

AMPHIPODA.

By CHAS. CHILTON.

INTRODUCTION.

The number of species of Amphipoda collected from Chilka Lake is not great, comprising only seventeen (17) species, but the collection is nevertheless of very considerable importance and interest. Most of the species were gathered at many different localities and often in very great numbers. They are nearly all of small size and in several cases the task of sorting them out and of distinguishing allied species was somewhat laborious. Most of the specimens have been referred to species already known, but I have had to establish three new species. A considerable amount of additional information is also given with regard to species previously described.

Several questions of interest arise with regard to the distribution of the species. Thus *Ampelisca pusilla* Sars, which was originally described from deep waters in Arctic Seas, is found in great abundance in the Lake. It also occurs in the river Ganges at Buxar about six hundred miles from the mouth and had previously been recorded from the east coast of Australia by Stebbing. The Indian specimens differ from the Arctic in having corneal lenses present, but in all other respects agree very closely with the Arctic forms.

Quadrivisio bengalensis Stebbing, originally described from Port Canning, Lower Bengal, evidently occurs in great abundance in some parts of the lake. It is found also in the island of Zanzibar, East Africa, and Dr. Annandale has sent me specimens from four different localities in the Talé Sap, Siam.

Grandidierella magna (Giles) seems hardly distinguishable from *G. mahafalensis* Coutière from Madagascar. The original specimen from which Dr. Giles described the species was taken at Megna Shoals, Bay of Bengal. In this species there appear to be two forms of the male, differing from one another in the characters of the first gnathopod. An allied form which agrees with most of the characters of *Grandidierella magna* except in the second gnathopods, is described below as a new species, *G. gilesi* sp. nov.

Melita inaequistylis (Dana) is a very widely distributed species occurring in India, South Africa, New Zealand, etc.

Perhaps the most striking example as regards the geographical distribution of the Chilka Lake Amphipoda is the species *Paracalliope fluviatilis* (G. M. Thomson). This species was described many years ago from New Zealand, where it is the common form occurring in nearly all freshwater streams, though it is also found in brackish waters and sometimes in water that is perfectly salt. It is evidently abundant in

Chilka Lake and in the collection there are also specimens from the lower reaches of the river Adyar near Madras. The species is almost certainly identical with *Pherusa australis* Haswell described from Botany Bay, New South Wales, and this helps to connect the extreme points at which the species is found.¹ This case forms a parallel to that of *Melita inaequistylis*, which is found in brackish waters in New Zealand and in India and Ceylon, but the latter species has been recorded from a greater number of marine localities.

Discussion of the importance of the distribution of the species, as mentioned above, must be held over for a later occasion, but it may be mentioned in connection therewith that *Xiphocaris*(=*Paratya*) *curvirostris* (Heller), the freshwater shrimp common in New Zealand streams, also occurs in Assam and that *Paracorophium excavatum* (G. M. Thomson), an Amphipod which occurs in brackish and fresh water on the coast of New Zealand, has recently been found in similar localities in Brisbane river, Queensland.²

One of the most interesting Amphipods in the Chilka Lake fauna is *Niphargus chilkensis* sp. nov. This form was found at various localities apparently under the same conditions as the other species. It possesses eyes, though these seem to be somewhat imperfect. It differs in several points from the species of *Niphargus* found in Europe and Northern Africa. A closely related species has recently been sent to me from the underground waters in the Philippine Islands.

Under each species I have given only those synonyms and references that appear to be of importance in connection with the present paper.

The names of authors followed by a date refer to the bibliographical list on p. 556.

I wish to express my grateful thanks to Dr. Annandale for the opportunity of examining and reporting upon this fine collection and to Miss E. M. Herriott, M.A., Assistant at the Biological Laboratory of Canterbury College, for preparing the figures and assisting me in other ways.

LIST OF SPECIES, WITH DISTRIBUTION.

1. *Ampelisca pusilla* Sars. Chilka Lake; Buxar, R. Ganges; Arctic Seas; North Atlantic; East coast of Australia.
2. *Amphilochus brunneus* Della Valle. Chilka Lake; North Sea; Mediterranean.
3. *Idunella chilkensis* sp. nov. Chilka Lake.
4. *Perioculodes longimanus* (Bate & Westw.). Chilka Lake; Ceylon; Arctic Ocean; North Sea; North Atlantic; Mediterranean.
5. *Synchelidium haplocheles* (Grube). Chilka Lake; Ceylon; North Sea; North Atlantic; Mediterranean.
6. *Paracalliope fluviatilis* (G. M. Thomson). Chilka Lake; Philippine Islands; New Zealand; Australia; (in fresh and brackish water).
7. *Niphargus chilkensis* sp. nov. Chilka Lake.

¹ Since this was written the species has been found in the Philippine Islands.

² See also S. Kemp's remarks on the distribution of certain Onychophora and other terrestrial animals (*Rec. Ind. Mus.*, Vol. VII, p. 491).

8. *Melita inaequistylis* (Dana) Chilka Lake; Ceylon; South Africa; New Zealand.
9. *Maera othonides* Walker. Chilka Lake; Ceylon.
10. *Quadrivisio bengalensis* Stebbing. Chilka Lake; Port Canning, Gangetic Delta; Zanzibar Island; Talé Sap, Siam.
11. *Orchestia platensis* Kröyer. Chilka Lake; Philippine Islands; widely distributed on warmer shores of America; Mediterranean; Hawaiian Islands; Tonga, Low Archipelago, etc.
12. *Talorchestia martensii* (M. Weber). Chilka Lake; Flores in Malay Archipelago.
13. *Hyale brevipes* Chevreux. Chilka Lake; Ceylon; Laccadive Archipelago; Seychelles.
14. *Grandidierella megnae* (Giles). Chilka Lake; Bay of Bengal; Madagascar.
15. *Grandidierella gilesi* sp. nov. Chilka Lake.
16. *Photis longicaudata* (Bate & Westw.). Chilka Lake; Philippine Islands; North Atlantic; North Sea; South Africa.
17. *Corophium triaonyx* Stebbing. Chilka Lake; Ceylon.

Ampelisca pusilla Sars.

Ampelisca pusilla Sars, 1891, p. 181, pl. 63, fig. 2.

Ampelisca pusilla Stebbing, 1906, p. 105; 1910, p. 576.

Ampelisca chevreuxi Walker, 1904, p. 254, pl. 3, fig. 15.

Localities :—

- 1 mile S. of Kalidai. Several.
- 3 to 2 miles S.E. by E. $\frac{1}{2}$ E. of Patsahanipur. Several.
- 2 to 8 miles N.E. $\frac{1}{2}$ E. of Kalidai. Many.
- 2 to 1 miles S.E. by S. of Patsahanipur. Several.
- 4 miles N.E. by $\frac{1}{2}$ E. of Kalidai. Many.
- 2 to 1 miles S.E. by S. of Patsahanipur. Several.

These specimens are all small, not more than about 5 mm. in length. I feel pretty confident in referring them to *Ampelisca pusilla*. Both male and female agree closely with the figures given by Sars in the proportions of the antennæ and the shape of the appendages and particularly in the fact that the fourth segment of the pleon is scarcely carinate in the female but is distinctly carinate in the male, the projection agreeing closely with Sars' figures. The specimens differ, however, from Sars' description in having corneal lenses present in the normal manner.

Stebbing has identified this species from Australia and remarks that in his specimen also the corneal lenses are present. Sars says that the species occurs off the coasts of Norway in considerable depths. The absence of corneal lenses in his specimens is doubtless due to a degeneration of the eyes caused by the depth at which it lives. I have little doubt that *A. chevreuxi* Walker should also be referred to this species. The Chilka Lake specimens agree closely with Walker's description except in having the first antenna about as long as the second, while he describes it as

reaching to one-third the length of the last joint of the peduncle of the lower antenna. The two antennæ are subequal in the female specimens I have examined, but the upper one is shorter than the lower in the male. In some other species the upper one varies much in length at different stages of development. As regards the telson the various descriptions agree as to its being divided almost to the base and having the divisions pointed. Walker states that there are three spines before the point on the outer margin. Sars gives two and Stebbing says that there is only one apical spinule in the Australian specimen; there is only one in the Chilka Lake specimens that I have examined. Sars says the telson is without dorsal denticles; in one female examined I found one minute dorsal denticle on one lobe but none on the other.

These and other points in the structure of various species of *Ampelisca* have been dealt with by myself in another paper.¹ Stebbing says *Ampelisca pusilla* closely approaches *A. rubella* A. Costa which has been described from the Mediterranean, and Sars says it is nearly allied to *A. amblyops* which again somewhat resembles *A. anomala* but differs in the absolute want of any corneal lenses. *A. anomala* has been recorded from South Africa by Stebbing (1910A, p. 450).

Dr. Annandale has sent me specimens from the River Ganges, Buxar, 600 miles up the river, which seem to be the same as the Chilka Lake specimens; in some the first antenna is shorter in comparison with the second antenna; the eyes are distinctly red, in some the whole eye is red, in others patchy.

[Taken commonly in the main area on or just above a muddy bottom in 4 to 8 feet of water some distance from shore. N.A.]

***Amphilocheus brunneus* Della Valle.**

Amphilocheus brunneus Della Valle, 1893, p. 596, pl. 4, figs. 5; pl. 29, figs. 1-15.

Amphilocheus brunneus Stebbing, 1906, p. 151.

Amphilocheus brunneus Chevreux, 1911, p. 192.

Amphilocheus neapolitanus Walker (part), 1901, p. 301.

Amphilocheus neapolitanus Walker, 1904, p. 255.

Amphilocheus melanops Walker, 1895, p. 298, pl. 18, fig. 12 and pl. 19, figs. 13-15.

Localities :—

2-8 miles N.E. $\frac{1}{2}$ E. of Kalidai. Several.

1 mile E. by N. of Patsahanipur. One.

2-6 miles E. by S. $\frac{1}{2}$ E. of Patsahanipur. Several.

Near Samal Island. Several, from Medusa.

Barkul. Several, from large Medusa.

I have no hesitation in referring these specimens to the species named above. They agree closely with the description and figures given by Della Valle and Walker. Walker has united both *A. melanops* and *A. brunneus* with *A. neapolitanus* Della Valle, but in that species as described by Della Valle the process of the fifth joint of the

¹ The identity of the two Amphipods, *Ampelisca eschrichtii* Kröyer and *A. macrocephala* Liljeborg. *Jour. Zool. Research*, Vol. 11, p. 75.

second gnathopod overlaps the palm and Chevreux, who was able to examine a large number of specimens, found this to be the case in all his specimens of *A. neapolitanus*, even those only 1 mm. long, while in *A. brunneus* it varied between the half and two-thirds and did not overlap the palm. Hence I refer the Chilka Lake specimens to *A. brunneus*, for in none of them does the process overlap the palm. Walker's specimen from Ceylon doubtfully referred to *A. neapolitanus* is probably the same.

[This species was habitually taken on the subumbrella and among the tentacles of the only large medusa found in the lake, *Acromitus rabanchatu*, Annandale. The amphipods were almost invariably present in this situation in adult medusae. N.A.]

Idunella chilkinsis sp. nov.

(Text-fig. 1).

Localities :—

1 mile E. by N. of Patsahanipur. Five males, one female.

2-6 miles E. by S. $\frac{1}{2}$ S. of Patsahanipur. One male, one female.

Specific Diagnosis.

Male. Pleon segments 2, 4 and 5 produced into minute dorsal teeth. Rostrum short or absent. First side plate large, broadly rounded in front, side plates 1 to 3 with minute denticle at lower hind corner. Postero-lateral angle of third pleon segment acute, a small sinus between the point and the convex hind margin.

Antenna 1 (fig. 1a) about three-fourths as long as the body, stout; first joint of peduncle about as long as the second but much stouter, third joint very short, not longer than first joint of flagellum; flagellum stout, consisting of about 35 joints, accessory flagellum small, of two slender joints.

Antenna 2 (fig. 1a) shorter than the first antenna, ultimate and penultimate joints of peduncle subequal, flagellum stout, about as long as peduncle.

Mouth parts closely resembling those of *I. aequicornis*.

First gnathopod (fig. 1d) large, basis slender, with two or three long setules near base of hind margin and a large group about the middle of anterior margin: ischium and merus short, subequal, two long setules at distal angle of merus; carpus very short, triangular, propod very large, longer than the rest of the limb, broadly oval, anterior margin regularly convex and without setae, palm very oblique, irregularly defined by 3 or 4 stout setules, having near the finger a prominent lobe ending in two or more blunt teeth, a depression near the lobe followed by a convex serrated and setulate portion leading to the defining setules; hind margin much shorter than palm, convex, fringed with minute setules; finger long and strongly curved, having a concavity near the base followed by a slight prominence, inner concave margin slightly irregular.

Second gnathopod much smaller, carpus produced near the antero-distal angle; propod oval, longer and broader than carpus, anterior margin convex, bearing tufts of slender setules; palm not very oblique, convex, with minute setules; hind margin longer than palm, with 4 or 5 tufts of setules; finger strongly curved, fitting closely on to the palm.

Peraeopods 1 and 2 as in *I. aequicornis*, slender, with long slender dactyls.

Peraeopods 3 to 5 increasing in length posteriorly, basal joint not greatly expanded, its hind margin straight and sharply serrate.

Third uropods (fig. 1g) with the inner branch much larger and broader than the

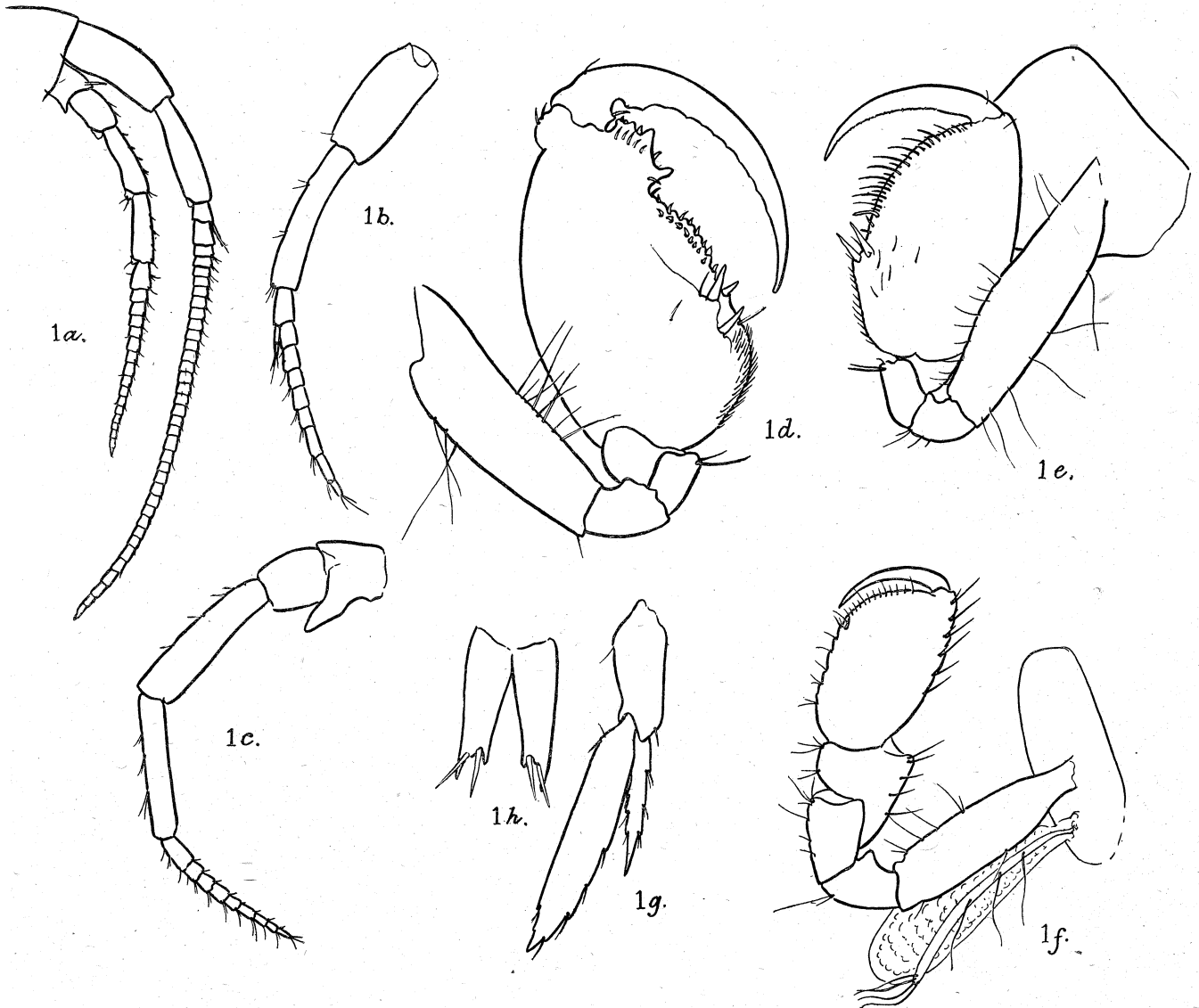


FIG. 1.—*Idunella chilkinsis* sp. nov.

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|-----------------------------|--------------------------------|
| a. Antennæ of male. | e. First gnathopod of female. |
| b. Upper antenna of female. | f. Second gnathopod of female. |
| c. Lower antenna of female. | g. Third uropod of female. |
| d. First gnathopod of male. | h. Telson of female. |

outer, outer with tufts of setules on both margins, inner one with fewer setules and these confined to the outer margin and apex.

Telson cleft to the base, each lobe narrow with outer angle strongly produced into a sharp tooth, two stout setules arising from the concave extremity.

Female, similar to the male except in the antennæ and gnathopods.

Upper antenna (fig. 1b) shorter, subequal with the lower (fig. 1c), flagellum not so stout as in the male.

First gnathopod (fig. 1e) much larger than the second, but not so large as in the male; propod oval, palm regularly convex, fringed with stout setules, hind margin not so abundantly fringed with setules as in the male; finger smaller, inner margin regularly concave and bearing a few minute setules.

Second gnathopod (fig. 1f) as in the male, but with propod rather smaller.

Length of body, 4 mm.

Colour. Pale yellow, with a few darker markings.

Remarks. This species agrees well with the characters of the genus and evidently comes pretty close to *I. aequicornis* Sars, from Arctic Seas. It differs in the male chiefly in the greater length of the antennæ, especially of the upper, and in the shape of the first gnathopod. In both sexes it differs also in the smaller accessory flagellum, the shape of the carpus of the second gnathopod and in the unequal branches of the third uropod.

The sexual differences appear to be confined to the antennæ and the gnathopods. In the male specimen examined the third uropods also differed from those of the female shown in fig. 1g in having both margins of the inner branch free from setae except for the small tuft near the base of the inner margin and the two or three towards the apex on each margin.

[Only taken in the main area of the lake on a muddy bottom some distance from shore in $4\frac{1}{2}$ to $5\frac{1}{2}$ feet of water. N.A.]

***Periocolodes longimanus* (Bate and Westw.).**

(Text-fig. 2.)

Periocolodes longimanus Stebbing, 1906, p. 237.

Periocolodes longimanus Sars, 1892, p. 313, pl. 110, fig. 2; pl. 111, fig. 1.

Monocolodes megapleon Giles, 1888, p. 235, pl. 7, fig. 12.

? *Oedicerus puliciformis* Giles, 1888, p. 248, pl. 7, fig. 5 and 6.

Localities :—

2 to 4 miles N.E. $\frac{1}{2}$ E. of Gunta Sila. Many.

1 mile N.N.E. of Breakfast Island. Several.

1 to 9 miles N.E. $\frac{1}{2}$ E. of Breakfast Island. Several.

2 to 8 miles N.E. $\frac{1}{2}$ E. of Kalidai. Several.

1 mile E. by N. of Patsahanipur. Several.

2 to 6 miles E. by S. $\frac{1}{2}$ S. of Patsahanipur. Several.

4 miles N.E. $\frac{1}{2}$ E. of Kalidai. Several.

1 to 2 miles S.E. by S. of Patsahanipur. Several.

This species was obtained in great abundance at some of the stations, the male specimens, however, being very rare. I refer them to *Periocolodes longimanus* (Bate and Westw.) with some hesitation. They agree on the whole well with Sars' figures except as regards the antennæ (fig. 2), which in both sexes have the third joint of the peduncle of the upper antenna considerably shorter than the second and the

flagellum rather stout and usually with 8 or 9 joints; the second antenna has the last two joints of the peduncle somewhat thickened and provided with long setae; the flagellum in the female is shorter than the peduncle and consists of four joints; in the male it is very slender and very long, the whole antenna being about three-fourths the length of the body. The branches of the uropods are slender, subequal, and with the extremities very acute; a few setules are present on the peduncles and sometimes also on the branches, particularly on those of the third; Sars says those of the third are quite unarmed.

Walker says that his *P. serra* from Ceylon much resembles *P. longimanus* but he describes the rostrum as being much longer than it is in the Chilka Lake specimens. The differences in the proportions of the segments of the peraeon are perhaps not important but he describes the outer ramus of the first uropod as half as long as the inner and the upper margins of the rami in adults strongly serrate. In my specimens the branches are subequal and though there may be a slight appearance of serration formed by the shallow notches from which the setules arise these are much less numerous and less conspicuous than in his figure.

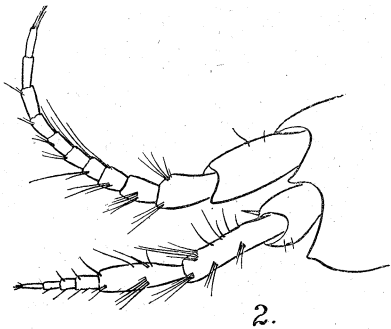


FIG. 2.—*Perioculodes longimanus*, antennæ of female.

Monoculodes megapleon Giles was described from a single specimen obtained off Chittagong. From Dr. Giles' description it seems to be the same species as the Chilka specimens and in some points to agree better with *P. longimanus*. Stebbing (1906, p. 238) says of it "perhaps identical with *P. longimanus*."

Oedicerus puliciformis Giles (1888, p. 248) is merely mentioned by Stebbing (1906, p. 742); if we disregard the difference in the description of the eyes, which may be due to the condition of the specimens, there does not seem to be anything in the figure to prevent Dr. Giles' specimen being a male of the species now under consideration, *i.e.* *P. longimanus*, the enlarged figure he gives of the terminal portion of the gnathopod agrees precisely with that of the Chilka specimens. Unfortunately for this suggestion, however, his specimen was described as a female carrying ova, though it was only 2 mm. long.

[A very abundant species in the main area on a muddy bottom some distance off shore. N.A.]

Synchelidium haplocheles (Grube).

Synchelidium haplocheles Stebbing, 1906, p. 242.

Synchelidium haplocheles Chevreux, 1911, p. 206.

Synchelidium brevicarpum Walker, 1904, p. 263.

Locality:—2 to 8 miles N.E. $\frac{1}{2}$ E. of Kalidai. A few specimens.

I think these specimens must be referred to the species named above. The male specimen dissected has the rostrum and antenna agreeing exactly with the description given by Stebbing and with Sars' figures, except that the first joint of the

flagellum of the first antenna is not densely clothed with fine hairs; perhaps the specimen is not fully matured, though the second antenna has the long slender flagellum characteristic of the male. The gnathopods are in minute agreement, even as regards the armature of the palm of gnathopod 1. So are the peraeopods, uropods and telson.

The other specimens also agree, but in some of them, which have not the characteristic second antenna of the male, this appendage is distinctly longer than antenna 1. Stebbing says, "Antenna 2 in the female shorter than antenna 1." Possibly my specimens are immature males.

Walker has recorded this species from Ceylon saying that his single specimen agrees with British examples even to the dark brown blotches on the fifth and sixth segments of the peraeon. My specimens are whitish with irregular reticulate patches of black on various parts of the body and appendages, the colour being well retained in the spirit specimens; the eye is black.

[Taken among filamentous algae on a muddy bottom in 5 to 6 feet of water. N.A.]

Paracalliope fluviatilis (G. M. Thomson).

(Text-fig. 3.)

Calliope fluviatilis G. M. Thomson, 1879, p. 240, pl. 10c, fig. 4, 4a-c.

Paracalliope fluviatilis Stebbing, 1906, p. 297.

Paracalliope fluviatilis Chilton, 1909A, p. 55.

Pherusa australis Haswell, 1880, p. 103, pl. 7, fig. 1.

Localities:—

Off Samal Island, 8-15 ft., 22-ix-13. Several.

Off Barkul, 3-4 ft., 21-31-vii-13. Several.

Off Barkul, at edge of lake, 21-vii-13. Several.

Barkul, 18-iv-05. Several.

East side of Rambha Bay. Several.

Adyar River, outskirts of Madras town, 3-4 ft. Several.

However unlikely it may at first appear these specimens agree in size, structure and colour with the species, *Paracalliope fluviatilis* (G. M. Thomson), which is the common one inhabiting freshwater streams in New Zealand. When first sorting out the Chilka Lake specimens I was struck by the superficial resemblance of some of the specimens in the pale orange colour and the long terminal peraeopods to the form I was familiar with in New Zealand and careful comparison of specimens has convinced me that they must be referred to the same species. I have previously pointed out (1909A, p. 55) that the New Zealand species, in addition to inhabiting the freshwater streams, is also to be found in brackish water and at times in water that is quite salt. It is found all over New Zealand and I have recently had specimens sent to me from Cape Maria van Diemen in the very north. I have also specimens collected in quite salt water in Auckland Harbour as well as those previously recorded from Dunedin Harbour. Stebbing (1906, p. 297) referred to this species the form described

under the name *Pherusa australis* by Haswell from Botany Bay, New South Wales. Unfortunately I have been unable to secure specimens from Australia and the types of Haswell's species are no longer available, but after carefully going through Haswell's description I am convinced that Mr. Stebbing is right; the description on the whole agrees well with the specimens and seems to be confirmed by the statement and by the figure showing that there are three spines on the inner border of the inner ramus of the third uropod; for these are certainly present as shown in Haswell's

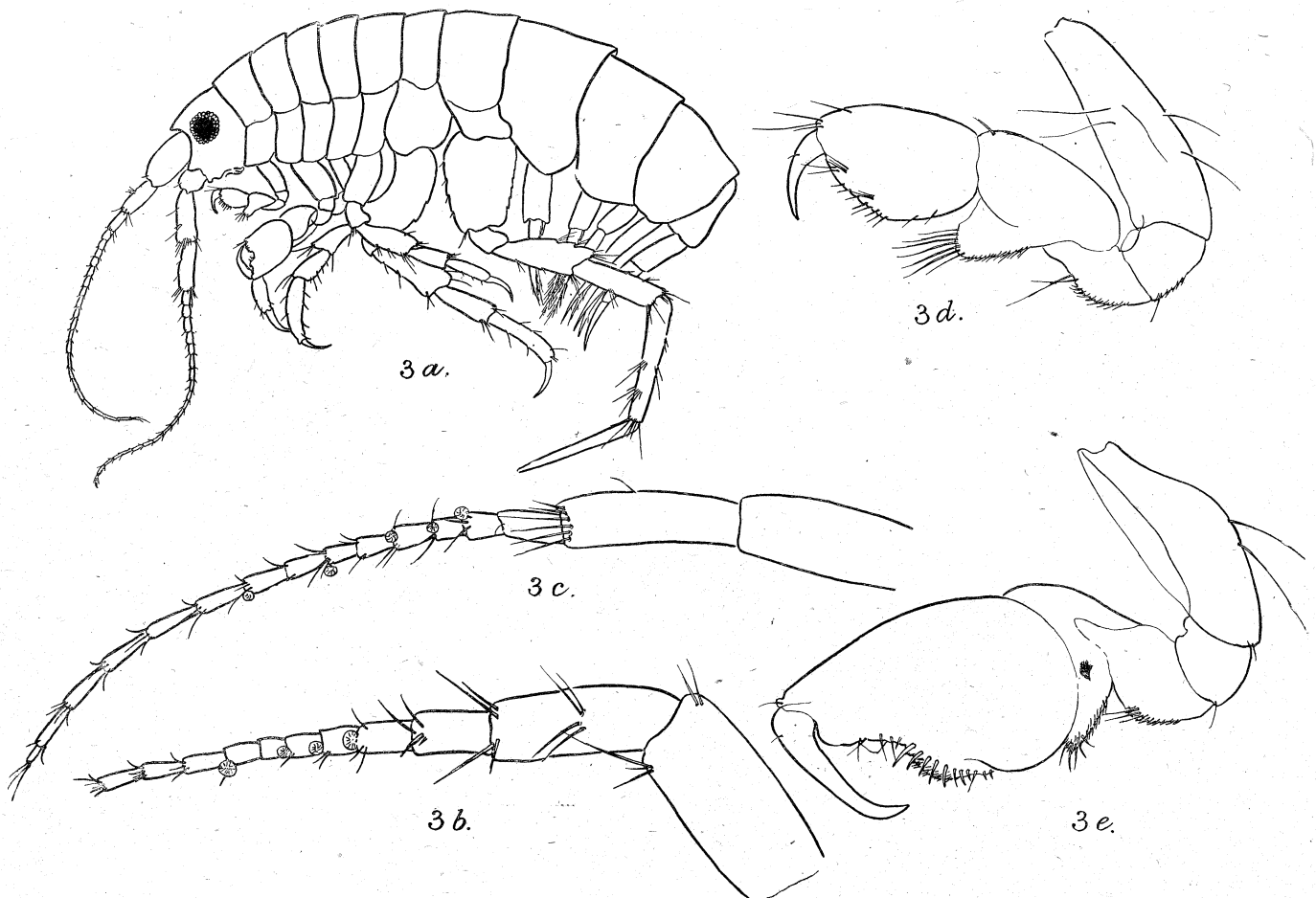


FIG. 3.—*Paracalliope fluviatilis*.

- a.—Whole animal, side view. c.—Lower antenna.
 b.—Upper antenna. d.—First gnathopod of male.
 e.—Second gnathopod of male.

figure in ordinary fully adult specimens, though the number may sometimes be greater or less than three. Probably the species will be found to occur in other fresh-water or brackish localities on the east coast of Australia or between Australia and India.¹

¹ Two or three weeks after posting the MS. containing the remarks made above I received from Professor C. F. Baker of Los Banos, Philippine Islands, a few amphipods from Nasugbu, south coast of Luzon, most of which proved to be specimens of *Paracalliope fluviatilis* (G. M. Thomson) quite

Paracalliope fluviatilis was described by Thomson as long ago as 1879. Unfortunately his figures were so greatly reduced in reproduction that they do not show clearly the structure of the various appendages and no other figures have yet been published. I have, however, the tracings that were made of Mr. Thomson's original figures for the purpose of reproduction and find that the main points in the structure of the gnathopods and of the telson and uropods are quite clearly shown. A description was given by Stebbing in 1906 and on the whole agrees well with the specimens. In 1899 Stebbing had established the genus *Paracalliope* for the species. There is one point in his generic diagnosis that requires alteration, for calceoli are certainly present in the males on some of the basal joints of the flagellum in both upper and lower antennæ. The species can generally be easily recognised by the greatly elongated fifth peraeopods and by the peculiar inverted position of the second gnathopod; this appendage seems to have a very loose articulation between the ischium and the carpus, so that the distal portion of the limb often faces in the direction opposite to the normal one (see fig. 3*a*). Stebbing has pointed out that this recalls the curious torsion in the first gnathopod of *Trischizostoma nicaense*.

I give figures of the whole animal (fig. 3*a*) and of the antennæ (figs. 3*b*, *c*) and the gnathopods (figs. 3*d*, *e*) which will render a detailed description unnecessary. It is difficult to represent the gnathopods accurately, for as Stebbing points out there are two margins to the palm and the outline therefore varies according to the position in which the gnathopod is mounted.

Stebbing places the genus under the family Calliopiidae, and this is probably its proper position, though the elongated fifth peraeopods are peculiar and the characters of the family are somewhat indefinite. It was doubtless from the elongated fifth peraeopods that Stebbing suggested that the species *Oedicerus novi-zealandiae* Dana was probably identical with *Paracalliope fluviatilis*. I have, however, pointed out elsewhere that *Oedicerus novi-zealandiae* is a distinct species and is in all probability identical with the species afterwards described by Stebbing as *Carolobatea schneideri* (1909, p. 620).

[Not uncommon on a muddy bottom off shore in the main area. N.A.]

Niphargus chilkensis sp. nov.

(Text-fig. 4.)

Localities:—

- Off Samal Island, 3-15 ft., 22-ix-13. One.
- Off Barkul, 21-vii-13. Two.
- One mile S. of Kalidai. Several.
- 4 to 9 miles E.½S. of Barkul bungalow. Several.
- 3 to 2 miles S.E. by E.½E. of Patsahanipur. Four.

similar to those from Chilka Lake and New Zealand. These are stated to have been collected in "shallow water," but there is nothing said as to whether the water was fresh, brackish or marine. Along with them was a single specimen which, though small and perhaps immature, appears to be *Photis longicaudata* (Bate and Westw.).

1 mile E. by N. of Patsahanipur. Five.

2 miles E. by S. $\frac{1}{2}$ S. of Patsahanipur. Several.

1 to 9 miles N.E. by E. of Kalidai. Several.

Specific Diagnosis:—

Body long and narrow, side plates small, much shallower than the segments. Pleon segment 3 with the postero-lateral angle quadrate. Eyes small, irregular, apparently imperfect. Upper antenna about three-fourths the length of body, first and second joints of peduncle subequal, elongate; third short, flagellum slender, longer than peduncle, accessory flagellum of two slender joints. Lower antenna a little longer than peduncle of upper, last two joints of peduncle subequal, flagellum shorter than last joint, consisting of one long joint followed by two or three indistinct ones. First gnathopod with the merus produced posteriorly into a rounded lobe, carpus much longer than the propod, with numerous tufts of setules on the posterior margin and on the surface near to it; propod widening distally, palm nearly transverse, evenly convex. Second gnathopod much larger than the first, carpus short, about one-third the length of the propod; propod irregularly oval, palm oblique, sinuous, about equal in length to the hind margin; finger strongly curved, bulging on the inner margin near its base. Third, fourth and fifth peraeopods increasing in size posteriorly, basal joint in the third narrow, slightly wider in the fourth and greatly widened and enlarged in the fifth, its posterior margin irregularly serrate, most distinctly so in the fifth peraeopod; in the fifth peraeopod the merus is dilated posteriorly. Third uropods greatly elongated, peduncle longer than the telson, outer branch formed of two subequal joints, somewhat broadened, inner branch small, tapering, tipped with one or two setae. Telson cleft to the base, each lobe narrowing posteriorly and bearing a stout setule at the extremity.

Colour (in spirit), whitish.

Length of body, about 10 mm.

I have referred this species to the genus *Niphargus* with which it agrees in most characters. It differs, however, from Stebbing's generic diagnosis (1906, p. 405) in the following points:—

1. The eyes are moderately well developed.
2. The third joint of the mandibular palp is hardly longer than the second.
3. The inner plate of the first maxilla is large and bears numerous setae.
4. The outer plate of the maxilliped bears numerous setae all of the same character, but has no spine teeth.
5. The second gnathopod is larger than the first and differently shaped.

The following are additional notes on the structure of this species. Most of the figures are taken from the type specimen which was the first one examined. Some specimens, rather larger, show slightly more developed characters in the antennae, gnathopods and in the fifth peraeopods in which the basal joint may be larger in proportion to the rest of the limb than is shown in figure 4*p*.

The basal portions of the antennae are shown in figure 4*b* from which the

proportions of the different joints can be readily seen. The tufts of setae on the second joint of the peduncle of antennæ 1 towards its extremity seem to be a characteristic feature and may be more developed than is shown in the figure.

The upper lip (fig. 4c) is regularly rounded and bears a few minute setae. In the mandible (fig. 4d) the molar tubercle is prominent and projecting, the cutting edge and spine row of the normal character, the palp has the first joint short, the next two joints subequal, bearing few setae except the distinct tuft at the end of the third joint. The first maxilla (fig. 4f) differs considerably from the generic description given by Stebbing in having the inner lobe broad and well developed and fringed with about 12 plumose setae. The second maxilla (fig. 4g) has the two lobes subequal, both with apical setae and the inner one with a few setae on its inner margin. The maxilliped (fig. 4h) has the inner lobe large with three stout spinules and a number of plumose setae, the outer lobe reaches only about half-way along the carpus and has its inner margin provided with numerous short setae, none of which are developed into spine-teeth.

In the first gnathopod (fig. 4k) the merus is produced posteriorly into a slight rounded lobe and appears to be covered with very minute setae, the rest of the appendage seems to be normal, having the characters already mentioned in the specific description.

The second gnathopod differs considerably from the first both in size and in structure and is rather different from the gnathopods of other species of the genus. The general character will be best learnt from the figure 4l; in larger specimens the propod may be somewhat larger and the swelling on the inner margin of the finger more pronounced.

The peraeopods are fully shown in the figures (figs. 4m, n, o, p) and do not call for further detailed description.

The branchiae (fig. 4m) are all somewhat large in size, rectangular at the base and narrowing a little towards the extremity.

In the first uropod (fig. 4q) the peduncle is much longer than the rami which are subequal; in the second (fig. 4r) the peduncle is only slightly longer than the rami; in both there are numerous spinules on the upper surface of the peduncle and the rami. The third uropods appear to vary in length in different specimens being sometimes as much as one-third of the total length of the body. In figure 4s they are shown in side view as attached to the animal, when viewed from above they appear somewhat broader. The telson (fig. 4t) is cleft to the base, each lobe narrowing posteriorly, the inner margin being nearly straight except towards the extremity, the outer strongly convex. A long spinule arises near the extremity of each lobe and on its inner side there are three minute setae; from the upper surface of each lobe towards the extremity arise two delicate sensory plumed setae.

In the large inner lobe of the first maxilla and in the gnathopods this species differs considerably from the species of *Niphargus* hitherto described. I have, however, specimens sent to me by Professor C. F. Baker from springs in the Philippine Islands which closely approach the Chilka Lake specimens in these

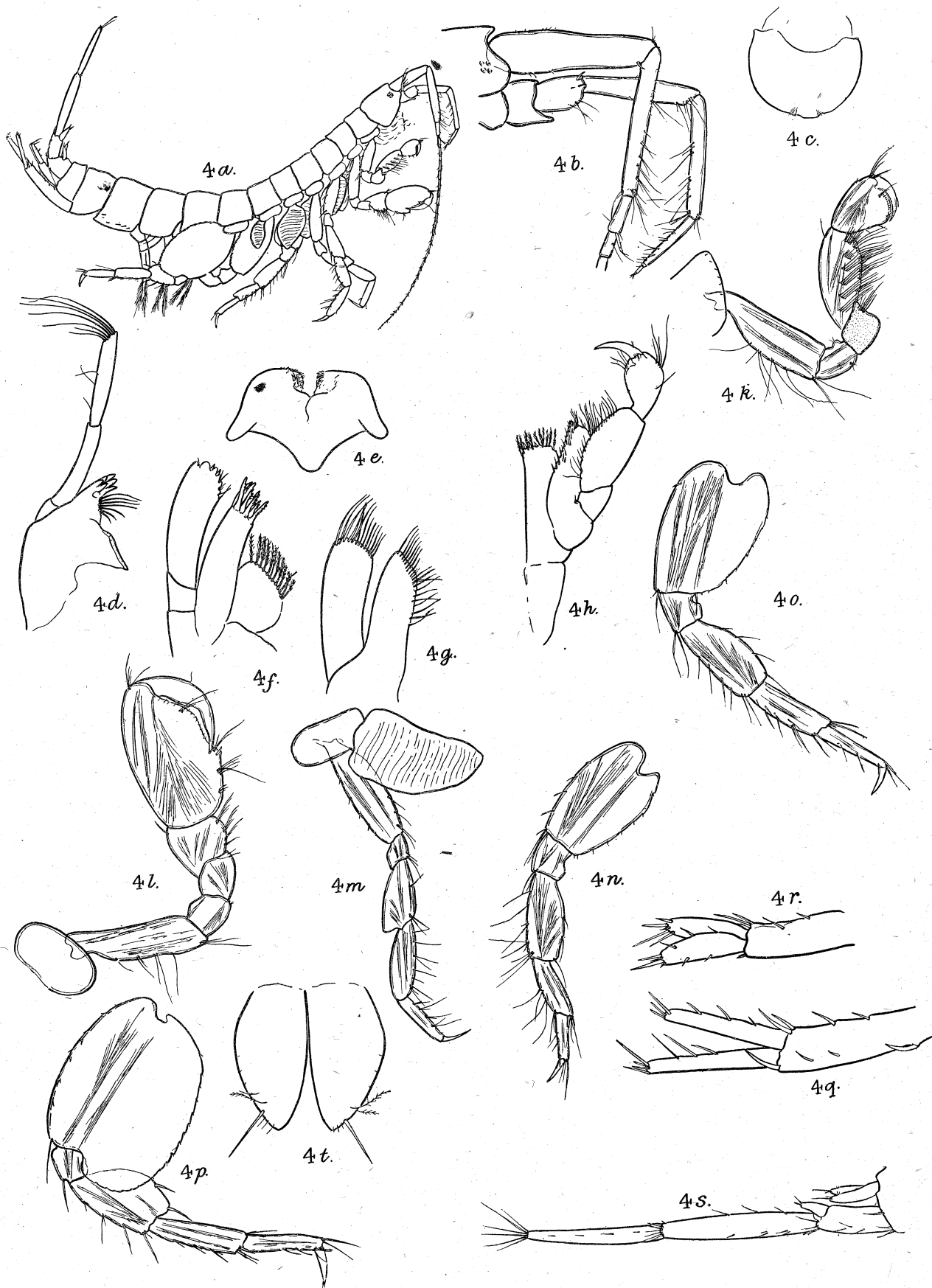


FIG. 4.—*Niphargus chilkensis* sp. nov.

a. Side view of whole animal.
 b. Antenna.
 c. Upper lip.
 d. Mandible.

e. Lower lip.
 f. First maxilla.
 g. Second maxilla.
 h. Maxilliped.
 i. First gnathopod.

l. Second gnathopod.
 m. First pereopod.
 n. Third pereopod.
 o. Fourth pereopod.
 p. Fifth pereopod.

q. First uropod.
 r. Second uropod.
 s. Third uropod and telson (side view).
 t. Telson.

characters. The gnathopods of *Niphargus chilkenis* present a somewhat striking resemblance to those of *Phreatogammarus propinquus* Chilton from New Zealand. That species, however, differs very considerably in the third uropods which, though elongated, have two branches each consisting of a single joint. The third uropods in *Niphargus* and allied species are subject to special development in the different species and it is possible that the resemblance in the gnathopods is of more importance from the point of view of relationship than the differences of the uropods.

[One of the commonest bottom species in the main area. N.A.]

Melita inaequistylis (Dana.)

Melita inaequistylis Stebbing, 1906, p. 429.

Melita inaequistylis Chilton, 1909, p. 630 and 1911, p. 564.

Melita inaequistylis Barnard, 1916, p. 191.

Melita zeylanica Stebbing, 1904, p. 22, pl. 5.

Melita tenuicornis Walker, 1904, p. 273, pl. 5, fig. 33.

Locality. Off Barkul, in fresh water. A few specimens, males and females. All small, largest about 4 mm.

This species has already been recorded from Ceylon by Stebbing and Walker and it is interesting to find that it extends into fresh and brackish waters in India, just as it does in New Zealand. I have discussed the species to some extent elsewhere and compared it with *M. palmata* to which I referred specimens from Kermadec Islands (1911, p. 564); since then I have found that the same form occurs on the coast of New Zealand along with the typical *M. inaequistylis*. The latter species is very wide-spread and has been recorded from Cape Colony by Barnard, who gives a description of his specimens and says that it will ultimately have to be united with *M. palmata* (1916, p. 192). I have little doubt that the species described by Fritz Müller from Brazil (1869, pp. 27, 28) under the names *M. messalina* and *M. insatiabilis* will also prove to be identical with one or other of these forms.

Maera othonides, Walker.

(Text-fig. 5.)

Maera othonides Walker, 1904, p. 271, pl. 5, fig. 29.

Localities :—

Off Samal Island, 8-15 ft., 22-ix-13. One.

North side Chirriya Island. One.

Chirriya Island. One.

8 miles W. by S. of Breakfast Island. Several.

Barkuda Island. One.

Chirriya Island. Three.

Maludaikuda Island. One.

Ennur backwater, near Madras town, 4-5 ft., Oct. 1913. One.

These specimens undoubtedly belong to Walker's species, though in one or two

points they do not quite agree with his description which was drawn up from a specimen only 8 mm. long and probably immature.

In the third pleon segment there may be one or two teeth on the lower margin and usually there are three or four very distinct teeth on the posterior margin; the anterior portion of the lower margin bears a series of spinules.

The accessory appendage of the first antenna may contain as many as five joints. Walker describes the hand of the second gnathopod in the female as being concave. In my specimens the palm is slightly convex (fig. 5c); in the male the palm is slightly concave towards the defining setules as shown in figure 5b.

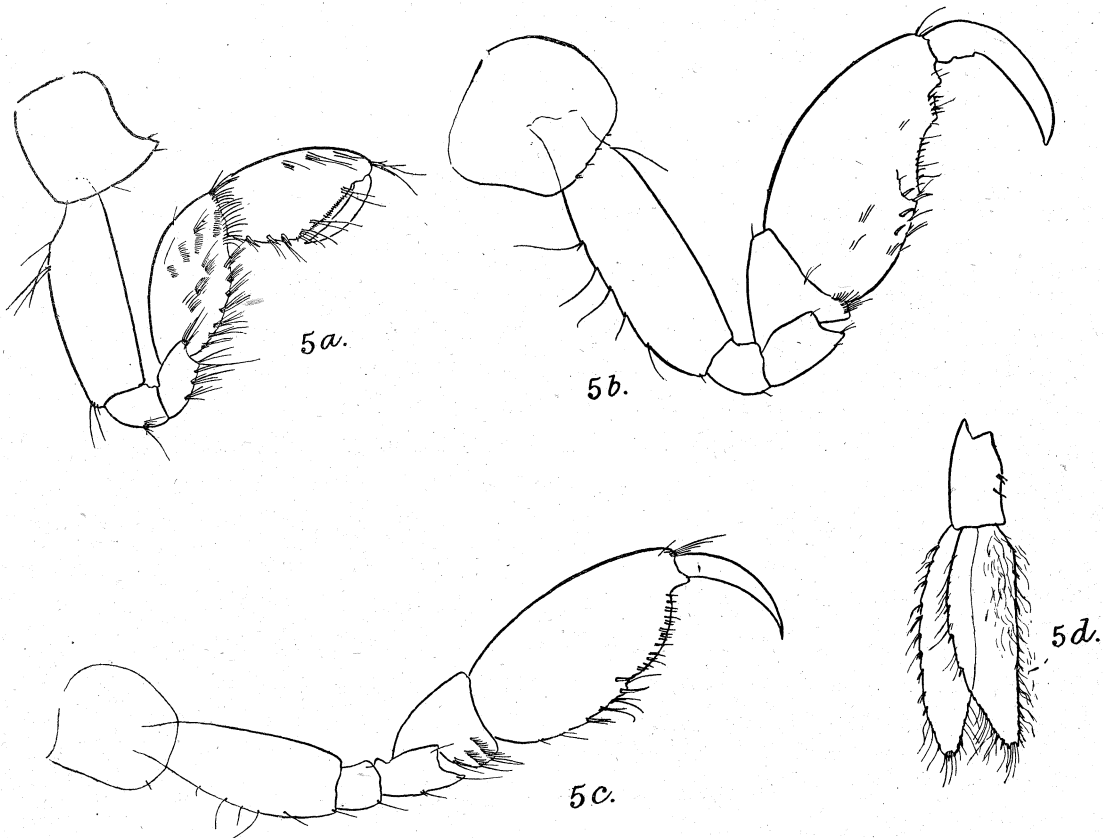


FIG. 5.—*Maera othonides* Walker.

- | | |
|------------------------------|--------------------------------|
| a. First gnathopod of male. | c. Second gnathopod of female. |
| b. Second gnathopod of male. | d. Third uropod. |

The third uropods (fig. 5d) especially in the older specimens bear a number of delicate woolly hairs and similar hairs are found on the dorsal surface of the posterior portion of the pleon. In the telson each lobe narrows greatly towards the acute extremity which bears one long setule and two or more smaller ones; in my specimens I cannot make out the second notch on the inside of each division which is described and figured by Walker; it is probably present only in immature specimens.

[Usually taken under stones just below water level, but also among algae off shore. N.A.]

Quadrivisio bengalensis, Stebbing.

(Text-fig. 6.)

Quadrivisio bengalensis Stebbing, 1907, p. 159, pl. 7.*Quadrivisio bengalensis* Chevreux, 1913, p. 15, fig. 1.*Localities*:—

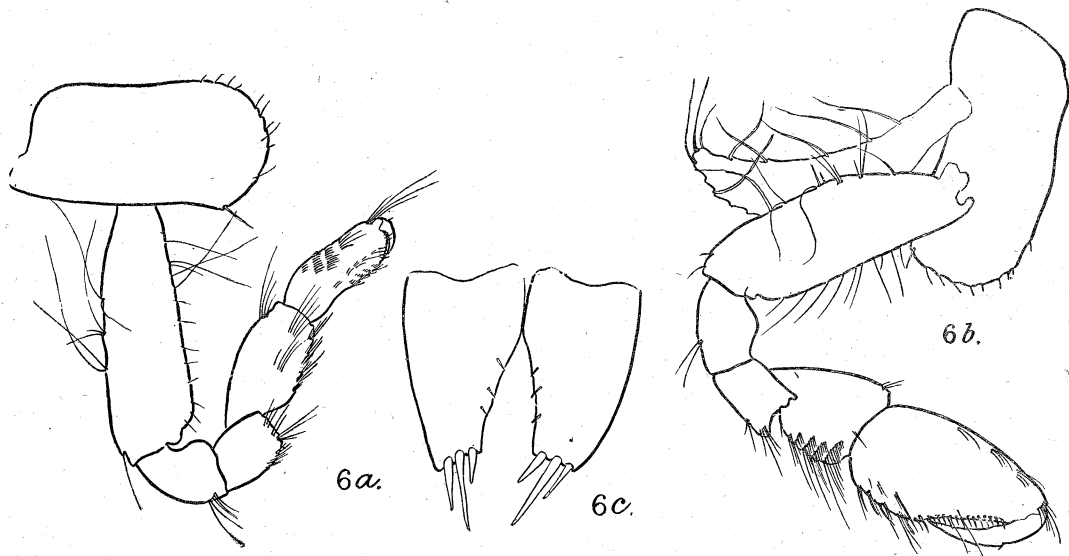
Off Samal Island, 8-15 ft., 22-ix-13. Many specimens, males and females, the largest about 12 mm. in length.

Off Barkul, 3-4 ft. Two specimens.

Off Satpara, 4-5 ft., 17-ix-13. One specimen.

Ghiakhala Headland and neighbouring island. Four specimens.

Main Channel, W. of Satpara Island. Four specimens.

FIG. 6.—*Quadrivisio bengalensis*.

a. First gnathopod of female.

b. Second gnathopod of female.

c. Telson.

I have compared these specimens both with Stebbing's description and with a co-type of his species from Port Canning, and consider that they should be referred to the same species although in one or two points they show slight differences. The antennæ differ very much in the two sexes, the peduncle of the lower one in particular being greatly elongated in the adult males. The widely spaced pair of denticles on the dorsal surface of the pleon segments are quite distinctly to be made out in adult specimens from Chilka Lake; in Stebbing's specimens they are said to be very small and difficult to observe. The main difference appears to be in the telson, Stebbing's figure is probably from a slightly abnormal specimen for it shows the two halves distinctly unlike, the right being shorter and more rounded at the end than the left half and with a different armature of setae. In specimens I have examined both halves are alike (fig. 6c) and in general shape resemble the left half of Stebbing's figure, narrowing towards the extremity, but they bear fewer setae,

namely three large ones at the apex and three minute ones on the inner margin of each lobe.

Chevreaux has recently (1913, p. 15) recorded the occurrence of *Quadrivisio bengalensis* in the island of Zanzibar; his specimens are found in a cave and have the eyes imperfect. He does not state whether there are any differences between his specimens and the description given by Stebbing.

Dr. Annandale has sent me specimens from four localities in the Talé Sap, Siam, which appear to be quite the same as the Chilka Lake specimens.

The peculiar character of the eye by which it is divided on each side into two separate pigmented portions is best marked in adult specimens. In one small specimen, 2 mm. in length, the eye on each side is single, being somewhat irregularly rounded and situated in the usual position slightly below the base of the upper antenna; in another specimen, slightly larger, the main portion of the eye corresponds with that in the first specimen, but it is continued upwards towards the dorsal surface of the head as a narrow pigmented projection. In older specimens this portion becomes enlarged, at first remaining connected with the older part of the original eye but later on becoming quite distinct. The appearance of the eyes in adults as seen from above is well shown by Stebbing (1907, pl. VII *oc*).

[Common under stones just below water-level all round the lake. Also seen swimming in pairs at the edge. N. A.]

Orchestia platensis Kröyer.

(Text-fig. 7).

Orchestia platensis Kröyer, 1845, Naturh. Tidskr. ser. 2, v.1, p. 304, pl. 2, f. 2.

Orchestia platensis Stebbing, 1906, p. 540.

Orchestia platensis Stebbing, 1900, p. 527, pl. 21a.

Orchestia platensis Chevreaux, 1908, p. 494, fig. 14.

Orchestia agilis Kunkel, 1918, p. 118, fig. 31.

Orchestia pickeringii Dana, 1852, p. 882, pl. 59, fig. 9.

Orchestia pickeringii Stebbing, 1900, p. 528.

Orchestia pickeringii Stebbing, 1906, p. 538.

Localities :—

Barkul. Several specimens, males and females.

Chirriya Island. Several.

After much consideration I am referring these specimens to *Orchestia platensis* Kröyer, a species which according to Stebbing has a very wide distribution. Kröyer's original specimens were from the Rio de la Plata, north-west of Monte Video, and Stebbing records the species from the Atlantic Coast of North America (where it has long been known as *Orchestia agilis* S. I. Smith), the Bermudas, the Mediterranean, Lake Tiberias and also from the Hawaiian Islands where it was obtained at two localities at heights of 3,000 and 2,000 ft. respectively.

I had first identified the Chilka Lake specimens with *O. pickeringii* Dana which had been recorded from Hawaiian Islands, California and from New South Wales.

In the short antennæ (figs. 7a, b) thickened in the males, and in the gnathopods (figs. 7c, d) and other appendages they seem to agree very closely with Dana's species as described by Stebbing in 1906, and they certainly correspond with other specimens in my collection from Tonga which I had also referred to this species.

Among the Chilka Lake specimens there were only a few males and probably not more than one quite fully developed; the second gnathopod of the largest and presumably the oldest one is represented in figure 7d and shows two low convex spinulose processes as described by Dana, though these are both about the same breadth. Stebbing in his figure of a male of *O. pickeringii* from the Hawaiian Islands shows the processes on the palm more separated and more pronounced, with the finger thickened about the middle, but as he points out, in younger specimens the inner margin of the finger is smoothly concave.

Later on I had occasion to examine and mount some specimens sent to me from Cold Spring Harbor, U.S.A. as *O. agilis* S. I. Smith, a species which Stebbing unites with *O. platensis*, and I was struck by the resemblance of them to the Chilka Lake speci-

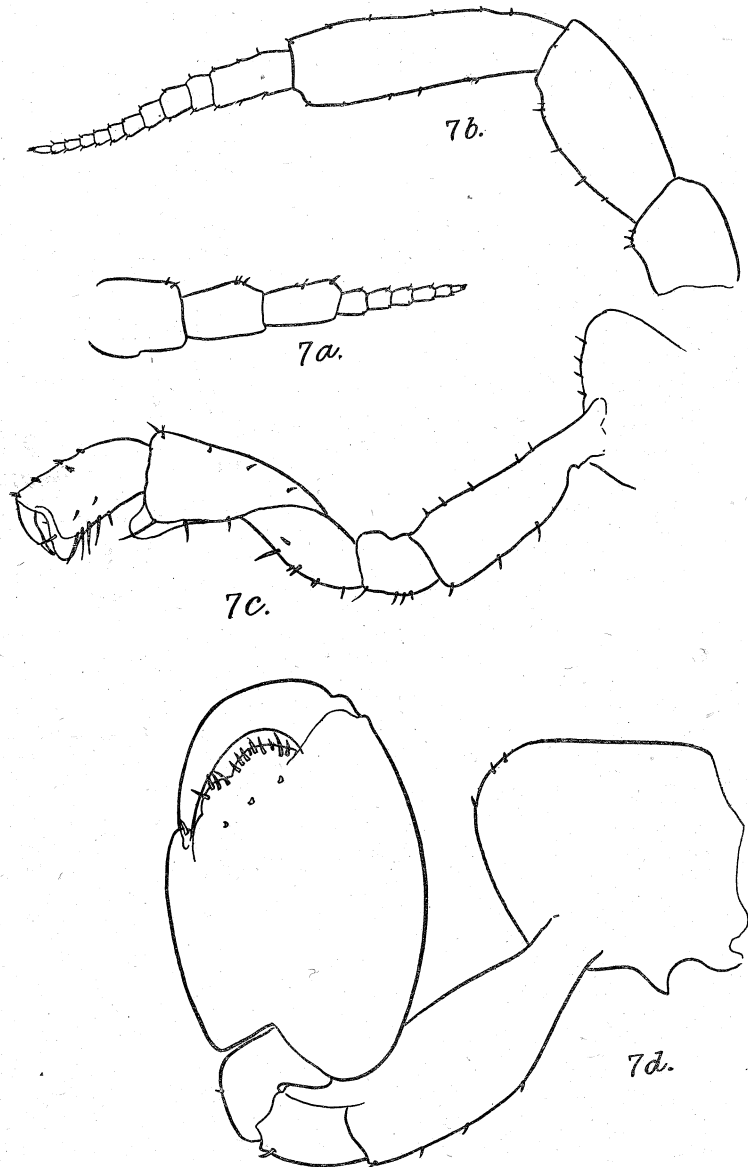


FIG. 7.—*Orchestia platensis*, male.

- | | |
|--------------------|----------------------|
| a. First antenna. | c. First gnathopod. |
| b. Second antenna. | d. Second gnathopod. |

mens. After careful comparison I can find no difference between the Cold Spring Harbor and the Chilka Lake specimens except in the character of the palm of the second gnathopod in the adult male, and I therefore feel pretty confident that the Chilka specimens should be referred to *O. platensis* and that the two species *O. platensis* and *O. pickeringii* will have to be combined. After coming to this

conclusion, I looked up Stebbing's report on the Amphipoda in the Fauna Hawaiiensis, and found that the specimens he had referred to *O. pickeringii* were taken at the same locality, on the same date, and at the same height as specimens he referred to *O. platensis*. He separates these two sets of specimens because of certain points in the number of joints in the second antennae, etc., but I doubt if these are sufficient to be of specific importance. Apparently he had no male specimens of *O. platensis* fully mature and he draws the palm of the second gnathopod evenly convex as it is in most of the Chilka Lake specimens. In his figure too he shows the second antenna more slender than in some of the Chilka Lake specimens, and this again probably indicates that the figure was taken from a male not fully developed and suggests the probability that the specimens he referred to *O. pickeringii* were only more developed examples of the same species.

I have been able to compare the Cold Spring Harbor specimens (*O. agilis*) with a specimen of *O. incisimana* Chevreux from the Mediterranean and agree with Stebbing that both of these should rightly be referred to *O. platensis*. In the Cold Spring Harbor specimens the carpus of the fifth peraeopod is slightly broadened, while in the Mediterranean specimens (*O. incisimana*) it is considerably broader. Apparently no one of the Cold Spring Harbor specimens that I have examined is quite fully developed, for Kunkel states that the merus and carpus of the fifth peraeopod in the adult male are greatly swollen. Stebbing, however, says of *O. platensis* "5th joint of peraeopods 4 and 5 also thick but without great widening," and these joints are not broadened in any of the Chilka Lake specimens. It is probable, therefore, that the broadening of these joints occurs only in very old males and that the animals may reach sexual maturity without any broadening, just as happens in *O. tucurauna* F. Müller and other species.

Chevreux (1908, p. 494) records *O. platensis* Kröyer from the Marutea du Sud and Taravai Islands in the Low Archipelago in the South Pacific. The description he gives of these specimens agrees very closely with those from Chilka Lake. He had been able to compare his specimens with some from Monte Video and states that the indentation in the palm of the second gnathopod of the male is less marked in the Monte Video than in the Mediterranean specimens, while it is hardly noticeable in his specimens from the Low Archipelago and apparently completely absent in those from the Hawaiian Islands referred to *O. platensis* by Stebbing. To this it should be added that the male specimen from the Hawaiian Islands which Stebbing refers to *O. pickeringii* has the palm distinctly divided into two lobes. Walker records *O. platensis* from Mahlosmadulu Atoll in the Indian Ocean; the brief description he gives agrees well with the Chilka Lake specimens. He states (1905, p. 119) that the specimens were obtained at a depth of 20 fathoms, but it is to be presumed that there was some error in the locality label.

Walker says that *O. anomala* Chevreux, from the Seychelles, appears to differ from *O. platensis* only in the averted point of the dactyl of the second gnathopod of the male, but in *O. anomala* the palm is much more oblique and the finger longer,

and Chevreux makes no mention of the thickened character of the second antenna and of the posterior peraeopoda found in typical specimens of *O. platensis*.

[A very abundant sand-hopper all round the lake wherever the shore is sandy. It remains concealed in burrows in the sand, especially under decaying weed, in the heat of the day but is abroad in the evening and early morning. Many animals feed upon it, including a pigmy shrew (*Pachyura hodgsoni*), geckos (*Hemidactylus frenatus* and *H. brookei*) and a dragonfly (*Brachythemis contaminata*), which catches it on the wing as it hops in the evening. We have never found it except on the foreshore. N.A.]

Talorchestia martensii (M. Weber).

(Text-fig. 8.)

Orchestia martensii M. Weber, 1892, p. 564, fig. 13—16.

Talorchestia martensii Stebbing, 1906, p. 553.

Localities:—Barkul, Chilka Lake. "Living in holes in mud under dead leaves and weeds," Dr. N. Annandale, 21-vii-13. Several specimens, in association with *Orchestia platensis*.

Off Barkul, 3-4 ft. One large male.

Satpara, edge of lake. One male, one female.

Barkuda Island. Several.

Specific Diagnosis:—

Male. Pleon segment 3 having postero-lateral corner with produced point. Antenna 1, second joint of peduncle the longest, flagellum shorter than peduncle, 5-jointed. Antenna 2, ultimate and penultimate joints of peduncle subequal and long, especially in fully developed males; flagellum nearly as long as peduncle, with about 20 joints. Gnathopod 1 with carpus much longer than the propod, produced distally into a narrow but well marked lobe; propod very slightly widened distally, distal lobe rounded, slightly shorter than the lobe on the carpus; palm short, concave; finger long, reaching far beyond the rounded lobe. Gnathopod 2 with basal joint and ischium grooved anteriorly for reception of propod when reflexed; the anterior margin of the basal joint with a regular row of about 10 distinct spinules in slight serrations; posterior margin with a smaller number of similar spinules; propod ovate, palm oblique, slightly convex, a little longer than the straight hind margin and marked with a double row of stout spinules, between which the finger lies when closed; a few small spinules on the hind margin; anterior margin convex and free from spinules; finger with inner margin concave near the base, followed by a rounded enlargement, whole inner margin with minute spinules. Basal joints of the 3rd-5th peraeopods well expanded, anterior margin convex, fringed with spinules; posterior margin straight with rounded corners and also fringed with spinules; none of the more distal joints specially enlarged. Telson narrowing towards the extremity, divided by a shallow emargination at the end into 2 small lobes, each bearing 3 spinules at the extremity, 3 or 4 other spinules being placed laterally on the telson itself.

Female. Resembling the male except in the gnathopods and in having the last two joints of the peduncle of antenna 2 less elongated. The first gnathopod differs from that of the male in having the carpus slightly shorter and without the rounded lobe; the propod more than half the length of the carpus, narrowing slightly distally so that there is no palm; finger slender, fully half as long as the propod.

In the second gnathopod, the basal joint is much broadened especially in the middle, having the anterior margin very convex and fringed with a number of short spinules; the carpus has the posterior margin produced into a rounded or somewhat angular lobe and the lobe of the propod extends far beyond the diminutive finger.

Length of body of the largest males, about 10 mm.; the females are slightly smaller, one ovigerous one, however, measured 9 mm.

These specimens agree so closely with the description and figures given by Weber that I have no hesitation in referring them to his species, while the structure of the first gnathopods, the dactyl of the second peraeopod and other characters show that Stebbing was right in transferring the species to the genus *Talorchestia*. The type specimens were taken under stones in and at the margin of the rivulet Lella on the south coast of East Flores in the Malay Archipelago, being found in association with *Orchestia floresiana*, and, as the description of the locality given for that species shows, the specimens were taken near the mouth of the stream, where the conditions would probably be brackish as at Lake Chilka.

In addition to the brief description given above, the following additional description of some of the appendages may be given:—

The length of the *second antennæ* (fig. 8b) varies considerably with the sex and with the stage of development. **In fully developed males they are nearly as long as the body**, the elongation being especially marked in the last two joints of the peduncle. In females and in younger males they are much shorter, often not more than one-third the length of the body. On the inner side the third joint of the peduncle is produced along the side of the 4th joint into a distinct lobe similar to that which is found in *Talorchestia brito* Stebbing; 4th and 5th joints subequal, slender, with spinules; flagellum 20-jointed, rather shorter than peduncle.

The *first gnathopod* of the male (fig. 8c) has the side-plate produced somewhat anteriorly with the lower margin fringed with rather stout spinules; the anterior surface of the basal joint is grooved to receive the distal portion of the limb when reflexed; the carpus is nearly twice as long as the propod and is produced into a narrowly rounded lobe at the postero-distal angle; the propod is only slightly widened at the end, but is produced into the usual narrow rounded lobe; the dactyl is long and slender, reaching far beyond the rounded process of the propod. The various joints are rather plentifully supplied with stout spinules, the distribution of which is shown in the figure (fig. 8c).

In the *second gnathopod* of the male (fig. 8d) the basal joint is of approximately the same breadth throughout except at the narrow base, the anterior margin is serrated and bears a regular row of numerous spinules, some also present on the posterior margin; the propod is large, oval, with the palm oblique, slightly convex,

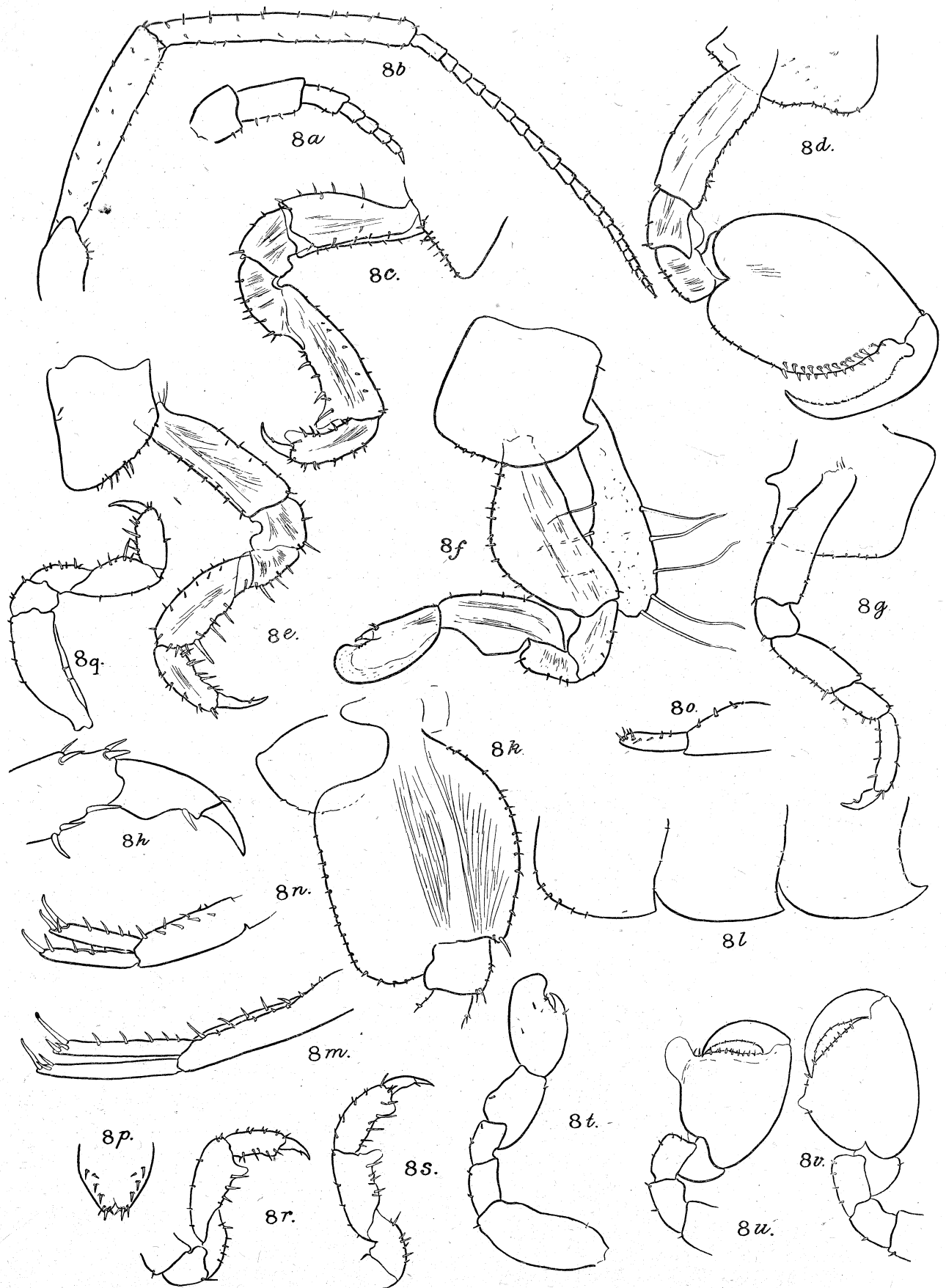


FIG. 8.—*Talorchestia martensii*.

a. First antenna of male.
 b. Second antenna of male.
 c. First gnathopod of male.
 d. Second gnathopod of male.
 e. First gnathopod of female.
 f. Second gnathopod of female.

g. Second pereopod.
 h. Extremity of same, more highly magnified.
 i. Basal joints of fifth pereopod.
 j. Lower margins of pleon segments 1 to 3.

m, n, o. First, second and third uropods.
 p. Telson.
 q, r, s. Three successive stages in development of first gnathopod of male.

t, u, v. Three corresponding stages in development of second gnathopod of male.

not distinctly marked off from the straight hind margin; the palm is armed with two rows of about a dozen spinules each, between which the dactyl fits when closed; the dactyl is long and curved, with a rounded projection on the inner margin near the base, separated from the base by a somewhat deep concavity. The inner margin of the dactyl bears a number of minute spinules.

The *second peraeopod* (figs. 8g, h) is a little shorter than the first, and its dactyl is irregularly shaped, showing an enlargement on the posterior margin towards the base.

In the *third, fourth and fifth peraeopods*, the basal joint is well developed and broad. In the *fifth* (fig. 8k) the anterior margin is convex and bears numerous setules, the posterior margin is straight with the upper and lower corners broadly rounded.

The inferior margin of the three pleon segments (fig. 8l) is rounded anteriorly and in the first segment bears 5 or 6 spinules, while in the second and third segments there are no spinules; the posterior angle in the third is produced into a subacute point and there are a few minute spinules on the posterior margin.

The *uropoda* (figs. 8m, n, o) are of the usual shape. In the first (fig. 8m) the outer ramus bears spinules only at the apex, while the inner has them also on the inner margin; in the third (fig. 8o) the peduncle is longer than the ramus and is somewhat broadened so that the upper margin is convex and bears three spinules.

The *telson* (fig. 8p) narrows to the distal end at which there is a narrow emargination; each lobe bears spinules along the posterior part of its lateral margin and at the extremity.

The female is of about the same size as the male, though specimens bearing eggs are often shorter than the largest males, and have the body rather less slender. The second antennæ are considerably shorter than in fully developed males, the last two joints of the peduncle being much less elongated; in this respect the females resemble the younger males. The differences in the first and second gnathopods are described below.

The *first gnathopod* of the ovigerous female (fig. 8e) has no process on either the carpus or the propod. The propod is shorter than the carpus, being about two-thirds its length and narrows slightly distally, so that there is no trace of any palm. The spinules on the various joints are numerous and rather conspicuous.

In the *second gnathopod* (fig. 8f) the basal joint is greatly broadened, so that the anterior margin is very convex, the greatest breadth being about the middle of the joint, the anterior margin bears numerous spinules; the carpus shows the shape described by M. Weber, with the rounded or somewhat angular enlargement on the posterior margin, and the broadly rounded lobe of the propod extends far beyond the end of the diminutive finger.

As the collection contained numerous specimens of various sizes, I have been able to trace out some points in the development of the gnathopods of the male. In very young specimens, about 6 mm. long, the first gnathopod is almost the same as in the female (fig. 8q), except that the carpus is slightly shorter in proportion to

the other joints and the whole appendage bears fewer spinules; at this stage there is no trace of the rounded lobes on the carpus or propod. In older specimens, about 7-8 mm. long, the rounded lobe on the carpus is fairly well developed (fig. 8r), but there is only a slight indication of the corresponding lobe on the propod. In still older specimens, 9 mm. long, both lobes are apparent (fig. 8s), though not quite so fully developed as in the adult male and the carpus has not yet attained its full length, being only slightly longer than the propod.

In the second gnathopod much greater differences are noticeable as the appendage develops. In a specimen which I take to be a very young male (fig. 8t) it has the same general shape as in the female, with the pellucid rounded lobe of the propod well developed and the finger quite small; the propod is, however, less elongated and broader in proportion than in an adult female.

In a specimen 8 mm. long the appendage has acquired quite a different appearance and resembles that of the mature males (fig. 8u), except that the propod still bears at the postero-distal end a large rounded lobe, evidently corresponding to the one found in the female and in the young male just described. The whole propod, however, is much broadened, and the finger much larger and better developed; the palm is, however, transverse or only slightly oblique.

In another male, 9 mm. long, the lobe on the hinder margin of the propod has almost disappeared, there being left only a small trace of it at the end of the palm (fig. 8v); the whole appendage and particularly the propod has increased in size and the palm is more oblique, so that the characters of the adult male have been nearly acquired.

[Common with the preceding species, but never so abundant. N. A.]

Hyale brevipes Chevreux.

(Text-fig. 9).

Hyale brevipes Chevreux, 1901, p. 400.

Hyale nilssoni (Rathke), var. *kuriensis*, Walker, 1904, p. 238.

Hyale nilssoni (Rathke), Walker, 1905, p. 925.

Hyale brevipes Walker, 1909, p. 337.

Localities:—

Off Samal Island, 8-15 ft. Several specimens, about 7 mm. long.

Off Barkul. Several.

8 miles W. by S. of Breakfast Island. One.

2 to 8 miles N.E. $\frac{1}{2}$ E. of Kalidai. Two.

Ghiakhala Headland and neighbouring island. Several.

Main channel W. of Satpara Island. Several.

These specimens agree well with Chevreux's description except that the antennæ are shorter and the eyes are round rather than pyriform. There is no doubt also that they belong to the same form as the one described by Walker from

Ceylon as *O. nilssoni* (Rathke) var. *kuriensis*, and from Lagoon Minikoi, near the Maldive Archipelago which was afterwards referred by him to *H. brevipes*, Chevreux. They agree with his specimens in most of the points which he mentions as being different from those of the typical *H. nilssoni* (Rathke), a species which has since been united by Stebbing with *H. prevostii*, Milne-Edwards.

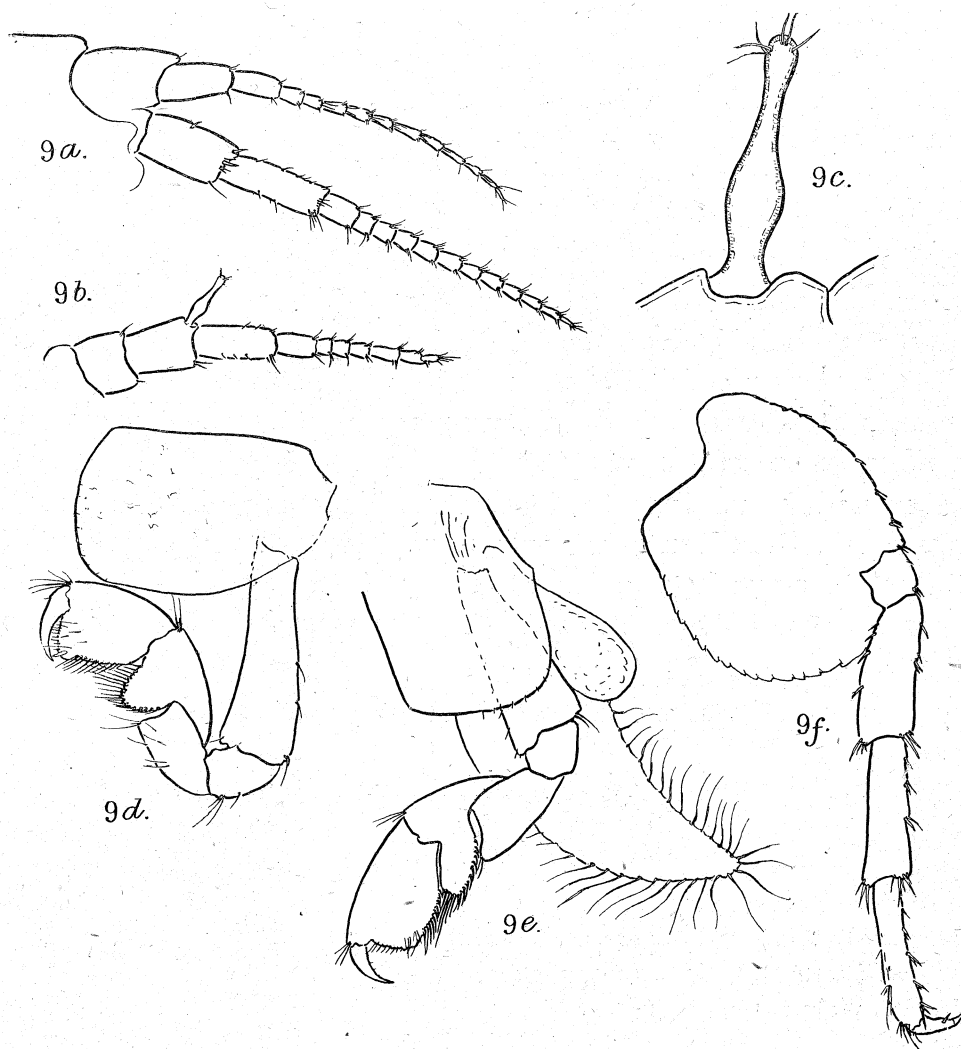


FIG. 9.—*Hyale brevipes*.

- | | |
|--|--------------------------------|
| a. Upper and lower antennæ. | d. First gnathopod of female. |
| b. Abnormal second antenna with appendage. | e. Second gnathopod of female. |
| c. Appendage more highly magnified. | f. Fifth pereopod. |

The following notes had been made before I noticed that Walker had identified his specimens with *H. brevipes* and may be of sufficient value to stand.

I have been able to compare my specimens with European specimens of *H. prevostii*, identified by Mr. Stebbing and Dr. Calman respectively. The chief difference seems to be that in the European specimens the process on the carpus in

the first gnathopod of the male and in both the first and second gnathopods of the female is smaller and narrower than in the Indian Ocean specimens. This is shown by Walker's figure of the first gnathopod of the male of *H. brevipes* and in those which I now give of the first and second gnathopods of the female (figs. 9*d, e*). In the European specimens the setae on the hind margin of the propod form a rather distinct tuft near the middle, while in the Lake Chilka specimens they form a continuous row from the base nearly to the palm; this character is perhaps not constant, for Stebbing describes *H. prevostii* as having the hind margin of gnathopod 1 of male "with spinules from the base to a submedian spine."

Again, in the European specimen the posterior margin of the basal joint of peraeopods 3-5 is described by Stebbing as being smooth, whereas in the Lake Chilka specimens it is distinctly, though not conspicuously, serrated (fig. 9*f*). I find, however, that though the hind margin in the European specimens is on the whole smooth, there are slight indications of serrations on some of the peraeopods.

In the Lake Chilka specimens the palm of the second gnathopod of the male is slightly convex, about the same as in the European specimens, though in the Minikoi specimens, Walker describes it as being "almost straight." Another diagnostic point, not mentioned, however, by Walker, is the presence or absence of setae on the hind margin of the sixth joint of peraeopods 4 and 5. Stebbing describes *H. prevostii* as having a "group of setae and spine at middle of hind margin." In the Lake Chilka specimens there is usually one rather fine seta and sometimes more; on the other hand in the European specimens that I have at my disposal, the hind margin is quite free from setae and spines.

The specimens from the Azores described under the name of *Hyale prevostii* by Chevreux (1908, p. 7, pl. i, fig. 3) seem on the whole to be almost the same as the Chilka Lake specimens. They agree in the points mentioned above for the gnathopoda and also fairly well in the characters specially mentioned by Chevreux in connection with the antennæ, the eyes and the rigid spine on the dactyl of the last five peraeopoda. The eyes in the Chilka specimens are certainly large, especially in the male, and irregularly oval or in some cases almost reniform; the spine on the dactyl of the peraeopoda is also present, but rather less marked than is shown in Chevreux's figure. The Chilka Lake specimens are, however, all smaller than those from the Azores described by Chevreux, none of them being more than 7 mm. in length, while Chevreux's male specimens were as much as 11 mm. long.

In one male specimen examined, the second antenna (figs. 9*b* and *c*) on one side was abnormal; it had apparently been injured and was much shorter than its fellow and had only seven joints in the flagellum and these somewhat irregular. More striking, however, was an abnormal appendage at the upper distal end of the penultimate joint of the peduncle. This looked at first almost like the accessory flagellum of species in which such a flagellum occurs, but was apparently composed of a single joint only, slightly wider towards the base than near the apex, the apex being rounded, slightly enlarged and bearing two or three fine setae. The integument was chitinised like an ordinary joint of the flagellum, and the whole append-

age was nearly half the length of the last joint of the peduncle. The corresponding antenna of the other side was quite normal; it is shown in figure 9a.

Stebbing has united *H. nilssonii* Rathke with *H. prevostii* M.-Edw. (1906, p. 565), but Chevreux (1911, p. 234) does not agree and retains *H. nilssonii* as a separate species though he unites with it *H. stebbingii* Chevreux, which he had previously described as a separate species. Chevreux says *H. prevostii* M.-E. is rather the same as *H. perieri* Lucas which is the commonest species of the genus in Western Mediterranean and accordingly he gives *H. perieri* as a synonym of *H. prevostii* M.-Edw. Stebbing kept *H. perieri* as a distinct species.

[A common bottom species in the main area. It also has the habit of congregating in enormous numbers on the upper surface of masses of drifting weed (*Potamogeton pectinatus*), to which it clings by means of its peraeopods, as a rule lying on one side. In this position it feeds on the minute algae, vorticellid Protozoa and Polyzoa (*Membranipora hippopus*) with which the weed is usually covered. N.A.]

Grandidierella magna (Giles).

(Text-fig. 10.)

Microdeutopus magna Giles, 1888, p. 243, pl. 7, figs. 1-4.

Microdeutopus magna Stebbing, 1906, p. 592.

Grandidierella mahafalensis Coutière, 1904, p. 173, with text-figs.

Grandidierella bonnieri Stebbing, 1908, p. 119, pl. vi.

Localities:—

Off Samal Island, 8-15 ft., 22-ix-13. Several.

Off Satpara, 4-5 ft., 17-ix-13. Several, immature.

Off Barkul, 3-4 ft., 21-vii-13. One, female.

Off Barkul, at edge of lake, 21-vii-13. One male (form 1), one female, 2 immature.

Barkul, 18-iv-05. Several, male (form 1) and female, many immature.

Adyar River, outskirts of Madras. 3-4 ft. One male (form 1) and females.

East side of Rambha Bay. Three.

6 miles S. S.W. of Kalidai. Male (form 2) and female.

3-2 miles S.E. by E.½E. of Patsahanipur. Several.

5-7 miles E. by N. of Patsahanipur. Several.

1 mile E. by N. of Patsahanipur. Several, male (form 2) and female.

2-6 miles E. by S.½ S. of Patsahanipur. Several, male (form 2) and female.

4 miles N. E.½E. of Kalidai. Many, mostly immature.

This species has given rise to much consideration. The first specimen that dissected and examined was easily seen to agree closely with the description given by Giles of *Microdeutopus magna*, a species that Stebbing in 1906 retained under the genus *Microdeutopus*. This specimen was a male, somewhat immature, and the stage appears to correspond pretty well with the one actually described by Giles. In the first gnathopod the carpus bears on its posterior margin a small tooth which was either absent from Giles' specimen or not observed by him. Giles had com-

pared his species with *Microdeutopus gryllotalpa*, *M. websteri* and other species of the genus. The small tooth on the posterior margin of the carpus in my first specimen is quite like the one figured by Sars in *M. propinquus* and at first sight seemed to confirm the affinity of this species to *Microdeutopus*. At the time I had not looked up Stebbing's description of *Grandidierella bonnierii*, but on doing so afterwards found that the species, of which I was then about to examine further specimens, agreed very closely in the characters both of the male and the female with Stebbing's description and figures, and I feel confident that his species is the same as *Microdeutopus megnæ* Giles. Stebbing referred his species to the genus *Grandidierella* which had been previously established by Coutière for a specimen from Madagascar, and following Coutière placed the genus under the Corophiidae. The general resemblance of the animals to *Microdeutopus* and to *Aora* is so great that in my opinion the genus should be placed under the Aoridae. The third uropods certainly are one-branched, but I do not consider this sufficient to outweigh the resemblance in all the other characters which, as will be seen from the following description, is very close. Stebbing distinguished his species from Coutière's by (1) the difference in the accessory flagellum in the first antenna and (2) the different proportions of the carpus of the first gnathopod of the male. From the examination of a large series of specimens I find that the accessory flagellum, though fairly distinct and perhaps sometimes nearly as long as the first joint of the main flagellum in immature specimens, becomes reduced in more adult ones to a minute lobe with one or two setae; Stebbing describes it in his specimens as being "microscopically small but carrying one or two setules." It will be seen also from the description given below that the shape and proportions of the carpus of the first gnathopod of the male vary very considerably during development, and in fully matured males the proportions come very close indeed to those given by Coutière, and I therefore consider his species a synonym of *Grandidierella megnæ* (Giles). In this species the proportions of the antennæ vary according to age much as they do in the genus *Aora*. Figure 10a shows the antennæ of an immature male; the antennæ are seen to be subequal, the upper pair a little longer than the lower; the second joint of its peduncle is considerably longer than the first and narrower, all three joints of the peduncle being fringed below with long setae; the flagellum consists of 15 fairly slender joints, the accessory flagellum being rather more than half the length of the first joint. The lower antenna is somewhat stouter than the upper and similarly fringed with long setae. In more adult males the second joint of the flagellum of the upper antenna (fig. 10b) becomes more elongated, the first joint being stouter in comparison and the third slightly shorter in proportion, the flagellum is greatly elongated and more slender, the accessory flagellum being reduced to a minute lobe. The peduncle, as will be seen from the figure, bears very few setae, a small group at the end of the first joint on the lower side being the most conspicuous. The lower antennæ in the adult male (fig. 10c) become very stout and pediform with the last two joints of the peduncle almost free from setae. The flagellum consists of about five joints only and bears a number of stout curved spines which are hardly deve-

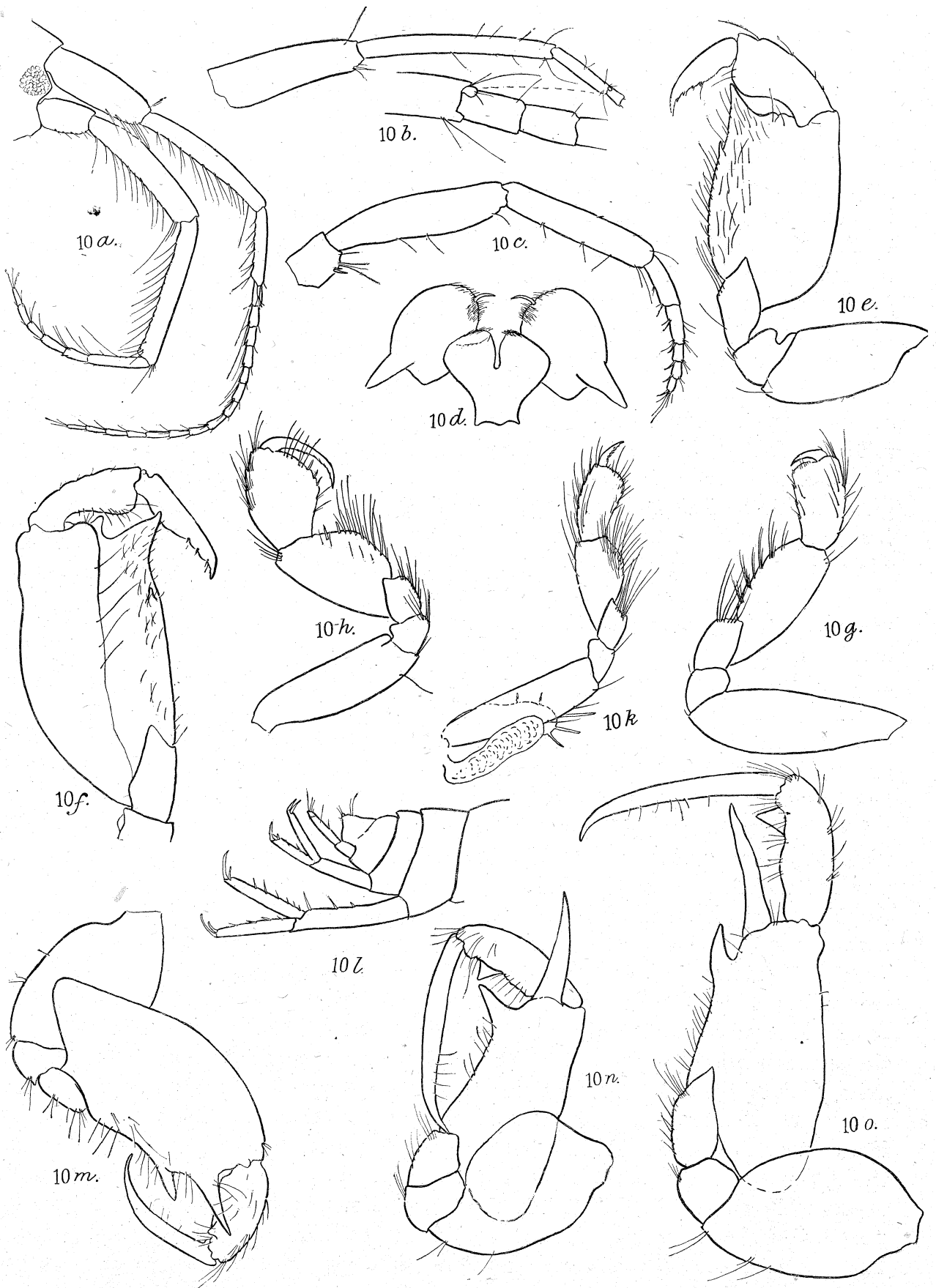


FIG. 10.—*Grandidierella magna* (Giles).

- a. Anterior portion of head of an immature male with antennae.
 b. Peduncle of upper antenna of older male with basal portion of flagellum more highly magnified.
 c. Lower antenna of older male.
 d. Lower lip.
 e. First gnathopod of male (form 1), somewhat immature.
 f. First gnathopod of male (form 1), more mature.
 g. Second gnathopod of male.
 h. First gnathopod of female.
 i. Second gnathopod of female.
 j. Terminal portion of body with uropods and telson.
 k. First gnathopod of male (form 2), somewhat immature.
 l. First gnathopod of fully developed male (form 2), in flexed position.
 m. The same, extended to show separate joints.
 n. First gnathopod of male (form 2), somewhat immature.
 o. The same, extended to show separate joints.

loped in the more immature forms. Figure 10b represents the upper antenna of a male whose first gnathopod is shown in fig. 10e, a male which I consider to be not quite fully mature; in older males the characters of the antennæ are still more pronounced.

The mouth parts have already been described and figured by Stebbing and do not call for detailed description. The outer lobes of the lower lip (fig. 10d) bear on their strongly convex margin a number of fine setules, one of which is much stouter than the rest and is divided distally, giving an appearance as if several of the setae had fused at the base.

The gnathopoda of the male of this form have been described by Coutière and Stebbing and are shown in figs. 10e, f, g.

The gnathopods of the female are shown in figs. 10h and k, corresponding very closely with the description and figures given by Stebbing. The first gnathopod is of the same general structure as the second but considerably stouter; the carpus is wide with its posterior margin strongly convex and setose; the propod widens distally, the palm being somewhat oblique and the finger is elongated and strongly curved towards the apex, its inner margin being serrate.

The peraeopoda do not require detailed description. The posterior pairs, especially the fifth, become greatly elongated in fully adult specimens, especially in the males.

The uropoda (fig. 10l) are closely similar to those of *Aora* except that the third one has only one branch. This branch is about twice as long as the peduncle and does not extend beyond the end of the second uropod.

The telson is broadened above and on each side ends in a sharp curved tooth with one or two slender setules. It closely resembles that of *Aora typica*.

Besides the form described above there appears to be another form of the male with differently shaped first gnathopods. As already stated, in immature males of the first form there is often found a small tooth on the posterior margin of the carpus as shown in fig. 10e. In the usual form of male this tooth is not further developed, but the carpus becomes massive and more elongated and the finger thickened as shown in the figure given by Coutière. In other forms, however, the tooth becomes much more elongated and prominent and the postero-distal angle of the carpus develops into a long pointed tooth, the base of which occupies nearly the whole of the palm; at the same time the antero-basal corner of the carpus becomes produced backwards into a well marked rounded lobe, overlapped on the outer side by a wide flange developed on the basis. These points are shown in fig. 10m, which is a fairly young male of this second form. It will be seen that there is scarcely any palm on the carpus, that the propod is somewhat narrowed at the base, widening afterwards and that it bears on its posterior margin a stout triangular tooth about one-third of its length from the apex. The finger is long, not greatly thickened, ending acutely and overlapping the tooth on the posterior margin of the carpus. The subsequent development of this appendage can be seen by comparing figures 10n and o, with fig. 10m. Fig. 10n shows the limb folded up, when it is difficult to distinguish the

different joints. In fig. 100 these have been partially separated so as to display them more clearly. The basis has become very greatly broadened, more than half as broad as long, this being mainly due to a flange on the outer side which appears to be for the purpose of receiving and covering the more distal part of the limb when bent back upon it. The ischium and merus are short and thick. The carpus has become much more elongated, with its antero-basal angle more produced backwards; distally it narrows, the tooth on the posterior margin is much more developed and projects out at an angle to the general plane of the carpus, while the postero-distal tooth is very greatly elongated, being nearly as long as the propod and projecting from the carpus at a different angle. The propod is narrowed, the tooth on its distal margin very prominent, while the finger is greatly elongated and narrow ensiform in shape, being much longer than the propod. The setules on the gnathopod are much fewer and less conspicuous than in the more immature forms, the finger for example bearing only a few on its concave surface. It will be seen from fig. 101, that this fully developed gnathopod forms a very efficient grasping organ, the propod and finger being capable of being bent back so that the finger reaches the merus.

[Common at the edge of the lake under stones and also just above the bottom in muddy water off shore. N. A.]

Grandidierella gilesi sp. nov.

(Text-fig. 11.)

Localities :—

Off Samal Island, 8-15 ft. One male, two females.

Off Satpara, 4-5 ft., 17-ix-13. Five females.

8 miles W. by S. of Breakfast Island. Two males, one female.

Off north shore of Samal Island. Three females.

Barkul Point. One male.

Satpara Bay. One male and one female.

Specific Diagnosis.

In general shape of the body, antennæ, peraeopods, etc. resembling *G. megnae*, but differing markedly in the gnathopods. In the male the first gnathopod (fig. 11a) is complexly subchelate, having the carpus greatly dilated; the basal joint is broad but not specially dilated, the ischium and merus are short, the latter bearing on its hind margin a fringe of long plumose setae; the carpus is very large, oval, but having the postero-distal angle produced into a sharp tooth; on the palm between this tooth and the base of the propod is a triangular projection; the hind margin of the carpus bears a very distinct fringe of long plumose setae and there is another slightly oblique row on the surface of the joint; the propod is narrow at the base, widening slightly distally and bears an oblique row of long plumose setae; the finger is strong, slightly curved and, with the propod, can be bent over to meet the distal tooth of the carpus. The description of the first gnathopod just given applies to a moderately mature male; in older specimens (fig. 11b) the carpus is somewhat more developed, the triangular process on its palm larger and irregular and the inner or posterior margin

of the propod is irregular, the central portion being produced into a blunt triangular tooth; the finger is much longer and has a projection on its outer margin near the base; the setae on the merus are still numerous, but there are comparatively few on the three terminal joints.

In the female the first gnathopod (fig. 11c) is of more normal shape and scarcely subchelate, the carpus is broader than the propod but not produced into a distal tooth, the propod is oblong about as long as the carpus; the four distal joints bear numerous long plumose setae as shown in the figure.

The second gnathopod in both sexes (fig. 11d) is somewhat similar to the first gnathopod of the female but more slender and has the merus produced distally into a lobe or scoop, something like that in *Paracorophium excavatum* G. M. Thomson, but much shorter; the length of this projection varies according to the develop-

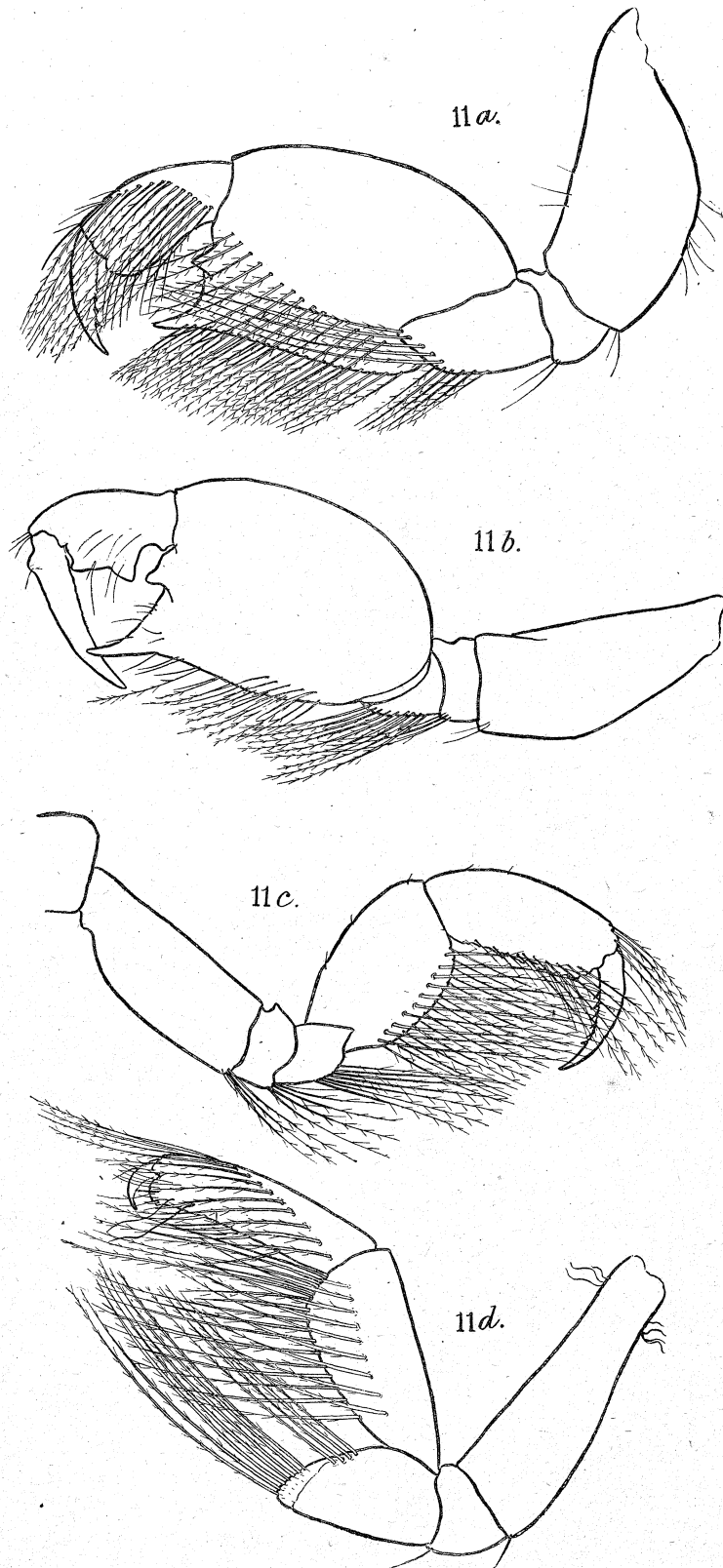


FIG. 11.—*Grandidierella gilesi*.

a. First gnathopod of male, somewhat immature.
b. First gnathopod of mature male.

c. First gnathopod of female.
d. Second gnathopod of male.

ment; the carpus and propod are similar to those of the first gnathopod of the female and are similarly armed with long plumose setae but they are considerably more slender.

The third uropod has only one branch as in *G. magna* but in old specimens this branch becomes somewhat more elongated than in that species.

Colour. Light yellow with dark patches or reticulate markings, particularly on the dorsal surface.

Length of body, about 7 mm.

The general resemblance of this species to *G. magna* is so great that I place it in the same genus. In the long plumose gnathopods it somewhat resembles *Xenochaira* Haswell, a genus which Chevreux rightly places in the Aoridae, but in *Xenochaira* the terminal uropoda are two-branched.¹

Photis longicaudata (Bate and Westw.).

(Text-fig. 12.)

Eiscladus longicaudatus Bate and Westwood, 1862, Vol. I, p. 412 (text-fig.).

Photis longicaudata Stebbing, 1906, p. 608.

Photis longicaudata Walker, 1904, p. 286, pl. vi, fig. 43.

Photis longicaudata Walker, 1909, p. 339.

Photis longicaudata Barnard, 1916, p. 243, pl. 28, fig. 26.

Photis longicaudata Chevreux, 1910, p. 249.

Locality. Middle of lake N.E. $\frac{1}{2}$ E. of Kalidai. A few small specimens, taken in midwater.

These specimens are small, only about 3mm. in length, and I think they are the same as those of the same size referred to this species by Walker from the west coast of Ceylon. Barnard has recorded the species from Natal and other localities in South Africa, and has given a description of his specimens. The Chilka Lake specimens agree on the whole with Barnard's description, but have the ocular lobe shorter and the antennæ with fewer joints in the flagellum. The gnathopods (figs. 12*a*, *b*) are slender and agree rather with the figure given by Walker than with that given by Barnard, there being no sign of the "blunt nodiform tooth just below the apex of the emargination on the inner surface of the palm" in the second gnathopod; the carpus in the second gnathopod is produced into a narrow process extending nearly half way along the hind margin of the propod, being apparently considerably longer and narrower than in Walker's specimens. The uropods in the small Chilka Lake specimens have the branches almost free from setae.

¹ I do not feel confident that *Grandidierella magna* and *G. gilesi* can be retained in the same genus, but I am not attempting at the present-time to discuss the validity or the affinities of the genus *Grandidierella*. The species *Hansenella longicornis*, for which Chevreux established the genus *Hansenella* in 1909, presents many resemblances in its appendages to *Grandidierella magna*. Chevreux says that *Hansenella* is very close to *Microdeutopus* and it has the third uropod two branched as in the genus, but in *Hansenella* the first gnathopoda of the female have quite the same aspect as the corresponding appendages in the males of *Microdeutopus* and of *Grandidierella*.

In recording his specimens of *Photis longicaudata* from Ceylon Walker stated that they were remarkably variable and it was a question whether that species should not be merged with others in the oldest recorded form, *P. reinhardi* Kröyer. At the same time he described a new species, *P. longimanus*, characterised mainly by the short stout second gnathopod and the structure of its carpal joint and the oval lobe arising from it. Later on Stebbing described a new species *P. dolichommata* from the east coast of Australia which appears to be closely related, but is distinguished by the greater length of the ocular lobes and by the more numerous jointed flagella of the antennæ and the setose furniture of the limbs, etc. Barnard has since recorded *P. longimanus* Walker from Durban Bay, South Africa, but has pointed out various characters in which his specimen differed from Walker's description, describing also a form he considers to be an immature male which shows characters nearer to those of Walker's specimens. But for this intermediate form Barnard says that he would have felt bound to make a new species of his other Durban specimens. Barnard also records *P. dolichommata* Stebbing from Cape St. Blaize, South Africa.

It seems likely from these facts that in the genus *Photis* we are dealing with forms that are very variable and that as new specimens are found, it will be increasingly difficult to divide them into separate species.

The species *P. longicaudata* as understood above is widely distributed in the North Atlantic, Mediterranean, Indian Ocean and at South Africa.

Corophium triaeonyx Stebbing.

Corophium triaeonyx Stebbing, 1904, p. 25, pl. 6a.

Locality. Manikpatna, 16-ix-13, 4ft. "Tubicolous Amphipoda from oyster shell." Several specimens.

These specimens undoubtedly belong to Stebbing's species from Ceylon. They agree well with his description and figures and also with a co-type that Mr. Stebbing has been good enough to send me. In the male the second antennæ agree closely with that of *C. crassicorne* Bruz., a species which is common in Europe, etc. It is doubtful whether *C. triaeonyx* is more than a local variety of *C. crassicorne*, but the third uropods are considerably narrower than in the latter species.

Walker (1904, p. 294) has recorded *C. crassicorne* Bruz. from Perija Paar Kerrai,

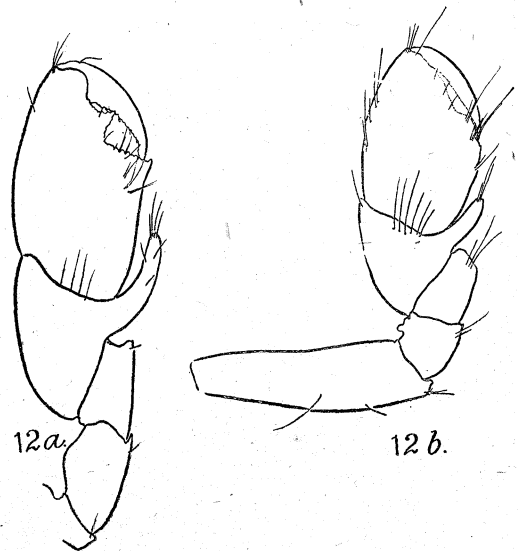


FIG. 12.--*Photis longicaudata*.
a. Second gnathopod of male.
b. Second gnathopod of female.

Ceylon, remarking that the only difference observed between his specimens and the European form was that there are two spines on the third joint of the lower antennæ in the female instead of one. Later on he recorded the same species from Suez without comment; the name was printed in the text as *C. bonnellii* M.-Edwards (1909, p. 343) but has been corrected to *C. crassicorne* Bruz. in the author's handwriting in the separate copy he was good enough to send me. *C. crassicorne* Bruz. also occurs in New Zealand.

[Only found on oyster shells in the beds at Manikpatna in the outer channel of the lake. It inhabits small tubes made of fragments of filamentous algae agglutinated together. N. A.]

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