LITTORAL COPEPODA FROM SOUTH AUSTRALIA
(1) HARPACTICOIDA

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Fig. 1–23.

The collection of littoral copepods in the South Australian Museum has been sent to me for examination, and I am indebted to the Director of the Museum, Mr. H. M. Hale, for this opportunity of studying them.

This collection comprised 15 tubes, divisible into two categories: A, samples taken by townet; and B, shore collections and dredgings. One of the former was taken at night, a light being used to attract animals, and so might be expected to contain bottom-living as well as planktonic forms. All of the collections were made in South Australia in the region of St. Vincent and Spencer Gulfs, with one exception from a salt lake at Beachport, with which we are not concerned at present.

The samples listed below, although divided into the two categories mentioned, are numbered consecutively, and these numbers are used in defining the occurrences of each species described.

A. Townettings.

I. Smith Bay, Kangaroo Island, from 8.0–8.15 p.m., 15/3/38; contained *Calanopia thompsoni* only.

II. Western Shoal, on the west side of Spencer Gulf, at 8.30 p.m., 20/2/38 (Calanoids and Harpacticoids), by K. Sheard and F. W. Moorhouse.

III. Blanche Harbour, at the north end of Spencer Gulf, 8.30 p.m. 8/3/38, by K. Sheard. (Mainly Calanoids, a few Harpacticoids.)

IV. Wallaroo Harbour, on the east coast of Spencer Gulf, at 8.15 p.m., 26/2/38. "Light shone on water from deck for 7 minutes, then townet hauled vertically." (Mainly Calanoids and one Peltidiid.)

V. Spencer Gulf, Eastern Shoal, mid-day haul, 4/3/38. (Calanoids only.)

VI. Beachport, on south-east coast of S. Australia, from a salt lake. (Calanoids and Ostracods only.)

B. Shore Collections and Dredgings.

VII. Moonta Bay, Spencer Gulf, from a weed-covered reef exposed at very low tide; coll. B. J. Weeding, Feb., 1939. (*Calanopia thompsoni*, Peltidiids, Laophontid, *Amphiascus* sp.)

VIII. Port Willunga, from southern face of reef in one fathom at low tide; coll. H. M. Hale and K. Sheard, 17/1/37. (Peltidiid.)

IX. Sellick Beach, to the south of Port Willunga, from a stone in five feet of water at low tide on south edge of reef; coll. H. M. Hale, 31/1/37. (*Calanopia thompsoni*, many Harpacticoids and some Cyclopoids.)

X. Sellick Beach, from Cambrian Rocks in one fathom at low tide; coll. H. M. Hale, 13/2/37. (Numerous Harpacticoids and Cyclopoids.)

XI. Sellick Beach, at low tide; coll. H. M. Hale, 25/3/39. (Numerous Harpacticoids and Cyclopoids.)

XII. Sellick Beach, coll. K. Sheard, April, 1939. (Numerous Harpacticoids and Cyclopoids.)

XIII. Sellick Reef, coll. K. Sheard, April, 1939. (Some Calanoids, numerous Harpacticoids and Cyclopoids.)

XIV. Spencer Gulf, washed from dredgings, March, 1938. (*Calanopia thompsoni*, Harpacticoids and Cyclopoids.)

XV. Reevesby Island, Sir Joseph Banks group on the western side of Spencer Gulf. (One Notodelphyoid, from east coast of island; coll. H. B. Cotton, 7/12/36.)

Dissections have been made of all the species described in the following pages, and the preparations have been deposited in the South Australian Museum. Picro-indigo-carmine was used for staining in every case, and Monk's (1938) Medium and Euparal for mounting. This method is very convenient, and the stain is most effective for chitin, as stated by Monk.

I am indebted to Mr. K. Sheard, of the South Australian Museum, for valuable advice and help in nomenclatorial matters, in which connection I have also received assistance from Professor G. E. Nicholls, of the University of Western Australia, to both of whom I offer my best thanks. It is a pleasure here to express my thanks to the Trustees of the Science and Industry Endowment Fund for a grant enabling me to purchase a dissecting microscope, which has been of the greatest use in carrying out this work.

NOTES ON THE DISTRIBUTION OF SPECIES.

There is little to remark upon concerning the distribution within the area from which the collections were made, since all those from the shore, where Harpacticoids are more abundant, were taken in a comparatively small region extending for about 10 miles or so along the coast, about 30 to 40 miles south of Adelaide.

The distribution of those species which have previously been recorded is, however, of interest. In general, the Harpacticoid fauna of this region shows a re-

lationship with that of Ceylon and the Malay Archipelago, the Red Sea, Mediterranean, and even the Bermuda region, which Willey (1930, p. 113; and 1935, p. 98) has shown to be affiliated with that of the Red Sea and Suez Canal.

This is particularly exemplified by the occurrence in this region of such forms as *Longipedia coronata*, *Peltidium speciosum*, *Porcellidium fimbriatum* and *P. acuticaudatum*, *Phyllothalestris mysis*, *Amphiascoides intermixtus*, *Laophonte cornuta*, *Ceyloniella armata* and *Metis jousseaumei*.

On the other hand there is also a relationship with the more southern islands, such as New Zealand and Kerguelen, as shown by the occurrence of *Altcutha signata* and *Porcellidium australe*, described from Kerguelen and *Porcellidium fulvum* from New Zealand.

FAMILY LONGIPEDIIDAE Sars 1903.

Genus LONGIPEDIA Claus 1863.

The genus comprises seven species, to which is added an eighth from this collection.

KEY TO THE FEMALES.

1. End segment of second endopod with 2 inner spines and 1 outer spine .. 2.
   End segment of second endopod with 2 inner spines only, *longispina* Monard 1928.
2. End segment of second endopod with first inner spine the most proximal .. 3.
   End segment of second endopod with outer spine the most proximal .. 6.
   End segment of second endopod with first inner spine exactly opposite the outer spine .. .. *rosea* Sars 1903.
3. Caudal rami as long as wide .. .. 4.
   Caudal rami half as long again as wide .. .. 5.
4. End segment of second endopod 3 times as long as two basal segments together; anal operculum with 4 denticles on each side of median spine, which extends beyond the caudal rami .. .. .. *minor* T. & A. Scott 1893.
   End segment of second endopod 4 times as long as two basal segments together; anal operculum with 2 denticles on each side of median spine, which extends beyond the caudal rami .. .. *weberi* A. Scott 1909.
5. Fifth leg with 1 terminal and 4 outer setae; anal operculum with long median spine extending beyond caudal rami and 2 lateral denticles and a fine hair on each side .. .. *coronata* Claus 1863.
   Fifth leg with 3 inner, 2 terminal and 2 outer setae; anal operculum with short median spine and 2 lateral spines as long as median spine and a fine hair on each side .. .. *brevispinosa* Gurney 1927b.
6. Fifth leg twice as long as wide; caudal rami as wide as long; anal operculum with median spine extending beyond caudal rami and with 1 large and 4 small denticles on each side .. .. *scotti* Sars 1903.
   Fifth leg 2·7 times as long as wide; caudal rami half as long again as wide; anal operculum with median spine extending beyond caudal rami and with 1 large and 3 small denticles and a fine hair on each side .. *australica* sp. nov.

LONGIPEDIA CORONATA Claus.

Occurrence: III, 2 females; XII, 1 female.

Distribution: Widely distributed on the shores of the North Sea, North Atlantic, Mediterranean, and Suez Canal, also taken at Ceylon, Nicobar Islands, Chilka Lake, and Malay Archipelago.

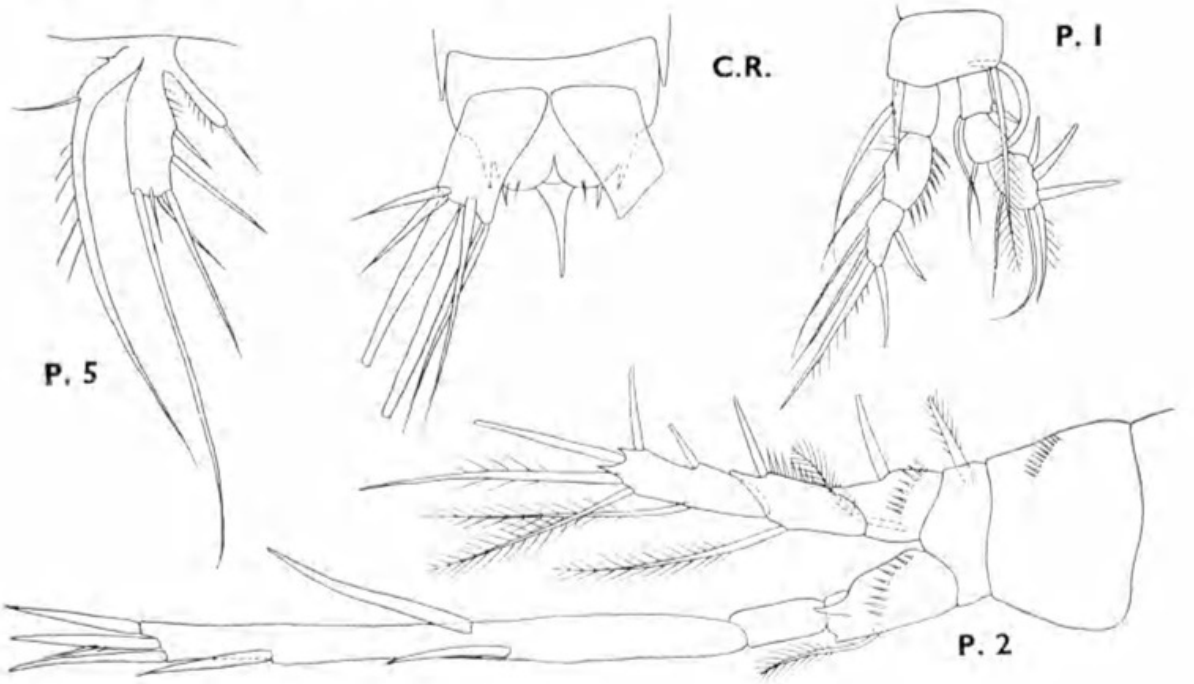

Fig 1. *Longipedia coronata* Claus, female.

This species is very variable, as has been shown by Gurney (1927b), and the specimens taken in these collections differ slightly from other forms (fig. 1), but there is little doubt that they should be referred to this species.

The most variable feature is size, which ranges from 0·56 mm. to 1·3 mm.; specimens found here measured about 1 mm.

LONGIPEDIA AUSTRALICA sp.nov.

Occurrence: II, 2 females; XII, 2 females, 1 male; XIV, 1 female.

Female: Length 1·1 mm. to 1·3 mm. This form resembles *L. scotti* in many respects, and might well be referred to that species but for some striking differences in the male. In the female the chief difference is in the shape of the fifth leg. The armature of the operculum is much as in *scotti*. The relative position of the spines on the end segment of the second endopod is somewhat different in *australica*, but in another specimen examined the positions were such as in *scotti*. The inner seta on the basal segment of the second endopod is quite short in *scotti*, and of a much greater length in the species found here (fig. 2).

The shape of the fifth leg in the form described as *L. scotti* Sars, by A. Scott (1909) and the very much longer setae, both on the basal segment of the second endopod and on the fifth leg, suggest that Scott's form is referable to the species described here. It is necessary that the male of his species should be found to be certain.

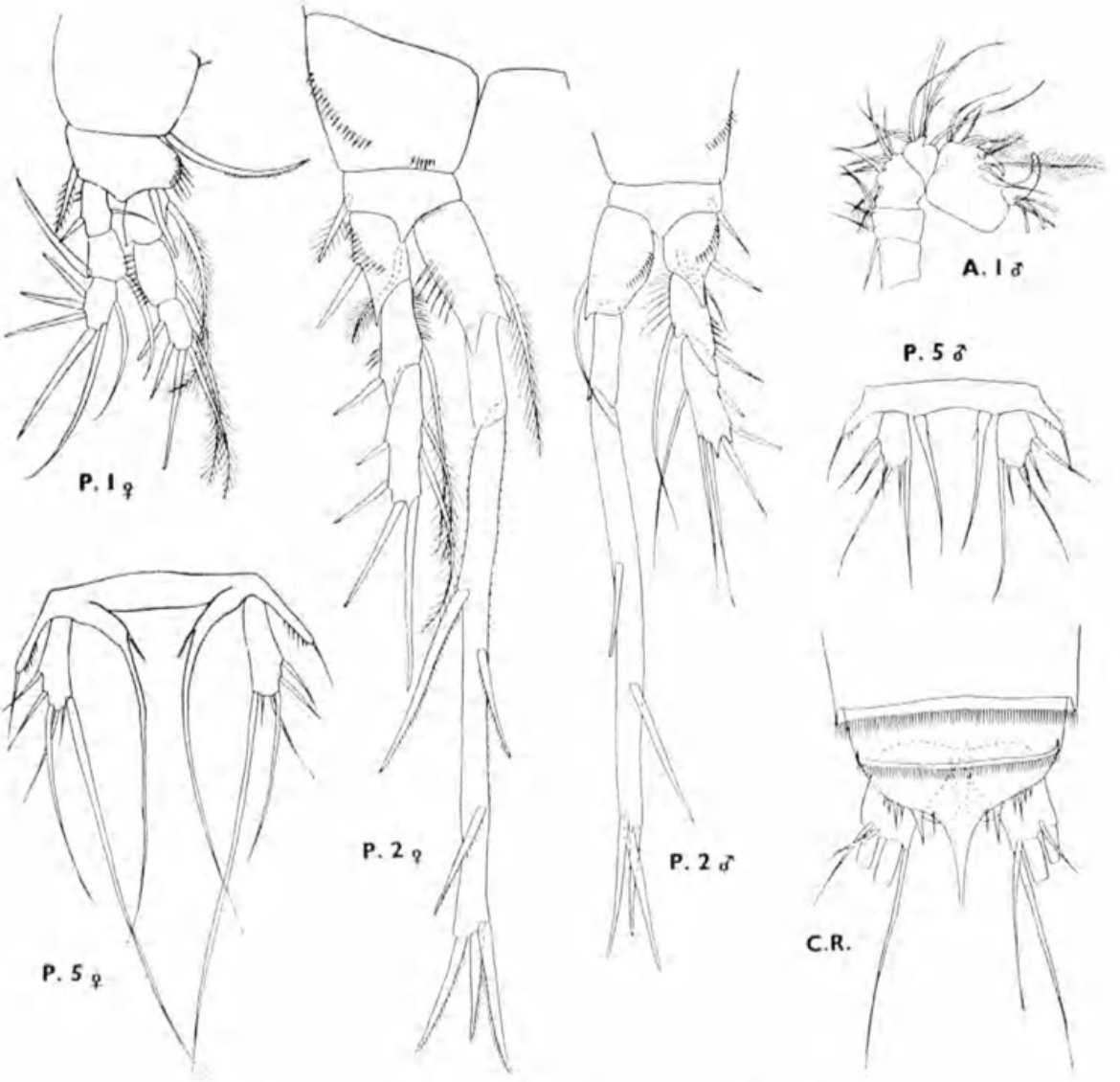

Fig. 2. *Longipedia australica* sp. nov., male and female.

Male: Length 0·96 mm. In the first antenna the swollen fifth segment is almost as wide as long, and bears several hook-like spines on its outer margin. These were not seen in *scotti* (Nicholls, 1935, p. 43), and the fifth segment is half as long again as wide. The better development of the setae on the basal segment of the second endopod and fifth legs also forms a distinctive feature of this species.

In the males of this genus the long segment of the second endopod bears only two spines (*coronata* appears to be an exception), and it is worth noting that in both *scotti* and *australica* it is the outer spine which disappears.

FAMILY PELTIDIIDAE Sars 1904.

The family is represented here by three genera, *Alteutha*, *Peltidium* and *Parapeltidium*. Numerically the material is very rich.

Lang (1936e, p. 30) suggests that *Dactylopusia platysoma* Thompson and Scott (1903) is a Peltidiid and not a Thalestrid, but if it is excluded from the latter family by the swimming legs and flattened body it is equally excluded from the *Peltidiidae* by the first legs. It appears to be intermediate and should perhaps be placed in a separate family.

The genus *Parapeltidium* was established by A. Scott (1909) for one specimen which differed from *Peltidium* in the possession of a narrow endopod to the first legs and in having the two segments of the fifth leg completely fused. As regards the first endopod this condition is regarded as being a male characteristic (see below), and has therefore no taxonomic value. The highly chitinized, fused fifth legs may be distinctive, and were found in two of the species taken here, which have, therefore, been assigned to *Parapeltidium*. The 5-segmented first antenna of *Parapeltidium johnstoni* Scott is not of generic value either, since it finds a parallel in *Peltidium aurivillii* (Cleve).

KEY TO PELTIDIDAE.

1. Body with anastomosing chitin bands .. .. 2.
   Body without such bands .. .. 3.
2. Fifth leg 2-segmented .. .. .. *Peltidium* Philippi 1839.
   Fifth leg 1-segmented .. .. .. *Parapeltidium* A. Scott 1909.
3. First endopod 3-segmented . .. . 4.
   First endopod 2-segmented . .. . 5.
4. Fifth leg 2-segmented; first exopod with 2 or more terminal claws.
   Alteutha Baird 1845.
   Fifth leg 1-segmented; first exopod with single large terminal claw.
   Alteuthella A. Scott 1909.
5. Rami of first leg subequal .. .. 6.
   Exopod of first leg twice as long as endopod .. .. *Eupelte* Claus 1860.
6. Basal segments of first leg linear, at right angles, rami long and slender.
   Paralteutha T. Scott 1912.
   Basal segments of first leg as wide as long, rami short and stout.
   Eupeltidium A. Scott 1909.

ALTEUTHA Baird 1845.

The following species have been assigned to this genus:

aberrans Czerniavski 1868,
austrina T. Scott 1912,
depressa Baird 1845,
dubia T. Scott 1912,
interrupta (Goodsir) 1845,
messinensis Claus 1863,
nana Brady 1910,
novae-zealandiae (Brady) 1899
purpurocincta Norman 1868,
sarsi Monard 1924,
signata Brady 1910,
triarticulatum (Haller) 1879,
trisetosa Lang 1936e,
typica Czerniavski 1868,
villosa Brady 1910.

Of these *triarticulatum* (Haller) is insufficiently described; of *aberrans* and *typica* I have not seen the descriptions, and these species are therefore not included in the key given below. According to Monard (1935a, p. 73) *typica* is probably a synonym of *messinensis* Claus. *A. villosa* Brady should clearly be transferred to Scott's genus *Paralteutha*.

Acording to Sars (1911, p. 365) the species described by him (1904) as *depressa* Baird should have been identified as *purpurocincta* Norman, and since I have not seen Baird's original description, *depressa* has also been left out of the key.

KEY TO ALTEUTHA FEMALES.

1. Size 0·4 mm. .. .. *nana* Brady 1910.
   Size at least 0·6 mm. .. .. 2.
2. Exopod of second antenna 2-segmented .. .. 3.
   Exopod of second antenna 3-segmented .. *messinensis* Claus 1863.
3. Basal segment of fourth exopod with inner seta .. .. .. 4.
   Basal segment of fourth exopod without inner seta .. .. .. 7.
4. End segment of fourth exopod with 2 outer spines. *novae-zealandiae* (Brady) 1899.
   End segment of fourth exopod with 3 outer spines .. .. .. 5.
5. First antenna 7-segmented . .. . *spinicauda* sp.nov.
   First antenna 8-segmented . .. .. *interrupta* (Goodsir) 1845.
   First antenna 9-segmented . .. . 6.
6. Distal segment of fifth leg 3 times as long as wide .. *signata* Brady 1910.
   Distal segment of fifth leg twice as long as wide .. *sarsi* Monard 1924.
7. Middle segment of fourth endopod with inner seta .. .. .. 8.
   Middle segment of fourth endopod without inner seta *austrina* T. Scott 1912.
8. Basal segment of fifth leg with inner extension .. .. .. 9.
   Basal segment of fifth leg without inner extension *purpurocincta* Norman 1868.
9. Caudal rami with four terminal setae .. .. *dubia* T. Scott 1912.
   Caudal rami with 3 terminal setae .. .. .. *trisetosa* Lang 1936e.

ALTEUTHA SPINICAUDA sp.nov.

Occurrence: XI, 3 females (1 ovigerous); XII, 1 male.

Female: Length 0·72–0·75 mm., width 0·39 mm. First antenna 7-segmented, with sensory filaments on third and fourth; second antenna with 2-segmented

Fig. 3. *Alteutha spinicauda* sp. nov., male and female; the maxillule and maxilla are from the male, other mouth parts from the female.

exopod; mandible palp bilobed; maxilliped well developed, with long claw. First legs with 2-segmented exopod with 3 terminal claws, endopod 3-segmented; legs 2–4 with following seta formula:

	endopod.	exopod.
p.2.	1.2.221.	1.1.223.
p.3.	1.2.321.	1.1.323.
p.4.	1.2.221.	1.1.323.

Fifth legs of usual shape. Caudal rami wider than long, with large spine at outer corner (fig. 3).

Male. Length 1·0 mm., width 0·48 mm. First antenna 7-segmented and somewhat modified; first legs with terminal portion of exopod, bearing claws, distinctly separated from end segment. Legs 2–4 as in female, but outer spines of fourth exopod modified on first and second segments; fifth legs strongly chitinized, with spines only, no setae. Caudal rami as in female.

This species differs from all but *nana* in having only 7 segments in the first antenna; the fifth legs are not unlike those of *nana*, allowing for the spines to have been broken in Brady's specimen, but the shape of the body and much greater size preclude this species from identity with Brady's.

? ALTEUTHA SIGNATA Brady 1910.

Occurrence: IX, 1 ovigerous female, 1 male.

Distribution: Kerguelen (Brady 1910, p. 552, pl. lxi, 10–18).

Female: Length 0·60 mm., width 0·31 mm. The head was unfortunately lost during dissection, but Brady states that the first antenna is 9-segmented. First legs

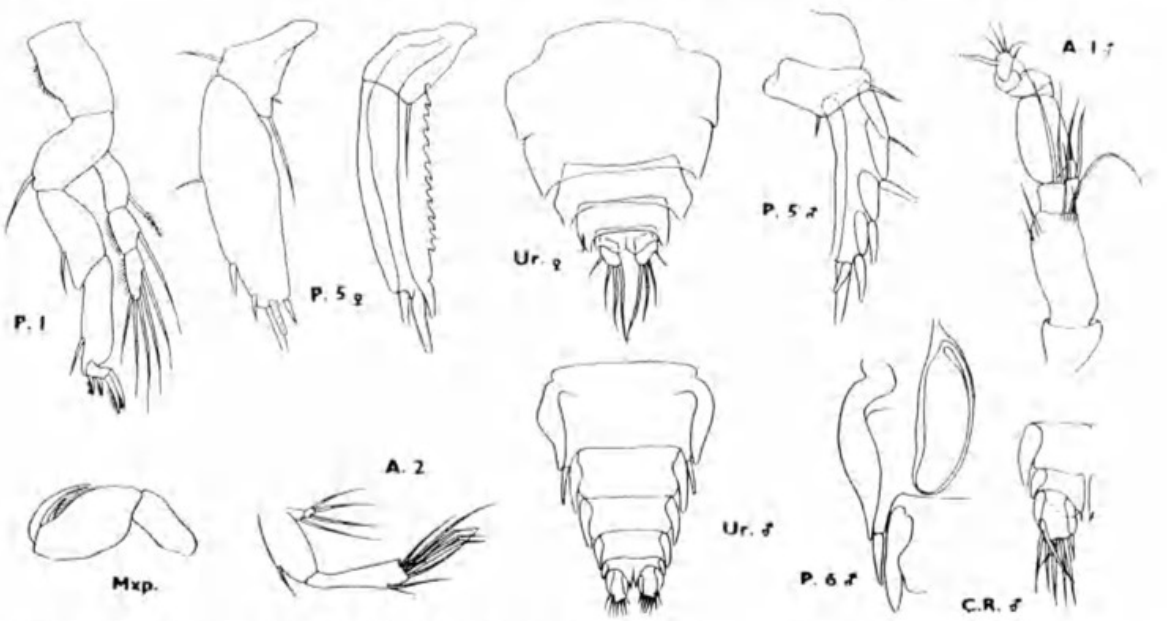

Fig. 4. ? *Alteutha signata* Brady, male and female. The female 5th leg is shown in two positions, and like that of the male is strongly chitinized.

with 3-segmented rami; setae of legs 2–4 exactly as in *spinicauda* (above); caudal rami at least as long as wide, armed with setae only.

Male: First antenna 8-segmented, slightly modified; second antenna with 2-segmented exopod; legs 1–4 as in female; urosome more slender than in female; fifth legs strongly chitinized, with spines and setae; sixth legs represented by a single spine; caudal rami as in female.

This species is almost certainly that described by Brady as *signata*, but his drawings make comparison difficult. In the text (p. 552) he states that the body is almost as wide as long, but this is not borne out by his figure (pl. lxi, 10), in which it is more than twice as long as wide. It is clear from his figures that the fifth legs have been drawn without dissection, so that a close comparison with the material found here cannot be made, but the position of the spines appears to be rather similar. The maxiliped is short and strongly constructed in both, and the caudal rami are very similar. The size and proportions are similar to those of Brady's species. In Brady's drawing the first exopod is relatively more slender than in the specimens found here.

PELTIDIUM Philippi 1839.

Pesta (1935, p. 367) lists 22 species of *Peltidium*, including the three new species described by him; Monard (1936) has since added another species, *rosei*; but *minutum* A. Scott (1909) is a synonym of *speciosum* Thompson and Scott (1903), and *serratum* Thompson and Scott should be transferred to *Parapeltidium*.

Two new species are described here, each represented by both sexes; in addition the previously unknown male of *speciosum* is described.

The males are distinguished in each case by three features: 1, modification of the first antenna, which may not be very marked; 2, structural difference in the first legs; 3, presence of sixth legs.

The difference in the first legs consists of a more slender structure; the basipod segments are longer than wide, the second segment carried at an angle to the first; the endopod does not have its segments broadened as in the female. In the first antenna the penultimate and ante-penultimate segments are usually modified with more or less pronounced hooks.

Amongst the species of *Peltidium* hitherto described, males are known in four cases: *purpureum* Philippi 1839, *rubrum* Brady 1915, *saccsphorum* and *forcipatum* Monard 1928.

Sars (1911) figures the male of *purpureum*, showing the urosome with sixth legs, and the modified first antenna. He does not illustrate the first legs of the male. The male of *rubrum* was lost in dissection, so that its complete structure is not known, but Brady (1915, pl. xiii) figures the first legs of both sexes. In his drawings the exact opposite condition to that found here appears to be the case. He makes no reference to the difference between the first legs of male and female in the text, and in view of his not infrequent mistakes of such a nature, it is not unreasonable to assume that he has transposed the two appendages in his plate. For *saccsphorum* Monard (1928, p. 316, fig. ix, x) gives a full description of the female, in which the first endopods are of the broad type, but dismisses the male in a few

words, with no information on the structure of its first legs. Of *forcipatum* Monard (1928, p. 317, fig. x) only the male is known. Here the first legs are of exactly the same type as has been found in the males of this collection.

Arising out of this three more species must be considered. Pesta (1935, p. 372, fig. 5) has described a species *gracilioides*, which he regards as close to *gracile* Claus 1889 (the specific name in both cases appears to have reference to the slender first endopod). He states that it is a female, but it is not apparently ovigerous, and he does not illustrate the first antenna. The first legs are clearly of the type found in the males of other species. It is possible, therefore, that he was here dealing with a male, although the urosome shows no sixth legs (but these are easily overlooked unless sought for). The same may apply to *gracile* Claus, though I have unfortunately not seen his description.

P. ovale Thompson and Scott (1903) was described as a female, the male being unknown. From a comparison of this species with the new species described below as *simplex*, which is distinguished from *ovale* chiefly on certain differences in the skeletal pattern, it is almost certain that *ovale* has been described from a male specimen. The urosome is not illustrated, so that it is not possible to discover whether sixth legs were present or not. In *simplex* the first antenna of the male is not modified, and is indistinguishable from that of the female; the fifth legs also show no difference, and the only distinguishing character, apart from the presence of the sixth legs, is the narrowness of the endopods of the first legs. For these reasons *ovale* is regarded as having been described from a male and therefore does not form an exception to the rule.

It is of interest to note that as a general rule in this genus the adult male is smaller than the ovigerous female. Furthermore, it is almost certain that the male transfers the spermatophore to the female when she is in the pre-adult stage, and at least no larger than the male. Three couples of *P. simplex* sp. nov. were taken in the paired state, and in each case the female was about to moult, and showed no trace of a skeletal pattern, whereas the male was mature.

Pesta's implication (indicated by a query, *loc. cit.*, p. 367) that *auricillii* (Cleve) may be a male (owing presumably to the few segments in the first antenna) is not supported either by the structure or number of segments in the first antenna as shown by Cleve (1901), or by the structure of the first legs. It is usual for the male of *Peltidium* species to have more segments in the first antenna than has the female.

KEY TO PELTIDIUM FEMALES.

1. End segment of first endopod with 3 appendages .. .. .. 2.
   End segment of first endopod with 4 appendages .. .. .. 6.
   End segment of first endopod with 5 appendages .. .. .. 16.

2. All appendages simple setae of equal thickness .. .. .. 3.
Inner appendage a thicker seta or spine .. .. 4.

3. Setae of equal length .. .. *conspicuum* Norman and Scott 1905.
Middle seta twice as long as other two .. .. *rosei* Monard 1936.

4. First antenna 6-segmented .. .. 5.
First antenna 7- to 9-segmented .. .. *purpureum* Philippi 1839.

5. End segment of fifth leg with 5 setae .. .. *simplex* sp.nov.
End segment of fifth leg with 6 setae .. *saccsphorum* Monard 1928.

6. The 2 inner appendages of first endopod thick setae or unmodified spines 7.
These appendages modified spines, usually laminate or scroll-like .. 9.

7. First antenna 6-segmented .. .. *exiguum* A. Scott 1909.
First antenna 7-segmented .. .. 8.
First antenna 8-segmented .. .. .. *robustum* Claus 1889.

8. End segment of fifth leg with 5 setae *speciosum* Thompson and Scott 1903.
End segment of fifth leg with 6 setae .. .. *rubrum* Brady 1915.

9. First antenna 7-segmented .. .. 10.
First antenna 8-segmented .. .. 15.

10. End segment of fifth leg with 4 setae .. *cinereum* Brady 1915.
End segment of fifth leg with 5 setae .. .. 11.

11. Fifth leg with outer branch of basal segment of three-quarters of end segment, extending beyond base of first seta . .. . 12.
Fifth leg with outer branch of basal segment half of end segment, not reaching base of first seta .. .. *intermedium* A. Scott 1909.

12. Basal segment of first antenna half as long again as second segment.
perplexum Thompson and Scott 1903.
Basal segment of first antenna about equal to second .. .. .. 13.

13. Rostrum rectangular; claw of maxilliped about half-length of end segment, forming an arc .. .. .. *angulatum* Thompson and Scott 1903.
Rostrum rounded; claw of maxilliped four-fifths of end segment, curved only distally .. .. 14.

14. Terminal claws of first exopod not more than 3 times end segment.
falcatum A. Scott 1909.
Terminal claws of first exopod at least 5 times end segment. *proximum* sp.nov.

15. Caudal rami extending beyond end of genital segment *monardi* Pesta 1935.
Caudal rami not reaching end of genital segment *hawaiiense* Pesta 1935.

16. First antenna 5-segmented; setae of first endopod unmodified.
aurivillii (Cleve) 1901.
First antenna 9-segmented; 2 inner setae of first endopod modified.
elegans Wolfenden 1905a.

Note. The data for *robustum* Claus 1889 have been taken from Pesta (1935, p. 367) since I have not seen the original work.

KEY TO PELTIDIUM MALES.

1. End segment of first endopod with 3 appendages .. .. .. 2.
End segment of first endopod with 4 appendages .. .. .. 7.

2. All these appendages simple setae .. .. 3.
   Inner appendage a spine .. .. 5.
3. Setae of equal thickness .. *gracile* Claus 1889 and *gracilioides* Pesta 1935.
   Inner seta thicker than terminal setae .. .. 4.
4. End segment of fifth leg with 5 setae *ovale* Thompson and Scott 1903.
   End segment of fifth leg with 6 setae .. *purpureum* Philippi 1839.
5. End segment of fifth leg with 5 setae .. .. 6.
   End segment of fifth leg with 6 setae .. *saccsphorum* Monard 1928.
6. Terminal setae of first endopod unequal; first antenna modified.
   forcipatum Monard 1928.
   Terminal setae of first endopod equal; first antenna unmodified.
   simplex sp.nov.
7. Two inner spines unmodified .. .. .. *rubrum* Brady 1915.
   Two inner spines modified, scroll-like .. .. 8.
8. First antenna 7-segmented .. .. *proximum* sp.nov.
   First antenna 8-segmented .. .. *speciosum* Thompson and Scott 1903.

As explained in the text, *gracile*, *gracilioides* and *ovale* are regarded as males, all the available evidence pointing in that direction, while there is no positive evidence against this interpretation. They are, therefore, included in this key.

Details for *gracile* are taken from Pesta (1935, p. 367), from which it appears that the original description is somewhat inadequate.

Although the description of the male of *saccsphorum* is incomplete, I have included it in the key to the males, since there is some doubt in my mind whether the illustration of p. 1 female given by Monard (1928, p. 315, fig. ix, 3) is not really that of the male. The slender condition of the first endopod (ignoring the fringed lamella) and the strongly developed inner spine lend support to this view.

Brady's illustration of the male of *rubrum* is confined to the first leg, and as explained above I consider that the first leg of male and female have been transposed. The illustration does not make clear the condition of its armature, but it appears to have 2 lateral setae and 2 inner simple spines on the endopod.

PELTIDIUM SIMPLEX sp.nov.

Occurrence: IX, several specimens of both sexes and young; X, 1 specimen; XI, 4 females; XII, 1 specimen; XIII, 1 immature.

Female: Length 1·56–1·68 mm.; width 0·90–0·99 mm. Body rounded in front, with rostrum projecting slightly towards the ventral surface, invisible dorsally; skeletal pattern strongly developed on a simple plan (fig. 5, A). First antenna 6-segmented, sensory filaments on third and fourth segments; second antenna with basal segment incompletely divided, exopod 2-segmented, attached at middle of basal segment; mouth parts more or less normal (fig. 6).

First legs with basal segment of endopod expanded, terminal segment less so, bearing 2 terminal setae and 1 inner spine; legs 2–4 with the following seta formula:

	endopod.	exopod.
p.2.	1.2.120.	1.1.223.
p.3.	1.2.220.	1.1.323.
p.4.	1.2.220.	1.1.323.

Fifth legs with end segment indistinctly separated from basal segment, elongate, with setae and spines all inserted distally; like the other appendages, the fifth legs are strongly chitinized. Caudal rami short, not visible dorsally.

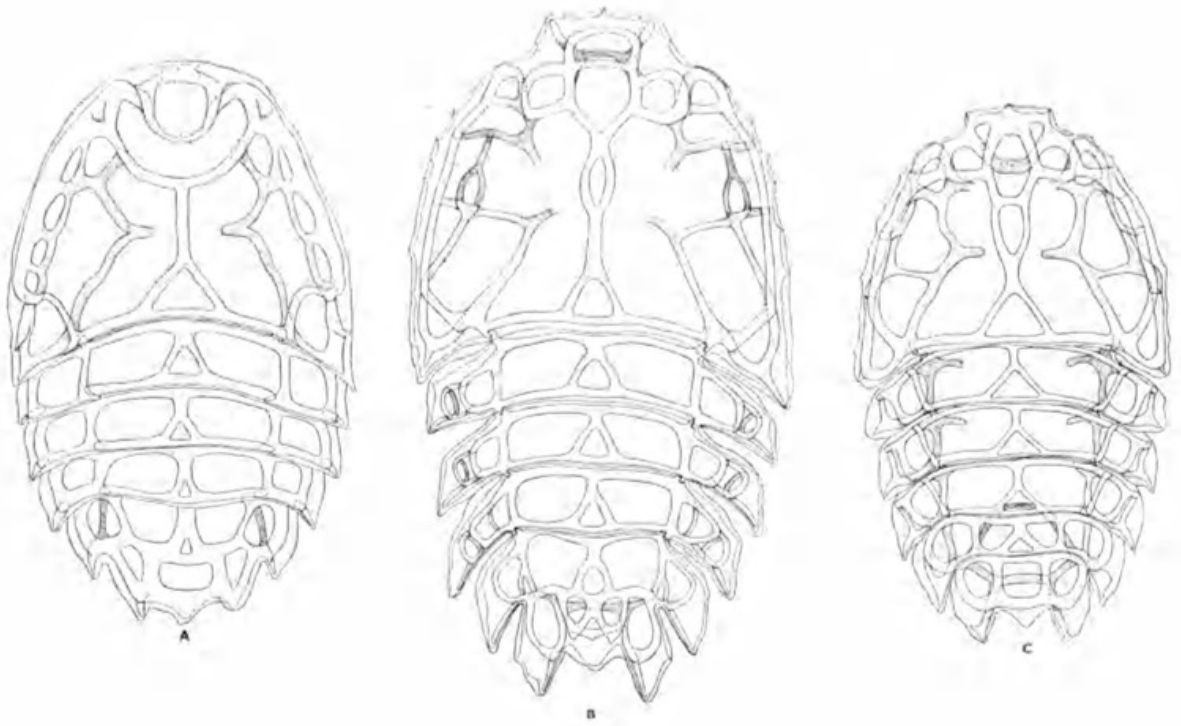

Fig. 5. A, *Peltidium simplex* sp. nov. B, *Peltidium proximum* sp. nov. C, *Peltidium speciosum* Thompson and Scott; skeletal patterns seen from above, not to same scale.

Male: Length 1·38 mm.; width 0·69 mm. Differs from female only in the smaller size of the first legs, with more slender endopods which are similarly armed, and in the possession of sixth legs. The male examined was obviously mature, and contained a spermatophore, but the first antenna is quite unmodified and indistinguishable from that of the female. The fifth legs are identical in both sexes.

This species resembles *ovale* in shape, but has a simpler design in its skeletal pattern, and differs in the fifth legs. The pattern is on the same general plan as in *ovale*, but differs in the anterior and posterior regions. The first antennae and

end segments of the first endopods are very similar to *ovale*, and it is probably an Australian form of this species.

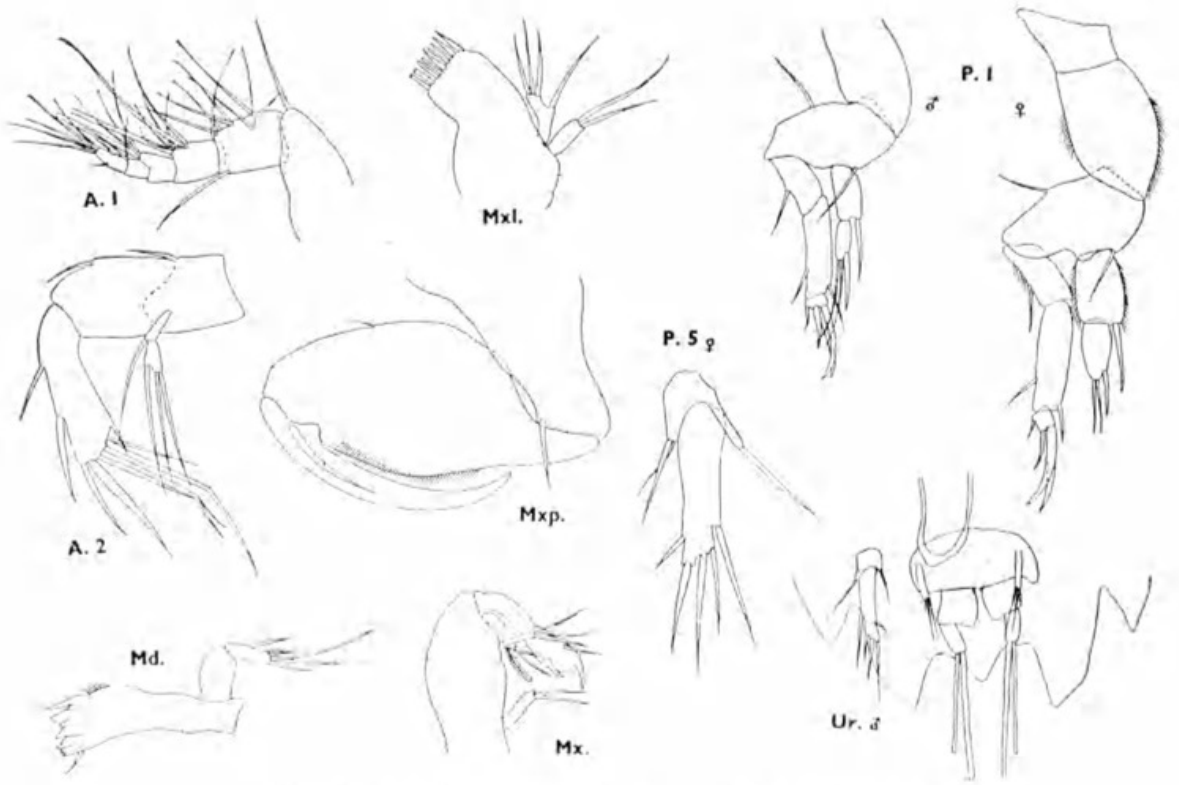

Fig. 6. *Peltidium simplex* sp. nov., male and female.

As already stated, in view of the similarity of the first antennae in both sexes of *simplex* and of its resemblance as a whole to *ovale*, it is assumed that *ovale* has been described from the male, since the first legs of that species show the usual modification found in males.

PELTIDIUM PROXIMUM SP.NOV.

Occurrence: VII, 13 females, 1 male; IX, several specimens; X, numerous specimens; XII and XIII, 5 females (1 ovigerous); XIV, 4 females.

Female: Length 1·62–1·80 mm., width 0·87–1·11 mm. Body with prominent rostrum; very slight dorsal crest on head and thoracic segments; segment bearing fifth legs fused with following segments; first antenna 7-segmented; second antenna with distinctly divided basal segment and long 2-segmented exopod; mouth parts normal (fig. 7).

First legs with basal segments sub-rectangular, endopod widened, end segment with 2 thin terminal setae and 2 inner setae, the latter strongly modified; seta formula of legs 2–4 as in *simplex*. Fifth legs with segments distinct, very small

inner expansion and long outer branch. Caudal rami short with long terminal setae.

Male: Length 1·38 mm.; width 0·75 mm. Body as in female. First antenna 7-segmented, with usual sensory filaments and modified segments; first legs with elongate second basal segment, endopod slender, with two inner setae modified,

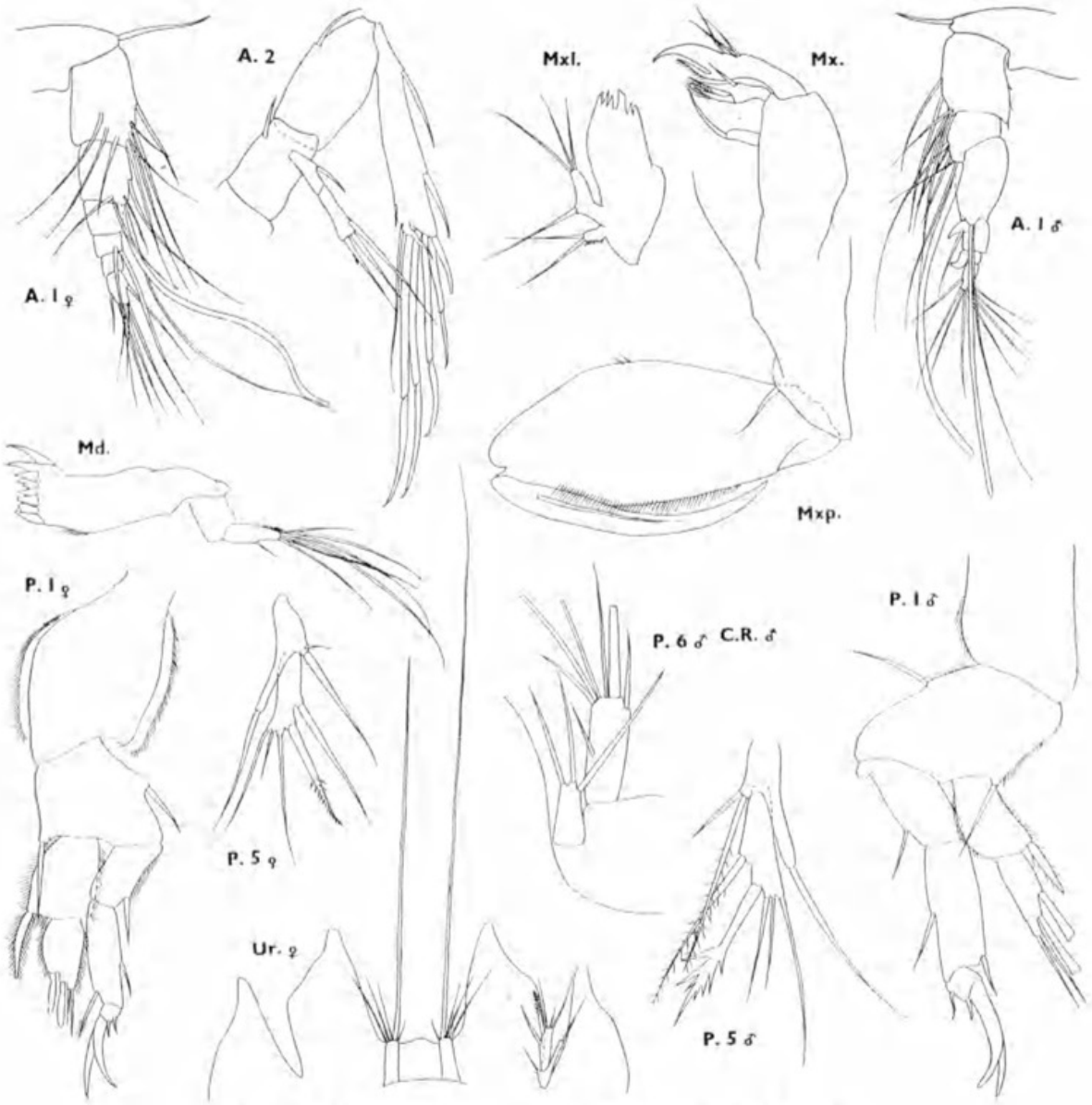

Fig. 7. *Peltidium proximum* sp. nov., male and female.

scroll-like as in *Parapeltidium dubium* (fig. 11); legs 2–4 as in female; fifth legs with second outer spine much more strongly denticulate than in female; sixth legs with 3 setae.

In the first and fifth legs this species resembles *perplexum* Thompson and Scott, but the skeletal pattern (fig. 5, B) shows certain differences, and the size of *perplexum* is much smaller (1·1 mm.).

PELTIDIUM SPECIOSUM Thompson and Scott 1903.

Peltidium speciosum Thomps. and Scott, 1903, p. 274, pl. xiii, fig. 12–17.
P. minutum A. Scott, 1909, p. 205, pl. lxv, fig. 16–20.

Occurrence: II, 5 specimens; VII, 5 specimens; X, numerous specimens; XI, 1 female; XII, 4 females; XIII, 1 female, 2 males; XIV, 6 females.

Distribution: Ceylon, washed from dredgings from pearl banks; Aru Islands, washed from dredgings from pearl banks, in 13 metres.

This species has been identified with *speciosum* on account of the structure of the appendages rather than the similarity of the skeletal pattern (fig. 5, C).

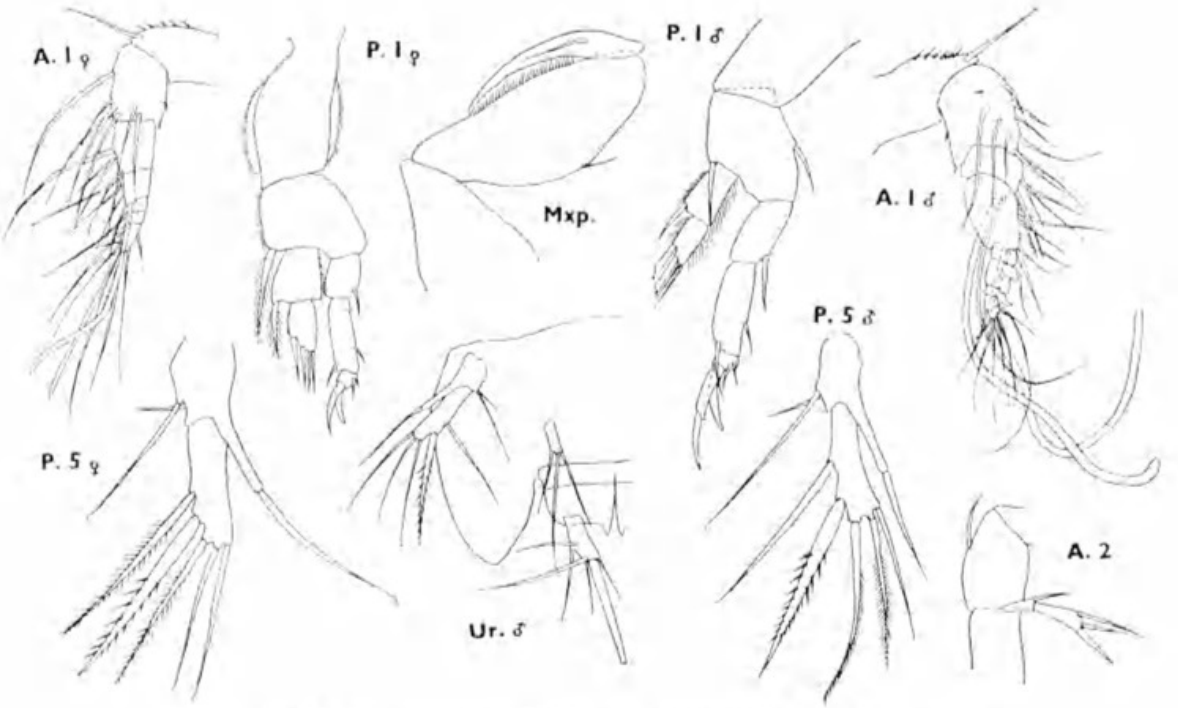

Fig. 8. *Peltidium speciosum* Thompson and Scott, male and female.

In both the Ceylon material and the Australian specimens the design reaches a rather complicated condition, and it is not certain whether all the longitudinal bars in the original drawings are on the dorsal surface or whether some may be ventral in position but connecting with those of the dorsal surface, as is the case in my specimens. For this reason a close comparison is not possible, but in general both A. Scott's *minutum* and the specimens found here agree with the original drawings, and in the structure of the appendages all three are in very close agreement. In size *minutum* is somewhat smaller (0·8 mm.), whereas this material agrees with that of Thompson and Scott, but the size of these Peltidiids varies over a considerable range, as has been shown.

Female: First antenna 7-segmented, with the usual sensory filaments; second antenna with basal segment distinctly divided; mouth parts as usual. First legs with both segments of the endopod widened, end segment with 2 thin terminal setae and two lateral modified setae; seta formula differs from the usual:

	endopod.	exopod.
p.2.	1.2.120.	1.1.223.
p.3.	1.2.320.	1.1.323.
p.4.	1.2.220.	1.1.323.

Fifth legs with segments distinct, second outer seta strong and spine-like with several large denticles.

Male: Length 1·08–1·32 mm., width 0·62–0·69 mm. The male has not previously been described. First antenna 8-segmented, modified as usual; second antenna with basal segment divided, exopod long, 2-segmented; mouth parts as in female. First legs with elongate basal segments and slender endopod, end segment with 2 long thin terminal setae and 2 inner modified setae. Legs 2–4 with seta formula as in female; fifth legs similar to those of female, but second outer spine more strongly denticulate; sixth legs with 3 setae.

PARAPELTIDIUM A. Scott 1909.

This genus was created for a single specimen taken in a vertical haul from 10 metres to the surface at night, while at anchor in Laiwui, Obi Major, Station 142 of the "Siboga" Expedition. An electric light was used in the net, and this is most probably a bottom living form.

The genus is retained, for the present, for such species of *Peltidium* as show a distinct fusion of the two segments of the fifth legs, and therefore includes *serratum* Thompson and Scott (1903), on whose "remarkable" fifth legs the authors commented at the time. Further points of similarity between the members of this genus, distinguishing them from *Peltidium*, are the noticeably flattened body and the development of dorsal crests to the body segments in the mid-line. These are stated to be present in *johnstoni* (A. Scott, 1909, p. 212) though not shown in the figure (pl. lxv, fig. 1). In the case of *serratum* they are illustrated (Thompson and Scott, 1903, pl. xiii, fig. 18) but not mentioned in the text. They are present and strikingly developed in both the species described here (fig. 9, 10). The males show the same sexual differences found in *Peltidium*.

There are, therefore, now 4 species to be included in this genus: *serratum* Thomp. and Sc., *johnstoni* Scott, *cristatum* and *dubium* spp.nov. The second of these, *johnstoni*, is presumably a male. Though described as a female there are no specifically female characters described or portrayed, whereas the first leg is obviously that of a male, and although supporting male characters are lacking,

yet in *Peltidium* also males with unmodified first antennae are known. The very strong chitinization of the fifth leg may perhaps be regarded as a male characteristic.

Thompson and Scott's species *serratum* is clearly a female; *cristatum* is here described from both sexes, while *dubium* is known only as a male.

As already shown the 5-segmented first antenna here has no generic value, while the slender endopod of the first legs has no systematic significance.

KEY TO PARAPELTIDIUM FEMALES.

First antenna 6-segmented; first endopod with 3 small subequal terminal setae; fifth leg with 6 setae .. .. .. *serratum* Th. and Sc. 1903.

First antenna 7-segmented; first endopod with 2 terminal setae and 1 inner spine-like seta; fifth leg with 5 setae .. .. .. *cristatum* sp.nov.

KEY TO THE MALES.

1. First endopod with 2 terminal setae and 1 inner thicker seta .. .. 2.
   First endopod with 2 terminal setae and 2 inner modified spines. *dubium* sp.nov.
2. Fifth leg with 1 short terminal spine, 1 inner and 3 outer spines and setae; first antenna 5-segmented .. .. .. *johnstoni* A. Scott 1909.
   Fifth leg with 1 long terminal spine, 2 inner and 2 outer spines; first antenna 8-segmented .. .. *cristatum* sp.nov.

PARAPELTIDIUM CRISTATUM sp.nov.

Occurrence: VII, 1 ovigerous female; VIII, 1 female; IX, 1 specimen; Rottnest Island, Western Australia, from weed-covered rocks on the shore at Bathurst Point, April, 1939, 1 male.

Female: Length 1·5–1·65 mm., width 1·08–1·11 mm. Body flattened in usual Parapeltidiid manner, with large rectangular rostrum and dorsal crest, each segment produced dorsally as well as laterally (see male in fig. 9, lateral view). Margin slightly serrated as in *serratum*. The skeletal pattern is of a simple design, with weak anterior and stronger posterior transverse bands to each segment, but without longitudinal connecting bars in the epimeral expansions. First antenna 7-segmented, with sensory filaments on third and fourth segments; second antenna 3-segmented, with 2-segmented exopod attached at distal end of basal joint; mouth parts normal (fig. 9).

First leg with endopod much broadened, bearing 3 unmodified terminal setae, the inner of which is much thicker than the other two and spine-like; seta formula of legs 2–4:

	endopod.	exopod.
p.2.	1.2.120.	1.1.223.
p.3.	1.2.220.	1.1.323.
p.4.	1.2.220.	1.1.323.

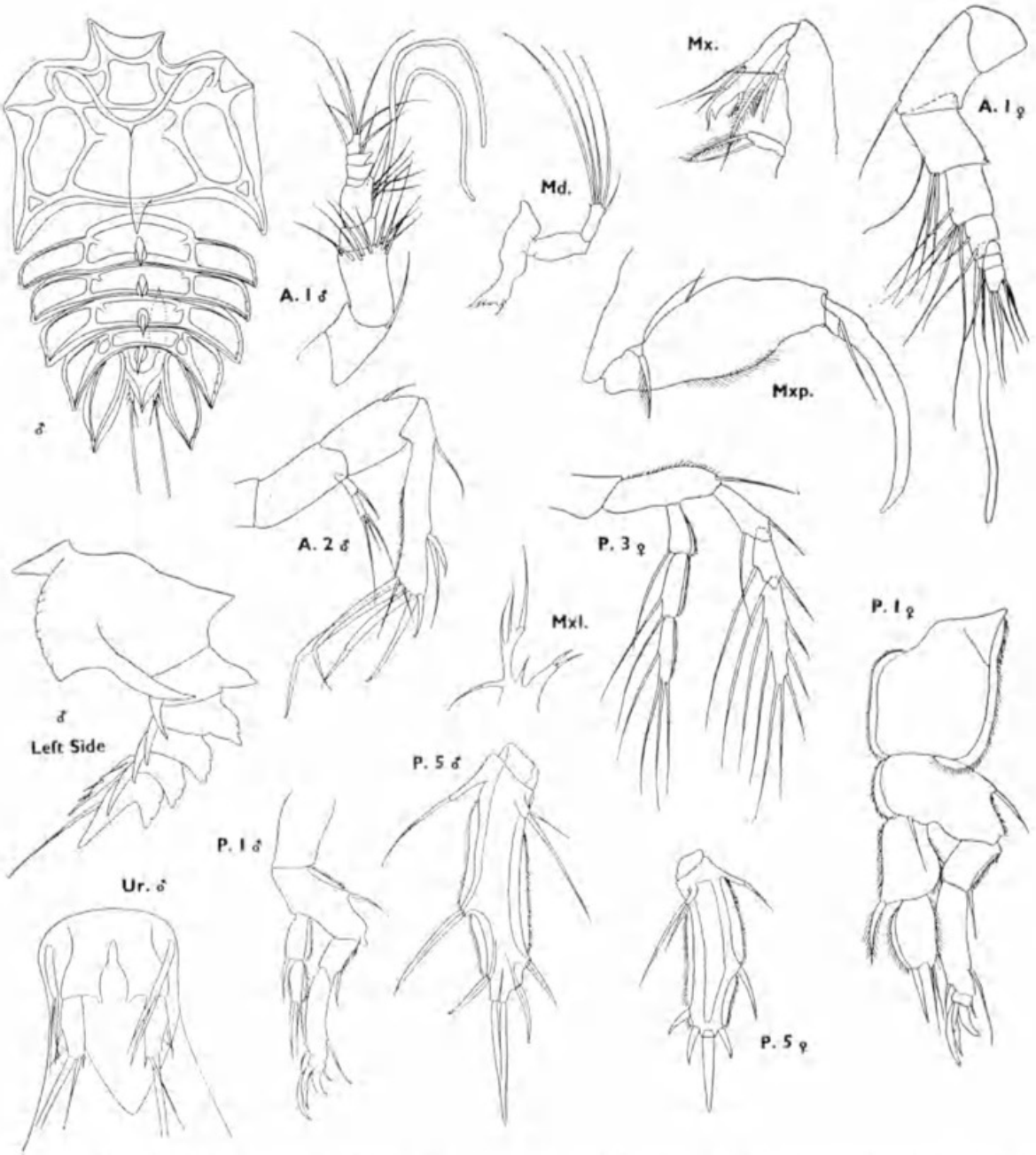

Fig. 9. *Parapeltidium cristatum* sp. nov., male and female. The first legs of both sexes are drawn to the same scale, but the male 5th leg is drawn at a magnification equal to twice that of the female 5th leg; mouth parts are drawn all to the same scale, but those of the male are slightly smaller than those of the female; maxilla from female, mandible, maxillule, and maxilliped from male.

Fifth legs with segments fused, strongly chitinized, with thin marginal lamella fringed with fine hairs. Caudal rami elongate, with terminal and lateral setae.

Male: Described from a single specimen taken in Western Australia. Length 1·23 mm., width 0·93 mm. Shape of body and skeletal pattern as in female. First antenna 8-segmented, sixth and seventh slightly modified for grasping, sensory

filaments on third and fourth; other head appendages as in female—the maxillule is somewhat reduced from the usual Peltidiid condition.

First legs with slender endopod, with 3 unmodified setae, the inner seta slightly thicker than the two terminal setae; legs 2–4 as in female; fifth leg scarcely different from that of female.

That this species is distinct from Scott's is evident from the relatively simple design of the skeletal pattern, and the greater number of segments in the first antennae. It differs from *serratum* in the skeletal pattern, first endopod and fifth legs.

PARAPELTIDIUM DUBIUM sp.nov.

Occurrence: IV, 1 male.

Male: Length 1·29 mm., width 0·81 mm. Body with rather irregular outline, rostrum asymmetrical, projecting; body segments with large lateral expansions

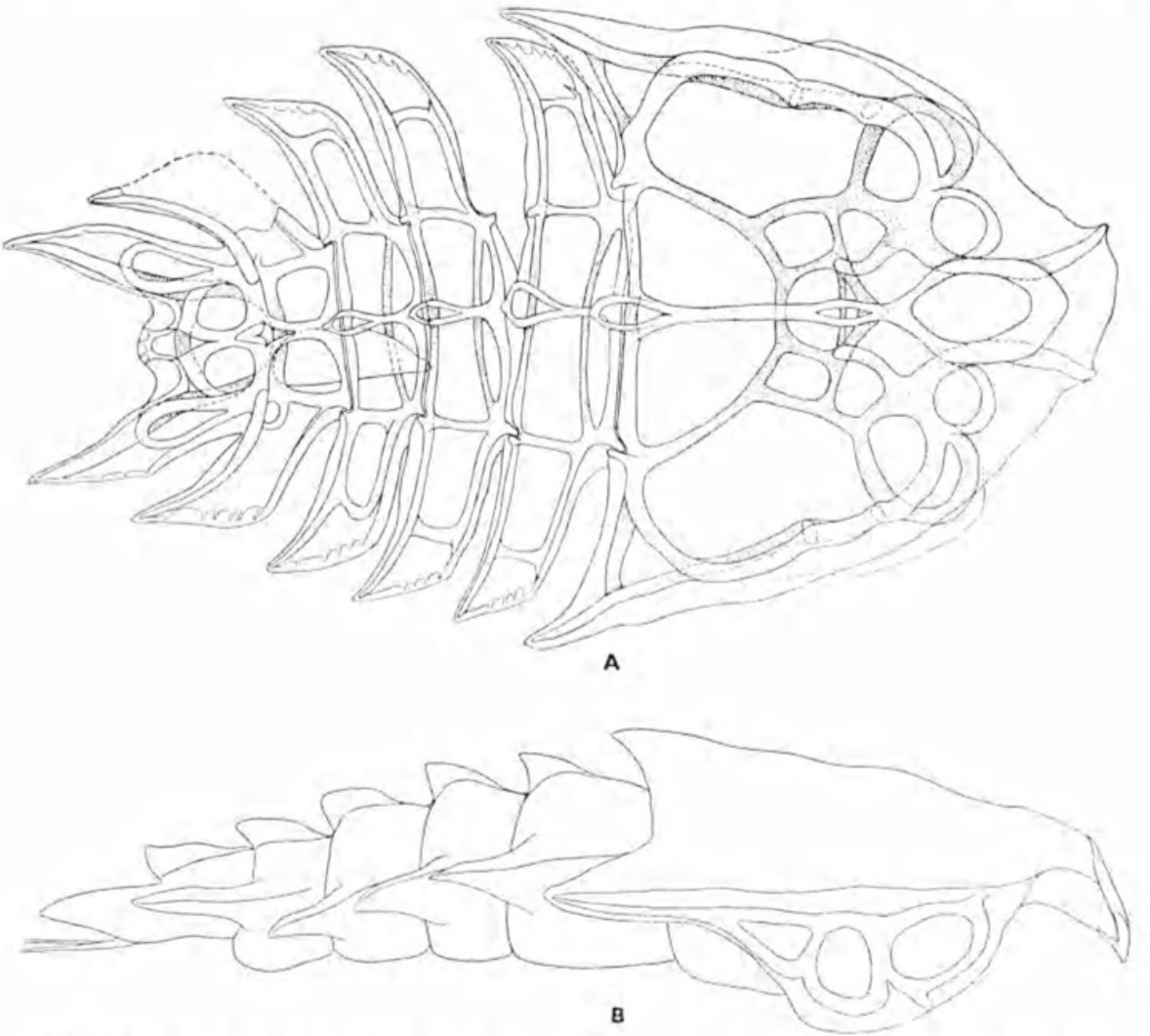

Fig. 10. *Parapeltidium dubium* sp. nov. A, skeletal pattern from above; B, male from right side.

and dorsal crests (fig. 10). First antenna 8-segmented, third and fourth with sensory filaments, sixth and seventh modified; second antenna with basal segment divided, exopod long, 2-segmented; mouth parts normal (fig. 11).

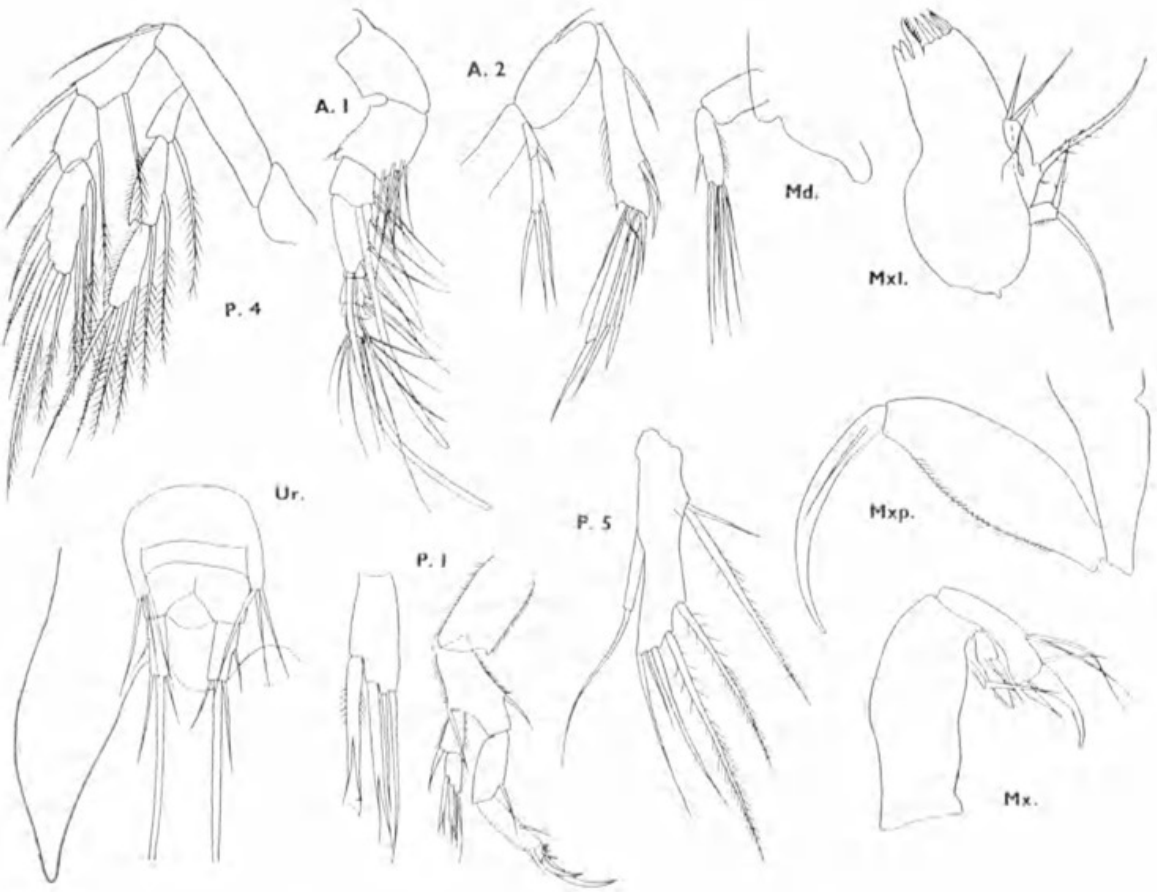

Fig. 11. *Pavapeltidium dubium* sp. nov., male.

First legs with elongate basal segments and slender endopod, bearing 2 thin terminal setae, and 2 modified scroll-like inner setae; legs 2–4 with the following seta formula (right side):

	endopod.	exopod.
p.2.	1.2.120.	1.1.223.
p.3.	1.1.320.	1.1.323.
p.4.	1.2.220.	1.1.323.

The third endopod on the right side is somewhat abnormal, but the left third leg was quite abnormal, the second and third segments of the endopod were fused and the exopod was 4-segmented; fifth legs with segments distinctly fused. Caudal rami long, with long setae, but invisible from above.

FAMILY TEGASTIDAE Sars 1904.

TEGASTES Norman 1903.

A single male specimen of a species of *Tegastes* measuring 0·33 mm. occurred in this collection (III), which I have been unable to identify with any of the known species. The dissection was, however, somewhat incomplete, and the species will not be described until more material has been obtained to enable a full study to be made.

FAMILY PORCELLIDIIDAE Sars, 1904.

PORCELLIDIUM Claus 1860.

Pesta (1935) has reviewed this genus, added two new species, and described a male and young without naming them. In his list of species (p. 375) No. 9 is missing (probably through a printer's error), and this is presumed to be *scutatum*, which is later mentioned in the text, but with no reference; unfortunately I have been unable to trace this species.

Of those listed by Pesta he states that *parvulum* and *ovatum* Haller (1880) are insufficiently described, and he regards them as *species incertae*; *tuberculatum* Wolfenden (1905a) is the young of *acuticaudatum* Thompson and Scott, according to Gurney (1927b); *wolfendeni* Brady (1910) is a synonym of *affine* Quidor (1906); and *rotundum* Brady (1910) is probably immature.

To these he adds *scotti* for *fimbriatum* of Thompson and Scott (1903), which he regards as distinct from *fimbriatum* Claus (1863), and *clavigerum* a new species from Hawaii. To these have been added two varieties of *fimbriatum*, described by Monard (1928): var. *macrurum* and var. *heraldicum*. Lang (1935) has suggested that *lecanoides* Claus (1889) is a variety of *fimbriatum*.

Pesta (*loc. cit.*) makes a new species of *fimbriatum* as described by Thompson and Scott on the proportions of the segments of the first antenna, length and position of the inner seta on the first endopod, the position of the rib in the fifth leg, differences in the caudal rami and the different distribution.

The proportions of the segments of the first antenna as stated in the text by Thompson and Scott are not borne out by the illustration (pl. xii, fig. 2), in which they closely resemble the proportions quoted by Pesta from Claus, and also agree with Sars' drawing (1911, pl. lxv, a.1). The position of the inner seta on the first endopod is probably due to faulty observation since the point of attachment of this seta is always hard to make out (cf. Pesta's drawing of this seta in *clavigerum*, *loc. cit.*, p. 377, in which it is stated to be attached basally). The position of the rib in the fifth leg is merely a question of the position in which the leg is drawn, since it is always more or less central, and forms the angle at which the two halves

of the boat-shaped segment meet. The difference in distribution has little value, since many Mediterranean species have been found as far away as the Malay Archipelago and Australia.

But the caudal rami show certain differences, as stated by Pesta, and even more important, the postero-lateral projections from the genital segment are distinctly rounded in *fimbriatum* Claus, and the fifth legs do not reach the ends of these projections, whereas in Thompson and Scott's drawing the projections are pointed, and the fifth legs extend beyond these points. For these reasons, therefore, *fimbriatum* of Thompson and Scott may be regarded as a distinct species, to which the name *scotti* has been given by Pesta.

As pointed out by Pesta (*loc. cit.*, p. 377) *clavigerum* is of the *fimbriatum* type, and its caudal rami resemble those of *fimbriatum* var. *macrurum* Monard (1928) in their armature. Monard's variety in the female shows a considerable difference in the proportions of the caudal rami from those of *fimbriatum* (length to width nearly 7 : 2 compared with 2 : 1), and *clavigerum* has the normal proportions of *fimbriatum*. Furthermore, Lang (1935) has illustrated the caudal rami of *lecanoides* Claus (1889) (the original description of which I have not seen), and stresses the resemblance between this species and *fimbriatum* var. *macrurum* Monard. It is probable, therefore, that *clavigerum* is identical with *lecanoides*, and this view is supported by comparison with the illustrations of this species given by Norman and Scott (1906).

Below is a key to the females of *Porcellidium*, from which are excluded those species which are uncertain, and those which appear to be synonyms as well as *scutatum*. For *tenuicauda* Claus (1860) and *lecanoides* Claus (1889) I have relied on the descriptions given by Brady (1880) and Norman and Scott (1906) respectively.

KEY TO PORCELLIDIUM FEMALES.

1. Genital segment with postero-lateral projections .. .. .. 2.
   Genital segment without such projections .. .. 11.
2. Projections from genital segment reaching end of anal segment but not to end of caudal rami .. .. 3.
   Projections from genital segment reaching end of caudal rami .. .. 9.
3. Caudal rami rectangular, truncate .. .. 4.
   Caudal rami tapering, pointed or rounded .. .. 5.
4. Projections from genital segment with convex outer margin; caudal rami tipped with 4 short spines and 1 seta .. *lecanoides* Claus 1889.
   Projections from genital segment with concave outer margin; caudal rami tipped with setae only .. .. *scotti* Pesta 1935.
5. Projections from genital segment reaching middle of caudal rami. *acuticaudatum* Thomp. and Scott 1903.
   Projections from genital segment extending only slightly beyond anal segment .. .. 6.

6. Caudal rami pyriform, tapering distally .. .. 7.
   Caudal rami sub-rectangular proximally, outer margin rounded distally 8.
7. Caudal rami each tipped with a single spine, without other armature.
   tenuicauda Claus 1860.
   Caudal rami tipped with a single seta, and with 4 outer and 2 dorsal setae.
   brevicaudatum Thomp. and Scott 1903.
8. First antenna 6-segmented .. *ravanae* Thompson and Scott 1903.
   First antenna 7-segmented .. .. .. *affine* Quidor 1906.
9. Fifth legs extending round caudal rami, overlapping posteriorly.
   interruptum G. M. Thompson 1883.
   Fifth legs not meeting behind caudal rami .. .. 10.
10. Body length to width as 3 : 2 .. .. *fimbriatum* Claus 1863.
    Body length to width as 2 : 1 .. .. *fulvum* G. M. Thompson 1883.
11. Caudal rami as long as wide .. .. .. *australe* Brady 1910.
    Caudal rami wider than long .. .. *charcoti* Quidor 1906.

PORCELLIDIUM FIMBRIATUM Claus 1863.

Occurrence: XII, 1 female.

Distribution: British Isles, Norway, Mediterranean.

A single specimen, an ovigerous female, was found in this collection, which showed the typical features of this species as described and illustrated by Sars

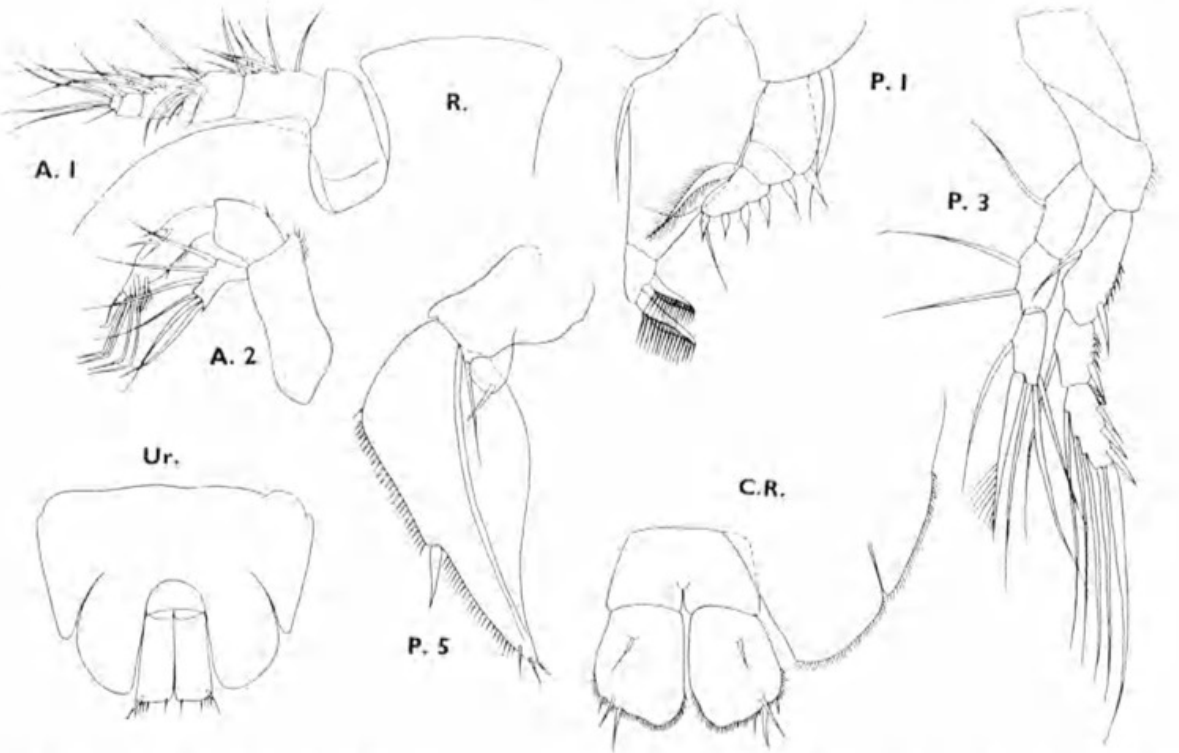

Fig. 12. *Porcellidium fimbriatum* Claus, urosome (Ur); and *Porcellidium fulvum* G. M. Thompson.

(1911). The lateral incisions in the expansions from the genital segment (fig. 12, Ur) are somewhat deeper than is shown by Sars, but there is little doubt that it is identical with Claus' species. Length 0·96 mm., width 0·60 mm.

PORCELLIDIUM FULVUM G. M. Thompson 1883.

Occurrence: IX, 1 female.

Distribution: Otago and Lyttleton Harbours, New Zealand.

This single specimen, which was not ovigerous and may not have been mature, is almost certainly identical with that described by Thompson. He states that it is "hardly more than half as long as broad"; this specimen was slightly narrower. "Anterior antennae very short . . . . not half the width of the body." "Caudal segments quadrate, ciliated at the extremity." The size of his specimen, however, was considerably greater than mine (1·25 mm. as against 0·66 mm.), but this is probably unimportant. Apart from the unusual shape, the most striking resemblance is in the shortness of the inner seta on the first endopod, which does not reach the end of the basal segment (fig. 12). The absence of an inner seta from the end segment of the first exopod in Thompson's drawing (pl. vi, fig. 10) cannot be regarded as important since it is easily overlooked.

Seta formula for legs 2–4:

	endopod.	exopod.
p.2.	1.2.121.	1.1.223.
p.3.	1.2.221.	1.1.323.
p.4.	1.1.121.	1.1.323.

PORCELLIDIUM ACUTICAUDATUM Thompson and Scott 1903.

Occurrence: XI, 1 ovigerous female.

Distribution: Suez Canal, Ceylon, Maldives, and Laccadives.

This species was originally described from Ceylon, and later described by Gurney from the Suez Canal. There can be little doubt that Wolfenden's *tuberculatum* is identical with this as stated by Gurney (1927b). The single ovigerous female taken here is somewhat larger than the type; it is intermediate in body proportions between the type and Wolfenden's form, and lacks the tuberculate exoskeleton. Length 1·08 mm., width 0·78 mm. The seta formula for legs 2–4 is as in *fulvum* above.

PORCELLIDIUM AUSTRALE Brady 1910.

Occurrence: XI, 2 specimens, male and female taken together.

Distribution: Kerguelen Island.

The single female, taken with the male attached, was unfortunately immature, and a condition similar to that in the *Peltidiidae* is observed here in that the male

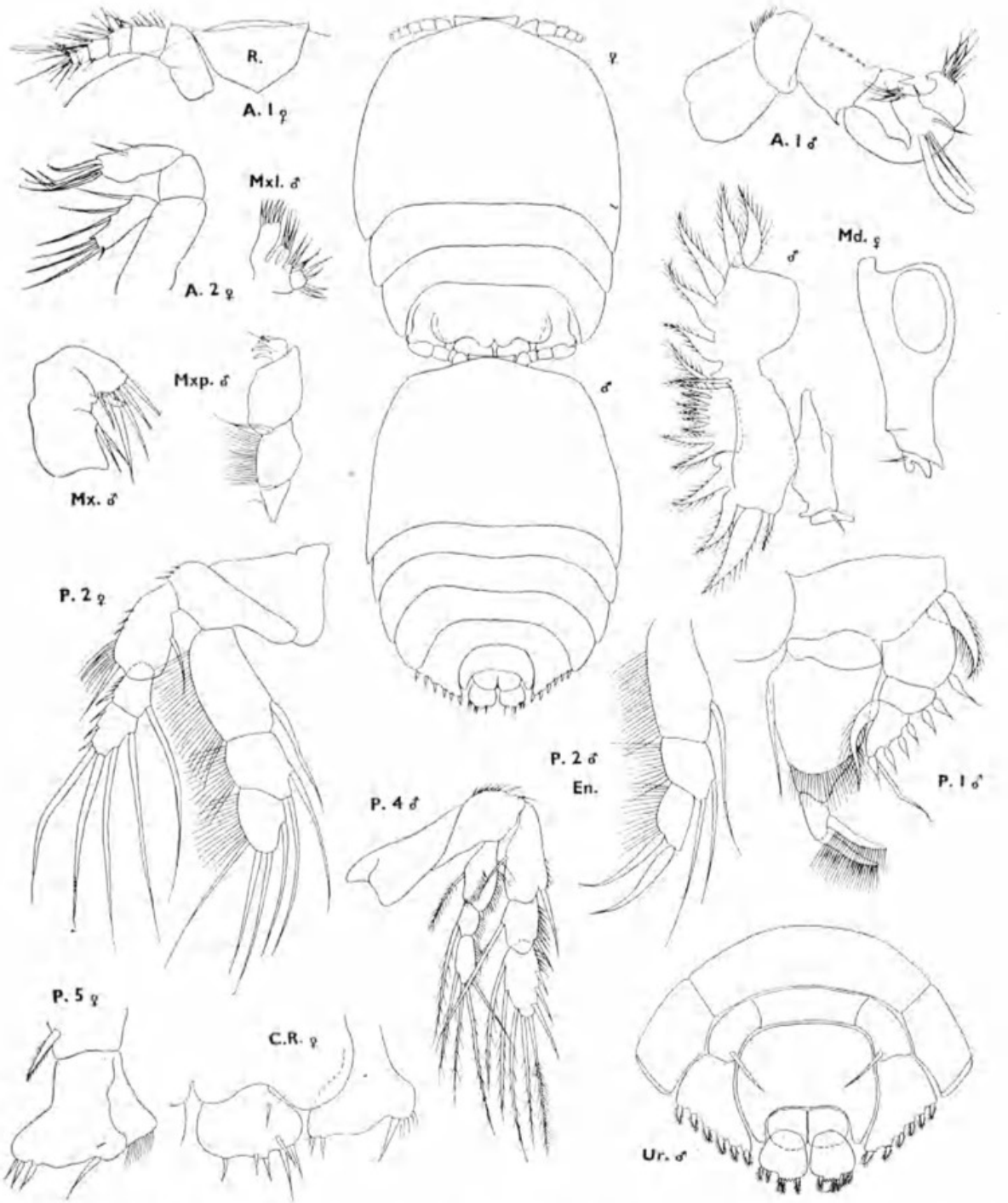

Fig. 13. *Porcellidium australe* Brady. The female rostrum and 1st antenna and male urosome are drawn in ventral view.

is found attached to immature females, while the latter is no larger than the male, whereas the adult female is always larger than the male. Unlike the Peltidiids, however, when the sexes pair the male is attached to the fifth legs of the female by means of its strongly prehensile first antennae, so that they are arranged *in tandem*. In the Peltidiids the male clasps the female around the cephalosome, or between

that and the first free thoracic segment, by means of its powerful maxillipeds. In both cases, where paired animals have been taken, the female was immature and about to moult into the adult condition, while the male was fully mature.

Although the female was immature it could be identified with Brady's species, and the male agrees well with his drawings as far as comparison could be made. Since his description is not very full, the specimens taken here are fully illustrated.

Length 0·60 mm., width 0·45 mm., both specimens the same size. The dorsal surface of the male is strongly tuberculate.

FAMILY TISBIDAE (Sars) 1904.

MACHAIROPUS Brady 1883.

Lang (1936b) in a revision of this genus has concluded that the genus *Psamathe* Philippi is identical with *Machairopus*, and since the older name is preoccupied, Brady's name must stand. He gives a key to the species, from which only *sarsi* Brady 1910 is excluded. Since then he has described another species, *antarcticus* Lang (1936c).

Two species occurred in this collection.

MACHAIROPUS INTERMEDIUS sp.nov.

Occurrence: IX, several specimens; X, 1 female, 1 young; XI, 4 ovigerous females, 4 young; XII, 4 females (3 ovigerous), 2 males.

Female: Length 0·84 mm. First antenna 9-segmented; second antenna with 4-segmented exopod, of which the third segment is the shortest; mouth parts more or less typical (fig. 14); first leg with middle segment of exopod swollen basally as in *plumosa* (Brady), though to a less extent. Seta formula of legs 2–4:

	endopod.	exopod.
p.2.	1.2.221.	1.1.223.
p.3.	1.2.321.	1.1.323.
p.4.	1.2.221.	1.1.323.

Fifth legs very much as in the type species, caudal rami as in *plumosa*. The genital segment is partially divided, ventrally and laterally.

Male: Length 0·66 mm. The male differs from the female only in the first antennae, which are 8-segmented, and fifth and sixth legs.

It is with some hesitation that this species is separated from *plumosa*, which has been redescribed by Lang (1934). A comparison with the original and with Lang's description shows several points of difference. Firstly in the proportions of the segments of the first antenna, in which it also differs from *longicauda*

(Philippi, 1840). The exopod of the second antenna lacks setae on the second and third segments; the mandible palp is different from that of Philippi's species. One of the distinguishing characters of Brady's species, according to Lang, is the swollen middle segment of the first exopod. In *intermedius* this segment is swollen but to a much smaller extent, the swelling being restricted to that portion proximal

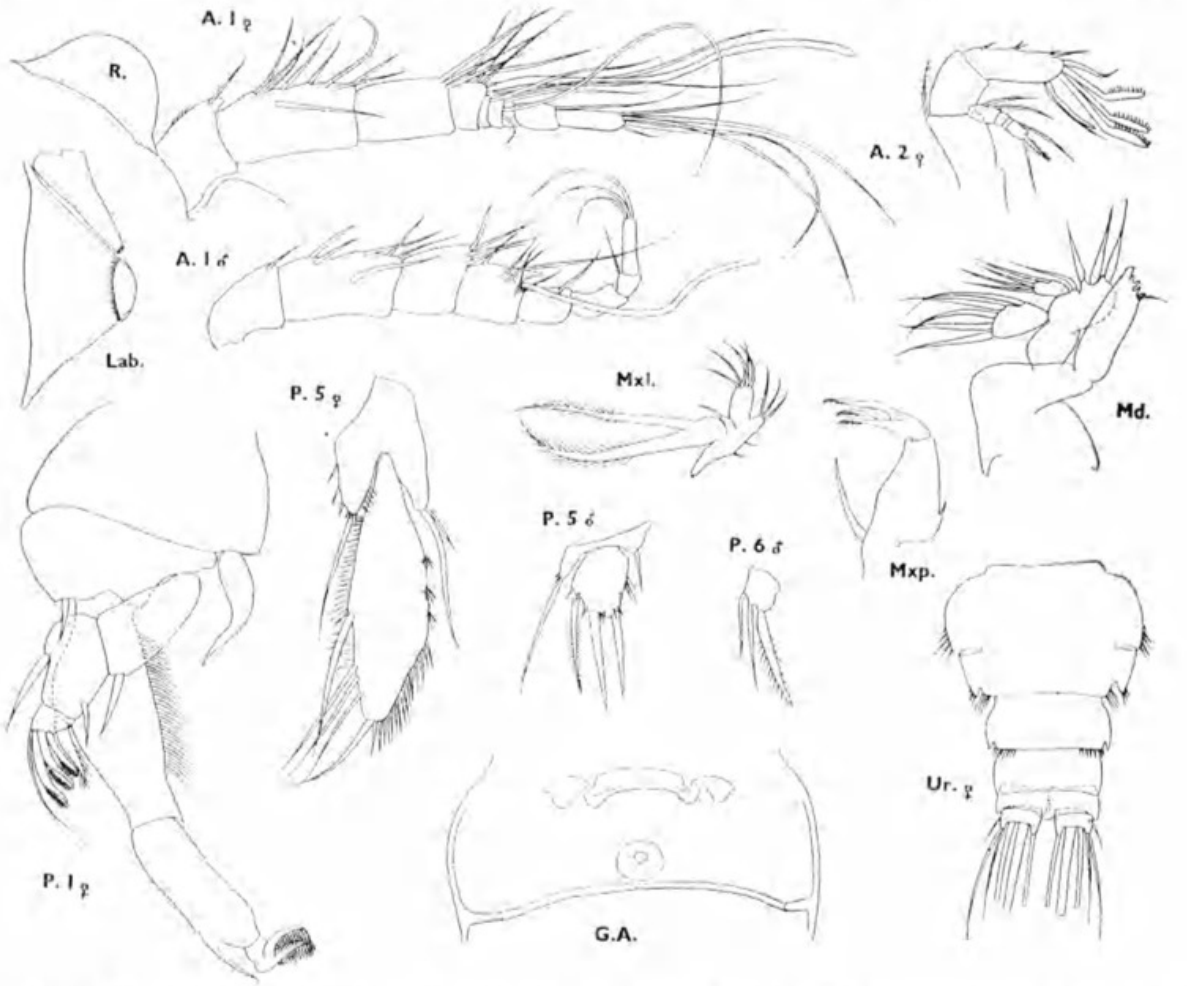

Fig. 14. *Machairopus intermedius* sp. nov., male and female. The labrum shows a recurved tip, and is accompanied by a mandible *in situ*; the drawing of the maxillule is taken from the male. The genital area of the female was drawn as seen through the urosome from the dorsal surface.

to the attachment of the seta. The fifth leg is very similar in all three species, and the caudal rami show only slight differences from those of *plumosa* (cf. Lang, *loc. cit.*, p. 19). The male differs from *plumosa* in the first antenna and fifth and sixth legs.

A second species of *Machairopus* occurred in collections from Sellick Beach (IX). An ovigerous female, measuring 0·69 mm., was found, but unfortunately the fifth legs were lost during dissection, and without these it is useless to describe the species.

FAMILY THALESTRIDAE Sars 1905.

Lang (1936e) has recently revised this family, and gives keys to the family and genera. He divides the family into four sub-families, chiefly on the sexual characters.

Sub-family DACTYLOPODIINAE Lang 1936.

EUDACTYLOPUS A. Scott 1909.

This genus contains three species, which are discussed by Lang (*loc. cit.* p. 35).

EUDACTYLOPUS AUSTRALIS sp.nov.

Occurrence: IX, 2 females; XII, 1 female; XIV, 1 female.

Female: Length 1·26–1·38 mm. Body comparatively slender, the urosome forming more than half the total length. First antenna 9-segmented; rostrum prominent, rounded, mobile—not always visible dorsally; second antenna with exopod distinctly 2-segmented; mouth parts showing greater development than in

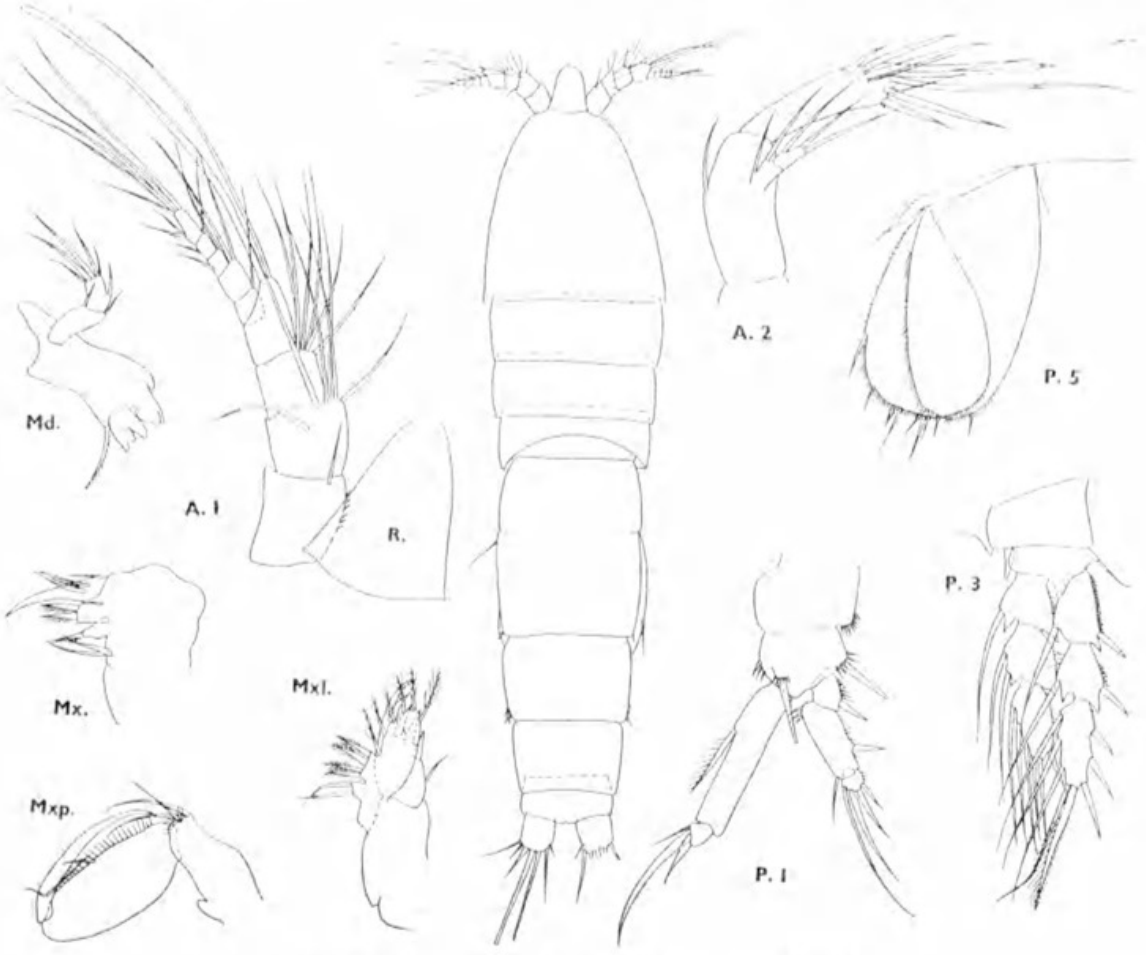

Fig. 15. *Eudactylopus australis* sp. nov., female.

type species (fig. 15). First legs like those of *robustus* (Claus, 1863); legs 2–4 with seta formula:

	endopod.	exopod.
p.2.	1.2.221.	1.1.223.
p.3.	1.2.321.	1.1.323.
p.4.	1.1.221.	1.1.323.

Fifth legs large, extending to the middle of the post-genital segment, basal segment with more or less parallel sides, end segment pyriform. Caudal rami as wide as long.

Male: Unknown.

This species shows several differences from previously described species. The genital segment is very large, and is almost as long as the remaining three urosome segments together. At the same time the body is relatively much more slender than in *robustus*. While the fifth legs are long, as in *robustus*, their segments are of a shape quite different from those of *robustus*, and they extend no further than the middle of the post-genital segment, whereas in *robustus* they reach at least to the hind margin of this segment. In *latipes* (T. Scott, 1894) they attain approximately the same position as in *australis*, but are of an entirely different shape. The 2-segmented exopod of the second antenna further distinguishes this species from *robustus* and from *spectabilis* (Brian, 1923).

Sub-family THALESTRINAE Lang 1936.

PHYLLOTHALESTRIS Sars 1905.

According to Lang (*op. cit.*, p. 43) the genus contains 3 species, with a possible fourth.

PHYLLOTHALESTRIS MYSIS (Claus) 1863.

Occurrence: XIII, 2 females (1 ovigerous).

Distribution: Norway, British Isles, Madeira, Mediterranean, Suez Canal, Ceylon, Obi Islands.

The two females in this collection show only small differences from the type. The size is somewhat smaller, 1·1 mm. instead of 1·4 mm., and the end segment of the second exopod has only 2 inner setae instead of 3 as shown by Sars (1911, pl. lxxi). Moreover, the inner seta on the basal segment of the fifth leg is relatively closer to the terminal setae, and the second outer seta of the distal segment is not differentiated as a spine, but this and the third seta are slightly stronger than the other 4. In a specimen taken in Western Australia these 2 setae are both small

spines. There seems to be a certain amount of variation in the fifth legs of this species (cf. Sars 1911, pl. lxxi, and Monard 1928, fig. xvii, 1). The Western Australian form agrees with that from Sellick Reef in the second exopod, but the inner seta on the basal segment of the fifth leg is missing.

FAMILY DIOSACCIDAE Sars 1906.

In conjunction with the present work I have made a revision of this family, dealing in particular with the genus *Amphiascus* and its closely-related genera.

This revision will be published separately. It need only be noted here firstly, that Gurney's (1927b) genus *Amphiascopsis* is retained, but has been enlarged to include a number of related forms, and, secondly, that the *debilis* forms and related species are placed in a new genus *Amphiascoides*.

A short definition of this new genus is given in the appropriate place.

AMPHIASCOPSIS Gurney 1927b.

AMPHIASCOPSIS LONGIPES sp.nov.

Occurrence: VII, 1 female, X, 5 females (4 ovigerous), 2 males; XIII, 2 females (1 ovigerous).

Female: Length 0·93–1·05 mm. Rostrum round anteriorly, with 1 seta on each side; first antenna 8-segmented; exopod of second antenna 3-segmented, middle segment with seta; first legs with very long endopod and large middle segment in exopod, typical of the genus; legs 2–4 also typical, with the following seta formula:

	endopod.	exopod.
p.2.	1.2.121.	1.1.223.
p.3.	1.2.321.	1.1.323.
p.4.	1.1.221.	1.1.323.

Fifth leg with distal segment nearly as wide as long, bearing 6 setae, basal expansion with 5 setae. Caudal rami as wide as long, setae unmodified.

Male: Length 0·90–0·96 mm. Differs from female only in the usual way. Basis of first endopod with large inner spine, which is strongly developed and curved; end segments of first endopod relatively longer than in female; second endopod modified as usual, with the spines strongly developed. Fifth legs with basal segments of opposite sides united in mid-line and each bearing 2 small spines; distal segments with 6 setae (2, 1, 3).

This species shows considerable resemblance to *lagunaris* Grandori, as illustrated by Brian (1928). It differs in the very long first endopod, with its short end

segments, and in the second endopod of the male. Other species of *Amphiascopsis* with very long first endopods are *sexsetatus*, *tenuiculus*, *gracilis*, *latifolius*, *minutus*, *aegyptius*, *phyllopus*, *havelocki*, *banyulensis*, and *hirsutus*. It differs from

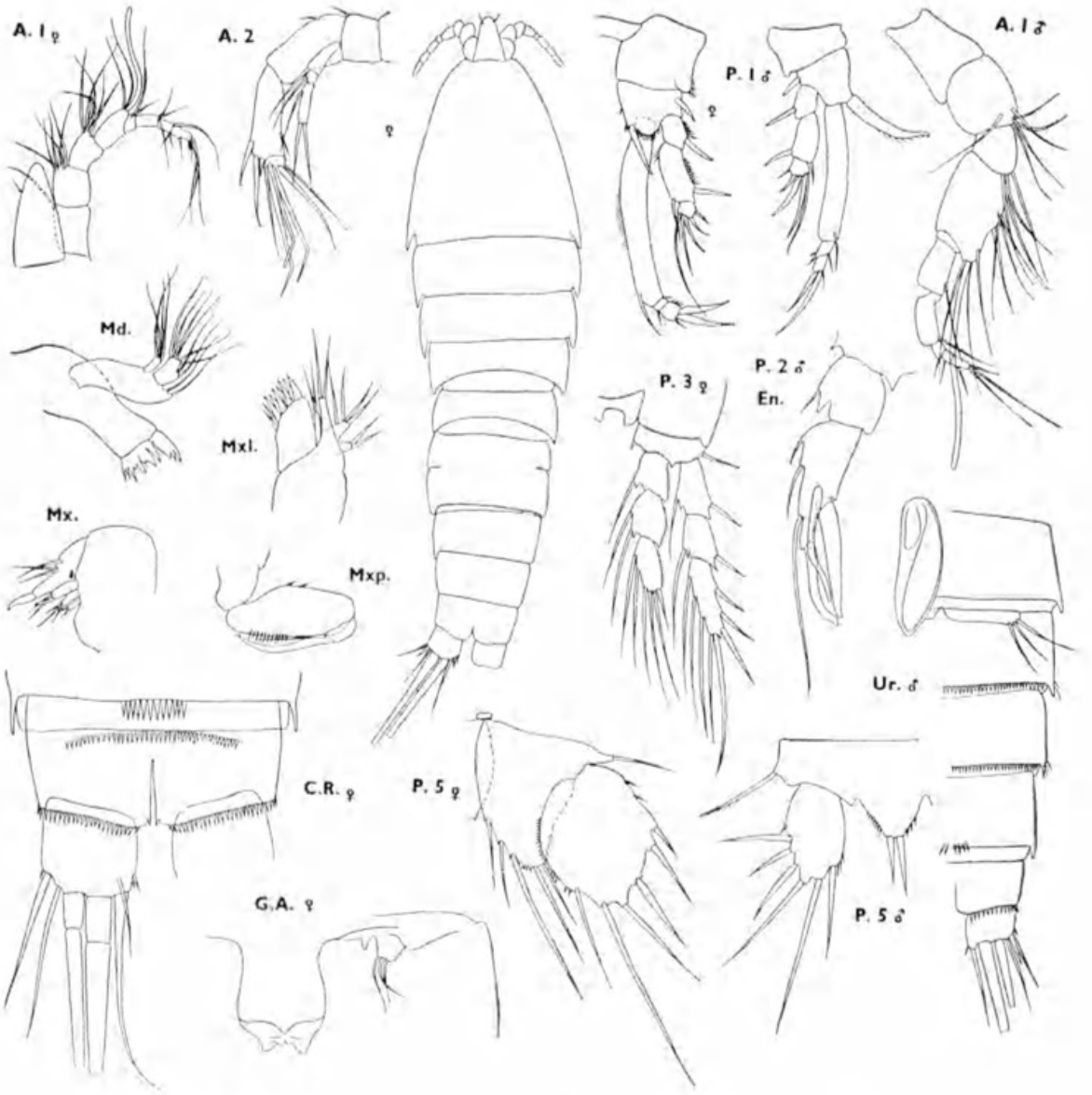

Fig. 16. *Amphiascopsis longipes* sp. nov., male and female.

the first two in the shape of the fifth legs, and from these and *gracilis* in having 3 inner setae on the end segment of the third exopod; from *latifolius* and the last 5 species in the first exopod, and from *minutus* in the fifth leg and male second endopod.

AMPHIASCOPSIS AUSTRALIS sp.nov.

Occurrence: XIII, 4 females, 1 male.

Female: Length 0·75–0·93 mm. Rostrum triangular, pointed, without lateral setae; first antenna 9-segmented, segments short and compact; exopod of second antenna 3-segmented, middle segment without seta; first legs of Amphiascopsid type but endopod not greatly elongated nor very slender; legs 2–4 with the usual seta formula for the genus, i.e. exactly as in *longipes* (above); fifth legs with basal

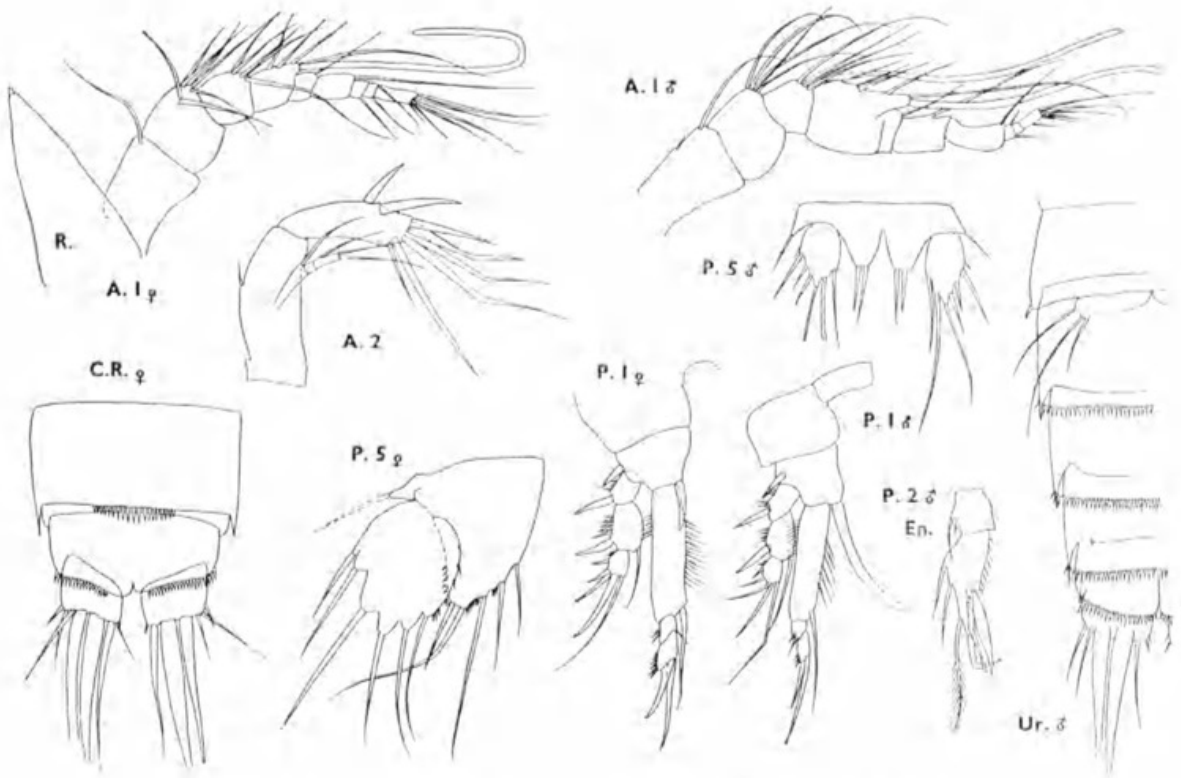

Fig. 17. *Amphiascopsis australis* sp. nov., male and female.

segment triangular, bearing 5 setae, end segment subcircular, with 6 setae. Caudal rami wider than long and nearly as long as anal segment, setae unmodified.

Male: Length 0·99 mm. First antenna 9-segmented; second antenna as in female. First legs with enlarged spine at base of endopod, otherwise as in female; second endopod modified, with 1 seta on basal segment, end segment with 3 lateral setae, 1 terminal spine-like seta and 2 spines attached about middle of segment. Remaining legs as in female. Fifth legs with basal segments of opposite sides united in mid-line, each bearing 2 spines; distal segments each with 6 setae (2, 1, 3).

This species, which was found associated with that described above, is very like it in some respects, but differs in the first antenna, exopod of second antenna,

first legs, caudal rami and rostrum. In several respects, particularly in the proportions of the first endopod, it resembles *attenuatus* (Sars 1906) but differs in the clearly 3-segmented exopod of the second antenna, the relatively wider first endopod, and in the shape and armature of the fifth legs. The male differs from that of *attenuatus*, which has been described by Wilson (1932, p. 218), in the first and second legs.

AMPHIASCOIDES gen. nov.

The following two characters serve to define this genus, which is composed of the *debilis* group of *Amphiascus sens. lat.*, with additions.

1: Middle segments of second and third endopods each with 1 inner seta.

2: Middle segment of first exopod without inner seta, end segment with only 4 setae and/or spines.

For the full description of the genus and list of species reference will have to be made to the text of the revision which it is hoped will be published during 1941.

AMPHIASCOIDES INTERMIXTUS (Willey) 1935.

Occurrence: X, 2 females; XIII, 1 ovigerous female.

Distribution: Bermuda.

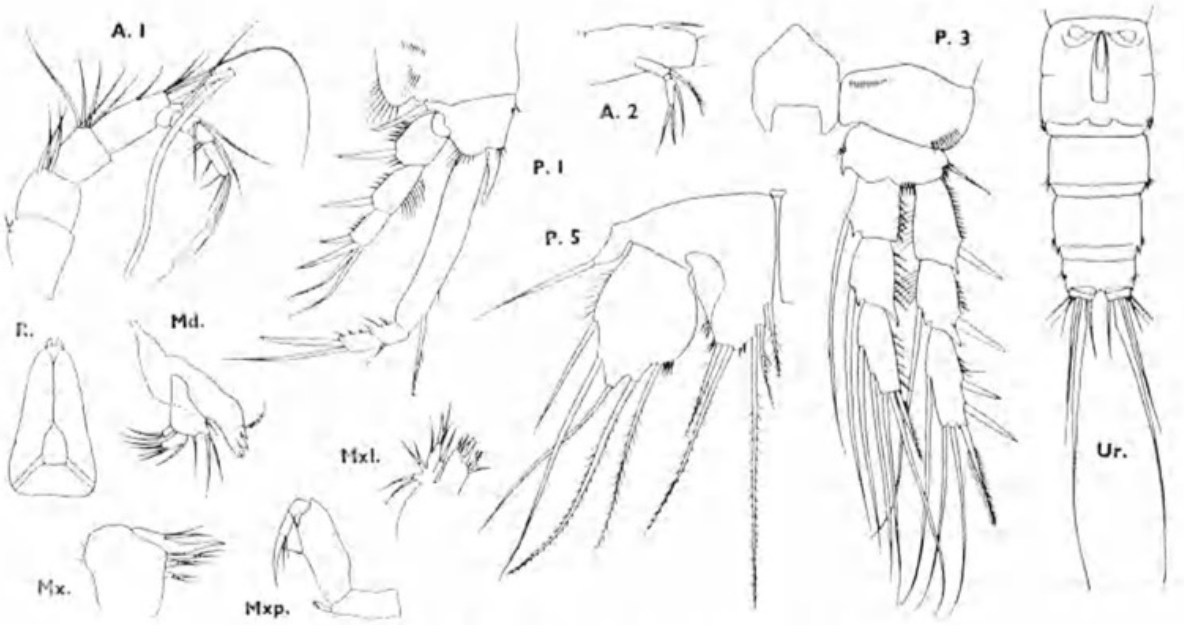

Fig. 18. *Amphiascoides intermixtus* (Willey), female.

In 1935 (p. 64) Willey described a species of *Amphiascus* from Bermuda, which was close to *A. debilis* (Giesbrecht) and which he named *subdebilis*; at the same time he found a variety (*intermixtus*) which differed only in the shape of the fifth leg. He has not illustrated his species very fully, and it is not known to what

extent *subdebilis* departs from *debilis*, except in the seta formula, fifth leg, and caudal rami. The species found here has the distal segment of the fifth leg indistinguishable from that of his variety, while the seta formula for legs 2–4 also agrees with *subdebilis*. In the proportions of the segments of the first endopod, however, it differs from *debilis* to a certain extent, as does also the rostrum, and failing information to the contrary it must be assumed that *subdebilis* agrees with *debilis* in these respects. It is uncertain what value should be ascribed to the proportions of legs, from a systematic aspect, and only extensive breeding experiments can enlighten us. The size of *subdebilis* is given as 0·47 mm., that of the variety as 0·69 mm.—the examples found here measured 0·90 mm.

In view of the considerable difference in size and its wide distribution I have raised the variety to the rank of a species, intermediate between *debilis* and *subdebilis*, as Willey's choice of name implies.

TYDEMANELLA A. Scott 1909.

Tydemanella A. Scott, 1909, p. 216.
Ialysus Brian, 1927.
Ialysus Gurney 1927b, p. 505.

The genus was regarded by Scott as a Thalestrid, related to *Dactylopodella*, which it resembles in shape and in the relatively large basal segment of the first endopod. It is, however, as stated by Lang (1936e, p. 18) clearly a Diosaccid, and belongs to the *Diosaccinae*. *Ialysus*, which I regard as synonymous with *Tydemanella*, was correctly placed in the *Diosaccidae* by its author, though both Gurney (1927b) and Monard (1935, p. 38) placed it in the *Thalestridae*. Furthermore, Monard (*loc. cit.*) includes *Tydemanella* in the *Thalestridae*, and Gurney (*loc. cit.*) states that *Ialysus* "differs very little" from *Vallentinia*, which Lang (*loc. cit.*) regards as synonymous with *Dactylopodella*. It is of interest to note that Scott (*loc. cit.*) states that *Tydemanella* "is closely related to *Dactylopodella*".

The close relationship of *Tydemanella* and *Ialysus* is thus independently established.

The generic diagnosis given by Scott (1909, p. 216) suffices for the two species hitherto described and for the new species described below. These are *typica* A. Scott 1909; *rufus* (Brian) 1927; and *robusta* sp.nov.

KEY TO THE FEMALES.

1. Segments 2, 3, and 4 of first antenna long and slender, at least twice as long as wide .. .. *typica* A. Scott 1909.
   These segments short and stout, no more than half as long again as wide .. 2.
2. Second segment of first antenna with large spine at distal corner. *rufus* (Brian) 1927.
   Second segment of first antenna without spine. .. *robusta* sp.nov.

TYDEMANELLA ROBUSTA sp.nov.

Occurrence: IX, 1 female, ovigerous; XIV, 1 male.

Female: Length 0·78 mm. (anterior portion 0·54, urosome 0·24 mm.); greatest width 0·36 mm. Body wide anteriorly, tapering gradually posteriorly.

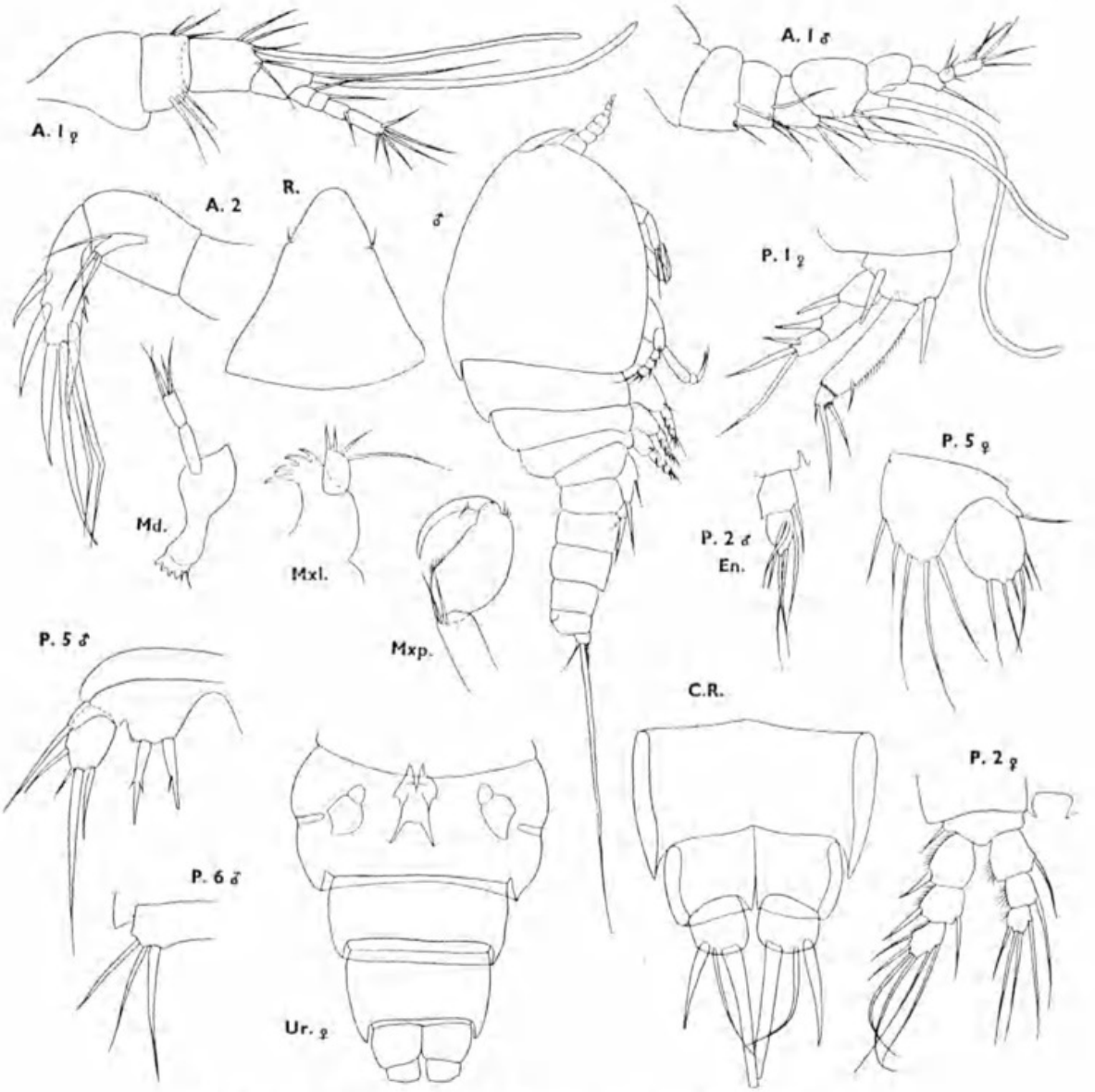

Fig. 19. *Tydemanella robusta* sp. nov., male and female.

Rostrum large, not always visible from above owing to curvature of body. Urosome wide anteriorly and tapering strongly to caudal rami, segments strongly chitinized; genital segment imperfectly divided. Caudal rami at least as wide as long, with 1 long terminal seta as long as the anterior portion of the body, 1 small seta, and 1 spine.

First antenna 8-segmented, the basal segments short and strongly built, and bearing sensory filaments on the third and fourth segments; distal portion with 3 short subequal segments and a long end segment; second antenna 2-segmented, with a small 1-segmented exopod attached at middle of basal segment, bearing 1 lateral and 2 terminal setae; mandible palp uniramous, 2-segmented, linear, the end segment with 4 setae; maxillule simply constructed, with 1 lobe; maxilla not seen; maxilliped normal.

First leg with 3-segmented exopod, without inner setae, and only 3 setae on end segment; endopod 2-segmented, basal segment as long as exopod but not greatly widened, end segment with 2 claws and 1 seta. Seta formula for legs 2–4:

	endopod.	exopod.
(1) p.2.	1.1.121.	0.1.222.
p.3.	1.2.221.	0.1.322.
p.4.	1.1.221.	0.1.322.

Fifth leg with wide basal segment bearing 5 setae, an oval distal segment with 6 setae. The female carries 2 egg-sacs, each with a few large eggs.

Male: Length 0·81 mm. (anterior portion 0·54, urosome 0·27 mm.). Body as in female, but urosome 5-segmented. First antenna 8-segmented, slightly modified; second antenna and mouth parts as in female; legs 1–4 as in female, but second endopod modified, 2-segmented, end segment with 1 lateral and 2 terminal setae, and a pair of spines inserted close together. Basal segment of first legs with large, strong, inner spine. Fifth legs with 2 strong spines on basal segment and 4 setae on distal segment; sixth legs with 1 large spine and 2 setae.

In the shape of the body this species agrees with the descriptions given for *typica* and *rufus*, but has a greater depth than is indicated in Scott's drawing. The first antenna closely resembles that of *rufus*, with the exception of the spine on the second segment in the latter. The second antenna is very like that of *rufus*, though with 2 terminal setae on the exopod in place of 1; in *typica* the exopod is very long and slender, and has a single terminal seta. The mandible palp differs from *typica* in the structure of the gnathobase. The mouth parts of *rufus* are neither described nor illustrated by Brian except for the maxilliped which is stated to be rather robust. Gurney (1927b, p. 505) describes the mandible palp as "apparently a long, slender, unbranched rod with three setae", which would

(1) In the single female at my disposal the 2nd endopods were asymmetrical, the end segment being imperfectly developed on one side. It is possible that there should be 2 setae on the middle segment, as in *rufus* (cf. Gurney 1927b, p. 506).

closely resemble the condition in the species described here. His illustration (fig. 133, D) of the maxilliped shows similarity with that of *robusta*. In *typica* the maxilliped is slender, differing from both *rufus* and *robusta*. The first legs agree in general with both species, but the endopod differs from *typica* in the relatively shorter terminal segment armed with 2 spines and 1 seta. In *rufus* the basal segment of the endopod is considerably broadened and not unlike that of *typica*. The exopod in *robusta* differs from the others in having only 3 appendages on the end segment (4 in the male, which has an additional small outer spine) and no inner seta on the middle segment. Legs 2–4 in *typica* are stated to be "nearly similar to those of *Dactylopodella*", which differs from that found here; in *rufus* they are described as being more or less like other Diosaccids.

The fifth legs are like *typica*, but with setae instead of spines on the basal segment, and are not very different from *rufus*. As in Brian's species, there are two egg-sacs, laterally compressed, with a few large ova. The egg-sacs of *typica* are unknown.

The male shows many points of similarity with that of *rufus*, particularly in the structure of the second endopod, though the shape of the end segment is not so strongly modified, and the inner spine on the basipod of the first legs is not enlarged as it is in *rufus*, but resembles that of the female.

FAMILY CANTHOCAMPTIDAE Sars 1906.

MESOCHRA Boeck, 1864.

? MESOCHRA PYGMAEA (Claus) 1863.

Occurrence: IX, 1 female.

Distribution: Norway, Heligoland, Bermuda, Woods Hole, Mediterranean, Suez Canal.

The single specimen, a female, occurring in this collection measured 0·27 mm., whereas previous records have given its size as from 0·33–0·40 mm. The structure of the first antenna could not be made out clearly in my preparation, neither was the exopod of the second antenna visible. It appears to differ in the number of setae on the end segment of the fifth leg, having only 4, and the inner seta on the basal segment of the first endopod is inserted mid-way along the margin instead of being slightly nearer the base. Since there is only the single specimen, and that not fully examined, it has been placed for the present, with Claus' *pygmaea*, which it very closely approaches.

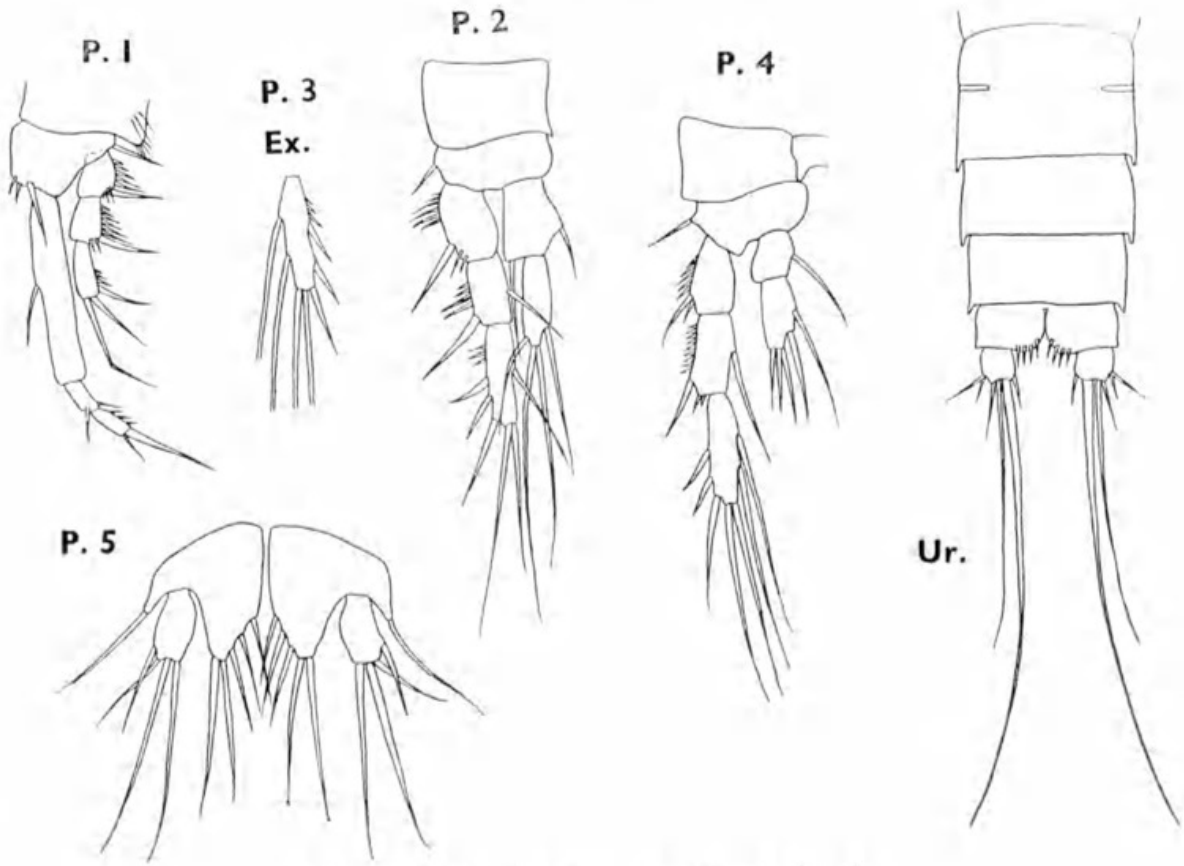

Fig. 20. ? *Mesochra pygmaca* (Claus), female.

ORTHOPSYLLUS Brady and Robertson 1873.

Until quite recently this genus has been regarded as a Cletodid, but it has been established by Lang (1936d) that it belongs to the *Canthocamptidae* (*loc. cit.*, p. 451). Four species have been described: *lincaris* (Claus) 1866; *propinquus* Monard 1926a; *wallini* Lang 1934; and *major* Klie 1939.

The last of these has, so far, been described only in a preliminary notice, without illustrations.

ORTHOPSYLLUS RUGOSUS sp.nov.

Occurrence: X, 2 females.

Female: Length 0·81 mm. for specimen in contracted condition, 1·05 mm. for specimen with body segments extended. Body of usual shape, tapering slightly posteriorly; rostrum prominent, slightly down-turned at extremity; anal operculum and portions of anal segment strongly denticulate; caudal rami with similar denticulate fringes to inner and outer margins.

Head appendages more or less normal, first antennae with the spur on the second segment slightly different on right and left sides (see fig. 21); end segment of mandible palp with 3 setae.

First legs with endopod segments subequal, basal segment without inner seta; legs 2–4 without inner setae on exopods, but 4th leg has a few inner hairs; seta formula:

	endopod.	exopod.
p.2.	0.110.	0.0.013.
p.3.	0.111.	0.0.013.
p.4.	1.111.	0.0.013.

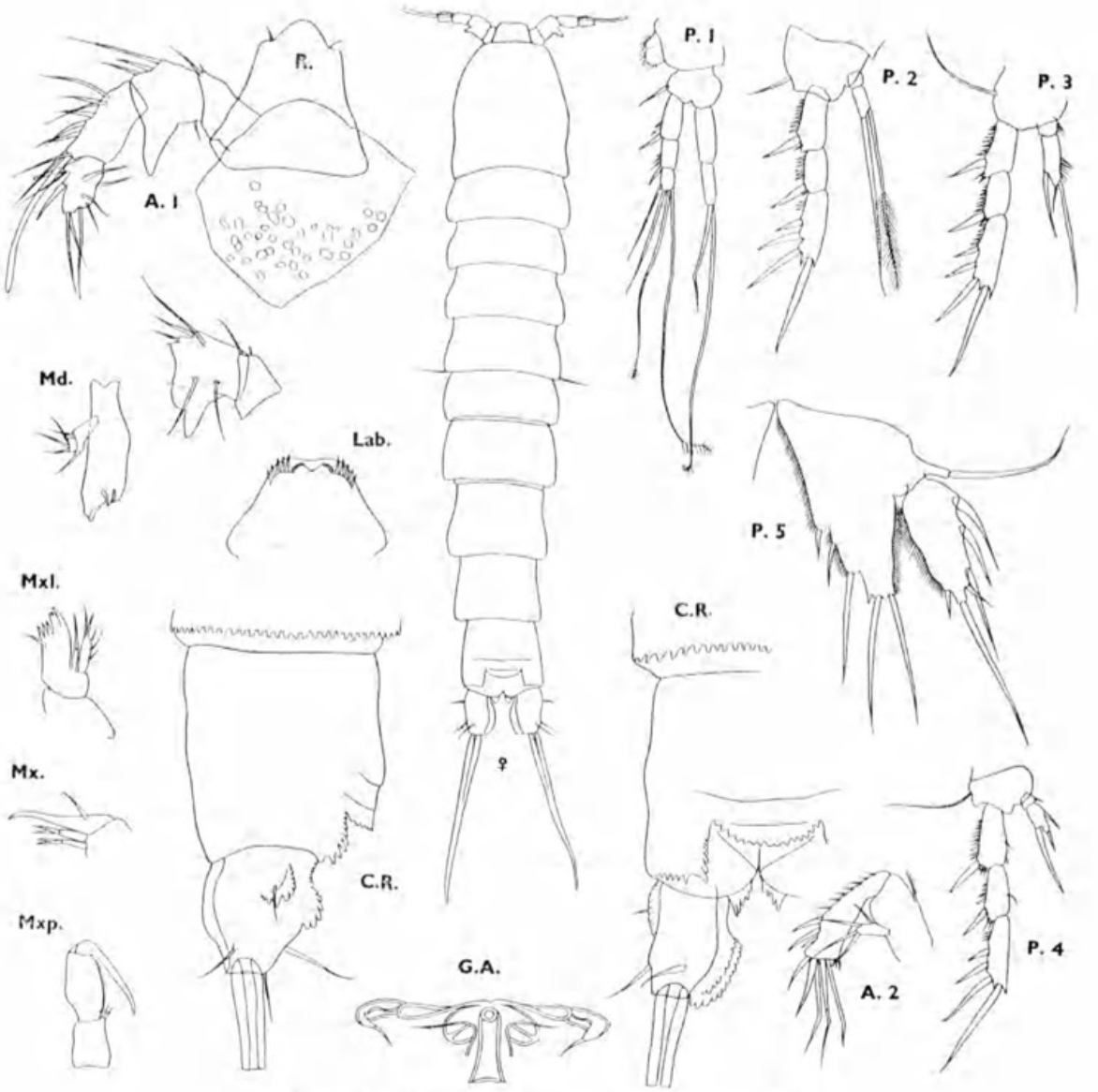

Fig. 21. *Orthopsyllus rugosus* sp. nov., female.

On the exopod of these legs the terminal seta which usually accompanies the spine, and is reduced in *lincaris*, is absent. The terminal seta on the third endopod is reduced to a fine hair. The fifth legs resemble those of *lincaris* rather than any other

species; Lang (1936e) has shown that Claus' species does occur with the segments of the fifth legs distinct.

Male: Unknown.

This species resembles *lincaris* in the structure of the fifth legs (allowing for the segments to be distinct) but differs from it in the caudal rami. In this respect it resembles the other three species. It differs from *propinquus* in the first legs, exopods of legs 2–4, fifth legs and caudal rami; *wallini* has only 2 outer spines on exopods 2–4, whereas here there are 3. Without illustrations it is difficult to compare this species with *major*, but it would appear to differ in the first legs, which are assumed to be like those of *lincaris*, and certainly differs in the maxillipeds.

FAMILY LAOPHONTIDAE Sars 1907.

LAOPHONTE Philippi 1840.

LAOPHONTE CORNUTA Philippi 1840.

Occurrence: VII, 2 females (1 ovigerous); IX, 3 ovigerous females; X, 1 female; XI, 1 female, 1 male; XIV, 1 ovigerous female.

Distribution: British Isles, Norway, Madeira, Mediterranean, Black Sea, Suez Canal, Ceylon, Malay Archipelago, Kerguelen, Falkland Islands.

Female: Length 0·90–1·02 mm. Several specimens of this clearly defined and widely distributed species were found; they do not depart from the description given by Sars 1911.

Male: Length 0·90 mm.

LAOPHONTE LONGISETA sp.nov.

Occurrence: IX, 1 male.

Male: Length 0·30 mm. Body of usual shape; first antenna 6-segmented, with the fourth segment only slightly swollen; second antennae and mouth parts normal; first legs very slender, exopod 2-segmented, endopod with very short end segment, terminal claw with small accessory seta; second legs apparently without endopod, but this may have been lost in dissection; third endopod with spine-like process at outer corner of middle segment; seta formula:

	endopod.	exopod.
p.2.	—	0.0.022.
p.3.	1.1.110.	0.0.012.
p.4.	0.120.	0.0.112.

Fifth legs with well developed end segment, bearing 5 setae, no inner basal expansion. Caudal rami little longer than wide, with an inner basal tuft of fine hairs

projecting laterally, giving a somewhat indistinct outline to the bases of the rami, and also imparting a superficial resemblance to *bulbifera*. Caudal setae longer than the whole body.

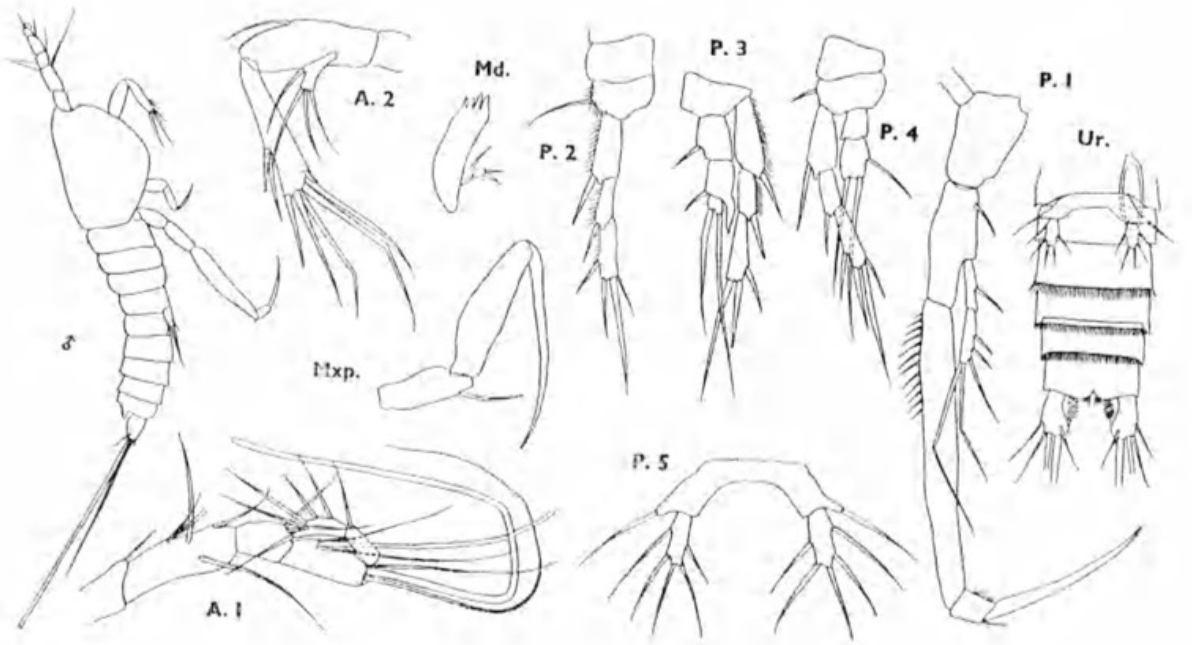

Fig. 22. *Laophonte longiseta* sp. nov. male.

This species approaches *rhodiaca* Brian (1928), of which only the male is known, but has fewer setae on the swimming legs. The fifth legs and caudal rami are remarkably alike in both. It seems possible that *rhodiaca* may be the male of *bulbifera*—the similarity extends to several points, but it will be necessary for them to be taken together for such a relationship to be established. In some respects also this new species resembles *bulbifera*, but there are no spurs on the first antennae, and the caudal rami do not project inwards.

FAMILY CEYLONIELLIDAE A. Scott.

CEYLONIELLA ARMATA (Claus).

Jurinia armata Claus 1866, p. 25.
Ceylonia aculeata Thompson and Scott 1903, p. 265.
Ceylonia armata A. Scott 1909, p. 227.
Ceylonia aculeata var. *adriatica* Brian 1923, p. 130.
Ceyloniella aculeata Wilson 1924 (1925), p. 14.
Lourinia armata Wilson 1924 (1925), p. 15.

Ceylonia armata Gurney 1927b, p. 567.
Ceyloniella aculeata var. *adriatica* Brian 1938, p. 23.
Ceyloniella armata Willey 1930, p. 111.
Ceyloniella armata Monard 1935a, p. 84.
Ceyloniella armata Monard 1937, p. 83.

This copepod was first described as *Jurinia armata* by Claus (1866) from the Mediterranean. In 1903 Thompson and Scott described a copepod *Ceylonia*

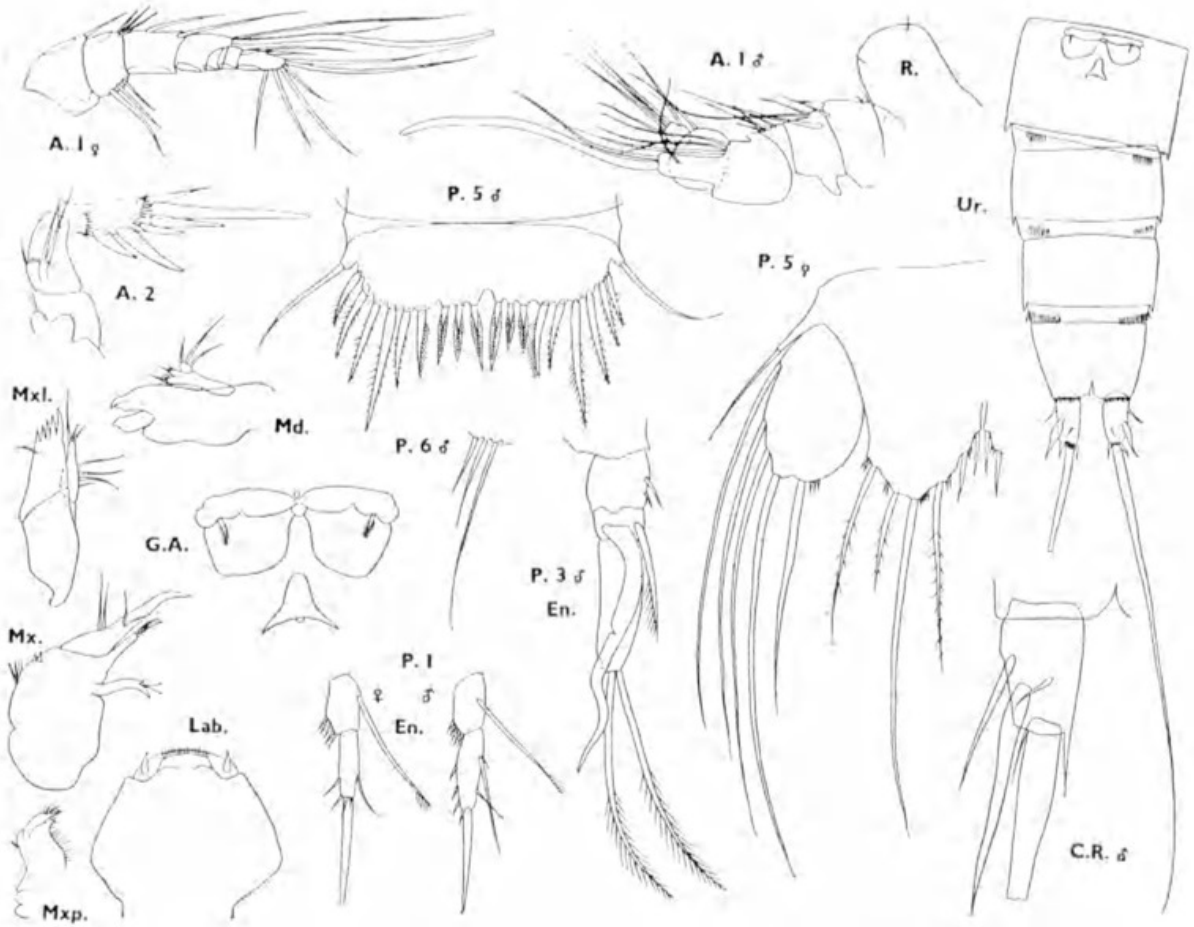

Fig. 23. *Ceyloniella armata* (Claus), male and female.

aculeata which A. Scott (1909) showed to be identical with Claus' *Jurinia armata*, but since Claus' generic name was preoccupied Thompson and Scott's generic name was retained. In 1924 Wilson showed that *Ceylonia* also was preoccupied, and renamed Thompson and Scott's genus *Ceyloniella*; at the same time he changed *Jurinia* to *Lourinia* without regard to its synonymy with *Ceylonia*. *Ceyloniella* stands as the correct generic name.

Occurrence: X, 5 females (4 ovigerous), 1 male; XI, 1 female, 2 males.

Distribution: Mediterranean, Suez Canal, Ceylon, Malay Archipelago.

Female: Length 0·93–1·32 mm.

Male: Length 1·02–1·23 mm. Despite certain minor differences when compared with Thompson and Scott's figures there can be no doubt that the specimens found here belong to this species. The caudal rami of the female illustrated show peculiar setae, which were not found in the male, nor in other specimens. The female fifth leg, moreover, lacks one seta on the distal segment, in comparison with the Ceylon material, thus conforming to Claus' and Gurney's descriptions. The seta formula for both sexes is identical, except for the male third endopod which is modified:

	endopod.	exopod.
p.2.	1.311.	0.1.123.
p.3.	1.321.	0.1.123.
p.4.	1.211.	0.1.123.

A single specimen of what may prove to be a new species occurred in the collection (also from Sellick Reef), but since it is represented by a non-ovigerous female, somewhat smaller than the other specimens, it is possibly only an immature specimen.

FAMILY METIDAE Sars 1911.

METIS Philippi 1843.

This genus has recently been revised by Steuer (1937), who includes a key to the species.

METIS JOUSSEAUMEI (Richard) 1892.

Occurrence: A considerable number of specimens occurred in the collections from Sellick Reef, both sexes being represented.

Distribution: According to Steuer (1937) it ranges from the North Atlantic to the Pacific (for details see Steuer, *op. cit.*).

There is nothing to distinguish the specimens found here from those found elsewhere. The depth of pigmentation appears to be a variable feature of the members of this genus. Specimens from South Australia were all colourless, whereas others taken from Rottnest Island, Western Australia, were bright red when captured. The pigment is destroyed on preservation in dilute formalin.

As in the case of Gurney's specimens (1927b, p. 571) the long caudal seta is longer than the whole body.

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