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Six new species of Copepoda (Clausiidae, Pseudanthessiidae, Polyankyliidae) associated with polychaetes from Korea

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Six new species of copepods associated with polychaetes are described from Korea. Included are *Indoclausia bipartita* n. sp., *Clausia parva* n. sp., and *Maxilliclausia propria* n. gen. n. sp. in the Clausiidae; *Pseudanthessius excertus* n. sp. in the Pseudanthessiidae; and *Polyankylis ovilaxa* n. sp. and *Sewelloya plana* n. gen. n. sp. in the Polyankyliidae. The new genus *Maxilliclausia* has a peculiar maxilla in which the distal segment forms a sucking disk, a non-prehensile antenna, vestigial legs 3 and 5, and lacks a maxilliped and leg 4. The two new species of the Polyankyllidae are discovered as external associates of terebellid polychaetes. The new genus *Sewelloya* has a simple female maxilliped bearing only two small setae on its terminal segment, an uniramous leg 4 bearing 1-segmented exopod, and a reduced leg 5 represented by three setae. The genera *Terebelliphilus* Kim, 2001 which was originally placed in the Sabelliphilidae, and *Octophiophora* Stock, 1988 and *Stockia* Sebastian and Pillai, 1974, both of the latters with uncertain familial positions, are transferred to the Polyankyliidae. A key to five genera of the Polyankyliidae are provided.

Keywords: new species, *Indoclausia*, *Clausia*, *Maxilliclausia* n. gen., *Polyankylis*, *Sewelloya* n. gen.

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Introduction

Copepods associated with polychaete hosts are relatively rarely reported and one reason for this might be their low prevalence rates (Kim *et al*., 2013). Nevertheless, polychaete annelids harbor very diverse copepod associates. Eleven families of cyclopoid copepods are recorded exclusively from polychaete hosts, but several other families include one or more species that live in association with polychaetes (Boxshall and Halsey, 2004; Kim *et al*., 2013).

In Korea, twelve species of copepods have been recorded as associates of polychaetes from the intertidal zone and shallow water. They are *Hemicyclops ctenidis* Ho and Kim, 1990, *H. membranus* Moon and Kim, 2010, *H. nasutus* Moon and Kim, 2010, *Foliomolgus cucullus* Kim, 2001, and *Hemadona clavicrura* Ho and Kim, 2004 in the Clausidiidae (Ho and Kim, 1990; 2004; Kim, 2001c; Moon and Kim, 2010); *Clausia antiqua* Kim, 2001, *C. lobata* Kim, 2000, *Likroclausia namhaensis* Ho and Kim, 2003, and *Rhodinicola laticauda* Ho and Kim, 2003 in the Clausiidae (Kim, 2000; 2001b; Ho and Kim, 2003); and *Terebelliphilus simplex* Kim, 2001, *Myxomolgus invulgus* Kim, 2001 and *Nasomolgus firmus* Humes and Ho, 1967 in the Sabelliphilidae (Kim, 1998; 2001a).

In this paper six new species are described from Korean waters, three of them belonging in the family Clausiidae, one in the Pseudanthessiidae, and two in the Polyankyliidae.

Materials and Methods

All copepod specimens were extracted from external washings of polychaetes collected by the author from the intertidal zone or shallow water around Korean coasts. Copepods and their hosts were fixed with absolute ethanol and sorted copepods were preserved in 80% ethanol. Before microscopic observation and dissection, copepod specimens were immersed in lactic acid for more than 10 minutes. Dissections were done using the hanging drop slide method (Humes and Gooding, 1964). Type specimens have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. In the armature formulae of legs in the descriptions of species, Roman numerals indicate spines and Arabic ones represent setae.

Descriptions

Family Clausiidae Giesbrecht, 1895
Genus *Indoclausia* Sebastian and Pillai, 1974

Indoclausia bipartita n. sp. (Figs. 1-3)

Material examined. 9 ♀♀, 12 ♂♂ from washings of several species of polychaetes epizoic on shells of the oyster *Ostrea denselamellosa* Lischke, bought at a fish market at Daecheon (36° 19′44″N, 126° 30′18″E) on the coast of the Yellow Sea, 15 August 2004. Holotype (♀, NIBRIV0000286624), allotype (♂, NIBRIV0000286625), and paratypes (6 ♀♀, 9 ♂♂, NIBRIV0000286626) have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Dissected paratypes (2 ♀♀, 2 ♂♂) are retained in the collection of the author.

Female. Body (Fig. 1A) elongate and cylindrical. Mean body length 2.87 mm (2.48-3.47 mm) based on 8 specimens. Dissected specimen 3.30 mm long. Prosome-urosome division indistinct. Prosome longer than urosome, unsegmented, but each somite clearly defined by constrictions between somites. Cephalothorax nearly circular, 653 × 693 μm, with slightly produced and truncated anterior apex. Second to fourth pedigerous somites 346 × 673, 426 × 574, and 495 × 564 μm, respectively, with rounded lateral margins. Urosome (Fig. 1B) 4-segmented, consisting of fifth pedigerous somite, genital double-somite, and 2 free abdominal somites. Fifth pedigerous somite about 465 × 594 μm and nearly hexagonal. Genital double-somite 238 × 520 μm, much wider than long; genital aperture located dorsally. Two free abdominal somites 158 × 350 and 218 × 304 μm, respectively. Anal somite (second free abdominal somite) distinctly longer than first free abdominal somite, without ornamentation on ventral surface. Caudal rami parallel and widely separated from each other; each ramus gradually narrowing distally, 264 × 105 μm (ratio 2.51 : 1), with 6 naked setae; outer lateral seta locating at midlength of ramus; largest terminal seta (seta V) 541 μm long; next largest seta (seta IV) 198 μm long; other 4 setae much smaller, shorter than ramus width.

Rostrum distinct, highly sclerotized and much broader than long, with convex posterior margin (Fig. 2A). Antennule (Fig. 1C) 383 μm long and 6-segmented, with armature formula 5 (or 6), 18, 14, 4, 2+aesthetasc, and 7+aesthetasc; first segment short but widest among segments; remaining segments gradually narrowing; suture between second and third segments indistinct; setae dense on second and third segments; all setae naked and thin. Antenna (Fig. 1D) 3-segmented; first segment (basis) longer and wider than 2 distal segments, with 1 seta medio-distally; second segment (first endopodal segment) unarmed but ornamented with large patch of fine spinules on mediodistal surface; terminal segment (second endopodal segment) shorter than second segment and armed with 4 distal claws of unequal sizes, 2 outer subdistal setae, 2 medial subdistal claws, and 1 minute medial seta proximal to 2 subdistal claws (Fig. 1E) and ornamented with 2 patches of fine spinules, one of latters on medial surface and the other on posterior surface (latter not figured in Fig. 1D, E).

Labrum unornamented, with deep and broad posteromedian invagination (Fig. 2A). Mandible (Fig. 1F) elongate, with 2 unequal distal elements: larger element 49 μm long, with 6 or 7 teeth in distal region; smaller element as flame-shaped broad seta. Paragnath not discernible. Maxillule (Fig. 2B) as a blunt lobe bearing 3 larger outer setae, 2 smaller inner setae and on posterior surface 1 large patch of minute spinules. Maxilla (Fig. 3C) 2-segmented; proximal segment much wider than long, with 1 large distal protuberance covered entirely with minute spinules; distal segment blade-like and bluntly ended, with 2 small setae (1 on anterior and 1 on posterior surfaces) and transparent flange on cutting edge. Maxilliped (Fig. 2D) 4-segmented; first segment widest but very short and unarmed; second segment with 1 patch of minute spinules on medial surface; small third segment unarmed; terminal segment gradually narrowed distally, terminating in blunt tip covered with minute spinules, with 2 small setae.

Legs 1 and 2 (Fig. 2E, F) with 2-segmented rami and patches of spinules on coxa, basis and segments of rami. Distal spines on second exopodal segment of these legs with minute spinules along outer margin. Setae on these legs small and naked. Leg 3 (Fig. 2G) lobate, with 3 naked setae distally. Leg 4 (Fig. 2H) also lobate, tipped with 1 seta, and with distal patch of minute spinules near base of seta. Armature formula of legs 1-4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1:	0-0;	1-0;	1-0; 2, II, 1;	0-0; 0, 1, 0
Leg 2:	0-0;	1-0;	1-0; 1, II, 1;	0-0; 0, 1, 0
Leg 3:	3 (on lobe)			
Leg 4:	1 (on lobe)			

Leg 5 (Fig. 3A) 2-segmented, consisting of protopod and 1-segmented exopod; protopod with 1 naked outer seta; exopod 222 × 67 μm (ratio 3.31 : 1), distally with several patches of minute spinules and 4 unequal, stiff setae; lengths of these setae 228, 433, 87, and 166 μm, respectively, from outer to inner. Leg 6 probably represented by 1 small seta in genital aperture (Fig. 1B).

Male. Body (Fig. 3B) similar to that of female. Mean body length 1.79 mm (1.25-2.07 mm), based on 10 specimens. Prosomal somites gradually narrowed from anterior to posterior. Cephalothorax 438 × 404 μm. Second to fourth pedigerous somites 154 × 342, 145 × 273, and 158 × 258 μm, respectively. Urosome 4-segmented as in female, and slightly shorter than prosome. Fifth pedigerous somite 175 × 283 μm. Genital somite 154 × 233 μm. Two free abdominal somites 125 × 204 and 175 × 175 μm, respectively. Anal somite with minute spinules on ventral surface. Caudal rami slightly divergent; each ramus 156 × 62 μm (ratio 2.52 : 1), with 6 caudal setae, and spinules

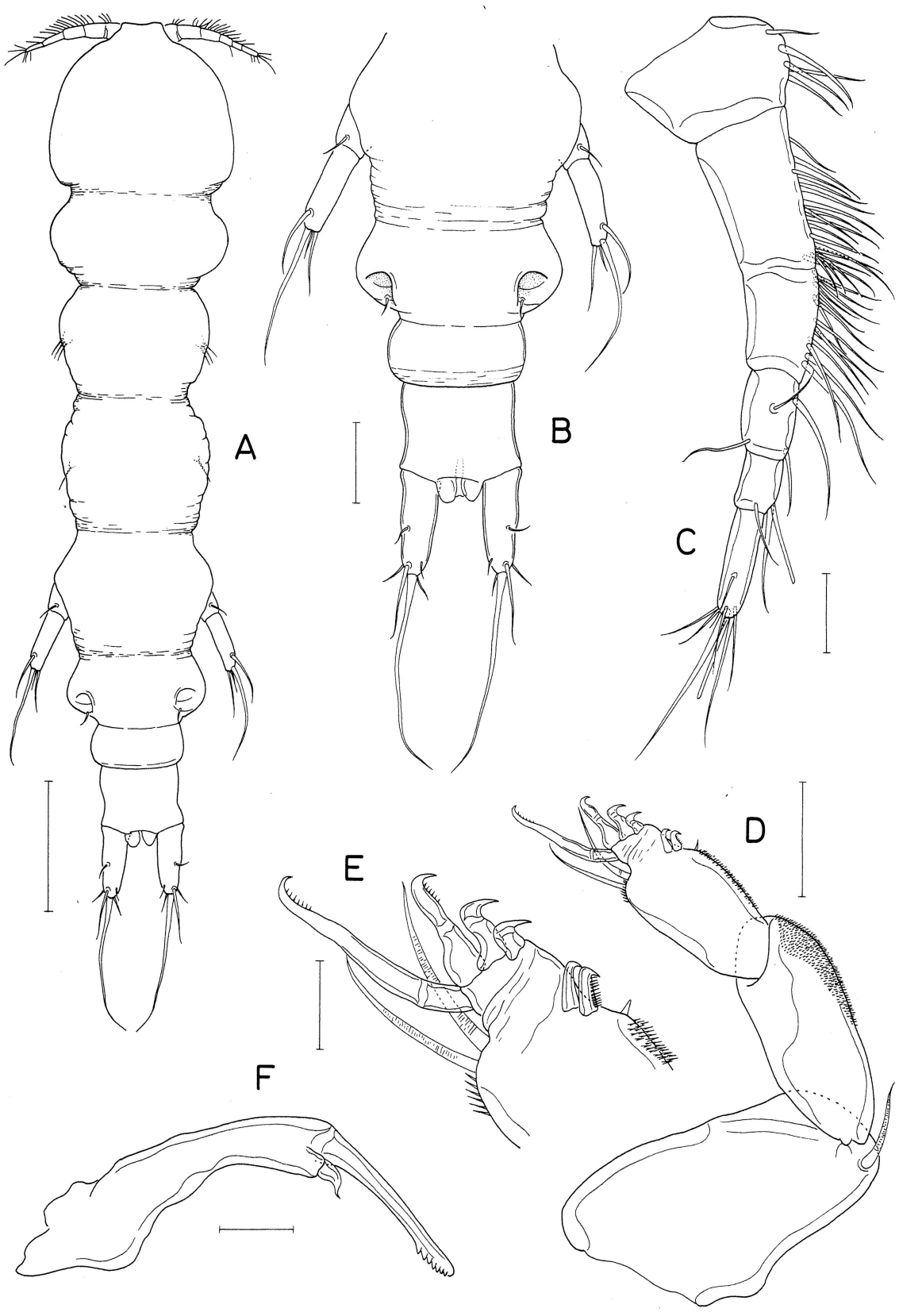

Fig. 1. *Indoclausia bipartita* n. sp., female. A. habitus, dorsal. B. urosome, dorsal. C. antennule. D. antenna. E. distal part of antenna. F. mandible. Scale bars: A. 0.5 mm. B. 0.2 mm. C, D. 0.05 mm. E, F. 0.02 mm.

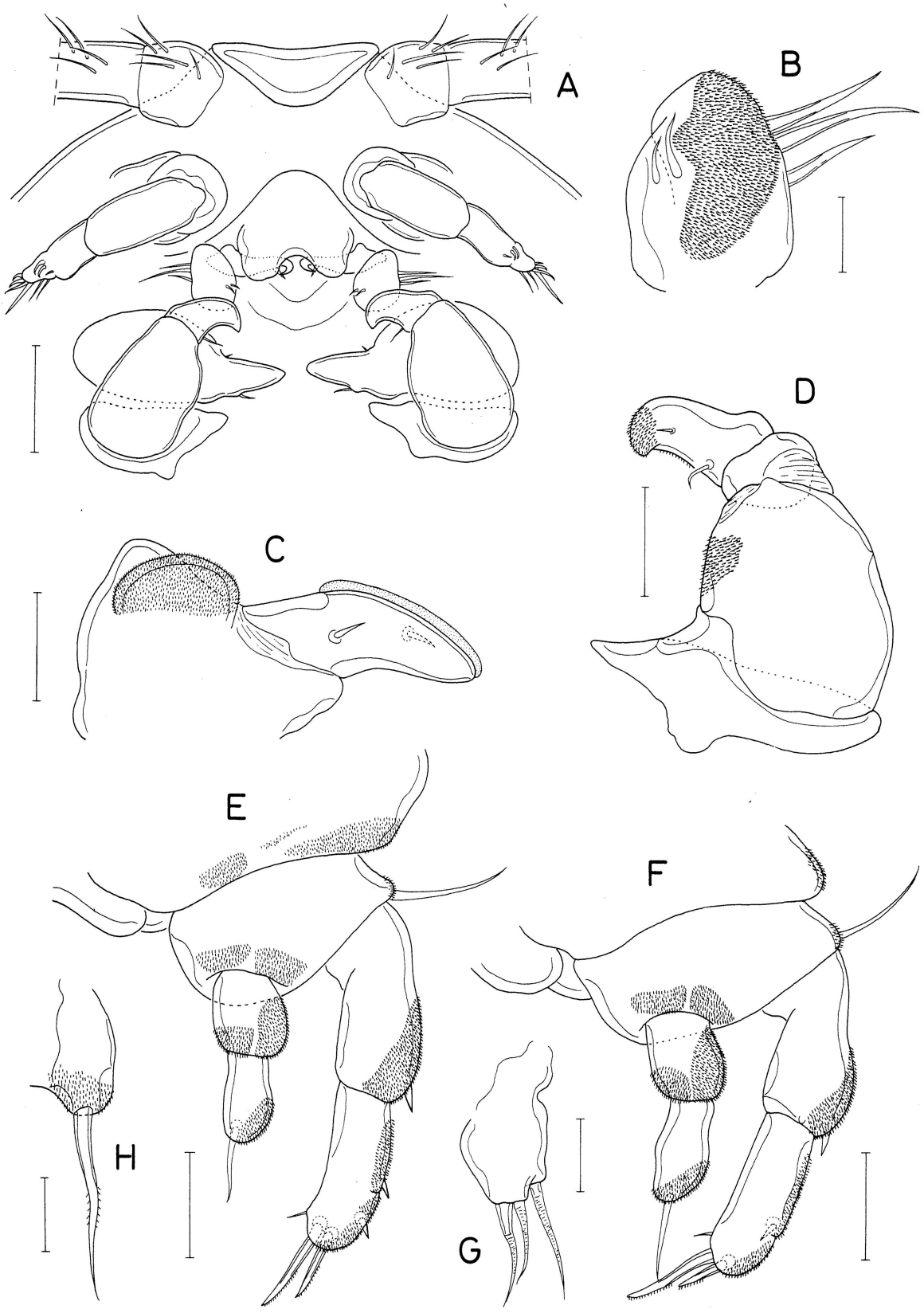

Fig. 2. *Indoclausia bipartita* n. sp., female. A. cephalic area, ventral. B. maxillule. C. maxilla. D. maxilliped. E. leg 1. F. leg 2. G. leg 3. H. leg 4. Scale bars: A. 0.1 mm. B. 0.02 mm. C-H. 0.05 mm.

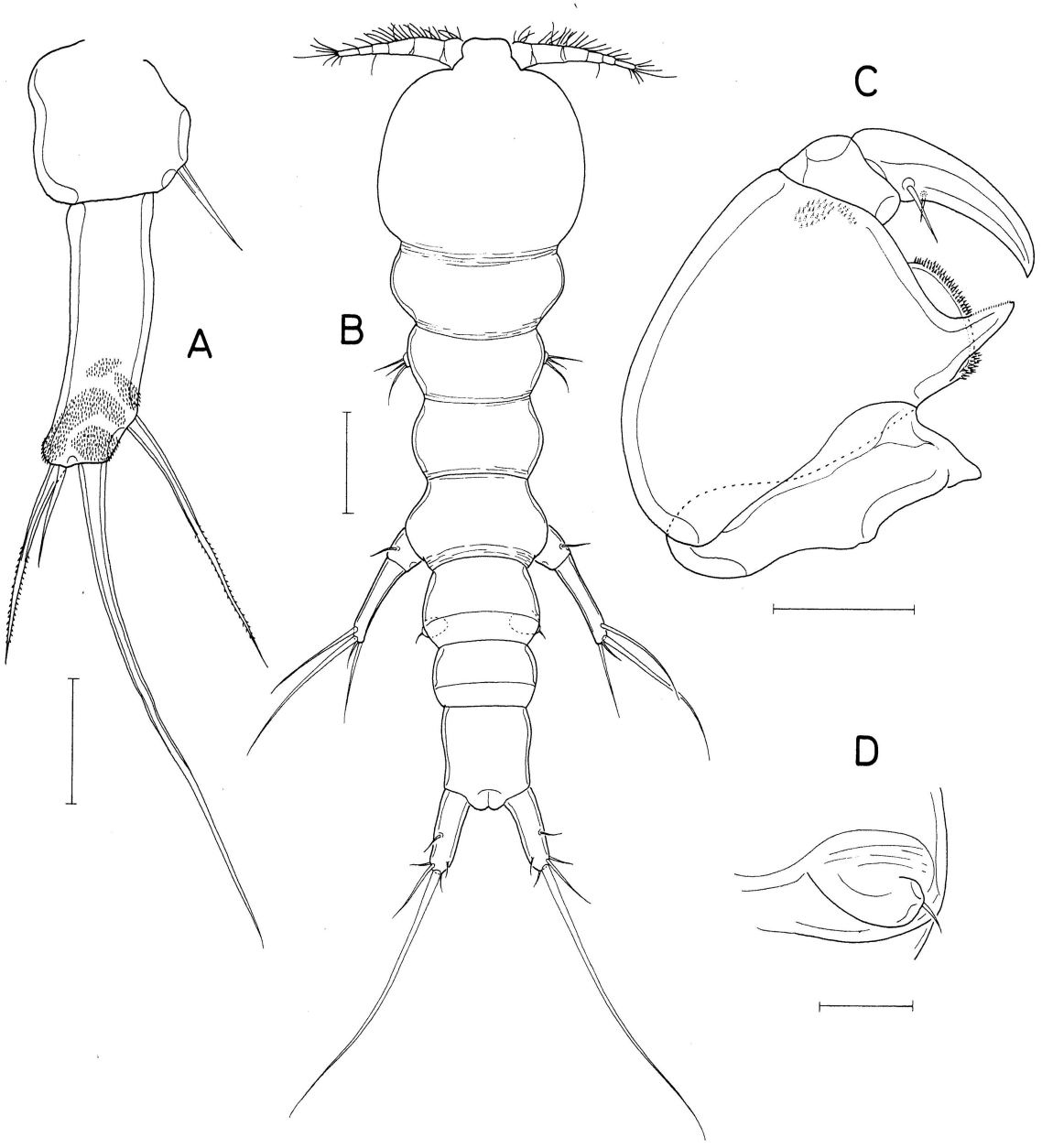

Fig. 3. *Indoclausia bipartita* n. sp. Female: A. leg 5. Male: B. habitus, dorsal. C. maxilliped. D. left genital operculum, ventral. Scale bars: A. 0.1 mm. B. 0.2 mm. C, D. 0.05 mm.

on ventral surface; largest terminal seta 620 μm long, other 5 setae small.

Rostrum, antennule, and antenna not different from those of female. Mouthparts, except for maxilliped, as those of female. Maxilliped (Fig. 3C) massive and 4-segmented; first segment short and unarmed; second segment laterally expanded, with 1 large claw-like process and 1 spinules-covered bulge on medial margin and 1 small patch of minute spinules distally; third segment small and unarmed; terminal segment as strong claw, forming pincers along with medial process on second segment, and bearing 2 small setae proximally.

Legs 1-4 as in female. Leg 5 as in female, but exopod more slender than that of female. Leg 6 represented by 1 small seta on genital operculum (Fig. 3D).

Etymology. The specific name *bipartita* refers to the two-segmented abdomen in both sexes of the new species.

Remarks. Currently, genera of the Clausiidae are defined mainly by the leg morphology (Kim *et al*., 2013). With the reduced legs 3 and 4 which are represented by a seti-

ferous lobe, the new species belongs to *Indoclausia* Sebastian and Pillai, 1974 which has comprised a single known species, *I. bacescui* Sebastian and Pillai, 1974. Although Sebastian and Pillai (1974) reported a scleractinian coral as host of *I. bacescui*, its true host is presumed to be a polychaete lived along with the coral. *Indoclausia bipartita* n. sp. differs from *I. bacescui* in the following points: (1) the abdomen is 2-segmented (vs. 4-segmented in *I. bacescui*); (2) the antenna is 3-segmented (vs. 4-segmented); (3) the distal segment of maxilla bears blade-like cutting edge (vs. distally bilobed and covered with spinules); (4) the maxilliped is distinctly 4-segmented (vs. obscurely segmented); and (5) legs 3 and 4 are tipped with 3 and 1 setae, respectively (vs. both tipped with 2 setae).

In copepods of the Clausiidae the abdomen is one- to four-segmented (generally four-segmented) in the female. The two-segmented abdomen of *I. bipartita* n. sp. is noticeable, because in the Clausiidae this feature is shared only with *Sheaderia bifida* Kim, Sikorski, O'Reilly and Boxshall, 2013. However, *Sheaderia bifida* is not related to the new species; this species from British waters has, unlike *I. bipartita*, a 5-segmented antennule, the 4-segmented antenna and female maxilliped, only a single distal spiniform element on the mandible, and no leg 3.

Genus *Clausia* Claparède, 1863

Clausia parva n. sp. (Figs. 4-6)

Material examined. 15 ♀♀, 3 ♂♂ from the polychaete *Hydroides ezoensis* Okuda epizoic on the shell of the oyster *Crassostrea gigas* (Thunberg), Gangneung Port (37° 46′15″N, 128° 57′08″E), depth about 50 cm, 21 November 2012. Holotype (♀, NIBRIV0000286627), allotype (♂, NIBRIV0000286628), and paratypes (11 ♀♀, 1 ♂, NIBRIV0000286629) have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Dissected paratypes (2 ♀♀, 1 ♂) are retained in the collection of the author.

Other material examined. 2 ♀♀ from washings of *Hydroides ezoensis* Okuda epizoic on the shell of *Crassostrea gigas*, Yangpo Port (35° 15′54″N, 129° 31′28″E), 31 July 2007.

Female. Body (Fig. 4A) elongate, cylindrical, and relatively small. Body length of dissected paratype 1.49 mm. Prosome indistinctly segmented, but 4 prosomal somites well-defined from one another by constrictions and thin exoskeletons between them. Maximum width of prosome 278 μm across second pedigerous somite. All prosomal somites with rounded lateral margins. Cephalothorax 275 μm wide and as long as wide, with truncated rostral protuberance. Second to fourth pedigerous somites similar in length and width, with rudimentary dorsal tergite (Fig. 4B). Urosome slightly shorter than prosome and 6-segmented. Fifth pedigerous somite 272 μm wide, as wide as prosomal somites. Genital somite 135 × 219 μm; genital apertures locating dorsolaterally in subdistal region of somite. Abdomen distinctly narrower than preceding somites, 96 × 126, 87 × 125, 67 × 110, and 108 × 102 μm, respectively; all abdominal somites smooth, without ornamentation. Caudal rami (Fig. 4C) small and widely separated from each other; each ramus 51 × 27 μm (ratio 1.89 : 1) and weakly tapering in distal half, with 6 naked setae; largest terminal seta (seta V) 250 μm long, markedly larger than other 5 setae; outer lateral seta located at midlength of ramus. Egg sac (Fig. 4D) uniserial, containing several eggs, and longer than urosome; each egg about 200 μm in diameter.

Rostrum as anterior protuberance of cephalothorax (Fig. 4A). Antennule (Fig. 4E) short, 142 μm long and 5-segmented, with armature formula 5, 23, 4, 2+aesthetasc, and 7+aesthetasc; all setae naked; first segment with proximal patch of minute spinules on anterior surface; second segment the longest, longer than combined distal 3 segments. Antenna (Fig. 4F) 3-segmented; first segment (basis) with 1 distal seta and patches of spinules on medial and outer surfaces; second segment (first endopodal segment) unarmed, with 2 patches of minute spinules; terminal segment (second endopodal segment) with 4 distal claws of unequal lengths, 2 small, subdistal claws (proximal one of them being setiform) on medial margin, 2 weakly pinnate setae on outer margin, and minute spinules on medial margin and middle of outer margin.

Labrum unornamented, with tapering posterior lobes, and deep and broad posteromedian invagination (Fig. 5A). Mandible with 2 very unequal, distal spines; larger anterior one of them with 5 teeth distally (Fig. 5A). Maxillule as lobe bearing 3 outer setae, 1 inner seta, and on ventral surface patch of minute spinules (Fig. 5A). Maxilla (Fig. 5B) 2-segmented; proximal segment broad, unarmed but with 1 small patch of minute spinules on dorsal (anterior) surface; distal segment forming distally obliquely expanded spinulose pad, with 2 small setae (each on anterior and posterior surface) and scattered minute spinules. Maxilliped (Fig. 5C) 3-segmented; first segment broad but short and unarmed; second segment the longest, with 2 small medial setae at proximal third of medial margin; terminal segment short, stout, and distally forming spinulose pad, with 1 subdistal spine.

Legs 1 and 2 (Fig. 5D, E) with 2-segemented rami; inner seta on coxa small, blunt and naked; basis with patch of spinules on posterior region near base of endopod; outer seta on basis thick and stiff; outer surfaces of rami covered with spinules; medial surface of first endopodal segment of leg 1 also covered with spinules; outer spines on leg 2 exopod with subdistal setule. Leg 3 (Fig. 5F) as small lobe bearing 2 setae. Leg 4 absent. Armature formula of

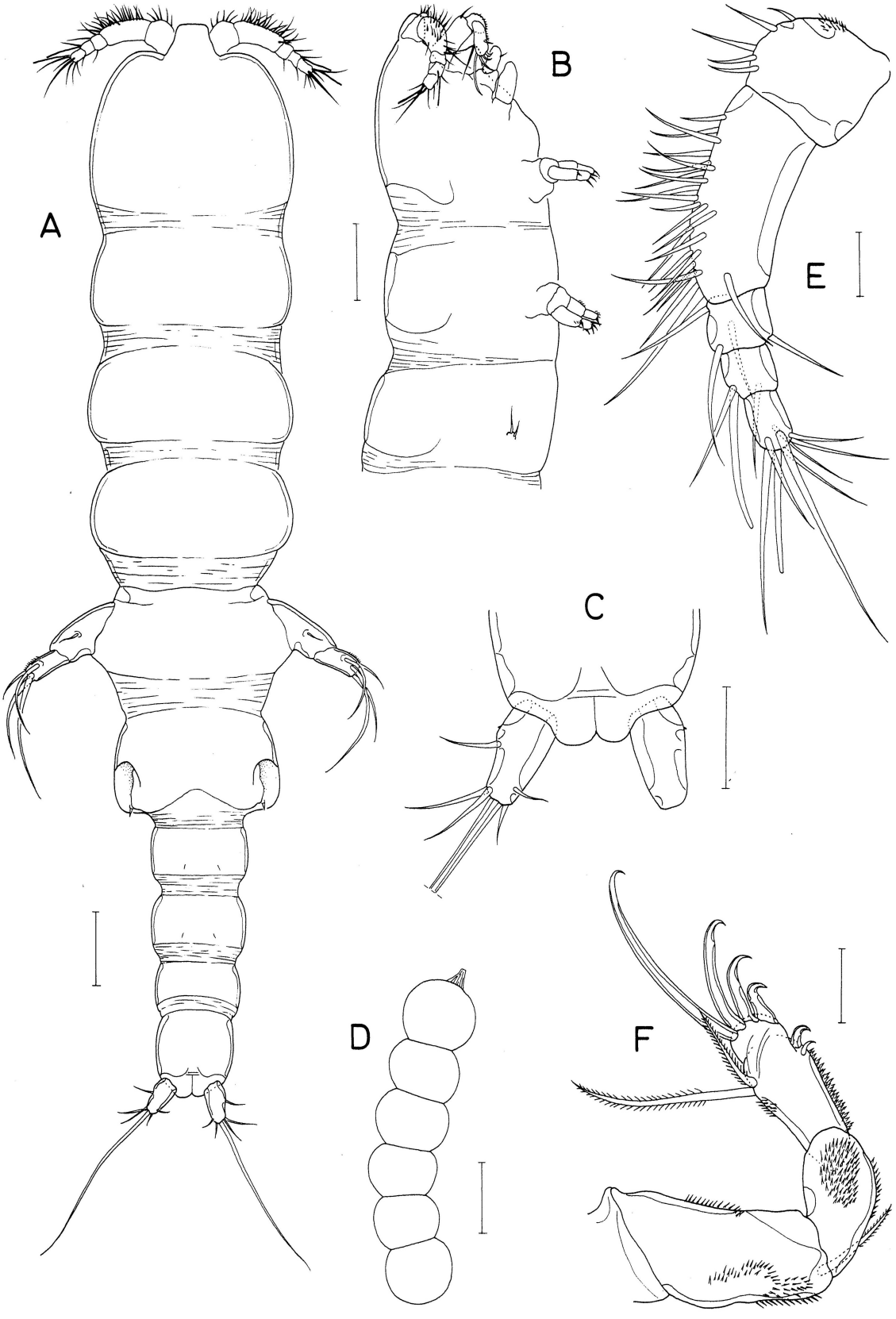

Fig. 4. *Clausia parva* n. sp., female. A. habitus, dorsal. B. anterior part of prosome, right. C. caudal rami, dorsal. D. egg sac. E. antennule. F. antenna. Scales: A, B. 0.1 mm. C. 0.05 mm. D. 0.2 mm. E, F. 0.02 mm.

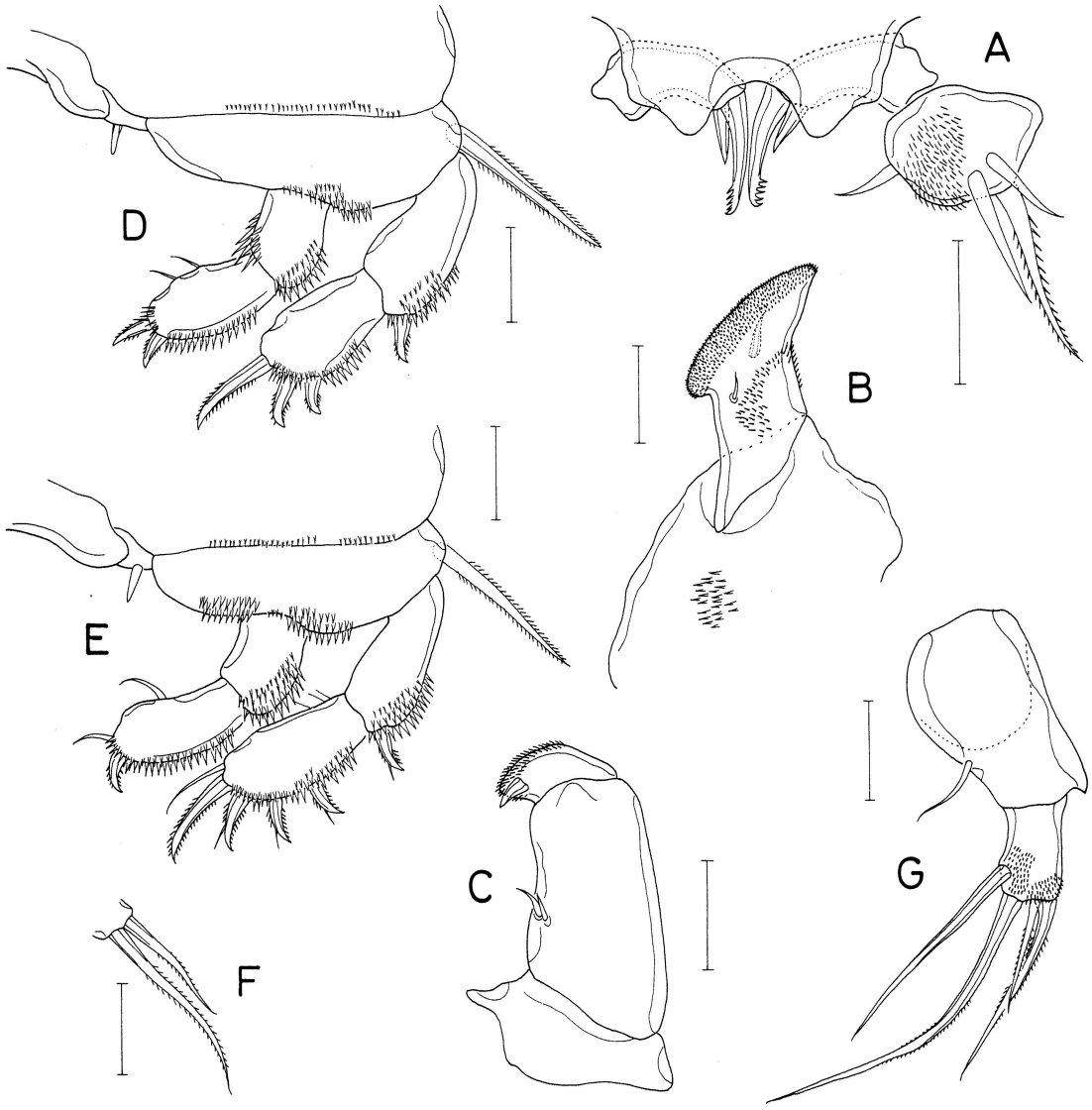

Fig. 5. *Clausia parva* n. sp., female. A. labrum, mandibles, and left maxillule. B. maxilla. C. maxilliped. D. leg 1. E. leg 2. F. leg 3. G. leg 5. Scale bars: A-F. 0.02 mm. G. 0.05 mm.

legs 1-3 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1:	0-1;	1-0;	I-0; II, I, 0;	0-0; 0, II, 2
Leg 2:	0-1;	1-0;	I-0; III, I, 1;	0-0; 0, I, 2
Leg 3:	2 (on lobe)			

Leg 5 (Fig. 5G) consisting of protopod and distal exopod; protopod 108 × 69 μm, articulated at base from somite, with 1 small outer seta. Exopod distinctly smaller than protopod, 51 × 32 μm (ratio 1.59 : 1); with 2 patches of minute spinules and 4 setae; these 4 setae smooth or weakly setulose, and 120, 172, 55, and 105 μm long, respectively, from outer to inner. Leg 6 represented by 1 small setule in genital aperture (Fig. 4A).

Male. Body (Fig. 6A) cylindrical as in female. Body length 0.89 mm in dissected paratype. Prosome well-segmented. Cephalothorax 221 × 190 μm, longer than wide. Three metasomites distinctly shorter than cephalothorax and 72 × 165, 51 × 151, and 44 × 146 μm, respectively. Fifth pedigerous somite 72 × 149 μm. Genital somite 94 × 140 μm, with weakly convex lateral margins. Four abdominal somites 62 × 102, 65 × 94, 58 × 79, and 87 × 81 μm, respectively. Caudal ramus 48 × 25 μm (ratio 1.92 : 1), not different from that of female in shape (Fig. 6B).

Rostrum, antennule and antenna as in female. Maxilliped (Fig. 6C) 3-segmented as in female; first segment small and unarmed; second segment strongly protuberant medially, with 2 naked setae on tapering medial protuberance; terminal segment forming strong, smooth, distally

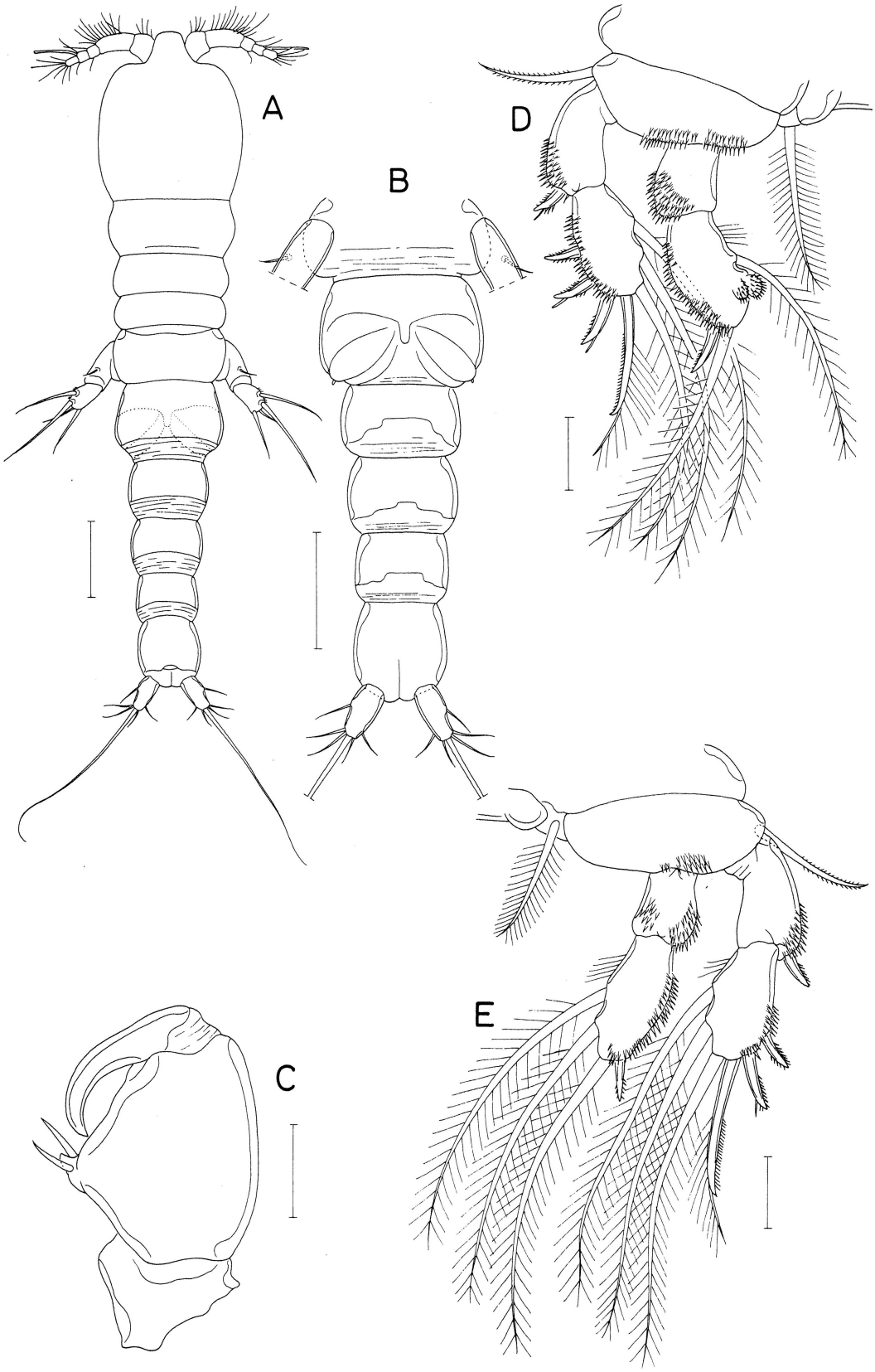

Fig. 6. *Clausia parva* n. sp., male. A. habitus, dorsal. B. urosome, ventral. C. maxilliped. D. leg 1. E. leg 2. Scale bars: A, B. 0.1 mm. C-E. 0.02 mm.

curved claw. Other mouthparts as in female.

Legs 1 and 2 (Fig. 6D, E) with 2-segmented rami as in female but with different armature formula; setae on coxa and rami well-developed and pinnate, unlike those of female. Terminal spine on distal exopodal segment in legs 1 and 2 larger than that of female, with subterminal setule. Second endopodal segment of leg 1 with 2 spinulose bulges on medial side posterior to base of medial seta (Fig. 6D). Leg 3 as lobe bearing 2 setae, as in female. Leg 4 absent. Armature formula of legs 1-3 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1:	0-1;	1-0;	I-0; III, I, 3 (or II, I, 2);	0-0; I, 1, 1
Leg 2:	0-1;	1-0;	I-0; II, I, 3;	0-0; 0, I, 3
Leg 3:	2 (on lobe)			

Leg 5 similar to that of female; exopod 48 × 31 μm (ratio 1.55 : 1). Leg 6 represented by 1 rudimentary seta on genital operculum (Fig. 6B).

Etymology. The specific name *parva* refers to the relatively small body size of the new species (the Latin *parvus* means "small").

Remarks. Kim *et al*. (2013) synonymized *Clausia uniseta* Bocquet and Stock, 1960 with the type species *C. lubbockii* Claparède, 1863. Therefore, the genus comprised only a single species (Kim *et al*., 2013). Major differences between *C. parva* n. sp. and *C. lubbocki* are found in the antennular segmentation and leg armature. The antennule of *C. parva* n. sp. is 5-segmented (vs. 6-segmented in *C. lubbockii*). The armature formulae of legs 1 and 2 of *C. parva* are I-0; II, I, 0 (vs. I-0; II, II, 1 in *C. lubbocki*) for leg 1 exopod; 0-0; 0, II, 2 (vs. 0-1; 0, I, 1 in *C. lubbocki*) for leg 1 endopod; I-0; III, I, 1 (vs. I-0; II, I, 1 *in C. lubbocki*) for leg 2 exopod; and 0-0; 0, I, 2 (vs. 0-1; II, I, 0 in *C. lubbocki* for leg 2 endopod).

The body of *C. parva* n. sp. (1.49 mm long in the female) is significantly smaller than that of *C. lubbocki* which was measured by Bocquet and Stock (1960) to be 2.25 mm and 2.4 mm (the latter as *C. uniseta*) or by Kim *et al*. (2013) to be 2.04 mm. Other minor morphological differences between the two species are noticed in the setation of the antennule, the form of the labrum and the distal segment of the maxilla, and the egg arrangement (uniserial in *C. clindrata* vs. biserial in *C. lubbocki*).

Maxilliclausia n. gen.

Diagnosis (based on female). Body cylindrical, consisting of cephalothorax, second to fifth pedigerous somites, genital somite, and 4 abdominal somites. Caudal ramus with 6 setae. Egg sac containing mutiserial eggs. Antennule 5- or 6-segmented; first segment with 4 setae. Antenna 4-segmented, non-prehensile, and consisting of coxa, basis, and 2-segmented endopod; terminal segment (second endopodal segment) blunt at tip, with setae, and lacking claw or spine. Labrum with elongate, digitiform posteromedian process. Mandible with extremely elongate distal spine. Maxillule lobate, with adhesion pad and setae. Maxilla, as an attachment organ, large and 2-segmented; second segment transformed to sucking disk. Maxilliped absent. Legs 1 and 2 with 2-segmented rami; coxa without inner element. Leg 3 lobate, bearing 3 setae. Leg 4 absent. Leg 5 represented by 2 setae.

Type species. *Maxilliclausia propria* n. sp.

Etymology. The generic name *Maxilliclausia* is the combination of the "maxilla", a mouthpart and "*Clausia*", the name of the type genus. It alludes to the possession by the new genus of a characteristic maxilla.

Remarks. With the possession of 2-segmented rami of legs 1 and 2, a rudimentary leg 3 consisting of a lobe tipped with three setae, and the absence of leg 4, the new genus *Maxilliclausia* can be placed near the genera *Clausia* Claparède, 1863, *Spionicola* Bjornberg and Radashevsky, 2009 and *Sheaderia* Kim, Sikorski, O'Reilley and Boxshall, 1013. *Spionicola*, in particular, is noticed, because its only species *S. mystaceus* Bjornberg and Radashvsky, 2009 is known as an associate of a polychaete living on molluscan shells in Brazilian waters (Bjornbeg and Radashevsky, 2009). However, *Maxilliclausia* n. gen. hardly can be considered to be a relative of these genera, due to a number of its autapomorphic morphological features. The most significant autapomorphy is displayed by its maxilla in which the distal segment is transformed to a sucking disk. This form of maxilla has not been reported in the Clausiidae and its related families. In the Clausiidae the key limbs for securing attachment to the host are the maxillae and/or maxillipeds, at least in females (Kim *et al*., 2013). In *Maxilliclausia* n. gen. the maxilla is transformed to function as an authentic attachment organ. In contrast, other possible attachment devices are suppressed to develop. For examples, the maxilliped is absent, the antenna does not carry any claw on distal segments, and the legs lack spines. The lacking of a maxilliped also is an autapomorphic feature, because all of known species in the Clausiidae are known of their maxillipeds, although this appendage is reduced to a setiferous lobe in some genera such as *Pseudoclausia* and *Spinonicola* (Bocquet and Stock, 1963; Bjornberg and Radashevsky, 2009) or a segmented vestige as in *Pontoclausia antiqua* (Kim, 2001b).

The presence of distal spine on the mandible is not uncommon in the Clausiidae. This spine is moderately long and tapering as in *Mesnilia cluthae* (T. and A. Scott, 1896) (see Kim *et al*., 2013) or short and stout as in *Rhodinicola gibbosus* Bresciani, 1964 (see Kim *et al*., 2013) and *Megaclausia mirabilis* O'Reilly, 1995 (see O'Reilly, 1995) or tapering and paired as in *Likroclausia namhaensis* Ho and Kim, 2003 (see Ho and Kim, 2003). However,

unlike in these species, the spine in *Maxilliclausia* is markedly elongated, extending to the posterior margin of the maxilla. Therefore, the elongated distal spine of the mandible also is a characteristic feature of *Maxilliclausia* in consideration that in clausiids having a single distal spine on the mandible this spine is short, not longer than the proximal segment.

In summary, the new genus *Maxilliclausia* may be clearly defined by its following characteristic features: (1) the antenna is of an unusual form, non-prehensile, without any claw on distal segments, but with large adhesion pad on the two endopodal segments; (2) the labrum has a large, digitiform posteromedian process; (3) the mandible is armed with a very elongate distal spine; and (4) the distal segment of the maxilla is transformed to a sucking disk; and (5) the maxilliped is absent.

Maxilliclausia propria n. sp. (Figs. 7, 8)

Material examined. 2 ♀♀ from washings of polychaetes (mixing of several species) collected from a tidal flat (34°49′54″N, 128°02′08″E), Namhae Island, on the southern coast of Korea, 21 June 2012. Holotype (intact ♀, NIBRIV0000286630) has been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Dissected paratype (♀) is retained in the collection of the author.

Female. Body (Fig. 7A) cylindrical, consisting of cephalothorax, second to fifth pedigerous somite, genital somite, and 4 abdominal somites. Body length 2.75 mm in dissected paratype. Somites from cephalothorax to genital somite not articulated from one another but well defined by deep constrictions between them and with convex lateral margins. Sizes of cephalothorax to fifth pedigerous somite 523 × 685, 277 × 454, 277 × 492, 292 × 531, and 431 × 568 μm, respectively. Cephalothorax nearly trapezoid, broadening distally, with rounded posterolateral corners and nearly circular dorsal sclerotization band. Fifth pedigerous somite subcircular, longer and broader than preceding metasomal somites. Genital somite 217 × 433 μm, much wider than long; lateral margins projected laterally and tapering; genital aperture large and locating dorsolaterally. Abdomen distinctly narrower than anterior part of body, smooth, and well-segmented; four abdominal somites 192 × 192, 196 × 175, 150 × 158, and 175 × 154 μm, respectively. Anal somite lacking anal operculum (Fig. 7B). Caudal ramus (Fig. 7C) 102 × 50 μm (ratio 2.04 : 1), with 6 naked setae; one (seta V) of 2 median terminal setae much larger than other 5 setae, about twice as long as second largest nearby seta (seta IV). Egg sac (Fig. 7D) 1.33 × 0.36 mm, containing multiserial eggs; each egg about 190 μm in diameter.

Rostrum as broad apical protuberance of cephalothorax, truncated apically, and not articulated at base (Fig. 7A). Antennule (Fig. 7E) distinctly narrowing distally, 307 μm long, and 6-segmented, but suture line between second and third segment indistinct and existing only on dorsal surface; armature formula 4, 11, 7, 4, 2+aesthetasc, and 7+aesthetasc; all setae naked; aesthetascs on 2 distal segments shorter than their accompanying setae. Antenna (Fig. 7F) 4-segmented, consisting of coxa, basis, and 2-segmented endopod; coxa short, much broader than long, and unarmed; basis with large outer protrusion ornamented apically with about 15 foliaceous, tapering processes, and with 1 small medio-distal seta; first endopodal segment about 94 × 32 μm, with large, corrugated adhesion pad on medial surface and 1 outer subdistal seta; second endopodal segment 88 × 32 μm, broadest at proximal 2/5 region, blunt distally, with large, corrugated adhesion pad along medial surface, and 5 (3 large and 2 small) setae on outer side.

Labrum (Fig. 8A) characteristically with large, digitiform posteromedian process extending to posterior region maxilla (Fig. 7G). Mandible (Fig. 8B) slender, 53 μm long (excluding distal spine), and armed distally with 1 elongate, rod-shaped spine of 83 μm long; this distal spine blunt at tip, with about 16 small teeth along distal 2/5 of outer margin. Paragnath absent. Maxillule (Fig. 7H) lobate, armed with 3 unequal outer setae and 1 small medial seta; distal part of maxillule expanded and forming large adhesion pad. Maxilla (Fig. 8C) 2-segmented; proximal segment elongated, unarmed but with large patch of spinules on posterior surface (Fig. 7G); distal segment stout and forming an sucking disc bearing 1 small seta anterodistally and corrugated adhesion rim along dorsodistal margin of disk. Maxilliped absent.

Legs 1 and 2 (Fig. 8D, E) biramous, with 2-segmented rami; coxa lacking inner seta, but with 1 row of minute spines on ventral (anterior) surface near distal margin; both sides of intercoxal sclerite roundly projected, with several rows of minute setules. Basis of leg 1 with large pinnate outer seta and 3 transverse rows of minute setules on ventral surface. Basis of leg 2 with smaller, naked outer seta and 2 transverse rows of minute setules on ventral surface. Rami of legs 1 and 2 with several longitudinal rows of minute setules along outer surface. Outer setae on exopod of legs 1 and 2 small. Leg 3 (Fig. 8F) as broad lobe tipped with 3 naked setae, medial one of which being thick. Leg 4 absent. Armature formula of legs 1 and 2 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1:	0-0;	1-0;	1-0; 3, 2, 2;	0-1; 0, 1, 1
Leg 2:	0-0;	1-0;	1-0; 2, 2, 3;	0-1; 0, 1, 1

Leg 5 (Fig. 8G) represented by 2 naked setae (1 thick and 1 slender). Leg 6 represented by 1 minute seta in genital aperture (Fig. 8H).

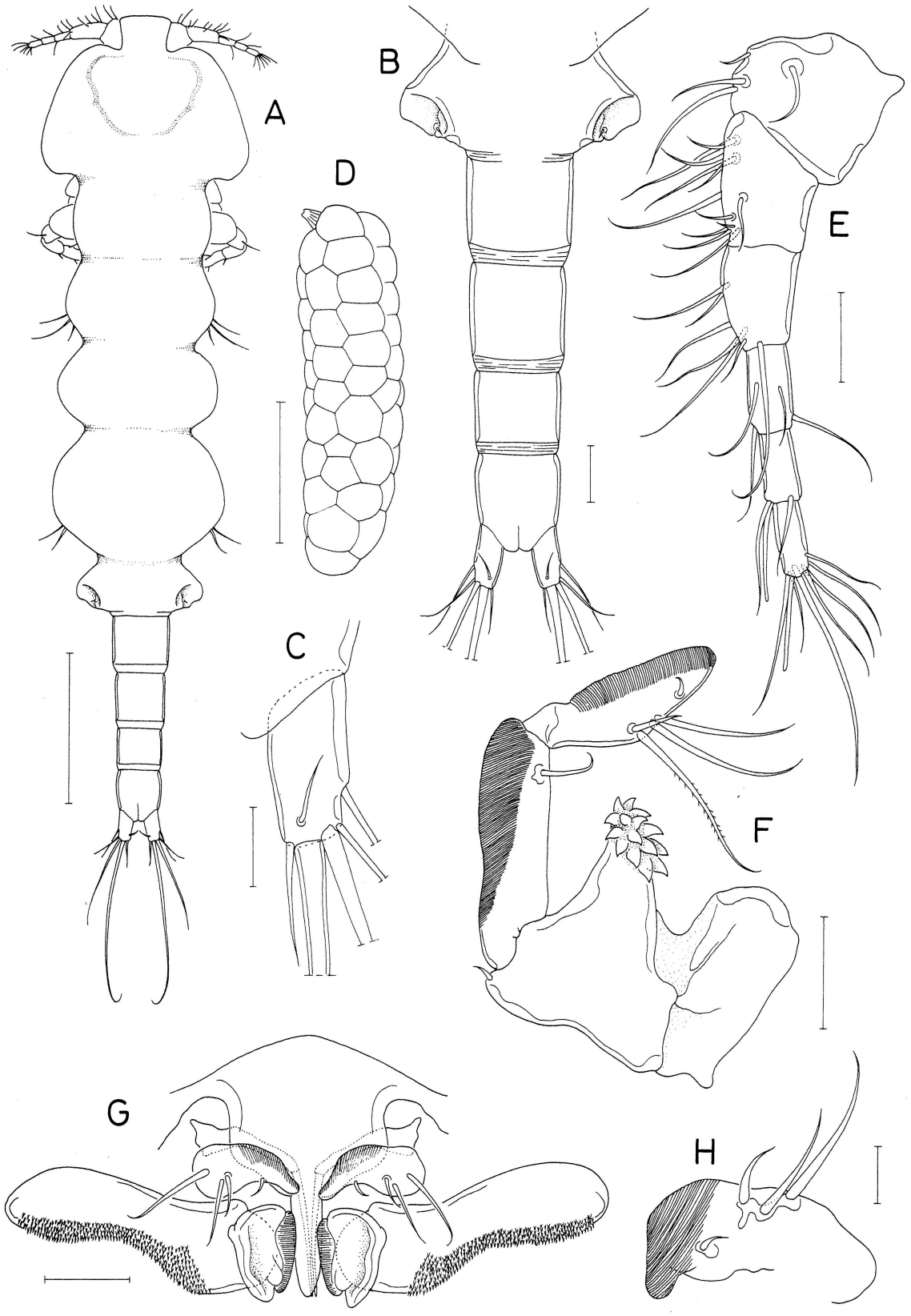

Fig. 7. *Maxilliclausia propria* n. gen. n. sp., female. A. habitus, dorsal. B. urosome, dorsal. C. right caudal ramus, dorsal. D. egg sac. E. antennule. F. antenna. G. mouthparts. H. maxillule. Scale bars: A, D. 0.5 mm. B. 0.1 mm. C, E-G. 0.05 mm. H. 0.02 mm.

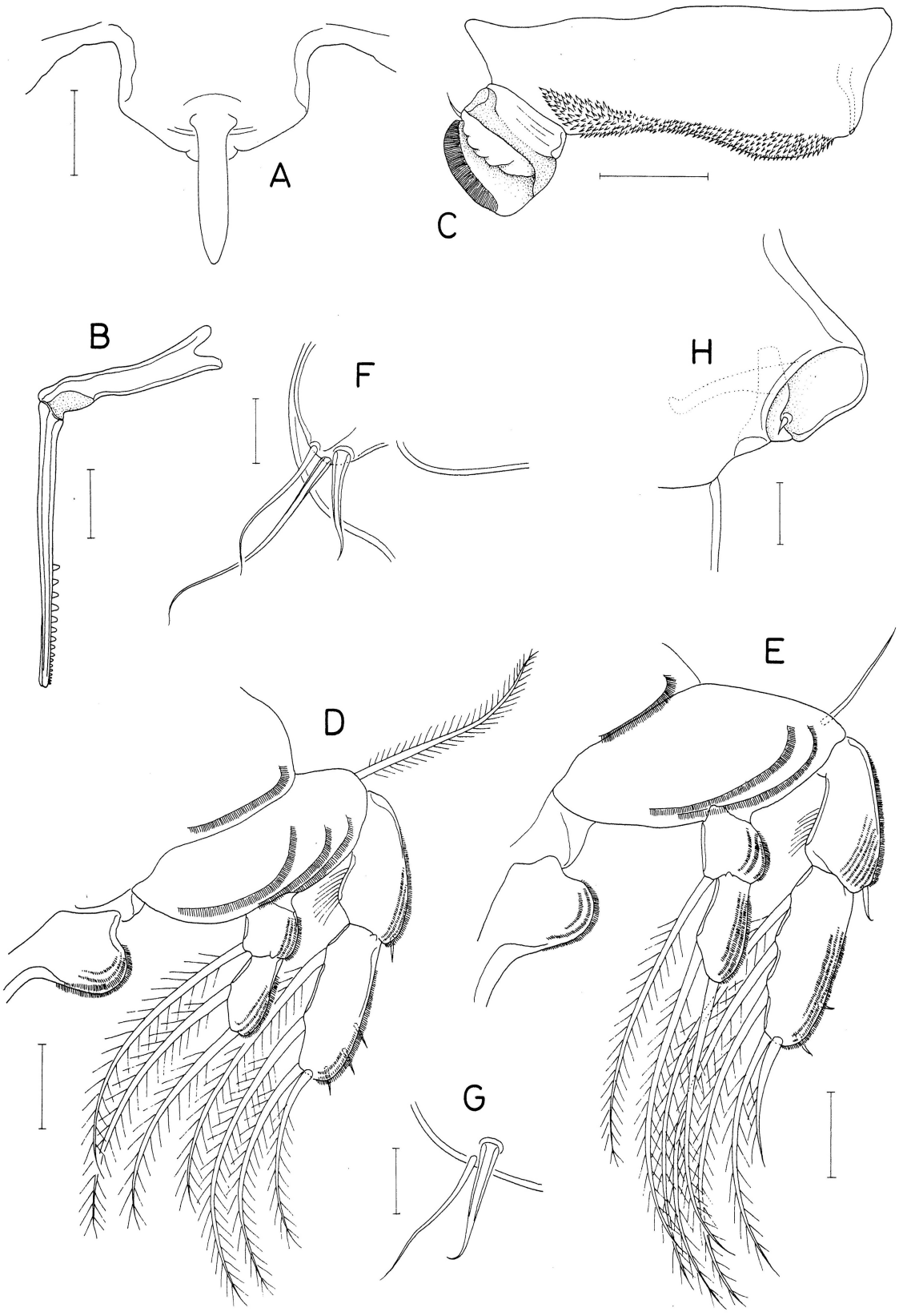

Fig. 8. *Maxilliclausia propria* n. gen. n. sp., female. A. labrum. B. mandible. C. maxilla. D. leg 1. E. leg 2. F. leg 3. G. leg 5. H. genital aperture, dorsal. Scale bars: A, C-H. 0.05 mm. B. 0.02 mm.

Male. Unknown.
Etymology. The specific name *propria* is derived from the Latin *proprius* (=peculiar), referring to the possession by the new species of the several unusual morphological features.

Family Pseudanthessiidae Humes and Stock, 1972
Genus *Pseudanthessius* Claus, 1889

Pseudanthessius excertus n. sp. (Figs. 9, 10)

Material examined. Six ♀♀ from polychaetes (mainly *Hydroides ezoensis* Okuda) epizoic on shells of the oyster *Crassostrea gigas* (Thunberg) attached to the wharf in Gangneung Port (37°46′15″N, 128°57′08″E), depth about 50 cm, 21 November 2012. Holotype (♀, NIBRIV 0000286631) and paratypes (3 ♀♀, NIBRIV00002866 32) have been deposited in the National Institute of Biological Resources (NIBR), Incheon. Dissected paratypes (2 ♀♀) are retained in the collection of the author.
Female. Body (Fig. 9A) rather small. Body length 945 μm in dissected and figured paratype (in other 2 measured specimens 868 and 968 μm). Prosome 584 μm long. Cephalothorax 403 × 372 μm, nearly globular, as dorsoventrally deep as wide, with weak dorsal suture delimiting cephalosome and first pedigerous somite. Second pedigerous somite broad, with prominent, tapering lateral projection on both side. Third and fourth pedigerous somite much narrower and shorter than second pedigerous somite, 240 and 154 μm wide, respectively, with round lateral margins. Urosome (Fig. 9B) 5-segmented. Fifth pedigerous somite 117 μm wide. Genital double-somite 140 × 132 μm, slightly longer than wide, with broad lateral expansion, widest at 0.4 region of somite length and gradually narrowing posteriorly from widest region; genital aperture large and locating dorsally. Three free abdominal somites 37 × 72, 26 × 60, and 51 × 60 μm, respectively. Anal somite twice as long as penultimate abdominal somite, with large anal region. Caudal ramus (Fig. 9C) 71 × 26 μm (ratio 2.73 : 1), slightly narrowing distally, with 6 setae; outer lateral seta (seta II) locating at 0.6 region of ramus length.

Rostrum (Fig. 9D) stout, as long as wide; proximal half with parallel lateral margins and distal half strongly tapering, with rounded posterior apex. Antennule (Fig. 9E) 183 μm long and 7-segmented; armature formula: 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 9F) 4-segmented; last segment 33 × 20 μm (ratio 1.65 : 1); armature formula: 1, 1, 2+claw, and 3+4 claws; claws slender; outermost one of 4 terminal claws distinctly longer than other 3.

Labrum (Fig. 9G) with elongate posterior lobes bearing hemi-circular notch on medial margin and membranous flange along posterior margin and distal part of medial margin. Mandible (Fig. 9H) curved in a right angle, with 1 broad, transparent scale on convex outer corner at base of blade; medial margin of blade with about 10 spines near middle of margin and fine spinules distally; outer margin of blade smooth, only with delicate striations; distal part of blade blunt, with small point, without lash. Paragnath as small digitiform process (indicated by dotted line in Fig. 9G). Maxillule (Fig. 9I) lobate, with 1 lateral and 3 distal setae; 2 larger ones of latters unilaterally spinulose in distal half. Maxilla (Fig. 10A) 2-segmented; proximal segment expanded but unarmed; distal segment armed with 3 setae: medial margin seta (seta I) large, almost extending to distal end of distal lash of segment; anterior seta (seta II) stout, spiniform, and spinulose along medial margin; proximal seta (seta III) small and blunt at tip; distal lash of second segment relatively short, armed with 2 rows of thick teeth on convex side and with setules along distal region. Maxilliped (Fig. 10B) 3-segmented; first segment unarmed; middle segment slightly longer than wide, with 1 massive spine bearing 4 teeth, 1 small seta, and 1 longitudinal row of minute spinules; distal segment terminating in spiniform process bearing 4 or 5 teeth, with 1 stout spine bearing 5 teeth.

Legs 1 (Fig. 10C), 2, and 3 (Fig. 10D) with 3-segmented rami. Leg 4 (Fig. 10E) with 3-segmented exopod and 1-segmented endopod. Third exopodal segment of leg 3 characteristically armed with 3 spines and 5 setae. Leg 4 with minute inner seta on coxa; endopod 46 × 15 μm, about 3 times as long as wide, with several setules on outer margin but lacking notch or process on outer margin. Armature formula of legs 1-4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1:	1-1;	1-0;	I-0; I-1; III, I, 4;	0-1; 0-1; I, 2, 3
Leg 2:	0-1;	1-0;	I-0; I-1; III, I, 5;	0-1; 0-2; I, II, 3
Leg 3:	0-1;	1-0;	I-0; I-1; II, I, 5;	0-1; 0-2; I, II, 2
Leg 4:	0-1;	1-0;	I-0; I-1; II, I, 5;	II

Leg 5 represented by a lobe bearing 1 dorsal seta proximally and 1 spine and 1 seta distally (Fig. 10F). Leg 6 represented 2 small setae (distal one of them proximally thick and distally thin) and 1 dentiform process on genital operculum (Fig. 10F)
Male. Unknown.
Etymology. The specific name *extcertus* is a Latin meaning "projecting" which alludes to the prominent lateral projections on the second pedigerous somite of the new species.
Remarks. Two extraordinary morphological features of *Pseudanthessius excertus* n. sp. may typify this species: the third exopodal segment of leg 3 is armed with 3 spines and 5 setae (armature formula II, I, 5), and the second pedigerous somite has a prominent lateral process on both sides. The second feature allows the new species to

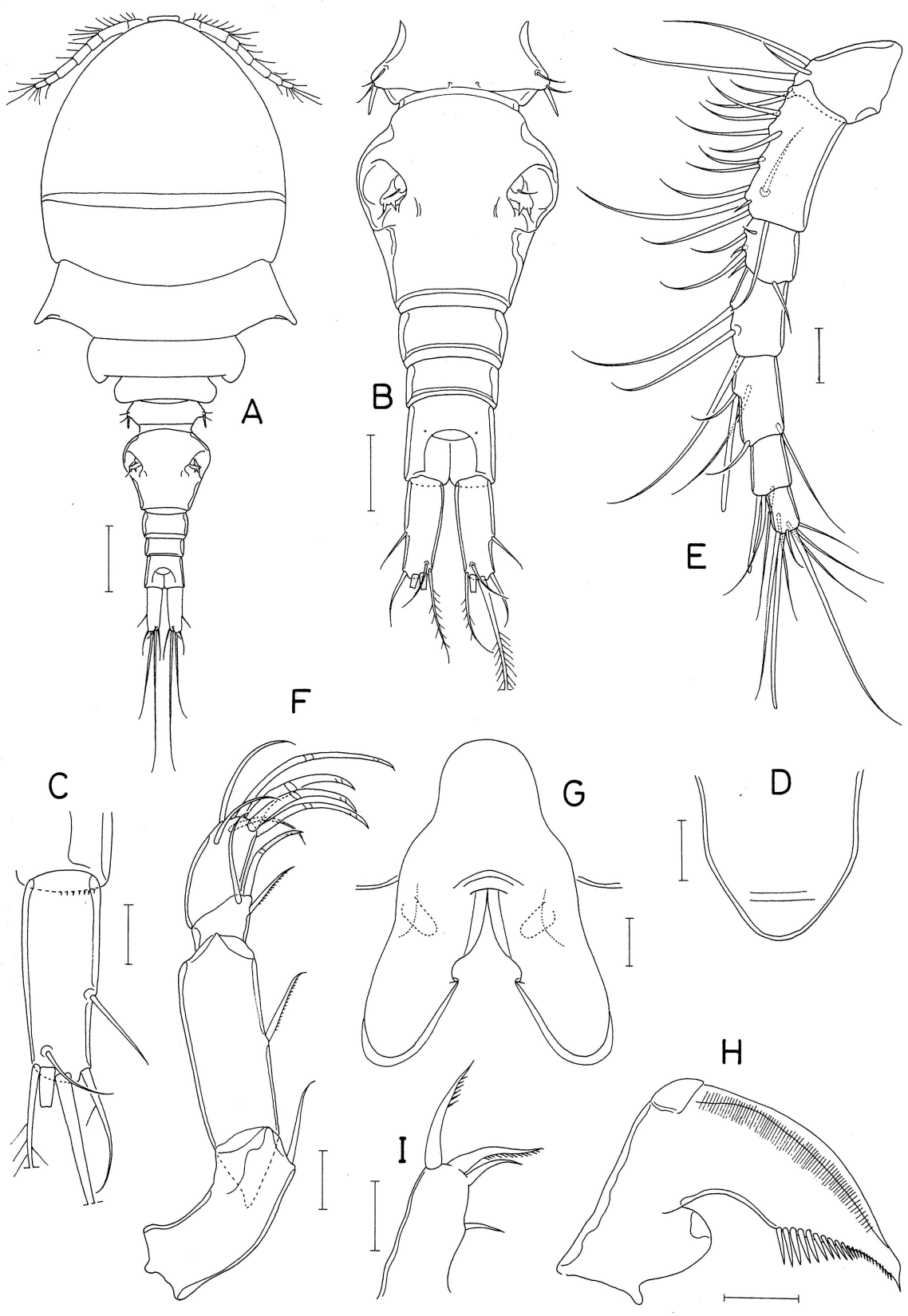

Fig. 9. *Pseudanthessius excertus* n. sp., female. A. habitus, dorsal. B. urosome, dorsal. C. right caudal ramus, dorsal. D. rostrum. E. antennule. F. antenna. G. labrum. H. mandible. I. maxillule. Scale bars: A. 0.1 mm. B. 0.05 mm. C-I. 0.02 mm.

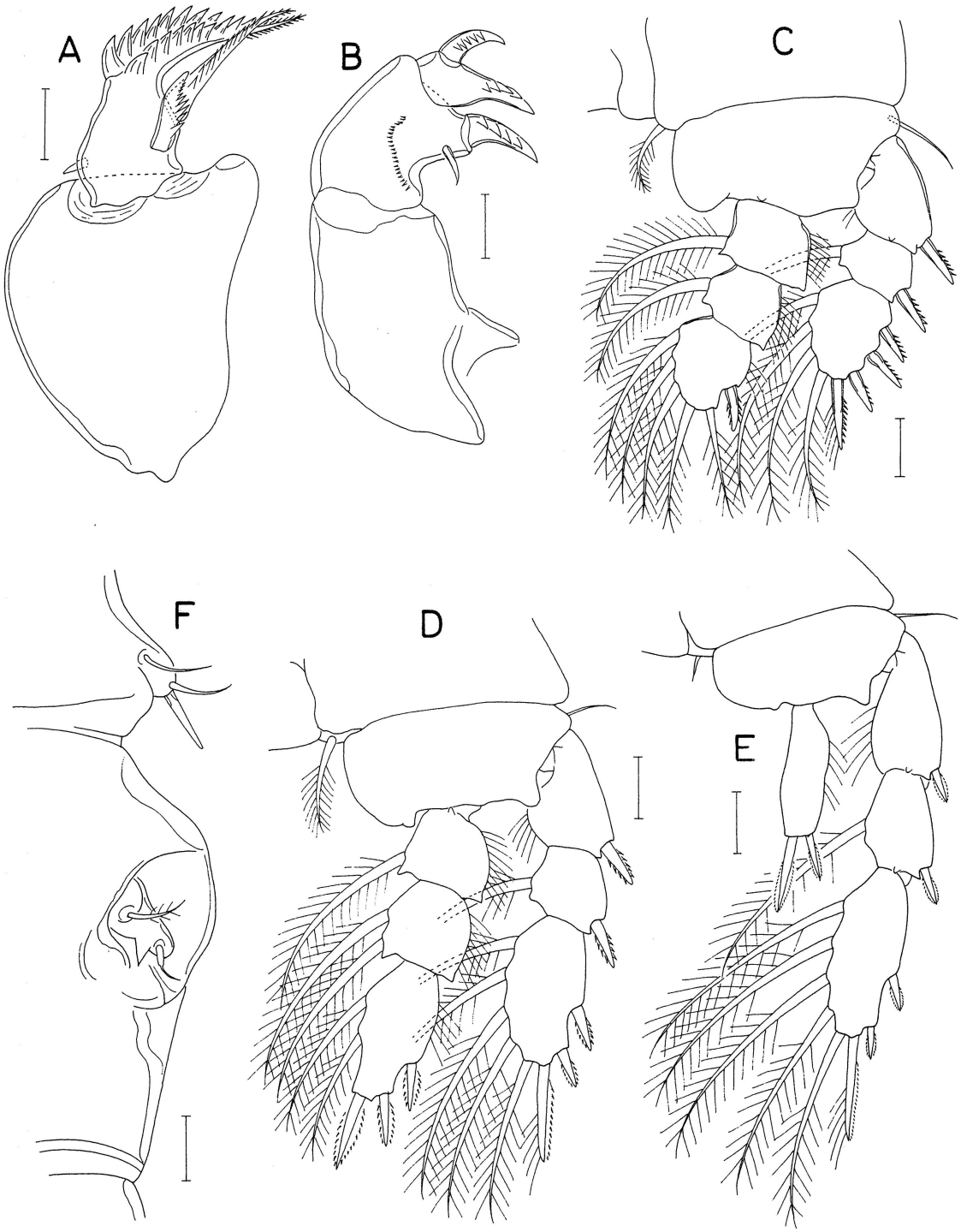

Fig. 10. *Pseudanthessius excertus* n. sp., female. A. maxilla. B. maxilliped. C. leg 1. D. leg 3. E. leg 4. F. right side of first two urosomal somites, dorsal. Scale bas: 0.02 mm for all.

be readily identified without dissection, because no similar process on the second pedigerous somite has been reported in *Pseudanthessius*. Within the genus an example of the first feature is known in *P. asper* Kim, 2009 which was described as an associate of a sponge in Madagascar (Kim, 2009). Otherwise, *P. asper*, which has a peculiar body form, is not related to *P. excertus* n. sp.

Family Polyankyliidae Ho and Kim, 1997
Genus *Polyankylis* Ho and Kim, 1997

Polyankylis ovilaxa n. sp. (Figs. 11-13)

Material examined. 17 ♀♀, 11 ♂♂ from the terebellid polychaete *Thelepus japonicus* Marenzeller collected from a tidal flat (34°49′54″N, 128°02′08″E), Namhae Island on the southern coast of Korea, 22 July 2001. Holotype (♀, NIBRIV0000286633), allotype (♂, NIBRIV0000286634), and paratypes (14 ♀♀, 8 ♂♂, NIBRIV0000286635) have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Dissected paratypes (2 ♀♀, 2 ♂♂) are kept in the collection of the author.

Female. Body (Fig. 11A) 838 μm long, excluding caudal seta, in dissected paratype. Prosome 512 μm long and strongly tapering posteriorly. Cephalothorax 333 × 343 μm, divided by faint dorsal suture line into cephalosome and first pedigerous somite. Cephalosome with apical, rostral prominence and slight lateral constriction indicating division between oral and maxillipedal areas. Second to fourth pedigerous somites with distinct epimera. Fourth pedigerous somite small. Urosome (Fig. 11B) 5-segmented. Fifth pedigerous somite 62 μm wide and distinctly narrower than genital double-somite. Genital double-somite 92 × 77 μm, consisting of broader anterior 70% and narrower posterior 30%, ventrally divided by transverse line into anterior and posterior halves (Fig. 11C). Three free abdominal somites narrow, unornamented, 37 × 40, 35 × 38, and 46 × 40 μm, respectively. Anal region large. Caudal rami rather slender, slightly divergent, and widely separated from each other by ramus width; each ramus 66 × 15 μm (ratio 4.40 : 1), with 6 naked setae; outer lateral seta locating slightly proximal to midlength of ramus; largest caudal seta (seta V) 206 μm long, more than twice as long as next longest nearby seta (seta VI); all caudal setae naked. Egg sac containing loosely aggregated eggs (Fig. 11A); each egg about 40 μm in diameter.

Rostrum tapering posteriorly, slightly wider than long, with round posterior apex (Fig. 11D). Antennule (Fig. 11E) slender, 202 μm long, and 6-segmented; all setae naked; armature formula: 2, 6, 6, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; 2 proximal setae on third segment obscurely positioned between second and third segments, therefore armature formula of first 3 segments may be interpreted as 2, 7, and 5 (or 2, 8, and 4). Antenna (Fig. 12A) 4-segmented, consisting of coxobasis and 3-segmented endopod; coxobasis narrow proximally and broadened distally, with 1 distal seta medially; first endopodal segment the longest segment, gradually broadening distally, with 1 seta in middle of medial margin; second endopodal segment short, armed with 1 claw and 2 setae (proximal seta very small); third endopodal segment 2.5 times as long as wide and armed with 3 claws and 2 naked outer setae; 2 medial claws strongly curved and smaller than outer one, the latter with subdistal spinule on medial margin.

Labrum (Fig. 12B) narrow and covering only part of mandible, with large posterior lobes, and deep and narrow median incision. Mandible (Fig. 12C) with short, strongly tapering blade and 2 spines (or spiniform scales) on convex side (proximal one distinctly longer than distal one); blade terminating in blunt tip, with more than 20 teeth along convex outer margin and wavy row of small, densely arranged spinules on concave medial margin. Paragnath not seen. Maxillule (Fig. 12D) lobate, slightly longer than wide, and armed with 4 setae (2 lateral and 2 distal); 2 middle ones of these 4 setae weakly pinnate unilaterally. Maxilla (Fig. 12E) 2-segmented; proximal segment ornamented proximally with patch of setules on posterior surface; distal segment drawn out into short, acutely tapering process bearing with 4 large and 1 small teeth on convex side; medial seta (seta I) large, longer than segment, with 1 row of large spines and 1 row of small spinules on distal (outer) margin and several setules on proximal (medial) margin; anterior seta (seta II) spiniform, unilaterally spinulose along medial margin; outer proximal seta (seta III) lacking. Maxilliped (Fig. 12F) 3-segmented. First segment (syncoxa) unarmed. Second segment (basis) inflated medially, with two large, spiniform setae; proximal seta much longer than segment, with 4 long setules on medial margin and 2 shorter setules on outer margin; distal seta slightly shorter than segment, almost straight, with minute spinules along outer margin and minute setules along medial margin. Terminal segment (endopod) forming distally slender, elongate claw and proximally with 1 spinulose spine, 1 small seta, and 1 spiniform process.

Legs 1-3 (Figs. 12G, 13A, B) with 3-segmented exopod and 2-segmented endopod. Leg 4 (Fig. 13C) uniramous, with 2-segmented exopod. Endopods of legs 1-3 longer than exopods; distal endopodal segment of these legs much longer than wide and with small, pointed process on outer margin. Three spines on outer and distal margins of exopod of leg 4 setiform, elongate and distally barbed. Armature formula of legs 1-4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1:	0-1;	1-0;	I-0; I-1; III, 4;	0-1; I, 1, 5
Leg 2:	0-1;	1-0;	I-0; I-1; III, 5;	0-1; II, I, 4
Leg 3:	0-1;	1-0;	I-0; I-1; III, 5;	0-1; II, I, 3
Leg 4:	0-0;	1-0;	I-0; II, I, 3;	(missing)

Leg 5 consisting of 1 dorsolateral seta on fifth pedigerous somite and 1-segmented, free exopod; exopod (Fig. 13D) small, 19 × 10 μm (ratio 1.90 : 1), carrying terminally 1 setiform spine and 1 long seta, both naked.

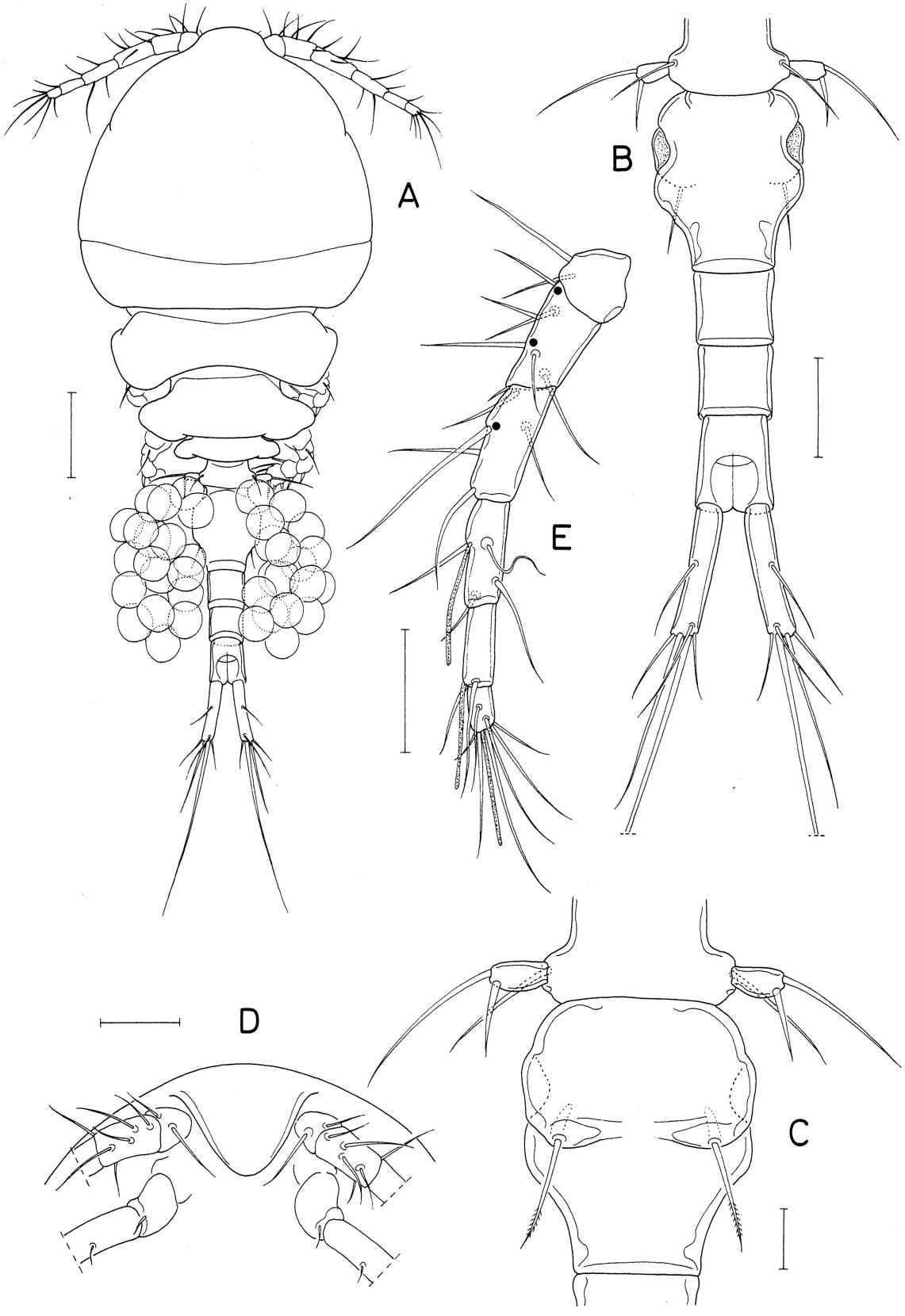

Fig. 11. *Polyankylis ovilaxa* n. sp., female. A. habitus, dorsal. B. urosome, dorsal. C. first two urosomal somites, ventral. D. rostral area, ventral. E. antennule. Scale bars: A. 0.1 mm. B, D, E. 0.05 mm. C. 0.02 mm.

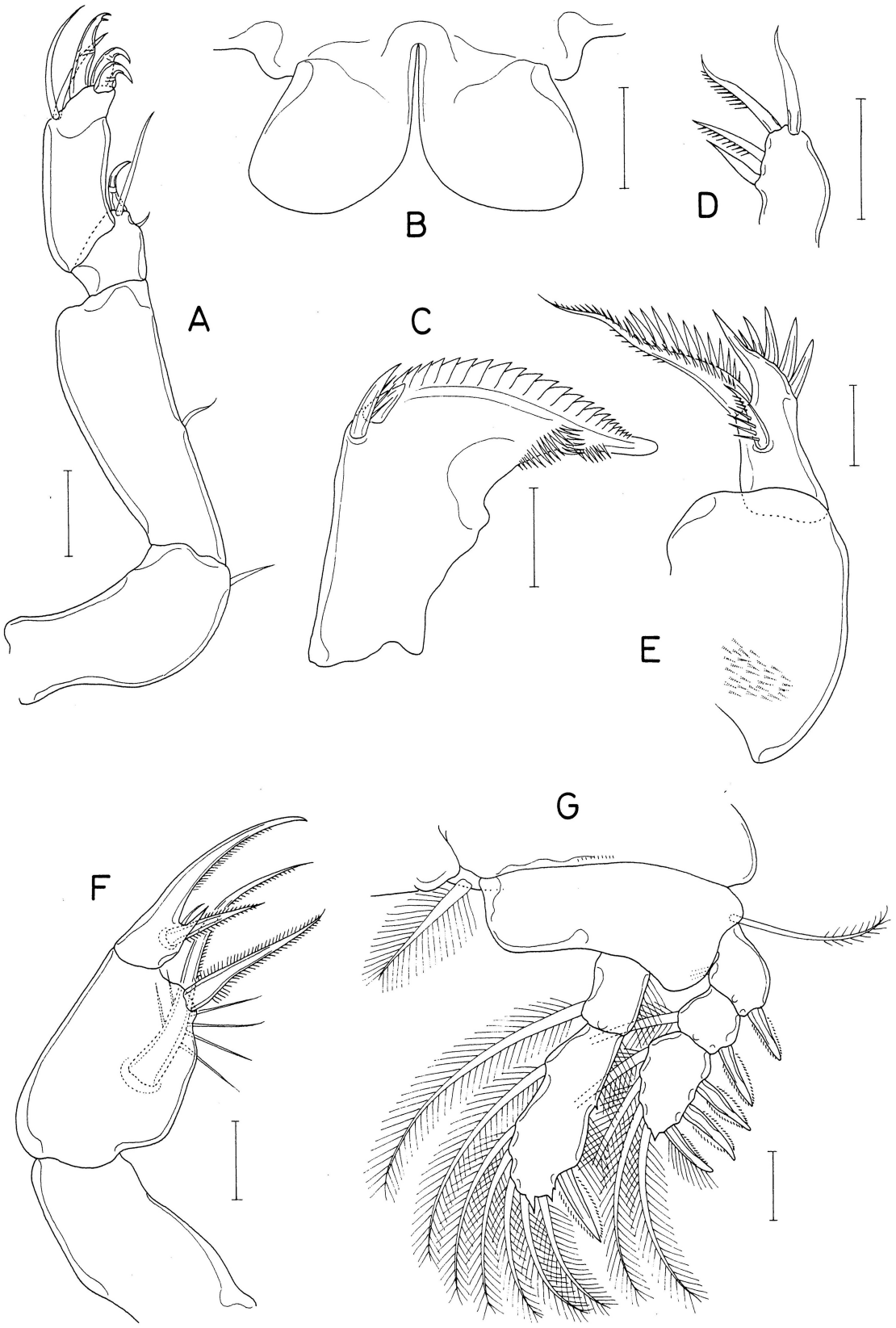

Fig. 12. *Polyankylis ovilaxa* n. sp., female. A. antenna. B. labrum. C. mandible. D. maxillule. E. maxilla. F. maxilliped. G. leg 1. Scale bars: A. 0.05 mm. B-G. 0.02 mm.

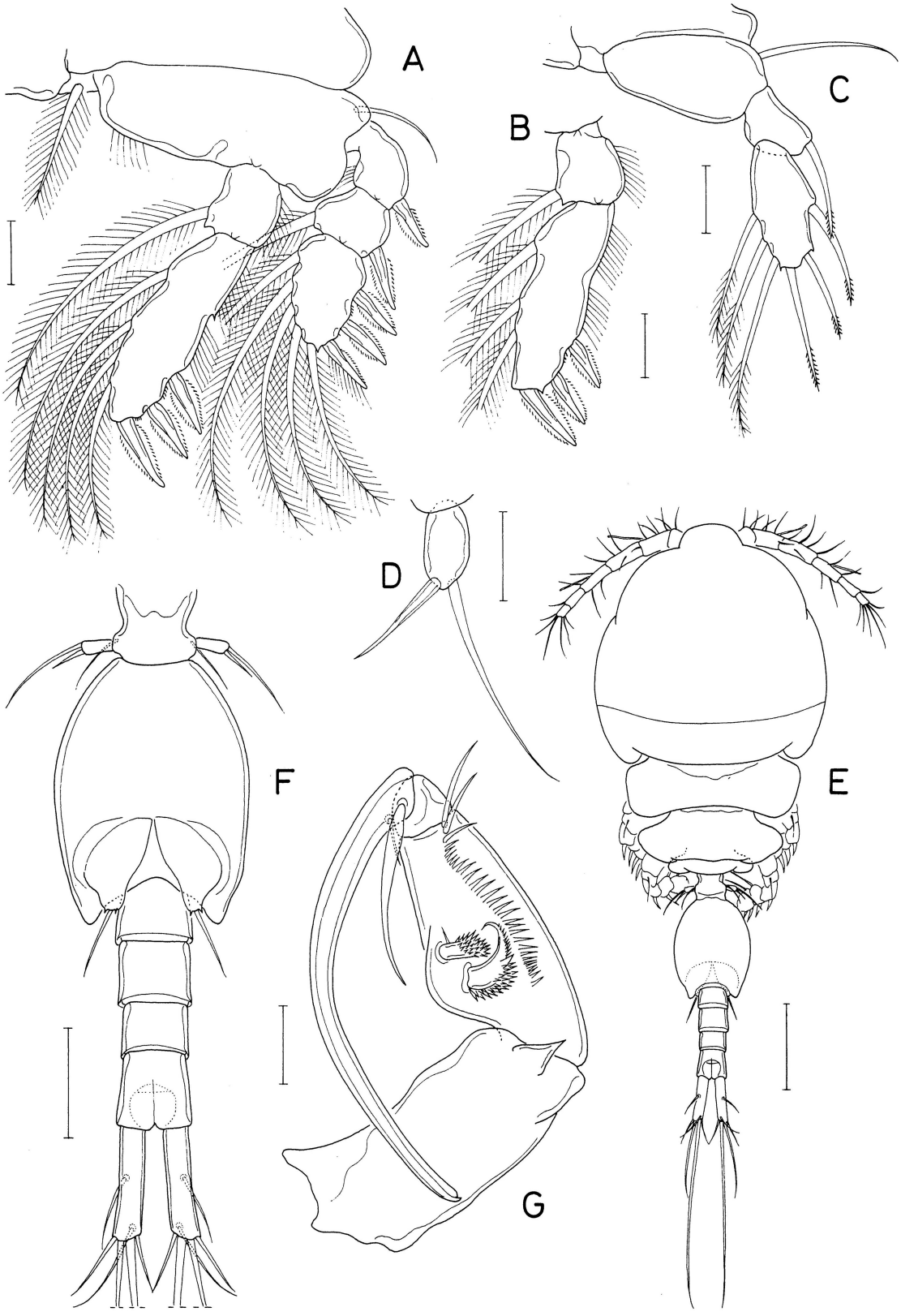

Fig. 13. *Polyankylis ovilaxa* n. sp. Female: A. leg 2. B. leg 3 endopod. C. leg 4. D. leg 5 exopod. Male: E. habitus, dorsal. F. urosome, ventral. G. maxilliped. Scale bars: A-D, G. 0.02 mm. E. 0.1 mm. F. 0.05 mm.

Table 1. Comparison of three species of *Polyankylis*

Characters	*P. orientalis*	*P. australis*	*P. ovilaxa* n. sp.
Body length (in mm)	1.04	0.612	0.838
Caudal ramus, L/W ratio	3.4	3	4.40
Antenna			
Claw on coxobasis	present	absent	absent
Armature on second endopodal segment	claw+2 setae	aesthetasc+2 setae	claw+2 setae
Third endopodal segment, L/W ratio	about 1.3	3.5	2.5
Claw on maxillary syncoxa	present	absent	absent
Armature on maxillipedal endopod	claw+spine+seta+point	2 spiniform spines+seta	claw+spine+seta+point
Leg 4 exopod	1-segmented	2-segmented	2-segmented
Leg 5 exopod, L/W ratio	2.31	1.8	1.90

Leg 6 represented by large seta on ventral surface of genital double-somite (Fig. 11C).

Male. Body (Fig. 13E) similar to that of female. Body length 702 μm in dissected paratype. Urosome (Fig. 13F) 6-segmented. Fifth pedigerous somite narrow, less than half width of genital somite. Genital somite longer than wide, 102 × 88 μm, with pronounced posterolateral corners. Four abdominal somites 26 × 36, 28 × 33, 22 × 30, and 33 × 33 μm, respectively. All abdominal somites smooth, without ornamentation. Caudal ramus 51 × 13 μm (ratio 3.92 : 1).

Antennule segmented and armed as in female except for addition of 2 aesthetascs on second segment and 1 aesthetasc on third segment, as indicated by dark dots in Fig. 11E. Antenna ornamented with spinules on outer margin of second segment (basis).

Labrum, Mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 13G) 4-segmented. First segment with large, acutely pointed process distally. Second segment with 1 longitudinal row of setules (3 distal ones enlarged) on outer surface, and 2 expanded, heavily barbed, transformed setae; proximal one of latters longer than distal one, gradually narrowing distally, with spinules on proximal half of proximal margin; distal seta blunt, short, with 1 setule proximally and spinules distally. Third segment small and unarmed. Terminal segment forming large, arched claw bearing proximally 1 large and 1 small setae.

Legs 1-4 not different from those of female. Leg 5 similar to that of female, but exopod 14 × 6 μm (ratio 2.33 : 1), more slender, and armed with 2 unequal, distal setae.

Etymology. The specific name *ovilaxa* is a combination of Latin words *ovum* (egg) and *laxus* (loose). It alludes to the loose aggregation of the eggs of the new species.

Remarks. *Polyankylis orientalis* Ho and Kim, 1997 was discovered from a tide pool on a mudflat in the Yellow Sea (Ho and Kim, 1997). The second species *Polyankylis australis* Karanovic, 2008 was found interstitially from South Australia (Karanovic, 2008). Although the two species were found in different hemispheres, they could be distinguished only by a few morphological details (Karanovic, 2008). *P. ovilaxa* n. sp. reveals no striking differences from the two congeners, either. However, they are distinguishable from one another and major differences are shown in the segmentation of leg 4 exopod and the armature of antenna. These and other morphological differences are summarized in Table 1.

Sewelloya n. gen.

Diagnosis. Body cyclopiform. Cephalothorax with faint dorsal surture between cephalosome and first pedigerous somite. Urosome 5-segmented in female and 6-segmented in male. Caudal ramus with 6 setae. Rostrum obscure. Antennule 6-segmented, with 2, 6, and 7 setae respectively on first to third segments in female, but in male with 1 additional aesthetasc on second segment. Antenna 4-segmented and consisting of coxobasis and 3-segmented endopod; second endopodal segment with 1 claw and 2 setae, and distal endopodal segment with 3 claws and 4 setae. Labrum with clearly defined posterior lobes. Mandible short, strongly tapering, with 1 claw-like element on convex side and curved row of spinules on convex margin. Maxillule with 4 setae. Maxilla 2-segmented; distal segment with 2 setae and short, curved distal process bearing several dentiform spines on convex margin. Female maxilliped 3-segmented; first segment unarmed; middle segment with 2 setae; distal segment small and tapering with 2 small setae and spinulose apex. Male maxilliped 4-segmented; first and third segment without seta; second segment with 2 stout spiniform setae; terminal segment as large claw bearing 2 setae proximally. Legs 1-3 with 3-segmented exopod and 2-segmented endopod. Leg 4 uniramous, with 1-segmented exopod. Leg 5 represented by 3 setae; free exopod absent. Leg 6 represented by 1 seta. Gender is feminine.

Etymology. The generic name *Sewelloya* is an anagram of the "Yellow Sea" where the type locality is located in. It also is in memory of R. B. Seymour Sewell (1880-1964) who was a British military doctor and copepod researcher.

Type species. *Sewelloya plana* n. sp.

Remarks. Three known species of *Polyankylis* are very

closely similar to one another and they are, in turn, different from *Sewelloya plana* n. sp. The close similarity of the three species of *Polyankylis* and their difference from the latter species suggest placing the new form in a separate genus. *Sewelloya* n. gen. differs from *Polyankylis* mainly in forms of the female maxilliped and leg 5. In the female maxilliped of *Sewelloya* n. gen. the basis (second segment) has two small setae which contrast to the very large ones in the species of *Polyankylis*. The endopod (distal segment) of the same appendage of *Sewelloya* is simplified as a short and tapering segment bearing two small setae in contrast to the complicated structure in *Polyankylis* where the endopod bears an elongated claw or spine and two other elements (setae or spines). Leg 5 of *Sewelloya* is represented by three setae. In contrast, leg 5 of *Polyankylis* uniformly consists of a lateral seta on somite and a free exopod bearing one seta and one setiform spine.

Less importantly, the mandible of *Sewelloya* carries only a single outer sines (vs. a pair of spines in *Polyankylis*) at the base of blade, and the antennule in the male of *Sewelloya* has only one additional aesthetasc on the second segment (vs. two aesthetascs on the second segment and one on the third in *Polyankylis*). These are also considered to be differences in generic level.

Sewelloya plana n. sp. (Figs. 14-16)

Material examined. 2 ♀♀, 1 ♂ from the terebellid polychaete *Loimia medusa* (Savigny) collected from the intertidal zone of Choonjangdae (36°09′40″N, 126°30′57″E), in the Yellow Sea, 03 January 2014. Holotype (♀, NIBRIV0000286636) and allotype (♂, NIBRIV0000286637), both intact, have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Dissected paratype (♀) is retained in the collection of the author.

Other material examined. 1 ♀, 1 ♂ (both dissected) from the same host and locality as type material, 01 February 2002.

Female. Body (Fig. 14A) dorsoventrally flat, with laterally inflated prosome and cylindrical urosome. Body length 1.19 mm in dissected paratype (1.12 mm in holotype). Prosome 775 μm long and consisting of cephalothorax and second to fourth pedigerous somites. Greatest width of prosome 555 μm. Cephalothorax divided dorsally by faint suture line into cephalosome and first pedigerous somite, with broad apical prominence and rounded posterolateral corners. Fourth pedigerous somite small and much narrower than preceding somite. Urosome (Fig. 14B) 5-segmented. Fifth pedigerous somite short but nearly as broad as genital double-somite, with 3 unequal setae (representing leg 5) on both sides. Genital double-somite consisting of expanded anterior part (67 × 165 μm) and narrower distal part (50 × 103 μm); these anterior and posterior parts divided dorsally by suture but not divided ventrally (Fig. 14B-D); genital aperture locating laterally (Fig. 14C). Genital double-somite and first and second free abdominal somites with membranous flange along posterodorsal margin (Fig. 14B) and spinules along posteroventral margin (Fig. 14D). Three free abdominal somites 58 × 97, 58 × 85, and 58 × 67 μm, respectively. Caudal rami slightly divergent; each ramus 92 × 26 μm (ratio 3.54 : 1), with 6 naked setae; seta I absent; seta II locating dorsally at halfway of ramus; seta V the largest, 396 μm long, more than 3 times as long as next longest seta. Egg sac unknown.

Rostral area broad but rostrum absent (Fig. 15A). Antennule (Fig. 14E) 300 μm long and 6-segmented; first to third segments gradually narrowing distally; armature formula 2, 6, 7 (one being minute), 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae slender and some of them weakly pinnate. Antenna (Fig. 14F) 4-segmented; coxobasis gradually broadened distally, with 1 small medio-distal seta and minute spinules in distal region; first endopodal segment the longest, gradually broadened distally, with 1 small seta on medial margin slightly distal to midlength of the margin and 1 transverse row of minute spinules near outer distal corner; second endopodal segment small, with short claw and 2 setae, proximal one of latters minute; third endopodal segment twice as long as wide, with 3 broad claws and 2 setae distally and 2 minute setae subdistally on outer side; medial one of 2 distal setae truncate and tipped by 1 spinule.

Labrum (Fig. 15B) small, with prominent distal lobes articulated at base. Mandible (Fig. 15C) short, strongly tapering, broad at base; convex outer side with 1 claw-like spine and several minute spinules; convex side of blade with row of fine teeth; concave side of blade with curved row of fine spinules; distal end of blade rather blunt, not flexible. Paragnath not seen. Maxillule (Fig. 15D) lobate, with 4 naked setae on oblique distal margin. Maxilla (Fig. 15E) 2-segmented; proximal segment with long membranous flange on outer (ventral) side, 1 tuft of setules on proximal region and 1 curved row of fine spinules on distal region; distal segment strongly recurved in distal region bearing 5 or 6 (usually 6) strong teeth along convex outer side and 1 row of minute spinules on anterior side, with 2 setae (setae I and II); seta I (medial seta) large, nearly as long as segment and spinulose along distal margin; seta II (anterior seta) stiff and spinulose along medial margin. Maxilliped (Fig. 15F) 3-segmented; first segment (syncoxa) unarmed but with 3 transverse rows of fine spinules on medial side; middle segment (basis) with 2 spiniform setae: small, spinulose medial one and larger, unilaterally spinulose one terminating in thin, setiform tip; distal segment (endopod) small, tapering, with 2 minute setae near middle and row of fine

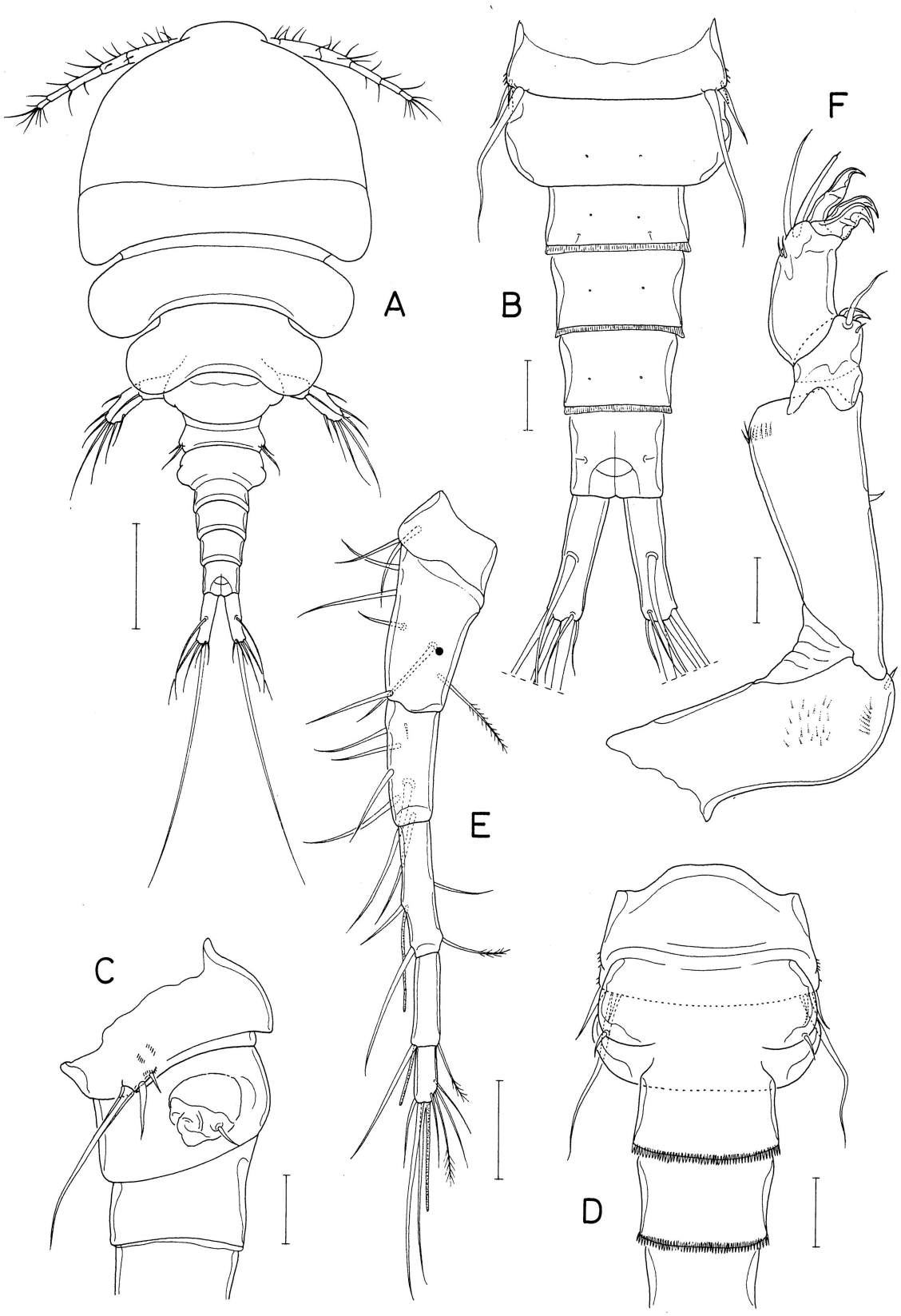

Fig. 14. *Sewelloya plana* n. gen. n. sp., female. A. habitus, dorsal. B. urosome, dorsal. C. anterior part of urosome, right. D. anterior part of urosome, ventral. E. antennule. F. antenna. Scale bars: A. 0.2 mm. B-E. 0.05 mm. F. 0.02 mm.

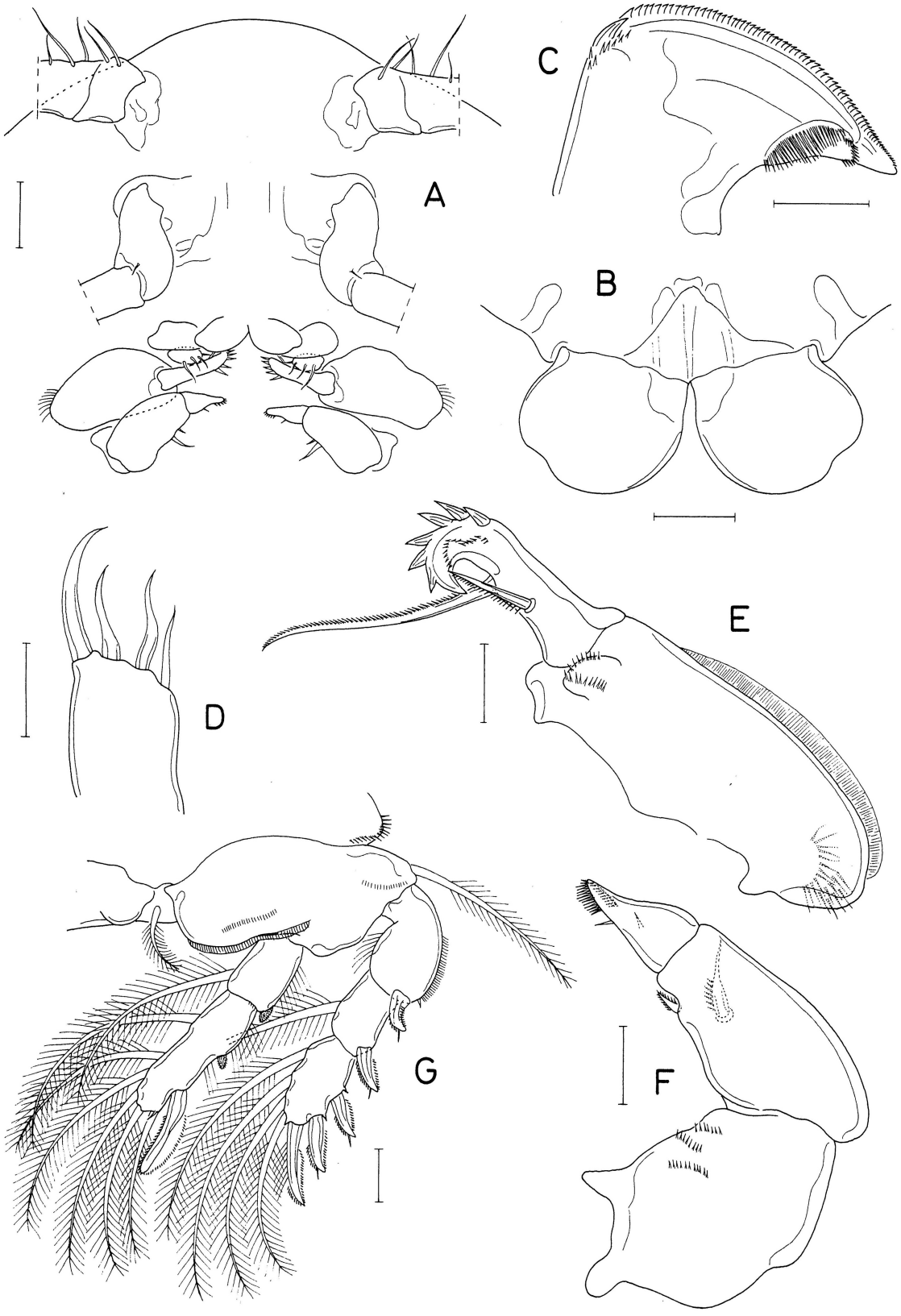

Fig. 15. *Sewelloya plana* n. gen. n. sp., female. A. cephalic region, ventral. B. labrum. C. mandible. D. maxillule. E. maxilla. F. maxilliped. G. leg 1. Scale bars: A. 0.05 mm. B-G. 0.02 mm.

spinules distally.

Legs 1-3 (Figs. 15G, 16A, B) biramous, with 3-segmented exopod and 2-segmented endopod. Leg 4 (Fig. 16C) uniramous, consisting of unarmed coxa, 1 seta-bearing basis, and 1-segmented exopod; intercoxal sclerite with pair of pointed distal processes; 7 setae on exopod stiff and spiniform. Coxa of legs 1-3 with small, pinnate inner seta and spinules on outer distal corner. Basis of leg 1 with 1 medio-distal, membranous flange near base of endopod and 2 rows of minute spinules on ventral surface. Basis of legs 2 and 3 with 2 ventral rows of minute spinules, each row near bases of exopod and endopod. Endopods of legs 1-3 with transparent knob on outer distal corner of proximal segment and outer margin of distal segment. First exopodal segment of legs 1-3 with fine spinules on outer margin. Armature formula of legs 1-4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1:	0-1;	1-0;	I-0; I-1; II, I, 4;	0-1; I, 2, 4
Leg 2:	0-1;	1-0;	I-0; I-1; II, I, 5;	0-1; II, I, 4
Leg 3:	0-1;	1-0;	I-0; I-1; II, I, 5;	0-1; II, I, 3
Leg 4:	0-0;	1-0;	2, 2, 3;	(missing)

Leg 5 represented by 3 unequal setae (Fig. 14C); lengths of these setae 112, 38, and 22 μm, respectively, from dorsal to medial; minute spinules present near base of setae. Leg 6 represented by 1 small, simple seta on genital operculum (Fig. 14C, D).

Male. Body (Fig. 16D) narrower than that of female. Body length 1.06 mm. Greatest width 450 μm measuring across cephalothorax. Urosome 6-segmented. Fifth pedigerous somite slightly narrower than genital somite. Genital somite 133 × 175 μm, with convex lateral margins, distinct genital operculum tipped by 1 seta, and deep posteroventral incision (Fig. 16E). Four abdominal somites gradually narrowing from proximal to distal. Caudal ramus 60 × 23 μm (ratio 2.61 : 1), shorter than that of female.

Rostrum absent, as in female. Antennule with 1 additional aesthetasc on second segment at opposite side of dot in Fig. 14E. Antenna as in female.

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 16F) 4-segmented; first segment with 2 tapering processes at medio-distal corner; second segment with convex outer margin and 1 medial, longitudinal row of fine spinules and armed with 2 massive, transformed spines on medial margin; latter 2 spines (proximal one larger than distal one) distally expanded and spinulose, and tipped by 1 setule; third segment small and unarmed; terminal segment forming long, strongly curved claw bearing 1 large and 1 minute setae proximally.

Legs 1-5 not different from those of female. Leg 6 represented by 1 seta on genital operculum (Fig. 16E).

Etymology. The name of the new species refers to the flat body and is derived from the Latin *planus* (=flat).

Genera recognized in the Polyankyliidae

While establishing the genus *Terebelliphilus* to incorporate a new species *Terebelliphilus simplex*, Kim (2001a) placed this genus in the Sabelliphilidae. *Terebelliphilus* is here transferred to the Polyankyliidae. It carries a number of morphological features sharing with the type genus of the family, *Polyankylis*, as follows: (1) the antennule is six-segmented, with a reduced number of setae on proximal segments; (2) the antenna has a claw on the second endopodal segment and three claws on the terminal endopodal segment; (3) the labrum has prominent posterior lobes; (4) the mandible has a short, strongly tapering blade; (5) the maxilla has a short distal lash bearing few teeth and a large medial seta (seta I); (6) legs 1-3 have 2-segmented endopods; (7) leg 4 lacks an endopod; and (8) the male maxilliped has two massive, transformed setae on the second segment. *Terebelliphilus simplex* was found as a associate of the terebelliphilid polychaete *Terebella ehrenbergi* Grube from an intertidal mudflat in the Yellow Sea.

The genera *Octophiophora* Stock, 1988 and *Stockia* Sebastian and Pillai, 1974 are here transferred also to the Polyankyliidae. *Octophiophora* was originally placed in the Nereicolidae (Stock, 1988), but Boxshall and Halsey (2004) removed it to *Octophiophora*-group, along with *Stockia*. *Octophiophora lacertae* Stock, 1988, the only species of the genus, was discovered from a vial contained various serpulid polychaetes collected in the Great Barrier Reef. *Octophiophora* has a vermiform body, peculiarly bearing four pairs of long lateral processes on the trunk. Nevertheless, it has several characteristic features sharing with *Polyankylis* and *Terebelliphilus*, as follows: (1) the antennule is reduced in segmentation and setation (five-segmented, with three setae on the first segment); (2) the antenna has a claw and two setae on the second endopodal segment and three claws in addition to setae on the terminal endopodal segment; (3) the mandible has a spinulose secondary blade on the concave medial margin, as in *Polyankylis orientalis*; (4) the basis of the maxilla has a large medial seta (seta I) and few teeth on the distal lash; (5) the maxilliped has a pair of large setae on the basis (second segment) and a long spiniform claw and a large seta on the endopod (terminal segment), as in *Polyankylis orientalis* and *P. ovilaxa* n. sp.; and (6) legs 1-4 lack an inner coxal seta, as in *Terebelliphilus*, and their endopods are reduced (in legs 1-3) or absent (in leg 4).

Stockia was originally recorded as a genus of the Clausiidae by the original describers (Sebastian and Pillai, 1974). It was described based on a single male and has not known

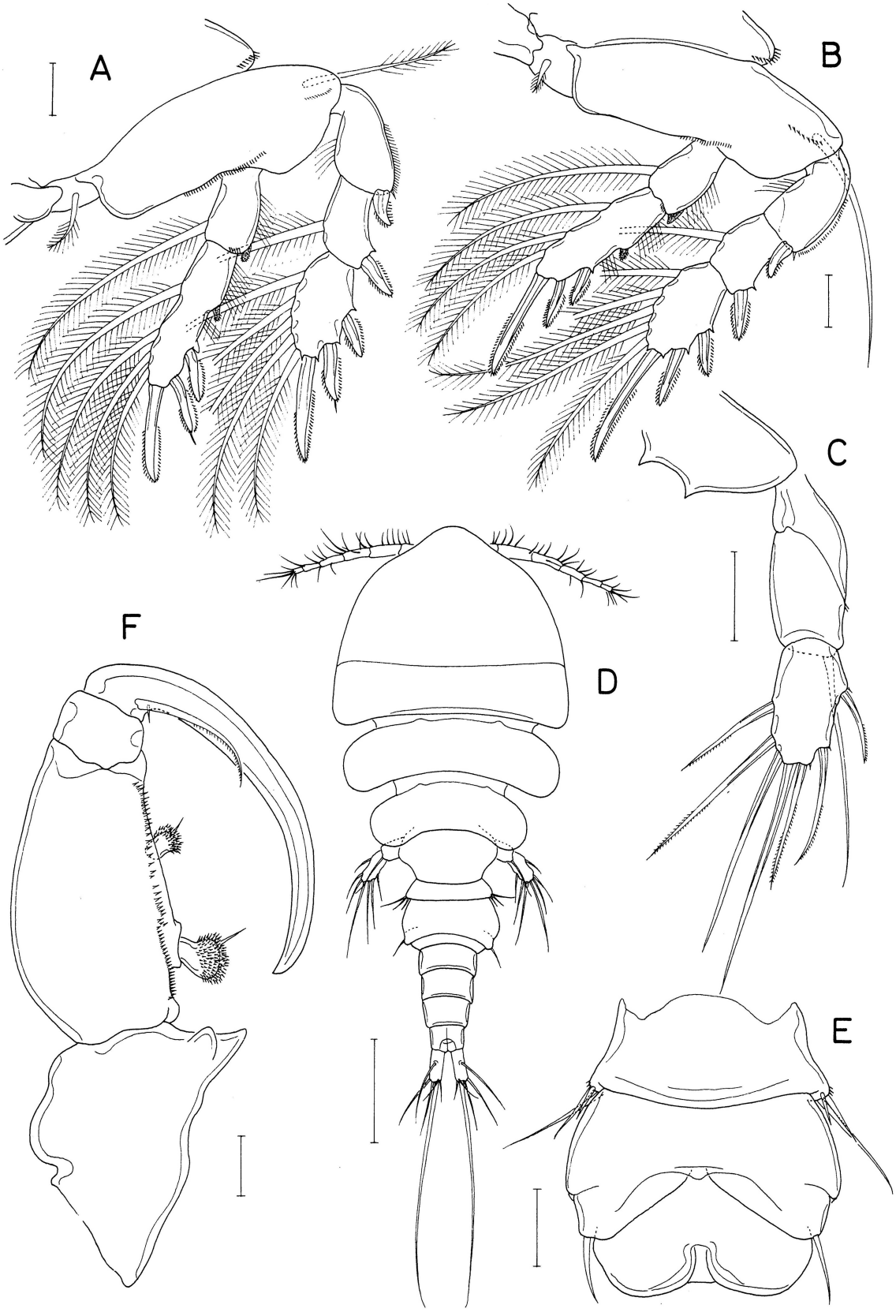

Fig. 16. *Sewelloya plana* n. gen. n. sp. Female: A. leg 2. B. leg 3. C. leg 4. Male: D. habitus, dorsal. E. first two urosomal somites, ventral. F. maxilliped. Scale bars: A, B, F. 0.02 mm. C, E. 0.05 mm. D. 0.2 mm.

of its labrum, mandible and maxillule. However, the maxilla is, as illustrated in the original description, not a form of the Clausiidae but a form of the Lichomolgoidea; its basis (distal segment) is curved, attenuated and claw-like distally. Moreover, the basis carries a relatively large medial seta (seta I), as in some copepods in the Lichomolgoidea. Within the Lichomolgoidea, it seems to belong to the Sabelliphilidae or the Polyankyliidae considering the antenna has a strong claw on the second endopodal segment and multiple claws on the terminal endopodal segment. Legs 1-4 of *Stockia* lack an inner coxal seta and its legs 3 and 4 lack an endopod. The latter features are considered to be of the Polyankyliidae and the genus *Stockia* would better to be placed in the Polyankyliidae.

With the transfer of the three genera, *Terebelliphilus*, *Octophiophora* and *Stockia*, into the Polyankyliidae, this family now contains five genera which may be distinguished using the key below. Known hosts of these copepods are serpulid polychaetes (Serpulidae) for *Octophiophora* and terebellid polychaetes (Terebellidae) for *Polyankylis ovilaxa* n. sp. and *Sewelloya plana* n. gen. n. sp. Although *P. orientalis* and *P. australis* are not known of their hosts, these two species are presumed to be dislodged from polychaetes. *Stockia* was likely dislodged from a polychaete associated with scleractinian coral.

A key to genera of the Polyankyliidae (based on females)

1. Legs 1-3 with 2-segmented exopod ..... *Stockia*
− Legs 1-3 with 3-segmented exopod 2
2. Body vermiform; antennule 5-segmented; endopod of legs 1-3 rudimentary ..... *Octophiophora*
− Body not modified; antennule 6-segmented; endopod of legs 1-3 well-developed and 2-segmented 3
3. Leg 4 with 3-segmented exopod; legs 1-3 without inner coxal seta; fourth pedigerous somite narrow, without epimera ..... *Terebelliphilus*
− Leg 4 with 1- or 2-segmented exopod; legs 1-3 with inner coxal seta; fourth pedigerous somite with epimera 4
4. Terminal segment of female maxilliped terminated in long spiniform claw or spine; leg 5 with free exopod bearing 2 elements ..... *Polyankylis*
− Terminal segment of female maxilliped simple and tapering, with 2 small setae; leg 5 represented by 3 setae ..... *Sewelloya* n. gen.

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