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SOME NEW NOTODELPHYID COPEPODS FROM AUSTRALIA

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SOMMAIRE

Description de trois espèces nouvelles de Copépodes des Notodelphyidae, trouvées dans la cavité pharyngienne d'Ascidies simples provenant de Sydney Harbour, Australie: *Pachypygus australis* n. sp. (dans *Pyura pachydermatina*), *Doropygus flexus* n. sp. (dans *Pyura praeputialis*) et *Doropygus curvipes* n. sp. (dans *Cnemidocarpa etheridgii*). Les deux espèces de *Doropygus* sont proches de *D. pulex*, représentant un groupe taxonomique dont les problèmes sont discutés.

INTRODUCTION

Insofar as our knowledge of the copepods inhabiting ascidians is concerned, the coasts of Australia are still very largely *terra incognita*. It is now over half a century since Schellenberg (1922) recorded nine such species, but remarkably few have been added - or perhaps even sought - in the intervening period. It is therefore a pleasure to acknowledge my indebtedness to Mrs. E.A. Egan of Sydney University, who has sent me four ascidicolous species from the general locality of Sydney Harbour. Of these, three notodelphyids (all of them new) are dealt with in this paper. The fourth, a small cyclopoid probably representing a new species of *Lichomolgus*, will be described when a rather more plentiful supply of mature specimens becomes available.

The notes given here on locality, colour, infestation levels etc., have been kindly furnished by Mrs. Egan.

Pachypygus australis n. sp. Fig. 1.

Material.- Numerous females from the pharynx of the simple ascidian *Pyura pachydermatina* (Herdman), the "sea tulip", collected 29.4.1973. The hosts were growing on old wharf piles in Neilsen Park, Port Jackson (Sydney Harbour). Other infected specimens of *P. pachydermatina* have been collected on the rock platforms of Cape Banks and Edwards Beach.

1 ♀ (holotype) and 2 ♀ (paratypes) have been deposited in the collections of the Zoölogisch Museum, Amsterdam (cat. nr. Co. 102.543); other paratypes have been sent to the British Museum (Natural

History), London (cat. nr. 1975, 919-921), and to the Australian Museum, Sydney (cat. nr. AM P 20606).

Description of female.- Five individuals averaged 4.2 mm in length, from the anterior curve of the cephalosome to the caudal rami inclusive. Size-range 3.7-4.4 mm. Body robust (fig. 1A) with rounded cephalosome terminating anteriorly in a rather sharply pointed rostrum (fig. 1B). Metasome of 4 progressively larger segments, the last enclosing the capacious brood pouch. Urosome of 6 segments, including an anal ring and the somite bearing the fifth legs.

Antennule (fig. 1C) 9-segmented, with the first 2 segments large and stout, and the third somewhat telescoped into the second. The setae appear to be distributed as follows: 1st segment - 3 setae; 2nd - 17; 3rd - 3; 4th - 5; 5th - 6; 6th - 4; 7th - 2; 8th - 3; 9th - 6.

Antenna (fig. 1D) 3-segmented. Proximal segment with 2 very slender, almost indiscernible setae distally, the second segment carrying 1 small seta at about ⅔ along its length, and the third bearing the usual terminal claw. Three small, slightly curved, graduated setae occur near the base of the claw. The armature of this segment is completed by a distal quartet of setae (one considerably longer than the others) and a very small, more proximally situated seta.

Mandible (figs. 1E, F). Basipodite with a single medial seta and a row of fine marginal denticles. First segment of endopodite with 4 graduated setae, second with 10 setae. Exopodite with 5 large ciliated setae. Masticatory lamella with 5 major teeth and 2 setules.

Maxillule (fig. 1G). Coxopodite with a long, ciliated seta and small, plumose setule. Major endite with 10 ciliated setae, second endite a projection terminating in a broad, blade-like seta. Basipodite with 4 setae of varying length. Endopodite rounded and bearing 7 ciliated setae. Exopodite rectangular, with 4 large, ciliated setae.

Maxilla (fig. 1H) composed of 5 segments, the first massive and bearing 9 setae and 1 setule. Second segment produced medially into a large falcate process, and carrying in addition 1 large and 1 smaller seta. Third segment small, almost square, with a single long seta. Fourth segment elongate, with 1 seta. Fifth segment very small, with 4 setae.

Maxilliped (fig. 1I) trimerous. The first and largest segment carries a proximal group of 4, and a distal group of 5, ciliated setae. The second bears a single seta, and the third, 4 setae.

First pereiopod (fig. 1K). Coxopodite with long, ciliated medial seta. Basipodite with slender lateral seta and stout medial spine. Both rami trimerous. The 2 basal endopodite segments each furnished with a single, medial, ciliated seta. Terminal segment with 6 long ciliated setae. Lateral borders of all 3 segments ciliated. The 2 basal exopodite segments each with a lateral spine and a medial seta. Terminal segment with 4 lateral spines and 4 medial setae. Medial borders of both basal segments ciliated, lateral borders with a number of small denticles or spinules.

Second pereiopod (fig. 1L). Coxopodite with long, slender, medial seta, basipodite with short lateral seta. Basal segment of endopod with 1 long seta, second with 2 setae and a ciliated lateral margin, third with 6 setae, some small denticles and ciliated lateral border. First segment of exopod markedly elongate, with 1 slender medial seta and a blunt latero-distal spine beside the base of which is a small plain seta. Second segment with medial seta, lateral spine and small plain seta. Terminal segment bearing 5 short, slender setae medially and 4 blunt spines.

Third pereiopod (figs. 1M, N). Coxopodite, basipodite, endopodite and basal segment of exopodite essentially similar to those of P2, save that the medial seta of the exopod's basal segment is plain rather than ciliated. Second exopodite segment lacking the small latero-distal plain seta. Terminal exopod segment with 4 short setae, a small medial projection and 4 blunt spines.

Fourth pereiopod (figs. 1 O, P). Coxopodite and basipodite with the usual setae, plus some small denticles as shown. Endopod noticeably smaller than exopod, trimerous, with all segments ciliated on lateral margin, and with 1 medial seta on basal segment, 2 on second segment, and 5 on third. Exopod trimerous, but strongly modified. Basal segment long, armed distally with a short, blunt spine. Middle segment short, indistinctly demarcated from terminal segment and bearing 2 setae of unequal length. Third segment short and linguiform, carrying 5 delicate setae, and with 2 blunt terminal spines. A large area of this segment is covered by small irregularly-arranged tubercles.

Fifth leg (fig. 1Q) uniramous, bimerous. Basal segment with marked lateral protuberance on which is situated a slender seta. Second segment long and narrow, carrying terminally a slender lateral seta and a short, thorn-like spine. Four rows of small denticles adorn the medial margin.

Caudal rami (fig. 1J) well developed, slightly tapered, approximately 4 times longer than the greatest breadth. Four small, stout hooks occur terminally, and 2 small setae are present at about the mid-point of each ramus.

No adult male has so far been found.

Colour: In life, this copepod is described as colourless with a few black patches, and with black ova in the incubatory pouch.

Biological notes: Infestations of up to 9 copepods per host have been observed. A co-habitant in the host is the nemertean *Gononemertes australiensis*.

Remarks: Up to now, 4 species have been assigned to *Pachypygus* - *P. gibber* (Thorell, 1859), long known from the coasts of western Europe; *P. macer* Illg (1958), from the eastern American sea-bord; *P. curvatus* Ooishi (1961) and *P. globosus* Ooishi (1963), both so far reported only from Japan.

Of these, the type-species *P. gibber* and the American *P. macer* would seem to be closely related allopatric species, the former occupying the western Atlantic and Mediterranean and the latter the eastern side of the Atlantic. However, whilst *P. gibber* occurs in a great variety of ascidian host families (Clavelinidae, Cionidae, Corellidae, Ascidiidae, Styelidae, Pyuridae and Molgulidae), *P. macer* appears to be restricted to styelids and pyurids. *P. curvatus* is known only from *Pyura michaelseni*, and *P. globosus* from the styelid *Cnemidocarpa areolata*.

The present form, *P. australis* n. sp. is clearly very close to the Japanese *P. curvatus*, and, like it, is found in a species of *Pyura* - *P. pachydermatina*. Indeed, were material available from areas to the north of Australia, this copepod might well be regarded merely as a geographic race of *P. curvatus*. However, in the absence of specimens from intermediate localities, it seems best to give it specific rank. In this case, we may tentatively suppose that an allopatric situation again obtains, with one species from the northern Pacific, and its close ally from the southern part of that ocean.

It may be mentioned here that *P. gibber* has been reported from south-west Australia (Schellenberg 1922, as *Notopterophorus gibber*) - a record queried by Illg (1958). The doubt expressed by Illg may well be valid, but it should perhaps be borne in mind that the host of Schellenberg's copepod was a species of *Ascidia* (*A. glabra*) - a genus which certainly harbours *P. gibber* on European coasts. It may be, therefore, that this versatile species has indeed penetrated Australian waters.

A key for the identification of *Pachypygus* species so far known is given below. This is based on females, the only males described to date being those of *P. gibber* (by Canu, 1892) and *P. macer* (by Stock, 1970).

1a. Exopodite of second and third pereiopods armed with 6 spines in addition to setae 2
 b. Exopodite of second and third pereiopods armed with 7 spines in addition to setae; metasome markedly inflated .... *P. globosus*

2a. Distal segment of exopodite of fourth pereiopod linguiform 3
 b. Distal segment of same not linguaform 4

3a. First and second segments of exopodite of P2 each bearing a small delicate seta adjacent to the latero-distal spine; third segment of P4 exopod with tubercles irregularly distributed; basal segment of fifth leg produced at outer distal angle into a distinct triangular protuberance .... *P. australis* n. sp.
 b. First and second segments of exopodite of P2 lacking the above-mentioned setae; third segment of P4 exopod with tubercles arranged in rows; basal segment of fifth leg not produced into a triangular protuberance .. *P. curvatus*

4a. Medial margin of third segment of P4 exopod straight and unornamented .... *P. macer*
 b. Medial margin of third segment of P4 exopod sinuate, set with spinules .... *P. gibber*

Doropygus flexus n. sp. Fig. 2

Material.- Numerous females from the pharynx of *Pyura praeputialis* (Heller), collected on the rock platform at Edwards Beach, Port Jackson (Sydney Harbour), March 1973. Also found at the Bottle and Glass Rocks (Port Jackson), Cape Banks (Botany Bay) and Harbord (just north of Port Jackson).

1 ♀ (holotype) and 2 ♀ (paratypes) have been deposited in the collections of the Zoölogisch Museum, Amsterdam (cat. nr. Co. 102.542); other paratypes have been sent to the British Museum (Natural History), London (cat. nr. 1975. 916-918), and to the Australian Museum, Sydney (cat. nr. AM P. 20605).

Description of female.- Seven individuals averaged 2.0 mm in length, from the anterior curve of the cephalosome to the caudal rami inclusive. Size-range, 1.7-2.3 mm. This is a fairly large-bodied species, characterized by the smoothly rounded brood pouch and the upwardly curved urosome (fig. 2A). The rostrum (fig. 2B) is evenly rounded.

Antennule (fig. 2B) obscurely 8-segmented. First 2 segments markedly swollen. Last segment elongate, with a slight constriction, indicating coalescence of 2 original segments. As far as can be determined, the setation is as follows: 1st segment - 3 setae; 2nd - 12, plus hook; 3rd - 5; 4th - 3; 5th - 3; 6th - 3; 7th - 1; 8th - 9. The ciliation present on a number of the setae has been omitted in the drawing.

Antenna (fig. 2C) trimerous, with the second segment short and somewhat inflated, and furnished with 1 very small seta near its distal extremity. Third segment elongate, carrying distally a small seta and a tiny adjacent setule. Terminal claw well developed, with 3 short, curved setae inserted near its base.

Mandible (figs. 2D, E). Masticatory lamella of usual type, edged by 5 main teeth, closely set denticles and 2 setules. Basipodite with seta on medial margin. Endopodite bearing 4 graduated setae on medial margin of first segment, and 8 setae on second segment. Exopodite with 4 large setae.

Maxillule (fig. 2F). Major endite of coxopodite with 9 setae, secondary endite terminating in a broad, pointed blade. Epipodite with a large, ciliated seta and a small ciliated setule. Basipodite bearing 3 large, ciliated setae. Endopodite small, rectangular, with 2 setae. Exopod with 4 setae, of which the most proximal is the largest.

Maxilla (fig. 2G) pentamerous. Large basal segment with 8 medial setae. Second segment bearing 1 seta and a shorter, curved, slightly denticulate element, seemingly intermediate between a standard seta and a falcate process. Third and fourth segments each with a single seta. Fifth segment small, with 3 terminal setae.

Maxilliped (fig. 2H) small, unimerous, almost square. Nine setae on medial margin and 2 longer terminal setae.

First pereiopod (fig. 2J). Coxopodite with long, ciliated medial seta. Basipodite bears laterally a short seta, swollen at the base but with abrupt distal taper, and a stout medio-distal spine. Rami trimerous. First and second segments of endopod each bearing a medial seta, terminal segment with 6 setae. First and second exopodite segments each with a medial seta and a lateral spine. Third segment with 4 spines along lateral margin and 4 setae on medial side.

Second pereiopod (fig. 2K). Coxopodite as before, basipodite with short plain seta. Endopod bimerous, but terminal segment showing evident coalescence of 2 constituent segments. Basal segment with 1 medial seta, and a clump of cilia on opposite margin. Terminal segment elongate, with 2 ciliated and 6 plain setae, plus a row of small spinules at proximal third. Exopod trimerous, first and second segments each with 1 lateral setiform spine and 1 medial seta. Terminal segment with 9 setiform elements, of which only the proximo-medial is ciliated.

Third pereiopod (fig. 2L) substantially similar to P2 in both segmentation and setation. A small thorn-like projection is present just proximal to the insertion of the medial seta of the endopod's basal segment, and similar projections occur laterally on the exopod's first 2 segments.

Fourth pereiopod (fig. 2M). Essentially similar to P3, but shows reduction of 1 seta on terminal segment of both endopod and exopod.

Fifth leg (fig. 2N) bimerous, with broad basal segment adorned by a setule and 2 rows of minute spinules. Second segment narrow, carrying terminally a longer and a shorter seta, and with 3 oblique rows of spinules on medial margin.

Caudal rami (fig. 2I) rather long and narrow with slight distal taper, and bearing terminally 4 short setae. A small lateral seta and a short medial seta are also present.

No adult male has so far been found.

Colour: The live copepod is described as colourless, with black ripening ova in the incubatory pouch.

Biological notes: Very heavy infestations have been noticed - up to 123 individuals per host. This copepod is apparently very active when removed from the ascidian. On eclosion of the young, the urosome flexes quite violently, forcing most of the nauplii and matrix out of the pouch.

Remarks.- Using Illg's (1958) key, this copepod would emerge as *Doropygus pulex*, but it is clearly distinct from any of the described forms of that species. Paradoxically, this is apparent more from superficial inspection of the general habitus than from detailed examination of the appendages. The evenly circular outline of the posterior part of the brood pouch and the curved urosome are, however, distinctive, and produce an effect more reminiscent of *D. dakarensis* Monniot. Nonetheless, the pronounced correspondence to *D. pulex* in most of the structural details places this form firmly within the *pulex* group of species. Possibly the antenna offers the most reliable means for distinguishing *D. flexus* from the Atlantic and Mediterranean forms of the type-species, since it carries 3 setae at the base of the terminal hook rather than 1 or 2. Additional support for its separate status might perhaps be adduced from the observation of its active behaviour in life, *D. pulex*, by contrast, being a markedly sluggish form. If, of course, we had more data on the bewildering variation (both geographical and host-wise) to which *D. pulex* is prone, a re-assessment of the new species might be in order. This question is further discussed at the end of the present paper.

Doropygus curvipes n. sp. Fig. 3

Material.- Several females from *Cnemidocarpa etheridgii* Hartmeyer (= *Styela etheridgii*) growing on wharf piles at the bases of the stalks of *Pyura pachydermatina* in Neilsen Park, and on rocks at the Bottle and Glass Rocks in Port Jackson. Collected May, 1973.
1 ♀ (holotype) has been deposited in the collections of the Zoölogisch Museum, Amsterdam (cat. nr. Co. 102.544).

Description of female.- Four specimens averaged 2.0 mm in length from anterior curve of cephalosome to posterior part of brood pouch. Size-range 1.8-2.1 mm (fig. 3A).

Antennule (fig. 3B). Nine-segmented, first 2 segments considerably inflated. The setation appears to be: 1st segment - 3 setae; 2nd - 13, plus barely curved hook; 3rd - 5; 4th - 2; 5th - 4; 6th - 2; 7th - 1; 8th - 2; 9th - 4. The bases of the antennules abut onto a well developed, U-shaped rostrum (fig. 3, O).

Antenna (fig. 3C) trimerous, middle segment slightly swollen. Basal segment with 2 very small setules at proximal third, and 2 or 3 similar setules forming a little clump at distal extremity. Middle segment with 1 setule near distal end. Third segment elongate, bearing a small setule proximally, and a large and a smaller seta side by side distally. The usual strong terminal hook is invested by a light membranous sheath, and from its base arise 3 fairly short, terminally curved setae.

Mandible (fig. 3D). Masticatory lamella with 5 main teeth, a row of closely set denticles and 2 separated setules. Basipodite with single seta on medial margin. First segment of endopod with 4 graduated medial setae. Second segment fringed by 8 setae. Exopodite elongate, with 4 very large, ciliated setae and 1 small plain seta near the tip of the lateral margin.

Maxillule (fig. 3E). Epipodite represented by seta and setule. Major endite with 9 setae on medial margin, secondary endite lobate, terminating in a distally ciliated lamella. Basipodite bearing 3 setae, of which 2 are large and subequal and the third smaller. Endopod rectangular, with 2 setae. Exopod bearing 4 setae, the most proximal being largest. The 2 distal setae are furnished with long cilia near their tips.

Maxilla (fig. 3F) pentamerous, with broad basal segment carrying 8 setae on medial margin. Second segment with 1 seta and a shorter, slightly curved setiform element. Third and fourth segments each bearing 1 seta. Fifth segment with 3 setae.

Maxilliped (fig. 3G) unimerous, rectangular, with 9 setae medially and 2 long terminal setae.

First pereiopod (fig. 3I). Coxopodite with the usual long medial seta, basipodite bearing laterally a seta swollen proximally but with an abrupt distal taper. Medio-distally, the basipodite carries a strong spine. Endopod curiously twisted in a medial direction about half-way along its length. This ramus would seem to be basically trimerous but the line of demarcation between the second and third segments is extremely faint and may indicate that coalescence of these 2 podomeres is well advanced. Basal and middle segments each with 1 medial seta, third segment with 6 setae. Exopod trimerous, basal and second segment each bearing a medial seta and a blunt lateral spine, terminal segment with 4 spines and 4 setae.

Second pereiopod (figs. 3 J, K). Coxopodite and basipodite substantially as in P1, except that the basipodite's seta is small and plain. Endopod bimerous, with basal segment bearing a medial seta and a patch of tiny spinules near the lateral margin. Distal segment elongate, with strongly indented medial margin ornamented with several small thorn-like spines. A transverse row of spinules suggests coalescence of 2 original segments. Eight setae present, plus 2 clumps of cilia on lateral margin. Exopod trimerous, basal and second segments each carrying a medial seta and a lateral setiform spine. Terminal segment (fig. 3K) typically with 9 setal elements, though figure 3J illustrates a specimen with only 8. (The other second pereiopod of this individual exhibited the usual 9 setae).

Third pereiopod (fig. 3L) essentially similar to P2.

Fourth pereiopod (fig. 3M). General appearance and segmentation similar to P3. However, the terminal segments of both exopod and endopod carry 1 seta less - 8 and 7 respectively.

Fifth leg (fig. 3N) bimerous, with broad basal segment adorned distally with a row of small spinules and 1 small latero-distal seta. Second segment elongate, lateral margin slightly curved. Terminally, a seta almost as long as the segment itself, a shorter seta, and a small thorn-like spine are present. Medial margin with 1 pronounced indentation, ornamented by small spinules.

Caudal rami (fig. 3H) rather elongate, with slight distal taper, and bearing terminally 4 short setae. A small lateral seta occurs at about ¼ from the proximal end, and 3 delicate medial setae are spaced approximately equidistant along the proximal half of the ramus.

No adult male has so far been found.

Colour: The ova in the incubatory pouches of live specimens are described as being a deep purple-wine colour.

Biological notes: Infestation level said to be low in October.

Remarks: Like the last species, this copepod would emerge on Illg's key as *Doropygus pulex*, though it fits none of the described variants of the type-species. Equally, it does not correspond to any of the 10 *Doropygus* species described since 1958.

D. curvipes n. sp. can be separated from *D. pulex* by the distorted P1 endopod, the much greater length of the terminal setae of P5, and the presence of 3 setae, rather than 1 or 2, at the base of the antennal hook, as well as by certain other less obvious features. It can be distinguished from *D. flexus* n. sp. by the more pointed shape of the brood pouch and by the distorted P1 endopod.

The marked similarity, however, of these new Australian doropygids to *D. pulex* emphasizes yet again the taxonomic problem, at once fascinating and frustrating, posed by the type-species. The following comments on the latter may therefore be relevant.

If we accept past identifications as correct, the geographical range of *D. pulex* is certainly enormous. It includes the north and south Atlantic, the North Sea and Irish Sea, the Skagerrak, the Mediterranean, the Indian Ocean and the north and south Pacific. But in addition to whatever variation might be expected in so wide a distribution, there is the significant element of host-difference to consider. Illg, in fact, lists no fewer than forty-two ascidian species from which this copepod has been recovered! - and several authors have noted subtle but reasonably constant variations seemingly connected with a particular host or host family (see, for example, Illg and Dudley, 1965). Unfortunately, however, many of the older records leave some doubt as to the true identity of the ascidian concerned - due, in part at least, to the confusing synonymy which the host group has accreted over the years. Moreover, very few accounts of *D. pulex* itself are sufficiently detailed or adequately enough illustrated to reveal the small but consistent differences apparently involved. Indeed, only four such good descriptions linked with reliably identified hosts come to mind - that of Illg (1958) from American and Bermudan styelids; Illg and Dudley (1961) from Mediterranean *Microcosmus sulcatus*; Illg and Dudley (1965) from Mediterranean *Ascidiella aspersa*; and Ooishi (1962) from Japanese *Styela plicata*.

Careful investigation of other localities and other hosts may eventually clarify this situation, but from the data already available it may be tentatively suggested that at least two main evolutionary lines in *D. pulex* can be discerned. The first infects the enterogonous ascidiids (and probably other enterogone families) and is characterized by the presence of 9 setae on the distal segment of the mandibular endopodite. The second.

is associated with the pleurogonous styelids and pyurids, and its members possess 8 (or sometimes 7) setae on this segment. A further distinction between these trends may possibly reside in the size of the antennal hook relative to the segment which bears it. In specimens from the enterogone host-line this hook is large - at least half as long as the segment - whilst in copepods from pleurogone hosts, it is appreciably smaller, being less than half the supporting segment's length. Examination of more material, however, would clearly be necessary before the validity of this suggestion could be established.

In conclusion, it should be mentioned that copepods referred to *D. pulex* have already been recorded in Australian waters. Schellenberg (1922) cites specimens from south-west Australia (in *Molgula nodosa*), south Australia (in *Pyura spinifera*), north Australia (in *Polycarpa obscura*) and Sydney (in *Styela plicata* and *Microcosmus exasperatus* var. *australis*). However, since the very complex taxonomic situation pertaining to this doropygid was not fully apparent fifty years ago, there must be some reservations as to the precise identity of Schellenberg's material. It is, for example, quite possible that he may have had before him either or both of the *Doropygus* species described in the present paper.

REFERENCES

CANU, E., 1892. Les copépodes du Boulonnais. Trav. Stat. zool. Wimereux, 6: 1-354.

ILLG, P.L., 1958. North American copepods of the family Notodelphyidae. Proc. U.S. natn. Mus. 107: 463-649.

ILLG, P.L. & P.L. DUDLEY, 1961. Notodelphyid copepods from Banyuls-sur-Mer. Vie Milieu (Suppl.), 12: 1-126.

----&----, 1965. Notodelphyid copepods from the vicinity of Naples. Pubbl. Staz. zool. Napoli, 34: 373-451.

OOISHI, S., 1961. A new notodelphyoid copepod, Pachypygus curvatus n. sp., found in Japan. Rep. Fac. Fish. prefect. Univ. Mie., 4: 87-92.

---------, 1962. Four species of notodelphyoid copepods newly found in Japan. Rep. Fac. Fish. prefect. Univ. Mie., 4: 7-25.

---------, 1963. On two new notodelphyoid copepods from the Bay of Matoya. Rep. Fac. Fish. prefect. Univ. Mie., 4: 419-428.

SCHELLENBERG, A., 1922. Neue Notodelphyiden des Berliner und Hamburger Museums mit ein Übersicht der Ascidienbewohnenden Gattungen und Arten. Mitt. zool. Mus. Berlin, 10: 219-274 and 277-298.

STOCK, J.H., 1970. Notodelphyidae and Botryllophilidae (Copepoda) from the West Indies. Studies Fauna Curaçao, 34 (123): 1-45.

THORELL, T., 1859. Bidrag till kännedomen om krustaceer som lefva i arter af slägtet Ascidia L. K. svenska Vetensk.Akad. Handl., 3 (8): 1-84.

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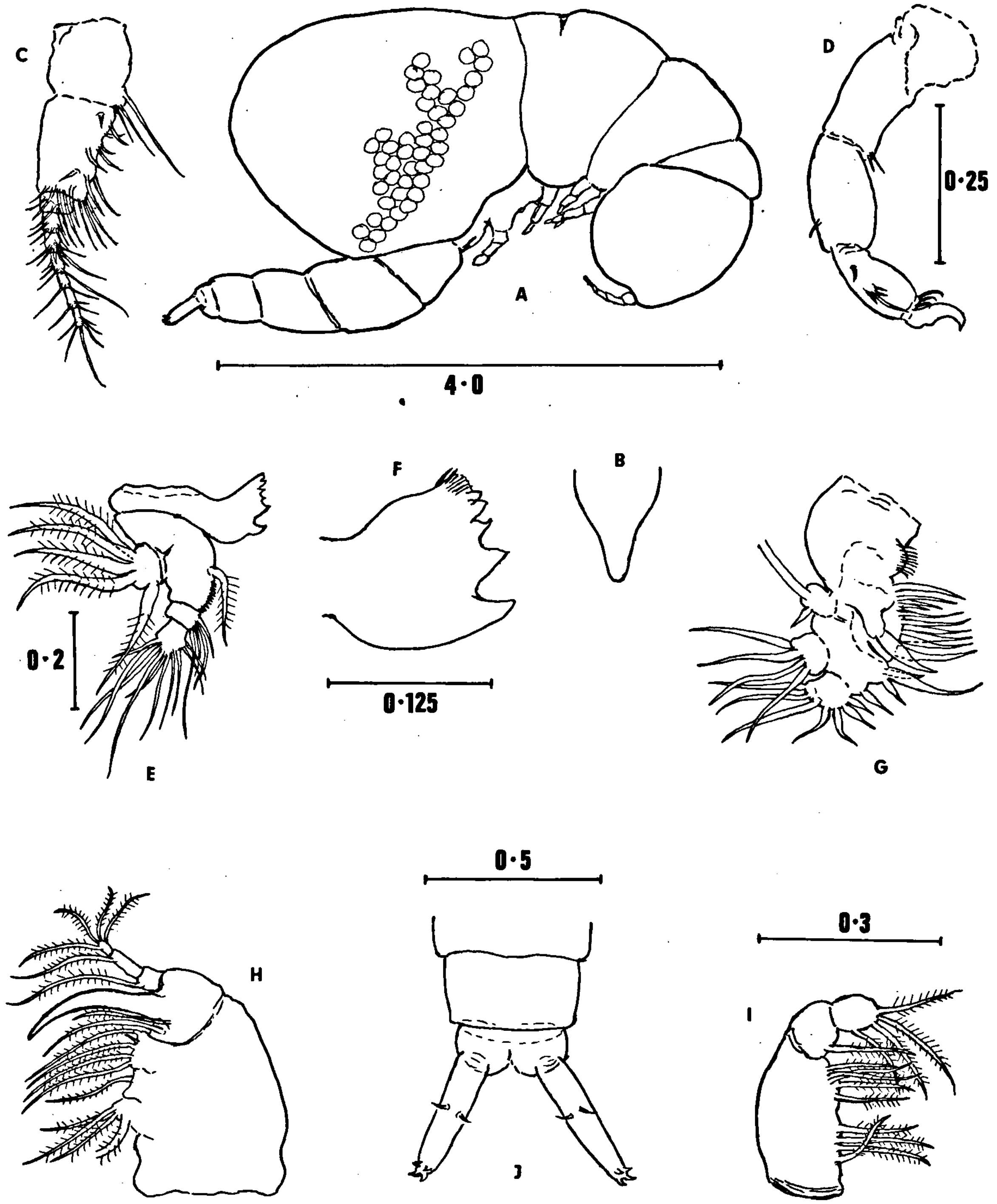
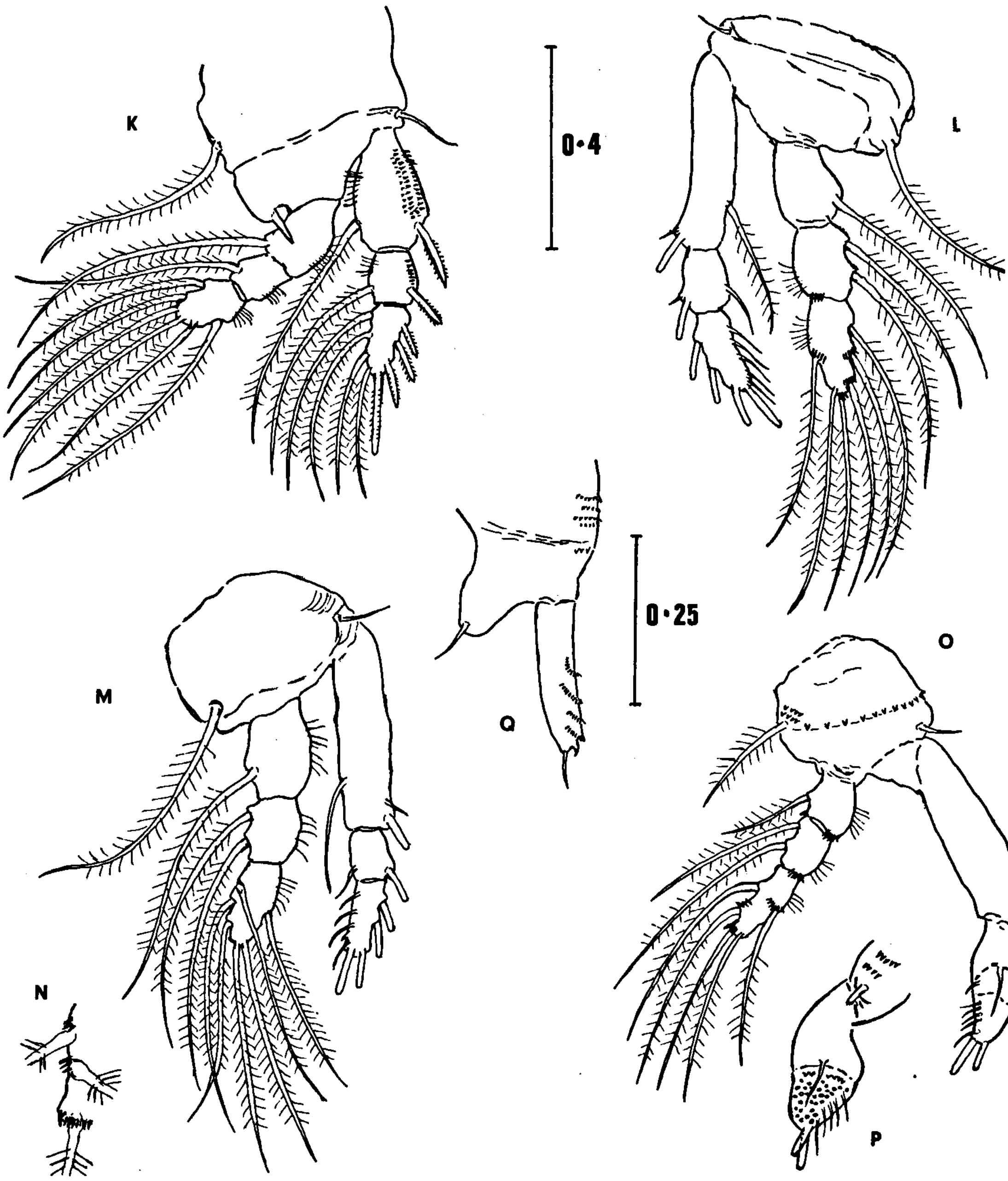
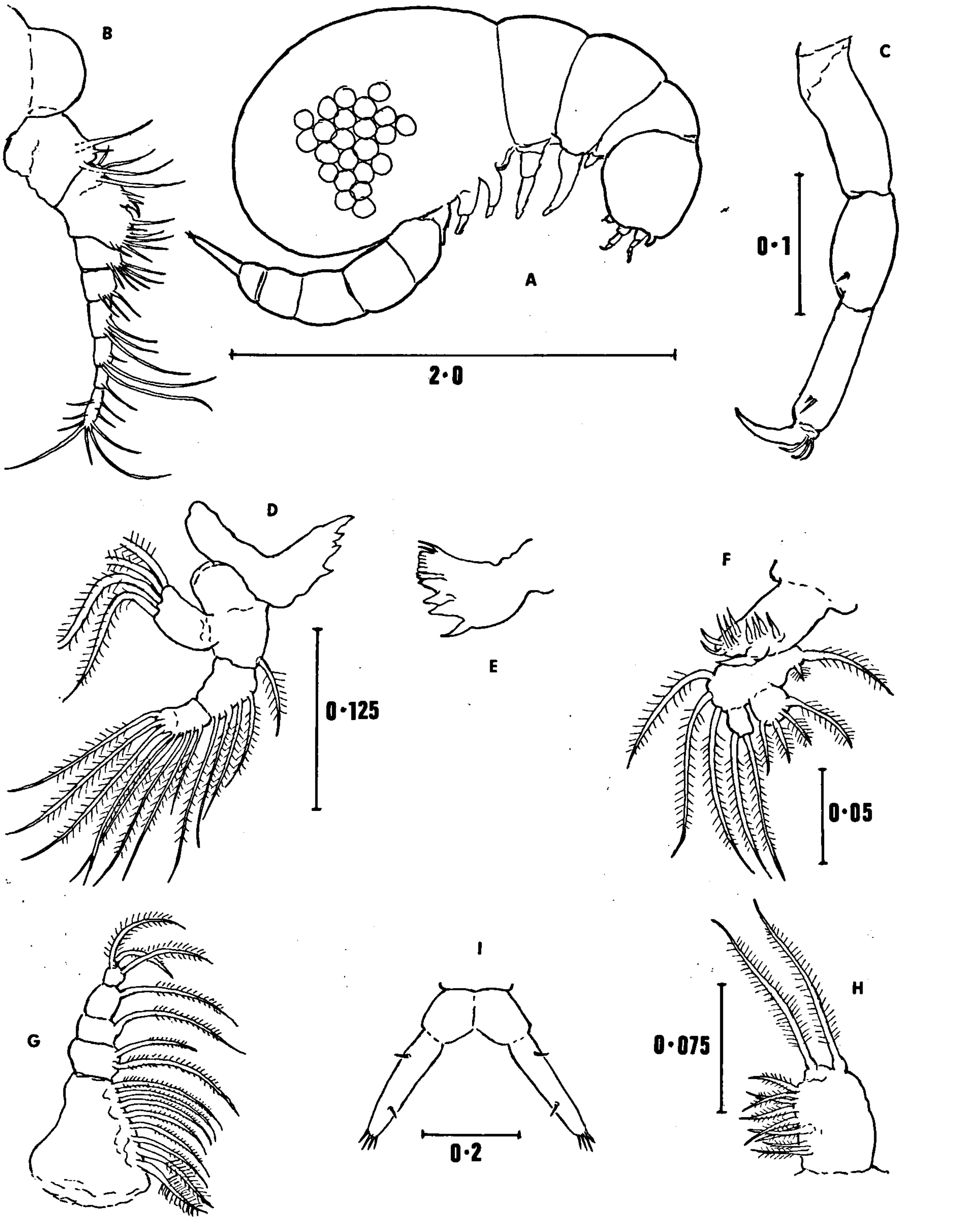


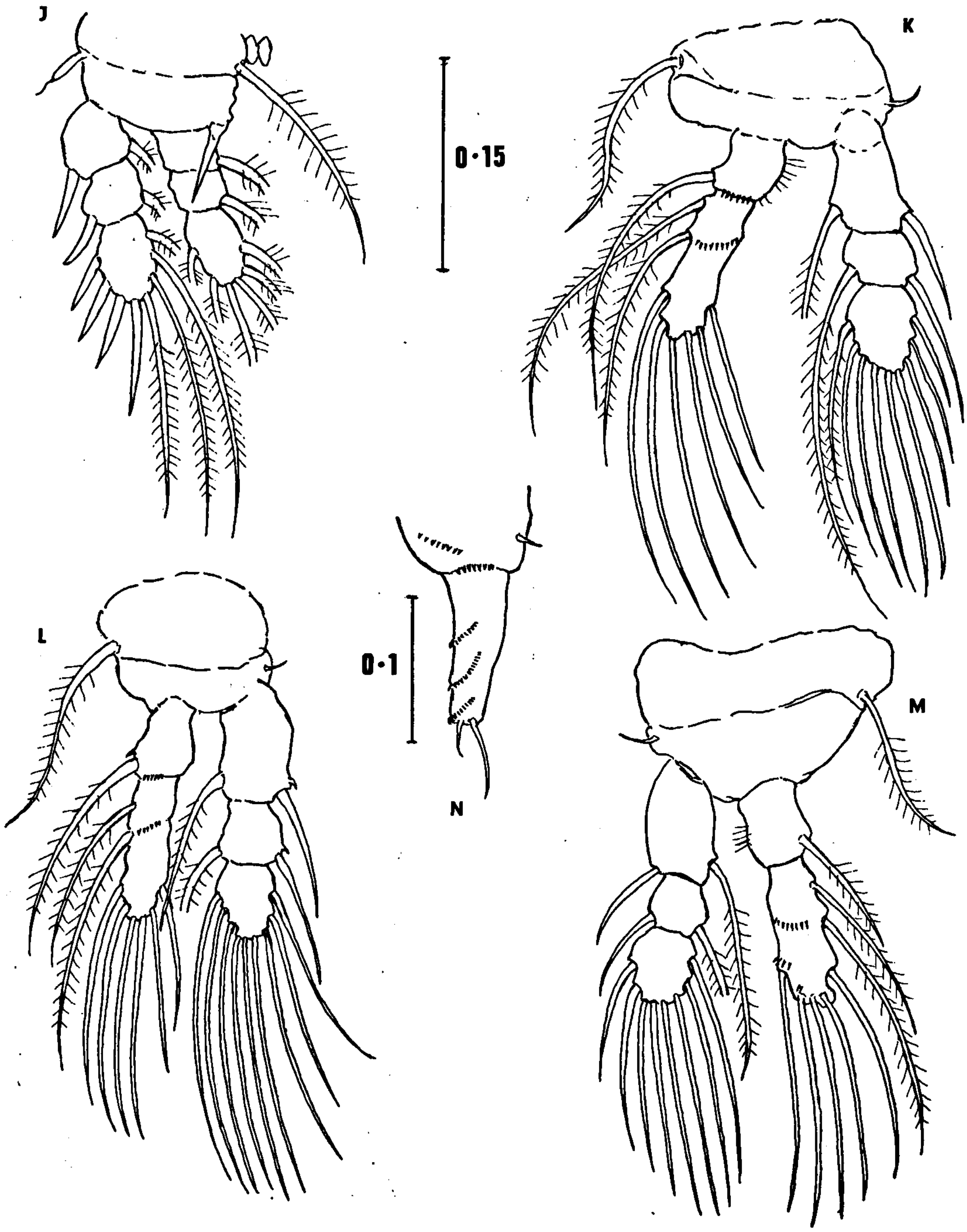
Figs. 1 A-J. *Pachypygus australis* n. sp., ♀. A, habitus, lateral view; B, rostrum; C, antennule (all ciliation omitted); D, antenna; E, mandible (all ciliation of endopodal setae omitted); F, detail of mandibular blade; G, maxillule (all ciliation omitted); H, maxilla; I, maxilliped; J, posterior part of urosome and caudal rami. (Scale figures all refer to millimetres.)



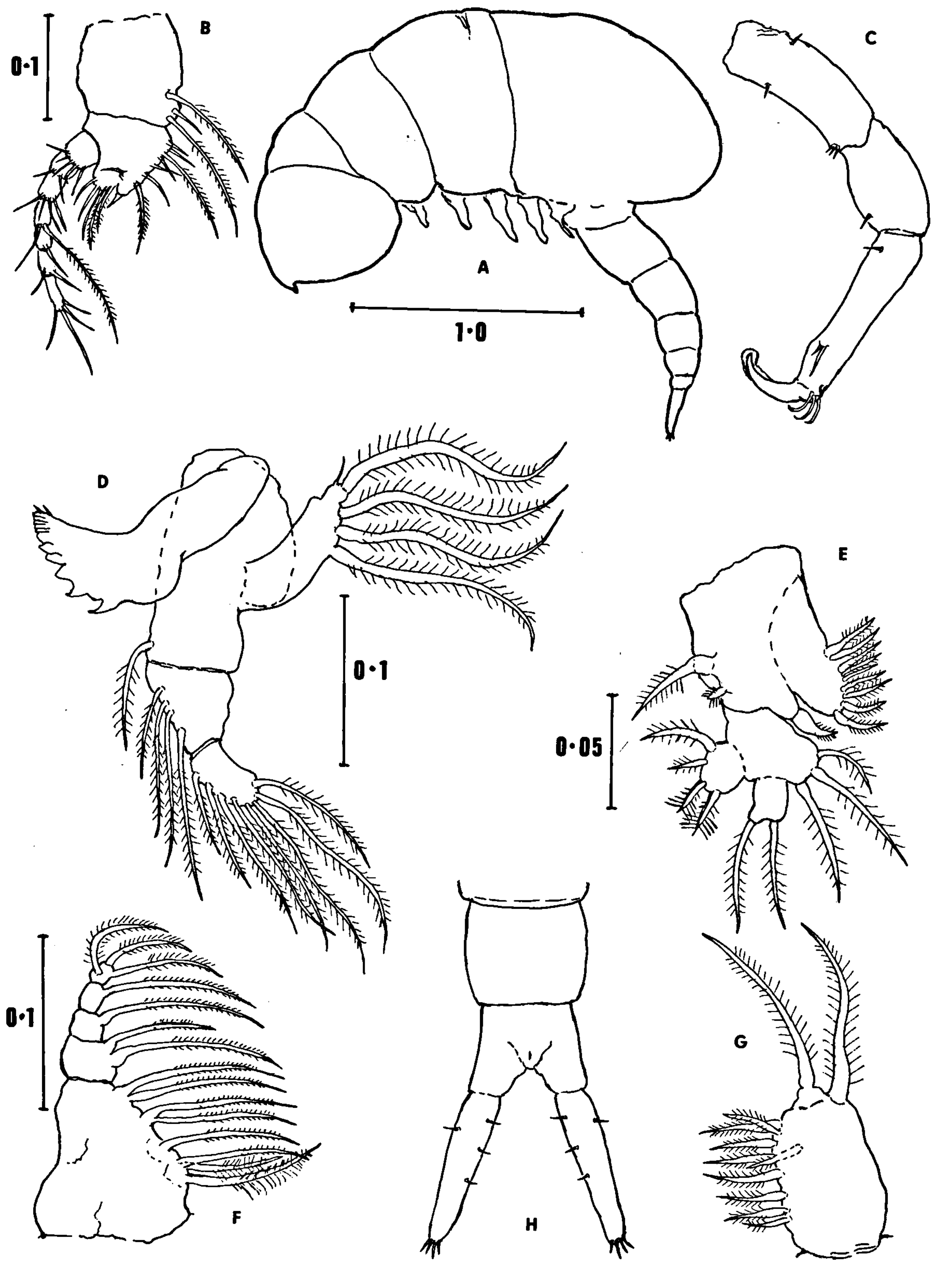
Figs. 1 K-Q. *Pachypygus australis* n. sp., ♀. K, first pereiopod; L, second pereiopod; M, third pereiopod; N, detail of margin, distal endopod segment of P3; O, fourth pereiopod; P, alternative view of distal segment of P4 exopod, showing the tubercles; Q, fifth leg. (Scale figures all refer to millimetres.)



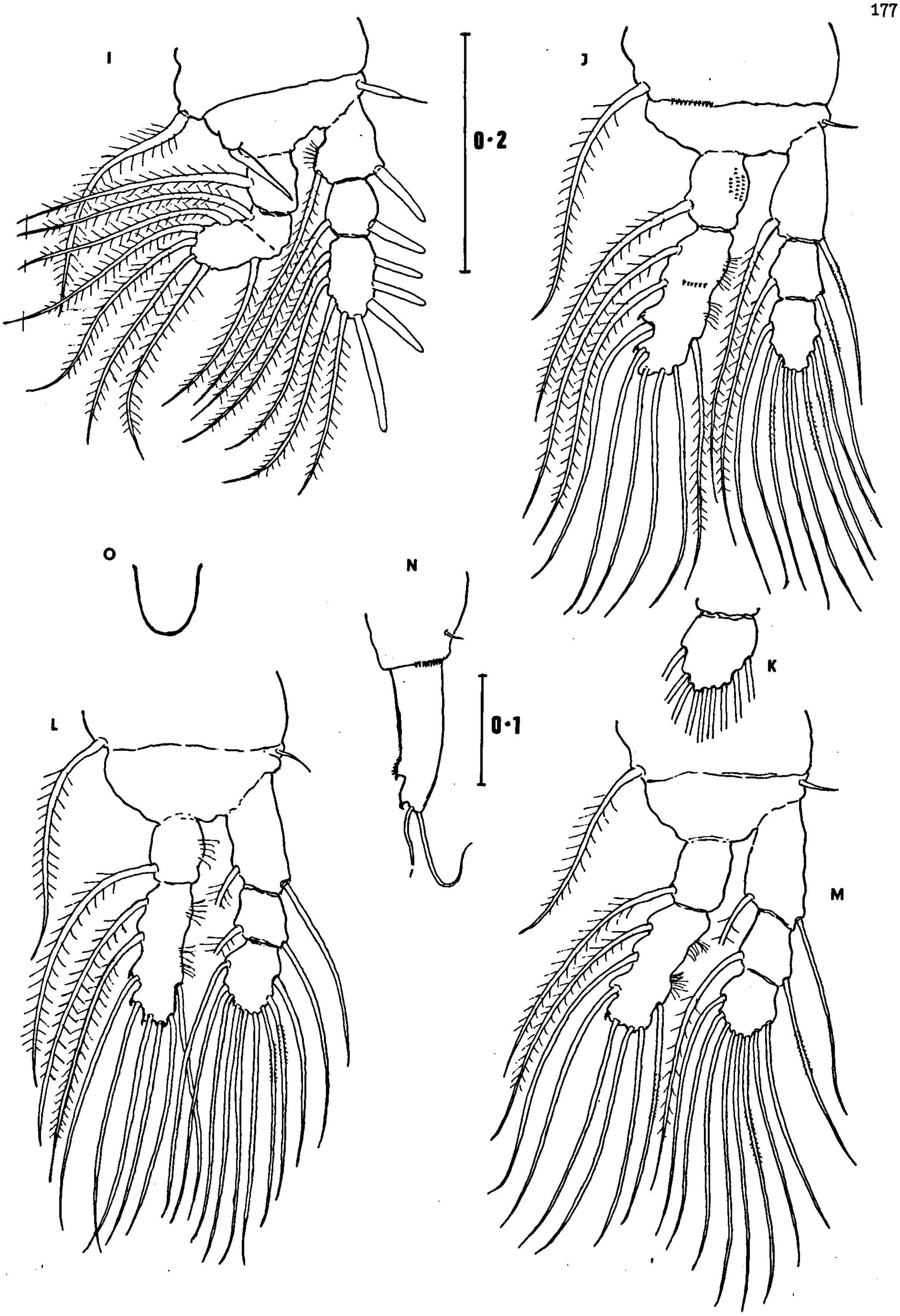
Figs. 2 A-I. *Doropygus flexus* n. sp., ♀. A, habitus, lateral view; B, rostrum and antennule (all ciliation of latter omitted); C, antenna; D, mandible; E, detail of mandibular blade; F, maxillule (ciliation of coxopodal setae omitted); G, maxilla; H, maxilliped; I, anal segment and caudal rami. (Scale figures all refer to millimetres.)



Figs. 2 J-N. *Doropygus flexus* n. sp., ♀. J, first pereiopod; K, second pereiopod; L, third pereiopod; M, fourth pereiopod; N, fifth leg. (Scale figures all refer to millimetres.)



Figs. 3 A-H. *Doropygus curvipes* n. sp., ♀. A, habitus, lateral view; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilla; G, maxilliped; H, posterior part of urosome and caudal rami. (Scale figures all refer to millimetres.)



Figs. 3 I–O. *Doropygus curvipes* n. sp., ♀. I, first pereiopod; J, second pereiopod; K, terminal exopod segment of more typical second pereiopod; L, third pereiopod; M, fourth pereiopod; N, fifth leg; O, rostrum (immature female). (Scale figures all refer to millimetres.)