved, measuring on an average .11 by .003 mm.

This species bears a strong general resemblance to the genotype, *Calyx nicæensis* (Risso), in that it has the unispicular detachable dermal skeleton and the multispicular main skeleton composed for the most part of anastomosing fibres running through the sponge with little or no apparent order.

Registered No., locality, etc.—P. $\frac{299}{1}$ (LV, 5), "Investigator" Sta. 10 C, off Cinque I., Andamans, 120-170 faths.

Trachyopsis halichondrioides Dendy (1905).

This species is remarkably common in all parts of the Indian Ocean. I have examined many examples from the E. Coast of S. Africa, Mauritius, Red Sea, Persian Gulf, Ceylon, etc. Its most remarkable feature is an extreme variability in external form, colour, size of spicule, disposition of skeleton, etc. That it is more common than one might suppose from the pages of our literature there can be no doubt, and many forms hitherto regarded as distinct may be found on further examination to be indetical with it. I am not at all sure of the systematic position of the species. It is usually placed near the genus *Halichondria* in the Haploscleridae, although its author suggested an affinity between it and the genera *Trachya* and *Spongosorites*. For my own part, I feel that there is good ground for regarding it as a very primitive Axinellid allied to *Axynissa* and *Prostylyssa*. The present collection contains three quite typical examples. All are small, one is spherical and a reddish-brown in colour, while the other two are quite amorphous and a pale yellow in colour.

Registered Nos., localities, etc.—P. $\frac{300}{1}$ (XXXV, 1 b), Malay Archipelago, Bally Strait, 160 faths.; P. $\frac{301}{1}$ (XXXVII), off Ceylon, 703 faths.; P. $\frac{302}{1}$ (XLVIII), "Investigator" Sta. 9, S. × W of N. Sentinel I., Andamans, 130-250 faths.

Phloeodictyon putridosa (Ridley and Dendy).

Rhizochalina putridosa, Ridley and Dendy, 1886, 1887.

Rhizochalina putridosa, Whitelegge, 1906.

As is not unusual in dealing with members of this genus, the difficulty of determining the species to which a specimen belongs is increased

by the fact that the specimen itself is only fragmentary. In the present instance, four more or less complete fistulae are present but it is impossible to tell with any degree of accuracy whether they have been broken from the main body or whether they represent complete sponges. The former is, I think, the more probable. They are about 5 mm. in diameter and the longest is about 5 cms. in length. The colour, in spirit, is pale yellow.

On comparing these fistulae with the 'Challenger' specimens a very strong similarity is at once evident despite the fact that the spicules are slightly smaller in the former, and I have little hesitation in assigning them to this species.

Previously known distribution.—Australia, Bahia (Ridley and Dandy) : Australia (Whitelegge).

Registered No., locality, etc.—P. $\frac{303}{1}$ (IV), "Investigator" Stn. 32, 16 miles E. of Devi R., Orissa Coast, 68 faths.

***Mycale spongiosa* (Dendy).**

Esperella spongiosa, Dendy, 1896.

Mycale fistulata, Hentschel, 1911A.

Mycale fistulata var. *macrochela*, Hentschel, 1911A.

The single specimen completely encrusts a shell forming a mass about 20 sq. cms. in extent and about 1 cm. thick. The dermal membranes have been, for the most part, worn away, leaving the coarse fibrous network of the main skeleton bare. In certain places, large cavernous openings lead from the surface into the sponge-tissues but whether these are true oscules or only cavities which have contained commensal worms it is impossible to say. The extremely poor state of the surface makes it impossible to study the nature of the pores. The colour, in spirit, is a dark, purple-brown.

The main skeleton consists of an irregular network of spiculo-fibre with well-defined primary fibres running towards the surface connected at very irregular intervals by secondary fibres. The thickness of the fibres varies considerably. The primaries consist of from twenty to fifty spicules, while the secondaries contain from four to twenty. In addition, loose bundles and isolated spicules are found lying between the meshes of the main network. There is apparently no special dermal skeleton, the dermal membranes resting directly on the ends of the ascending primary fibres. In addition to the subtylostyles, the only spicules present are anisochelae and sigmata.

Spicules.—(1) *Subtylostyles* of the usual form, with slightly developed oval head, .196 by .004 mm.

(2) *Anisochelae*, usually in rosettes in the choanosome but scattered singly in the ectosome, varying in length from .036 to .028 mm.

(3) *Sigmata*, thin, contorted, abundant in the choanosome, .045 mm. in length.

Despite certain small differences in shape and size of spicules there is, I think, sufficient resemblance between *Esperella spongiosa*, *Mycale fistulata* et var. and the present specimen to justify my regarding them all as belonging to the same species. Assuming such to be the case,

M. spongiosa is yet another example of a species of *Mycale* common to both Australia and the Indian Ocean.

Registered No., locality, etc.—P. $\frac{304}{1}$ (XXXVIII), off Ceylon, 703 faths.

***Biemna annexa* (Schmidt).**

(For synonymy and description *vide* Lundbeck, 1902.)

The two representatives of this species furnishes what is probably the biggest surprise of the whole collection of deep-sea sponges from the Indian Ocean. The first specimen is a yellow, flattened, discoidal cushion-shaped mass about 4-5 mm. thick and covering a circular area of 2.5 cms. diameter. The second, a dried, encrusting sponge, has a skeleton of loosely arranged tylostyles forming an irregular network, which, just below the surface, ends in dermal brushes of spicules. The dermal brushes, like the rest of the skeleton, are very irregular and often very diffuse. The spicules are tylostyli of two, more or less, distinct sizes, sigmata and trichiform toxa whose dimensions correspond exactly with those of the corresponding spicules given by Lundbeck (*l. c.*). It may be said in conclusion, that this sponge from the Indian Ocean is identical with Schmidt's species which has, hitherto, only been found in the N. Atlantic.

Previously known distribution.—Northern Atlantic (*vide* Lundbeck, 1902).

Registered No., locality, etc.—P. $\frac{305}{1}$ (XXII), "Investigator" Stn. 297, Gulf of Oman, 25°11' 30" N., 57° 15' E., 689-700 faths.; P. $\frac{306}{1}$ (LXII), "Investigator" Sta. 232, Laccadive Sea, 7° 17' 30" N., 76° 54' 30" E., 430 faths.

***Biemna liposigma*, sp. n.**

The spiculation of this species is so characteristic and unusual that the formation of a new species for so small and fragmentary a specimen may, I think, be justified. The holotype is a small fragment, roundly conical in shape, about 10 mm. high and about 8 mm. in diameter at the base. The colour, in spirit, is a pale yellow. Several conspicuous oscules are distributed over the general surface of the sponge whose diameters range from 1-2 mm. The surface has a minutely reticulate appearance but is glabrous to the touch. The texture is firm but compressible.

The skeleton, which is really the only thing about this sponge which can be satisfactorily described, is composed entirely of styli and raphides, the latter being divided into three distinct categories. In the choanosome, the larger raphides, usually present in bundles of from twenty to forty, form the most conspicuous feature of the skeleton. The raphides may occur either singly or in bundles and they are distributed, together with the styli, without apparent order throughout the whole of the choanosome. In the dermal membrane, however, some sort of order can be seen and it is probably the regular arrangement of the styli and the bundles of raphides lying parallel to and just beneath

which give the surface its reticulate appearance. It seems almost possible to regard such an arrangement as a special dermal skeleton, and, indeed, the whole skeleton, including the disposition of the dermal spicules, strongly recalls that of *Halichondria panicea*.

Spicules.—(1) Styli, smooth, slightly curved especially in the basal third, .6 mm. long by .024 mm. thick.

(2) Rhaphides, .5 mm. long by .004 mm. thick. These spicules, in common with the other categories of raphides are smooth, slender, and sharply pointed at each end.

(3) Rhaphides, .084 mm. long by .004 mm. thick.

(4) Rhaphides, .03 mm. long by .0015 mm. thick.

This appears to be a true *Biemna* which is characterised by the complete absence of sigmata, a condition almost unique in the genus.

Registered No., locality, etc.—P. ³⁰⁷/₁ (LI), Andamans, 271 faths.

***Sceptrospongia coronata* Dendy (1926A).**

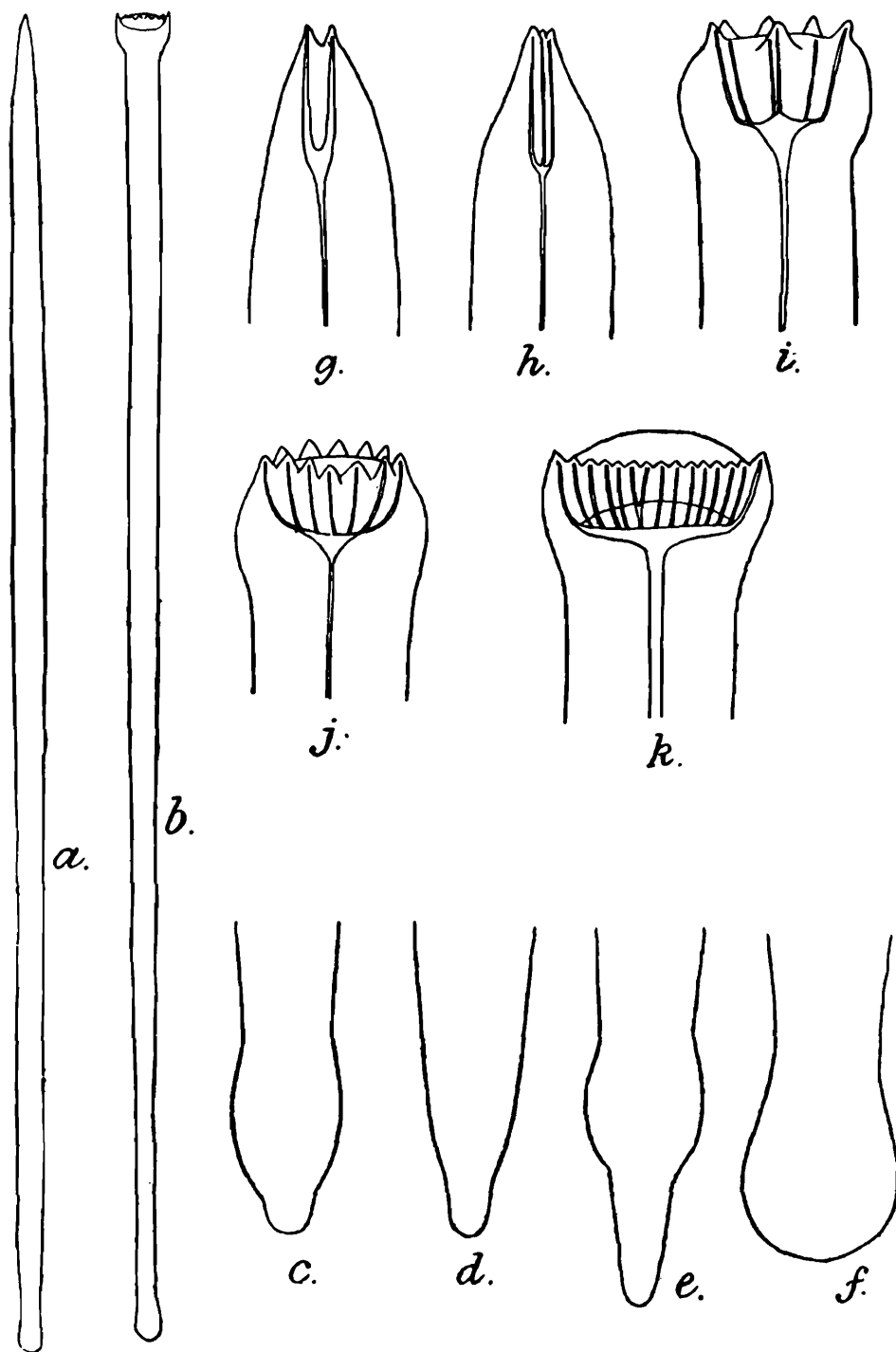
The two sponges described below were first mentioned by Dendy in relation to his study of the origin and growth of the sponge-spicules. Although he did not give a complete description of the sponge in question, he discussed certain points of the skeleton and the following description is written in correlation with that author's remarks.

The two sponges are very similar in all respects so that the description of the holotype will suffice. It is subspherical, about 1.5 cm. in greatest diameter. The colour in spirit is a pale yellowish-grey. In life it appears that the sponge was attached to some sort of coral-mass. The surface is even but minutely hispid. The oscules, of which there are two, are of a peculiar formation, in that each consists of an irregularly branching narrow slit. Directly beneath this is a cavernous subdermal cloacal cavity receiving the openings of the exhalant canals. The pores are inconspicuous and apparently distributed evenly over the general surface of the sponge.

The skeleton may be conveniently divided into main and dermal portions. The main skeleton is composed of monactinal megascleres forming a central irregular mass at the centre of the sponge, from which radial bands of spicules run more or less vertically to the surface, where they spread out into 'brushes' just beneath the ectosome. The spaces between the radial bundles are occupied by a confused mass of megascleres in a manner similar to that found at the centre of the sponge. The dermal layer is composed of stephanotyles with their bases embedded in the ectosome and their distal ends projecting more or less at right angles. In addition, anisochelae, sigmata and trichodragmata are present. These are confined chiefly, if not wholly, to the choanosome.

Spicules.—(1) *Tylostyles*, *subtylostyles*, *styles* and *strongyloxea*. I have included all these forms of spicule under one head because they are obviously derivatives of one spicule-form and may not be separated. They are all monactinal and the most numerous is the strongyloxeote. This is not exactly the same thing as the corresponding spicule of the genus *Donatia*, to which it bears a strong resemblance, but since it is an unusual form of spicule I can see no other way of expressing its form.

Apparently, it is a monactinal spicule which has become secondarily oxeote with bluntly pointed ends. The other three forms are derivatives



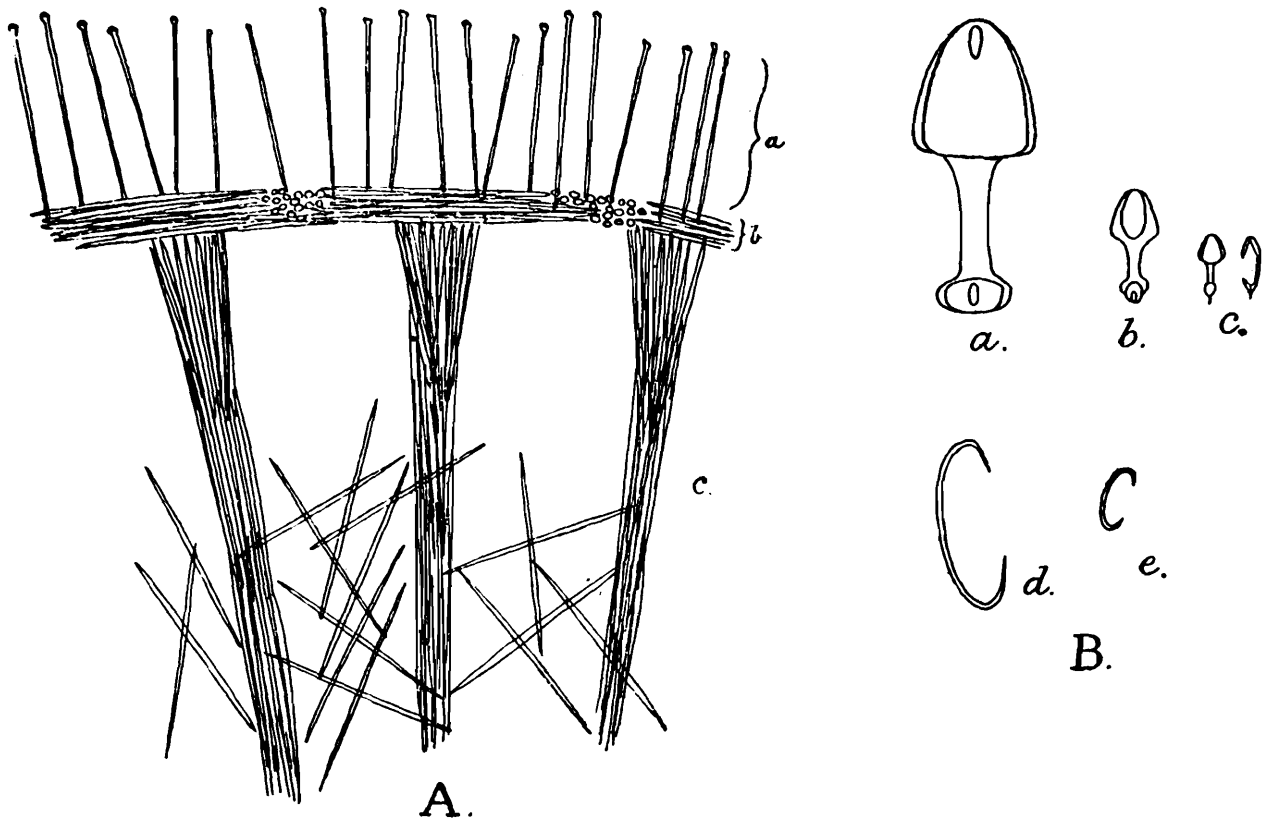
TEXT-FIG. 4.—*Sceptrospongia coronata* Dendy.

- a.* Style from the choanosome compared with—*b.* Stephanotyle. Both $\times 200$; *c, e.* Bases of subtylostyles of the choanosome, $\times 1000$; *d.* Base of stronglyloxeote of choanosome, $\times 1000$; *f.* Base of tylostyle of choanosome, $\times 1000$; *g—k.* Various heads of stephanotyles, $\times 1000$.

of this spicule in which the proximal end bears a small head variously developed (text-fig. 4 *a, c, d, e, f*). The average size of the spicules is $\cdot 36$ by $\cdot 013$ mm.

(2) *Stephanotyles* (text-fig. 4 *b, g, h, i, j, k*) of the dermal layer. These are of the same proportions as 1, and appear to have been derived from the same form of spicule, viz., the stronglyloxeote, as the spicules of the main skeleton. Dendy (*l. c.*) has already referred to the variable character of the stephanotyle and in my opinion a double evolution has taken

place in the skeleton of this one species of sponge. Since they are the most numerous, one naturally takes the stronglyloxeote as the more typical and, from its form, the most primitive spicule present. In the main skeleton a series of derivatives may be traced in which the enlarge-



TEXT-FIG. 5.—*Sceptrospongia coronata* Dendy.

- A. Diagrammatic representation of a radial section through the type: *a.* Layer of stephanotyles projecting at the surface; *b.* Ectosomal layer of tangentially disposed megascleres; *c.* Choanosome with radial bundles and interstitially scattered megascleres; B. Microscalers: *a, b, c.* Anisochelae of three kinds; *d, e.* Sigmata of two sizes. All $\times 350$.

ment of the proximal end into a 'head' is the principal factor in the change of form, while in the stephanotyle the distal end has become modified by the multiplication of the axial canals and the consequent enlargement of the end.

- (3) *Anisochelae* (text-fig. 5 B *a*), .075 mm. long.
- (4) *Anisochelae* (text-fig. 5 B *b*), .027 mm. long.
- (5) *Anisochelae* (text-fig. 5 B *c*), .015 mm. long.
- (6) *Sigmata* (text-fig. 5 B *d*), very numerous, often centrotylote, .045 mm. long by .0025 mm. thick.
- (7) *Sigmata* (text-fig. 5 B *e*), .018 mm. long.
- (8) *Trichodragmata*, numerous, in bundles measuring .045 by .009 mm.
- (9) *Trichodragmata*, in bundles measuring .015 by .009 mm.

This is altogether a remarkable species which will repay a studied comparison with the Mycaleae when that group is revised.

Registered Nos., localities, etc.—P. $\frac{308}{1}$ (XXVII, 5), "Investigator" Stn. 385, Arabian Sea, 16° 40' N., 71° 53' E., 630 faths.; P. $\frac{309}{1}$ (XLVI, 2), 8 miles W of Interview I., Andamans, 45-270 faths,

Damiriopsis, gen. nov.

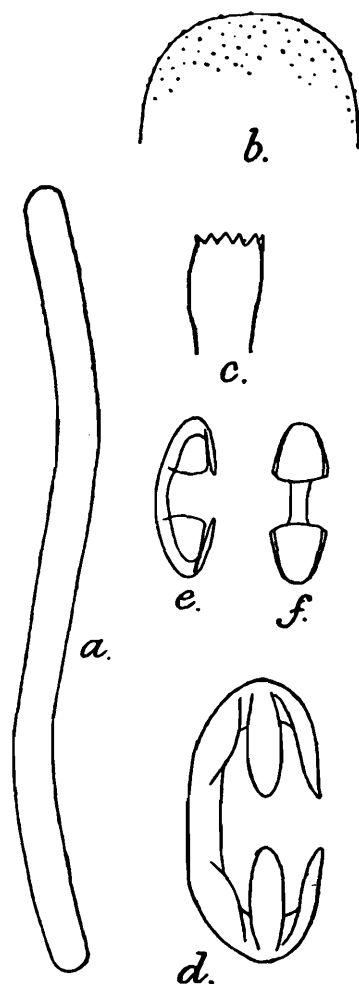
Diagnosis.—Plocamixee in which the main skeleton consists of an irregular reticulation of amphistrongyles with minutely-roughened heads arranged in a loose manner, not connected with spongin. Auxiliary spicules are present in the form of slender tornota with spined heads. Microscleres are tridentate and palmate isochelae. There is no special dermal skeleton.

The genus approximates very closely to several of the genera of the Plocameae. This section of the Ectyoninae includes the following genera:—*Plocamia* Schmidt, *Damiria* Keller, *Plocamiopsis* Topsent, *Lithoplocamia* Dendy, with *Dirrhopalum* Ridley and *Heteroclathria* Topsent as possible synonyms of *Plocamia* itself. Of these, the present genus is more nearly allied to *Damiria* from which it differs in the presence of tornota and chelae.

Damiriopsis brondstedti, sp. n.

(Pl. I, figs. 3, 4.)

The holotype is one of five specimens, all closely resembling each other, obtained in a single haul of the dredge. They are small irregularly



TEXT-FIG. 6.—*Damiriopsis brondstedti*, sp. n.

- a. Strongyle of main skeleton, $\times 100$; b. End of strongyle magnified to show minute spination, $\times 500$; c. End of tornote, $\times 1000$; d. Tridentate isochela, $\times 500$; e. f. Palmate isochela, $\times 500$.

massive sponges whose dimensions are roughly 2 by 1 cm. by .5 cm. high, the volume being about 1 cc. In external form they are singularly

like *Protoschmidtia cerebrum*. There is a delicate dermal membrane through which the spicules of the underlying skeleton project rendering the surface minutely hispid. Conspicuous sub-dermal cavities are visible through the dermal membrane. The oscules are about 1.5 mm. in diameter and lead into deep cloacal tubes running vertically downwards to the base of the sponge. The colour is a greyish-yellow.

The main skeleton consists of an irregular reticulation of loosely aggregated amphistrongyles lying singly or in bundles, of 3 to 6 spicules, in the choanosome. Here and there bundles of tornota are mixed with the main skeleton without apparent order, more particularly at the surface.

Spicules.—(1) *Amphistrongyles* (text-fig. 6 *a*, *b*), usually slightly curved, often irregularly angulated, smooth but for the extreme end of the spicule where they are minutely roughened, measuring .756 by .036 mm.

(2) *Tornota* (text-fig. 6*c*), straight, slender, smooth, beset at each end with a crown of small spines, measuring .264 by .006 mm.

(3) *Isochelae* (text-fig. 6*d*), large, tridentate, .054 mm. long.

(4) *Isochelae* (text-fig. 6 *e*, *f*), small, palmate, varying somewhat in size but measuring on an average about .034 mm. long.

Registered No., locality, etc.—P. $\frac{310}{1}$ (XLVII), Andamans, 130-290 faths.

***Anchinoe dubia*, sp. n.**

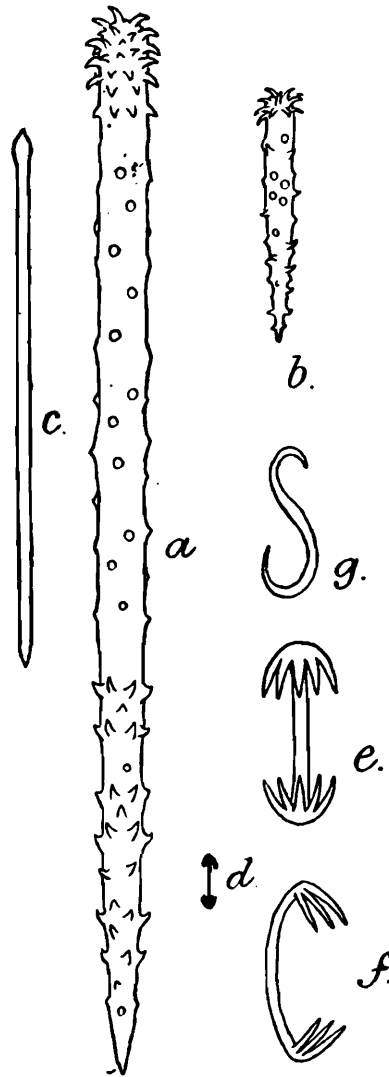
(Pl. I, fig. 5.)

The two specimens referred to this species are sufficiently alike for the description of the holotype, P. $\frac{12}{1}$ (XXX, 2), to suffice for them both. The sponge is clavate, about 11 cms. in height and nearly 3 cms. in diameter at its broadest point, which is near the apex. The tissues are thrown into a large number of minute folds so that the sponge is minutely clathrous. Neither oscules nor pores are discernible. The centre of the sponge is slightly more solid than the rest of the tissues, so that something akin to an axial core is present. The colour, in spirit, is a brownish-yellow.

The skeleton consists of stout plumose columns of acanthostyles and each column is composed of a bundle of acanthostyles lying parallel throughout the whole length of the columns; other, but similar, acanthostyles are set at right angles to the central core. The true echinating spicules are also acanthostyles, considerably smaller than the foregoing, and are found scattered sparsely along the whole length of the columns projecting at all angles. In addition, auxilliary spicules in the form of tornota are found in the dermal membrane, where they often occur in brushes at the apices of the plumose columns, or scattered in the tissues surrounding the main skeleton. The microscleres are small chelae and contorted sigmata. There is no special dermal skeleton. The tornota, which might at first sight suggest such a thing, cannot be regarded as anything more than auxiliary spicules, since they are equally abundant in the choanosome and ectosome.

Spicules.—*Acanthostyles* (text-fig. 7*a*), of the main skeleton. These vary much in size but measure on an average .28 mm. long and .02 mm.

at the thickest point, inclusive of the spines. The spicules are beset with spines along the whole length but more particularly at the base and the apex.



TEXT-FIG. 7.—*Anchinoë dubia*, sp. n.

a. Acanthostyle of main skeleton, $\times 350$; *b.* Echinating acanthostyle, $\times 350$; *c.* Tornota, $\times 350$; *d.* Isochela unguifera, $\times 350$; *e, f.* The same greatly enlarged, $\times 1500$; *g.* Sigmata, $\times 350$.

(2) *Acanthostyles* (text-fig. 7*b*), echinating the fibres of the main skeleton. These are .07 mm. long and .011 mm. thick at the base, inclusive of the spines. In appearance, they much resemble the larger acanthostyles but form a quite distinct category.

(3) *Tornota* (text-fig. 7*c*), smooth, straight spicules abundantly scattered throughout the skeleton. The ends of these spicules are seen to vary enormously when examined with a $\frac{1}{2}$ " immersion. They may be oval and slightly elongated, hastate, mucronate or more or less globular. Length of spicule, .14 mm., thickness not exceeding .004 mm. along the major part of the shaft.

(4) *Isochelae unguiferae* (text-fig. 7 *d, e, f*), with 5 small teeth at each end of the slightly-curved shaft. Total length, .011 mm.

(5) *Sigmata* (text-fig. 7*g*), contort, numerous. Length from bend to bend, .042 mm.

The species is by no means a typical *Anchinoë* but for the moment I can see no other genus in which it might conveniently be placed. The

absence of smooth spicules in the centres of the plumose columns of the main skeleton, together with the unusual character of the chela, make it very doubtful whether the species can be included in the genus at all. In view, however, of the numerous controversial points which a discussion of the affinities of the present species would raise I prefer to leave the matter until a more opportune moment.

Registered Nos., localities, etc.—P. $\frac{311}{1}$ (XXIX), "Investigator" Stn. 464, S. of Ceylon, 6° 2' 30" N., 81° 29' E., 52-68 faths.; P. $\frac{312}{1}$ (XXX, 2), "Investigator" Stn. 464, S. of Ceylon, 6° 2' 30" N., 81° 29' E., 52-68 faths.

***Leucophloeus fenestratus* Ridley.**

(For synonymy *vide* Dendy, 1921B, p. 124.)

A single white crust on a shell is the sole representative of this species in the collection.

Previously known distribution.—Australia, Indo-Pacific and Indian Ocean.

Registered No., locality, etc.—P. $\frac{313}{1}$ (XXXV, 1 b), Malay Archipelago, Bally Strait, 160 faths.

***Phakellia cactoides*, sp. n.**

(Pl. I, figs. 6, 7, 8.)

The species is interesting since it demonstrates the difficulty of distinguishing between the genera *Axinella*, *Phakellia* and *Auletta*, as we at present understand them. The holotype is sessile and lobose (Pl. I, fig. 6), the body of the sponge being made up of a number of flattened, fleshy lobes which spring from each other in an altogether irregular manner very much in the fashion of a cactus plant. The extremely hispid nature of the surface, due to the projection of the large spicules, only serves to strengthen the similarity to that xerophytic plant. The second specimen, however, is roughly lamellar, consisting of a few thin lamellae springing from the base but remaining closely apposed throughout their length (fig. 7). The third, like the second, consists of lamellae disposed at all angles to each other which frequently coalesce at the edges giving the appearance of a set of tubes. In reality they are no more than longitudinal channels, running vertically through the length of the specimen, formed by the folding of the lamellae and the fusion of their margins. They are in no sense oscula or cloacal tubes. Nevertheless, it suggests a way in which tubular individuals may arise and furnishes one more piece of evidence of the inadequacy of the genus *Auletta*, unless it can be proved that that genus is founded on something more than mere external form. In external form the first two specimens resemble very strongly *Phakellia fusca* Thiele, and *Axinella mariana* R. and D. from which, however, they are separated by the absence of strongyles. The third specimen is very like *Auletta consimilis* Thiele from which it is separated by the size of the spicules. There is, moreover, a strong likeness between the present species and Thiele's *Auletta ? celebensis*. Colour, in spirit, pale-yellow.

The skeleton consists entirely of large styli, measuring 1.2 by .032 mm., forming a confused layer at the centre of the lamellae from which other styli radiate outwards in all directions. There is no axial condensation of spicules as in the more typical Axinellid skeleton.

Registered No., locality, etc.—P. $\frac{314}{1}$ (VIII), "Investigator" Stn. 141, Bay of Bengal, 14° 11' 6" N., 80° 24' E., 88 faths.

Auletta elongata Dendy (1905, 1921B).

(Pl. I, fig. 9.)

The specimen consists of a single tube about 9 cms. in length from which two short lateral tubes arise, one on either side, about halfway up. The diameter of these tubes is 8 mm. except at the base of the main tube where a certain narrowing takes place. The skeleton is the same as that described by Dendy for the Ceylon specimens but the only spicules present are styli, measuring, on an average, .9 by .015 mm. The colour, in spirit, is a yellowish white. I have compared this specimen with the others described by Dendy and am confident of the accuracy of my determination despite the absence of oxea and strongles.

Previously known distribution.—Ceylon, Indian Ocean.

Registered No., locality, etc.—P. $\frac{315}{1}$ (XXX, 1), "Investigator" Stn. 464, S. of Ceylon, 6° 2' 30" N., 81° 29' E., 52-68 faths.

Auletta lyrata (Esper) var. **brevispiculata** Dendy (1905, 1921B).

(Pl. I, fig. 10.)

The single specimen consists of four tubes springing from a common base and rising to a height of about 7 cms. These tubes branch dichotomously, many of the secondary tubes anastomosing, and have a uniform diameter of 3 mm. The walls of the tubes are .5 mm. thick. The spicules are of the usual size and shape for this variety but are crowded into a dense *Petrosia*-like, reticular network.

Previously known distribution.—Ceylon, Indian Ocean (Dendy).

Registered No., locality, etc.—P. $\frac{316}{1}$ (XXXI, 2), "Investigator" Stn. 352, Mergui Archipelago, 12° 15' 20" N., 97° 10' 10" E., 62 faths.

Bubaris Grey (1867E).

Genotype :—*Hymeraphia vermiculata* Bowerbank.

We do not know precisely what were the ideas of authors previous to Dendy as to the systematic position of this genus but that author placed it among the Clathrireae, of which group he regarded it as a reduced form. He says (1921B, p. 62), "The subsymmetrical megascleres found in the interior of the sponge must be regarded as derived from the normal styli and the genus seems to be a derivative of *Microciona* and *Aulospongia*." Topsent, on the other hand, has consistently placed the genus in the Axinellidae. For my part, I can see no alternative to accepting Topsent's view. The normal species of the genus have most things in common with the genus *Phakellia*. The two species,

B. conulifera and *B. salomonensis*, by the addition of trichites, make a close approach to *Tragosia*. The presence of angulated oxea in so many species recalls strongly the spiculation of the more typical species of the genus *Axinella*, while the ease with which oxea, styli and strongyla may replace each other in the spiculation is decidedly characteristic of the Axinellidae as a whole and of no other group of sponges.

The presence of trichites in two species of the genus revives the old controversy of the taxonomic value of these spicules. It so frequently happens that the same author at one time regards these spicules as sufficient basis for a generic distinction and at others as of specific importance only, that one is left in doubt as to what line of action should be followed. On the whole, I incline to the view that they are not, *per se*, of generic importance. In the absence of any precise knowledge of their origin, function or significance our opinion must be based on circumstantial evidence. In the genus *Mycale*, for example, the idea of using them as a basis for the further sub-division of the genus would be ludicrous. On the other hand, the genera *Phakellia* and *Tragosia* are separated on this feature alone. In the present genus, *B. conulifera* Dendy is so like *B. columnata* mihi in all other respects save the presence of trichites (*i.e.*, trichodragmata) that they could not be logically placed in separate genera.

REVISION OF THE SPECIES OF *BUBARIS*.

Of the species of *Bubaris* hitherto known to us, five must undoubtedly be removed to other genera. They are :—

1. *Bubaris constellata*, Topsent, 1893F.

Hallmann (1917) has already made this species the genotype of a new genus *Paratimea*.

2. *B. verticillata*, Topsent, 1891 (*non* Bowerbank) is closely allied to certain species of *Grayella* and is accordingly removed, at least provisionally to that genus.

3. *B. gallica*, Topsent (1893F), is a new name for 2.

4. *B. reptans*, Kirkpatrick (1903B) is certainly no *Bubaris* but its affinities are not clear at the moment. I propose a new genus of which this species shall be the genotype, *Gilchristia*, after the late Dr. J. B. F. Gilchrist whose name will always be associated with the pioneer work in connection with the collecting of South African sponges. The genus must be placed provisionally, *incertae sedis*, among the Suberitidae.

5. *B. ornata*, Dendy (1924A) belongs to the genus *Plocamra* rather than to *Bubaris*.

LIST OF VALID SPECIES OF *BUBARIS*.

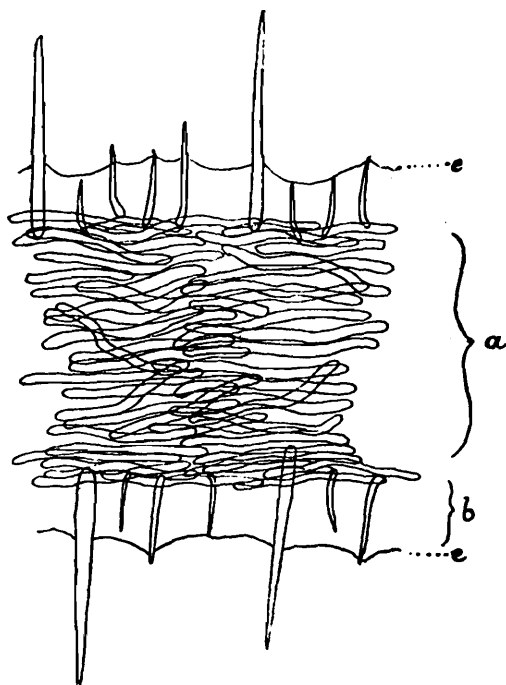
1. *B. vermiculata* (Bowerbank).
2. *B. sosia*, Topsent, 1904A.
3. *B. mastophora* (Schmidt) Topsent, 1904A
4. *B. murrayi*, Topsent, 1913B.
5. *B. aurantiaca* (Lendenfeld) Hallmann, 1914C.
6. *B. radiata*, Dendy, 1916A.
7. *B. salomonensis*, Dendy, 1921B.

8. *B. conulifera*, Dendy, 1921B.
9. *B. oxeata*, Dendy, 1924A.
10. *B. elegans*, Dendy, 1924A.
11. *B. ligulata*, sp. n.
12. *B. durissima*, sp. n.
13. *B. columnata*, sp. n.

***Bubaris columnata*, sp. n.**

(Pl. II, fig. 1.)

This sponge is typically lamellar and sessile. The largest specimen present, taken as the holotype, consists of a single lamella folded on itself in such a way as to give rise to an incompletely-formed cup 4 cms. high. The lamellae themselves are composed of a number of stout columns of vermicular strongyles which rise vertically from the base and end in the upper margin of the sponge. On the way they branch and anastomose to a large extent. The interstices between the network thus formed are filled with loose tissues containing a few sparsely-scattered styli. The surface is strongly hispid and harsh to the touch. Neither pores nor oscules are visible. The colour, in spirit, is a greyish-yellow.



TEXT-FIG. 8.—*Bubaris columnata*, sp. n.

Section through the lamella (semi-diagrammatic). *a*. Axial core of vermiform strongyles ; *b*. Region occupied by extra-axial skeleton ; *e*. Ectosome.

The skeleton (text-fig. 8) consists of two portions, an axial portion formed by the ascending columns of strongyles already noted and a radial, or extra-axial, formed of a single layer of styli coating the axial portion, with their bases loosely embedded in the outer layers of the axial skeleton and their apices projecting slightly beyond the ectosome.

Spicules.—(1) *Strongyles*, vermicular, smooth, varying in length from .5 to .72 mm. and in thickness from .016 to .024 mm.

(2) *Styli* smooth, sometimes straight but usually with an abrupt curve or 'crook' at the base, measuring .228 to .48 mm. by .012 to .024 mm.

(3) *Styli* long, smooth, straight or at most only gently curved, usually .96 mm. long or thereabouts and varying in thickness from .022 to .04 mm. These styli form a category distinct from the preceding and are responsible for the marked hispidation of the surface.

Probably the only real difference between this species and *B. radiata* Dendy is in the size of the spicules.

Registered Nos., locality, etc.—P. $\frac{317}{1}$ (XLIV, i, ii), Andaman Sea, Lat. 13° 17' N., Long. 93° 7' E., 90 faths.

***Bubaris durissimma*, sp. n.**

(Pl. II, fig. 2.)

The single representative is an erect, branching sponge, 7.5 cms. high, consisting of a main stem 1 cm. in diameter which bifurcates at the apex and bears two small lateral branches, one of which is also dichotomously branched. The surface is slightly uneven and minutely hispid, and is marked with an irregularly reticulate pattern, which is produced by the stout columns of spicules which run from the central axial skeleton to the surface at right angles to the long axis of the branches. Both the ends of the spicule-columns and the aspiculous spaces between them are covered by a very fine ectosomal tissue. The texture is hard. The colour, in spirit, a pale yellow. Neither oscules nor pores are visible.

The skeleton consists, as usual, of an axial and a radial portion. The axial skeleton consists of a closely-felted mass of angulated oxea with a small admixture of vermicular strongyles occupying the major portion of the sponge. In a typical transverse section of a branch, the axial skeleton is 8 mm. in diameter and the layer of flesh containing the columns of spicules supporting the outer tissues is no more than 1 mm. thick, so that the axial skeleton comprises a little more than $\frac{3}{5}$ ths of the total volume of the sponge. The extra-axial skeleton consists of short plumose columns of styli with a slight admixture of angulated oxea.

Spicules.—(1) *Oxea*, smooth, usually sharply-angulated at the centre but sometimes straight or even, rarely vermicular, composing the axial skeleton and found also in small quantities extra-axially, .24 to .372 mm. long and .011 to .016 mm. thick.

(2) *Strongyles*, smooth, vermicular, occasionally occurring in the axial skeleton, .6 by .013 mm.

(3) *Styli*, smooth, straight, gently curved but more often straight with a decided, abrupt curve at the base, .18 to .48 mm. long by .012 to .016 mm. thick.

The present species has much in common with *B. conulifera* Dendy but is separated from that species by the absence of trichodragmata.

Registered No., locality, etc.—P. $\frac{318}{1}$ (XXXI, i), "Investigator" Stn. 532, Mergui Archipelago, 12° 15' 20" N., 97° 10' 10" E., 62 faths.

Bubaris ligulata, sp. n.

(Pl. II, fig. 3.)

The two representatives of this species, closely similar to each other in all respects, are erect, leaf-like sponges. The holotype, P. $\frac{319}{1}$ (XXXI, 3, i), consists of a round, pad-like basal attachment from which springs a stout stalk which in turn passes insensibly into a thin, flattened, frond-like portion constituting the body of the sponge. The total height is 14 cms. of which 5 cms. is stalk. The diameter of the latter is, on an average, no more than 4 mm. The upper portion or body does not exceed 1.5 cms. in width or 2 mm. in thickness. The surface is even but very minutely hispid. The colour, in spirit, is a pale yellow. Neither pores nor oscules are visible.

The skeleton consists of two portions, axial and radial. The first is very dense and tightly-packed, but without visible spongin, and in the stalk it takes the form of a dense cylindrical agglomeration of vermicular strongyles. This gradually flattens out and becomes less dense as the tip of the frond is reached. The strongyles in this portion of the skeleton are disposed some in a plane parallel to the long axis of the sponge, others at right angles to them, like the threads in a piece of cloth. The radial skeleton consists of a single layer of radially-arranged styli with their bases loosely embedded in the outer layers of the axial skeleton and their apices projecting slightly beyond the ectosomal tissues.

Spicules.—(1) *Strongyles* of the axial skeleton, smooth, obtusely rounded at each end, the whole spicule gently angulated at the centre so that it resembles a boomerang in shape. The size varies immensely, the length from .085 to .35 mm. and the thickness, at the middle of the spicule, from .0085 to .017 mm.

(2) *Styli* of the radial skeleton, smooth, with the proximal end gently and obtusely rounded and the distal end sharply pointed, usually gently curved towards the inner end of the spicule. The length varies from .24 to .372 mm., the thickness, .012 mm., is fairly constant.

Registered No., locality, etc.—P. $\frac{319}{1}$ (XXXI, 3, i, ii), "Investigator" Stn. 532, Mergui Archipelago, 12° 15' 20" N., 97° 10' 10" E., 62 faths.

Suberites perfectus Ridley and Dendy (1886, 1887).

The single specimen consists of a laterally compressed, clavate lobe about 6 cms. high and about 2 cms. across at the widest point. The characteristic dermal reticulation is not so strongly marked as in the holotype, probably because the present specimen is less mature. The oscules are situated on the summit of thin-walled elevations, as in the holotype, but are fewer in number, four only being present. The arrangement of the skeleton and the size and shape of the spicules are quite typical for the species.

Previously known distribution.—Port Jackson, Australia (Ridley and Dendy); New Zealand (Brondsted).

Registered No., locality, etc.—P. $\frac{320}{1}$ (XXXV), Malay Archipelago, Bally Strait, 160 faths.

***Pseudosuberites cava* Sollas (1902).**

(Pl. II, fig. 4.)

The single specimen is encrusting a fragment of shell. It is about 6 cms. by 5 cms. in extent and less than 1 cm. thick at the thickest point. The internal portions are very cavernous and the characteristic feature of the species is that "the sponge consists of two lamellae, one attached to the substratum, the other being the dermal membrane, while columns containing bundles of spicules stretch vertically between them." The surface is very minutely hispid. The colour, in spirit, is yellow. The styli measure, on an average, .5 mm. by .012 mm.

Previously known distribution.—Malay Peninsula.

Registered No., locality, etc.—P. $\frac{321}{1}$ (XXXV, 2), Malay Archipelago, Bally Strait, 160 faths.

***Cryptospongia*, gen. nov.**

Euceratosa in which the individual consists of a long slender stalk surmounted by a flattened, discoid head; the fibres of the stalk are stout, with little pith and are differentiated into two layers, an outer and an inner; those of the head are strongly pithed and form an irregularly anastomosing network.

***Cryptospongia enigmatica*, sp. n.**

(Pl. II, fig. 5.)

There are a dozen specimens of whose relationships it is difficult to speak with any certainty. A typical example consists of a slender stalk bearing a flattened manubrial or agariciform head, semicircular in outline. The longest stalk found was 11 cms. in length and the same diameter, 1.5 mm., throughout. The texture is tough and cork-like. The surface is usually beset with numerous very slight protuberances which make it harsh to the touch. The head is often 3 cms. in diameter, and 2 mm. thick at the centre. There is no trace of a basal attachment or rooting process on any of the specimens. The form is suggestive of the Hexactinellid genus *Caulophacus*.

In longitudinal section, the stalk consists of an outer cortical layer composed of fibres more densely aggregated and of a darker brown colour than those of the inner, medullary, region. The medullary region is made up of longitudinal fibres, about .020 mm. in diameter, connected at rare intervals by secondary transverse fibres. There is apparently little pith or core in the fibres of the stalk.

The fibres of the head are much more delicate and pliable than those of the stalk. The head is in the form of a continuous network of branching fibres which anastomose in an irregular manner. The fibres themselves are .060 mm. in diameter, of which $\frac{9}{10}$ ths is occupied by the pith.

No soft tissues are discernible.

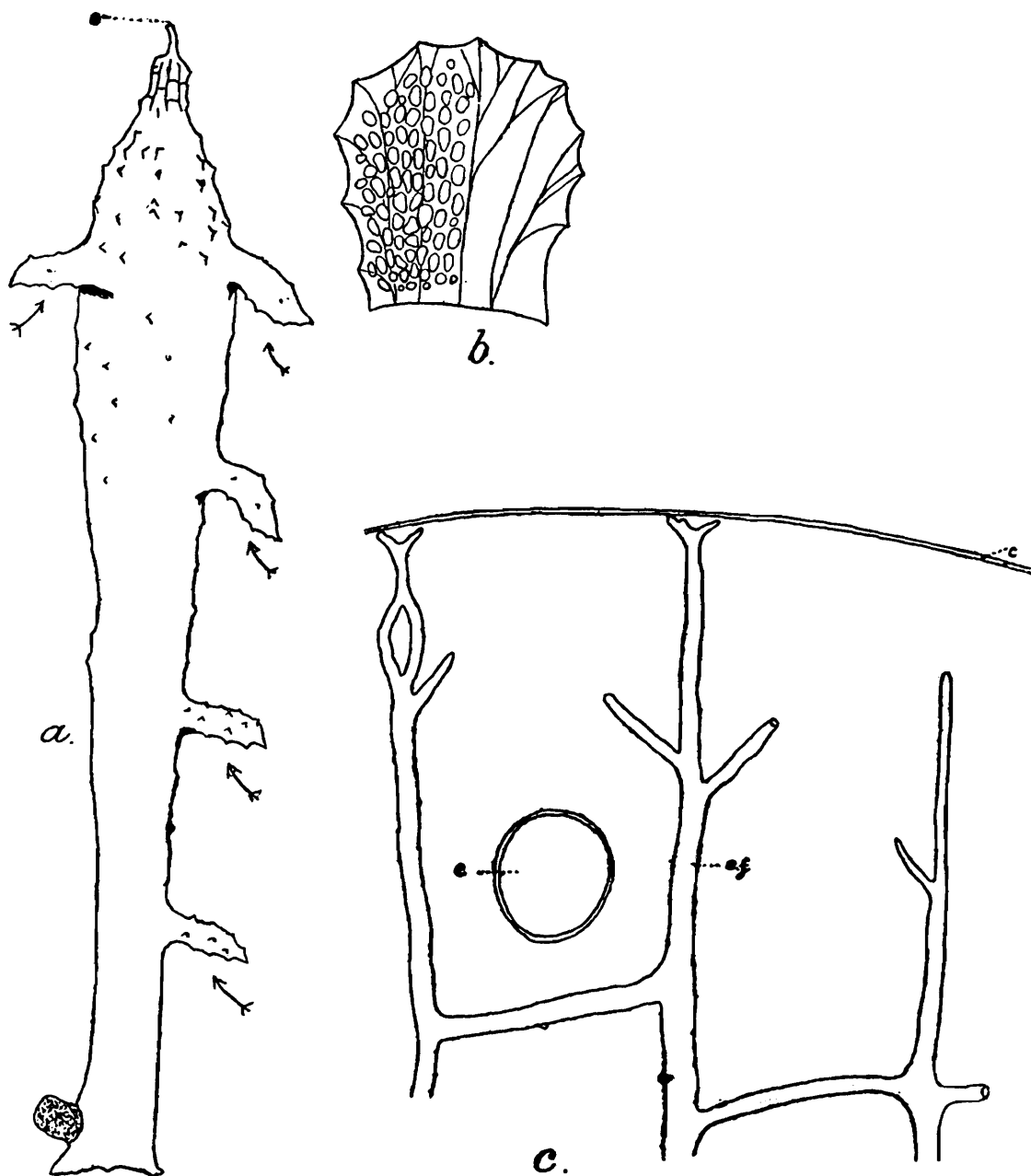
At first sight there is considerable resemblance between these forms and certain Algae but the non-septate, anastomosing nature of the fibres and the depths at which the specimens were obtained disposes of the suspicion that they may be lowly plants.

These organisms are in every way most unusual sponges and I am by no means convinced that they may not ultimately prove to belong to some other group of organisms. The macerated state in which they were found, however, forbids further speculation and I have been compelled to regard them as sponges, for the moment, at all events.

Registered No., locality, etc.—P. $\frac{322}{1}$ (XLI), "Investigator" Stn. 4, off Ten Degree Channel, S. of Andaman Is., 1045 faths.

Stenospongia, gen. nov.

Spongiidae of symmetrical form with conulated surface and special pore-areas; skeleton consists of non-pithed fibres forming a reticulation in which the primary fibres, running vertically to the surface and barely distinguishable from the secondary fibres, are connected at intervals by the transverse secondary fibres; flagellated chambers small, possibly diplodal.



TEXT-FIG. 9.—*Stenospongia aligera*, sp. n.

- a.* The whole sponge with terminal osculum (o) and the direction of currents entering the sponge marked by arrows; *b.* The undersurface of one of the lateral pore-bearing processes showing the 'veins' of spongin fibre supporting it and the pores (marked on the left hand side only); *c.* Section at right angles to the surface showing the cuticle (c), a portion of the skeleton and an embryo (e).

***Stenospongia aligera*, sp. n.**

(Pl. II, fig. 6.)

In external form the sponge is clavately cylindrical, about 8 cms. high and 1 cm. in diameter at the thickest point, near the apex, tapering to about .5 cm. in diameter at the base. There is a single terminal oscule at the apex and the pores are restricted to the undersurfaces of a number of lateral wing-like processes. The whole surface is slightly conulose and covered with a tough cuticle. The dark surface markings seen in Pl. II, fig. 6, are the hydrorhizae of epizoid hydroids. The colour, in spirit, is a pale brown. Attachment to the substratum was by means of a small basal plate.

The skeleton consists of an irregular net-work of pithed fibres, in which primary and secondary fibres may be distinguished, but there is no special dermal skeleton. Both primary and secondary fibres are about .08 mm. in diameter.

Numerous spherical embryos, about .8 mm. in diameter, are present in the choanosome.

The most remarkable feature of the species is the restriction of the pores to pore-areas on the lateral processes (text-fig. 9b). Here, as is so frequently the case in sponges, pore-specialisation is correlated with the development of a chitinous cuticle covering the ectosome.

Registered No., locality, etc.—P. $\frac{323}{1}$ (XXXII, 5), "Investigator" Stn. 535, Mergui Archipelago, 13° 4' 30" N., 96° 44' E., 65 faths.

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EXPLANATION OF PLATE I.

FIG. 1.—*Gellius megastoma*, sp. n., holotype, natural size.

FIG. 2.—*Protoschmidtia cerebrum*, sp. n., holotype, natural size.

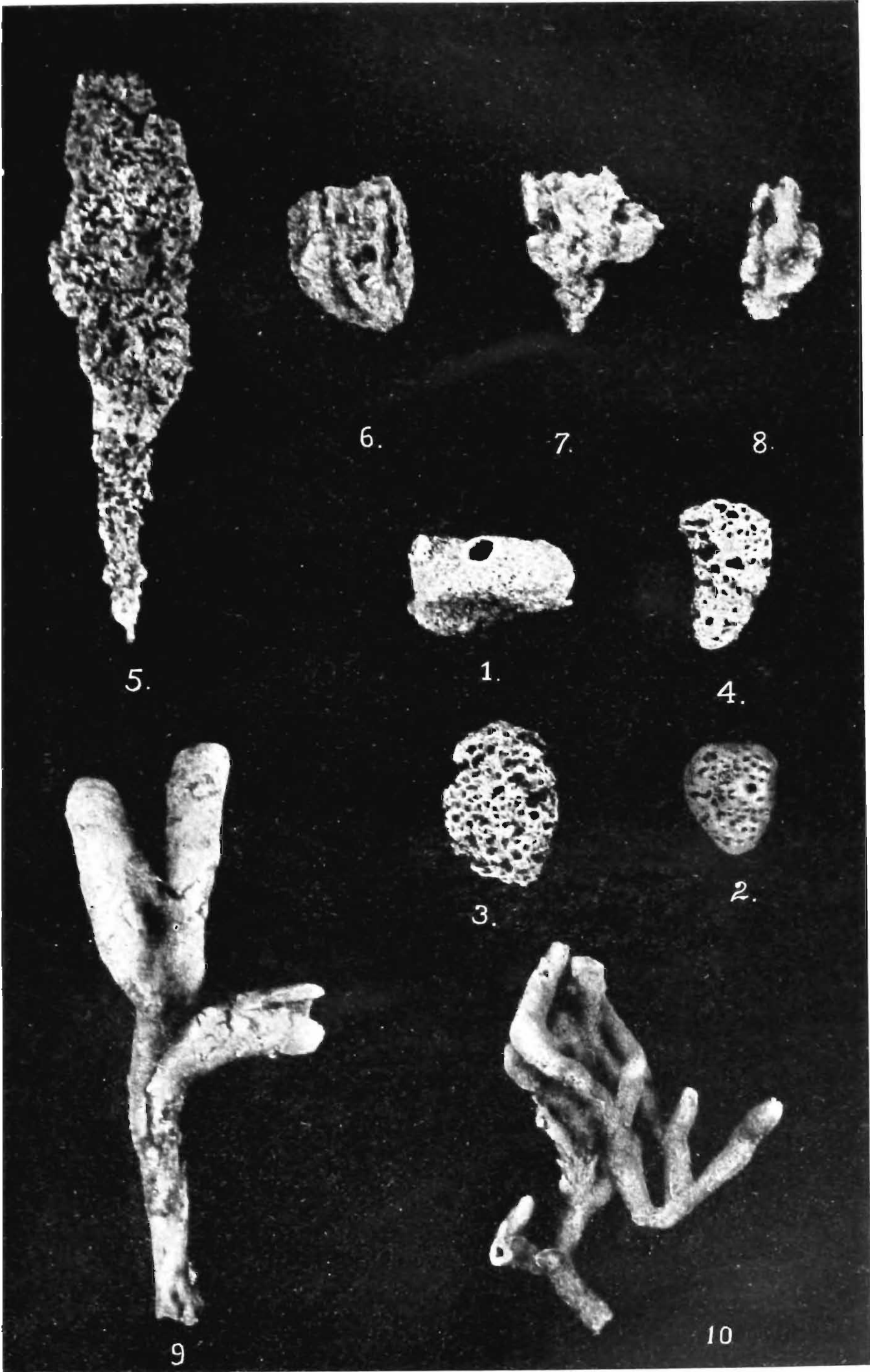
FIGS. 3, 4.—*Damiriopsis brondstedti*, sp. n., fig. 4 = holotype, natural size.

FIG. 5.—*Anchinoë dubia*, sp. n., holotype, $\times \frac{1}{2}$.

FIGS. 6, 7, 8.—*Phakellia cactoides*, sp. n., fig. 6 = holotype, natural size.

FIG. 9.—*Auletta elongata* Dendy, natural size.

FIG. 10.—*Auletta lyrata* var. *brevispiculata* Dendy, $\times 2$.



Deep-Sea Sponges.

EXPLANATION OF PLATE II.

- FIG. 1.—*Bubaris columnata*, sp. n., holotype, about natural size.
FIG. 2.—*Bubaris durissimma*, sp. n., holotype, about natural size.
FIG. 3.—*Bubaris ligulata*, sp. n., holotype, $\times \frac{2}{3}$.
FIG. 4.—*Pseudosuberites cava* Sollas, natural size.
FIG. 5.—*Cryptospongia enigmatica*, sp. n., holotype, natural size.
FIG. 6.—*Stenospongia aligera*, sp. n., holotype, natural size.



Deep-Sea Sponges.

FURTHER OBSERVATIONS ON THE ORAL APPARATUS OF THE TADPOLES OF THE GENUS *MEGALOPHRYS*.

By SUNDER LAL HORA, D.Sc., F.L.S., F.Z.S., Zoological Survey of
India, Calcutta.

(Plate III.)

The tadpoles of *Megalophrys* with the 'funnel' mouth have received considerable attention in recent years, but the precise functions of the peculiar structure surrounding the mouth are still a matter of dispute among naturalists. In November, 1926 I made extensive observations on the tadpoles of *M. parva* Boulenger in a small stream below Dumpep, Khasi Hills, Assam. I was about to send the result of my observations to press when I noticed an article by Dr. M. A. Smith entitled, "The function of the 'Funnel' Mouth of the Tadpoles of *Megalophrys*, with a Note on *M. aceras* Boulenger." ¹ As the views expressed in this publication differed materially from those in my account I decided to go through the whole literature once again and to reconsider the observations made by several authors.

My previous observations ² on the oral apparatus of the tadpoles of *M. parva* were mainly based on the material examined in captivity during my short visits to Dumpep. The view that I then advanced regarding the function of the funnel, namely that it acts as an anchoring device, was suggested to me by the form of the funnel when the tadpole lay at the bottom and by the fact that all the specimens were then obtained by vigorously shaking water weeds with a small bag-net. During my recent visit to the same place the tadpoles were again found in great abundance among the water plants, *Eriocaulon miserum* Kaern., that grew in the course of a shallow and rapid-running current (see photograph, Plate III). The plants form a very thick growth and the tadpoles lay among the roots and the bases of stems securely sheltered from the current. Moreover, the current bends the plants in the direction of the flow and under these circumstances the tadpoles lay doubly secure in their peculiar habitat. On closer examination they were found lying in all positions among these thickets. This time a thorough search was made in other parts of the stream with the result that the tadpoles were found in sheltered positions throughout its course. A few tadpoles were collected from under stones or in crevices in relatively deep water, but they were very common in similar situations in shallow water at the sides of the stream. A few were actually picked up from under moist stones in damp places a short distance away from the current. In short the tadpoles were only found in situations where they had not to contend against the

¹ Smith, *Proc. Zool. Soc. London*, pp. 983-988, figs. 2 (1926).

² Hora, *Journ. As. Soc. Bengal* (n. s.) XVIII, pp. 9-15, figs. 2 (1922); *Rec. Ind. Mus.* XXV, pp. 584, 585 (1923).

rapidity of the flow, and when some of them were made to drift in a rapid current flowing over a smooth rock it was observed that they were carried helplessly along by the current and were unable to maintain themselves in any definite position. By the impact of the current they were turned round and round on their longitudinal axes till they got into deeper water, where for sometime they lay motionless and apparently stupified. Soon afterwards, however, they regained activity and sought shelter under stones or in crevices. If, however, they happened to drift into a pool with smooth rocks on all sides the tadpoles came to the surface and applied their heads constantly against the rock as if seeking shelter. Once they were successful in finding a suitable place they lay for an indefinite period in any position, chiefly horizontal, with the 'funnel' folded. The positions of certain tadpoles were carefully noted on a rock in a sheltered pool and during the two or three days they were under observation there was no evidence of any movement from their respective positions. In deep pools the tadpoles sometimes lay in the open at the bottom. It may be noted that in the course of the torrential stream the *tadpoles were not seen hanging from the surface film and feeding at the surface*. Indeed this would be in my view impossible.

In pools and puddles these tadpoles have been observed by Annandale¹, Smith² and Griffin³ to spend most of their time hanging from the surface film and feeding in this position, and it was probably this attitude of the animal that suggested to the earlier authors the function of the funnel as a float. Pools which occur in the course of hill streams are subject to sudden floods and in these the conditions described above for the stream below Dumpep prevail at least for a part of the year. If observations were to be made in such places during floods, there is every likelihood that they will correspond to those described by me.

It is now generally admitted that the chief function of the 'funnel' is to enable the animal to collect its food. Both Weber and Annandale (*op. cit.*) had an idea that the 'funnel' helps the animal in feeding at the surface. Describing the function of the funnel Annandale says: "It is possible also that it assists in the capture of the minute plants and animals on which the species feeds, though I can give no direct evidence for this function. If a tadpole is watched when it is hanging from the surface film, it will be remarked that the float is constantly expanding and contracting, owing to the respiratory movements of the mouth, and that, although the movements are too gentle to overcome the friction produced by the body and tail, which hang more or less vertically downwards in the water, and so to cause the animal to progress in one direction or another, they produced distinct currents on the surface, which bring towards the mouth any minute particles which may chance to be floating in its vicinity." Smith and Griffin seem independently to have reached the same conclusions based on a similar set of observations. To the former, however, we are indebted

¹ Annandale, *Fasciculi Malayenses, Zoology*, pp. 131, 132; 275-280, 1 fig. (1903).

² Smith, *Journ. Nat. Hist. Soc. Siam* II, pp. 37, 38; 269, 270 (1916-17).

³ Griffin, *Ann. Carnegie Mus.* XVII, pp. 399-401, fig. 1 (1927).

for the experimental demonstration of the method of feeding of these animals in quiet waters at the surface. I have, however, never observed the animal feeding at the surface under natural conditions, but a study of the plankton-gathering devices¹ of certain animals living in ecological association with these tadpoles and feeding on a similar type of food suggested to me that the oral apparatus was a feeding mechanism. In swift streams there is always a quantity of plankton food, which is gathered from the rapid current in different ways. This is accomplished in a *Simulium* larva by means of a pair of fans placed besides its mouth, in certain caddis-worms which live in tubes by means of nets of silk that strain organisms out of water, and in certain may-fly and caddis-fly larvæ, which stick firmly to current-swept boulders, by spreading out their bristle-fringed feet widely "to gather in any organism that may be adrift in the passing water" (Needham & Lloyd, p. 364). The oral apparatus of the *Megalophrys* tadpole is not only capable of gathering plankton, while the animal quietly lies at the bottom, but is capable of performing the same function while the tadpole is suspended from the surface film or is floating in mid-water. It may, however, be remarked that the tadpole of *Megalophrys* is not a passive creature like the other plankton-gathering animals referred to above, for it sets up a strong current² which is both respiratory and assimilatory. When open at the surface the oral apparatus with its "teeth" breaking the surface film would serve to prevent large particles from entering the mouth while at the same time permitting the entry of small particles. The 'funnel' in its folded condition under water serves the same function and possibly serves to prevent the escape of small particles in flowing water. Devices for this last purpose are common among several aquatic insects.³ In the bubbling waters of the shallow and swift-flowing streams I believe the plankton food is uniformly distributed throughout the different levels of the current. The *Megalophrys* tadpoles harbouring in sheltered places under such circumstances are thus enabled to suck in the necessary amount of food from the passing current. In a pool, pond or lake on the other hand "Plancton organisms tend to be uniformly distributed in a horizontal direction" (Needham & Lloyd, p. 306), and it is known that, "A number of filamentous blue-green algae, such as *Anabaena* and a few flagellates, accumulate on the surface during periods of calm, hot weather (Needham & Lloyd, p. 296). In the behavior of the *Megalophrys* tadpole at different times of the year we meet with a very close correlation between its position in water and the presence of food at a particular level. In a swift current, though the food is equally plentiful at the surface, the tadpole is unable to make use of it on account of the physical conditions described above.

The next point that deserves consideration is the form of the 'funnel' at the surface and below it. Here I would like to draw attention to the beautiful tail-coronet of a *Stratiomys* larva (Miall, p. 190) which

¹ Needham & Lloyd, *Life in Inland Waters*, p. 364 (New York: 1916).

² Boschma, *Bijdr. Dierkunde Amsterdam* (Max Weber Feest-nummer) XXII, pp. 9-12. 1 fig. (1922).

³ Miall, *Aquatic Insects*, p. 385 (London: 1903).

behaves, in its relation to the surface film, in the same way as does the 'funnel' of the *Megalophrys* tadpole. Both expand at the surface only and remain folded up under water; in both advantage is taken of the surface film to save the muscular energy which would otherwise have to be expended in swimming to counteract the tendency to sink. In the case of the *Megalophrys* tadpole the unfolding of the 'funnel' is due to a muscular action on the part of the animal, the contraction of the muscles "will cause the basal part of the funnel to become rigid and therefore to unfold itself, while the free extremity is probably flaccid under all conditions, being forced to straighten itself by external pressure as the tadpole rises to the surface" (Annandale, p. 278). In the *Stratiomys* larva probably something of the same nature happens when the tail-coronet is unfolded at the surface.¹

It is obvious, therefore, that a certain amount of muscular energy is expended in the act of unfolding the 'funnel' and in its continuous expansion. In normal times, I believe, the animal spends most of its time under water and is thus saved from spending this energy. Moreover, if the 'funnel' were to be expanded under water much more muscular energy would be required, for at the surface the physical properties of the surface film would materially help in the unfolding of the funnel and in its continued suspension. We have seen that there is a flaccid portion all round the margin of the 'funnel' that is not supplied with muscles. Under water only the basal portion of the 'funnel' can, therefore, be expanded and in this position the marginal flaccid portion will flap with the eddies of the current and will, therefore, be a source of distinct disadvantage to the animal. The muscles are situated only in the ventral wall of the 'funnel' and for the size of the structure are by no means strong. So the unfolding of the 'funnel' requires some extra help which is afforded by the surface film and this probably accounts for the fact that the animal is never seen with the 'funnel' expanded under water.

Dr. Malcolm A. Smith has found these tadpoles feeding "in the shallowest puddles, among thick vegetation" and he remarks about their natural posture as follows: "Here amongst water-weed they spent most of their time, with the body resting upon a brick and parallel with the surface of the water, and in this situation they were to be seen constantly feeding" (Smith, p. 985, 1926). We have seen above that in pools the plankton food is horizontally distributed and it is always more plentiful near the edges. In shallow water where the tadpole can rest with its body touching the bottom the muscular pull needed for the continuous expansion of the 'funnel' will be considerably reduced, for there will then be no pulling at the surface caused by the weight of the tadpole. These are the two main factors which determine the distribution of the tadpoles near the edge of a puddle. In a flowing stream the tadpoles were found in larger numbers along the shore, and probably in this case also the food conditions govern their distribution.

¹ Dr. F. Brocher has very ably discussed the phenomenon of the surface film and its importance in understanding the biology of aquatic organisms. (*Ann. Biol. Lacustre* IV, pp. 89-138, 44 figs. 1909-11).

The fact that the tadpole is capable of maintaining itself at any depth requires further consideration. There is no doubt that the oral-apparatus helps to make the anterior end buoyant as has been shown by experiments described in one of my former papers (Hora, pp. 584, 585 : 1923), but the finer adjustments that are needed by the animal to suspend itself at a particular level are, in my opinion, performed by the developing lungs. I have already shown¹ the nature of these structures, but it may be well to repeat the main facts. In young individuals the lungs are represented by two thin-walled sacs which are distended with bubbles of air. As growth progresses these sacs are considerably reduced in dimension, their walls become gradually thickened and they assume more and more the form of the regular lungs of the adult. I have observed tadpoles giving out bubbles of air both under water and when hanging from the surface. Dr. H. M. Smith (p. 987, 1926) says that, "All of the brevipitid larvae that I am acquainted with, however, —*Kaloula pulchra* excepted—have the power of remaining suspended at any depth they like in the water." I hope it will be possible to demonstrate at no distant date that the developing lungs of these tadpoles have also been modified in the same way as those of the 'funnel' mouthed tadpoles of *Megalophrys*, for without a hydrostatic organ it is not possible to imagine how their suspension is regulated.

It has been pointed out already that these tadpoles live in hill-streams which are liable either to break up into a series of pools and puddles that may dry up altogether, or to become rapid torrents generated by a single shower. It is under such varying conditions that the oral apparatus and the hydrostatic lungs of the *Megalophrys* tadpoles seem to have been evolved. The 'funnel', besides enabling the animal to feed at all times and under all conditions, makes the anterior end buoyant which is a distinct advantage when the animal happens to be carried away by a flood. The anterior part of the body is saved from being carried against rocks. The 'funnel' also enables the animal to hang from the surface film and to have free access to the atmospheric air required for the hydrostatic lungs. The lungs on the other hand make the whole animal buoyant, so that it spins round in a swift current without damaging any part of its body against a rock and, moreover, they act as well-regulated hydrostatic organs enabling the animal to maintain itself at any depth. In tadpoles living in drying-up pools with a decreasing quantity of oxygen in solution for respiration, the free air in the lungs would help to oxygenate the blood but this requires further elucidation as the facts at our disposal do not warrant any conclusions.

In the preceding pages I have attempted to show the diversity of ways in which organs like the 'funnel' and lungs of *Megalophrys* tadpoles perform their functions under diverse conditions, and it is evident that there is a close correlation between the mode of life of the tadpole and the environmental conditions that prevail at different times of the year. On this point Dr. H. M. Smith says that, "It seems highly improbable, however, that so highly specialized a structure can have been evolved for more than one particular purpose; and any others

¹ Hora, *Rec. Ind. Mus.* XXV, p. 585 (1923).

it may at times perform are merely incidental ones." Moreover, he remarks: "There is certainly a very close connection between the unfolding of the funnel and hanging by it from the surface of the water, while the fact that the creature has never been seen below the surface of the water with its lips unfolded suggests that the function of the funnel is connected with the surface of the water and with that only." It is, however, well known that highly specialized structures are sometimes capable of performing different functions under different conditions. When an animal becomes so highly specialized that it cannot respond to a change in the environment it is doomed to destruction. Only those organisms can survive under these conditions whose structures are sufficiently plastic to enable them to exist under changing conditions. I would, however, like to give here a few common examples to refute Dr. Smith's statement. It is admitted that the wing of a bird is a highly specialized structure and it is also known that some of the diving birds are good fliers. Those who have watched these birds feeding under water know with what ease and perfection the wings are used as paddles for swimming. One has only to watch a cormorant being fed in glass tanks full of water at the London Zoological Gardens. Take the case of the climbing perch (*Anabas testudineus*) of India and further east. The ventral fins are used in the normal way under water, but are differently used when it begins to climb a tree. "In one of the Loaches (*Misgurnus fossilis*) air is swallowed and passed along the alimentary canal until it is finally voided at the anus."¹ "In the adult *Ceratodus* an organ occurs which is equally lung and air-bladder."² Though in the beginning a structure may serve a particular purpose, in the course of its evolution it may take on other functions so as to keep the organism in direct adaptation to its environmental conditions. A highly specialized organ in its structure sometimes shows the various uses to which it may have been applied at different times in the course of its evolution and sometimes it so happens that a structure functions in a totally different way from that for which it may have been originally evolved.

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¹ Bridge, *Cambridge Nat. Hist. Fishes* VII, p. 292 (1904).

² Kerr, *Text-book of Embryology* II, p. 168 (1919).

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EXPLANATION OF PLATE III.

The Habitat of the tadpoles of *Megalophrys parva* Boulenger. A portion of a small torrential stream below the Dumpep Dak Bungalow, Khasi Hills, Assam.



Habitat of *Megalophrys* tadpoles.

D. BAGCHI, Photo.