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Poecilostome Copepods (Crustacea: Cyclopoida) Associated with Marine Invertebrates from Tropical Waters

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ABSTRACT

Twenty-two new species of poecilostome copepods associated with marine invertebrates are described from the West Indies, Madagascar, and Pacific coast of Panama. They are *Anthessius nosybensis* n. sp. and *Discanthessius solitarius* n. gen. n. sp. in the Anthessiidae; *Cemihyclops tenuis* n. sp., *Hemicyclops tripartitus* n. sp., *H. humesi* n. sp., *H. magnus* n. sp., and *Leptinogaster minuta* n. sp. in the Clausidiidae; *Schedomolgus crenulatus* n. sp. and *S. parvipediger* n. sp. in the Anchimolgidae; *Kelleria multiovigera* n. sp. in the Kelleridae; *Lichomolgus angustus* n. sp. and *L. fusiformis* n. sp. in the Lichomolgidae; *Pseudanthessius acutus* n. sp., *P. asper* n. sp., and *Tubiporicola pediger* n. gen. n. sp. in the Pseudanthessiidae; *Acanthomolgus tenuispinatus* n. sp. and *Notoxynus lokobensis* n. sp. in the Rhynchomolgidae; *Eupolymniphilus occidentalis* n. sp. and *E. brevicaudatus* n. sp. in the Sabellephilidae; *Enalcyonium robustum* n. sp. and *E. grandisetigerum* n. sp. in the Lamippidae; and *O. binoviger* n. sp. in the Myicolidae. *Hemicyclops geminus* Stock is synonymized with *H. columnaris* Humes which is now known as a species of amphi-American distribution. *Hemicyclops columnaris* Humes, *Modiolicola trabalis* Humes, and *Ostrincola breviseti* Ho and Kim are redescribed.

Key words: Copepoda, Cyclopoida, association, new genus, new species, Madagascar, Panama, West Indies

INTRODUCTION

The late Dr. Arthur G. Humes collected a vast number of copepods associated with marine invertebrates from the tropical waters, such as the West Indies, Madagascar, New Caledonia, Moluccas, the Philippines, east coast of Australia, and the Pacific coast of Panama. He examined as many as 305,863 specimens and established 700 new species and one new subspecies (Huys and Boxshall, 2001), most of which from these tropical waters. The above numbers of specimens and taxa were not all those he collected, but many of them were left unexamined. After the passing away of Dr. Humes, his collections of copepods were soon moved to the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Some of these unexamined copepod material have been studied by Kim (2003, 2004a, b, c, d, 2005a, b, c, 2006b, 2007a) and the remainings are dealt with in the present work or to be reported in the near future. In the present paper, 22 new poecilostome species in ten families are described and three species are redescribed, as follows:

Order Cyclopoida

Family Anthessiidae

1. *Anthessius nosybensis* n. sp. from Madagascar.
2. *Discanthessius solitarius* n. gen. n. sp. from Madagascar.

Family Clausidiidae

3. *Cemihyclops tenuis* n. sp. from the West Indies.
4. *Hemicyclops columnaris* Humes, 1984 from the West Indies and the Pacific coast of Panama.
5. *Hemicyclops tripartitus* n. sp. from Jamaica.
6. *Hemicyclops humesi* n. sp. from Puerto Rico.
7. *Hemicyclops magnus* n. sp. from Bahamas.
8. *Leptinogaster minuta* n. sp. from the Pacific coast of Panama.

Family Anchimolgidae

9. *Schedomolgus crenulatus* n. sp. from Madagascar.
10. *Schedomolgus parvipediger* n. sp. from Madagascar.

Family Kelleridae

11. *Kelleria multiovigera* n. sp. from Madagascar.

Family Lichomolgidae

12. *Lichomolgus angustus* n. sp. from Madagascar.
13. *Lichomolgus fusiformis* n. sp. from Madagascar.
14. *Modiolicola trabalis* Humes, 1959 from Madagascar.

Family Pseudanthessiidae

15. *Pseudanthessius acutus* n. sp. from the West Indies.

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16. *Pseudanthessius asper* n. sp. from Madagascar.
17. *Tubiporicola pediger* n. gen. n. sp. from Madagascar.

Family Rhynchomolgidae
18. *Acanthomolgus tenuispinatus* n. sp. from Madagascar.
19. *Notoxynus lokobensis* n. sp. from Madagascar.

Family Sabellephilidae
20. *Eupolymniphilus occidentalis* n. sp. from the West Indies.
21. *Eupolymniphilus brevicaudatus* n. sp. from Madagascar.

Family Lamippidae
22. *Enalcyonium robustum* n. sp. from Madagascar.
23. *Enalcyonium grandisetigerum* n. sp. from Madagascar.

Family Myicolidae
24. *Ostrincola breviseti* Ho and Kim from Madagascar.
25. *Ostrincola binoviger* n. sp. from Madagascar.

MATERIALS AND METHODS

Copepod specimens studied in this work were collected by the late Dr. Arthur G. Humes from Madagascar in 1955, 1960, 1963, and 1967 and the Pacific coast of Panama in 1981 and by A. G. Humes and R. U. Gooding from the West Indies in 1959. These specimens were mostly caught from shallow water and have been preserved in ethanol.

In the description of species, the collection data, including scientific names of hosts are taken from Dr. Humes' collection notes. Lengths of copepod specimens were measured from the anterior apex to the caudal rami, excluding caudal setae. Before dissection, specimens were immersed in lactic acid for at least 10 minutes. Dissections were done using the reversed slide method. All figures were drawn with the aid of a drawing tube equipped on a light microscope. Descriptions and illustrations of species are based on the dissected paratypes except for some species represented by a single specimen. In the description of species, the female is thoroughly described and the male is briefly described chiefly on the basis of sexually dimorphic characters. In the armature formulae of legs, Roman numerals indicate spines, and Arabic ones representing setae. Type specimens have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C., United States.

DESCRIPTIONS

Order Cyclopoida Burmeister, 1834

Family Anthessiidae Humes, 1986
Genus *Anthessius* Della Valle, 1880
***Anthessius nosybensis* n. sp. (Figs. 1-3)**

Material examined. Two ♀♀, 1♂ from the bivalve *Arca antiquata* L. Nosy Bé, Madagascar, 23 July 1955, collected by A. G. Humes. Holotype (♀: right antenna damaged) and allotype (♂: left antennule and left maxilliped dissected out) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratype (♀) is kept in the collection of the author.

Female. Body (Fig. 1A) narrow. Length of dissected paratype 1.56 mm (holotype 1.64 mm). Maximum width 544 μm. Prosome 944 μm long. Dorsal furrow incomplete between cephalosome and first pedigerous somite. Second and third pedigerous somites rimmed with membrane along lateral and posterodorsal margins. Urosome (Fig. 1B) 5-segmented. Fifth pedigerous somite 139 μm wide. Genital double-somite 194 × 197 μm, strongly expanded laterally in middle. Genital area large and located dorsolaterally in middle of lateral expansion. Three free abdominal somites 83 × 108, 75 × 101, and 117 × 98 μm, respectively. Anal somite with spinules proximally on ventral surface (Fig. 1C). Caudal ramus 140 × 41 μm (ratio 3.41 : 1), with 6 setae; outer lateral seta naked and located at midlength of outer margin; outer distal seta spiniform and tipped by setule. Egg sac (Fig. 1D) large, 700 × 240 μm, containing numerous eggs; each egg 70 μm in diameter.

Rostrum broad, with obscure posterior margin (Fig. 1E). Antennule (Fig. 1F) 326 μm long and 7-segmented, with armature formula 4, 15, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked; some of setae long on first and second segments. Antenna (Fig. 1G) 3-segmented, with armature formula 1, 1, and 6+4 claws; segments approximately 92 × 42, 67 × 42, and 83 × 38 μm, respectively from proximal to distal; 4 terminal claws distinct, outermost one of them distinctly longer than other 3.

Labrum (Fig. 1H) with deep median incision; posterior part bilobed, each lobe strongly tapering, with rounded posterior margin. Mandible (Fig. 1I) with large inner seta bearing spinules on distal margin; distal lash with 2 large teeth proximally on convex margin, both bearing 1 subsidiary denticle, and followed by row of denticles; no hyaline element visible between lash and inner seta. Maxillule (Fig. 1J) armed with 4 setae (including 2 small ones), and terminally bifurcated; larger outer furca apically pointed, with 2 spiniform processes, smaller medial furca pectinated along medial margin. Maxilla (Fig. 1K) 2-segmented; first segment unarmed; second segment terminating in short, spiniform lash, with on convex side proximal spiniform, pointed process followed by minute setule, spiniform seta, and 5 strong

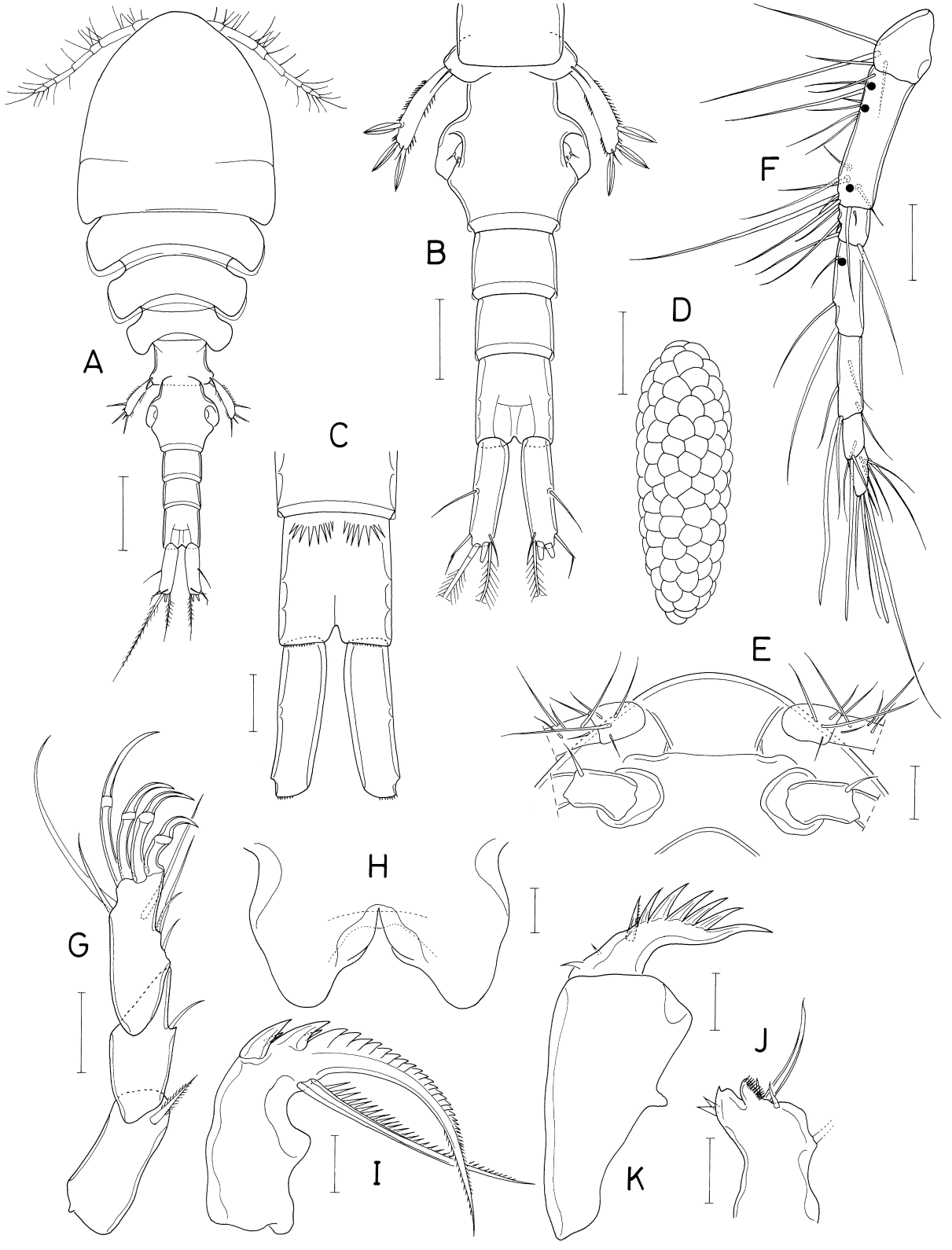

Fig. 1. *Anthessius nosybensis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, distal part of abdomen, ventral; D, egg sac; E, rostral area, ventral; F, antennule (dots indicating places of additional aesthetascs in male); G, antenna; H, labrum; I, mandible; J, maxillule; K, maxilla. Scales: A, D, 0.2 mm; B, 0.1 mm; C-G, 0.05 mm; H-K, 0.02 mm.

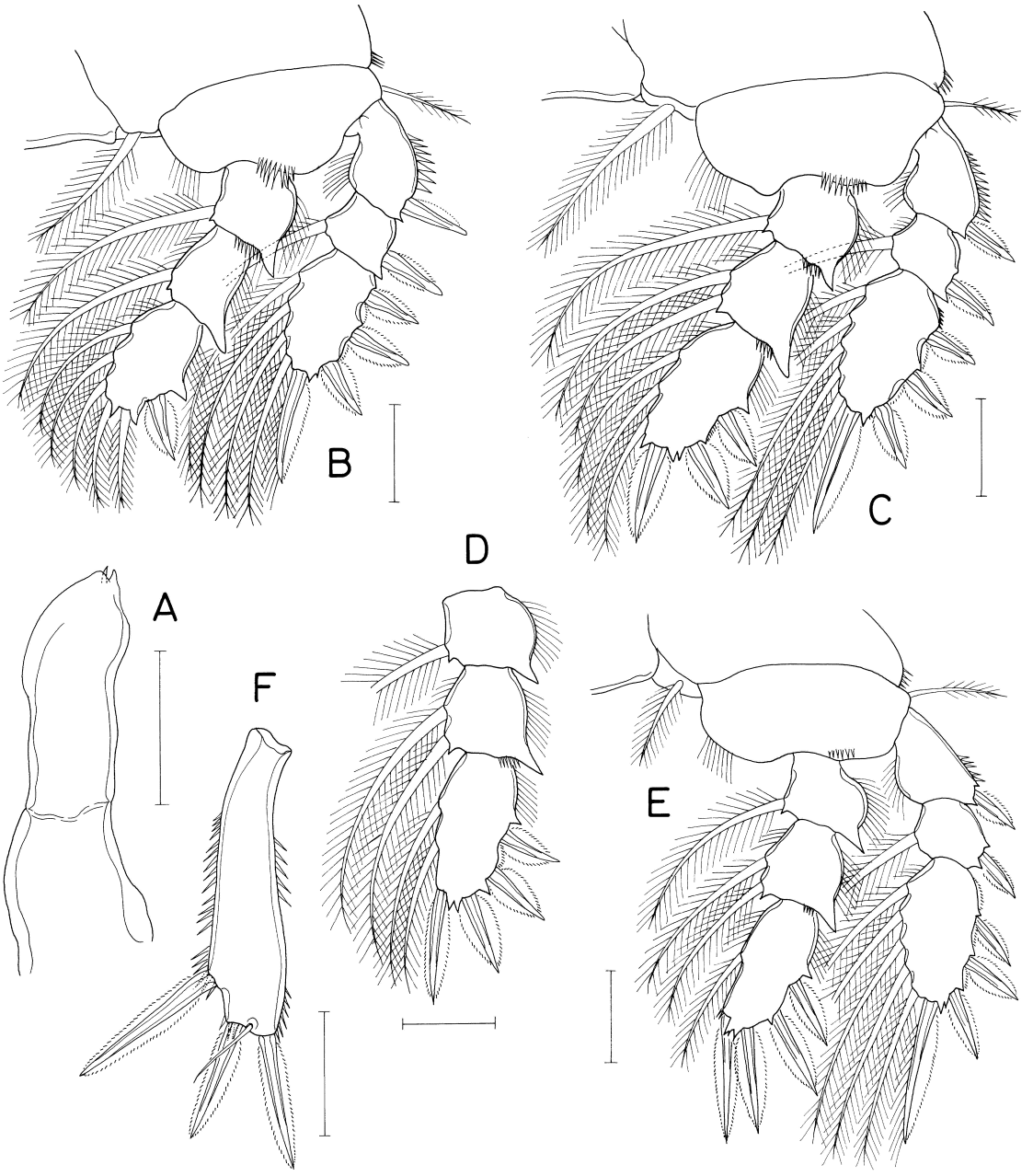

Fig. 2. *Anthessius nosybensis* n. sp., female. A, maxilliped; B, leg 1; C, leg 2; D, endopod of leg 3; E, leg 4; F, free segment of leg 5. Scales: 0.05 mm for all.

teeth. Maxilliped (Fig. 2A) digitiform, with obscure, rudimentary suture line near proximal 2/5 region and apically 1 small tapering process and 1 small setule.

Legs 1-4 with 3-segmented rami (Fig. 2B-E) and small but plumose outer seta on basis. Legs 2-4 with bifurcate terminal process on third endopodal segment. Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,2,3.

Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,3.

Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; II,II,2.

Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; II,II,1.

Leg 5 2-segmented, but first segment not delimited from somite; Free segment (Fig. 2F) elongated, 124 × 32 μm (3.88 : 1), with spinules on outer and inner margins, and 3 spines

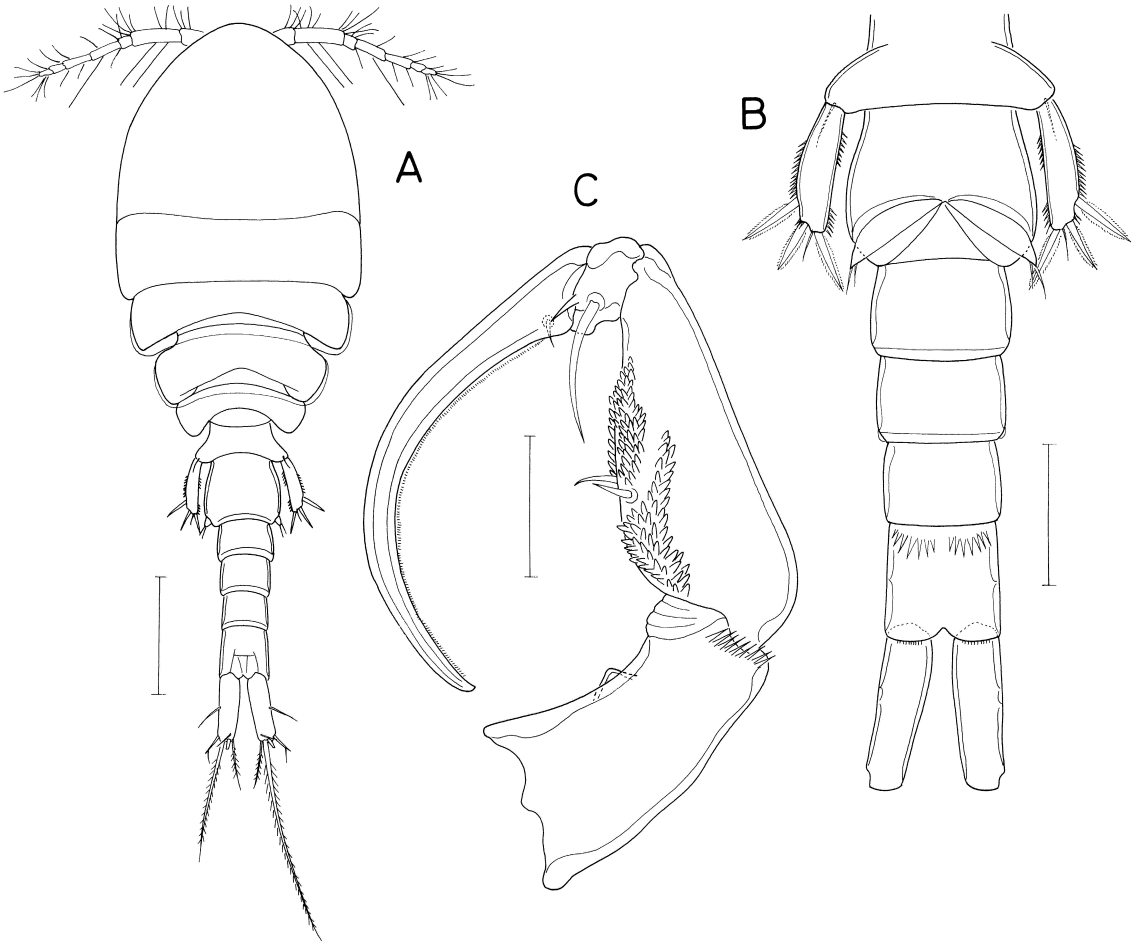

Fig. 3. *Anthessius nosybensis* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, maxilliped. Scales: A, 0.2 mm; B, 0.1 mm; C, 0.05 mm.

(lengths 65, 50, and 55 μm, respectively, from outer to inner) and 1 small seta (32 μm) between 2 inner spines. Leg 6 represented by 1 small setule and 1 minute spinule in genital area (Fig. 1B).

Male. Body form as in female (Fig. 3A). Urosome (Fig. 3B) 6-segmented. Fifth pedigerous somite 165 μm wide. Genital somite 115 × 137 μm. Four abdominal somites 72 × 102, 60 × 94, 60 × 83, and 83 × 83 μm, respectively. Caudal ramus 120 × 35 μm (3.43 : 1).

Rostrum as in female. Antennule with 4 additional aesthetascs: 3 on second and 1 on fourth segments, as indicated by dots in Fig. 1F. Antenna with 1 long additional seta on inner margin of terminal segment (thus 4 setae on this margin).

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 3C) consisting of 3 segments and terminal claw; first segment unarmed but with small, conical process on inner side and row of spinules near outer distal corner; second segment tapering, with 2 small, equal setae and 3 patches of denticles on inner surface; small third segment with 1 setiform spinule and 1 large seta; terminal claw large and strongly curved, with 1 small setule proximally.

Legs 1-4 as in female. Fifth leg with first segment completely fused to somite; free segment shaped and armed as in female. Leg 6 represented by 2 small setules on posterolateral corner of genital flap.

Etymology. The specific name *nosybensis* is derived from the type locality, Nosy Be.

Remarks. *Anthessius nosybensis* n. sp. has a long free segment of leg 5, which is 3.9 times as long as wide in the female. Such a long free segment of leg 5, exceeding 3 times as long as wide, is observable in about 10 known species of *Anthessius*. However, only four of these 10 species carry 4 spines (armature formula III,I,5) on the third exopodal segment of leg 4, as the new species. They are *A. arenicolus* (Brady, 1872), *A. lighti* Illg, 1960, *A. pleurobranchiae* Della

Valle, 1880, and *A. stylocheili* Humes and Ho, 1965. These four species may be distinguished from the new species by their following features different from those of the new species.

In *A. arenicolus*, the terminal segment of antenna is about three times as long as wide according to the illustration in the redescription by Bocquet and Stock (1958), the body is significantly larger, 1.9 mm (Brady, 1880) or 2.2 mm (Bocquet and Stock, 1958) in the females, the three spines on the free segment of leg 5 are setiform and plumose, the distal process (lash) of the second segment of maxilla is short, and the antennule is sex-segmented (Brady, 1880; Bocquet and Stock, 1958).

In *A. lighti*, the caudal ramus is 2.6 times as long as wide, the terminal segment of antenna is nearly as long as wide, and the free segment of leg 5 lacks spinules on the outer margin.

Anthessius pleurobranchiae was described on the basis of the male. According to the illustration given by Della Valle (1880), the free segment of leg 5 of the male is distinctly tapering, forming a striking contrast to that of new species in which it is distally broadened.

In *A. stylocheili*, the terminal segment of antenna is wider than long, the free segment of leg 5 lacks spinules on the outer margin, and the first segment of male maxilliped carries large setae.

Discanthessius n. gen.

Diagnosis (female). Body with flat, broad prosome and small, narrow urosome. Urosome 5-segmented. Antennule 6-segmented. Antenna 3-segmented, with armature formula 1, 1, 6+4 claws. Labrum with large ventral sucker. Mandible as in *Anthessius*, but with 2 hyaline elements near base of inner seta. Other mouth organs and legs 1-5 also as general form and armature of *Anthessius*.

Etymology. The generic name is a combination of *diskos*, the Greek meaning "disc", and *Anthessius*, the name of type genus of the family. It alludes to the possession of a large disc-shaped sucker on the labrum.

Remarks. This genus is very similar to the genus *Anthessius*, except for the possession of a large sucker on the labrum, as the striking distinguishing feature. The presence of the sucker on the labrum has never been reported in the family Anthessiidae until now.

Discanthessius solitarius n. sp. (Figs. 4-6)

Material examined. Holotype (♀) from the scleractinian coral *Seriatophora subseriata* Ehrenberg, in the depth of 0.9 m, Pointe Mahatsinjo, Nosy Bé, Madagascar, 5 September 1960, collected by A. G. Humes. Holotype (dissected and mounted on a slide) has been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C.

Female. Body (Fig. 4A) with large prosome and small urosome. Length 1.68 mm. Prosome 1.12 × 0.93 mm, broad and dorsoventrally flat. Cephalosome separated from first pedigerous somite by weak dorsal furrow, with slightly truncated anterior apex. Urosome (Fig. 4B, C) 5-segmented. Fifth pedigerous somite relatively long and 195 μm wide. Genital double-somite 180 × 185 μm, widest at anterior third, with slightly convex lateral margins. Genital area located laterally. Three free abdominal somites 75 × 128, 62 × 118, and 70 × 113 μm, respectively. All these somites unornamented. Caudal ramus directed straightly backward, 71 × 44 μm (ratio 1.61 : 1), tapering in lateral view (Fig. 4C), with protruding posterior margin bearing row of spinules (Fig. 4D) and 6 caudal setae; small lateral and dorsal setae naked; other 4 setae plumose.

Rostrum broad and short, its posterior margin unclear (Fig. 4E). Antennule (Fig. 4F) long, slender, 693 μm, and 6-segmented, with armature formula 4, 15, 6, 3, 4+aesthetasc, and 9+2 aesthetascs; setae small and naked; aesthetascs thin and confluent with setae; terminal segment distally incompletely divided into 2 parts. Antenna (Fig. 4G) 3-segmented, with armature formula 1, 1, and 6+4 claws; each segment about 107 × 66, 77 × 61, and 142 × 48 μm, from proximal to distal; terminal segment with thick setules on outer distal corner; 3 inner setae small, one of them located near middle of inner margin, other 2 located distally; outermost one of 4 terminal claws longer than other 3.

Labrum (Fig. 5A) consisting of large sucker and 2 strongly tapering posterior lobes. Mandible (Fig. 5B) with 2 pectinate plates on convex margin; distal lash long and bearing denticles on both margins; inner seta large and bearing spinules along distal margin; 2 small hyaline digitiform elements (proximal one of them tipped by setule-like process) between bases of inner seta and distal lash. Paragnath (Fig. 5C) lobate and setiferous. Maxillule (Fig. 5D) with 2 small and 2 larger setae and 2 pointed spiniform processes apically. Maxilla (Fig. 2E) 2-segmented; first segment unarmed; second segment with 2 setae and terminating in moderately long spiniform lash bearing 6 or 7 spines on convex margin and 6 small spinules on concave margin. Maxilliped (Fig. 5F) unsegmented, distally curved and tapering, terminated in small papilliform process, with 1 small apical seta.

Legs 1-4 with 3-segmented rami (Figs. 5G, H, 6A, B). Outer seta on basis of these legs naked and thin. Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,2,3.

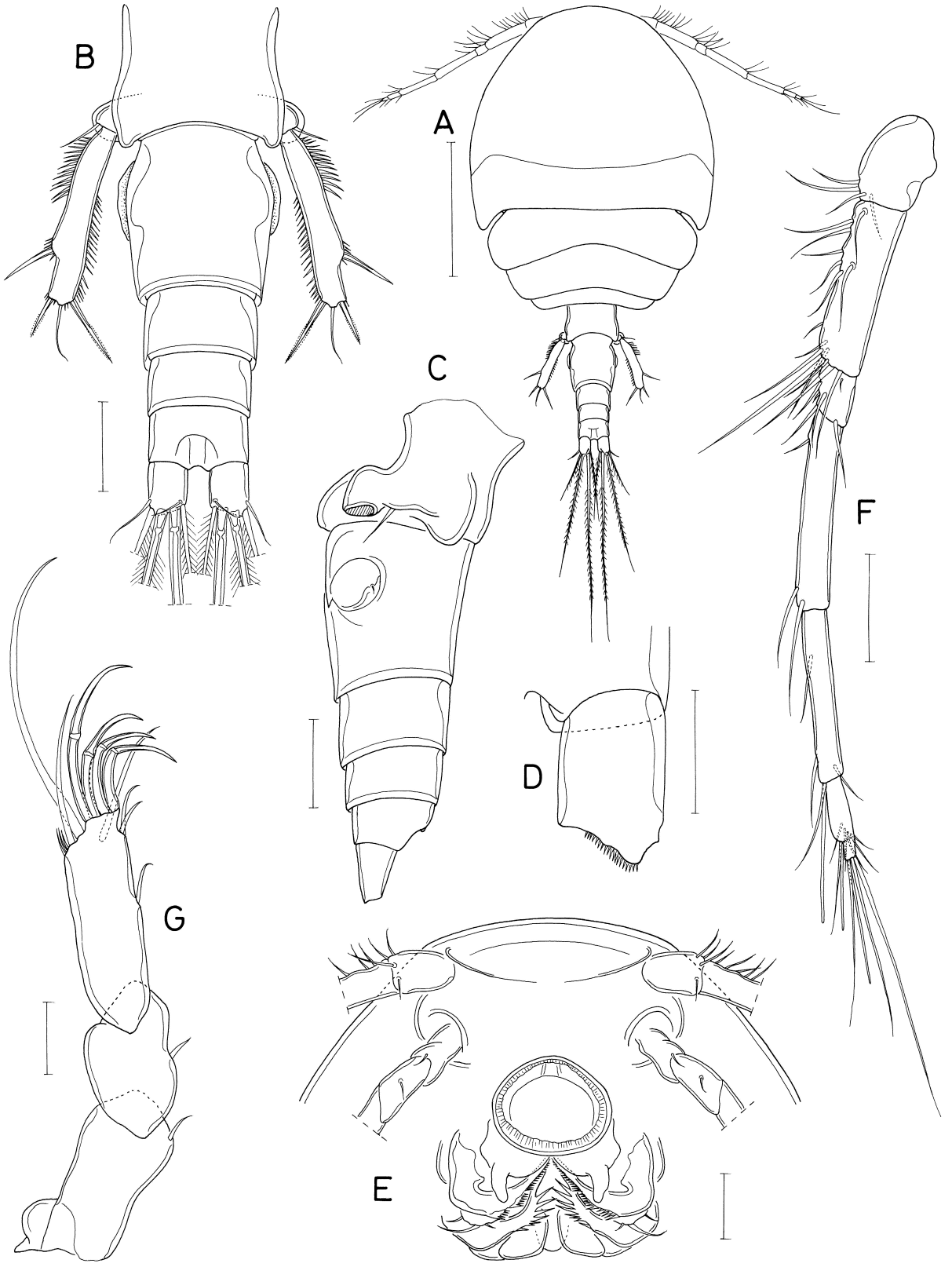

Fig. 4. *Discanthessius solitarius* n. gen. n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, urosome, lateral; D, left caudal ramus, ventral; E, cephalic area, ventral; F, antennule; G, antenna. Scales: A, 0.5 mm; B, C, E, F, 0.1 mm; D, G, 0.05 mm.

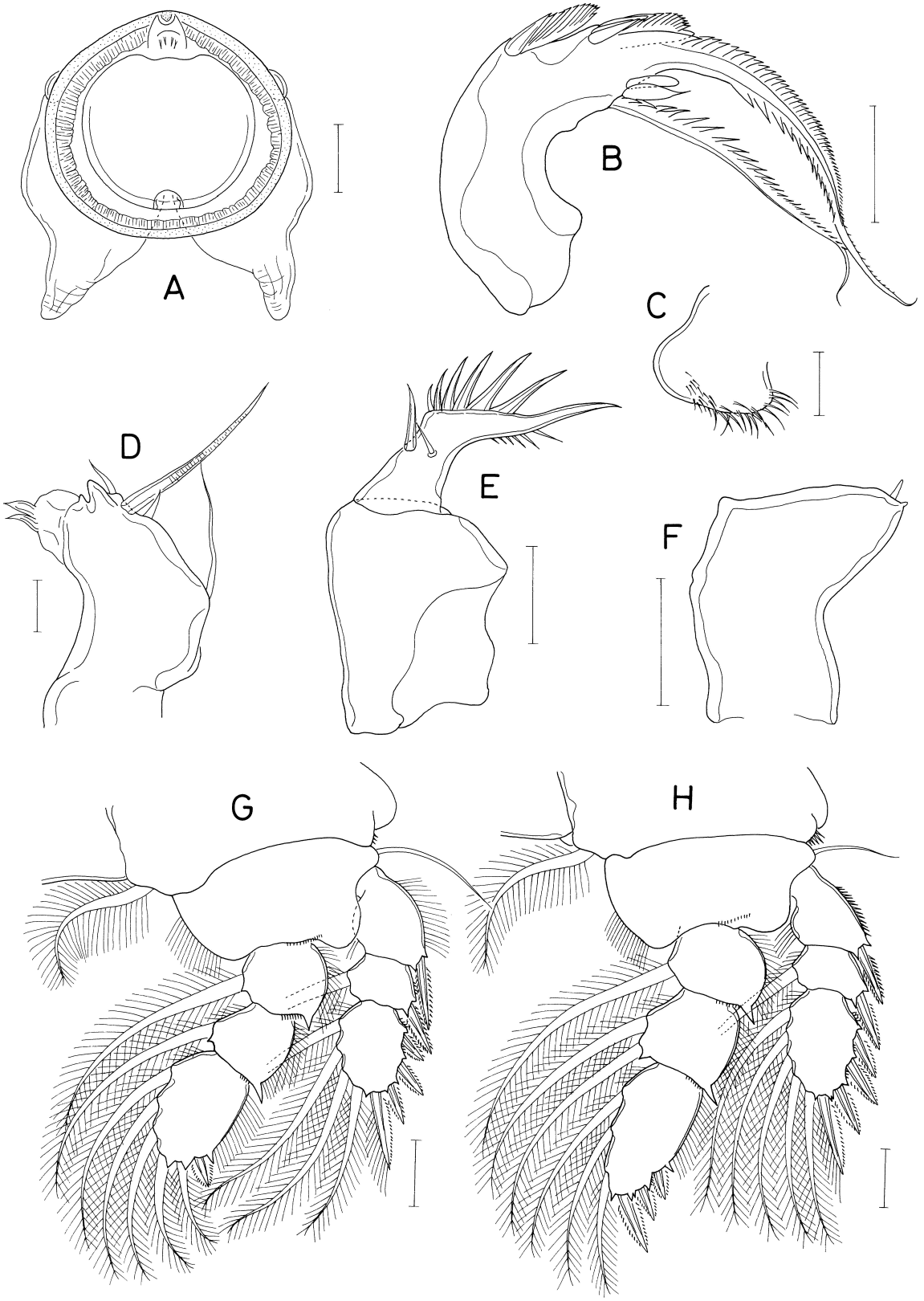

Fig. 5. *Discanthessius solitarius* n. gen. n. sp., female. A, labrum, ventral; B, mandible; C, paragnath; D, maxillule; E, maxilla; F, maxilliped; G, leg 1; H, leg 2. Scales: A, B, E-H, 0.05 mm; C, D, 0.02 mm.

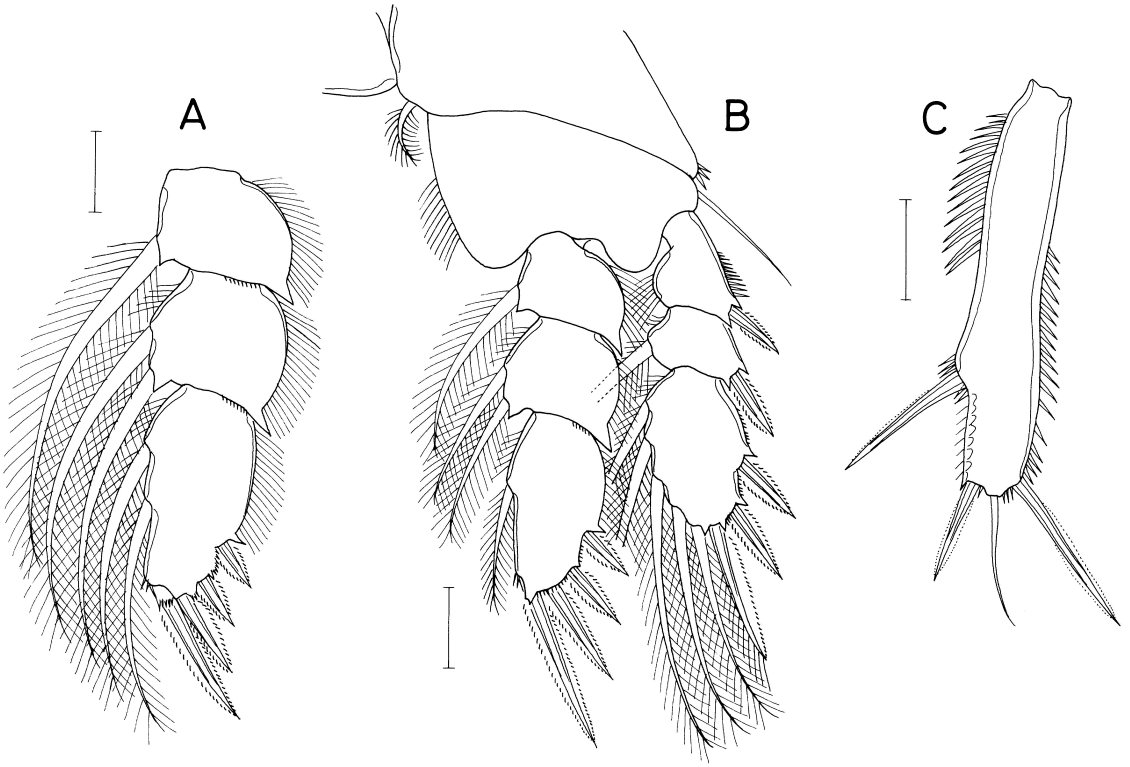

Fig. 6. *Discanthessius solitarius* n. gen. n. sp., female. A, endopod of leg 3; B, leg 4; C, free segment of leg 5. Scales: 0.05 mm for all.

Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,II,3.
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,III,2.
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5; enp. 0-1; 0-2; I,III,1.

Leg 5 2-segmented; basal segment not demarcated from somite, with 1 small dorsolateral seta; free segment elongate, 208 × 43 μm (4.84 : 1) with 3 spines (1 outer and 2 distal), 1 distal seta, and spinules on proximal 1/3 of outer margin and distal 2/3 of inner margin; outer spine 75 μm long, located at 72% region of outer margin; 2 distal spines 52 μm (outer) and 87 μm (inner), respectively; distal seta 65 μm and naked. Leg 6 probably represented by 1 minute setule in genital area (Fig. 4C).

Male. Unknown.

Etymology. The specific name *solitarius* is a Latin meaning "solitary", which alludes to the finding only a single specimen of the new species.

Family Clausidiidae Embleton, 1901
Genus *Cemihyclops* Karanovic, 2008
***Cemihyclops tenuis* n. sp. (Figs. 7-9)**

Material examined. Six ♀♀, 9♂♂ from burrows of *Callianassa*, Caballo Ahogado, Puerto Rico, 19 August 1959, collected by A. G. Humes and R. U. Gooding. Holotype (♀), allotype (♂), and paratypes (4 ♀♀, 7♂♂) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C., United States. Dissected paratypes (1♀, 1♂) are kept in the collection of the author.

Other material examined. Eleven ♀♀, 8♂♂ from burrows of *Callianassa*, in depths of 0.6-0.9 m, north side of Caballo Ahogado, Puerto Rico, 10 August 1959, collected by A. G. Humes and R. U. Gooding.

Female. Body (Fig. 7A) relatively large but slender. Length of dissected specimen 2.82 mm (other 4 measured specimens 2.63, 2.80, 2.85, and 2.90 mm). Prosome 1.45 mm long. Cephalothorax nearly triangular, 770 × 814 μm. Cephalothorax and second and third pedigerous somites with pointed posterolateral corners of epimera. Urosome (Fig. 7B) 5-segmented. Fifth pedigerous somite 300 μm wide. Genital doublesomite 490 μm long, T-shaped, with expanded anterior part (365 μm wide across this area) and narrower, cylindrical posterior part (245 μm wide across this area). Genital area located laterally in anterior part and of somewhat irregular

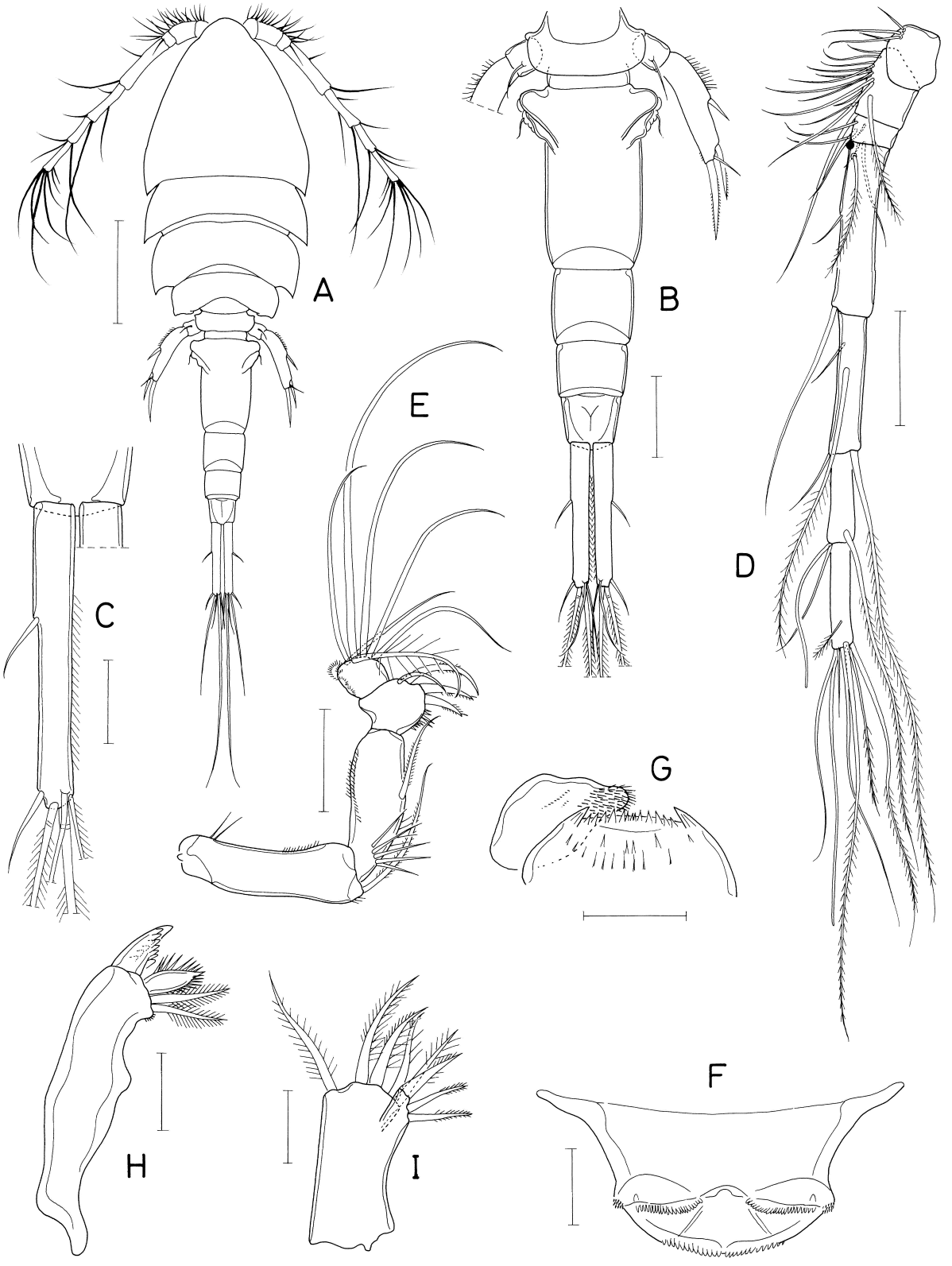

Fig. 7. *Cemihyclops tenuis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, caudal ramus, dorsal; D, antennule; E, antenna; F, labrum, dorsal; G, labium and right paragnath, ventral; H, mandible; I, maxillule. Scales: A, 0.5 mm; B, 0.2 mm; C-E, G, 0.1 mm; F, H, I, 0.05 mm.

form. Three abdominal somites gradually shortened and narrowed, 180 × 210, 143 × 180, and 130 × 150 μm. Anal somite unornamented. Caudal ramus (Fig. 7C) elongate, 367 × 50 μm (ratio 7.34 : 1), with setules on inner margin and 6 caudal setae. Outer lateral seta positioned at 38% length of outer margin. Inner one of 2 median terminal setae longest among 6 setae and 960 μm. Next longest, outer one of these two setae 510 μm. Egg sac (Fig. 8G) elliptical, 645 × 324 μm; each egg about 185 μm in diameter.

Antennule (Fig. 7D) 1.10 mm long, large, with armature formula 4, 14, 6, 3, 4, 2+aesthetasc, and 7+aesthetasc. Fourth segment longest among segments; first to third segments short, combined these 3 segments not longer than fourth segment. Some setae on fifth to terminal segments enlarged and plumose. Antenna (Fig. 7E) with armature formula 1, 1, 4, and 7. Third segment with bullate inner margin and 3 thick, spiniform setae and 1 slender seta. Terminal segment 35 × 38 μm, slightly wider than long.

Labrum (Fig. 7F) as general form of genus. Labium with various spinules and cusps (Fig. 7G). Mandible (Fig. 7H) with 4 terminal elements: 1 claw-like ventral element, 1 plate -like spine, and 2 dorsal setae. Paragnath as unarticulated lobe distally bearing setules and spinules (Fig. 7G). Maxillule (Fig. 7I) bilobed, with 5 setae on larger outer lobe and 3 setae on small inner lobe. Maxilla (Fig. 8A) 2-segmented. First segment with 2 plumose setae, one of which with 1 naked, enlarged subsidiary seta. Second segment distally with 1 setiform spine, 2 strong processes (or spines), and 1 seta. Maxilliped (Fig. 8B) 4-segmented. First segment with 2 large setae. Second segment with 2 inner setae and row of long setules. Third segment small and unarmed. Terminal segment small but armed with 5 elements, one of which spiniform and another one bifurcate.

Legs 1-4 (Figs. 8C-E, 9D) with 3-segmented rami, with following armature formula.

Leg 1: coxa 0-1; basis 1-I;	exp. I-0; I-1; III,I,4;	
	enp. 0-1; 0-1; I,5	
Leg 2: coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5;	
	enp. 0-1; 0-2; I,II,3	
Leg 3: coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5;	
	enp. 0-1; 0-2; I,III,2	
Leg 4: coxa 0-1; basis 1-0;	exp. I-0; I-1; II,I,5;	
	enp. 0-1; 0-2; I,III,I	

Leg 1 with enlarged outer seta on basis, extending well over tip of exopodal setae; inner spine on basis 130 μm, extending over posterior margin of second endopodal segment. Inner coxal seta of legs 2-4 expanded, leaf-like. Leg 2 with outer spine on first exopodal segment and proximal outer spine on third exopodal segment together forming pincers (Fig. 8D).

Leg 5 (Fig. 8F) 2-segmented. First segment well demarcated from somite, with 1 dorsolateral seta. Second segment slender, 302 × 76 μm (ratio 3.97 : 1), armed with outer spine (100 μm), subterminal spine (145 μm) and seta (78 μm), and terminal spine (212 μm). Proximal half of outer margin with fine setules, and inner margin with minute spinules. Leg 6 probably represented by 1 setule in genital area (Fig. 7B).

Male. Body similar to that of female. Length of dissected specimen 2.61 mm. Urosome 6-segmented. Fifth pedigerous somite 246 μm wide. Genital somite 504 × 412 μm, with prominently posteriorly projected genital flap (Fig. 9A). Four abdominal somites 154 × 202, 154 × 184, 116 × 158, and 99 × 127 μm, respectively. Caudal ramus 320 × 44 μm (ratio 7.27 : 1).

Antennule with 1 additional seta on fourth segment (as indicated by black dot in Fig. 7D). Antenna as in female.

Maxilliped (Fig. 9B) comprising 3 basal segments and distal claw. First segment with 2 long setae. Second segment with 2 inner setae and greatly expanded inner margin bearing 2 or 3 rows of spinules. Small third segment unarmed. Distal claw very long, longer than proximal 3 segments combined, and strongly curved at distal third, proximally with 1 spiniform process and 2 setae (Fig. 9C). Other mouth organs as in female.

Legs 1-4 as in female. Leg 5 with basal segment clearly demarcated from somite. Free segment 296 × 57 μm (ratio 5.19 : 1). Leg 6 represented by 1 small seta on genital flap (Fig. 9A).

Etymology. The specific name *tenuis*, a Latin meaning “slender”, alludes to the slender body of the new species.

Remarks. This addition of a second species may reinforce the distinctiveness of the genus *Cemihyclops* Karanovic, 2008. *Cemihyclops ceduensis* Karanovic, 2008 and *C. tenuis* n. sp. share the following characteristics as distinguishing features of the genus: 1) the spine on the first exopodal segment and the first spine on the third segment of leg 2 form pincers; 2) leg 1 bears the enlarged outer seta on basis, which is much more longer than the exopod of the same leg; 3) the caudal rami are elongate; 4) the antennule lacks an aesthetasc on the fifth segment, but with elongated distal three segments; 5) the free segment of leg 5 is elongate; and 6) the body is slender.

Although the two species share diagnostic characters, they are different species distinguishable by the following differences: 1) the body of female *C. tenuis* is distinctly larger (2.63-2.90 mm long) than that of *C. ceduensis* (1.51-1.56 mm); 2) the ratio of the length to width of caudal ramus is 7.34 : 1 in *C. tenuis* but 5.5 : 1 in *C. ceduensis*; 3) the inner margin of caudal ramus is ornamented with setules in *C. tenuis* but naked in *C. ceduensis*; 4) some setae on the antennule are plumose in *C. tenuis* but all of them are naked in *C. ceduensis*; 5) the inner coxal seta of legs 2-4 is expanded

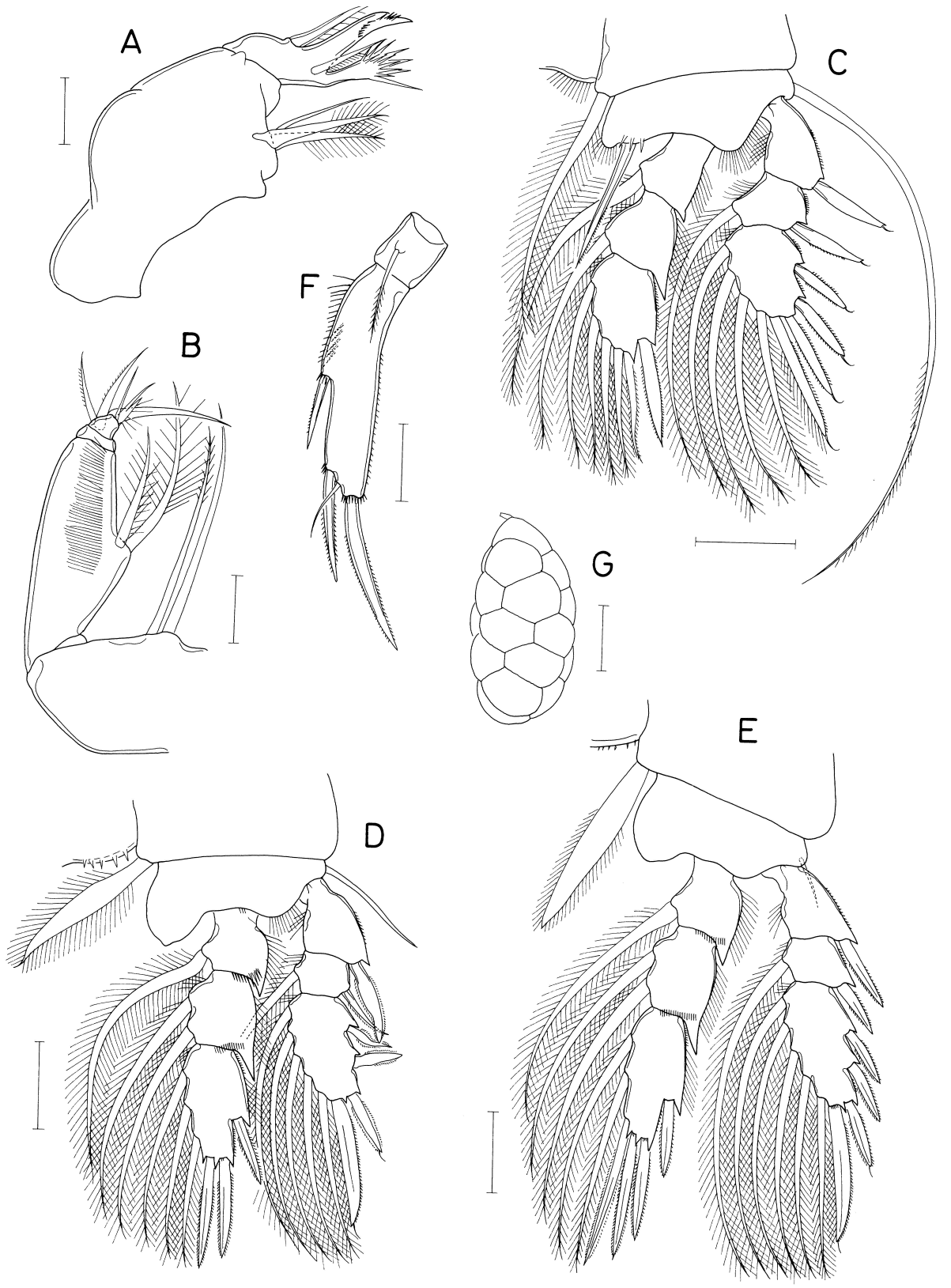

Fig. 8. *Cemihyclops tenuis* n. sp., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 5; G, egg sac. Scales: A, B, 0.05 mm; C-F, 0.1 mm; G, 0.2 mm.

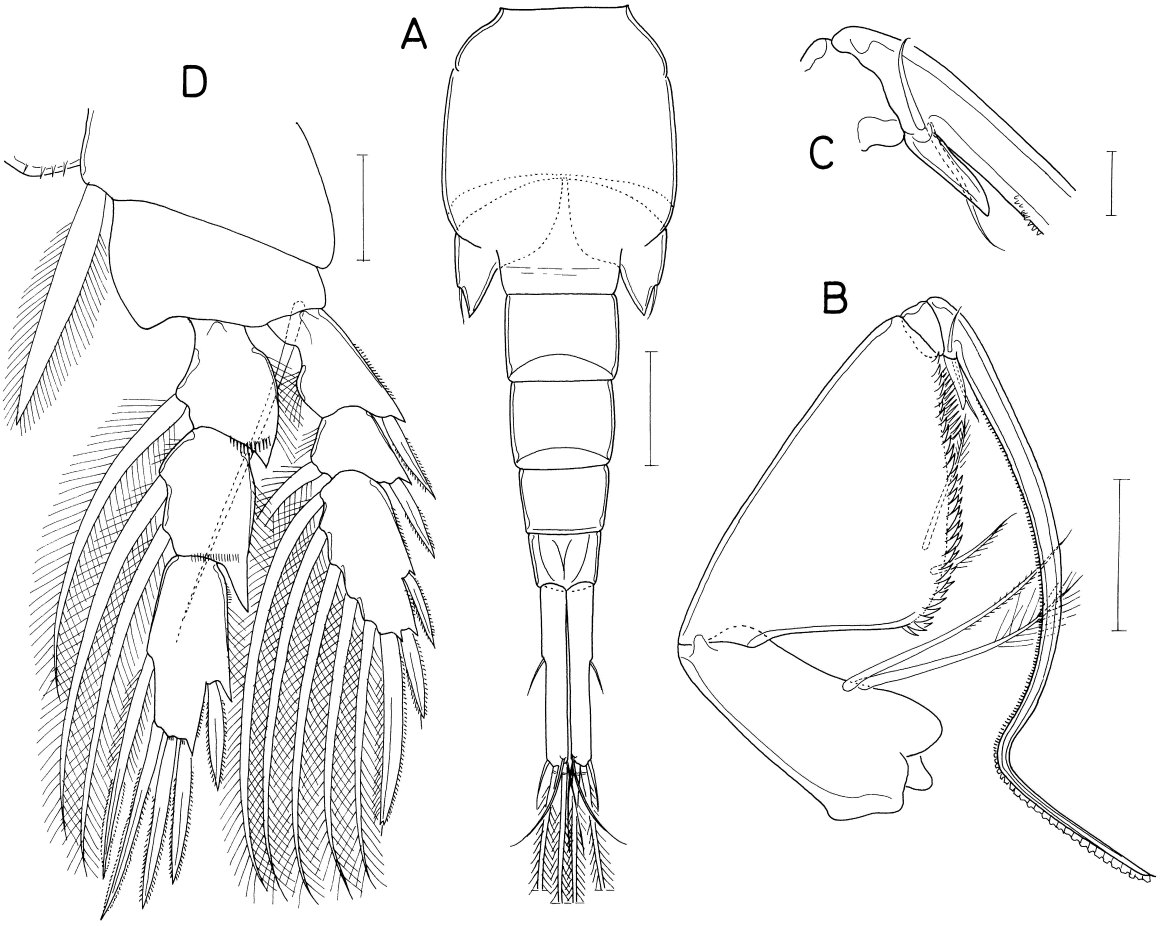

Fig. 9. *Cemihyclops tenuis* n. sp. Male: A, genital somite and abdomen, dorsal; B, maxilliped; C, proximal area of claw of maxilliped. Female: D, leg 4. Scales: A, 0.2 mm; B, D, 0.1 mm; C, 0.02 mm.

in *C. tenuis* but plain in *C. ceduensis*; 6) the third endopodal segment of leg 3 is armed with four spines and 2 setae (formula I,III,2) in *C. tenuis* but with three spines and three setae (I,II,3); and finally 7) the free segment of female leg 5 is 3.97 times as long as wide in *C. tenuis* in comparison with 4.5 times in *C. ceduensis*.

Cemihyclops is similar to *Goodingius* Kim, 2007 in having the slender body, the elongated caudal rami, and the same armature formula on rami of leg 4, but is distinguishable from the latter by the 5-segmented urosome in the female, the possession of four elements on the mandible, and the possession of an inner coxal seta on leg 4.

Genus *Hemicyclops* Boeck, 1873

Remarks. *Hemicyclops* Boeck, 1873, is a genus of primitive copepods living in loose association with various marine invertebrates (Stock, 1992). In the revision of this genus and related genera of the family Clausidiidae, Vervoort and Ramirez (1966) recognized 23 species as valid in *Hemicyclops*, including *H. thalassius* they described as new, with several other incompletely known species being treated as invalid. Since then 19 more species have been added newly, including *H. nichollsi* Karanovic, 2008 which is the most recently described species in the genus, thus 42 species are known in this genus.

Recently, Kim (2007b) created a new genus *Goodingius* to incorporate *Hemicyclops adhaerens* (Williams, 1907), *H. elongatus* Wilson, 1937, *H. arenicolae* Gooding, 1960 and *H. subadhaerens* Gooding, 1960. He redefined the genus *Giardella* Canu, 1888, and assigned to this genus *H. carinifer* Humes, 1965 and *H. caissarum* Kihara and Rocha, 1993, in addition to *Giardella callianassae* Canu, 1888, *G. thompsoni* A. Scott, 1906, and *G. ricoensis* Kim, 2007. Of remaining 36, *H. geminatus* Stock, 1992 will be treated in the present paper as a synonym of *C. columnaris* Humes, 1984.

Therefore, with the removing the six species of *Hemicyclops* to the different genera and the synonymization of a species, the genus *Hemicyclops* now consists of 35 known species.

***Hemicyclops columnaris* Humes, 1984 (Figs. 10-13)**

Hemicyclops columanaris Humes, 1984, p. 33, figs. 1-3.
Hemicyclops geminatus Stock, 1992, p. 70, figs. 1-19.

Material examined. From Pacific coast of Panama (all specimens collected by A. G. Humes): 3♀♀, 3♂♂ from the hermit crab *Calcinus obscurus* Stimpson, in rocky intertidal pools, Naos Marine Laboratory, Smithsonian Tropical Research Institute (STRI), Naos Island, Pacific coast of Panama, 20 October 1981; 2♂♂ from the scleractinian coral *Porites lobata* Dana, in the depth of 12-17 m, north side of Uraba Island, 24 October 1981; 1♂ from the scleractinian coral *Pavona giganteus* Verrill, in the depth of 3 m, Chapera Island, 11 November 1981; 2♀♀, 2♂♂ from the hermit crab *Calcinus obscurus* Stimpson, intertidal, Saboga Island, 14 November 1981.

From the West Indies (all specimens collected by A. G. Humes and R. U. Gooding): 2♀♀ from the hermit crab *Petrochirus diogenes* (L.), Bimini, Bahamas, 29 May 1959; 1♀ from washings of a sponge, off Lerner Marine Laboratory, Bimini, Bahamas, 29 May 1959; 1♀ from washings of the ophiuroid *Ophiocoma riisei* Lutken (=*O. wendtii* Muller and Troschel), off Lerner Marine Laboratory, Bimini, Bahamas, 1 June 1959; 3♀♀ from a hermit crab, south end of Pidgean Cay, Bimini, Bahamas, 4 June 1959; 9♀♀, 3♂♂ from burrow water of *Callianassa*, Bimini, Bahamas, 5 June 1959; 5♀♀, 2♂♂ from 9 hermit crabs, Bimini, Bahamas, 8 June 1959; 10♀♀, 10♂♂ from the hermit crab *Calcinus tibicen* (Herbst), Hastings Reef, St. Matthias' Church, Barbados, 23 July 1959; 1♀, 1♂ from the hermit crab *Dardanus venosus* (H. Milne-Edwards), Drunken Man's Cay, Jamaica, 3 September 1959.

The following is a supplementary description based on the specimens associated with the hermit crab *Calcinus tibicen* (Herbst) collected in Barbados, West Indies.

Female. Body (Fig. 10A) with moderately broad prosome. Length 1.29 mm (1.09-1.44 mm), based on 10 specimens (dissected specimen 1.43 mm). Urosome (Fig. 10B) slightly shorter than prosome. Genital double-somite 297 μm long, T-shaped, with anterior portion expanded laterally (180 μm wide across this portion) and remaining posterior portion cylindrical (147 μm wide across this portion). Three abdominal somites 117 × 131, 88 × 120, and 68 × 110 μm. Anal somite with row of spinules along posteroventral margin (Fig. 10C). Caudal rami slightly divergent. Each ramus 76 × 52 μm (ratio 1.46 : 1), with setules on distal half of inner margin and 4 minute spinules at inner distal corner (Fig. 10C). Egg sac (Fig. 10D) variable in shape and size, oval or elliptical. Each egg about 58 μm in diameter.

Antennule (Fig. 10E) 363 μm long and 7-segmented, with armature formula 4, 15, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc. Antenna as Fig. 10F. Outer distal corner of second segment with triangular hyaline membrane. Terminal segment 30 × 23 μm, longer than wide.

Labrum as Fig. 10G. Mandible (Fig. 10H) with 4 distal elements, including 2 dorsal setae. Paragnath (Fig. 10I) lobate, unarticulated, with numerous spinules and setules. Maxillule (Fig. 10J) bilobed, with 5 setae on outer lobe, 3 setae on inner lobe, and spinule-like process on outer margin (indicated by arrowhead in Fig. 10J). Maxilla (Fig. 10K) with row of minute setules on first segment (indicated by arrowhead in Fig. 10K). Maxilliped (Fig. 11A) with row of minute setules along inner margin distal to inner setae (indicated by arrowhead in Fig. 11A). Terminal segment armed with 2 spiniform elements and 3 setae.

Leg 1 (Fig. 11B) with small, spinule-like process near base of inner spine on basis (indicated by arrowhead in Fig. 11B). Inner coxal seta and inner seta on first endopodal segment of legs 1-4 bluntly ended (as indicated by arrowheads in Fig. 11C). Armature formula of legs 1-4 as follows:

Leg 1:	coxa 0-1; basis 1-I;	exp. I-0; I-1; I,I,6; enp. 0-1; 0-1; I,5
Legs 2 & 3:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,II,3
Leg 4:	coxa 0-1; basis 1-0;	exp. I-0; I-1; II,I,5; enp. 0-1; 0-2; I,II,II

Free segment of leg 5 (Fig. 8E) 131 × 53 μm (ratio 2.47 : 1). Leg 6 not seen.

Male. Body (Fig. 12A) shaped as in female. Length 1.14 mm (1.02-1.25 mm), based on 10 specimens. Urosome (Fig. 12B) 6-segmented. Fifth pedigerous somite 193 μm wide, laterally tapering. Genital somite 138 × 145 μm, gradually broadened distally, with small genital flaps and pointed posterolateral corners (Fig. 12H). Four abdominal somites 117 × 117, 93 × 108, 63 × 98, and 50 × 95 μm, respectively. Caudal ramus 62 × 42 μm (ratio 1.48 : 1).

Antennule with 2 additional setae, each on third and fourth segments (as indicated by dots in Fig. 10E). Antenna as in female. Labrum (Fig. 12C) strongly constricted laterally. Mandible, paragnath, and maxillule as in female. Maxilla (Fig. 12D) lacking row of minute setules on first segment. Second segment terminated by stout claw. Maxilliped (Fig. 12E) consisting of 3 segments and terminal claw. First segment with 1 long seta. Second segment greatly expanded proximally, with 2 small setae and 3 rows of spinules along inner margin. Small third segment unarmed. Terminal claw

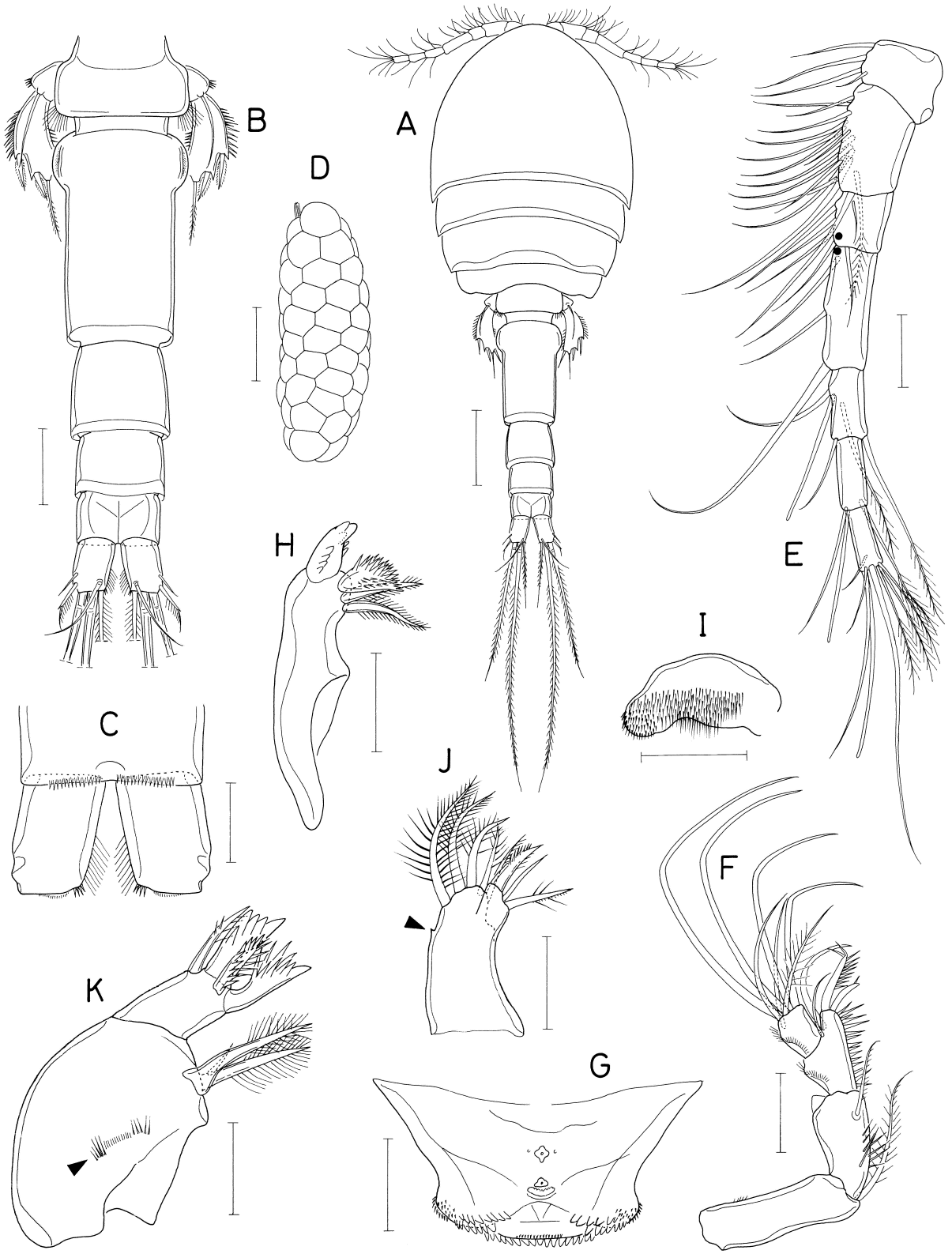

Fig. 10. *Hemicyclops columnaris* Humes, female. A, habitus, dorsal; B, urosome, dorsal; C, caudal rami, ventral; D, egg sac; E, antennule; F, antenna; G, labrum, dorsal; H, mandible; I, paragnath; J, maxillule; K, maxilla. Scales: A, 0.2 mm; B, D, 0.1 mm; C, E-K, 0.05 mm.

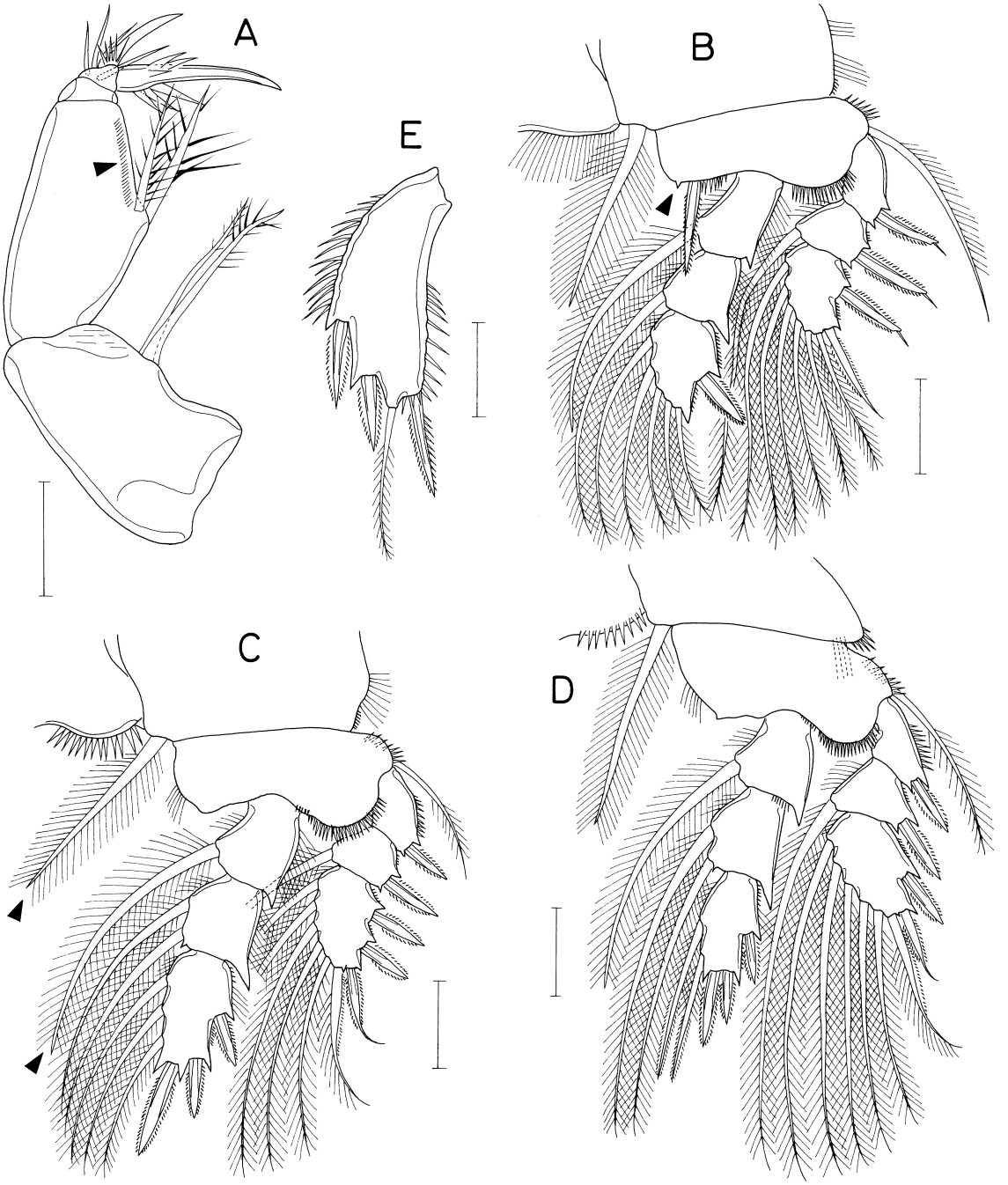

Fig. 11. *Hemicyclops columnaris* Humes, female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, free segment of leg 5. Scales: 0.05 mm for all.

accompanied proximally by 1 spiniform element (indicated by arrowhead in Fig. 12F) and 4 small setae.

Leg 1 lacking inner spine on basis (Fig. 12G). Legs 2-4 as in female. First segment of leg 5 completely fused with somite. Leg 6 represented by 1 spine on genital flap (Fig. 12H).

Remarks. *Hemicyclops geminatus* Stock, 1992 is here synonymized with *H. columnaris* Humes, 1984. A re-examination of specimens from the Pacific coast of Panama and the West Indies revealed that the specimens from both seas do not belong to different species. They share not only almost all significant morphological traits, except for a slight size difference (Humes, 1984, described 1.03-1.24 mm in

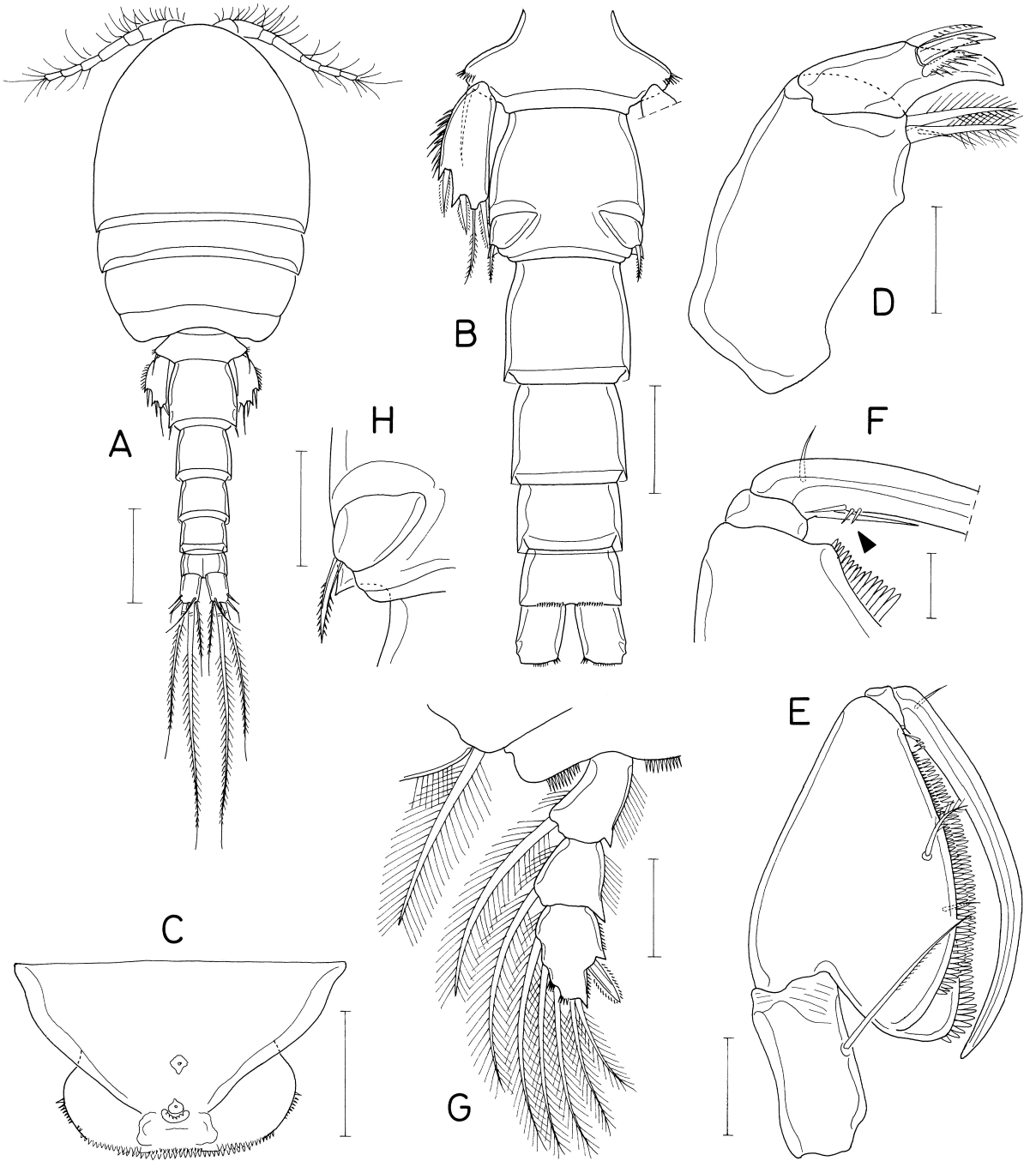

Fig. 12. *Hemicyclops columnaris* Humes, male. A, habitus, dorsal; B, urosome, ventral; C, labrum; D, maxilla; E, maxilliped; F, area of third segment of maxilliped; G, endopod of leg 1; H, genital area, ventral. Scales: A, 0.2 mm; B, 0.1 mm; C-E, G, H, 0.05 mm; F, 0.02 mm.

the female and 0.97-1.20 mm in the male), but also various minor features as indicated by arrowheads in Figs. 10J, K, 11A-C, 12F.

Humes (1984) recorded only the scleractinian coral *Porites lobata* Dana as the host of *H. columnaris* from the Pacific coast of Panama. Stock (1992) collected this species of copepod from three species hermit crabs *Calcinus tibicen* (Herbst), *Paguristes grayi* Benedict, and *Dardanus venosus* (H. Milne-Edwards) in Curacao, West Indies. The major host of the copepod in West Indies seems to be *C. tibicen*,

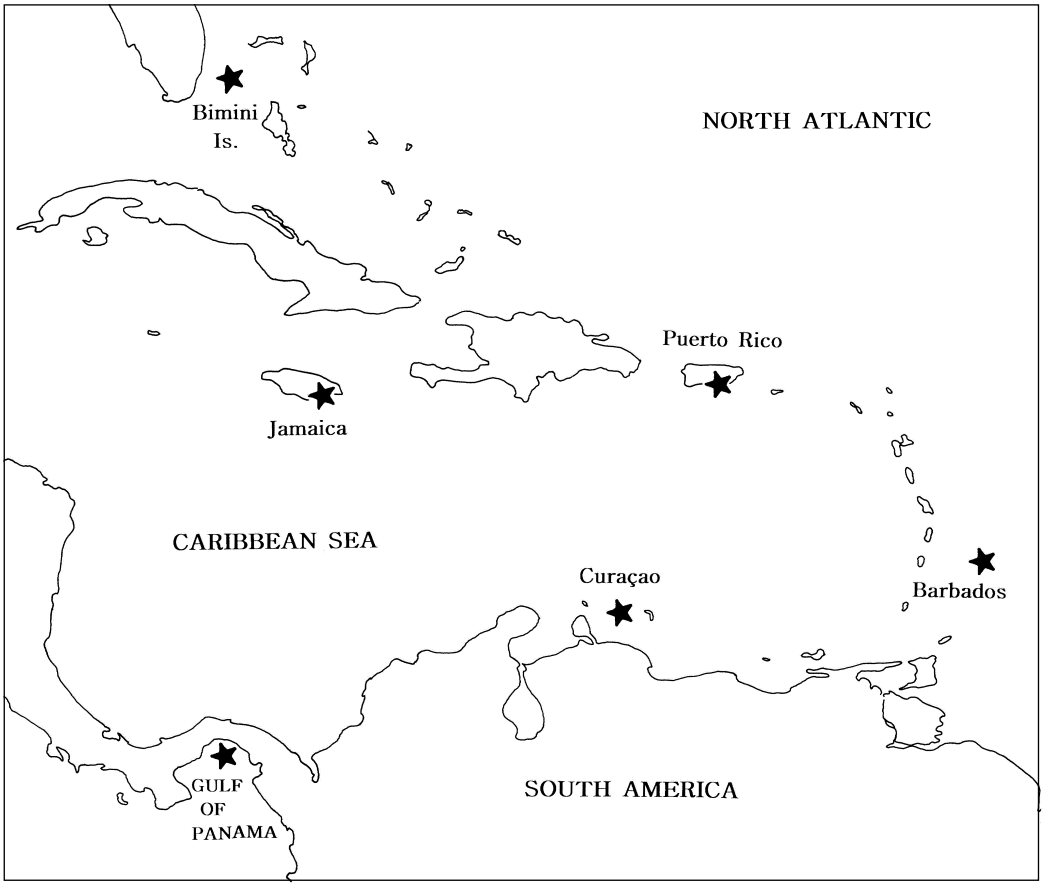

Fig. 13. Amphi-American distribution of *Hemicyclops columnaris* Humes.

because 58 of 82 specimens he examined were collected from that hermit crab.

In the present report, additional species of invertebrates are reported as hosts of *H. columnaris*: the hermit crab *Calcinus obscurus* Stimpson and the scleractinian coral *Pavona giganteus* Verrill from the Pacific coast of Panama; and the hermit crab *Petrochirus diogenes* (L.), an unidentified sponge, the ophiuroid *Ophiocoma riisei* Lutken, and an unidentified species of *Callianassa* from the West Indies.

Although Humes (1984) recorded the scleractinian coral *Porites lobata* as the type host of *H. columnaris*, the hermit crabs are considered to be the major host group of *H. columnaris*. Among the hermit crabs, two species are remarkable in particular, *Calcinus obscurus* distributed on the Pacific coast of Panama and *C. tibicen* distributed in the West Indies. According to Poupin and Bouchard (2006), these two species of hermit crabs are closely allied and differentiated from a common ancestor after the formation of the Panama Isthmus about 3 million years ago. Therefore, the amphi-American distribution (Fig. 13) of *H. columnaris* suggests that the geographic isolation for about 3 million years has not been sufficient to produce a speciation of *H. columnaris*, although the specific differences of hosts have already developed during the same time.

Hemicyclops tripartitus n. sp. (Figs. 14-16)

Material examined. Three ♀♀, 1♂ from invertebrate burrows, Rackham's Cay, Jamaica, 3 September 1959, collected by A. G. Humes and R. U. Gooding. Holotype (♀), allotype (♂; right antennule, maxilla, and Maxilliped dissected out), and paratype (1♀) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C., United States. Dissected paratype (1♀) is kept in the collection of the author.

Female. Body (Fig. 14A) rather narrow. Body length of dissected largest specimen 2.41 mm. Maximum width 866 μm across second pedigerous somite. Prosome 1.19 mm long,

slightly shorter than urosome. Cephalothorax 627 × 864 μm. Second and third pedigerous somite with angular posterolateral corners, but those of fourth pedigerous somites rounded. Urosome (Fig. 14B) 5-segmented. Fifth pedigerous somite 304 μm wide, with tuft of setules on posterolateral corners. Genital double-somite 388 × 258 μm, much longer than wide, ventrally flat, with double lateral expansions in anterior half, meandering sclerotized line on dorsolateral sides in middle. Anterior one of double expansions accompanied posterodorsally with small claw; genital area located laterally in this expansion (indicated by arrowhead in Fig. 14B). Three free abdominal somites 217 × 179, 146 × 163, and 75 × 146 μm, respectively. Anal somite distinctly smaller than preceding abdominal somites, with several spinules on posteroventral margin (Fig. 14C). Caudal ramus 183 × 56 μm (3.27 : 1), weakly tapering, with 7 setae (including outer proximal setule) and on distal 1/3 of inner margin setules (Fig. 14C). Egg sac (Fig. 14D) elongate, 1.01 × 0.26 μm; each egg 87 μm in diameter.

Rostrum not discernible. Antennule (Fig. 14E) 500 μm long and 7-segmented, with armature formula 4, 15, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc. Fourth segment longest among segments. Antenna (Fig. 14F) 4-segmented, with armature formula 1, 1, 4, and 7; third segment with distinctly projected inner distal corner, one of seta on this segment spiniform; terminal segment 36 × 30 μm, slightly longer than wide.

Labrum (Fig. 14G) proximally broadened, with minute spinules and denticles on posterior margin. Mandible (Fig. 14H) distally armed with 4 elements: 1 claw-like element bearing denticles, 1 plate-like setigerous element, and 2 plumose setae. Paragnath (Fig. 14I) bilobed; larger distal lobe distally curved and weakly articulated; both lobes setigerous. Maxillule (Fig. 14J) distally bilobed and armed with 5 and 3 setae on each lobe. Maxilla (Fig. 15A) 2-segmented; basal segment with 2 inner distal setae (one of them accompanied basally by subsidiary setule) and row of minute spinules near middle; distal segment distally armed with 4 elements, 2 of them massive and spiniferous. Maxilliped (Fig. 15B) 4-segmented; first segment with 2 inner setae (one of them distally plumose); second segment also with 2 setae; small third segment unarmed; fourth segment small but armed with 2 spines (smaller one of them proximally with seta; larger one with 6 large spinules), 3 setae, and crown of 6 spinules (Fig. 15C).

Legs 1-4 with 3-segmented rami. Leg 1 with setules on posterior margin of intercoxal plate; inner spine of basis slender, 91 μm, and extending to middle of second endopodal segment. Legs 2-4 with spinules on posterior margin of intercoxal plate. Two inner setae on third endopodal segment of leg 4 proximally plumose and distally spiniferous. Armature formula of legs 1-4 as follows:

Leg 1:	coxa 0-1; basis 1-I;	exp. I-0; I-1; I,I,6; enp. 0-1; 0-1; I,5
Legs 2 & 3:	coxa 0-1; basis 1-0;	exp. I-0; I-1; II,I,6; enp. 0-1; 0-2; I,II,3
Leg 4:	coxa 0-1; basis 1-0;	exp. I-0; I-1; I,I,6; enp. 0-1; 0-2; I,II,II

Leg 5 2-segmented; basal segment not demarcated from somite, with 1 dorsodistal seta; free segment broadened distally, 185 × 90 μm (2.06 : 1), with spinules on most of outer margin and distal half of inner margin, and distally with 3 spines (72, 52, 85 μm long, respectively, from outer to inner) and 1 plumose seta (133 μm long). Leg 6 not seen.

Male. Body (Fig. 16A) hardly distinguishable from that of male. Body length 2.28 mm. Urosome (Fig. 16B) 5-segmented as in female. Genital double-somite 541 × 258 μm, also very similar to that of female in dorsal view, only distinguishable from that of female by having genital flaps in ventral view. Three free abdominal somites 229 × 175, 117 × 158, and 70 × 144 μm, respectively. Caudal ramus 171 × 52 μm (3.17 : 1).

Rostrum as in female. Antennule with 2 additional setae, each on third and fourth segments (at locations indicated by dots in Fig. 14E). Antenna as in female.

Labrum, mandible, paragnath, maxillule as in female. Maxilla (Fig. 16C) differing from that of female by having in second segment 1 claw-like process, 1 spine, 1 spiniform seta, and 1 small spine tipped by setule. Maxilliped (Fig. 16D) consisting of 3 segments and terminal claw; first segment with 1 large, naked seta; second segment proximally expanded and strongly tapering, with 2 isolated inner setae and 3 rows of denticles on inner side; small third segment unarmed; terminal claw strongly curved distally and proximally with 1 spiniform process and 2 unequal setae.

Leg 1 without inner spine on basis (Fig. 16E). Legs 2-4 as in female. Free segment of leg 5 171 × 79 μm (2.16 : 1). Leg 6 represented by 1 small spinule on genital flap (Fig. 16B).

Etymology. The specific name *tripartitus*, a Latin meaning "divided into three parts", alludes to the three-segmented abdomen in the male.

Remarks. The most characteristic feature of *Hemicyclops tripartitus* n. sp. seems to be the five-segmented urosome in the male. In *Hemicyclops* the adult males of all known species have six-segmented urosome consisting of the fifth pedigerous somite, genital somite, and four abdominal somites. Unlike this generality, the male of the new species has a urosome consisting, like that of the female, of the fifth pedigerous somite, genital double-somite, and three free abdominal somites. Due to this unusual tagmosis of the urosome, the male of *H. tripartitus* n. sp. can hardly be distinguished from the female in dorsal view of body.

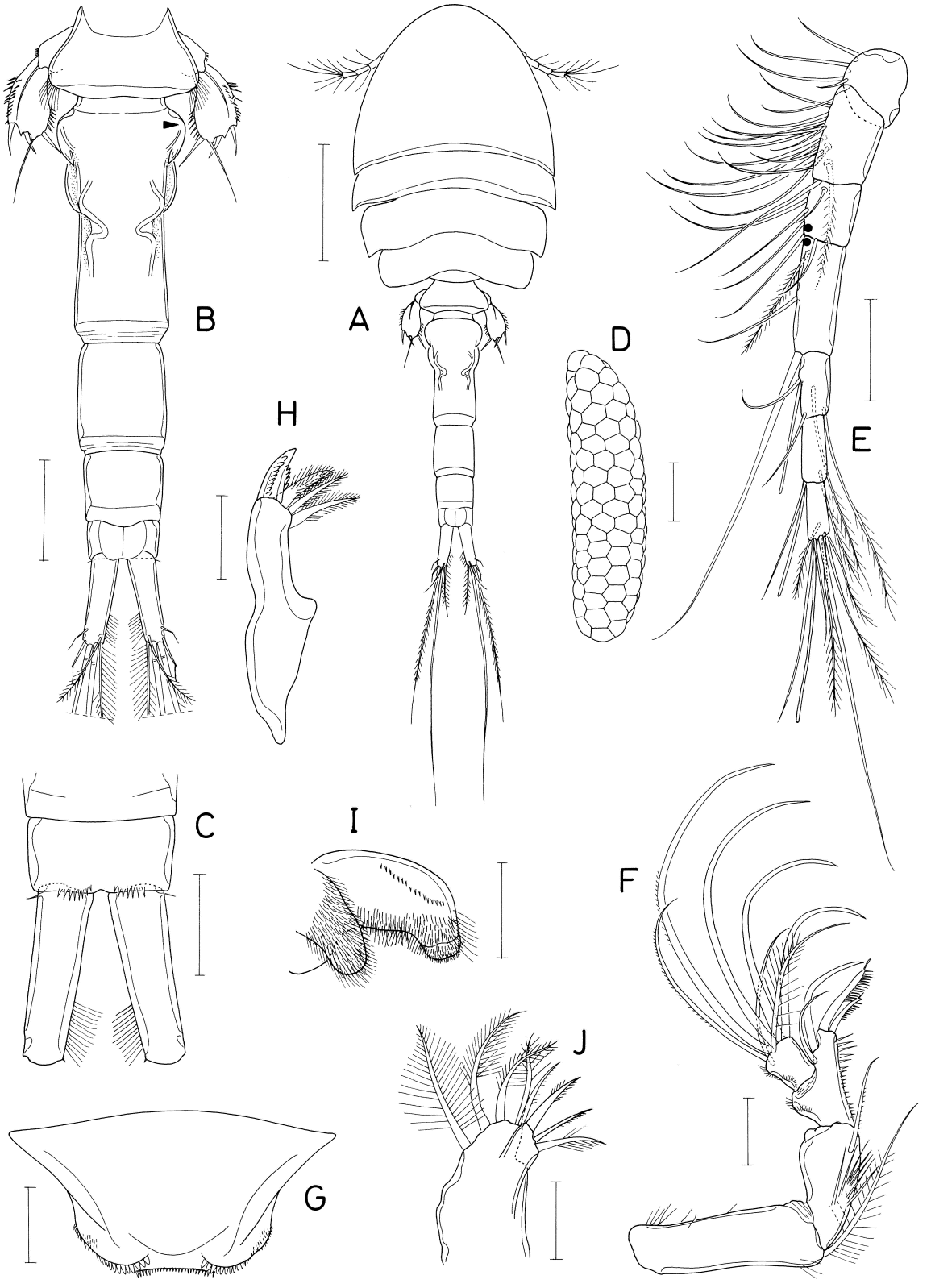

Fig. 14. *Hemicyclops tripartitus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, anal somite and caudal rami, ventral; D, egg sac; E, antennule; F, antenna; G, labrum, dorsal; H, mandible; I, paragnath; J, maxillule. Scales: A, 0.5 mm; B, D, 0.2 mm; C, E, 0.1 mm; F-J, 0.05 mm.

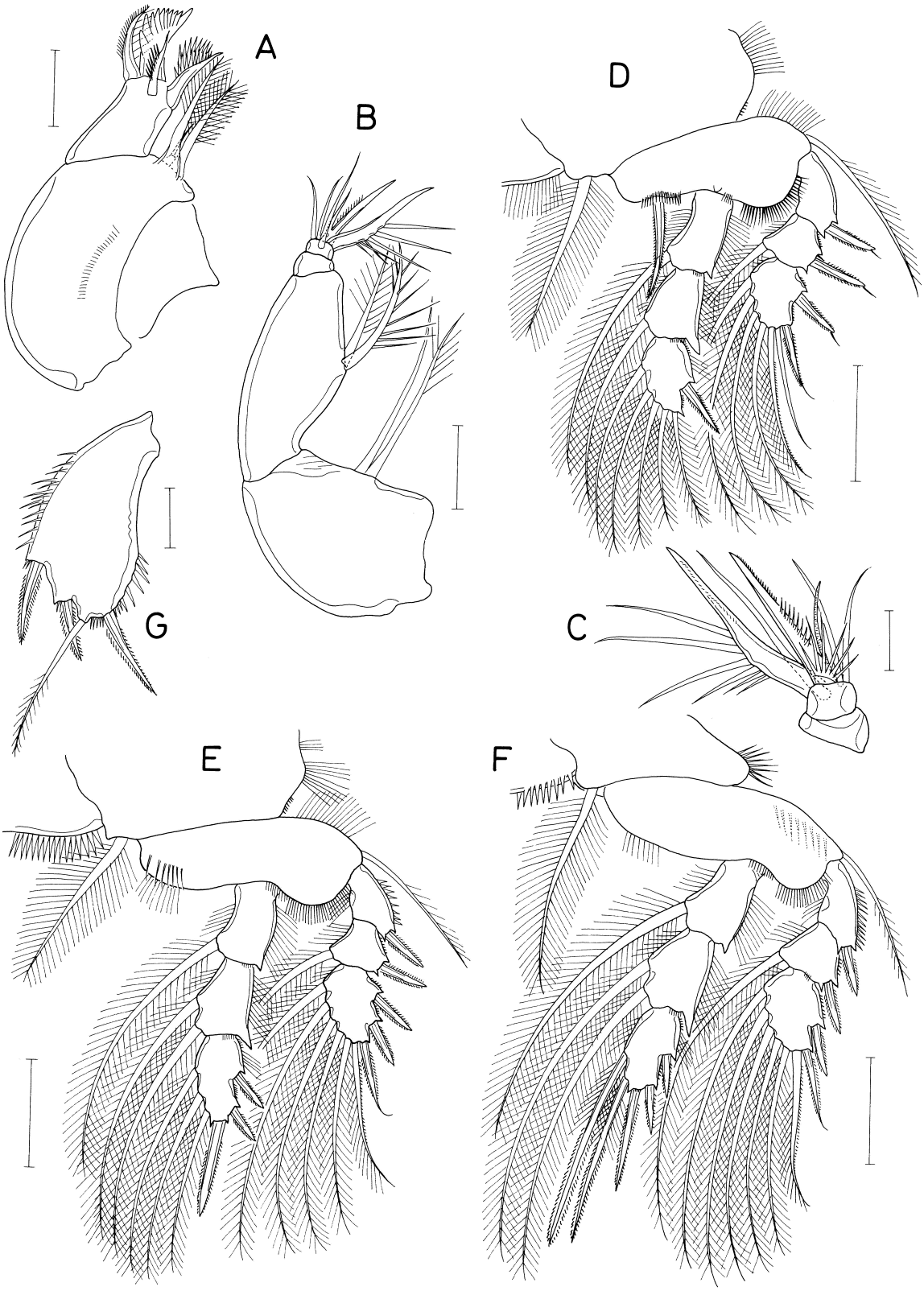

Fig. 15. *Hemicyclops tripartitus* n. sp., female. A, maxilla; B, maxilliped; C, distal part of maxilliped; D, leg 1; E, leg 2; F, leg 4; G, free segment of leg 5. Scales: A, B, G, 0.05 mm; C, 0.02 mm; D-F, 0.1 mm.

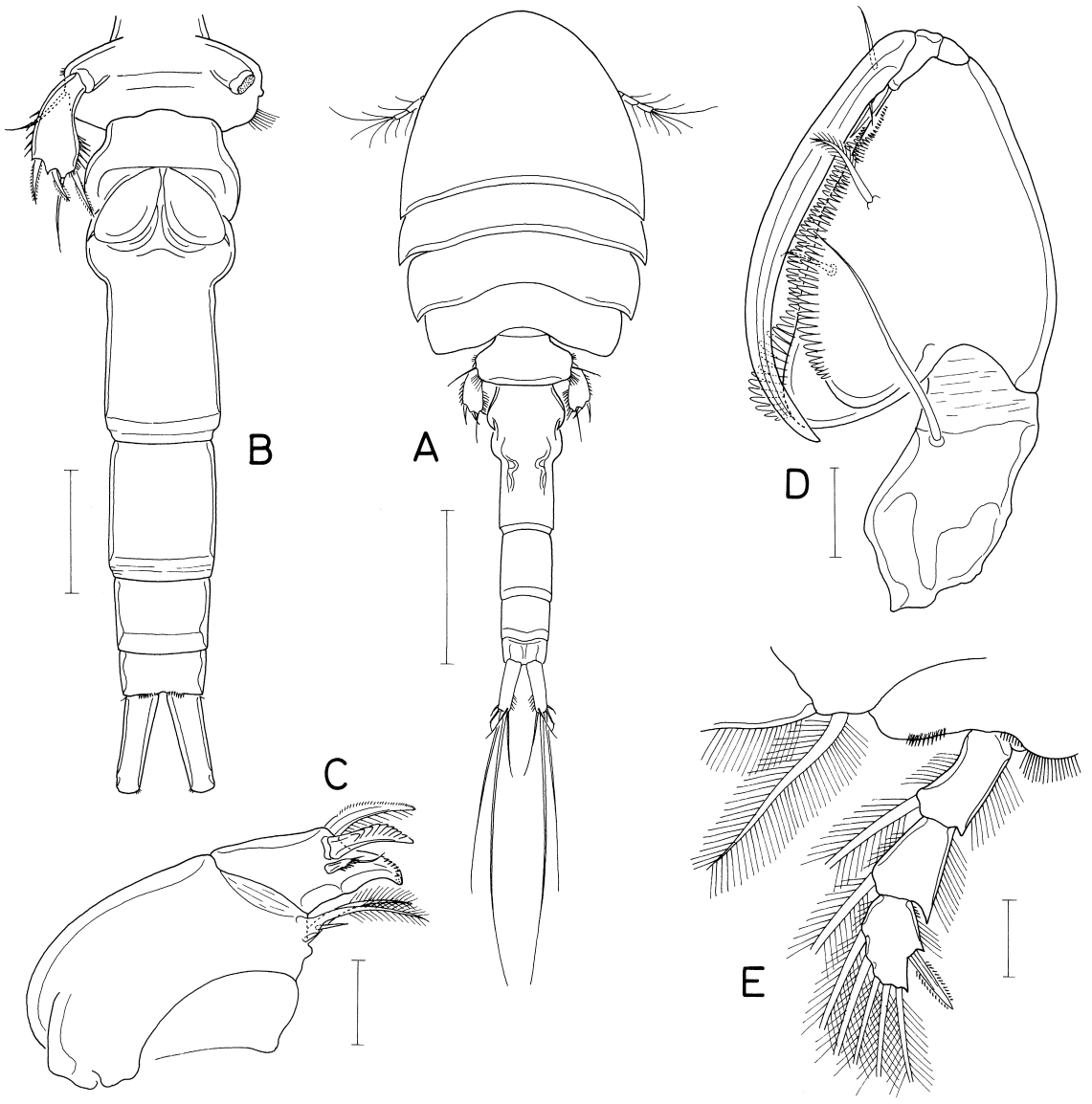

Fig. 16. *Hemicyclops tripartitus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, maxilla; D, maxilliped; E, endopod of leg 1. Scales: A, 0.5 mm; B, 0.2 mm; C-E, 0.05 mm.

Hemicyclops tripartitus n. sp. can be compared with its congeners on the basis of female morphology. The form of the genital double-somite is important in the taxonomy of *Hemicyclops*. In the new species the genital double-somite is 1.89 times as long as wide, with two pairs of weak lateral expansions in anterior half (anterior expansion bearing a claw-like posterodorsal process) and a pair of curved dorsal sclerotizations. This form of the genital double-somite is unique among known species of *Hemicyclops*. Similar double lateral expansions are observable in *H. thalassius* Vervoort and Ramirez, 1966 and *H. axiophilus* Humes, 1965, but in the latter two species the genital double-somite is not so long as that of the new species and lacks either the claw-like process on the anterior expansion or the curved dorsal sclerotizations.

***Hemicyclops humesi* n. sp. (Figs. 17-19)**

Material examined. Three ♀♀, 10♂♂ from burrows of *Callianassa*, Caballo Ahogado Reef, Puerto Rico, 19 August 1959, collected by A. G. Humes and R. U. Gooding. Holotype (♀), allotype (♂), and paratypes (1♀, 8♂♂) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C., United States.

Dissected paratypes (1♀, 1♂) are kept in the collection of the author.

Female. Body (Fig. 17A) similar to that of preceding species. Body length of dissected specimen 2.08 mm, and maximum width 711 μm. Prosome 964 μm long, shorter than urosome. Cephalothorax and 2 next prosomal somites with pointed posterolateral corners. Urosome (Fig. 17B) slender and 5-segmented. Fifth pedigerous somite 260 μm wide, with tuft of setules near posterolateral corners. Genital double-somite 427 μm long, with distinct lateral constriction at midlength delimiting anterior and posterior halves; anterior half 238 μm wide across broadest anterior region, with 2 weak longitudinal sclerotizations on dorsal surface; genital area located near middle of anterior half; posterior half 177 μm wide and unornamented. Three free abdominal somites becoming shorter from anterior to posterior, 208 × 153, 135 × 138, and 77 × 130 μm, respectively. Anal somite with minute spinules on medial part of posteroventral margin (Fig. 17C). Caudal rami divergent, each ramus 146 × 53 μm (2.75 : 1), with 6 naked setae and 1 outer proximal setule; outermost terminal seta stiff, spiniform and tipped by setule; longest inner median terminal seta 714 μm long; next longest outer median terminal seta 471 μm long. Egg sac (Fig. 17D) elongate, 700 × 188 μm.

Rostrum semicircular and wider than long. Antennule (Fig. 17E) 7-segmented and 429 μm long, with armature formula 4, 15, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; plumose setae: 1 on second, 2 on fifth, 1 on sixth, and 4 on terminal segments. Antenna (Fig. 17F) 4-segmented with armature formula 1, 1, 4, and 7; second segment with transverse row of long spinules near base of seta; third segment with strongly projected inner distal corner and spinules on inner margin; terminal segment 33 × 25 μm, longer than wide.

Labrum (Fig. 17G) as general form of genus. Mandible (Fig. 17H) armed distally with 1 claw, 1 spiniferous plate, and 2 plumose setae. Paragnath (Fig. 17I) lobate, bearing many minute spinules and setules. Maxillule (Fig. 17J) distally bilobed and armed with 5 setae on larger lobe and 3 setae on smaller lobe. Maxilla (Fig. 18A) 2-segmented; first segment with 2 setae, one of them proximally bearing 1 small subsidiary setule; second segment distally armed with 1 seta, 1 spiniform seta, and 2 thick spines. Maxilliped (Fig. 18B) 4-segmented; first and second segments each armed with 2 setae; small third segment unarmed; terminal segment (Fig. 18C) terminating by spiniform process bearing 6 spinules on inner margin and armed with 4 simple setae and 1 spine bearing proximal crown of 5 spinules.

Leg 1 (Fig. 18D) with setules on posterior margin of intercoxal plate; inner spine on basis slender and 81 μm long; outer spines on exopod longer than width of segments. Legs 2-4 with spinules on inetercoxal plate (Fig. 18E, F). Two inner spines on third endopodal segment of leg 4 plumose proximally but with minute spinules distally. Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-I; exp. I-0; I-1; I,I,6;
enp. 0-1; 0-1; I,5
Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; II,7;
enp. 0-1; 0-2; I,II,3
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,6;
enp. 0-1; 0-2; I,II,3
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; I,I,6;
enp. 0-1; 0-2; I,II,II

Leg 5 2-segmented; basal segment with 1 dorsodistal seta and tuft of outer distal setules (Fig. 17B); free segment (Fig. 18H) proximally narrowed, about 153 × 67 μm (2.28 : 1), with spinules distally on both inner and outer margins and 3 spines (67, 65, and 85 μm, respectively from outer to inner) and 1 long seta (144 μm) on terminal margin. Leg 6 not seen.

Male. Body (Fig. 19A) similar to that of female. Body length of dissected largest specimen 2.11 mm. Prosome 1.04 mm long. Maximum width 738 μm. Urosome (Fig. 19B) 6-segmented). Fifth pedigerous somite 300 μm wide. Genital somite subcircular, 253 × 285 μm. Four abdominal somites 212 × 200, 184 × 180, 127 × 154, and 77 × 135 μm, respectively. Third abdominal somite with expanded posterodorsal margin. Caudal ramus 150 × 54 μm (2.78 : 1).

Rostrum as in female. Antennule with 2 additional setae, each on third and fourth segments as indicated by dots in Fig. 17A. Antenna as in female.

Labrum, mandible, praragnath, and maxillule also as in female. Maxilla (Fig. 19D) with distal segment bearing 1 stout claw-like process, 1 spine, 1 spiniform setae, and 1 naked seta. Maxilliped (Fig. 19C) consisting of 3 segments and terminal claw; first segment with 1 naked seta; second segment greatly expanded proximally and strongly tapering, with 2 separated inner setae and 3 rows of denticles on inner margin; small third segment unarmed; terminal claw proximally armed with 1 spiniform process and 2 small setae.

Leg 1 without inner spine on basis. Legs 2-4 as in female. Leg 5 with basal segment completely fused to somite, leaving 1 dorsal seta; free segment 136 × 66 μm (2.06 : 1). Leg 6 represented by 1 spiniform seta on genital flap (Fig. 19B).

Etymology. This species is named for the late Dr. Arthur G. Humes who collected the type specimens of the new species.

Remarks. *H. humesi* n. sp. seems most closely allied to the preceding *H. tripartitus* among species of *Hemicyclops* in having the slender body, the elongated genital double- and first free abdominal somites each of which is distinctly longer than wide, the similar forms of antennule, antenna, man-

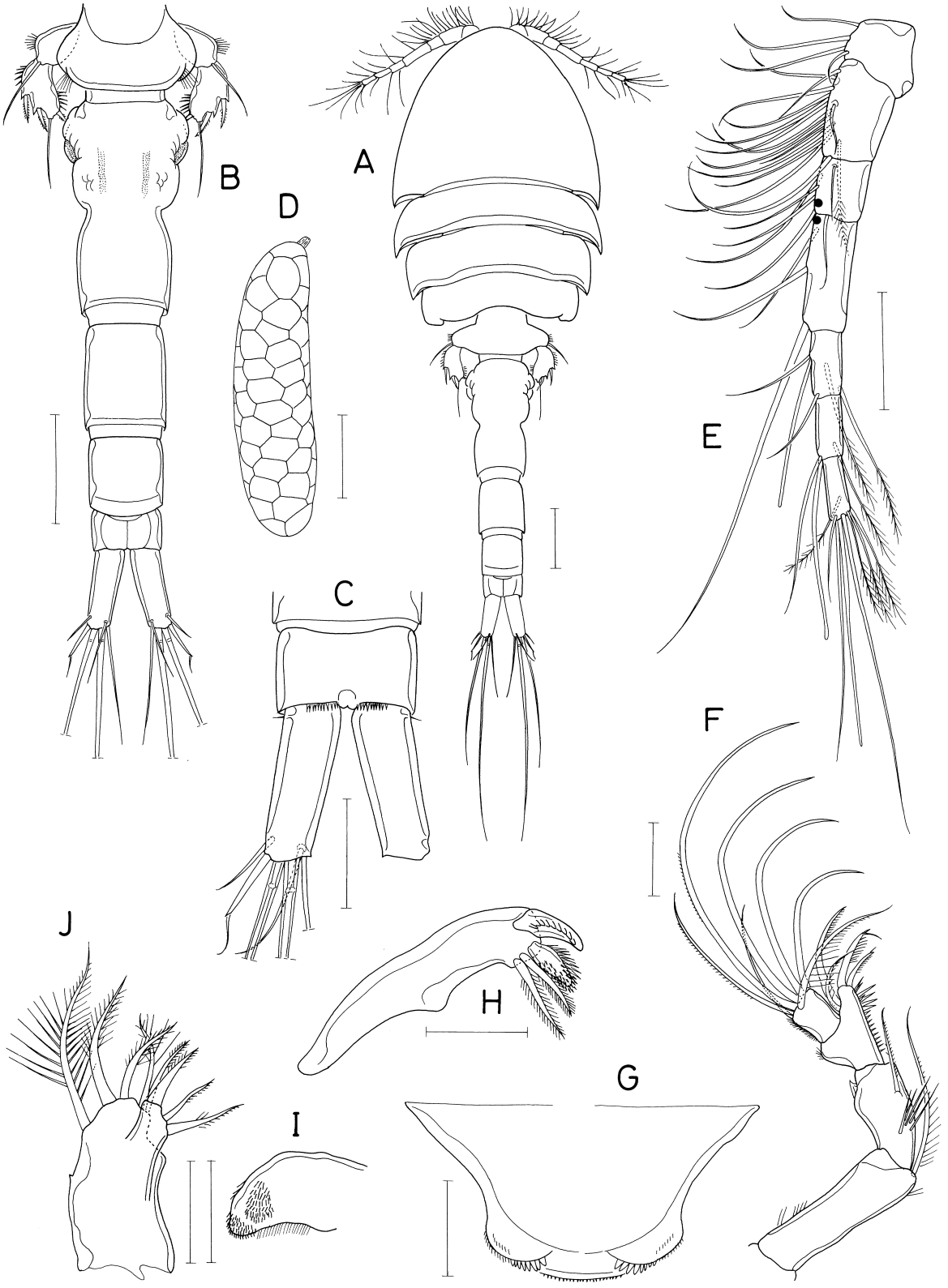

Fig. 17. *Hemicyclops humesi* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, anal somite and caudal rami, ventral; D, egg sac; E, antennule; F, antenna; G, labrum, dorsal; H, mandible; I, paragnath; J, maxillule. Scales: A, B, D, 0.1 mm; C, E, 0.1 mm; F-J, 0.05 mm.

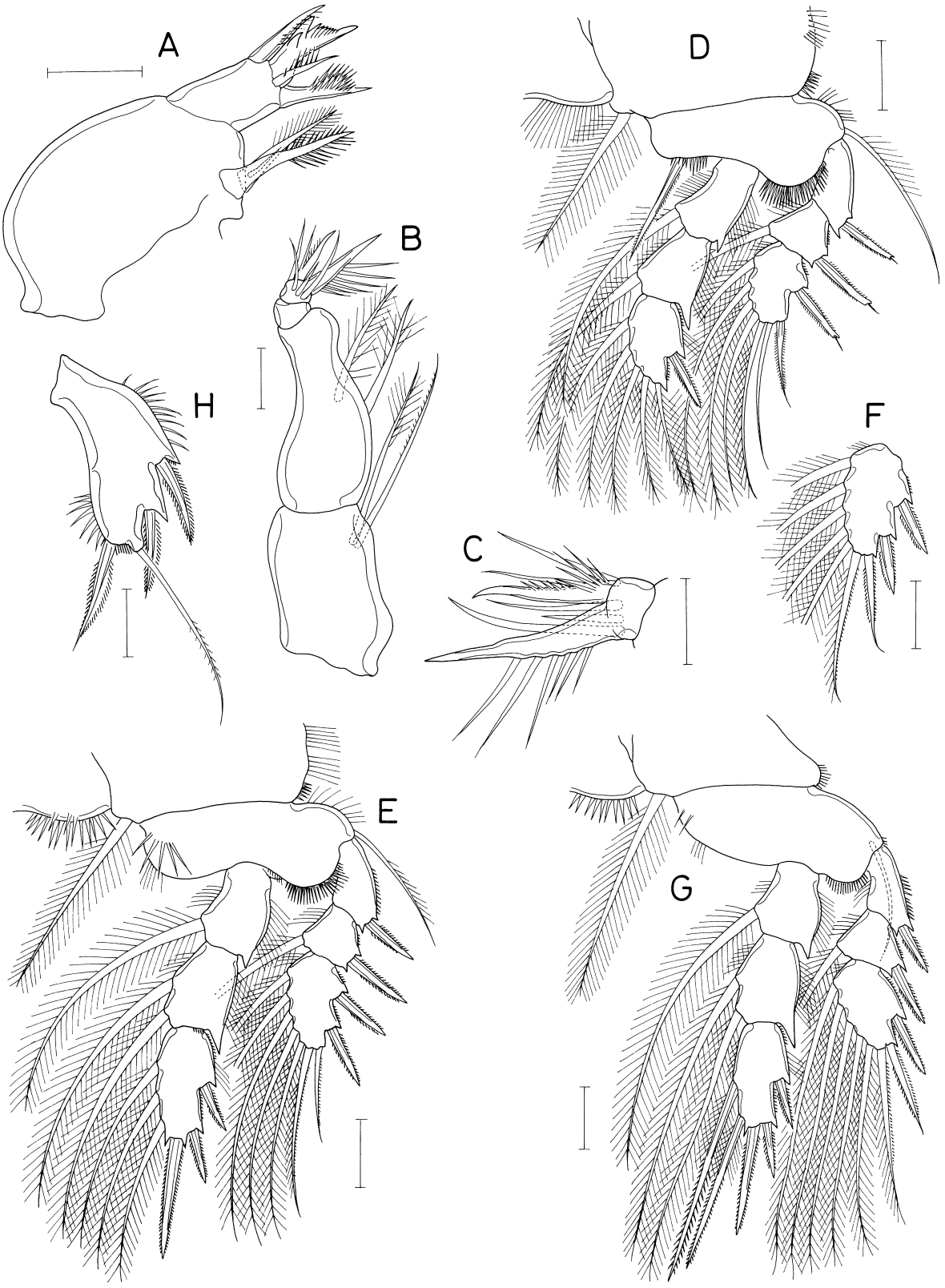

Fig. 18. *Hemicyclops humesi* n. sp., female. A, maxilla; B, maxilliped; C, distal part of maxilliped; D, leg 1; E, leg 2; F, third exopodal segment of leg 3; G, leg 4; H, free segment of leg 5. Scales: A, D-H, 0.05 mm; B, C, 0.02 mm.

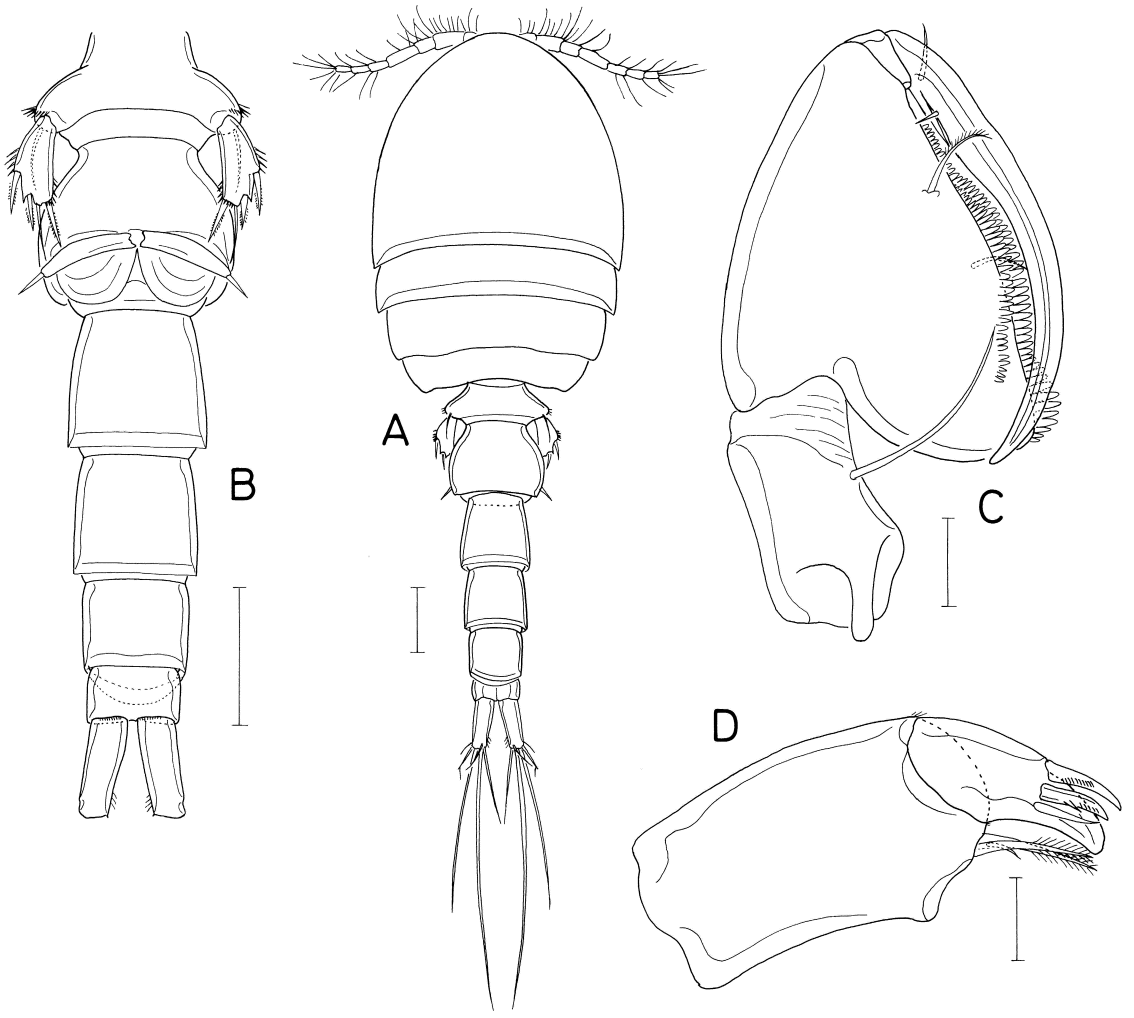

Fig. 19. *Hemicyclops humesi* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, maxilliped; D, maxilla. Scales: A, B, 0.2 mm; C, D, 0.05 mm.

dible, and maxillule, and the similar shape and armature formulae of legs 1, 3, 4, and 5. However, the new species possesses the shorter caudal ramus which is 2.75 times longer than wide in the female (compared to 3.27 times in *H. tripartitus*), the unarticulated paragnath (distally articulated in *H. tripartitus*), the armature formula II,7 of the third exopodal segment of leg 3 (II,I,6 in *H. tripartitus*), and the six-segmented male urosome (five-segmented in *H. tripartitus*). The presence of a lateral constriction on the female genital double-somite may allow easy identification of *H. humesi* without dissection.

Hemicyclops magnus n. sp. (Figs. 20-22)

Material examined. Three ♀♀, 2 ♂♂ from burrows of *Callianassa*, in the low tide sand, Nixon's Harbor, Bimini, Bahamas, 2 June 1959, collected by A. G. Humes and R. U. Gooding. Holotype (♀), allotype (♂), and paratype (1♀) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C., United States. Dissected paratypes (1♀, 1♂) are kept in the collection of the author.

Female. Body (Fig. 20A) large. Body length of dissected largest specimen 3.04 mm. Prosome moderately broad, 1.56 mm long. Maximum width 1.16 mm. Cephalothorax 0.81 × 1.16 mm. Cephalothorax and next 2 prosomal somites with angular posterolateral corners. Urosome (Fig. 20B) 5-segmented. Fifth pedigerous somite 430 μm wide, with small posterolateral bulge bearing dense spinules. Genital double-somite nearly T-shaped, 590 μm long, with anterior expansion bearing nearly straight lateral margins (410 μm wide across this expansion), followed by narrowed region bearing

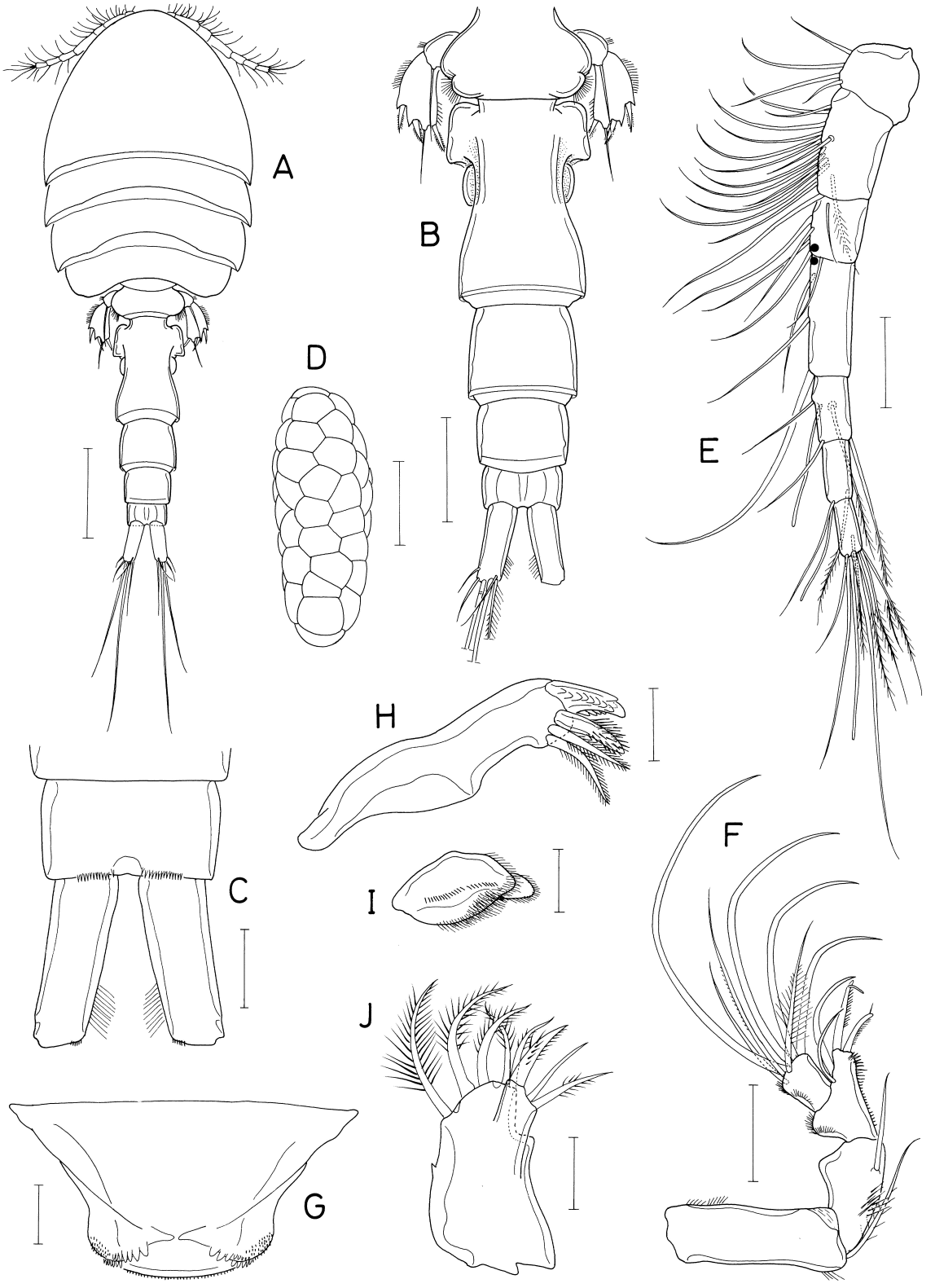

Fig. 20. *Hemicyclops magnus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, anal somite and caudal rami, ventral; D, egg sac; E, antennule; F, antenna; G, labrum, dorsal; H, mandible; I, paragnath; J, maxillule. Scales: A, 0.5 mm; B, D, 0.2 mm; C, E, F, 0.1 mm; G-J, 0.05 mm.

semicircular process and posterior part becoming broadened distally (360 μm wide across this region). Genital area located laterally on anterolateral expansion. Three free abdominal somites 270 × 310, 195 × 265, and 125 × 226 μm, respectively. Anal somite with small spinules on posteroventral margin (Fig. 20C). Caudal rami divergent; each ramus 230 × 85 μm (2.71 : 1), with setules on distal third of inner margin and 6 setae; innermost terminal seta plumose, other 5 setae naked. Egg sac (Fig. 20D) 630 × 240 μm,; each egg 115 μm in diameter.

Rostrum semicircular. Antennule (Fig. 20E) 575 μm long and 7-segmented, with armature formula 4, 15, 6, 3, 4+ aesthetasc, 2+aesthetasc, and 7+aesthetasc; plumose setae: 1 on second, 2 on fifth, 1 on sixth, and 4 on terminal segments. Antenna (Fig. 20F) 4-segmented, with armature formula 1, 1, 4, and 7; inner distal corner of third segment strongly projected; terminal segment 50 × 42 μm, slightly longer than wide.

Labrum (Fig. 20G) as in preceding species. Mandible (Fig. 20H) armed distally with 4 elements. Paragnath (Fig. 20I) setiferous and distally articulated. Maxillule (Fig. 20J) distally bilobed, with 5 setae on larger and 3 setae on smaller lobes. Maxilla (Fig. 21A) 2-segmented; first segment with 2 inner setae, one of them accompanied proximally by 1 setule; second segment distally armed with 2 strong spines, 1 spiniform seta, and 1 smaller seta. Maxilliped (Fig. 21B) 4-segmented; first segment with 2 inner setae; second segment with inner margin projected in middle bearing 2 setae on projection; small third segment unarmed; terminal segment armed with 2 spines (one of them proximally bearing 1 setule and 4 spinules) and 3 simple setae (Fig. 21C).

Leg 1 (Fig. 21D) with setules on posterior margin of intercoxal plate. Legs 2-4 with spinules on same area (Fig. 21E, F). Inner spine on basis of leg 1 slender and 127 μm long. Two inner spines on third endopodal segment of leg 4 plumose proximally but with spinules distally. Armature formula of legs 1-4 as follows:

Leg 1:	coxa 0-1; basis 1-I;	exp. I-0; I-1; I,I,6; enp. 0-1; 0-1; I,5
Legs 2 & 3:	coxa 0-1; basis 1-0;	exp. I-0; I-1; II,I,6; enp. 0-1; 0-2; I,II,3
Leg 4:	coxa 0-1; basis 1-0;	exp. I-0; I-1; I,I,6; enp. 0-1; 0-2; I,II,II

Leg 5 2-segmented; first segment with 1 dorsodistal seta; second segment 252 × 123 μm (2.05 : 1), with spinules near middle of outer margin and distal part of inner margin, and distally 3 spines (97, 85, and 107 μm long, respectively, from outer to inner) and 1 seta (160 μm long). Leg 6 not seen.

Male. Body similar to that of female. Body length of dissected specimen 3.03 mm. Prosome 1.49 × 1.10 mm. Urosome (Fig. 22A) 6-segmented. Fifth pedigerous somite 450 μm wide. Genital somite 377 × 467 μm, proximally narrowed, with angular posterolateral corners. Four abdominal somites 305 × 322, 278 × 283, 166 × 236, and 111 × 211 μm, respectively. Caudal ramus 211 × 81 μm (2.60 : 1).

Rostrum as in female. Antennule with 2 additional setae, each on third and fourth segments (at places of dots in Fig. 20E). Antenna as in female.

Labrum (Fig. 22B) different from that of female by having large, strong posterior tubercle bearing small posterior notch. Mandible, paragnath, and maxillule as in female. Maxilla (Fig. 22C) with distal segment bearing blunt, claw-like process (with granules apically), 2 spines, and 1 seta. Maxilliped (Fig. 22D) consisting of 3 segments and terminal claw; first segment with 1 naked seta; second segment greatly expanded proximally and strongly tapering, with 2 separated inner setae and 3 rows of denticles on inner margin; small third segment unarmed; terminal claw proximally with 1 setiform spine and 2 small setae.

Leg 1 without inner spine on basis (Fig. 22E). Legs 2-4 as in female. Leg 5 with first segment completely fused to somite, leaving 1 dorsal seta; free segment 240 × 115 μm. Leg 6 represented by 1 small spiniform seta on genital flap (Fig. 22A).

Etymology. The specific name *magnus* (a Latin meaning "large") alludes to the large size of body of the new species.

Remarks. The presence of the sexually dimorphic labrum which bears a large posterior tubercle in the male seems the most striking feature of *Hemicyclops magnus* n. sp. Because many species of *Hemicyclops* are not known of their males, it is necessary to compare the new species with others based on the female morphology. The female genital double-somite of the new species bears a strong anterolateral expansion, constricted mid-region, and increasingly broadened posterior region. Only *H. gomsoensis* Ho and Kim, 1992 known from the Far East (Ho and Kim, 1992) has a figure of the genital double-somite approaching that of the new species, although its details are different from the new species. More significant differences are in the armature of the third endopodal segment of leg 4 (formula I,II,II in *H. magnus*, but I,II,2 in *H. gomsoensis*) and male leg 6 (consisting of 1 spiniform seta in *H. magnus*, but 2 spiniform setae in *H. gomsoensis*).

The large body size may be one of distinguishing features of the new species, because no species in *Hemicyclops* has been reported yet to have body length exceeding 3 mm.

Genus *Leptinogaster* Pelseneer, 1929

Remarks. Boxshall and Halsey (2004) excluded *Leptinogaster* from the family Clausidiidae and placed in the "*Teredicola*-group", along with the genera *Foliomolgus* Kim, 2001,

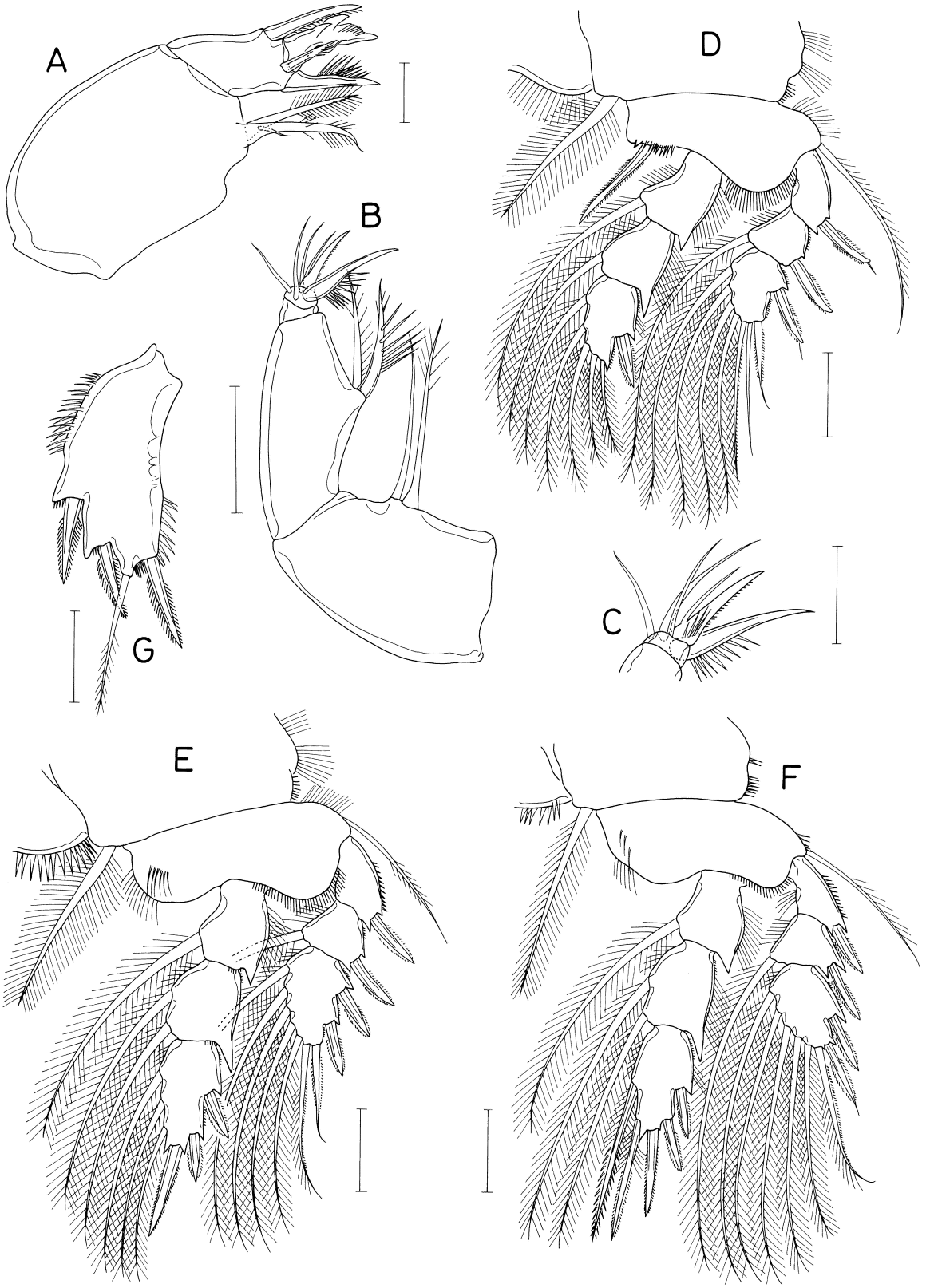

Fig. 21. *Hemicyclops magnus* n. sp., female. A, maxilla; B, maxilliped; C, distal part of maxilliped; D, leg 1; E, leg 2; F, leg 4; G, free segment of leg 5. Scales: A, 0.05 mm; B-G, 0.1 mm.

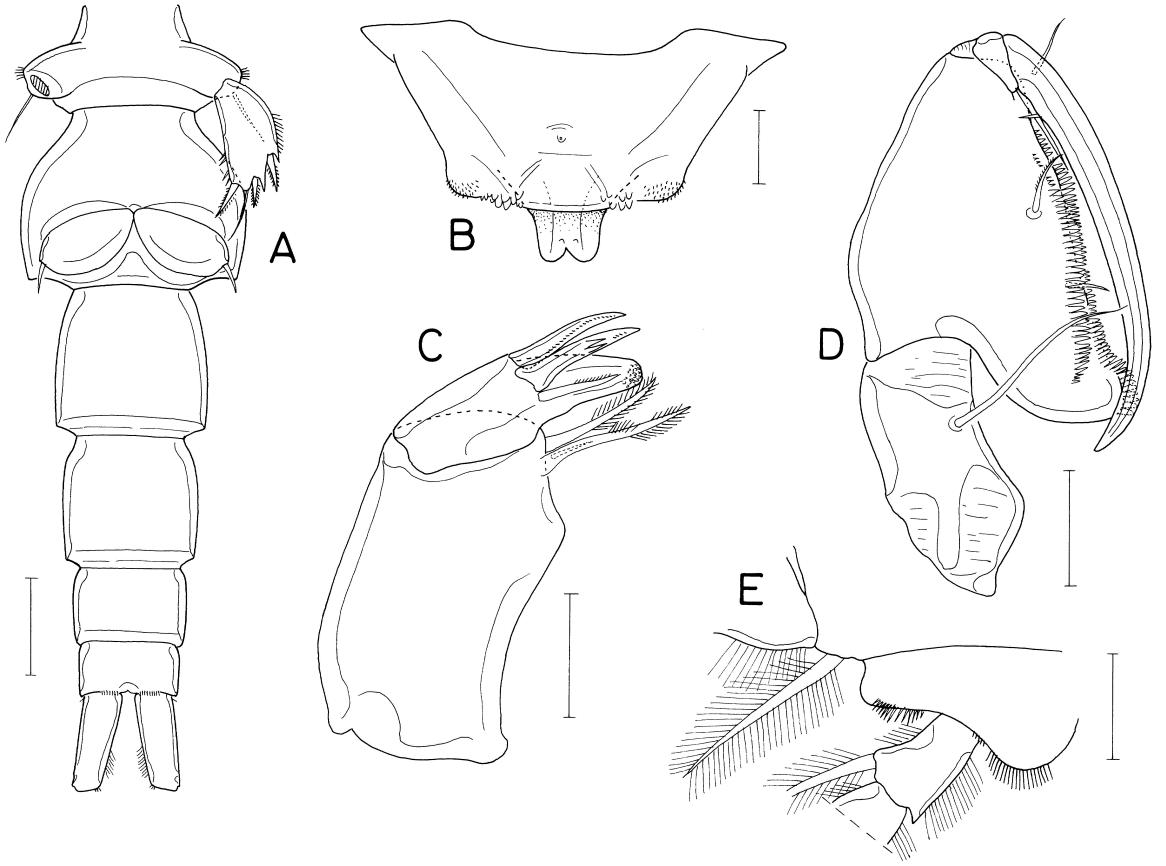

Fig. 22. *Hemicyclops magnus* n. sp., male. A, urosome, ventral; B, labrum, dorsal; C, maxilla; D, maxilliped; E, area near first endopodal segment of leg 1. Scales: A, 0.2 mm; B, 0.05 mm; C-E, 0.1 mm.

Pholadicola Ho and Wardle, 1992, and *Teredicola* C. B. Wilson, 1942. However, this genus is treated tentatively as a member of the Clausidiidae in this paper.

***Leptinogaster minuta* n. sp. (Figs. 23-25)**

Material examined. Eighteen ♀♀ and 1♂ from the bivalve *Protothaca asperrima* (Sowerby), Chiman, Darien, Pacific coast of Panama, 5 November 1981, collected by A. G. Humes. Holotype (♀) and paratypes (15 ♀♀) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (2 ♀♀, 1♂) are retained in the collection of the author.

Female. Body (Fig. 23A) slender, without distinction between prosome and urosome. Body length 1.32 mm (1.25-1.38 mm), based on 10 specimens. Suture lines among prosomal somites obscure but each somite clearly distinguishable by lateral constrictions. Cephalothorax of largest dissected specimen 296 × 271 μm, with anteriorly protruded rostral area. Second to fourth pedigerous somites similar in length and width. Fifth pedigerous somite 212 μm wide. Genital double-somite 200 × 177 μm, widest at anterior 1/3, with rounded lateral margins (Fig. 23B). Genital areas positioned dorsolaterally. Three free abdominal somites 88 × 110, 75 × 98, and 129 × 88 μm, respectively. Anal somite slightly tapering, ventrally with 4 proximal patches of spinules and distal spinules near base of caudal rami (Fig. 23C). Caudal ramus slightly tapering, 77 × 27 μm (2.85 : 1), with 6 naked setae; outer lateral seta located at 44% region of outer margin of caudal ramus; largest terminal seta 275 μm and next longest nearby seta 67 μm. Egg sac not seen.

Rostrum wider than long, with indistinct posterior margin. Antennule (Fig. 23E) 171 μm long and 6-segmented, with armature formula 5, 15, 9, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked; first segment with several spinules on anterior margin. Antenna (Fig. 23F) 4-segmented, with armature formula 1, 1, 2+claw, and 4; second and third segments ornamented with spinules on inner margin; setae on third segment very small, one of them spinule-like; claw on third segment strong and accompanied by small

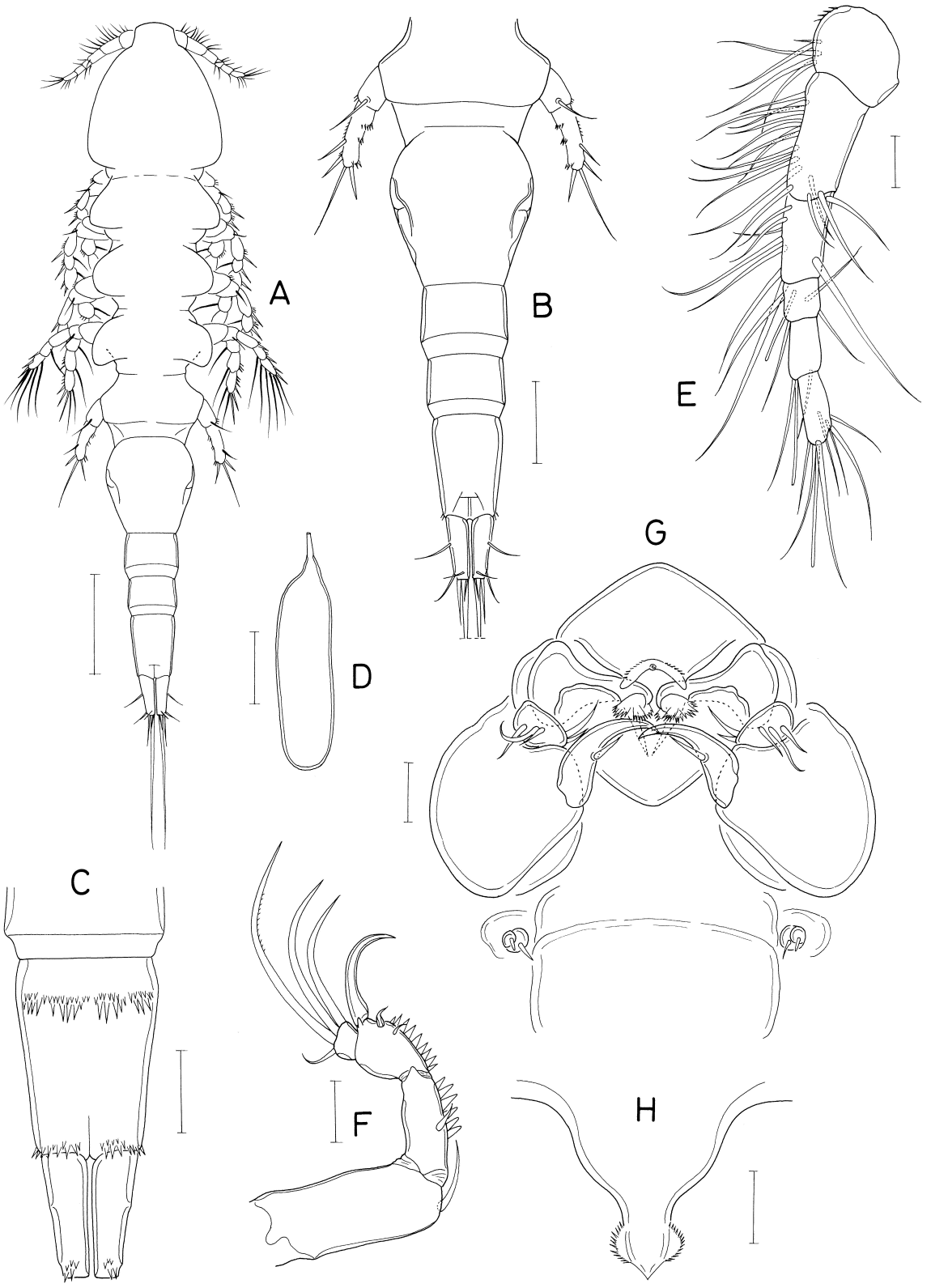

Fig. 23. *Leptinogaster minutus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, distal part of abdomen, ventral; D, spermatophore from female; E, antennule; F, antenna; G, oral area; H, labrum. Scales: A, 0.2 mm; B, 0.1 mm; C, D, 0.05 mm; E-H, 0.02 mm.

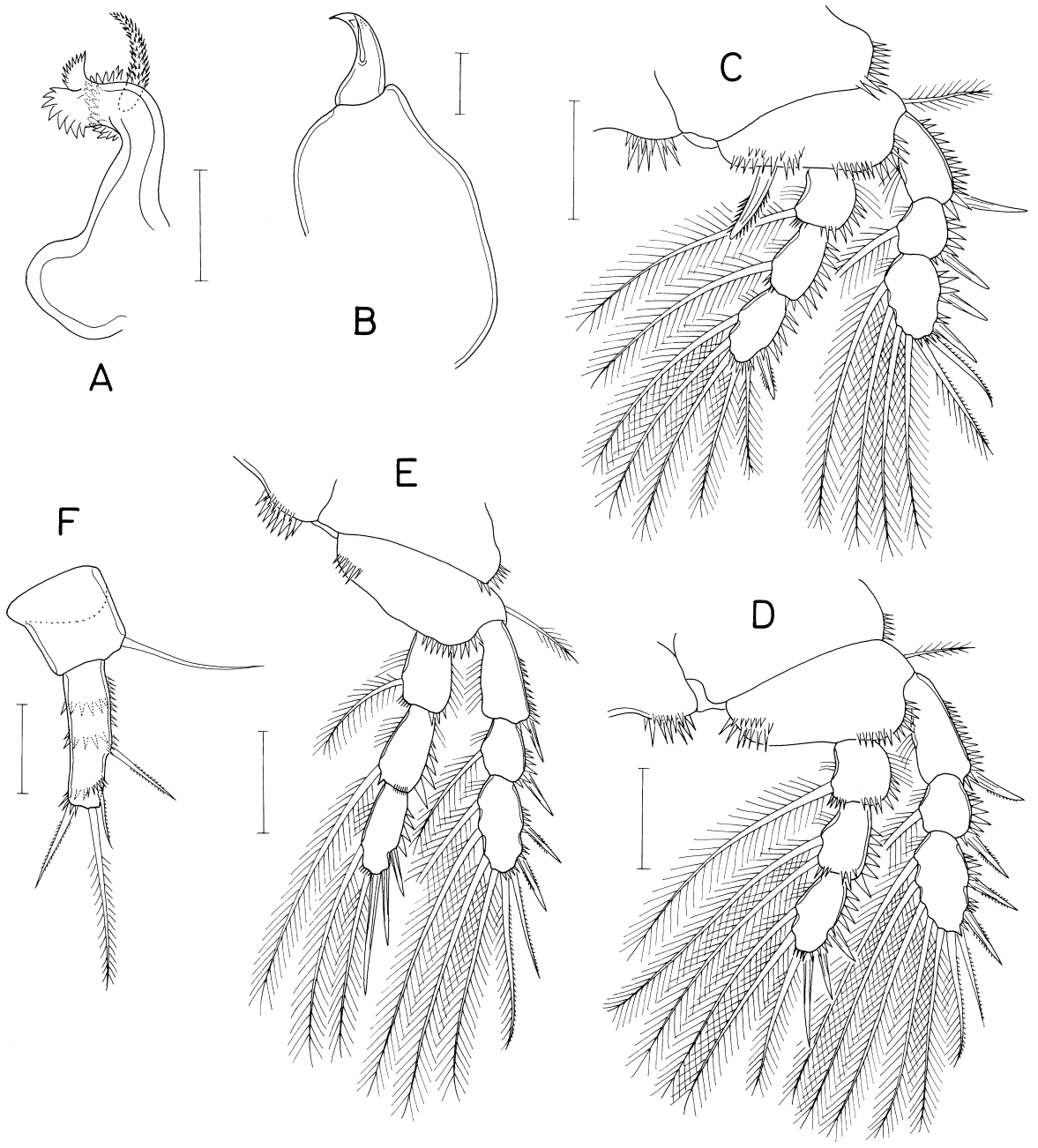

Fig. 24. *Leptinogaster minuta* n. sp., female. A, mandible; B, maxilla; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scales: A, B, 0.02 mm; C-G, 0.05 mm.

papilliform process near base.

Labrum (Fig. 23H) strongly tapering posteriorly, with spinulated posteromedian process. Mandible (Fig. 24A) distally with 1 rod-shaped, barbed element, 1 tuft of spinules, and 2 serrated elements. Maxillule distally with 3 outer and 2 inner setae (Fig. 23G). Maxilla (Fig. 24B) 2-segmented; first segment large but unarmed; second segment claw-like, with 1 seta and distally 1 denticle on both sides. Maxilliped vestigial (Fig. 23G), represented by small, distally bilobed process; each lobe tipped by 1 seta.

Legs 1-4 with 3-segmented rami but without inner seta on coxa (Fig. 24C-E). Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-0; basis 1-I; exp. I-0; I-1; II,2,4;
enp. 0-1; 0-1; I,2,3

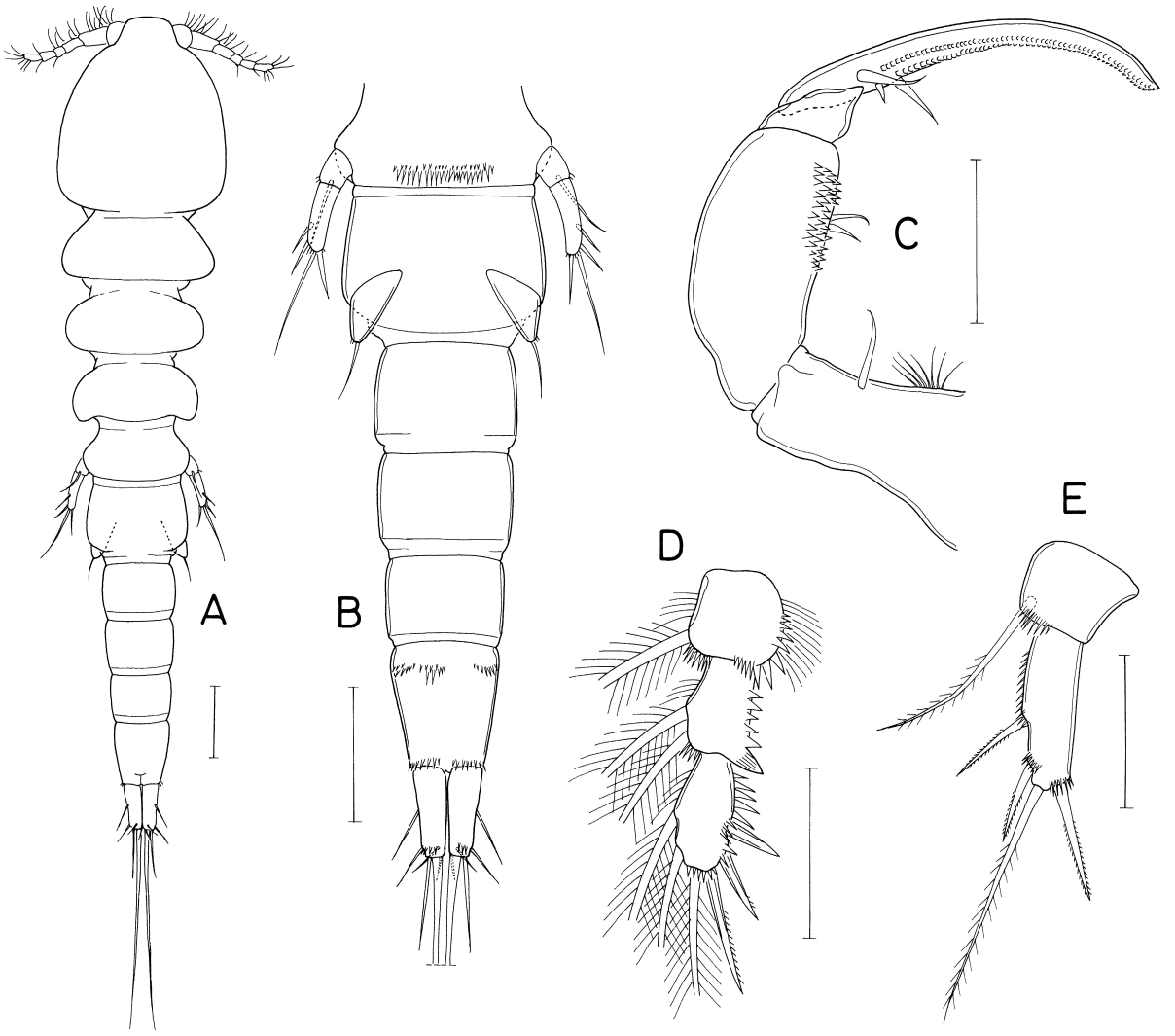

Fig. 25. *Leptinogaster minuta* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, maxilliped; D, endopod of leg 2; E, leg 5. Scales: A, B, 0.1 mm; C-E, 0.05 mm.

Legs 2 & 3: coxa 0-0; basis 1-0; exp. I-0; I-1; II,2,5; enp. 0-1; 0-2; II,I,3
Leg 4: coxa 0-0; basis 1-0; exp. I-0; I-1; II,II,4; enp. 0-1; 0-1; II,I,2

Leg 5 (Fig. 24F) 2-segmented; basal segment unornamented, with 1 naked seta; distal segment 83 × 25 μm (3.32 : 1), with spinules and 4 setae; outer seta 47 μm, located slightly posterior to middle of outer margin; three distal setae 35, 103, and 52 μm, respectively from outer to inner. Leg 6 not seen.

Male. Body (Fig. 25A) similar to that of female. Body length 1.13 mm. Urosome (Fig. 25B) 6-segmented. Fifth pedigerous somite 158 μm wide, with patch of spinules on posteromedian region of ventral surface. Genital somite 112 × 148 μm, nearly quadrangular. Four abdominal somites 77 × 106, 77 × 100, 62 × 87, and 96 × 81 μm, respectively. Anal somite tapering as in female. Caudal ramus 66 × 24 μm (2.75 : 1). Spermatophore taken from female (Fig. 23D) 167 × 40 μm.

Rostrum, antennule, antenna, and mouthparts, except for maxilliped, as in female. Maxilliped (Fig. 25C) consisting of 3 segments and terminal claw; first segment with 1 seta and 1 tuft of several setules on inner margin; second segment with 2 setae and patch of spinules on inner margin, outer margin distinctly convex; small third segment unarmed; terminal claw with rows of granules along concave margin and proximally with 3 setae.

Leg 1 as in female. Outer distal corner of second endopodal segment of leg 2 well-developed (Fig. 25D). Leg 5 with basal segment bearing plumose outer distal seta and several spinules near base of seta; distal segment 55 × 17 μm. Leg 6

represented by 1 naked seta on genital flap (Fig. 25B).

Etymology. The specific name *minuta* is derived from the Latin "minutus", meaning "small", which alludes to the small body size of the new species.

Remarks. Boxshall and Halsey (2004) included *Strongylopleura pruvoti* Monod and Dollfus, 1932 in the genus *Leptinogaster*. However, *S. pruvoti* has, unlike the species of *Leptinogaster*, two strong terminal claws on the antenna which is similar to that of *Philoblenna*, the simple mandible, the second segment of maxilla similar to that of lichomolgoids, only two terminal setae on the free segment of leg 5, and only two-segmented endopod of leg 4 in which the second segment bears two terminal spines (see Monod and Dollfus, 1932, 1934). These features suggest that *S. pruvoti* should be placed in the family Lichomogidae.

The genus *Leptinogaster* is known to have various armature formulae of legs 1-4 depending on species. However, the armature formula of legs seems not reliable in distinguishing species due to its infraspecific variability. In *L. inflata* (Allen, 1956), for example, the armature formula of the third exopodal segment of leg 3 was II,7 in the original description (Allen, 1956), but II,6 in the specimen(s) of Gooding (1963), the armature formula of the third exopodal segment of leg 4 was II,6 in the original description but II,5 in the specimen(s) of Gooding (1963), and the number of setae on the second endopodal segment of leg 4 was 1 in the original description or 2 in the specimen(s) of Gooding (1963), although the specimens were all from the type locality, Bahamas.

One of diagnostic traits of *Leptinogaster minuta* n. sp. is the shortness of caudal ramus which is 2.71 times as long as wide. In most species of *Leptinogaster*, the ratio of the length to width of the caudal ramus distinctly exceeds 3, except in *L. histrio* (Pelseneer, 1929) which has an inflated metasome unlike the new species.

Another diagnostic feature of *L. minuta* is the small size of body. The small body, less than 2 mm long, as in the new species, was recorded for *L. dentata* (Humes and Cressey, 1958) and *L. scobina* (Humes and Cressey, 1958), both known from West Africa. However, these two West African species have the long caudal ramus which is about five times (2.71 times in the new species) as long as wide, two claws (one claw in the new species) on the third segment of antenna, and only six elements (8 in the new species) on the third exopodal segment of leg 4 (Humes and Cressey, 1958).

Family Anchimolgidae Humes and Boxshall, 1996

Genus *Schedomolgus* Humes and Stock, 1972

***Schedomolgus crenulatus* n. sp. (Figs. 26-28)**

Material examined. Eleven ♀♀, 6♂♂ from the scleractinian coral *Acropora cytherea* Dana, low tide, Pointe Lokobe, Nosy Bé, Madagascar, 13 August 1960, collected by A. G. Humes. Holotype (♀), allotype (♂), and paratypes (9♀♀, 4♂♂) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1♀, 1♂) are retained in the collection of the author.

Female. Body (Fig. 26A) with broad prosome and narrow urosome. Body length of dissected specimen 1.23 mm. Maximum width 555 μm across second pedigerous somite (=third prosomal somite). Prosome 705 μm long. Cephalosome and first pedigerous somite demarcated by dorsal furrow. Second pedigerous somite broadened posteriorly, with pointed posterolateral corners. Third pedigerous somite with small, pointed anterolateral process and blunt, denticulated posterolateral corners (Fig. 26I); epimera of this somite extending well over fourth pedigerous somite. Fourth pedigerous somite small, much narrower than anterior somites. Urosome (Fig. 26B) 5-segmented. Fifth pedigerous somite short and 225 μm wide, with minute spinules on lateral tips. Genital double-somite 163 × 180 μm, nearly quadrate, with slightly expanded anterior part and angular posterolateral corners; genital areas located dorsally at anterior 1/5 length of somite. Three free abdominal somites becoming distinctly narrowed from anterior to posterior, 88 × 133, 65 × 78, and 75 × 68 μm, respectively. Caudal ramus (Fig. 26C) 96 × 24 μm (4.0 : 1), distally tapering, with 6 setae; lateral and dorsal setae naked, other setae plumose; longest inner median terminal seta 114 μm, next longest innermost terminal seta 100 μm.

Rostrum broad with obscure posterior margin (Fig. 26D). Antennule (Fig. 26E) slender, 298 μm long, and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 26F) 3-segmented; first segment short but broad, with 1 small inner distal setule; second segment approximately 140 × 39 μm, with 1 minute setule near middle of inner margin and 3 longitudinal rows of pits on surface; third segment approximately 55 × 22 μm, slightly curved evenly and unarmed; terminal claw small and 22 μm long.

Labrum (Fig. 26G) with broad posterior lobes bearing membrane along posterior margin. Mandible (Fig. 26H) with distinct inner proximal notch; inner margin weakly bilobed and spiniferous; convex margin distinctly protruded, with 4 digitiform processes of different sizes; terminal lash slender, with spinules on margins and 3-5 denticles on proximal part. Maxillule (Fig. 27A) with 3 apical setae, one of them distinctly smaller. Maxilla (Fig. 27B) 2-segmented; first segment unarmed; second segment with proximal setule, anterior seta and smooth, leaf-like inner seta; terminal lash thin, forming right angle with segment, with spinules on all convex margin and minute spinules on distal half of concave margin. Maxil-

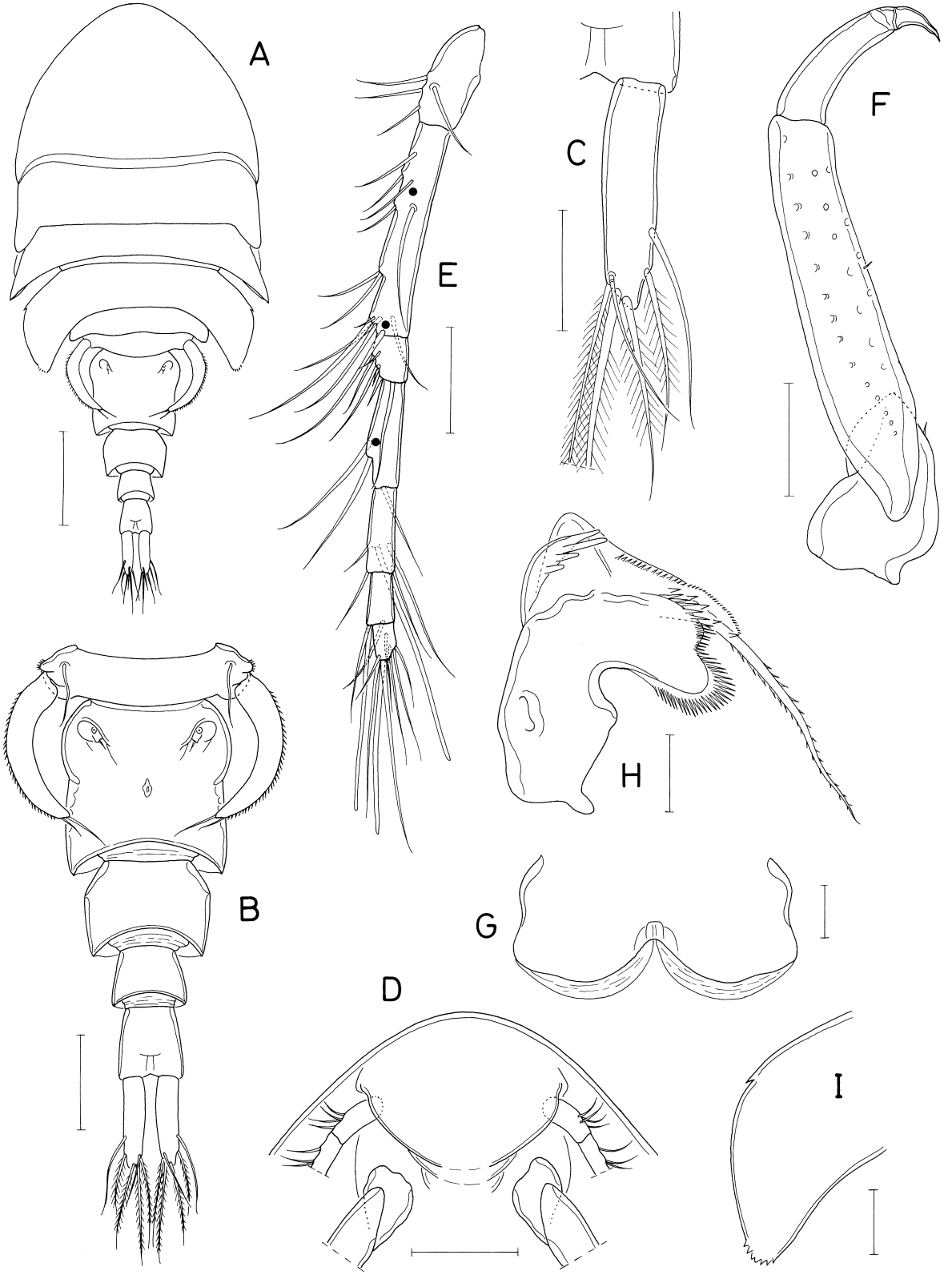

Fig. 26. *Schedomolgus crenulatus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, caudal ramus, dorsal; D, rostral area, ventral; E, antennule (dots indicating places of additional aesthetascs in male); F, antenna; G, labrum; H, mandible; I, epimera of third pedigerous somite. Scales: A, 0.2 mm; B, D, 0.1 mm; C, E, F, I, 0.05 mm; G, H, 0.02 mm.

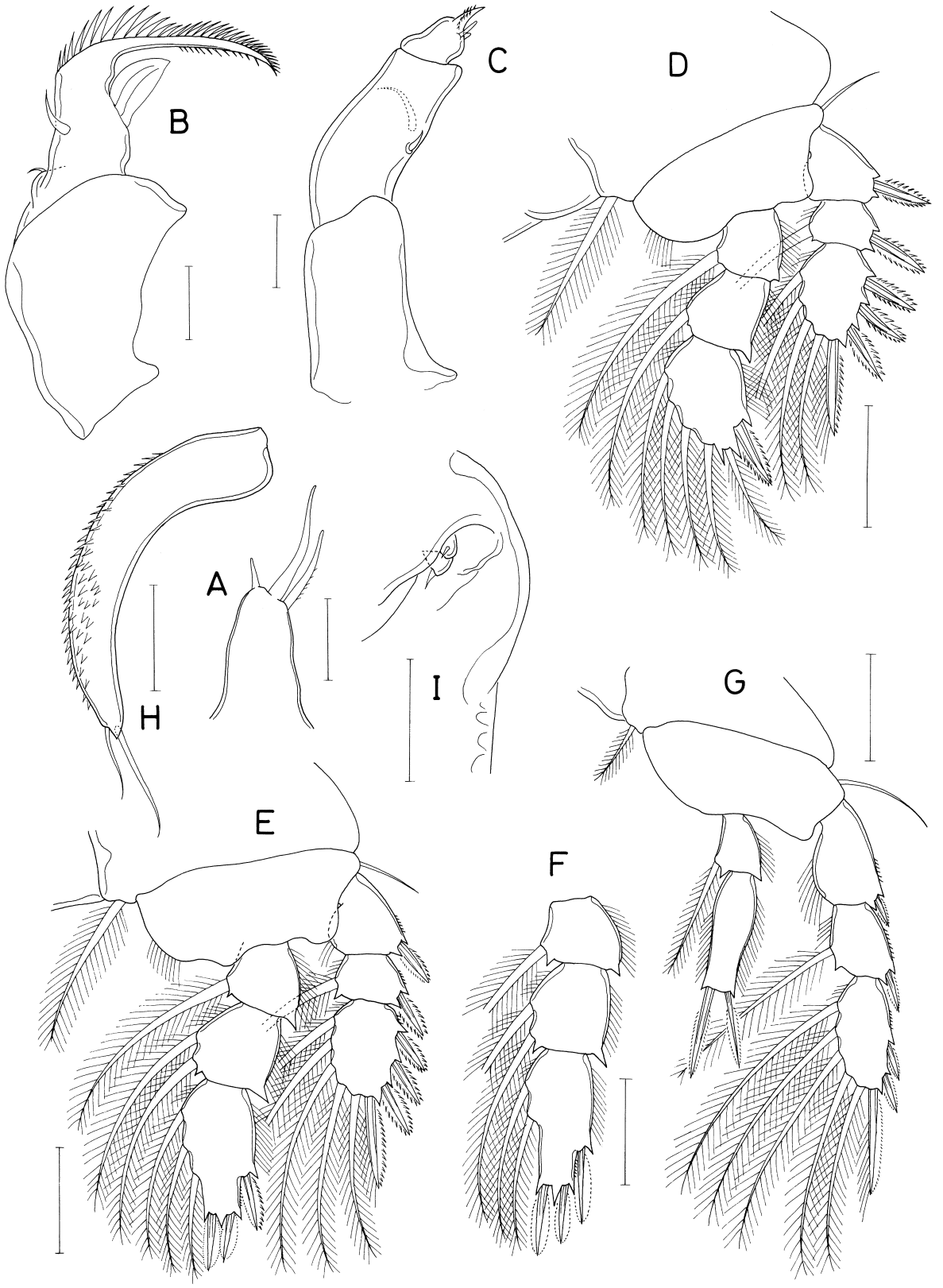

Fig. 27. *Schedomolgus crenulatus* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, endopod of leg 3; G, leg 4; H, free segment of leg 5; I, right genital area, dorsal. Scales: A-C, 0.02 mm; D-I, 0.05 mm.

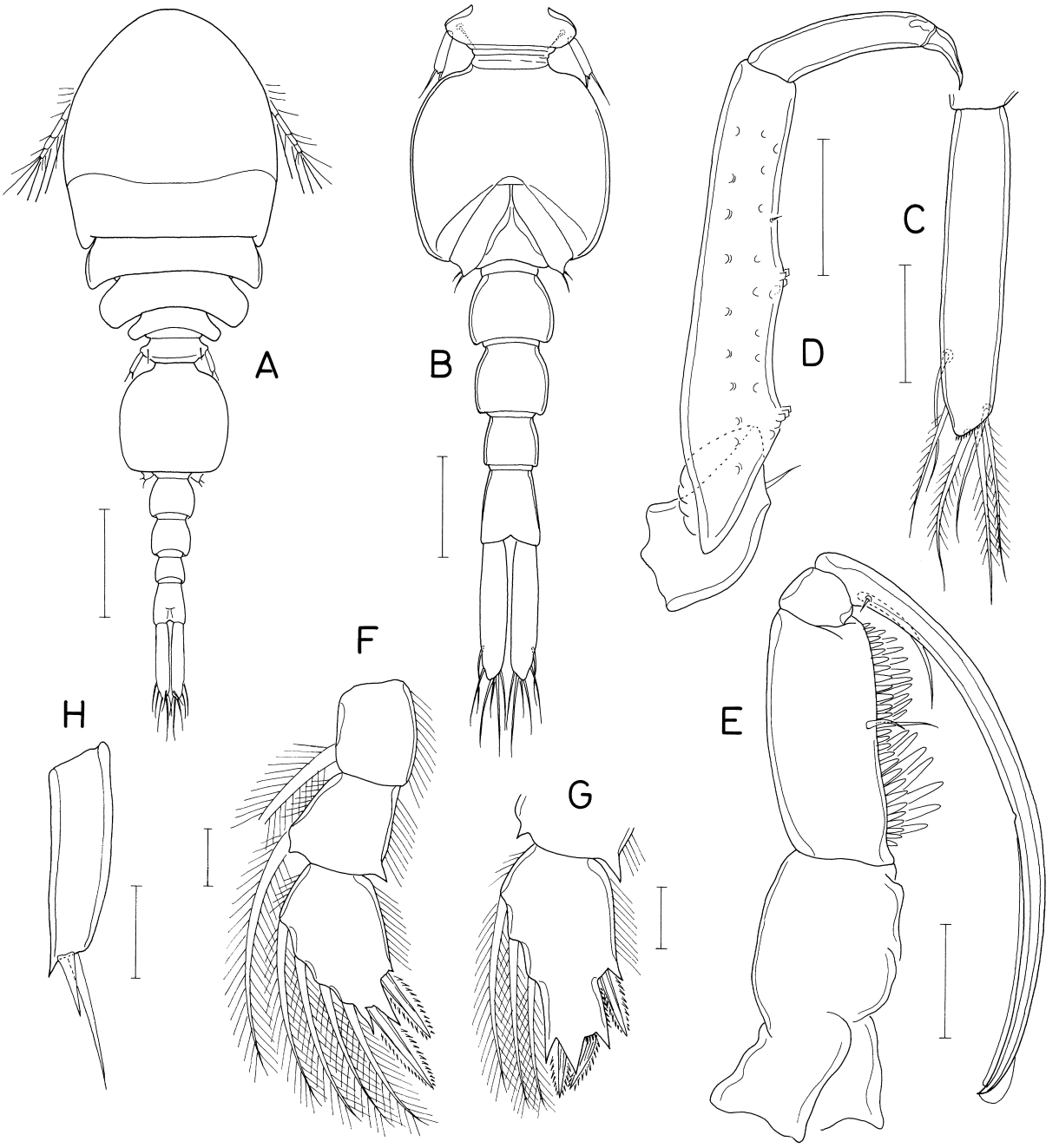

Fig. 28. *Schedomolgus crenulatus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, right caudal ramus, ventral; D, antenna; E, maxilliped; F, endopod of leg 1; G, third endopodal segment of leg 2; H, free segment of leg 5. Scales: A, 0.2 mm; B, 0.1 mm; C-E, 0.05 mm; F-H, 0.02 mm.

liped (Fig. 27C) 3-segmented; first segment unarmed; second segment with 2 unequal inner setae; small terminal segment with 2 small, blunt setae and tipped by spiniform process bearing minute spinules.

Legs 1-3 with 3-segmented rami (Fig. 27D-F). Leg 4 (Fig. 27G) with 3-segmented exopod and 2-segmented endopod. Outer seta on basis of legs 1-4 relatively small and naked. Distal segment of endopod of leg 4 57 × 20 μm, with setules on both inner and outer margins; its 2 terminal spines 43 (inner) and 35 μm (outer). Armature formula of legs 1-4 as

follows:

Leg 1: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,1,4
Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,3
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,2
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. 0-1; II

Leg 5 consisting of dorsal seta on fifth pedigerous somite and free segment; free segment (Fig. 27H) elongate, strongly arched and distally tapering, 185 × 32 μm (5.78 : 1), with denticles on outer surface and 2 naked terminal setae (outer seta 35 μm, and inner seta 57 μm). Leg 6 represented by 2 spinules in genital area (Fig. 27I).

Male. Body (Fig. 28A) narrower than that of female, with posteriorly tapering prosome. Body length of largest dissected specimen 1.29 mm. Maximum width 402 μm. Prosome 616 μm long. Urosome (Fig. 28B) 6-segmented. Fifth pedigerous somite 130 μm wide. Genital somite 200 × 198 μm, with rounded anterolateal and posterolateral corners. Four abdominal somites 70 × 85, 75 × 73, 54 × 55, and 73 × 60 μm, respectively. Caudal ramus (Fig. 28C) 140 × 27 μm (5.19 : 1).

Rostrum as in female. Antennule with 3 additional aesthetascs: 2 on second and 1 on fourth segments, as indicated by dots in Fig. 7E. Antenna (Fig. 28D) with 2 weak protuberances on inner margin, each bearing several quadrate scales.

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 28E) consisting of 3 segments and terminal claw; first segment largest but unarmed; second segment with 2 small setae and 2 rows of spinules on inner margin; small third segment unarmed; terminal claw as long as 3 proximal segments combined, proximally with 1 seta and 1 small setule.

Leg 1 with 2 spines and 4 setae on third endopodal segment (Fig. 28F). Third endopodal segment of leg 2 (Fig. 28G) with same armature as in female, but median terminal process broader and inner terminal spine directed inward. Legs 3 and 4 as in female.

Free segment of leg 5 (Fig. 28H) small, straight, 45 × 13 μm (3.46 : 1), terminally with 1 point, 1 spiniform seta (13 μm) and 1 naked seta (30 μm). Leg 6 represented by 2 small setules on genital flap (Fig. 28B).

Etymology. The specific name *crenulatus* alludes to the crenate posterodistal corner of epimera of the third pedigerous somite (Fig. 26I).

Remarks. The genus *Schedomolgus* comprises nine known species, all associated with scleractinian corals, as follows: *S. arcuatipes* (Humes and Ho, 1968), *S. tener* (Humes, 1973), *S. exiliculus* Humes, 1993, *S. idanus* Humes, 1993, *S. insignellus* Humes, 1993, *S. majusculus* Humes, 1993, *S. dumbensis* Kim, 2003, *S. tenuicaudatus* Kim, 2003, and *S. walteri* Kim, 2003.

Schedomolgus crenulatus n. sp. have the caudal ramus which is 4.0 times as long as wide and therefore differs from *S. arcuatipes*, *S. exiliculus*, and *S. tenuicaudatus* all three bearing the caudal ramus which is more than 5.0 times as long as wide. *Schedomolgus crenulatus* have 3 elements on the maxillule and therefore differs from *S. dumbensis*, *S. tener*, and *S. walteri* all of which have 4 elements on the maxillule. *Schedomolgus crenulatus* differs also from *S. idanus* and *S. insignellus* by having an elongate free segment of female leg 5, which is 5.78 times as long as wide, in contrast to its ratios 4.06 and 3.75 respectively in the latter two species (Humes, 1993). The remaining species *S. majusculus* is known only by the male. The male of *S. crenulatus* is distinguished from the male of *S. majusculus* by having the longer second antennary segment which is distinctly more than twice as long as the third segment (at most 1.5 times as long in *S. majusculus* when measured on the basis of the illustration given by Humes, 1993) and shorter free segment of leg 5 (45 μm long, versus 81 μm long in *S. majusculus*) bearing two unequal terminal setae (subequal in *S. majusculus*).

Schedomolgus parvipediger n. sp. (Figs. 29-31)

Material examined. Twenty-two ♀♀, 4♂♂ from a scleractinian coral (*Goniopora* sp.), in the depth of 2 m, Ampombilava, Nosy Bé, Madagascar, 5 June 1967, collected by A. G. Humes. Holotype (♀), allotype (♂), and paratypes (20♀♀, 2♂♂) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1♀, 1♂) are kept in the collection of the author.

Female. Body (Fig. 29A) 1.97 mm long in moderately large specimen. Maximum width 750 μm. Prosome ovoid, dorsoventrally deep, 1.12 mm long. Dorsal furrow indistinct between cephalosome and first pedigerous somite. Urosome (Fig. 29B) 5-segmented. Fifth pedigerous somite 268 μm wide and tapering laterally, Genital double-somite expanded anteriorly and strongly tapering posteriorly, 276 × 306 μm, widest across anterior 1/3 region, with rounded lateral margins. Genital areas located dorsally at midlength. Three free abdominal somites 85 × 135, 59 × 122, and 109 × 118 μm, respectively. Caudal ramus (Fig. 29C) 239 × 54 μm (4.43 : 1), slightly tapering, with 6 naked setae; largest inner median terminal seta 173 μm; next longest outer median terminal seta 127 μm; other 4 setae very small. Egg sac (Fig. 29D) 533 × 258 μm, each egg large, about 146 μm in diameter.

Rostrum broad and posteriorly forming broad ridge (Fig. 29E). Antennule (Fig. 29F) slender, 414 μm long, and 7-seg-

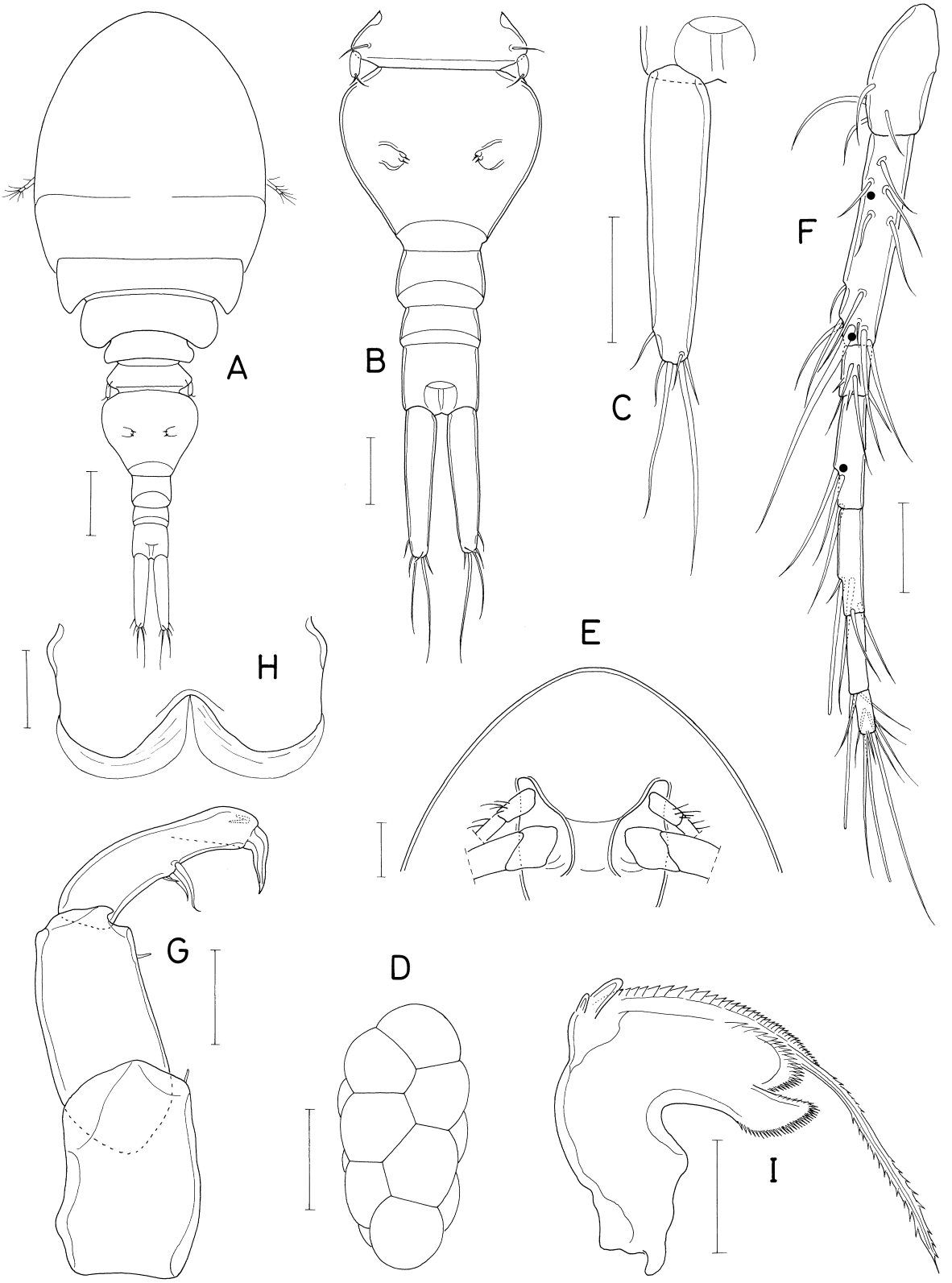

Fig. 29. *Schedomolgus parvipediger* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, dorsal; D, egg sac; E, rostral area, ventral; F, antennule (dots indicating places of additional aesthetascs in male); G, antenna; H, labrum; I, mandible. Scales: A, D, 0.2 mm; B, C, E, 0.1 mm; F-I, 0.05 mm.

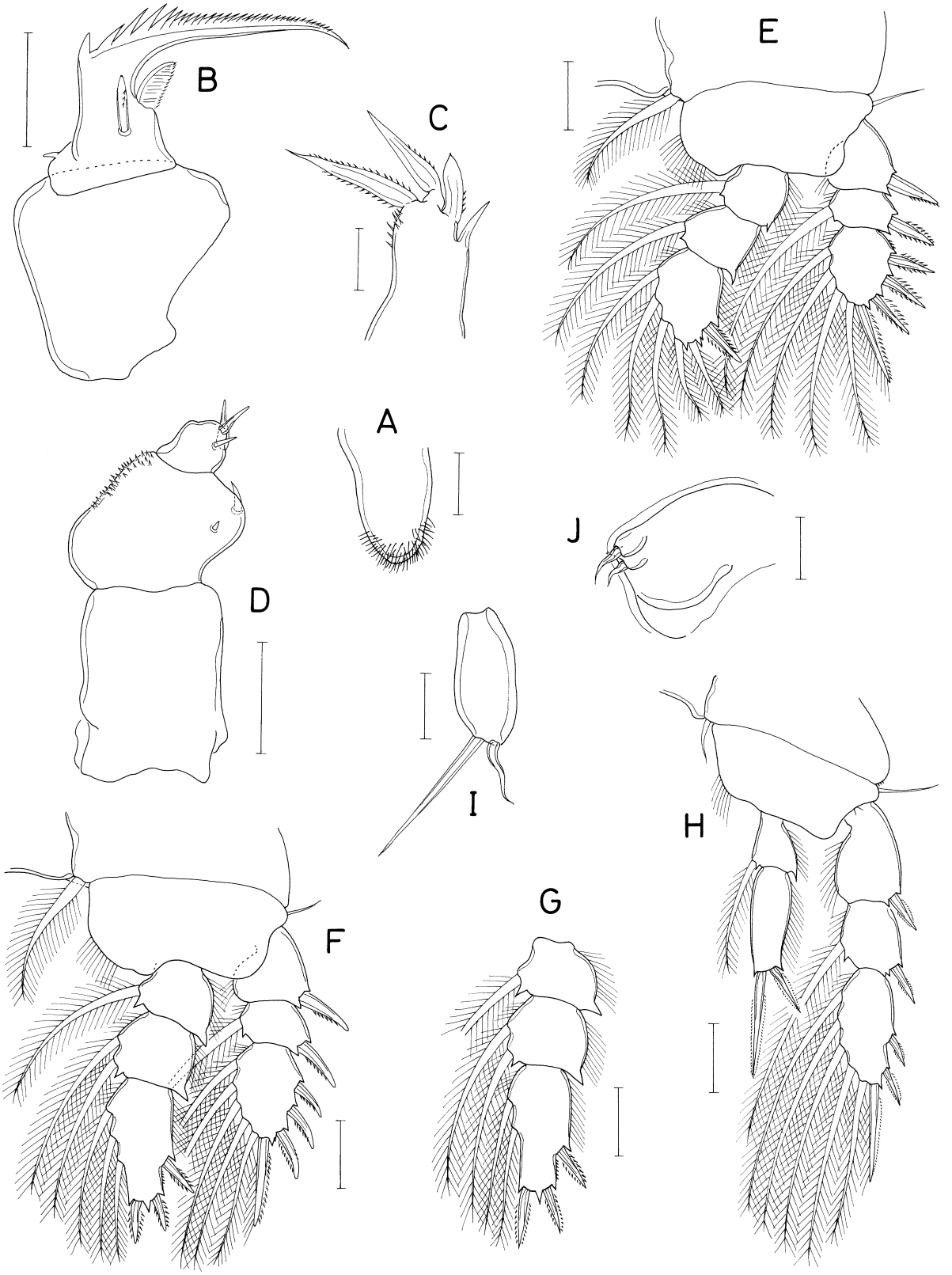

Fig. 30. *Schedomolgus parvipediger* n. sp., female. A, paragnath; B, maxilla; C, maxillule; D, maxilliped; E, leg 1; F, leg 2; G, endopod of leg 3; H, leg 4; I, free segment of 5; J, right genital area. Scales: A, C, I, J, 0.02 mm; B, D-H, 0.05 mm.

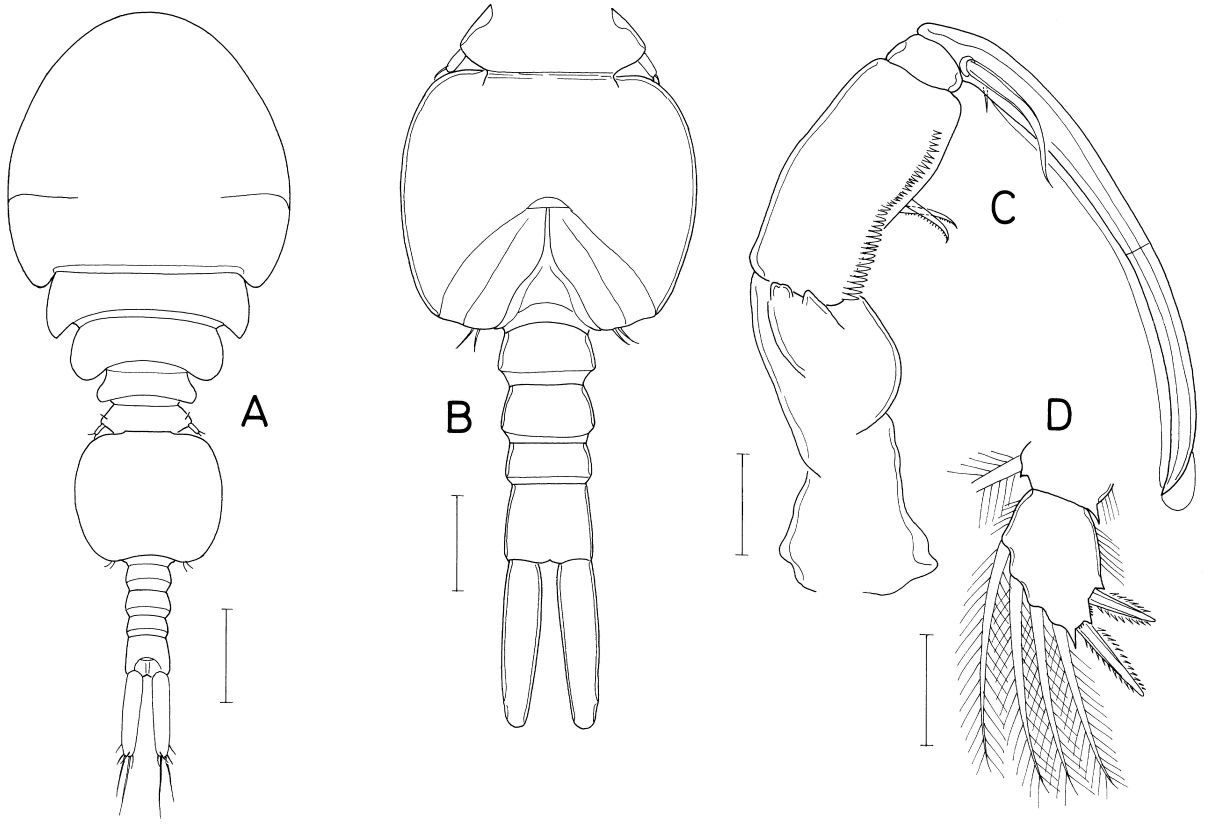

Fig. 31. *Schedomolgus parvipediger* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, maxilliped; D, third endopodal segment of leg 1. Scales: A, 0.2 mm; B, 0.1 mm; C, D, 0.05 mm.

mented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 29G) 3-segmented; segments distinctly narrowed from proximal to distal; first segment 100 × 76 μm, with small and blunt inner distal seta; second segment about 94 × 61 μm, with small inner subdistal seta; terminal segment 100 (measured along middle axis) × 32 μm, with 3 unequal setae in middle of inner margin and 2 small outer distal setae directed proximally; terminal claw small, twisted, and 33 μm long.

Labrum (Fig. 29H) with broad posterior lobes, each bearing broad membrane on posterior margin. Mandible (Fig. 29I) with distinctly bilobed inner margin bearing spinules; proximal lobe well extending over distal lobe; convex margin with 2 unequal digitiform processes followed by denticles; terminal lash elongate and denticulated. Paragnath (Fig. 30A) lobate bearing numerous setules apically. Maxillule (Fig. 30C) with 3 foliaceous setae and 1 subdistal spiniform element. Maxilla (Fig. 30B) 2-segmented; first segment unarmed; second segment with spiniform proximal process, blunt anterior seta bearing 3 minute denticles, and leaf-like inner seta; terminal lash long, with 1 blunt proximal process followed by denticles on convex margin. Maxilliped (Fig. 30D) 3-segmented; first segment unarmed; second segment dilated, wider than long, with 2 unequal, spiniform setae on inner side and many denticles in distal half of outer side; terminal segment with 3 setae, 2 of them spiniform.

Legs 1-3 with 3-segmented rami (Fig. 30E-G). Leg 4 (Fig. 30H) with 3-segmented exopod, 2-segmented endopod, and small, naked inner seta on coxa; distal segment of endopod 77 × 29 μm, with setules on outer margin, its 2 terminal spines unequal in size, 77 (inner) and 38 μm (outer). Armature formula of legs 1-4 as in preceding species.

Leg 5 consisting of 1 small, naked dorsolateral seta on fifth pedigerous somite and free segment; free segment (Fig. 30I) small, nearly ovoid, 41 × 18 μm (2.28 : 1), terminally with 1 straight spiniform seta (46 μm) and 1 smaller, twisted seta (21 μm). Leg 6 represented by 2 small setae in genital area (Fig. 30J).

Male. Body (Fig. 31A) similar to that of female. Body length 1.60 mm, and maximum width 611 μm. Prosome 850 μm long. Cephalothorax nearly globular. Urosome (Fig. 31B) 6-segmented. Fifth pedigerous somite 194 μm wide. Genital somite nearly globular, 264 × 306 μm. Four abdominal somites 67 × 102, 61 × 97, 42 × 89, and 83 × 94 μm, respectively.

Caudal ramus 178 × 39 μm (4.56 : 1).

Rostrum as in female. Antennule with 3 additional aesthetascs: 2 on second and 1 on fourth segments. Antenna additionally with 1 row of scales on inner margin of second segment.

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 31C) consisting of 3 segments and terminal claw; first segment distally with 2 weak tubercles; second segment with 2 similar setae in middle of inner margin and 1 longitudinal row of spinules on inner side; small third segment unarmed; terminal claw large, proximally with 1 seta and 1 setule.

Third endopodal segment of leg 1 with 2 spines and 4 setae. Legs 2-4 as in female. Leg 5 very small. Leg 6 represented by 2 small setae on genital flap (Fig. 31B).

Etymology. The specific name *parvipediger* is a combination of the Latin words, *parvus* (small)+*pedis* (the foot)+*gero* (to carry). It alludes to the very small free segment of leg 5 in the new species.

Remarks. *Schedomolgus parvipediger* n. sp. typically has a tiny free segment of leg 5, which is 2.28 times as long as wide in the female. With this feature, the new species can be distinguished from all congeners, because the recorded least ratio of the length to width of the free segment of female leg 5 in the genus is 3.75 known for *S. insignellus* Humes, 1993.

The maxillule of the new species bears four elements and this feature is shared by *S. dumbensis* Kim, 2003, *S. tener* (Humes, 1973), and *S. walteri* Kim, 2003. However, the new species is distinguishable from these three congeners by having the elongate caudal ramus (ratio 4.43 : 1, compared to 3.51 or less in three congeners) and broad genital double-somite which is wider than long (longer than wide in three congeners).

Family Kelleridae Humes and Boxshall, 1996

Genus *Kelleria* Gurney, 1927

***Kelleria multiovigera* n. sp. (Figs. 32-34)**

Material examined. Ten ♀♀, 12♂♂ from a tubular lavender sponge, Pointe Lokobe, Nosy Bé, Madagascar, 16 August 1960, collected by A. G. Humes. Holotype (♀), allotype (♂), and paratypes (8♀♀, 10♂♂) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1♀, 1♂) are kept in the collection of the author.

Female. Body (Fig. 32A) stout, with large prosome and small urosome. Body length 1.70 mm (1.57-1.90 mm), based on 8 specimens. Length of dissected specimen 1.85 mm, and maximum with 916 μm. Prosome 1.21 mm long. Cepahosome and first pedigerous somite separated by faint dorsal furrow. Second pedigerous somite with posteriorly expanded posterolateral corners. Urosome (Fig. 32B) stocky and 5-segmented. Fifth pedigerous somite wider than genital double-somite, 365 μm wide. Genital double-somite 231 × 315 μm, its anterior half strongly expanded laterally, and narrower posterior half slightly tapering. Three free abdominal somites short, 65 × 165, 50 × 154, and 100 × 154 μm, respectively. Caudal ramus 108 × 60 μm (1.80 : 1), with strongly tapering posterior margin (Fig. 32C); outer lateral and inner dorsal setae naked, other 4 setae plumose. Egg sac (Fig. 32D) large, 861 × 442 μm, containing numerous eggs; each egg 69 μm in diameter.

Rostrum prominent and strongly tapering posteriorly (Fig. 32E). Antennule (Fig. 32F) 520 μm long and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 32G) 4-segmented, with armature formula 1, 1, 2+claw, and 5+2 claws; terminal segment 125 × 46 μm, its 2 terminal claws rather slender, 115 and 104 μm long, respectively.

Labrum (Fig. 32H) with deep and wide median incision; posterior lobes prominent, each with parallel lateral margins and slightly convex distal margin. Mandible (Fig. 32I) with strongly tapering gnathobase, with short, whip-like lash; inner margin with proximal patch of 3-5 spinules and distal patch of 5 spinules; convex margin with 5-7 small proximal spinules followed by about 10 large spines. Paragnath lobate, bearing setules apically. Maxillule (Fig. 32J) with 3 unequal terminal setae and 1 subdistal, setiform process. Maxilla (Fig. 33A) 2-segmented; first segment unarmed; second segment terminating by spiniform process, with simple anterior seta and strong, spiniform inner seta bearing 2-5 spinules on distal margin and 2-7 spinules on proximal margin; convex margin with 5 or 6 thick spines. Maxilliped (Fig. 33B) 3-segmented; first segment largest but unarmed; second segment with 2 large inner setae, both 75 μm long (proximal seta with spinules on distal margin, and distal seta with minute spinules on both margins); terminal segment small and terminating in long, setiform process, with 3 setae.

Legs 1-3 with 3-segmented rami (Fig. 33C, D). Leg 4 (Fig. 33F) with 3-segmented exopod and 1-segmented endopod; endopod 125 × 40 μm, with 1 small cusp on outer margin; 2 terminal spines 104 (inner) and 73 μm (outer); inner seta on coxa very small. Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,5.
Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,3.
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,2.
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. II,1.

Leg 5 consisting of small dorsal seta on fifth pedigerous

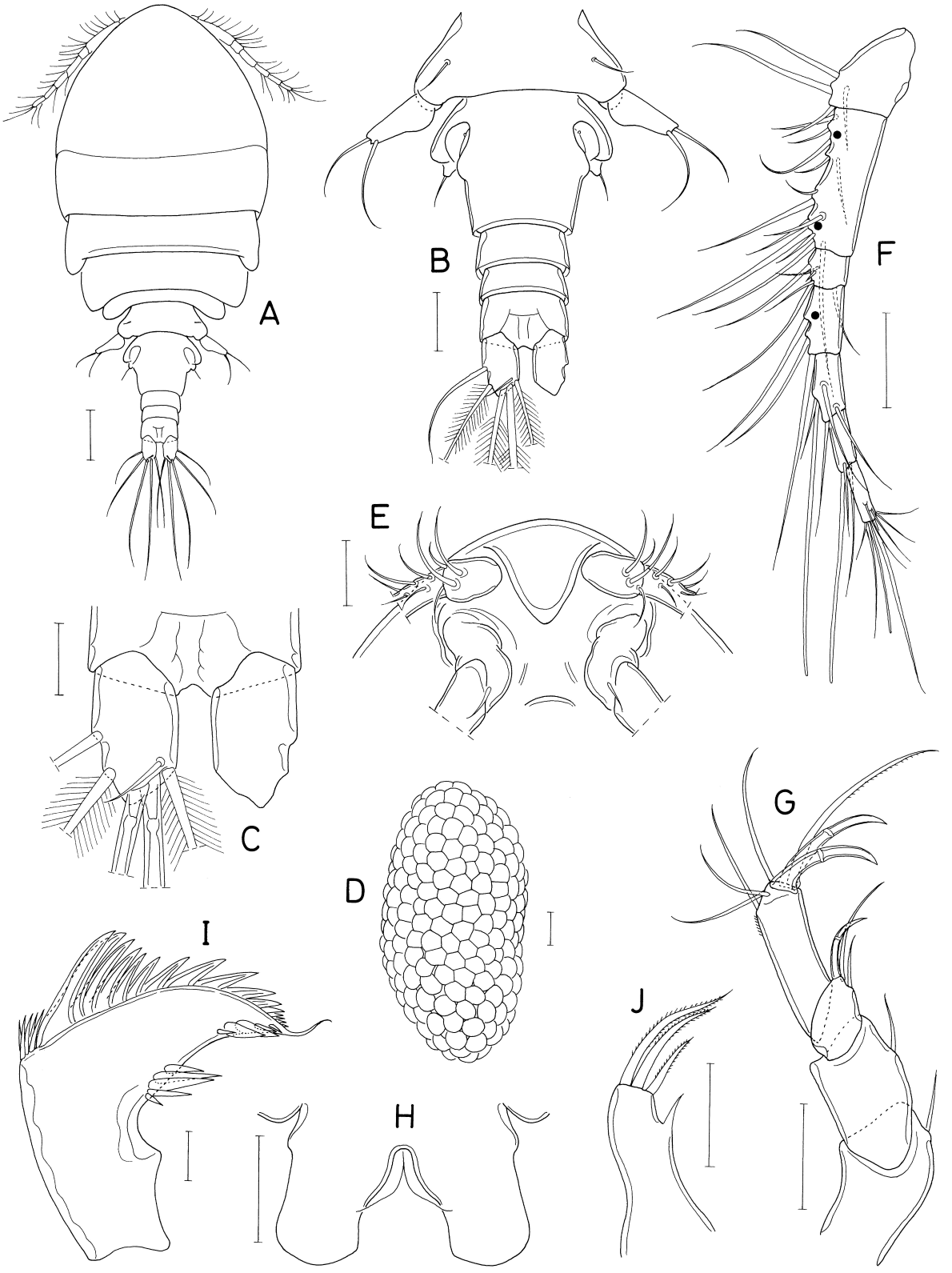

Fig. 32. *Kelleria multiovigera* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, caudal rami, dorsal; D, egg sac; E, rostral area, ventral; F, antennule (dots indicating places of additional aesthetascs in male); G, antenna; H, labrum; I, mandible; J, maxillule. Scales: A, 0.2 mm; B, D-H, 0.1 mm; C, J, 0.05 mm; I, 0.02 mm.

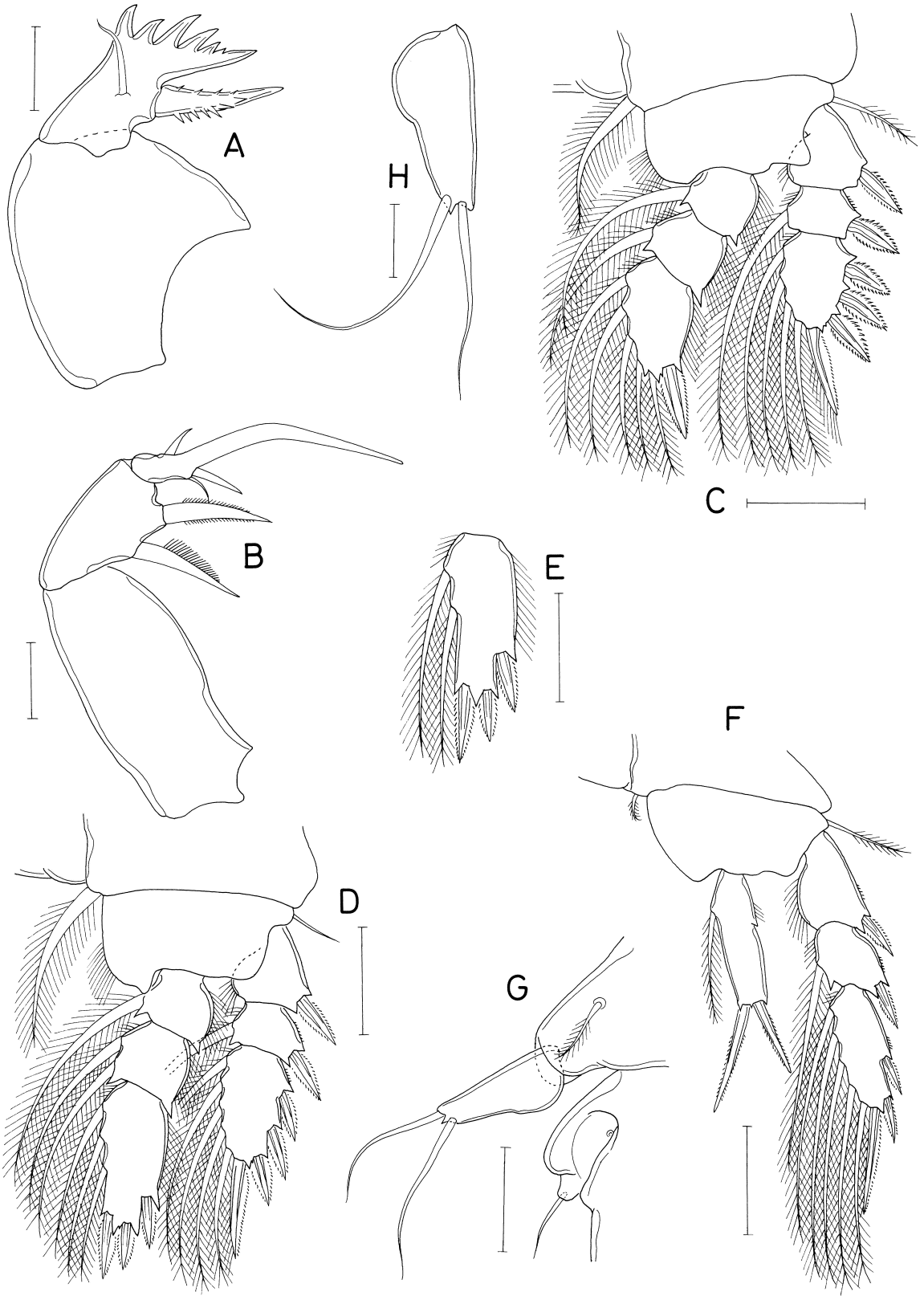

Fig. 33. *Kelleria multiovigera* n. sp., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, third endopodal segment of leg 3; F, leg 4; G, left side of first two urosomal somites, dorsal; H, free segment of leg 5. Scales: A, B, H, 0.05 mm; C-G, 0.1 mm.

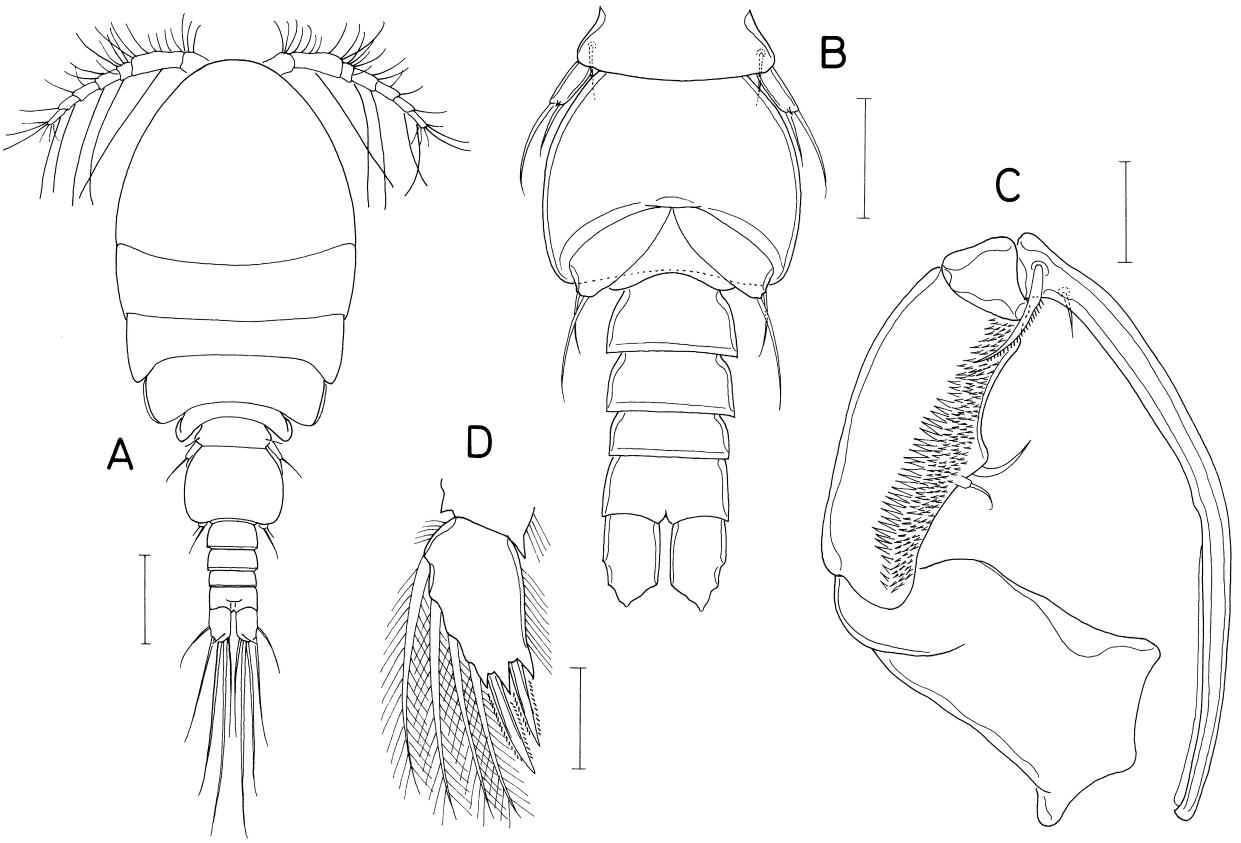

Fig. 34. *Kelleria multiovigera* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, maxilliped; D, third endopodal segment of leg 1. Scales: A, 0.2 mm; B, 0.1 mm; C, D, 0.05 mm.

somite and free segment (Fig. 33G); free segment (Fig. 33H) smooth, distinctly tapering, 127 × 57 μm (2.23 : 1), with weak inner proximal swelling and 2 naked terminal setae of 143 (outer) and 167 μm (inner). Leg 6 represented by 1 simple seta in genital area (Fig. 33G).

Male. Body (Fig. 34A) similar to that of female. Body length of dissected specimen 1.32 mm. Maximum width 544 μm. Prosome 800 μm long. Urosome (Fig. 34B) 6-segmented. Fifth pedigerous somite 170 μm wide. Genital somite 185 × 218 μm, slightly broadened distally. Four abdominal somites 50 × 110, 50 × 108, 38 × 103, and 55 × 108 μm, respectively. Caudal ramus 80 × 48 μm (1.67 : 1).

Rostrum as in female. Antennule with 3 additional aesthetascs: 2 on second and 1 on fourth segments (at places of dots in Fig. 32F). Antenna as in female.

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 34C) consisting of 3-segments and terminal claw; first segment unarmed; second segment with 2 setae, larger one of them on protuberance of inner margin and smaller one mounted on small papilla, and several longitudinal rows of numerous spinules; small third segment unarmed; terminal claw large, proximally with 1 spinule-bearing seta and 1 setule.

Leg 1 with third endopodal segment armed with 2 spines and 4 setae (Fig. 34D). Legs 2-4 as in female. Leg 5 small, with parallel lateral margins and terminally 1 spiniform process and 2 unequal setae. Leg 6 represented by 2 unequal setae on genital flap (Fig. 34B).

Etymology. The specific name *multiovigera*, a combination of Latin words *multi* (numerous)+*ovum* (egg)+*gero* (to carry), alludes to the numerous eggs in the egg sac of this species.

Remarks. It is remarkable that *Kelleria multiovigera* n. sp. has, as a distinguishing feature, a relatively large body size, bearing the body length ranging 1.59-1.90 mm. The largest body length reported previously is 1.44 mm known for *K. grandisetiger* Kim, 2006 (Kim, 2006a).

In most known species of *Kelleria* the caudal ramus of the female is more than 2.5 times as long as wide and/or the free segment of leg 5 bears one or two processes on the inner margin. Only *K. multiovigera* n. sp. and *K. andamanensis* Sewell, 1949 lack both traits. *Kelleria andamanensis* differs from *K. multiovigera* in having the following features in the

female (Sewell, 1949): 1) the small body, only 0.8 mm long in the female; 2) the genital double-somite is longer than wide; 3) the lateral seta which is located posterior to genital area on the genital double-somite is very large; 4) the free segment of leg 5 is slender, without a proximal swelling; and 5) the distal margin of the second segment of maxilla bears 7 spines of irregular sizes.

Family Lichomolgidae Kossmann, 1877
Genus *Lichomolgus* Thorell, 1860
***Lichomolgus angustus* n. sp. (Figs. 35-37)**

Material examined. Five ♀♀, 5♂♂ from the bivalve *Pteria macroptera* Lamarck, in the depth 10 m, Pointe Lokobe, Nosy Bé, Madagascar, 27 December 1963, collected by A. G. Humes. Holotype (♀), allotype (♂), and paratypes (3♀♀, 3♂♂) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1♀, 1♂) are kept in the collection of the author.

Female. Body (Fig. 35A) narrow. Body length of dissected specimen 1.25 mm. Maximum width 400 μm. Prosome 700 μm long and distinctly tapering posteriorly. Cephalothorax nearly quadrate, 396 μm long, divisible into cephalosome and first pedigerous somite by incomplete dorsal furrow. Urosome (Fig. 35B) slender and 5-segmented. Fifth pedigerous somite 123 μm wide. Genital double-somite 154 × 129 μm, with distinct anterolateral expansion and slightly tapering posterior part; genital area located dorsally at midlength of somite. Three free abdominal somites 69 × 67, 60 × 58, and 67 × 50 μm, respectively. First 2 of abdominal somites bearing spinules along posteroventral margin. Anal somite with 2 patches of spinules on proximal part of ventral surface (Fig. 35C). Caudal ramus elongate, 193 × 19 μm (10.2 : 1), with 6 naked setae; outer lateral seta located at 61% region of outer margin; largest inner median terminal seta 283 μm long, and next longest nearby seta 166 μm long.

Rostrum as ventral protuberance, without posterior margin (Fig. 35D). Antennule (Fig. 35E) 313 μm long and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; setae naked and generally large. Antenna (Fig. 35F) 4-segmented, with armature formula 1, 1, 3, and 5+2 claws; first and second segment similar in length; one of 3 setae on third segment very large, much longer than terminal segment; terminal segment about 79 × 24 μm, with spinules along outer margin; 2 terminal claws large, similar in size; 2 terminal setae on terminal segment large and claw-like, bearing annulation in middle.

Labrum (Fig. 35G) with broad median incision and tapering posterior lobes. Mandible (Fig. 35H) slender, with long lash and spinules on inner margin and lateral surface. Maxillule (Fig. 35I) armed with 1 large seta, 1 small but thick seta, 1 triangular process, and 1 setule-like process. Maxilla (Fig. 36A) with unarmed basal segment; distal segment with simple anterior seta, spiniform inner seta bearing spinules along distal margin, and elongate terminal lash bearing spinules on proximal half of convex margin. Maxilliped (Fig. 36B) 3-segmented, each segment 46, 58, and 23 μm long from proximal to distal; first segment unarmed; second segment with 2 unequal setae near distal 1/3 region; terminal segment distinctly tapering and sharply pointed, with 1 small inner seta.

Legs 1-3 with 3-segmented rami (Fig. 36C-E). Leg 4 (Fig. 36F) with 3-segmented exopod and 2-segmented endopod. Distal endopodal segment of leg 4 84 × 31 μm, with 1 pointed process on outer margin; its 2 terminal spines 77 μm (inner) and 38 μm (outer). Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,5.
Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,3.
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,2.
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. 0-1; II.

Leg 5 consisting of dorsolateral seta on fifth pedigerous somite and free segment; free segment (Fig. 36G) smooth, 78 × 20 μm (3.90 : 1), broader in proximal half and narrower in distal half (15 μm wide in this region), terminally with 1 spiniform seta (31 μm) and 1 longer seta (62 μm). Leg 6 represented by 2 setae and 2 small spiniform processes in genital area (Fig. 36H).

Male. Body (Fig. 37A) similar in form to that of female. Mean body length 806 μm (769-838 μm), based on 5 specimens. Body length of dissected specimen 832 μm, and maximum width 279 μm. Prosome 441 μm long. Urosome (Fig. 37B) 6-segmented. Fifth pedigerous somite 83 μm wide. Genital somite nearly ovoid, 133 × 130 μm. Four abdominal somites 33, 38, 38, and 40 μm long, respectively. Caudal ramus 84 × 17 μm (4.94 : 1).

Rostrum as in female. Antennule with 2 additional aesthetascs, each on second and fourth segments. Antenna (Fig. 37C) with 1 additional seta on third segment, thus 4 on this segment.

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 37D) consisting of 3 segments and terminal claw; first segment unarmed; second segment as long as first, with slightly projected inner margin near middle, 2 small, subequal setae, and spinules along whole inner side; small third segment unarmed; terminal claw large, 138 μm long, proximally with 1 seta and 1 setule.

Legs 1-4 not different from that of female. Free segment of leg 5 57 × 14 μm, with nearly parallel lateral margins and

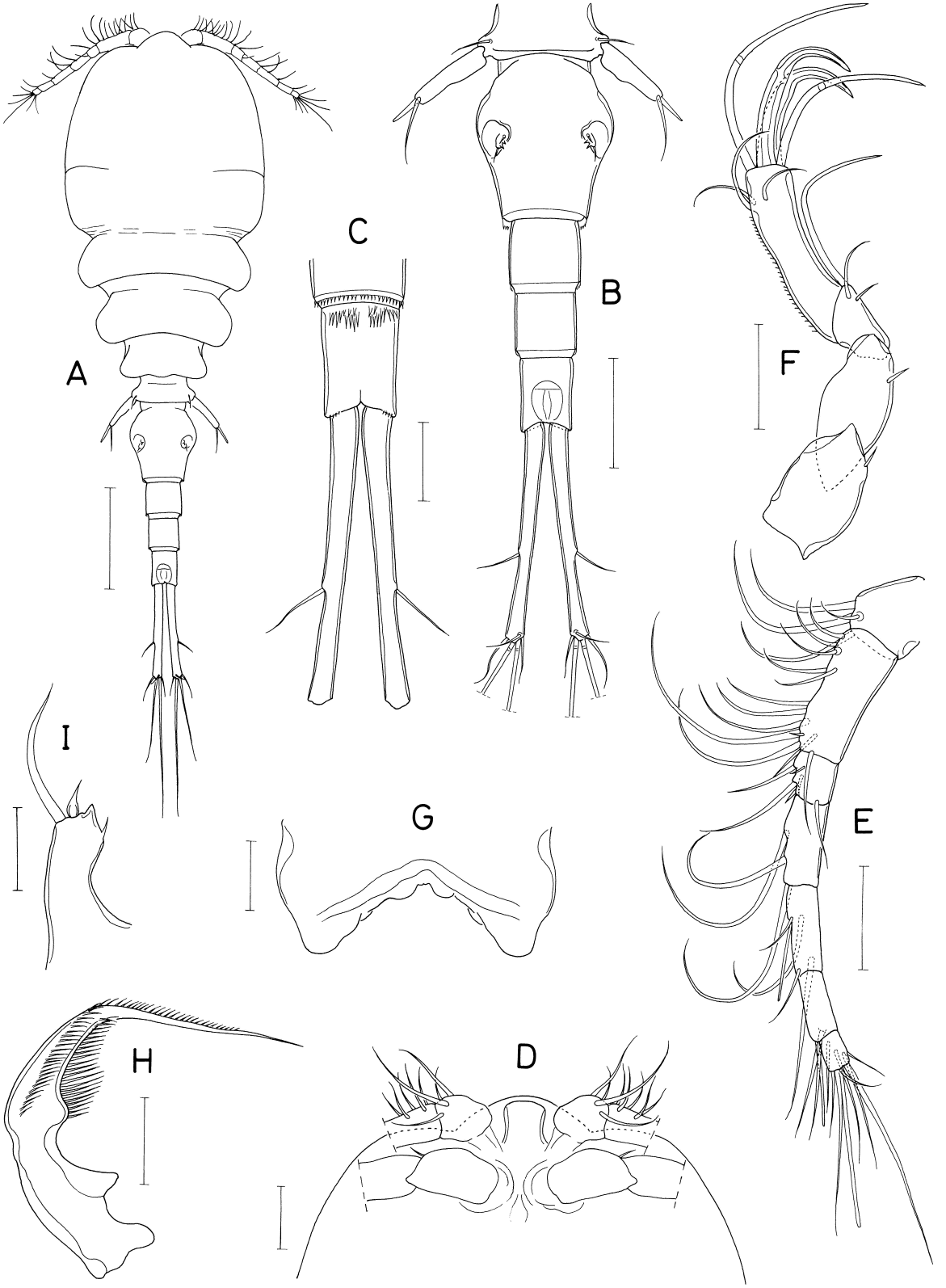

Fig. 35. *Lichomolgus angustus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, distal part of abdomen, ventral; D, rostral area, ventral; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scales: A, 0.2 mm; B, 0.1 mm; C-F, 0.05 mm; G-I, 0.02 mm.

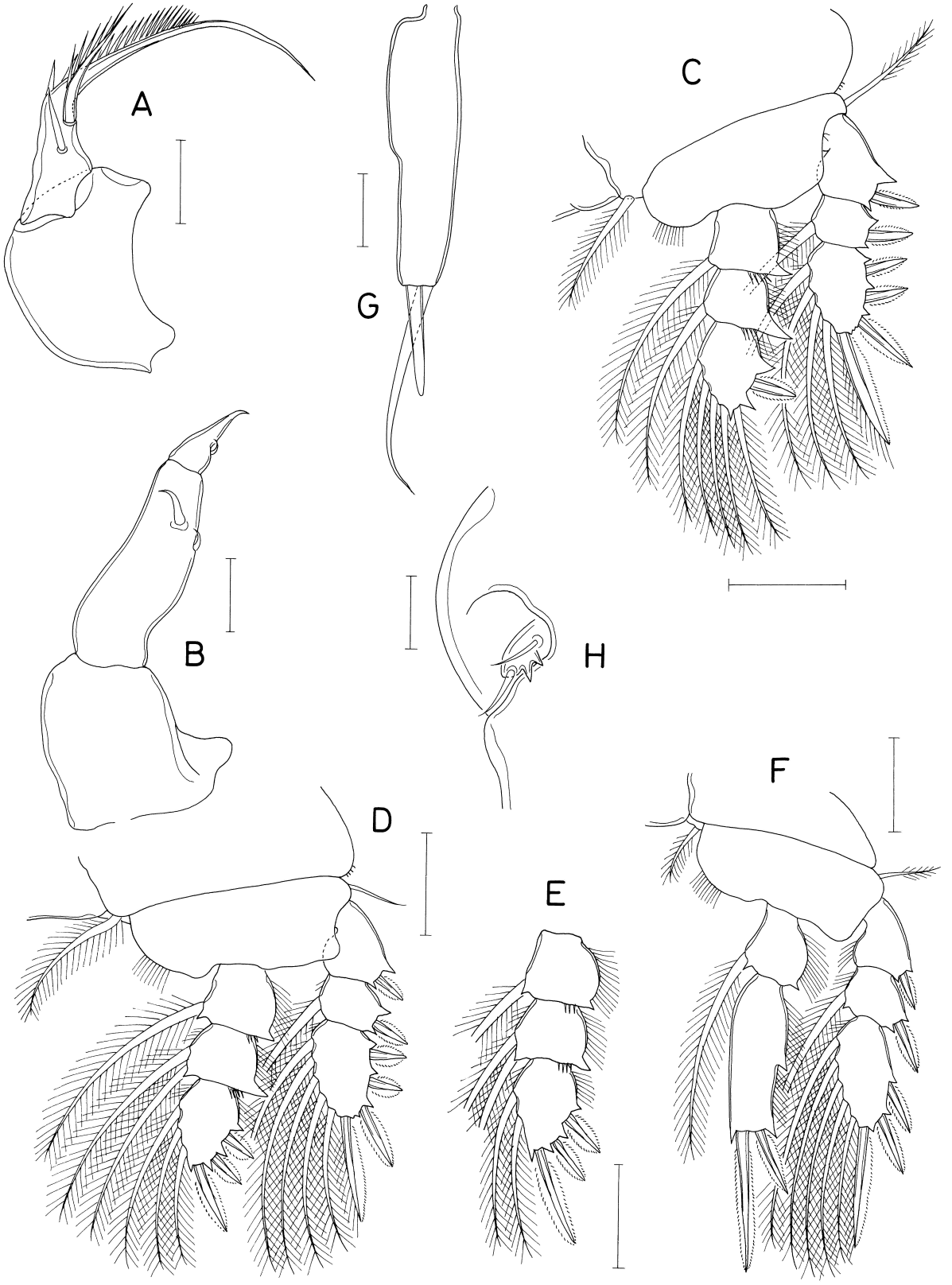

Fig. 36. *Lichomolgus angustus* n. sp., female. A, maxilla; B, maxillipe; C, leg 1; D, leg 2; E, endopod of leg 3; F, leg 4; G, free segment of leg 5; H, left genital area. Scales: A, B, G, H, 0.02 mm; C-F, 0.05 mm.

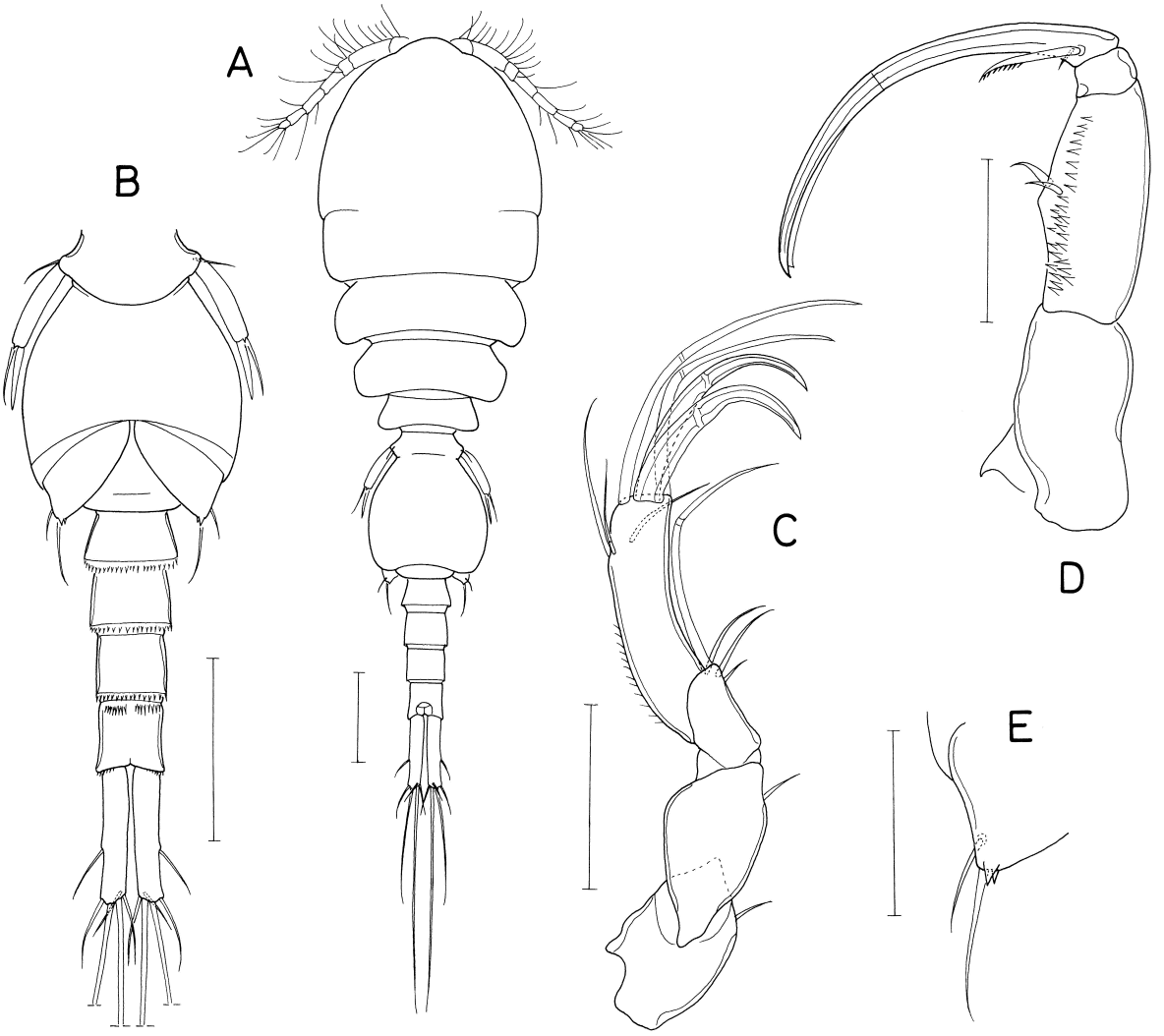

Fig. 37. *Lichomolgus angustus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antenna; D, maxilliped; E, posterodistal corner of genital somite, ventral. Scales: A, B, 0.1 mm; C-E, 0.05 mm.

terminally 1 pointed process, 1 spine (36 μm), and 1 seta (40 μm). Leg 6 represented by 2 seta and 2 spinules on genital flap (Fig. 37E).

Spermatophore 152 × 66 μm and sac-like.

Etymology. The specific name *angustus* is the Latin meaning "slender" which alludes to the slender body of the new species.

Remarks. The most striking feature of *Lichomolgus angustus* n. sp. is the possession of the elongate caudal ramus which is 10.2 times as long as wide. Similarly long caudal ramus is shared by six species in *Lichomolgus*: *L. elegantulus* Stock, 1960; *L. forficula* Thorell, 1860; *L. ieversi* Thompson and Scott, 1903; *L. leptodermatus* Gooding, 1957; *L. marginatus* Thorell, 1859; and *L. uncus* Jones, 1976. Another diagnostic feature of *L. angustus* n. sp. is the presence of a pointed process on the outer margin of the distal endopodal segment of leg 4. This feature is shared by only two species among the above six species, *L. ieversi* and *L. uncus* which are distinguishable from the new species by the following ways.

Humes (1973) redescribed *Lichomolgus ieversi* based on the specimens associated with the pectenid *Pecten distans* Lamarck from the New Caledonia. According to him, in *L. ieversi* the free segment of female leg 5 is 6.0 times as long as wide (66 × 11 μm) and bears parallel lateral margins, but lacks a weak proximal expansion, unlike in *L. angustus* n. sp., although otherwise these two species are very similar, especially in the form of antenna.

In *Lichomolgus uncus* the free segment of female leg 5 is widest at its 3/4 region (Jones, 1976), the genital double-somite and the second endopodal segment of leg 4 are tapering

distally, the second free abdominal somite is the longest among three free abdominal somites (lengths 102, 152, and 49 μm, respectively). These features are not applicable to *L. angustus* n. sp.

***Lichomolgus fusiformis* n. sp. (Figs. 38-40)**

Material examined. Eleven ♀♀, 1♂ from the ascidian *Polycarpa madagascariensis* Hartmeyer, 18 August 1967, in the depth of 30 m, approximately 13° 05′S, 48° 22′E, near Nosy Bé, Madagascar, collected by A. G. Humes. Holotype (♀) and paratypes (9♀♀) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1♀, 1♂) are kept in the collection of the author.

Female. Body (Fig. 38A) with moderately broad prosome and narrow urosome. Body length 938 μm (904-969 μm), based on 10 specimens. Body length of dissected specimen 963 μm, and maximum width 421 μm. Prosome ovoid, 650 μm long, with weak dorsal furrow between cephalosome and first pedigerous somite. Urosome (Fig. 38B) 5-segmented. Fifth pedigerous somite 92 μm wide. Genital double-somite ovoid, 153 × 116 μm, and much longer than abdomen; genital area located dorsolaterally at posterior quarter. Three free abdominal somites short, 28 × 63, 20 × 57, and 33 × 53 μm, respectively. Anal somite with transverse row of large spinules on proximal part of ventral surface and minute spinules along posteroventral margin (Fig. 38C). Caudal ramus broad, 32 × 25 μm (1.28 : 1), with minute spinules on convex posteroventral margin and 6 setae; both rami touching each other; longest inner median seta 396 μm, next longest nearby seta 271 μm; outer lateral, inner dorsal, and innermost terminal setae naked, other 3 setae plumose. Egg sac (Fig. 38D) large in relation to body size, 630 × 183 μm; each egg 58 μm in diameter.

Rostrum strongly tapering posteriorly (Fig. 38E). Antennule 254 μm long and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 38G) 4-segmented; first segment with 1 inner distal seta; second segment distinctly longer than first, about 83 × 28 μm, with 1 inner seta located near distal 30% region of inner margin; third segment with 3 inner setae; terminal segment about 50 × 19 μm, with 3 subdistal setae, 3 claw-like setae bearing annulation, and 1 claw.

Labrum (Fig. 38H) with deep median incision and nearly quadrate, strongly projected posterior lobes. Mandible (Fig. 38I) slender, with spinules on both inner and outer margins and elongate terminal lash bearing spinules on margins. Maxillule (Fig. 39A) with 3 very unequal setae distally. maxilla (Fig. 39B) with unarmed basal segment; distal segment with anterior seta, large inner seta bearing spinules along distal margin, and very long lash bearing spinules along proximal half of convex margin. Maxilliped (Fig. 39C) 3-segmented; first segment unarmed and about 58 × 33 μm; second segment 54 × 25 μm, slightly expanded in middle, with 2 equally small setae in distal 1/4 region; terminal segment slender, spiniform, 23 μm long, with minute proximal seta.

Legs 1-3 with 3-segmented rami. Outer seta on basis of legs 1-4 small (Fig. 39D, E, G). Leg 4 (Fig. 39G) with 3-segmented exopod and 2-segmented endopod; inner seta on coxa small and naked; distal endopodal segment 59 × 17 μm, with spiniform process on outer margin, its 2 terminal spines 41 μm (inner) and 28 μm (outer). Armature formula of legs 1-4 as in preceding species.

Leg 5 consisting of dorsolateral seta on fifth pedigerous somite and free segment; free segment (Fig. 39H) small, 22 × 11 μm (2.0 : 1), gradually broadened distally and armed terminally with 1 spine (29 μm) and 1 naked seta (67 μm). Leg 6 represented by 1 plumose seta, 1 smaller naked seta, and 1 spinule in genital area (Fig. 39I).

Male. Body (Fig. 40A) narrower than that of female. Body length 741 μm. Maximum width 269 μm. Prosome 482 μm long. Urosome (Fig. 40B) 6-segmented. Fifth pedigerous somite 72 μm wide. Genital somite roughly quadrate, 128 × 113 μm. Four abdominal somites 20 × 48, 23 × 47, 20 × 45, and 25 × 44 μm, respectively. Caudal ramus 25 × 20 μm (1.25 : 1).

Rostrum as in female. Antennule with 3 additional aesthetascs: 2 on second and 1 on fourth segments, as indicated by dots in Fig. 38F. Antenna with 1 additional seta on third segment, thus 4 setae on this segment.

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 40C) consisting of 3 segments and terminal claw; first segment broad and unarmed; second segment longer than first, 82 μm long, with 1 longitudinal row of spinules and 2 transformed setae (smaller one tipped by setule and larger one peg-like, translucent, with subterminal setule) in middle of inner margin; small third segment unarmed; terminal claw 161 μm long, with 1 seta and 1 setule proximally.

Legs 1-4 as in female. Free segment of leg 5 20 × 11 μm, terminally with 1 spine (27 μm) and 1 seta (50 μm). Leg 6 represented by 2 naked setae on genital flap (Fig. 40B).

Etymology. The specific name *fusiformis* alludes to the fusiform female genital double-somite of the new species.

Remarks. *Lichomolgus fusiformis* n. sp. has a very stout caudal ramus which is 1.28 times as long as wide in the female. With this configuration of the caudal ramus, *L. fusiformis* n. sp. can be distinguishable from most species of *Lichomolgus*, because in the majority of species of *Lichomolgus* the caudal ramus is more than twice as long as wide and in two species (*L. eganae* Gotto, 1975 and *L. indicus* Unnerkutty, 1961) the caudal ramus is wider than long. Only a single species, *L.*

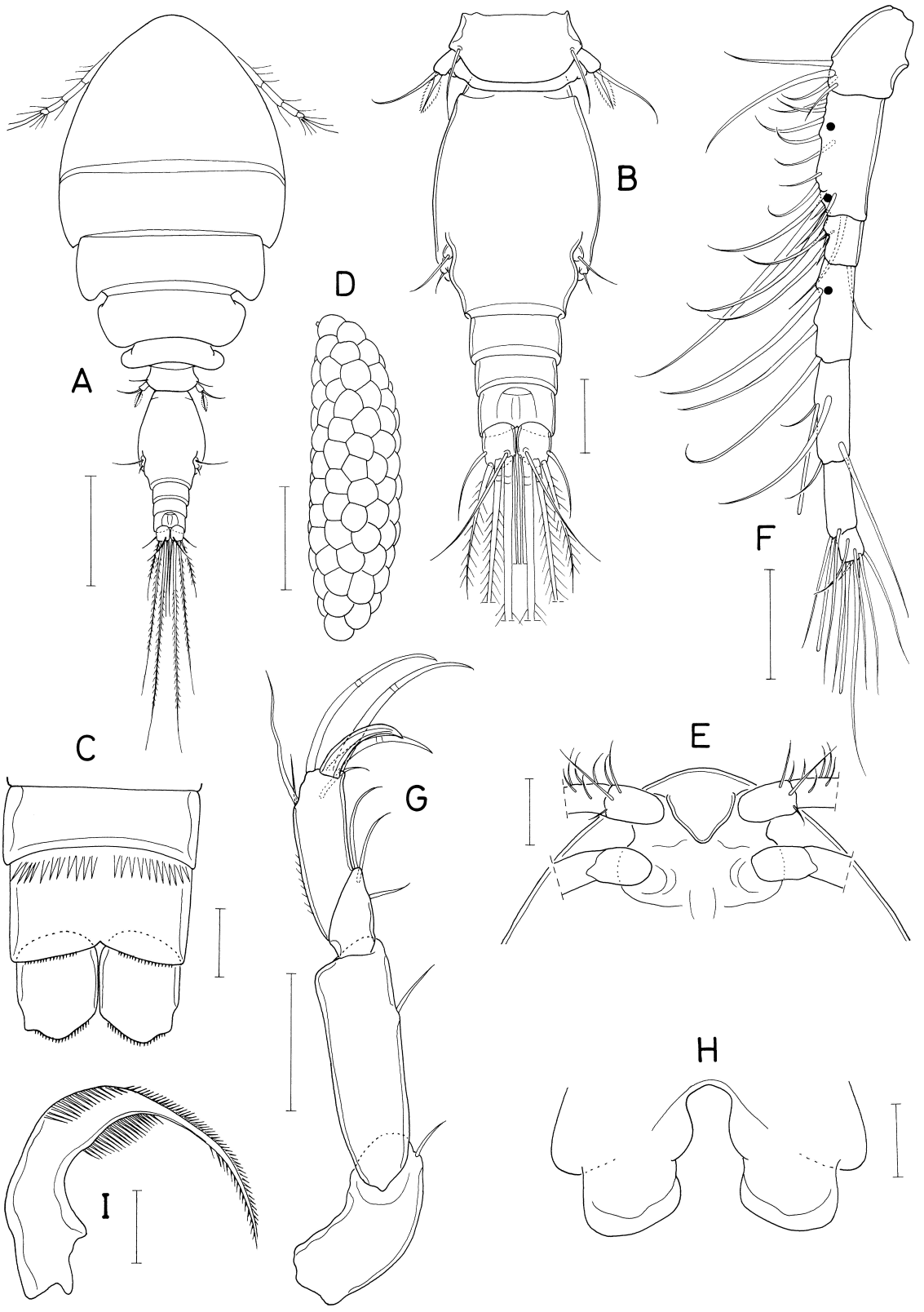

Fig. 38. *Lichomolgus fusiformis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, distal part of abdomen, ventral; D, egg sac; E, rostral area, ventral; F, antennule (dots indicating places of additional aesthetascs in male); G, antenna; H, labrum; I, mandible. Scales: A, D, 0.2 mm; B, E-G, 0.05 mm; C, H, I, 0.02 mm.

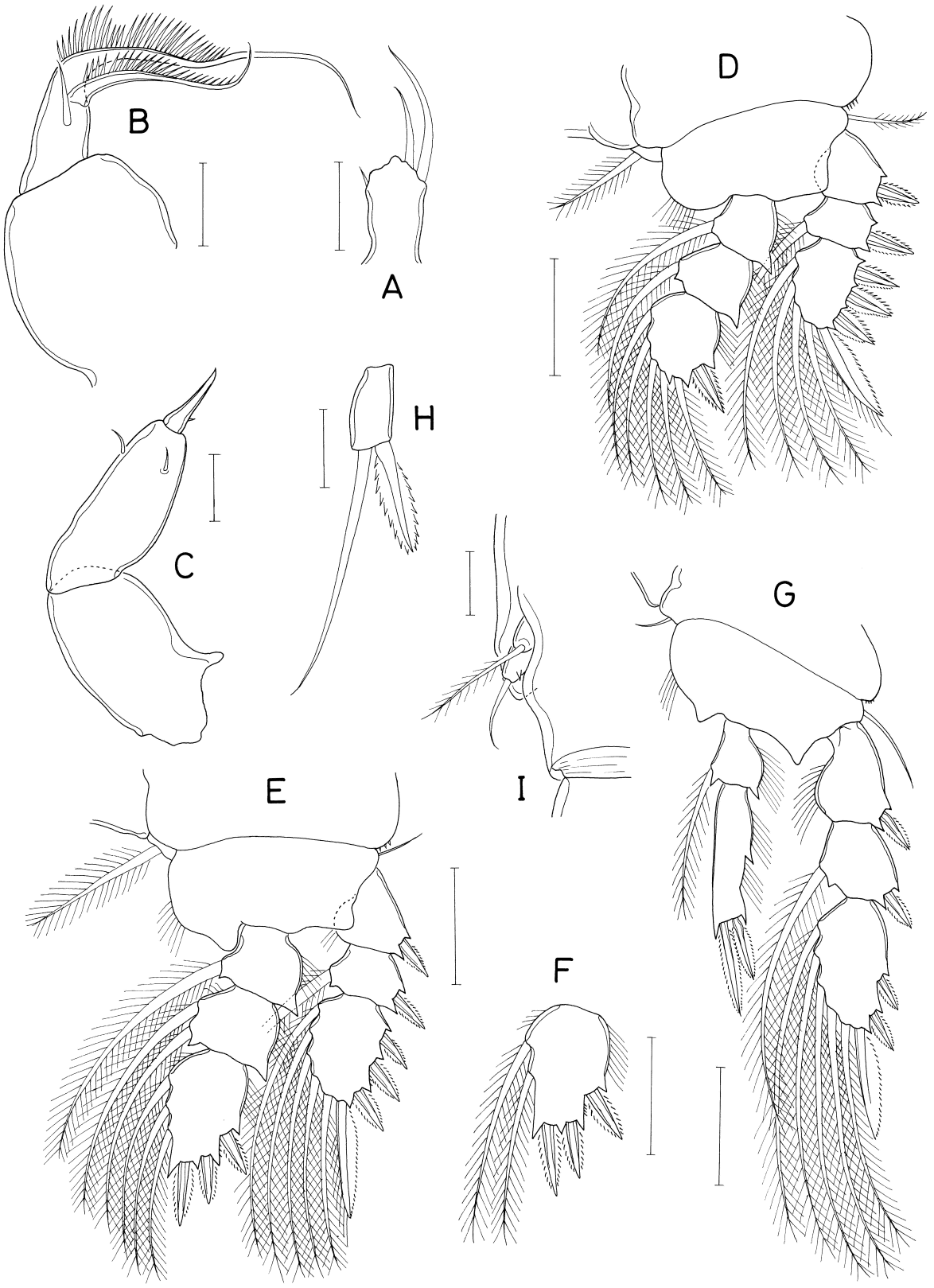

Fig. 39. *Lichomolgus fusiformis* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, third endopodal segment of leg 3; G, leg 4; H, free segment of leg 5; I, left genital area, dorsal. Scales: A-C, H, I, 0.02 mm; D-G, 0.05 mm.

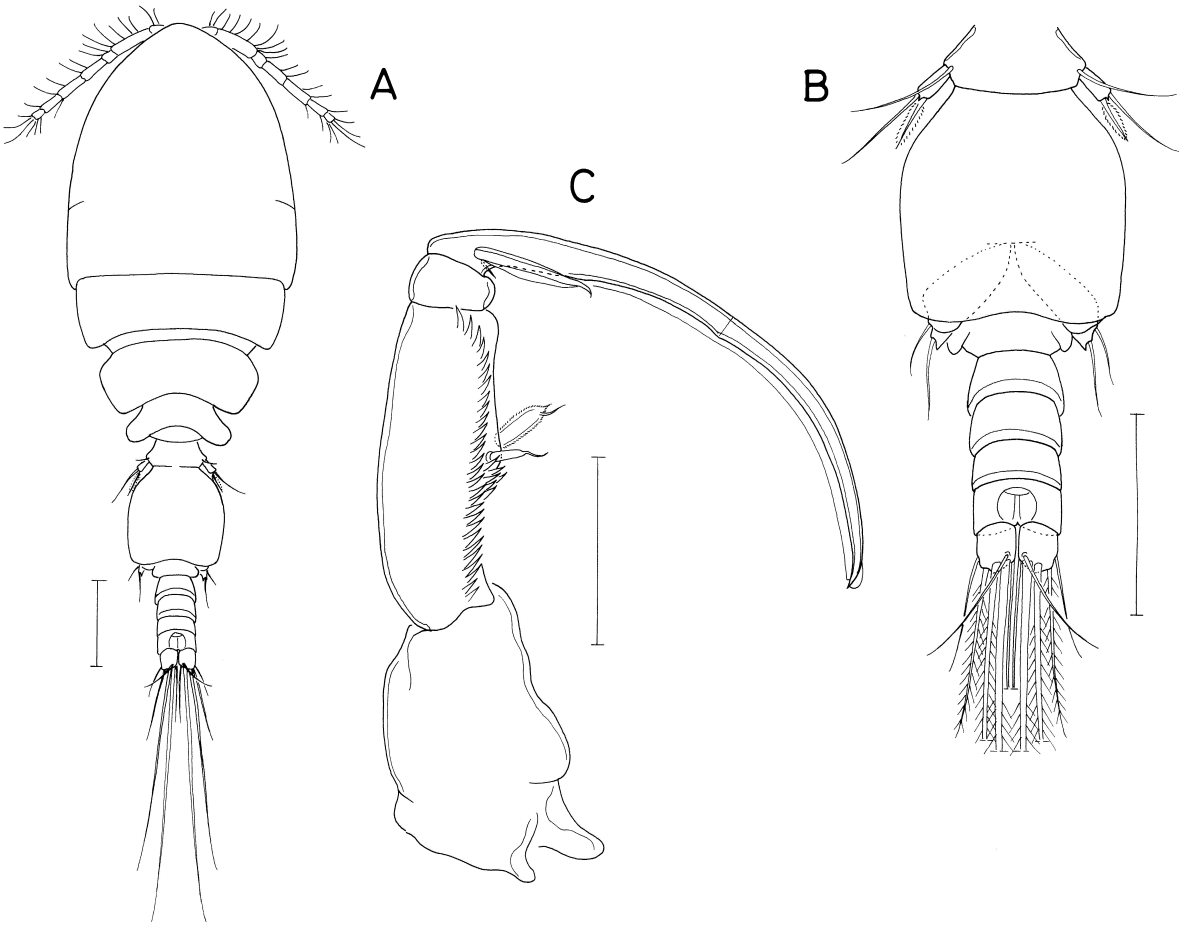

Fig. 40. *Lichomolgus fusiformis* n. sp., male. A, habitus, dorsal; B, urosome, dorsal; C, maxilliped. Scales: A, B, 0.1 mm; C, 0.05 mm.

nakaii Matsuzaki and Ogawa, 1989, has a configuration of the caudal ramus similar to that of the new species. *Lichomolgus nakaii* is, like *L. fusiformis*, an associate of ascidians in Japan (Matsuzaki and Ogawa, 1989) and Korea (Kim, 1998). When examined a Korean female specimen of *L. nakaii*, the caudal ramus is 1.37 times as long as wide, a similar proportion as that of *L. fusiformis*. But in the same specimen, the anal somite lacks, unlike in *L. fusiformis*, a proximal row of spinules on the ventral surface and the genital area is located at midlength of genital double-somite.

In addition to the short caudal ramus, *L. fusiformis* has some diagnostic features such as the small free segment of leg 5 and the characteristic form of genital double-somite in which the genital areas are located at posterior region.

Genus *Modiolicola* Aurivillius, 1882

***Modiolicola trabalis* Humes, 1959 (Figs. 41-43)**

Material examined. One ♀, 3♂♂ from *Arca antiquata* L., Nosy Bé, Madagascar, 23 July 1955, collected by A. G. Humes.

Female. Body (Fig. 41A) relatively narrow. Body length 930 μm, and maximum width 319 μm. Urosome (Fig. 41B) 5-segmented. Fifth pedigerous somite 112 μm wide. Genital double-somite 115 × 110 μm, with slightly expanded anterior part. Genital double- and first 2 free abdominal somites with spinules on posteroventral margin (Fig. 41C). Three free abdominal somites 40 × 73, 38 × 60, and 56 × 52 μm, respectively. Caudal ramus 118 × 19 μm (6.21 : 1), with 6 naked setae; outer lateral seta located about 43% region of ramus; longest inner median terminal seta 67 μm, and next longest one 40 μm.

Antennule (Fig. 41D) slender and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae thin and naked. Antenna (Fig. 41E) 4-segmented, with armature formula 1, 1, 2, and 4+3 claws; third and terminal segments each about twice longer than wide when measured along outer margin; three terminal claws

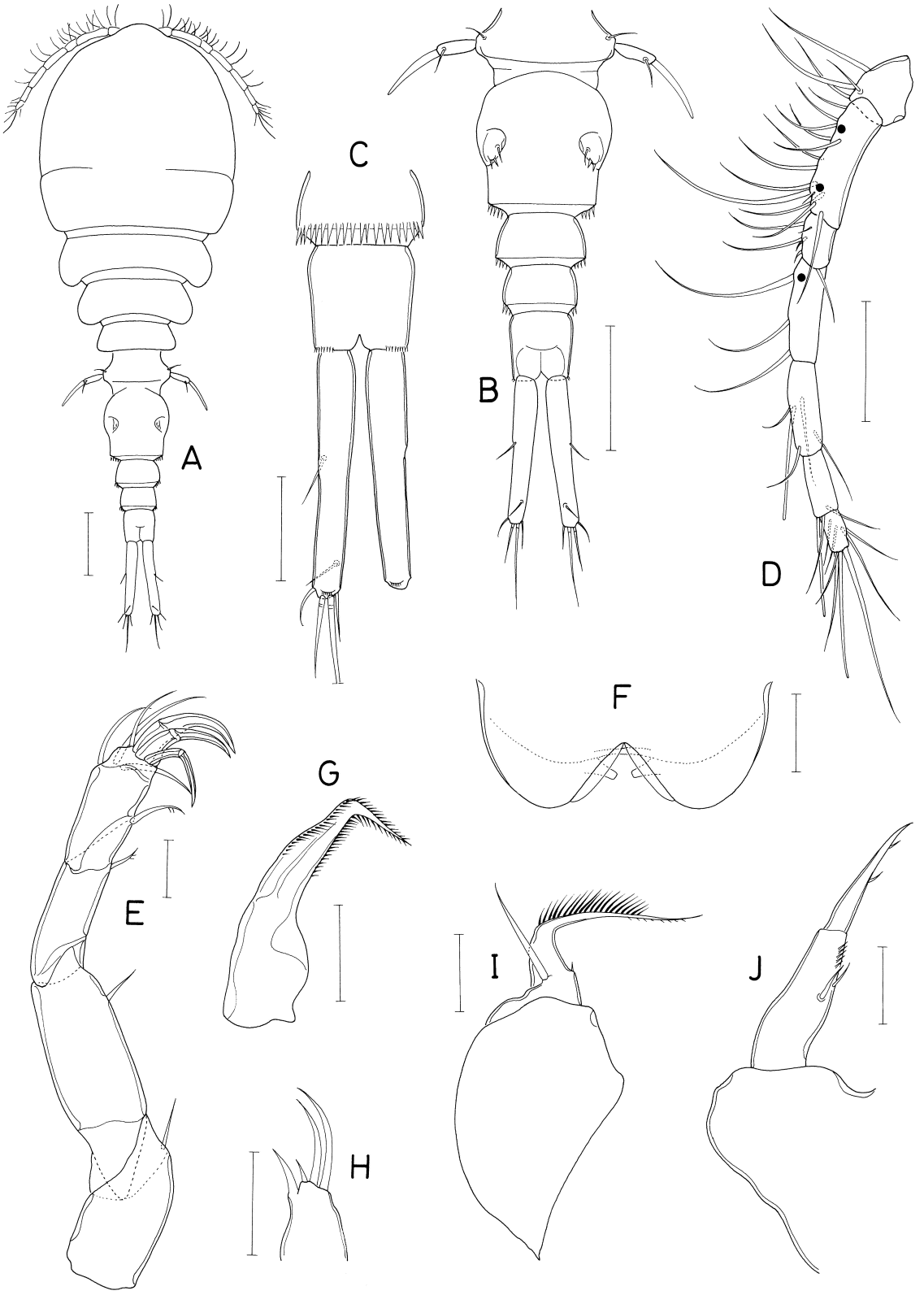

Fig. 41. *Modiolicola trabalis* Humes, female. A, habitus, dorsal; B, urosome, dorsal; C, distal part of abdomen, ventral; D, antennule (dots indicating places of additional aesthetascs in male); E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilla; J, maxilliped. Scales: A, B, 0.1 mm; C, D, 0.05 mm; E-J, 0.02 mm.

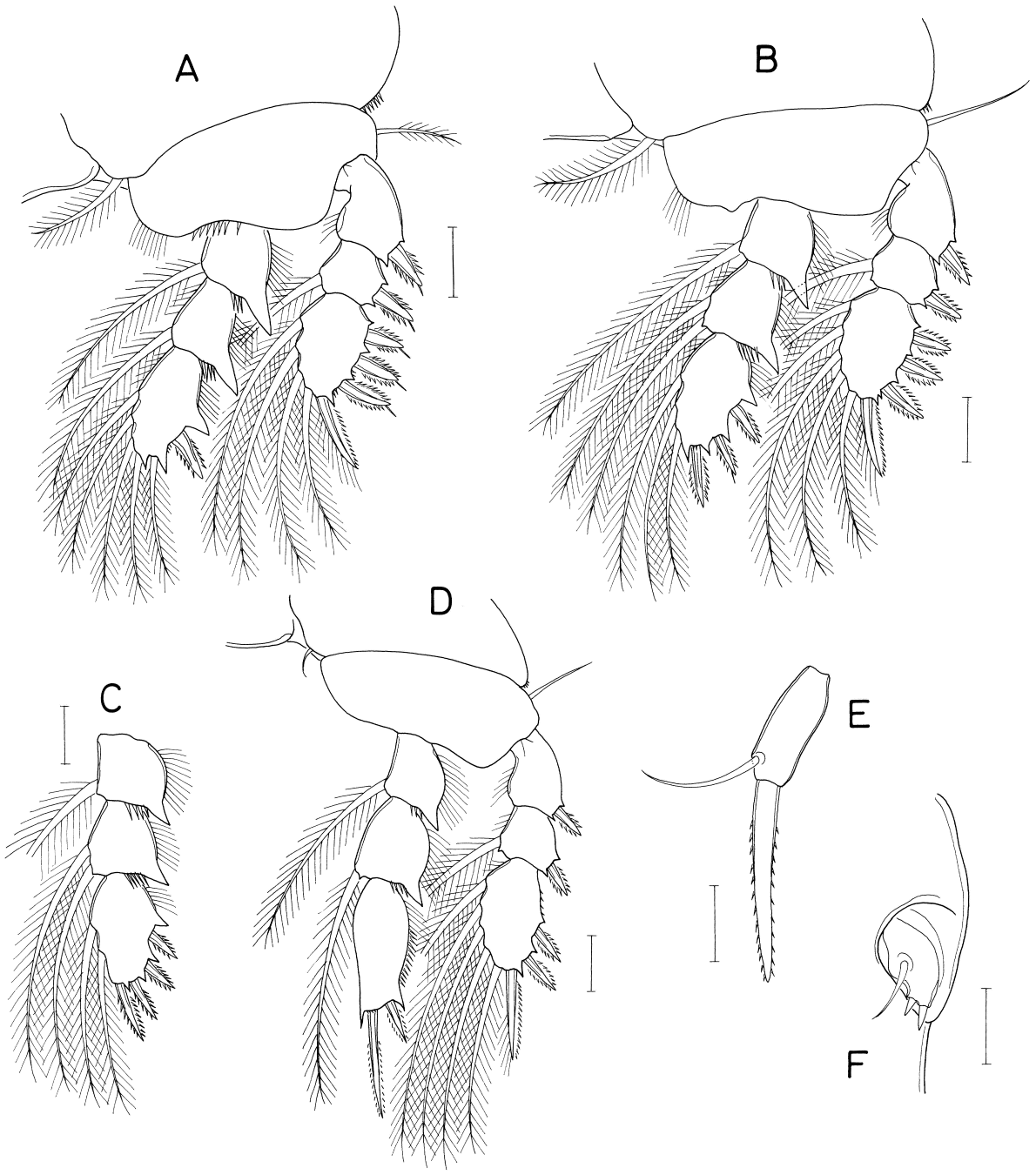

Fig. 42. *Modiolicola trabalis* Humes, female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, free segment of leg 5; F, right genital area. Scales: 1.02 mm for all.

subequal in length but very different in thickness.

Labrum (Fig. 41F) with semicircular posterior lobes, each with membrane on inner margin and 1 inner, truncate digitiform process. Mandible (Fig. 41G) narrow, tapering, and distally curved in right angle, with spinules on both margins. Maxillule (Fig. 41H) with 1 small and 2 larger naked apical setae and 1 subterminal setiform process. Maxilla (Fig. 41I) with large but unarmed first segment; second segment with 1 large anterior seta and minute, rudimentary inner seta; distal lash thin, long, and forming right angle with segment, with spinules along convex margin. Maxilliped (Fig. 41J) 3-segmented; first segment broad but unarmed; second segment

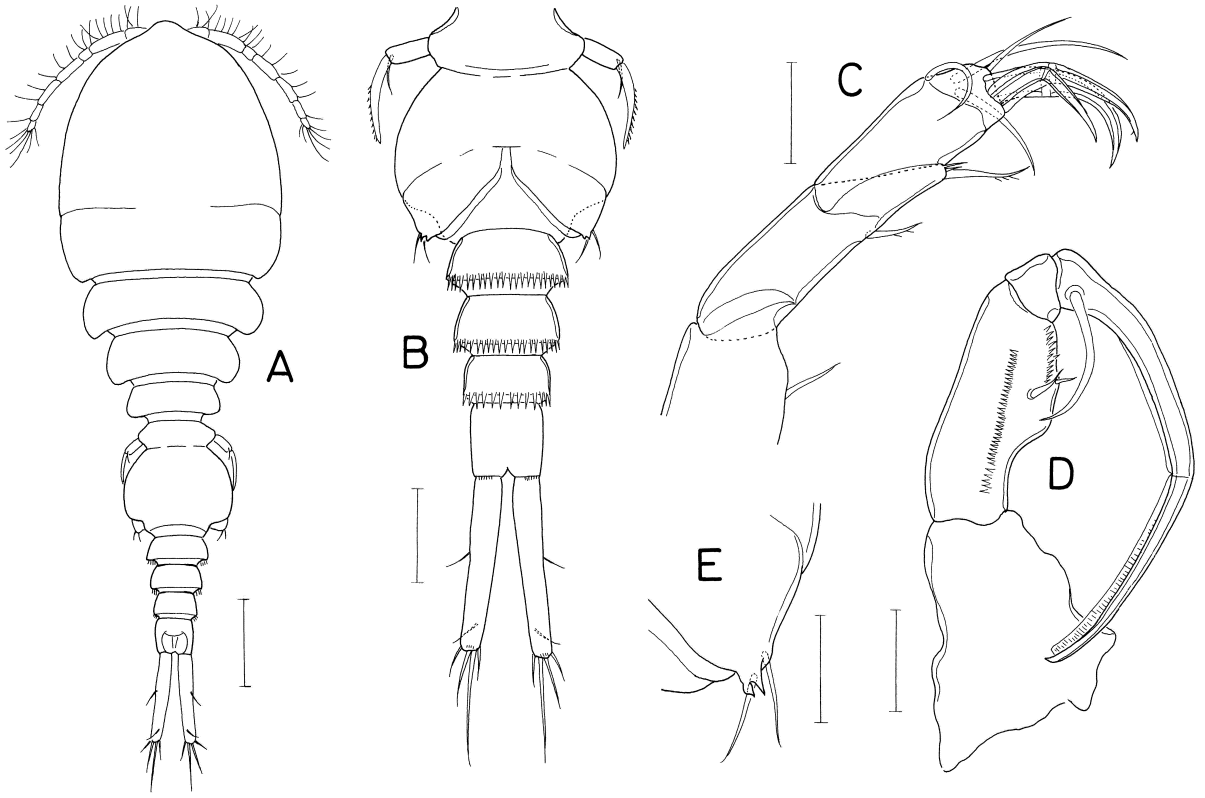

Fig. 43. *Modiolicola trabalis* Humes, male. A, habitus, dorsal; B, urosome, ventral; C, distal part of antenna; D, maxilliped; E, posterodistal part of genital somite, ventral. Scales: A, 0.1 mm; B, 0.05 mm; C-E, 0.02 mm.

about 40 μm long and tapering, with 2 inner setae and several spinules on distal part of inner margin; terminal segment thin, 34 μm long and sharply ended, with 1 small middle and another small distal setules.

Legs 1-4 with 3-segmented rami (Fig. 42A-D). Outer distal corner of first and second endopodal segments of these legs, especially those of leg 1, strongly projected. Third endopodal segment of leg 4 48 × 20 μm, with setules proximally and spinules distally on outer margin; its 2 terminal spines 41 μm (inner) and 16 μm (outer). Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,5.
Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; II,I,3.
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; II,II,2.
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. 0-1; 0-1; II.

Free segment of leg 5 (Fig. 42E) small, 33 × 13 μm (2.54 : 1), nearly quadrangular, terminally with large spine (54 μm) and smaller naked seta. Leg 6 represented by 1 seta and 2 spiniform processes in genital area (Fig. 42F).

Male. Body (Fig. 43A) similar in form to that of female. Body length 821 μm, and maximum width 254 μm. Urosome (Fig. 43B) 6-segmented. Fifth pedigerous somite 83 μm wide. Genital somite 85 × 118 μm and nearly circular. Four abdominal somites 35 × 67, 32 × 57, 25 × 47, and 40 × 40 μm, respectively. First to third abdominal somite ornamented with spinules along posteroventral margin. Caudal ramus 96 × 15 μm (6.40 : 1).

Antennule with 3 additional aesthetascs: 2 on second and 1 on fourth segments, as indicated by dots in Fig. 41D; these aesthetascs thin and short. Antenna with 2 additional minute setules at inner distal corner of third segment (Fig. 43C).

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 43D) consisting of 3 segments and terminal claw; first segment broad and unarmed; second segment expanded in distal 3/5, with 2 small inner setae, 1 longitudinal row of spinules laterally and another shorter longitudinal row of spinules on distal part on inner margin; small third segment unarmed; terminal claw very long, proximally with 1 large seta.

Legs 1-4 armed and shaped as in female. Free segment of leg 5 23 × 10 μm. Leg 6 represented by 2 setae and 2 spinule-like processes on genital flap (Fig. 43E).

Remarks. Humes (1959) described this species based on four females and a single male associated with *Arca decussata* Sowerby. The present female specimen from *Arca antiquata* L. shows some deviations from the original description as follows:

1) The body is 0.93 mm long (versus 0.804-0.864 mm in the type specimens); 2) the genital double-somite is 115 × 110 μm (versus 96 × 130 μm); 3) the terminal segment of antenna is armed with 3 claws and 4 setae (versus 3 claws and 3 setae); 4) the maxillule is armed with 3 setae and 1 setiform process (versus 2 setae and 1 process); 5) the maxilliped is armed with setae on the terminal segment (versus naked, without setae); 6) the third endopodal segment of leg 1 is armed with 1 spine and 5 setae (versus 1 spine and 4 setae). The above discrepancies are thought to be artifacts. The characteristic forms of the antenna and maxilliped, and in particular the form of mandible which is curved distally in a right angle, are well accorded between the specimens from *Arca decussata* and *A. antiquata*.

Family Pseudanthessiidae Humes and Stock, 1972
Genus *Pseudanthessius* Claus, 1889
***Pseudanthessius acutus* n. sp. (Figs. 44, 45)**

Material examined. Holotype (♀) from washings of sponges and compound tunicates, Port Royal, Jamaica, 2 September 1959, collected by A. G. Humes and R. U. Gooding. Holotype (dissected and mounted on a slide) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C.

Female. Body (Fig. 44A) small. Body length 762 μm, and maximum width 354 μm. Prosome ovoid, 500 μm long, with obscure dorsal furrow between cephalosome and first pedigerous somite. Urosome (Fig. 44B) 5-segmented. Fifth pedigerous somite 93 μm wide. Genital double-somite 125 × 98 μm, consisting of broader anterior 3/4 and narrower posterior 1/4 (57 μm wide across this region), with sharply pointed process at posterolateral corner of anterior expansion. Genital area large and located dorsolaterally near midlength of somite. Three free abdominal somites 17 × 52, 11 × 48, and 40 × 48 μm, respectively. Anal somite longer than 2 preceding somites combined, with spinules on posteroventral margin. Caudal ramus 45 × 22 μm (2.05 : 1), straightly directed backward, with spinules on posteroventral margin and 6 setae (Fig. 44C); outer lateral seta spiniform and tipped by seta-like element; longest inner median terminal seta 346 μm; next longest nearby seta 254 μm.

Rostrum beak-like (Fig. 44D). Antennule (Fig. 44E) 217 μm long and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked and some of them very long. Antenna (Fig. 44F) 4-segmented; first and second segments each with 1 seta; small third segment with 1 claw and 2 setae; terminal segment 45 × 20 μm and armed with 3 setae and 4 claws, 2 of latters setiform.

Labrum (Fig. 44G) with long and narrow posterior lobes and deep median incision. Mandible (Fig. 44H) proximally strongly recurved, with tapering gnathobase, 1 pointed transparent process on convex side near base of gnathobase, finely serrated convex margin and spinulated inner margin. Maxillule (Fig. 44I) armed with 3 distal (2 of them with spinules unilaterally) and 1 lateral setae. Maxilla (Fig. 44J) 2-segmented; basal segment unarmed; distal segment with small outer proximal seta, anterior seta bearing minute proximal spinules, and large inner seta bearing dense spinules; distal lash long, with dentate convex margin and proximal row of 6 small denticles. Maxilliped (Fig. 45A) 3-segmented; first segment longest but unarmed; second segment with 2 setae, one of them spiniform, with pectinate distal margin; small terminal segment terminating in long, spiniform process, with 1 spine and 1 seta.

Legs 1-3 with 3-segmented rami (Fig. 45B, C). Leg 4 (Fig. 45E) with 3-segmented exopod and 1-segmented endopod; inner seta on coxa small and naked; endopod with distinct pointed process on outer margin, its 2 terminal spines 75 μm (inner) and 45 μm (outer). Armature formula of legs 1-4 as follows:

Leg 1:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,4; enp. 0-1; 0-1; I,5
Leg 2:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,II,3
Leg 3:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,II,2
Leg 4:	coxa 0-1; basis 1-0;	exp. I-0; I-1; II,I,5; enp. II

Leg 5 represented by posterolateral process on first urosomal somite, bearing 2 plumose setae and 1 spine (58 μm). Leg 6 represented by 1 seta, 1 spinule, and 1 small transformed seta (ovoid, bearing setule) in genital area (Fig. 45F).

Etymology. The specific name *acutus*, Latin meaning "pointed", alludes to the pointed posterolateral process posterior to genital double-somite.

Remarks. About 40 species are known in the genus *Pseudanthessius*. Of these, 11 species are known to have, like *P. acutus*, a pointed process on the outer margin of endopod of leg 4. In six of these 11 species the caudal ramus is distinctly longer than that of *P. acutus*, namely, more than 3.0 times as long as wide. None of the remaining five species (*P. dimorphus* Stock, 1995; *P. exilicornis* Stock and Humes, 1995; *P. obscurus* Scott, 1909; *P. sauvagei* Canu, 1891; *P. tenuis* Nicholls, 1944) has the anal somite which is more than twice as long as the preanal somite (more than three times in *P.*

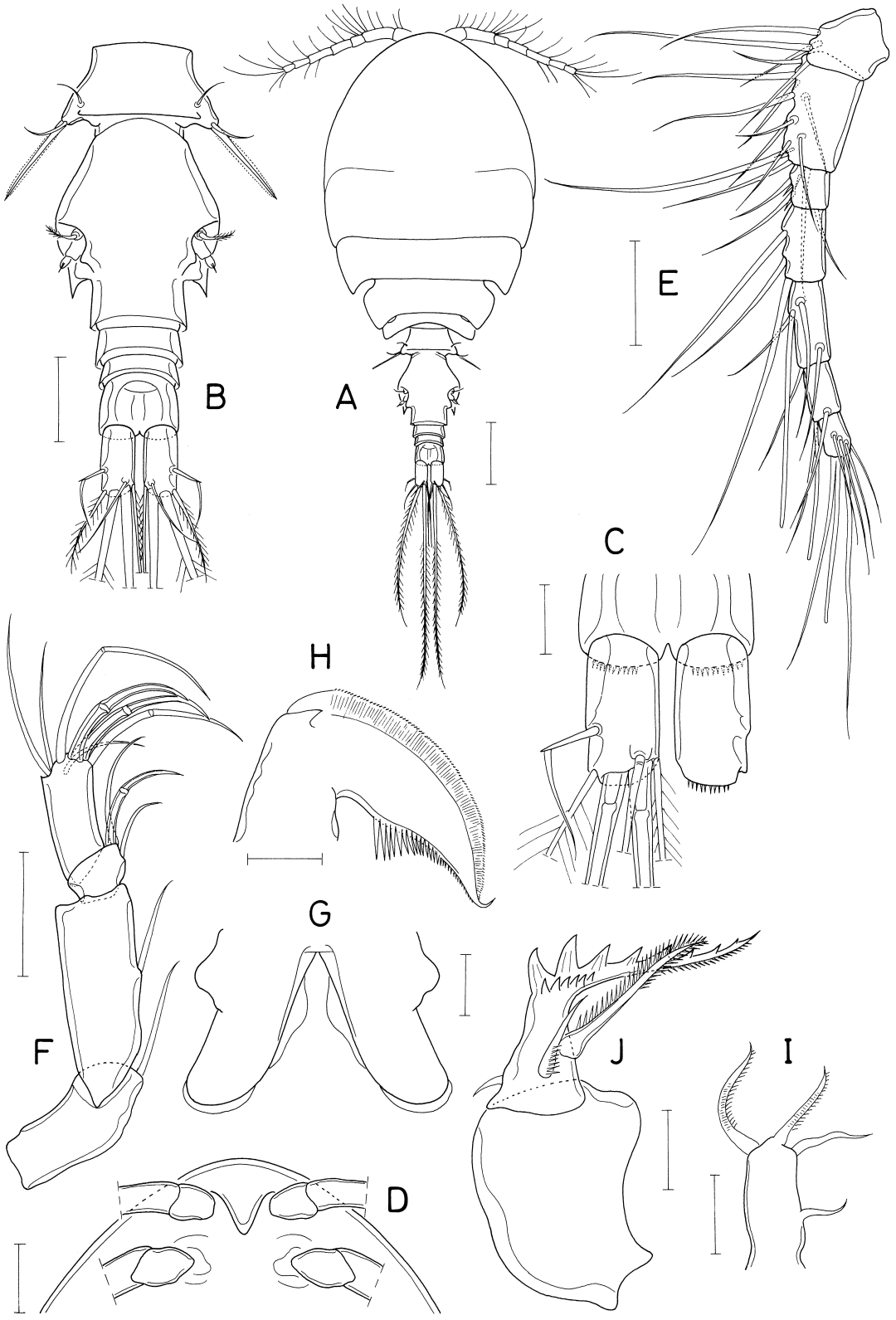

Fig. 44. *Pseudanthessius acutus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, caudal rami, dorsal; D, rostral area, ventral; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scales: A, 0.1 mm; B, D-F, 0.05 mm; C, G-J, 0.02 mm.

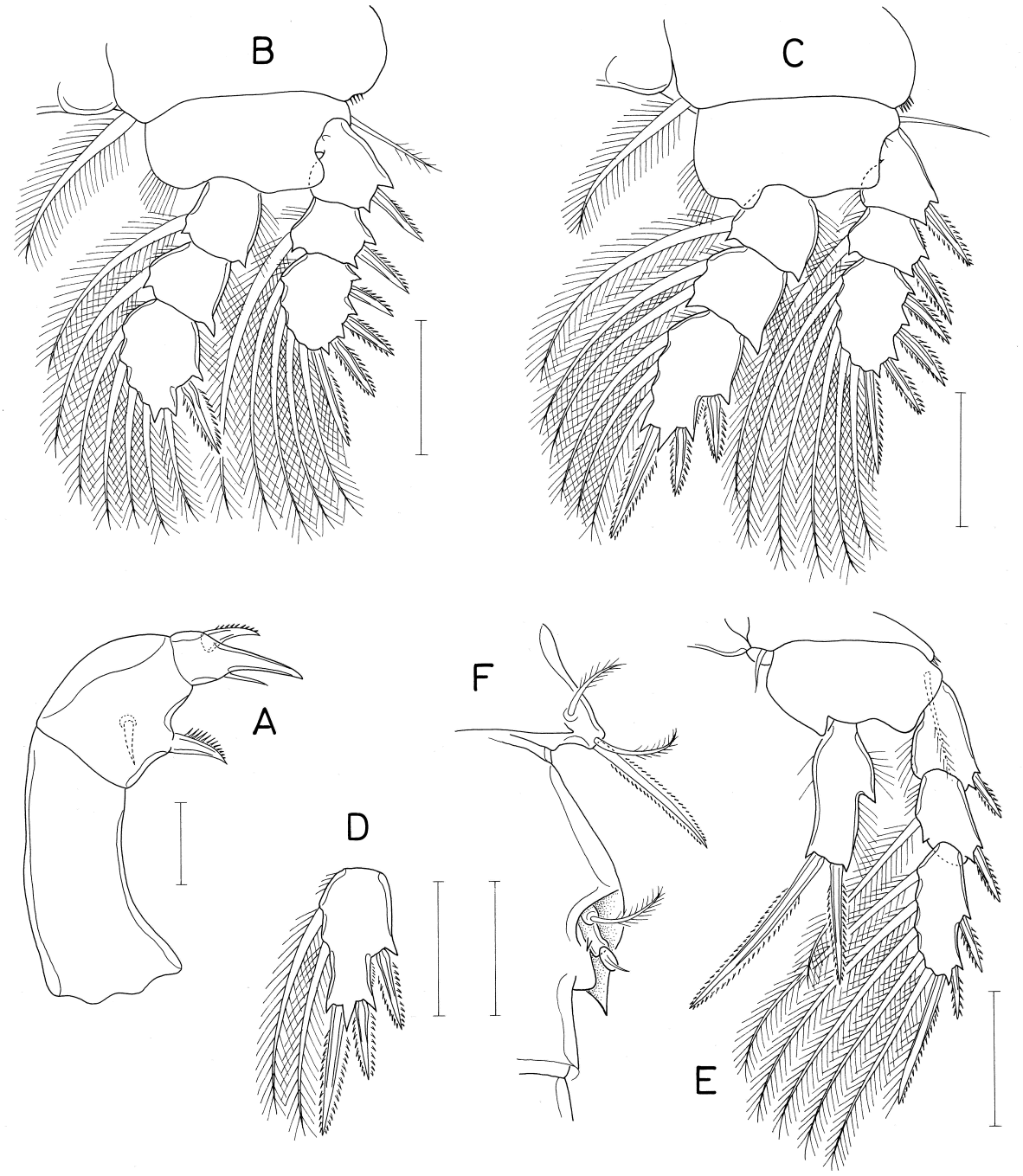

Fig. 45. *Pseudanthessius acutus* n. sp., female. A, maxilliped; B, leg 1; C, leg 2; D, third endopodal segment of leg 3; E, leg 4; F, right side of first two urosomal somites, dorsal. Scales: A, 0.02 mm; B-F, 0.05 mm.

acutus). This feature in combination with the presence of a pointed large lateral process on the genital double-somite may typify the new species.

Pseudanthessius angularis (Humes and Ho, 1970), which is known as an associate of crinoids in Madagascar (Humes and Ho, 1970), has lateral angles on the genital double-somite, as the new species. But *P. angularis* is not similar to the new species in other respects, for examples, the caudal rami and the two distal setae on the endopod of leg 4 are much shorter than those of *P. angulatus*.

***Pseudanthessius asper* n. sp. (Figs. 46, 47)**

Material examined. Two ♀♀ from a sponge of *Agelas* sp., in the depth of 23 m, south of Tany Kely, Near Nosy Bé, Madagascar, 30 July 1967, collected by A. G. Humes. Holotype (♀) has been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratype (1♀) is kept in the collection of the author.

Female. Body (Fig. 46A, B) with greatly expanded prosome, narrow urosome, and numerous small pits on dorsal surface. Body length of dissected paratype 1.25 mm (holotype 1.22 mm), and maximum width 695 μm. Prosome 715 μm long and consisting of cephalothorax and 3 pedigerous somites. Cephalothorax much wider than long, its posterolateral corners slightly extending posterolaterally. Second pedigerous somite gradually narrowed posteriorly. Third pedigerous somite broadened distally, with spherical posteromedian tubercle. Fourth pedigerous somite markedly narrower than anterior somites, with roundly expanded posterolateral corners and large posteromedian tubercle. Urosome (Fig. 46C) 5-segmented. Fifth pedigerous somite 158 μm wide; Genital double-somite 183 × 165 μm, consisting of laterally expanded anterior 2/3 and narrower posterior 1/3 (113 μm wide across this area). Genital areas large and located dorsally near midlength of somite. Three free abdominal somites 52 × 106, 34 × 104, and 87 × 115 μm, respectively. Anal somite with broad posteromedian invagination. Caudal rami widely separated from each other by distance of more than their width, each ramus 120 × 35 μm (3.43 : 1), with 6 setae; outer lateral seta naked and located at 56% region of ramus; dorsal and outermost terminal setae naked, other 3 terminal setae weakly plumose.

Rostrum roundly projected posteriorly (Fig. 46D). Antennule (Fig. 46E) 348 μm long and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 46F) rather stout and 4-segmented, with armature formula 1, 1, 3, and 5+2 claws; terminal segment about 70 × 41 μm, its 2 terminal claws very unequal in size.

Labrum (Fig. 46G) with long, tapering and divergent posterior lobes and deep median incision. Mandible (Fig. 46H) with 1 distinct, claw-like process on convex side; gnathobase strongly tapering and continued to slender, long, whip-like lash. Maxillule (Fig. 46I) armed with 1 setiform lateral process, 1 subdistal seta, and 2 terminal spinule-bearing setae. Maxilla (Fig. 47A) 2-segmented; first segment unarmed; second segment with 3 proximal setae, largest inner one of them with teeth on distal margin; distal lash long and slender, with teeth along convex distal margin and proximally 2 or 3 subsidiary denticles. Maxilliped (Fig. 47B) 3-segmented; largest first segment unarmed; second segment with 1 seta and 1 spinule-bearing spine; third segment extended to large spiniform process, proximally with 1 spine and 1 seta.

Legs 1-3 (Fig. 47C-E) with 3-segmented rami; outer seta on basis of these legs small and naked. Leg 4 (Fig. 47F) with 3-segmented exopod and 1-segmented endopod; inner seta on coxa small and naked; endopod slender and 70 × 17 μm, its 2 terminal spines 86 μm (inner) and 52 μm (outer). Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,4; enp. 0-1; 0-1; I,5
Leg 2: coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,II,3
Leg 3: coxa 0-1; basis 1-0;	exp. I-0; I-1; II,I,5; enp. 0-1; 0-2; I,II,2
Leg 4: coxa 0-1; basis 1-0;	exp. I-0; I-1; II,I,5; enp. II

Leg 5 (Fig. 47G) consisting of weak lateral process on first urosomal somite, bearing 2 naked setae and 1 spine (48 μm). Leg 6 represented by 1 seta, 1 spine bearing small setule, and 1 spiniform process in genital area (Fig. 47H).

Male. Unknown.

Etymology. The specific name *asper*, meaning “rough” in Latin, alludes to the presence of numerous pits on somites, thus giving appearance of the rough body surface.

Remarks. *Pseudanthessius asper* n. sp. can be easily differentiated from all congeners by the following features. It has the numerous pits on body surface, the widely isolated caudal rami, and the unique form of prosome in which the third and fourth pedigerous somites bear a large posteromedian tubercle on dorsal surface, the cephalothorax overhangs the second pedigerous somite, and the posterolateral corners of third and fourth pedigerous somites are pronounced. The presence of a distinct scale on the convex side of mandible, the slender endopod of leg 4, and the long anal somite which is more than twice as long as the preanal somite are also diagnostic features of the new species.

***Tubiporicola* n. gen.**

Diagnosis (female). Body cyclopiform. Urosome 5-segmented. Antennule 7-segmented. Antenna 4-segmented, with armature formula 1, 1, 2+claw, and 3+4 claws; claws slender and setiform. Labrum with posterior lobes divergent, tapering, and elongate. Mandible strongly recurved and tapering. Maxillule with 3 elements. Maxilla with large inner seta on distal segment. Maxilliped 3-segmented, with 2 setae on third segment. Legs 1-3 with 3 segmented rami. Leg 4 with 3-segmented exopod and 1-segmented endopod bearing 2 terminal spines. Leg 5 with free segment bearing 1 seta and 1 spine terminally.

Etymology. The generic name *Tubiporicola* is derived from the generic name of the host *Tubipora* and the Latin *colo* (to

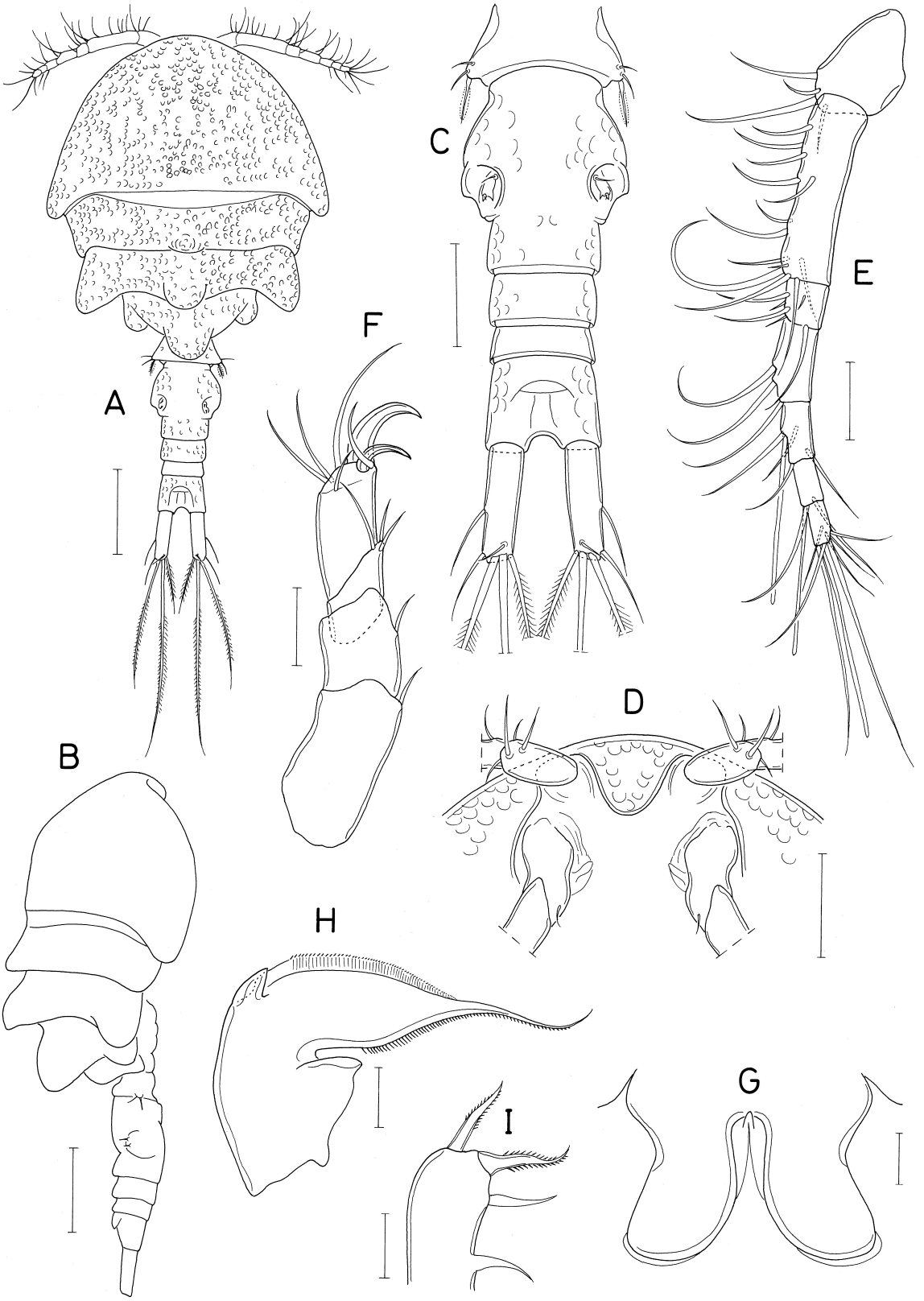

Fig. 46. *Pseudanthessius asper* n. sp., female. A, habitus, dorsal; B, urosome, lateral; C, urosome, dorsal; D, rostral area, ventral; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scales: A, B, 0.2 mm; C, D, 0.1 mm; E, F, 0.05 mm; G-I, 0.02 mm.

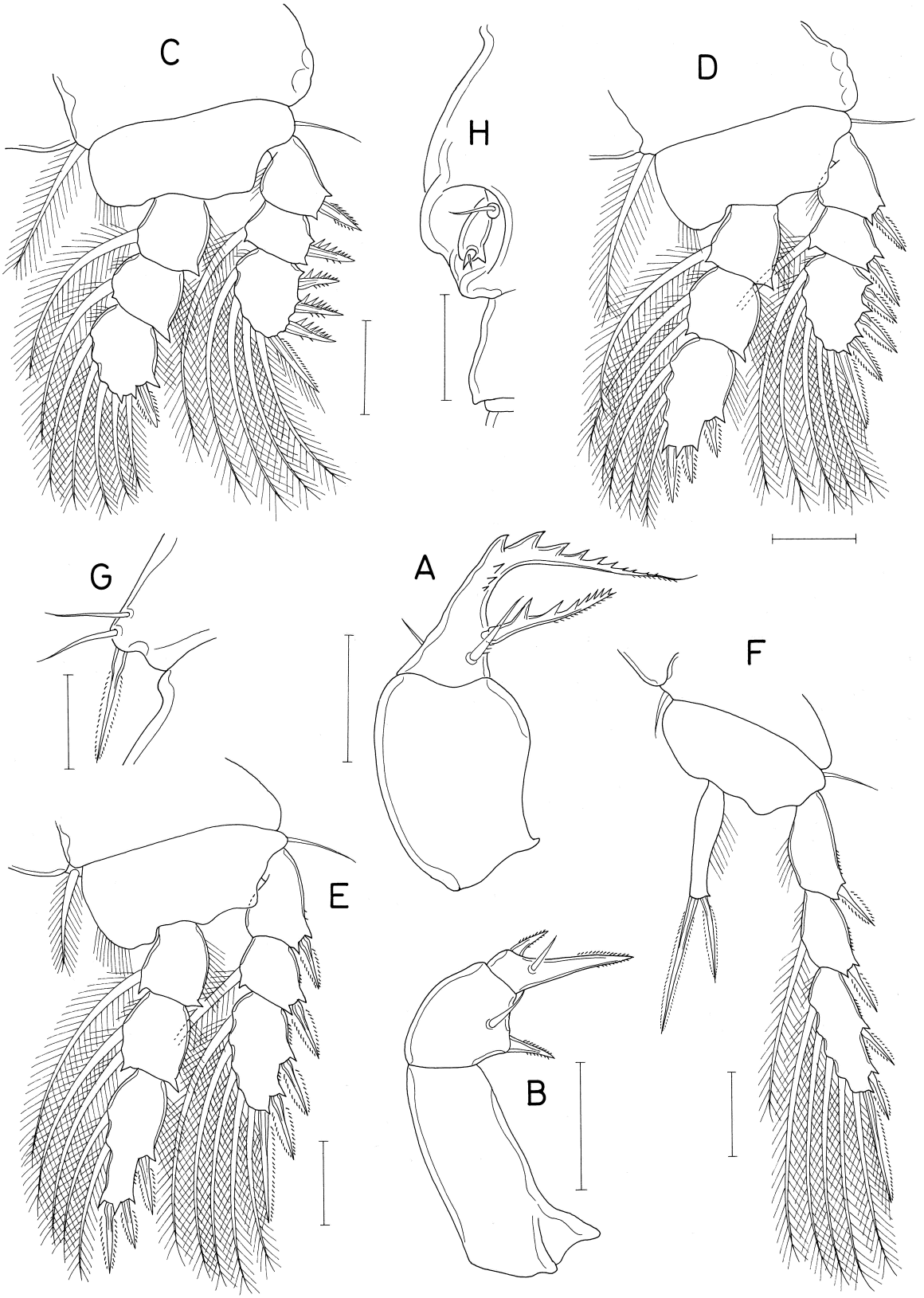

Fig. 47. *Pseudanthessius asper* n. sp., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5; H, left genital area. Scales: 0.05 mm for all.

inhabit). Gender is masculine.

Type species. *Tubiporicola inflatus* n. sp.

Remarks. The familial position of this new genus is unclear between the families Sabelliphilidae and Pseudanthessiidae. The form of mandible, which is usually very important in the taxonomy of the lichomolgoid families, and the shape of labrum of *Tubiporicola* are hardly usable in the determination of its familial position because of close similarities of these appendages between some members of the two families. Although the new genus has a free segment on leg 5, which is an unusual feature for the Pseudanthessiidae, it is determined to place in that family on the basis of the morphology that the antenna bears three elements (not four) on the third segment and leg 4 carries a single-segmented endopod.

Among five genera known in the Pseudanthessiidae (Humes and Boxshall, 1996), only *Sipadania* Humes and Lane, 1993 can be compared with *Tubiporicola* n. gen., because it has a free segment on leg 5, as the new genus. However, *Tubiporicola* cannot be placed in a same genus with *Sipadania*, because the latter genus has a two-segmented endopod of leg 4 and two strong terminal claws on the antenna.

The primary hosts of pseudanthessiids are echinoderms. Therefore, it is unusual to record the new genus from a scleractinian coral.

Tubiporicola inflatus n. sp. (Figs. 48, 49)

Material examined. Two ♀♀ from the stoloniferan coral *Tubipora musica* L., in the depth of 1 m, Pointe à la Fièvre, Madagascar, 15 June 1967, collected along with *Eupolymniphilus brevicaudatus* n. sp. by A. G. Humes. Holotype (♀) has been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratype (♀) is retained in the collection of the author.

Female. Body (Fig. 48A) with elliptical prosome and slender urosome. Body length of dissected specimen 1.03 mm. Maximum width 522 μm. Prosome 861 μm long. Cephalothorax 600 μm long, more than twice as long as remaining part of prosome, with rudimentary dorsal furrow restricted on both sides. Urosome (Fig. 48B) 5-segmented. Fifth pedigerous somite 145 μm wide. Genital double-somite 188 × 140 μm, weakly tapering posteriorly, with maximum width at anterior 1/3 region; genital area located dorsolaterally at midlength of somite. Three free abdominal somites 43, 30, and 75 μm long, respectively. Anal somite as long as 2 preceding somites combined, with spinules on posteroventral margin. Caudal ramus (Fig. 48C) slightly broadened distally, 84 × 30 μm (2.80 : 1), with 6 setae; dorsal seta located at 72% region of ramus and naked; outermost terminal seta proximally stiff, spiniform and plumose, and tipped by setule; inner dorsal seta tipped on digitiform process; 2 median terminal setae very long, 885 μm (inner) and 678 μm (outer).

Rostrum small, short, and strongly tapering, with angular posterior apex (Fig. 48D). Antennule (Fig. 48E) 337 μm long and 7-segmented, with armature formula 3, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; first and second segment broader than remaining segments; all setae naked, but many of them very long; aesthetascs relatively short. Antenna (Fig. 48F) 4-segmented and slender; first segment with 1 long inner distal seta; second segment with fine spinules along outer margin and 1 seta at distal 1/3 region of inner margin; small third segment with 1 slender claw and 2 setae; terminal segment 87 × 23 μm and armed with 4 slender claws and 3 small setae.

Labrum (Fig. 48G) with divergent posterior lobes and deep median incision; each lobe distinctly longer than wide and tapering. Mandible (Fig. 48H) strongly recurved and tapering; convex side with 1 claw-like element; concave margin with 8 irregularly-directed spines and fine spinules. Maxillule (Fig. 49A) proximally narrowed and armed with 2 unequal apical setae and 1 small lateral seta. Maxilla (Fig. 49B) with unarmed proximal segment; distal segment with small proximal seta, spinule-bearing anterior seta, large denticulate inner seta, and large, claw-like distal process; distal lash demarcated from distal segment and elongate, with denticulate outer margin and minute spinule-bearing inner margin. Maxilliped (Fig. 49C) 3-segmented; first segment largest but unarmed; second segment expanded in middle, with 2 remotely separated, unequal setae; third segment slender, 55 μm long, and tapering, with 2 proximal setae and subdistal spinules.

Legs 1-3 with 3-segmented rami (Fig. 49D, E). Leg 4 (Fig. 49G) with 3-segmented exopod and 1-segmented endopod; inner seta on coxa small and naked; endopod 75 × 27 μm, with acutely pointed small process on outer margin and terminally with 2 large spines of 90 μm (inner) and 70 μm (outer) long. Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,5
Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,3
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,2
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. II

Leg 5 consisting of free segment and plumose dorsolateral seta on fifth pedigerous somite (Fig. 49H); free segment 54 μm long, with large, process-like inner proximal extension (free segment 53 μm wide including this extension) and terminally 1 naked seta (62 μm) and 1 large serrate spine (126 μm). Leg 6 represented by 1 plumose seta, 1 smaller naked seta and 1 minute spinule-like process in genital area (Fig. 49H).

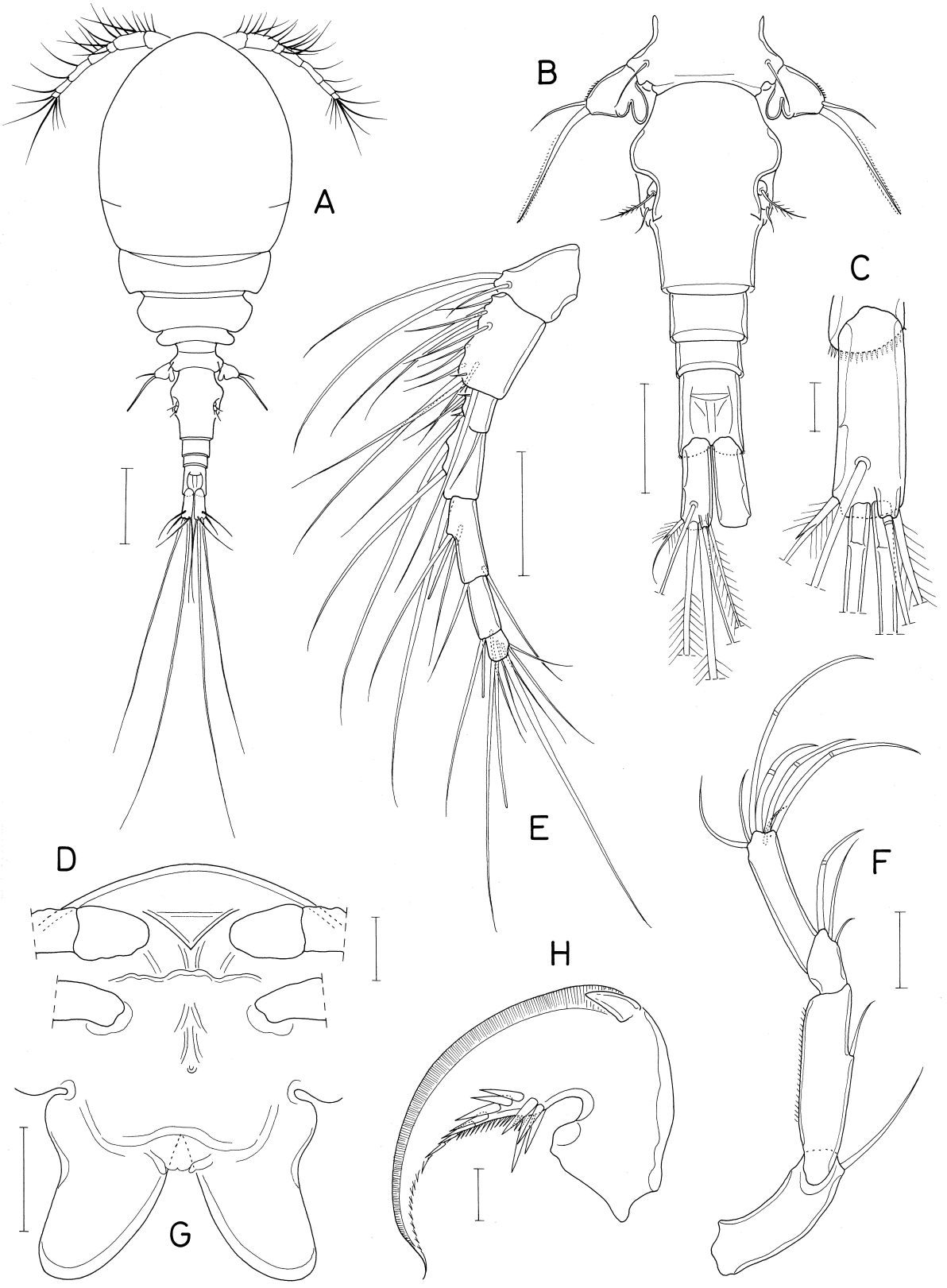

Fig. 48. *Tubiporicola inflatus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, dorsal; D, rostral area, ventral; E, antennule; F, antenna; G, labrum; H, mandible. Scales: A, 0.2 mm; B, E, 0.1 mm; C, H, 0.02 mm; D, F, G, 0.05 mm.

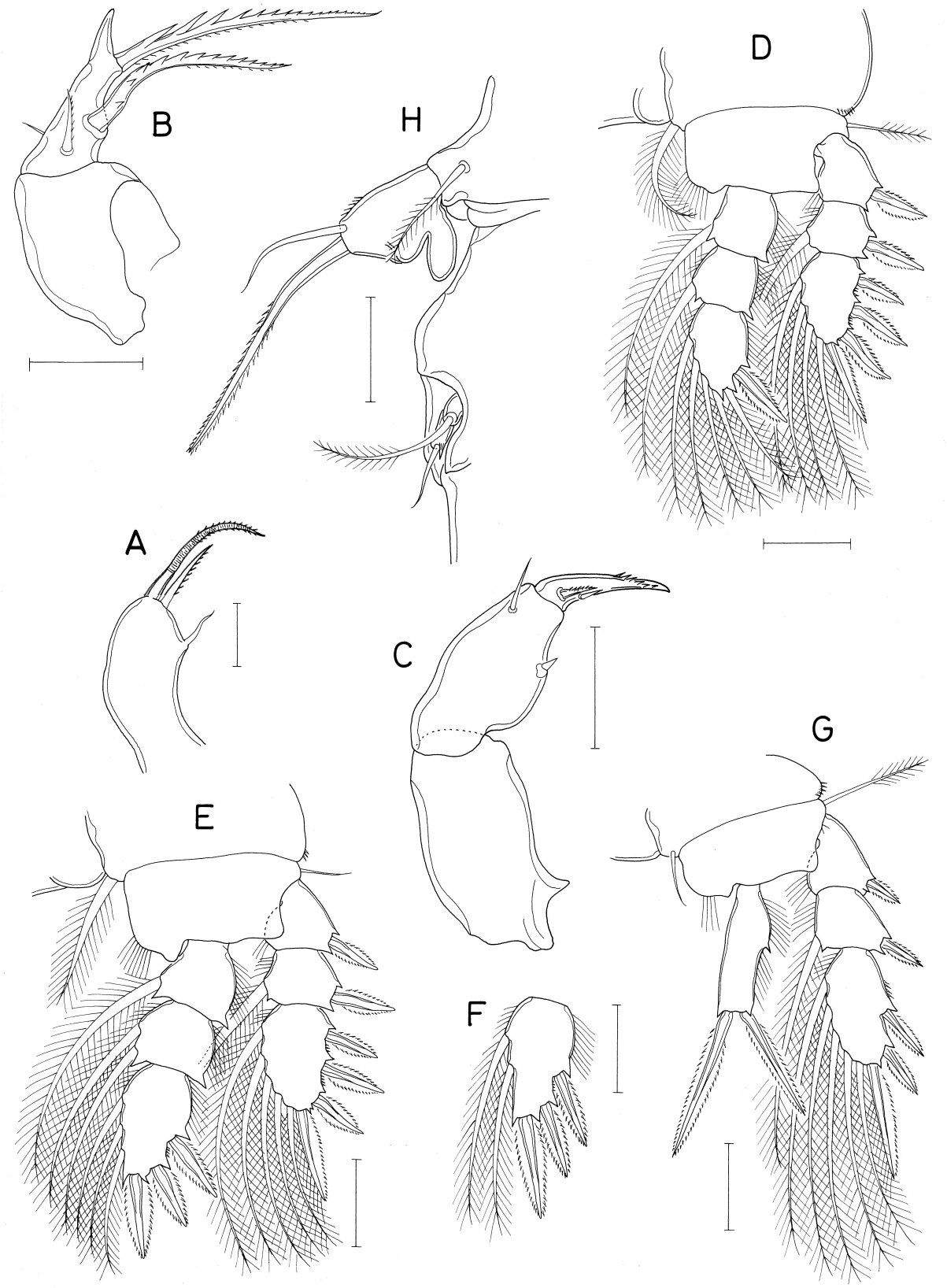

Fig. 49. *Tubiporicola inflatus* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, third endopodal segment of leg 3; G, leg 4; H, left side of first two urosomal somites, dorsal. Scales: A, 0.02 mm; B-H, 0.05 mm.

Male. Unknown.

Etymology. The specific name *inflatus* alludes to the presence of a large inner inflation on the free segment of leg 5.

Family Rhynchomolgidae Humes and Stock, 1972

Genus *Acanthomolgus* Humes and Stock, 1972

***Acanthomolgus tenuispinatus* n. sp. (Figs. 50-52)**

Material examined. Thirty-two ♀♀, 23♂♂ from the alcyonacean coral *Nephthea galbuloides* Verseveldt, in the depth of 25 m, south of Tany Kely, Madagascar, 14 August 1967, collected by A. G. Humes. Holotype (♀), allotype (♂), and paratypes (30♀♀, 21♂♂) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1♀, 1♂) are retained in the collection of the author.

Female. Body (Fig. 50A) with broad prosome and small urosome. Mean body length 770 μm (750-790 μm), based on 8 specimens. Body length of dissected specimen 781 μm, and maximum width 404 μm. Prosome 585 μm long, occupying more than 70% of body length. Cephalothorax nearly globular, divided into cephosome and first pedigerous somite by weak dorsal furrow. Urosome (Fig. 50B) 5-segmented. Fifth pedigerous somite 102 μm wide. Genital double-somite 107 × 102 μm, consisting of laterally expanded anterior part and short, narrower posterior part (65 μm wide across this area); genital areas large and located dorsally at midlength of somite. Three free abdominal somites much wider than long, 17 × 58, 12 × 57, and 28 × 55 μm, respectively. Anal somite with spinules along posteroventral margin. Caudal ramus 25 × 22 μm (1.14 : 1), with spinules on convex posteroventral margin and 6 setae (Fig. 50C); longest inner median terminal seta 385 μm, and next longest outer median terminal seta 296 μm; inner dorsal, outer lateral, and outermost terminal setae naked, other 3 setae plumose.

Rostrum roundly projected posteriorly (Fig. 50D). Antennule slender and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 50F) 4-segmented, with armature formula 1, 1, 3, and 5+2 claws; first segment 60 × 33 μm; second segment 75 × 34 μm, with spinules on outer margin and near base of inner seta; terminal segment 95 × 18 μm (5.28 : 1), one of its small terminal setae scalpel-like; 2 terminal claws slender and long, 95 μm and 85 μm, respectively.

Labrum (Fig. 50G) with broad posterior lobes. Mandible (Fig. 50H) with deep inner proximal notch, slightly convex inner margin bearing row of spinules; convex side slightly protruded, proximally with oblique row of several spinules; distal lash elongate and thin, with spinules on margins. Paragnath as setiferous lobe (Fig. 50G). Maxillule (Fig. 50I) with 3 terminal (1 small and 2 equally large) and 1 subdistal setae. Maxilla (Fig. 51A) with unarmed first segment; second segment with small proximal seta, minute spinule-bearing anterior seta, and spinule-bearing inner seta; distal lash long, with dentate convex margin. Maxilliped (Fig. 51B) 3-segmented; first segment with 1 patch of spinules distally; second segment with 2 setae (36 and 14 μm long, respectively); terminal segment with 1 spine and 2 unequal setae.

Legs 1-3 with 3-segmented rami (Fig. 51C, D). Leg 4 (Fig. 51F) with 3-segmented exopod and 2-segmented endopod; inner seta on coxa very small, obscure; inner spine on first endopodal segment 22 μm long; second endopodal segment 61 × 19 μm, its 2 terminal spines 67 μm (inner) and 33 μm (outer). Armature formula of legs 1-4 as follows:

Leg 1:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,4; enp. 0-1; 0-1; I,5
Leg 2:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,II,3
Leg 3:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,II,2
Leg 4:	coxa 0-1; basis 1-0;	exp. I-0; I-1; II,I,5; enp. 0-I; II

Free segment of leg 5 (Fig. 51G) 110 μm long, with proximal expansion bearing sharply pointed process, narrowed region just posterior to proximal expansion, and gradually broadened distal part; outer margin with spinules; terminal margin truncated, with 2 naked setae of 101 μm (inner) and 60 μm (outer), respectively. Leg 6 probably represented by 2 setae and 1 pointed process in genital area (Fig. 51H).

Male. Body (Fig. 52A) narrower than that of female. Body length of dissected specimen 617 μm, and maximum width 219 μm. Prosome 403 μm long. Cephalothorax 257 μm long, with dorsal furrow restricted to both lateral sides. Urosome (Fig. 52B) 6-segmented. Fifth pedigerous somite 64 μm wide. Genital somite large, 134 × 133 μm, and nearly globular. Four abdominal somites small, 17 × 38, 16 × 42, 10 × 41, and 11 × 44 μm, respectively. Caudal ramus 19 × 19 μm.

Rostrum as in female. Antennule with 3 additional aesthetascs: 2 on second and 1 on fourth segments, as indicated by dots in Fig. 33E. Antenna as in female.

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 52C) with unarmed first segment of 81 μm long; second segment 69 μm long and gradually broadened distally, with 2 similar setae and longitudinal row of spinules on inner margin, inner distal corner of this segment extended (Fig. 52D); third segment small and unarmed; terminal claw 141 μm long, with 1 smooth proximal seta.

Leg 1 with third endopodal segment bearing 2 large spines, 5 setae, and more developed terminal process (Fig. 52E). Legs 2-4 as in female. Free segment (Fig. 52F) of leg 5 small, 31 × 9 μm, its 2 terminal setae naked and very unequal in size, 49 and 17 μm long, respectively. Leg 6 represented

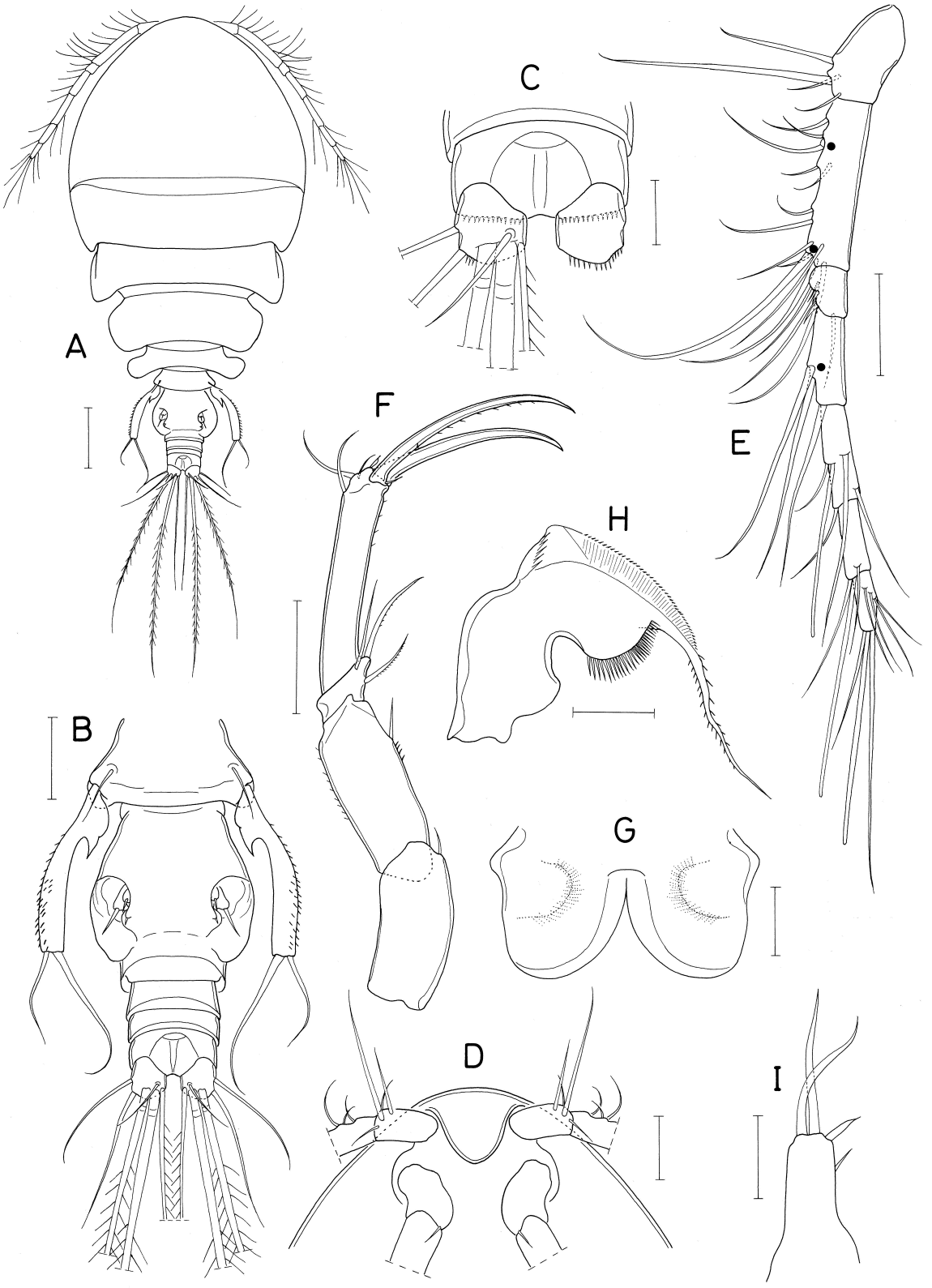

Fig. 50. *Acanthomolgus tenuispinatus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, anal somite and caudal rami, dorsal; D, rostral area, ventral; E, antennule (dots indicating places of additional aesthetascs in male); F, antenna; G, labrum; H, mandible; I, maxillule. Scales: A, 0.1 mm; B, D-F, 0.05 mm; C, G-I, 0.02 mm.

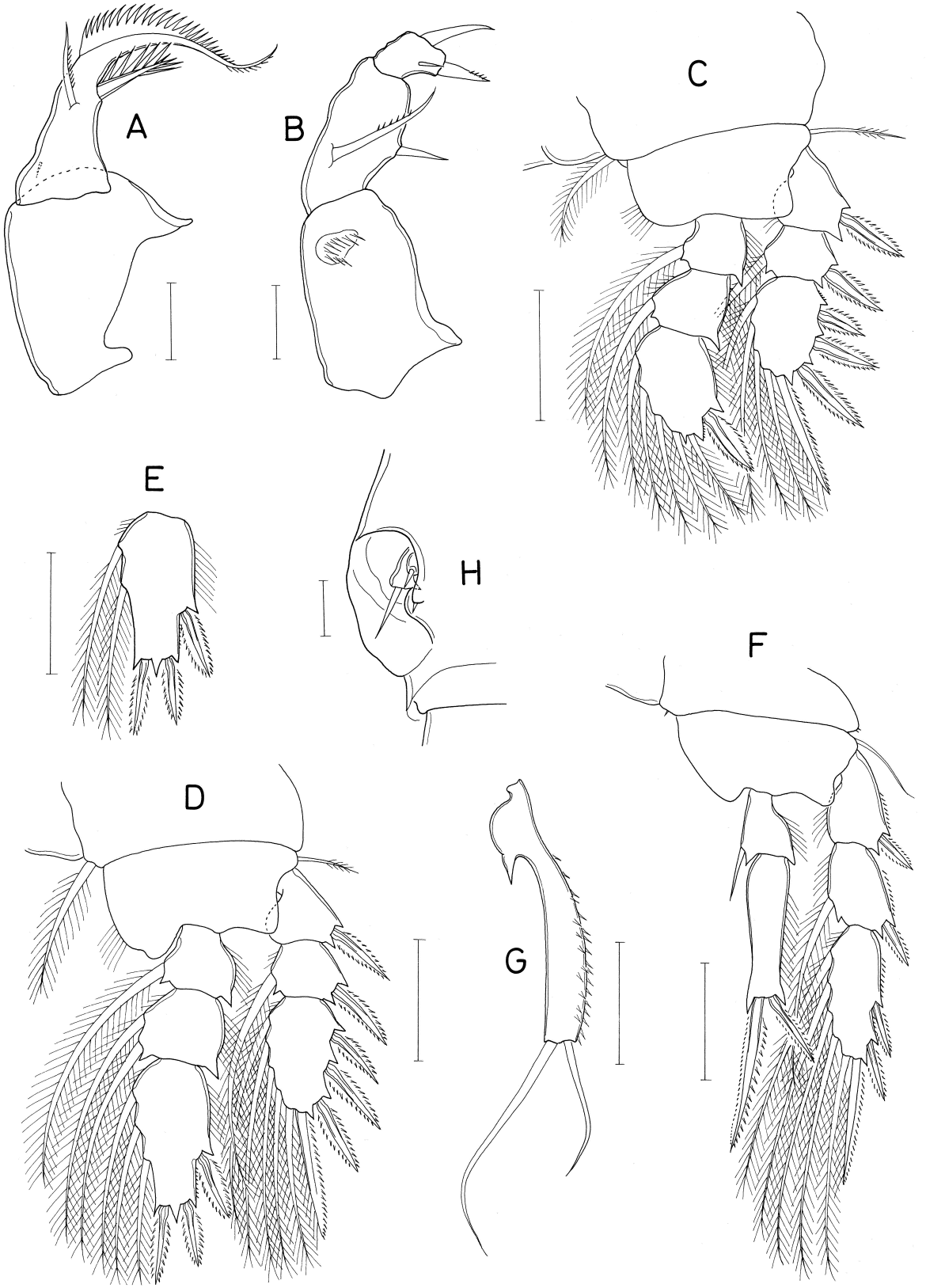

Fig. 51. *Acanthomolgus tenuispinatus* n. sp., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, third endopodal segment of leg 3; F, leg 4; G, free segment of leg 5; H, left genital area, dorsal. Scales: A, B, H, 0.02 mm; C-G, 0.05 mm.

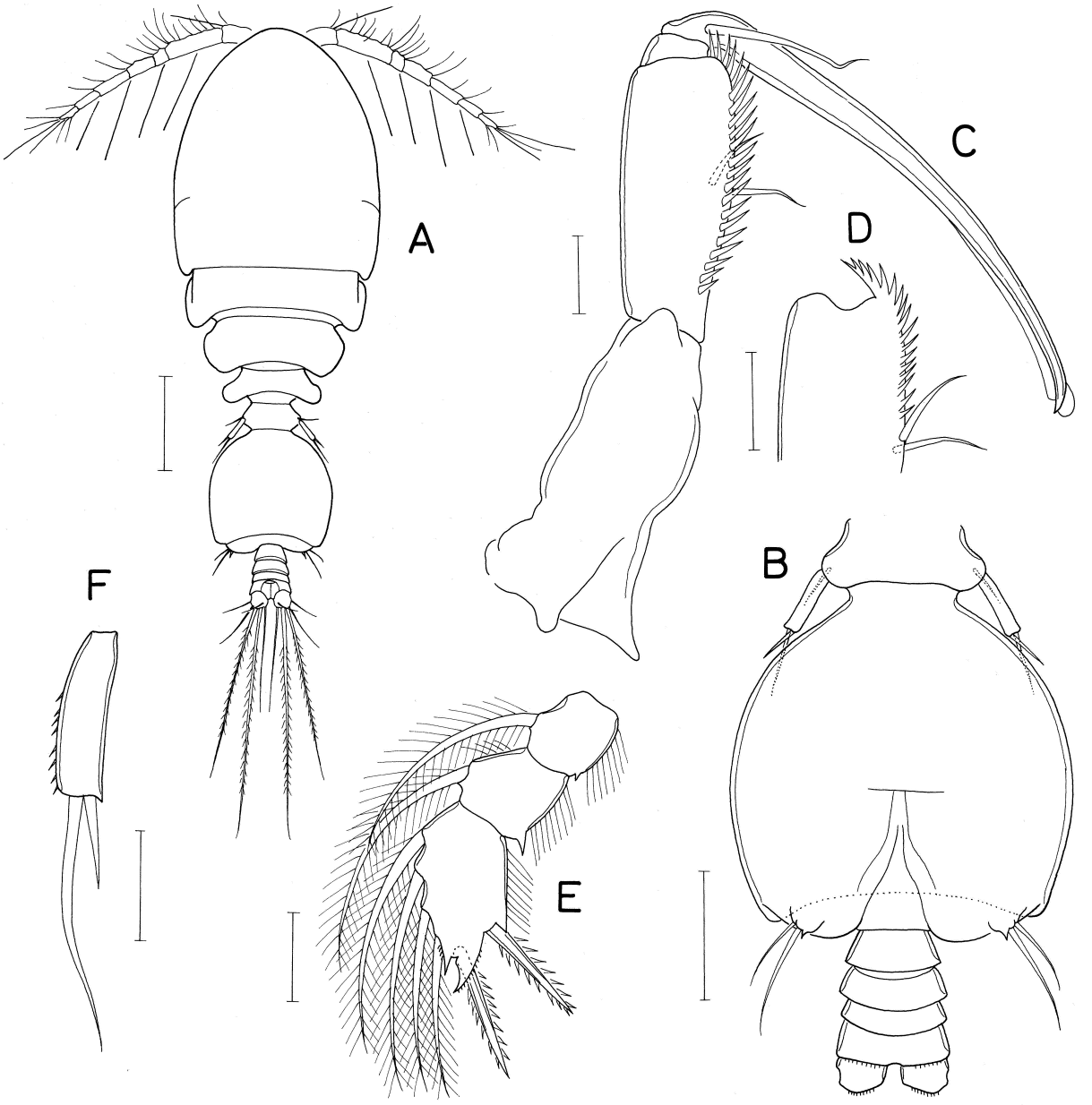

Fig. 52. *Acanthomolgus tenuispinatus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, maxilliped; D, distal part of second segment of maxilliped; E, endopod of leg 1; F, free segment of leg 5. Scales: A, 0.1 mm; B, 0.05 mm; C-F, 0.02 mm.

by 2 unequal setae and small cusp on genital flap (Fig. 52B).

Etymology. The specific name *tenuispinatus* is a combination of the Latin *tenuis* (slender) and *spina* (spine). It alludes to the possession of 2 long terminal spines on the antenna.

Remarks. Boxshall and Halsey (2004) counted 33 species in the genus *Acanthomolgus*. Six additional new species have since been described by Kim (2005a) and Kim (2007a). Among a total of 39 species, only four are known to have, like *A. tenuispinatus* n. sp., the inner proximal, beak-like process on the free segment of leg 5 in the female: *A. arctatipes* Humes, 1974; *A. astrictus* Humes and Stock, 1973; *A. cuneipes* (Humes and Ho, 1968); and *A. longispinifer* (Humes and Ho, 1968). These four species can be differentiated from *A. tenuispinatus* by having the following features different from those of the new species:

Acanthomolgus arctatipes is an associate of the gorgonacean *Echinogorgia sasappo* (Esper) from Madagascar (Humes, 1974). In this species the antenna bears the terminal segment (62 × 14 μm) shorter than that of *A. tenuispinatus* n. sp., its 2 terminal claws (each 42 and 38 μm long) are

distinctly shorter than terminal segment; the distal margin of distal segment of maxilla is very delicately serrated; and the free segment of leg 5 is smaller (86 μm long in the female and 25 μm long in the male) than that of *A. tenuispinatus*.

In *Acanthomolgus astrictus* which is associated with the gorgonacean *Acanthogorgia aspera* Pourtalès in Madagascar (Hume and Stock, 1973), the terminal segment of antenna is 79 × 21 μm (ratio 3.76 : 1), its two terminal claws are 57 and 53 μm long, respectively, and the shorter claw is about twice as thick as the longer; the convex side of mandible is more pronounced; and the free segment of male leg 5 is more slender, 41 × 9 μm (ratio 4.56 : 1).

In *Acanthomolgus cuneipes* which is associated with the alcyonacean *Stereonephthya acaulis* Verseveldt in Madagascar (Humes and Ho, 1968), the terminal segment of antenna is shorter, 74 × 22 μm, its two terminal claws are stout, 43 μm (stouter one) and 46 μm (slender one), respectively; and the free segment of leg 5 is 134 μm long in the female, with a blunt inner proximal process and 51 × 8 μm in the male.

In *Acanthomolgus longispinifer* associated with the gorgonacean *Siphonogorgia pendula* Studer in Madagascar (Humes and Ho, 1968), the terminal segment of antenna is 55 × 23 μm (ratio 2.39 : 1), its two terminal claws are very stout, 39 μm (stouter one) and 44 μm (slender one); the outer spine on the first exopodal segment of leg 1 is very long (44 μm), more than twice as long as the outer spine on the second segment; and the free segment of leg 5 is 106 μm long in the female and 32 × 6 μm in the male.

Genus *Notoxynus* Humes, 1975

***Notoxynus lokobensis* n. sp. (Figs. 53-55)**

Material examined. Three ♀♀, 5♂♂ from the actiniarian *Radianthus ritteri* (Kwietniewski), in the depth of 1.2 m, Pointe Lokobe, Nosy Bé, Madagascar, 25 October 1960, collected by A. G. Humes. Holotype (♀), allotype (♂), and paratypes (1♀, 3♂♂) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1♀, 1♂) are retained in the collection of the author.

Female. Body (Fig. 53A) with broad prosome. Body length of dissected specimen 1.78 mm (other 2 specimens 1.71 and 1.72 mm). Maximum width 720 μm. Prosome 1.01 mm long. Cephalothorax distinctly wider than long, with truncated apex and rudimentary dorsal furrow restricted in sides. Urosome (Fig. 53B) 5-segmented. Fifth pedigerous somite 258 μm wide, distinctly wider than next somite. Genital double-somite 200 × 231 μm, with slightly convex lateral margins. Three free abdominal somites 88 × 153, 67 × 141, and 116 × 125 μm, respectively. Anal somite with 2 tapered projections on posteroventral margin, each near base of caudal ramus (Fig. 53C). Caudal ramus slightly tapering, 200 × 48 μm (4.17 : 1), with 6 setae; all setae shorter than ramus; outer lateral seta located at midlength of outer margin of caudal ramus.

Rostrum blunt and semicircular (Fig. 53D). Antennule (Fig. 53E) 7-segmented, its armature formula 4, 12, 5, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae thin and naked; aesthetascs thin and hardly distinguishable from setae. Antenna (Fig. 53F) 4-segmented, with armature formula 1, 1, 3, and 5+2 claws; second segment longest among segments; terminal segment 52 × 30 μm; 2 terminal claws greatly unequal, larger one about 66 μm long, longer than terminal segment, and smaller one rudimentary, one of terminal setae originated from this small claw.

Labrum (Fig. 53G) with broad and rounded posterior lobes and wide median incision. Mandible (Fig. 53H) with broad inner proximal notch; inner margin straight and oblique to distal lash, with row of large spinules; convex margin slightly protruded; distal lash elongate, as long as remaining part of mandible, with spinules on margins. Paragnath (Fig. 53I) as blunt lobe bearing numerous setules. Maxillule (Fig. 53J) armed apically with 3 simple setae. Maxilla (Fig. 54A) with large but unarmed basal segment; second segment with 3 setae, inner one of them spiniform, bearing spinules; distal lash with dentate convex margin. Maxilliped (Fig. 54B) 3-segmented; first segment large, much wider than long, but unarmed; second segment gradually narrowed distally, with 2 small setae; third segment lobate, with 2 small setae.

Legs 1-3 with 3-segmented rami (Fig. 54C-E); setae on third endopodal segment small. Spines on these legs small and usually thin. Leg 4 (Fig. 57F) with 3-segmented exopod and 2-segmented endopod; second endopodal segment 115 × 67 μm and inflated. Armature formula of legs 1-4 as follows:

Leg 1:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,4; enp. 0-1; 0-1; I,5
Leg 2:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,5; enp. 0-1; 0-2; I,II,3
Leg 3:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,5; enp. 0-1; 0-2; I,II,2
Leg 4:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,5; enp. 0-1; II,1

Free segment of leg 5 (Fig. 54G) 167 × 40 μm (4.18 : 1), broadest in middle, with minute denticles on convex outer margin and terminally 1 simple seta (72 μm) and 1 small spine (38 μm). Leg 6 represented by 2 small setae in genital area (Fig. 54H).

Male. Body narrower than that of female. Body length of dissected specimen 1.61 mm, and maximum width 606 μm. Prosome 853 μm long. Urosome (Fig. 55A) 6-segmented. Fifth pedigerous somite 186 μm wide. Genital somite globular,

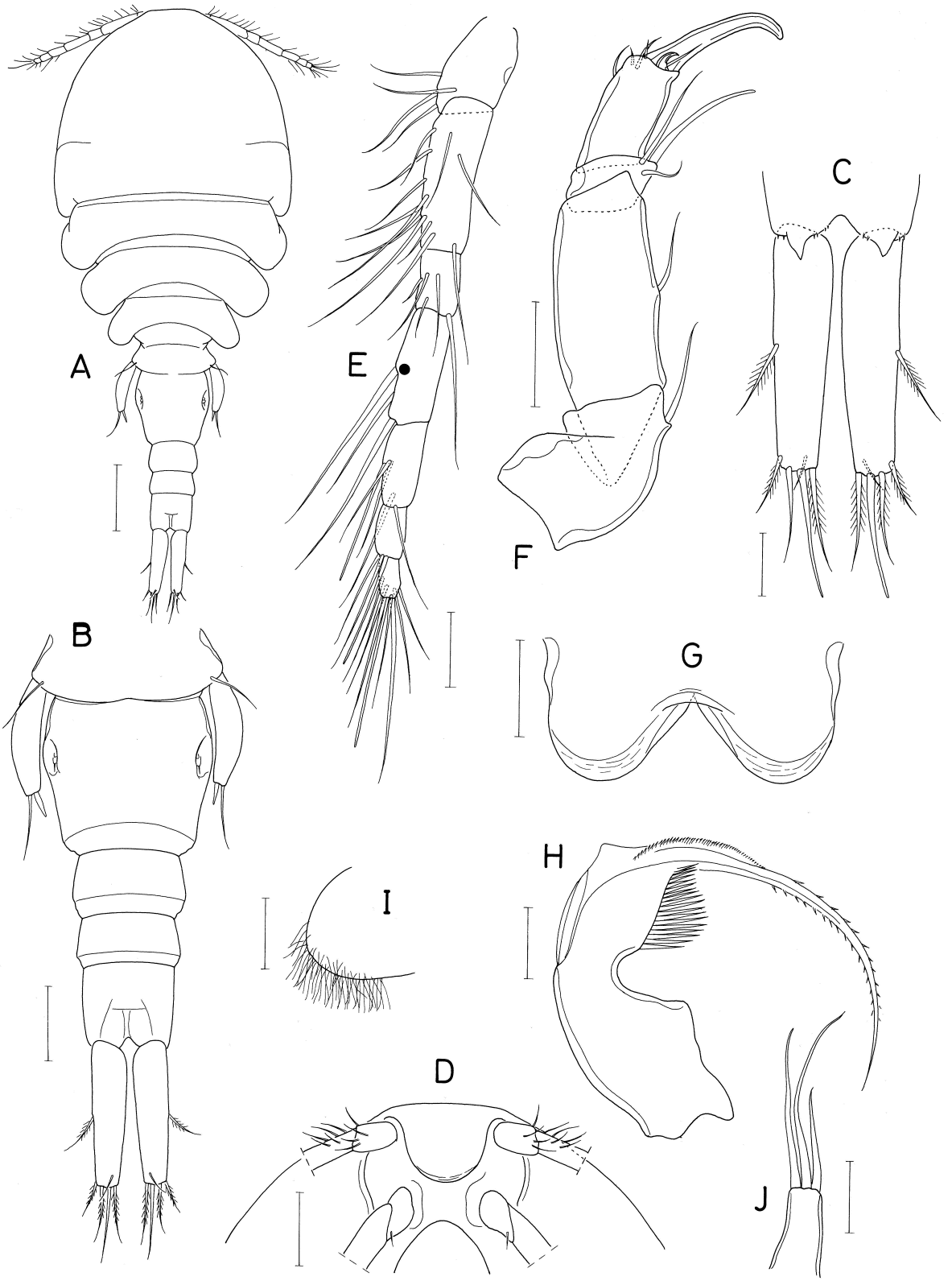

Fig. 53. *Notoxynus lokobensis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, caudal rami, ventral; D, rostral area, ventral; E, antennule (dot indicating place of additional aesthetasc in male); F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scales: A, 0.2 mm; B, D, 0.1 mm; C, E-G, 0.05 mm; H-J, 0.02 mm.

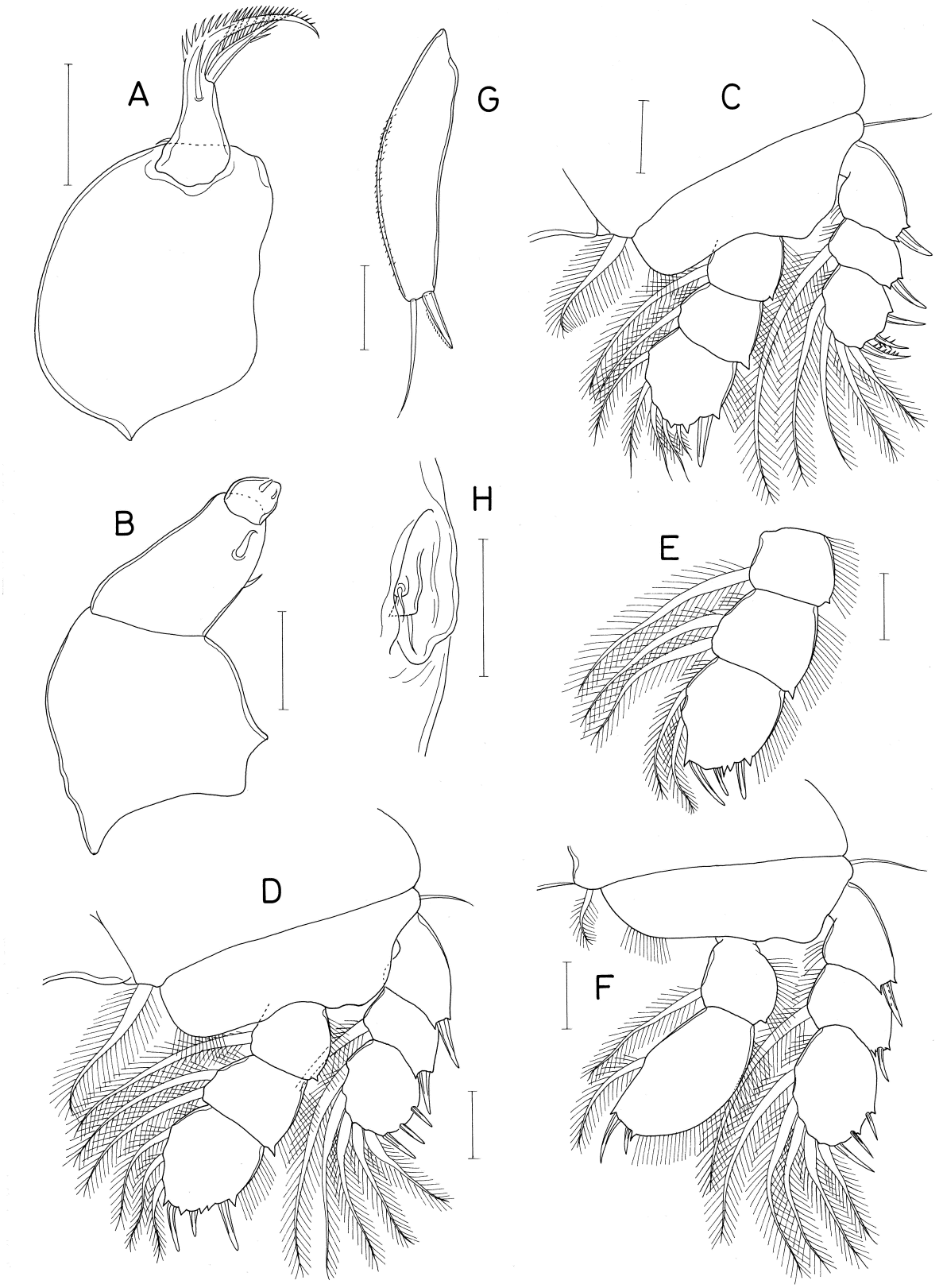

Fig. 54. *Notoxynus lokobensis* n. sp., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, endopod of leg 3; F, leg 4; G, free segment of leg 5; H, right genital area. Scales: 0.05 mm for all.

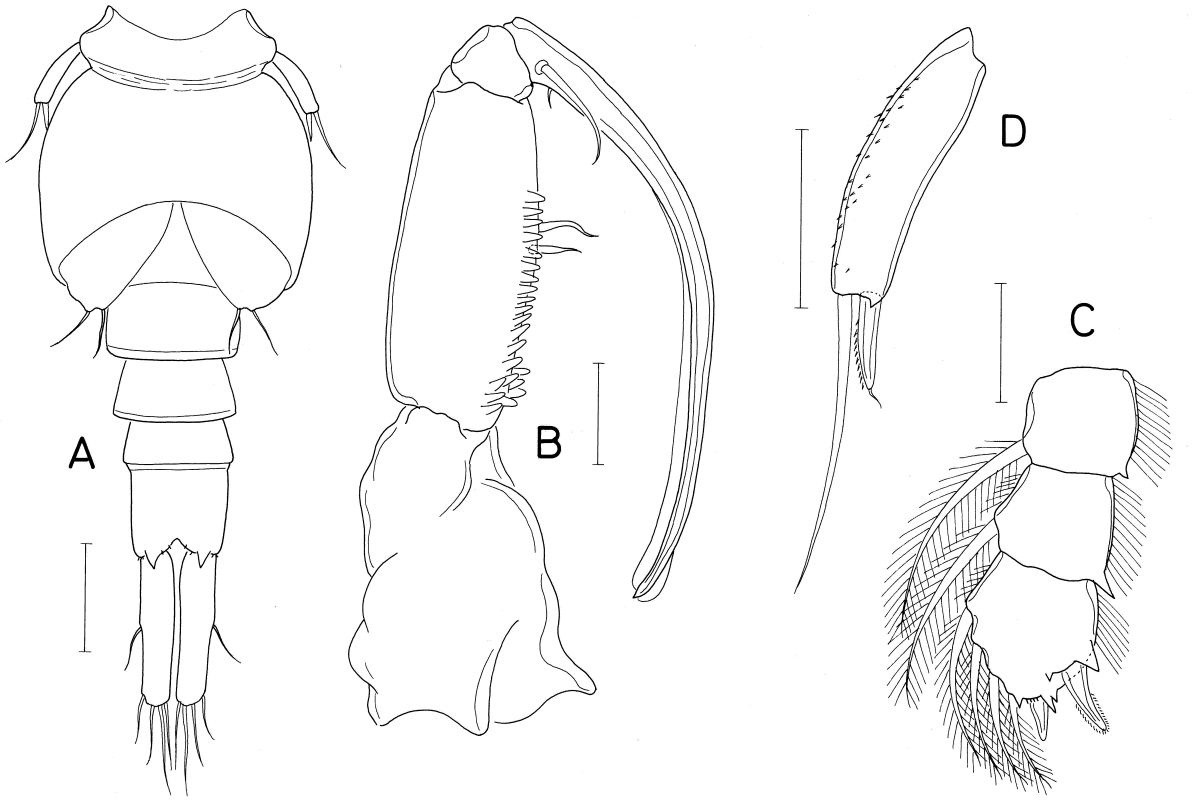

Fig. 55. *Notoxynus lokobensis* n. sp., male. A, urosome, ventral; B, maxilliped; C, endopod of leg 1; D, free segment of leg 5. Scales: A, 0.1 mm; B-D, 0.05 mm.

194 × 258 μm. Four abdominal somites 74 × 130, 56 × 116, 46 × 106, and 80 × 94 μm, respectively. Caudal ramus 140 × 34 μm (4.12 : 1).

Rostrum as in female. Antennule with 1 additional aesthetasc on fourth segment, as indicated by dot in Fig. 53E. Antenna not different from that of female.

Labrum, mandible, paragnath, maxillule, and maxilla as in female. Maxilliped (Fig. 55B) consisting of 3 segments and terminal claw; first segment unarmed; second segment with 2 simple inner setae and spinules on inner margin; third segment unarmed; terminal claw large and strongly curved, proximally with 1 seta and 1 small setule.

Leg 1 with 2 spines and 4 setae on third endopodal segment (Fig. 55C). Legs 2-4 as in female. Free segment of leg 5 81 × 22 μm (3.68 : 1); terminal seta and spine 86 and 27 μm, respectively. Leg 6 represented by 2 small similar setae on genital flap (Fig. 55A).

Etymology. The specific name *lokobensis* is taken from the name of the type locality Pointe Lokobe in Nosy Bé, Madagascar.

Remarks. With removing *Notoxynus tertius* Kim, 2000 to the genus *Lutumidomus* Kim, 2006 (Kim, 2006c), the genus *Notoxynus* comprises currently only 2 species. They are *N. crinitus* Humes, 1982 and *N. mundus* Humes, 1975.

Notoxynus lokobensis n. sp. differs from *N. mundus* in having 3 spines and 4 setae on the third exopodal segment of leg 1 (4 spines and 4 setae in *N. mundus*), 3 spines and 5 setae on the third exopodal segment of legs 2 and 3 (4 spines and 5 setae in *N. mundus*) and the longer free segment of leg 5.

Notoxynus lokobensis is very similar to *N. crinitus*. Both species share many significant characters, such as the tapering posteroventral process on the anal somite, the similar shapes of the body, mandible, maxilliped, and free segment of leg 5 and the identical armature formula of legs. Although difference between the two species is slight, they may be differentiated by the following ways.

The caudal ramus of *N. lokobensis* is 200 × 48 μm, shorter than that of *N. crinitus* (273 × 94 μm, according to Humes, 1982), the free segment of female leg 5 is 167 × 40 μm, more slender than that of *N. crinitus* (125 × 49 μm), the first segment of maxilla is smooth (with hairs in *N. crinitus*), the body is 1.78 mm in largest female specimen which is smaller than *N. crinitus* (1.92-2.24 mm), and the second and third segments of antennule are armed with 12 and 5 setae, respectively (13 and 6, respectively, in *N. crinitus*). These differences seem to be enough to separate them as different species.

Family Sabelliphilidae Gurney, 1927
Genus *Eupolymniphilus* Humes and Boxshall, 1996
***Eupolymniphilus occidentalis* n. sp. (Figs. 56, 57)**

Material examined. Two ♀♀, 1♂ from washings of sponges and compound ascidians, Port Royal, Jamaica, 2 September 1959, collected by A. G. Humes and R. U. Gooding. Holotype (♀) has been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1♀, 1♂) are retained in the collection of the author.

Female. Body (Fig. 56A) with moderately broad prosome and narrow urosome. Body length of dissected specimen 1.17 mm (holotype 1.21 mm), and maximum width 538 μm. Prosome 722 μm long. Cephalosome demarcated from first pedigerous somite by weak dorsal furrow. Second pedigerous somite with pointed posterolateral corners. Urosome (Fig. 56B) 5-segmented. Fifth pedigerous somite 181 μm wide. Genital double-somite 190 × 148 μm, laterally expanded in middle; narrower posterior part 90 μm wide. Genital area large and positioned at midlength of somite. Three free abdominal somites 38 × 83, 25 × 81, and 75 × 77 μm, respectively; all segments unornamented. Caudal ramus (Fig. 56C) quadrangular, 94 × 35 μm (2.69 : 1). Caudal setae 6 in number, consisting of dorsal, dorsodistal, and 4 distal setae; dorsal seta modified, with proximal expansion bearing articulation and tipped with slender setule (Fig. 56C); outer distal seta spiniform proximally and tipped with simple setule.

Rostrum triangular and evenly tapering (Fig. 56D). Antennule (Fig. 56E) 323 μm long and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked and some of them very long. Antenna (Fig. 56F) 4-segmented; first segment with 1 inner distal seta; second segment with 1 seta on inner margin and angular outer distal corner; third segment about 35 × 27 μm, with 1 claw and 3 setae; terminal segment 48 × 25 μm, armed with 4 setae and 3 setiform claws.

Labrum (Fig. 56G) with strongly tapering posterior lobes and deep median incision; each lobe with convex inner margin. Mandible (Fig. 56H) tapering and recurved, with spinules on inner margin and 1 large dentiform scale on convex side followed by finely denticulate convex margin. Maxillule (Fig. 56I) strongly tapering, with 3 apical and 1 lateral setae. Maxilla (Fig. 56J) with unarmed first segment; second segment with small proximal seta, delicately spinulated anterior seta, and large, saw-like inner seta; terminal lash elongate, with denticulate convex margin. Maxilliped (Fig. 57A) 3-segmented; first segment unarmed; second segment largest among segments, with 2 simple setae; distal segment claw-like, with 1 small seta.

Legs 1-4 with 3-segmented rami (Fig. 57B-E). Outer seta on basis of these legs small and naked. Armature formula of legs as follows:

Leg 1: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,5
Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,3
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,I+2
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. 0-1; 0-1; I,II,II

Leg 5 consisting of 1 seta on lateral process of first urosomal somite and free segment; free segment 47 × 24 μm and armed distally with 1 large spine (135 μm) and 1 small seta (Fig. 57F). Leg 6 represented by 2 small setae (both proximally thickened) and 1 spinule in genital area.

Male. Body slender than that of female. Body length 805 μm, and maximum width 282 μm. Prosome with nearly parallel lateral margins. Urosome (Fig. 57G) 6-segmented. Fifth pedigerous somite 112 μm wide. Genital somite 129 × 131 μm, nearly quadrate, with angular posterolateral corners. Four abdominal somites 32 × 60, 26 × 58, 15 × 54, and 42 × 52 μm, respectively. Caudal ramus 58 × 24 μm.

Rostrum as in female. Antennule with 4 additional aesthetascs: 2 on each second and fourth segment, as indicated by dots in Fig. 56E. Antenna as in female.

Labrum, mandible, maxillule, and maxilla also as in female. Maxilliped (Fig. 57H) consisting of 3 segments and terminal claw; first segment unarmed and constricted in middle; second segment with 2 setae (proximal one of them curved) and row of minute spinules; small third segment unarmed; terminal claw large, proximally with 1 broad seta and 1 small setule.

Legs 1-4 as in female. Terminal spine on free segment of leg 5 73 μm. Leg 6 represented by 2 unequal setae on genital flap.

Etymology. The specific name *occidentalis* (Latin meaning "western") refers to the geographical origin (the West Indies) of the new species.

Remarks. Kim (2006d) recognized four species as valid in the genus *Eupolymniphilus*. In *Eupolymniphilus occidentalis* n. sp. the dorsal one of caudal setae is modified to an articulated element, with the expanded proximal part and slender distal seta and the mandible bears a scale on the convex side. These characters of the new species are shared only by *E. orientalis* Kim, 2006 among four congeners. Unlike the new species, *E. orientalis* has a sleeve-like lateral expansion on both sides of the fifth pedigerous somite. The caudal ramus of *E. orientalis* is 1.50 times as long as wide and shorter than the anal somite, whereas it is 2.69 times as long as wide and longer than the anal somite in the new species.

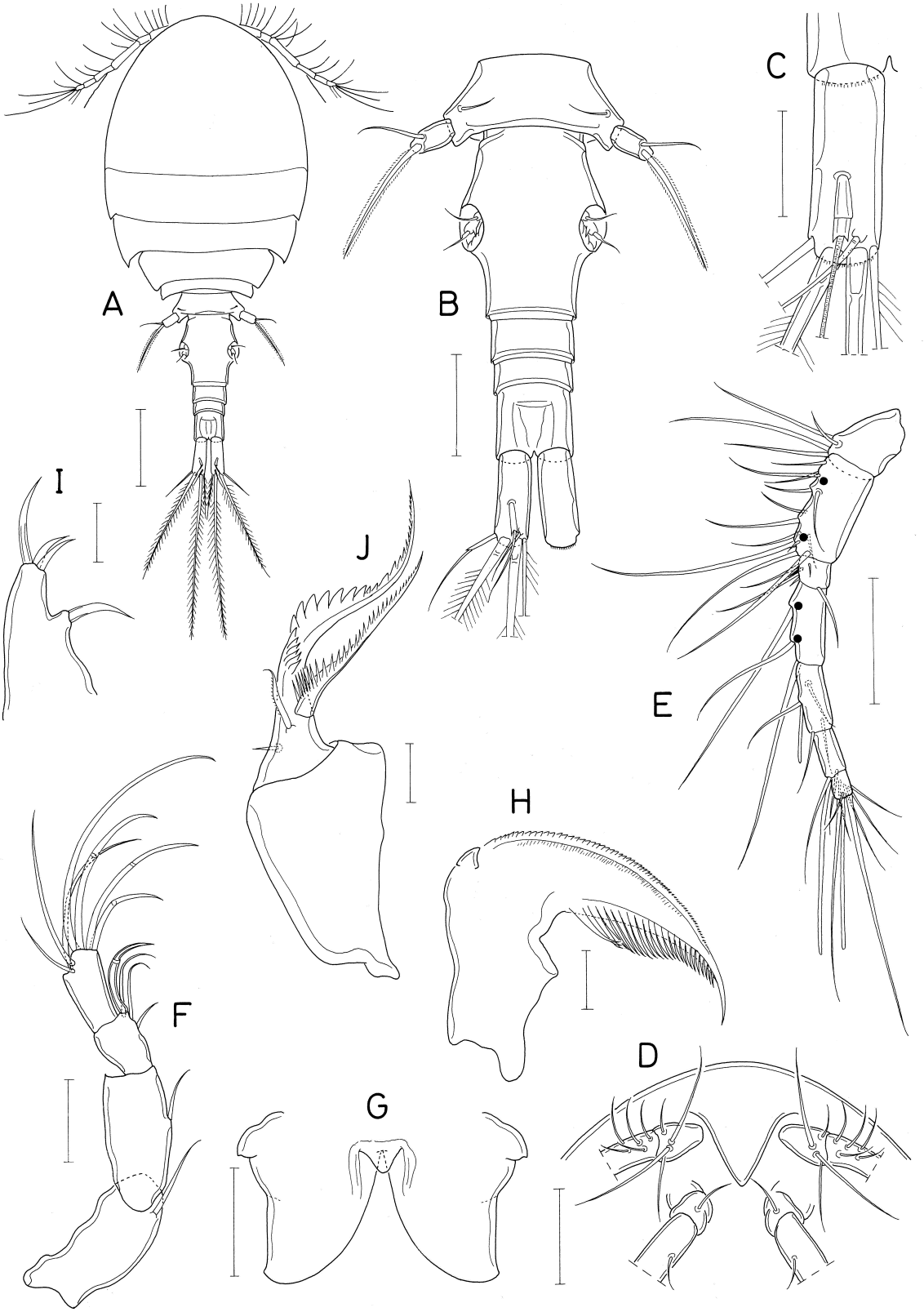

Fig. 56. *Eupolymniphilus occidentalis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, dorsal; D, rostral area, ventral; E, antennule (dots indicating places of additional aesthetascs in male); F, antenna; G, labrum, H, mandible; I, maxillule; J, maxilla. Scales: A, 0.2 mm; B, D, E, 0.1 mm; C, F, G, 0.05 mm; H-J, 0.02 mm.

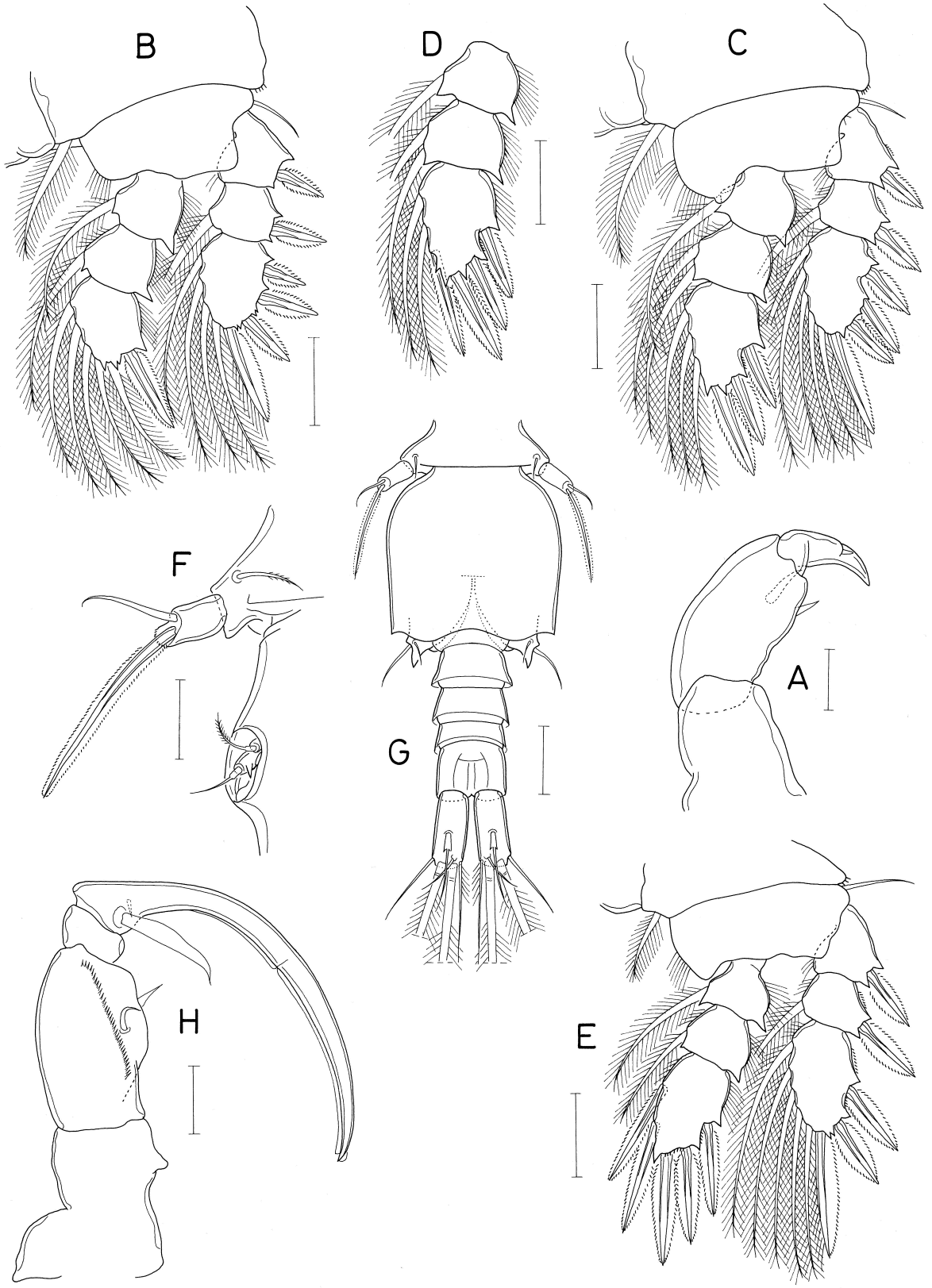

Fig. 57. *Eupolymniphilus occidentalis* n. sp. Female: A, maxilliped; B, leg 1; C, leg 2; D, endopod of leg 3; E, leg 4; F, left side of first two urosomal somites, dorsal. Male: G, urosome, dorsal; H, maxilliped. Scales: A, H, 0.02 mm; B-G, 0.05 mm.

***Eupolymniphilus brevicaudatus* n. sp. (Figs. 58, 59)**

Material examined. Two ♀♀ from the stoloniferan coral *Tubipora musica* L., in the depth of 1 m, Pointe à la Fièvre, Nosy Bé, Madagascar, 15 June 1967, collected by A. G. Humes. Holotype (♀) has been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratype (♀) is retained in the collection of the author.

Female. Body (Fig. 58A) moderately slender. Body length of dissected specimen 1.03 mm. Maximum width 454 μm. Prosome 721 μm long. Cephalothorax divided by dorsal furrow into cephalosome and first pedigerous somite. Lateral margin of epimera of third pedigerous somite rimmed by narrow membrane. Urosome (Fig. 58B) 5-segmented, small, not longer than half length of prosome. Fifth pedigerous somite 155 μm wide, with sleeve-like, posterior extension on both sides near base of free segment of leg 5 (Figs. 58B, 59H). Genital double-somite 154 × 135 μm, consisting of laterally expanded anterior 2/3 and narrower posterior 1/3 (85 μm wide across narrower posterior part). Genital areas located dorsolaterally. Three free abdominal somites 31 × 81, 18 × 77, and 48 × 75 μm, respectively. Posteroventral margin of anal somite ornamented with fine spinules. Caudal ramus (Fig. 58C) 35 × 34 μm (1.03 : 1), distinctly shorter than anal somite, with 6 setae; posteroventral margin equipped with fine spinules; dorsal seta located at center of ramus, rod-shaped proximally and tipped by setule. Innermost and outermost terminal setae with stiff, spiniform proximal part and setiform distal part.

Rostrum distinct and strongly tapering (Fig. 58D). Antennule (Fig. 58E) 356 μm long and 7-segmented, with armature formula 4, 13, 6, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked and several one of them very long. First and second segments wider than other segments. Antenna (Fig. 58F) 4-segmented; first segment with 1 inner distal seta; second segment with 1 inner seta and acutely pointed outer distal corner. Third segment with 1 claw and 3 setae. Fourth segment 55 × 24 μm, with 4 setiform claws, 3 setae, and pointed outer distal corner.

Labrum (Fig. 58G) with long and tapering posterior lobes and deep posteromedian incision. Mandible (Fig. 58H) strongly recurved, with 1 scale on convex side, row of spines on concave margin of blade; blade moderately elongate and evenly tapering; convex margin of lash with numerous minute denticles. Maxillule (Fig. 59A) armed with 3 apical and 1 lateral setae. Maxilla (Fig. 59B) with unarmed first segment; second segment with small proximal seta, delicately spinulated anterior seta, and large spinulated inner seta; inner margin distal to inner seta with spinules; distal lash slender and basally well demarcated from second segment, with dentate outer margin. Maxilliped (Fig. 59C) with unarmed first segment; second segment with convex outer margin, 1 small tubercle proximally on inner margin and 2 subdistal naked setae. Third segment slender, distally tapering, with 1 small seta.

Legs 1-4 with 3-segmented rami (Fig. 59D-G). Armature formula of these legs as follows:

Leg 1:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,4; enp. 0-1; 0-1; I,5
Leg 2:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,II,3
Leg 3:	coxa 0-1; basis 1-0;	exp. I-0; I-1; III,I,5; enp. 0-1; 0-2; I,II,I+2
Leg 4:	coxa 0-1; basis 1-0;	exp. I-0; I-1; II,I,5; enp. 0-1; 0-1; I,II,II

Leg 5 consisting of free segment and 1 plumose dorsolateral seta on fifth pedigerous somite (Fig. 59H); free segment 34 × 17 μm and armed terminally with 1 long spine (120 μm) and 1 naked seta (58 μm). Leg 6 represented in genital area by 2 plumose, proximally thickened setae.

Male. Unknown.

Etymology. The specific name *brevicaudatus* is from the Latin *brevis* (short) and *cauda* (tail). It alludes to the possession of the broad and short caudal rami by the new species.

Remarks. The most striking distinguishing feature of *Eupolymniphilus brevicaudatus* n. sp. is the short caudal rami which is nearly as long as wide. With this feature it can be readily distinguished from all congeners, because the reported shortest caudal ramus, with the ratio of length to width 1.5 : 1, was found in *E. orientalis* Kim, 2006 (Kim, 2006d). The presence of a pair of small, pointed distal processes between bases of two terminal spines on the third endopodal segment of leg 4 also may serve to distinguish this species.

In having a modified dorsal seta on the caudal ramus and a scale on the convex side of mandible, the new species is comparable with *E. orientalis* Kim 2006 and the preceding *E. occidentalis*. It is more similar to *E. orientalis* than to *E. occidentalis* in sharing a sleeve-like posterolateral extension on the fifth pedigerous somite. However, the new species is distinguishable from the both congeners by having the two outstanding features mentioned above.

Family Lamippidae Joliet, 1882

Genus *Enalcyonium* Olsson, 1870

***Enalcyonium robustum* n. sp. (Fig. 60)**

Material examined. Ninety-nine ♀♀ from the alcyonacean coral *Dendronephthya* (*Roxasia*) *regia* Verseveldt, 13° 15′50″ S, 48° 08′35″E, Madagascar, 28 August 1967, collected by A. G. Humes. Holotype (♀) and paratypes (96♀♀) have been deposited in the National Museum of Natural History,

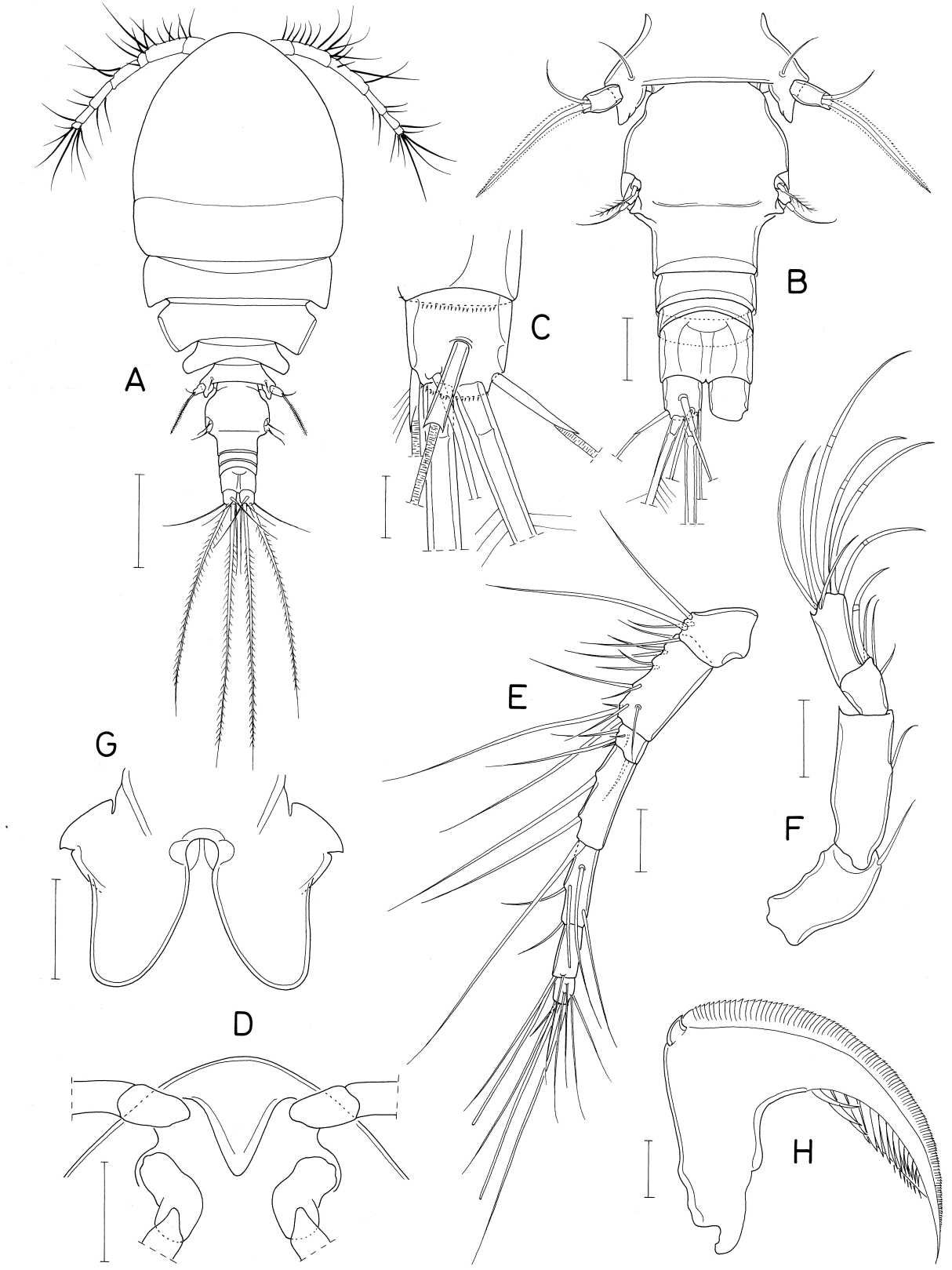

Fig. 58. *Eupolymniphilus brevicaudatus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, dorsal; D, rostral area, ventra; E, antennule; F, antenna; G, labrum; H, mandible. Scales: A, 0.2 mm; B, D-G, 0.05 mm; C, H, 0.02 mm.

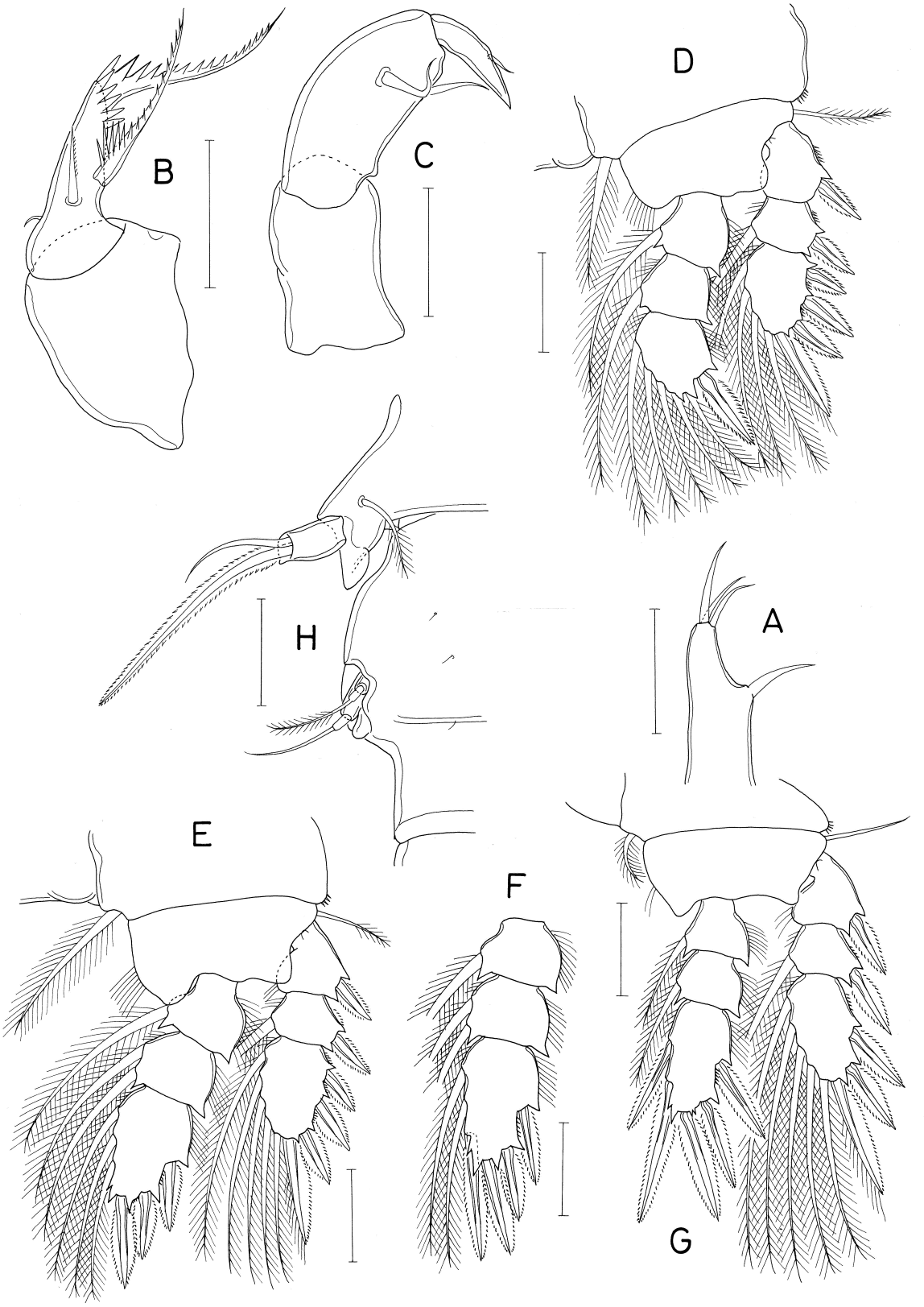

Fig. 59. *Eupolymniphilus brevicaudatus* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, endopod of leg 3; G, leg 4; H, left side of first two urosomal somites, dorsal. Scales: 0.05 mm for all.

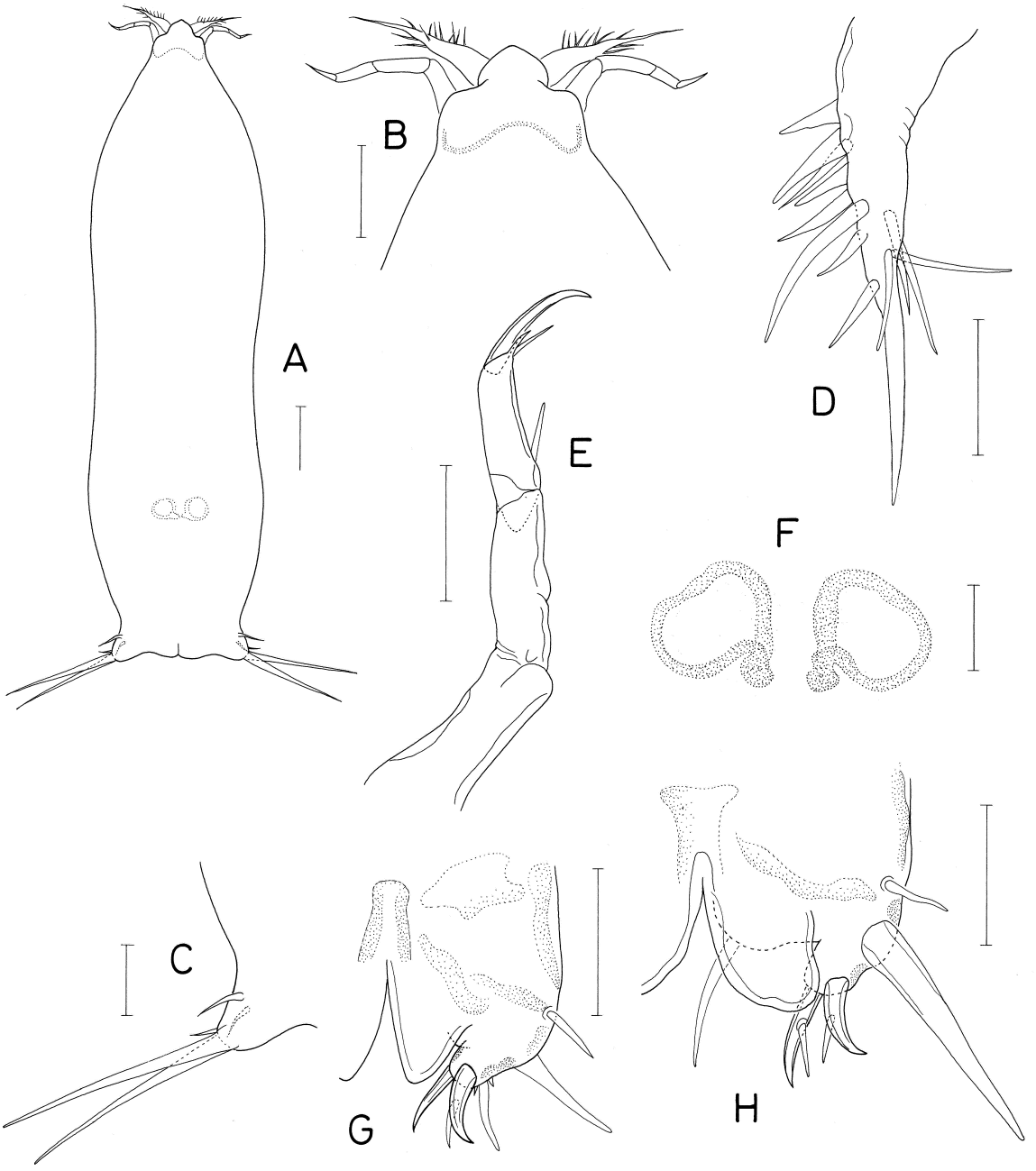

Fig. 60. *Enalcyonium robustum* n. sp., female. A, habitus, dorsal; B, cephalic area, dorsal; C, caudal ramus, dorsal; D, antennule; E, antenna; F, genital areas; G, leg 1; H, leg 2. Scales: A, 0.1 mm; B, C, 0.05 mm; D-H, 0.02 mm.

Smithsonian Institution, Washington, D. C. Dissected paratypes (2♀♀) are kept in the collection of the author.

Female. Body (Fig. 60A) cylindrical, tapering anteriorly, with slightly concave lateral margins near middle, thus forming weak lateral constriction of trunk. Body length of dissected specimen 1.0 mm. Maximum width 273 μm across region of genital area. Cephalic area (Fig. 60B) 81 μm wide, with nearly parallel lateral margins and weak dorsal sclerotization near posterior border; rostral area pronounced, strongly tapering anteriorly, about 39 μm wide. Genital area (Fig. 60F) as nearly circular ring of sclerotization, with lateral diameter 28 μm; both genital areas separated by distance of about 10 μm. Caudal ramus (Fig. 60C) short, blunt, directed posterolaterally, and not delimited from body, with 5 caudal

setae consisting of 2 stiff, large setae (177 and 165 μm, respectively) and 3 small setae (35, 23, and 19 μm, respectively).

Antennule (Fig. 60D) unsegmented, approximately 75 μm long including terminal seta and tapering, with 13 setae including large terminal process (this process about 33 μm long). Antenna (Fig. 60E) 3-segmented, each 28, 25, and 22 μm from proximal to terminal (measured along middle axis). First and second segments unarmed. Third segment with 1 inner proximal seta and 2 inner distal setae, one of latters process-like. Terminal claw 19 μm long, curved and acute.

Oral appendages not seen.

Leg 1 (Fig. 60G) with exopod and inner lobe (posterior lobe). Protopod area with 1 outer seta. Exopod with 1 large proximal seta, 1 smaller distal seta accompanied at base by 2 small denticles on outer margin, and 2 distal spines (suggested armature formula 2,II), outer one of latters larger than inner one, with seta. Inner lobe prominent and tapering. Leg 2 (Fig. 60H) with exopod, interramal lobe, and inner lobe. Protopod area with 1 seta. Exopod with 1 enlarged seta and 2 distal spines (armature formula 1,II); both spines similar in size, each with seta. Interramal lobe not prominent but with 1 large seta. Inner lobe (posterior lobe) large, well-developed, extending over exopod. Legs 3-6 absent.

Male. Unknown.

Etymology. The specific name *robustum* alludes to the robust body of the new species.

Remarks. Twenty-nine species are recognized in the genus *Enalcyonium*. Six species among them, i.e., *E. concinnum* (Humes, 1957), *E. digitigerum* Ho, 1984, *E. lobophyti* Kim, 2004, *E. rubicundum* Olsson, 1868, *E. setigerum* (Zulueta, 1908), and *E. varicauda* Stock, 1973, are selected for a comparison with *E. robustum* n. sp., all of which have a combination of two proximal setae and two distal spines (armature formula 2,II) on the exopod of leg 1. However, *E. robustum* can be easily separated from them, because none of these six species has a constricted trunk and a combination of two large and three small setae on the caudal ramus (the combinations of caudal setae of these species are 5 large setae in *E. digitigerum*; 3 large+1 small setae in *E. concinnum*; 3 large+2 small setae in *E. lobophyti* and *E. rubicumdum*; and 4 large+1 small setae in *E. setigerum* and *E. varicauda*).

Enalcyonium grandisetigerum n. sp. (Fig. 61)

Material examined. Fifty-three ♀♀, 14♂♂ from the alcyonacean coral *Dendronephthya* (*Roxasia*) *cirsium* Kukenthal, 13° 15′50″S, 48° 08′35″E, Madagascar, 29 August 1967, collected by A. G. Humes. Holotype (♀), allotype (♂), and paratypes (50♀♀, 13♂♂) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (2♀♀, 1♂) are kept in the collection of the author.

Female. Body (Fig. 61A) cylindrical, with slightly concave lateral margins, forming weak trunk constriction slightly posterior to midlength. Body surface with minute sensillae. Mean body length 712 μm (653-780 μm) based on 10 specimens. Body length of dissected specimen 776 μm. Maximum width 169 μm across widest anterior 30% region of body. Narrowest 65% region of body 150 μm wide. Cephalic area (Fig. 61B) 68 μm wide. No distinct dorsal sclerotization visible on posterior region of cephalic area. Rostral area prominent, anteriorly tapering. Genital area (Fig. 61E) as nearly elliptical ring of sclerotization, with lateral diameter about 22 μm; both genital areas separated by distance of about 8 μm. Caudal ramus short, directed posterolaterally (Fig. 61A), not demarcated from body, with 2 large setae (196 and 188 μm long, respectively) and 2 small setae (both 46 μm long).

Antennule (Fig. 61C) unsegmented, tapering, and approximately 77 μm long including terminal setiform process, with 13 setae including terminal process (this process about 31 μm long). Antenna (Fig. 61D) slender and 3-segmented; each segment 33, 20, and 27 μm from proximal to terminal (measured along axis). First and second segments unarmed. Third segment with 1 inner proximal seta and 2 inner distal setae. Terminal claw 19 μm long, thin and weakly curved. Oral appendages not seen.

Leg 1 (Fig. 61G) with exopod and inner lobe (posterior lobe). Protopod area with 1 outer seta. Exopod with 2 outer setae and distally 1 strong, claw-like spine (not demarcated from exopod) and 1 inner seta (armature formula 2,I,1). Inner lobe prominent and tapering. Leg 2 (Fig. 61H) with exopod, interramal lobe, and inner lobe. Protopod area with 1 enlarged seta. Exopod with 1 enlarged seta and 2 distal, seta-bearing spines (armature formula 1,II); outer one of latters not demarcated form exopod. Interramal lobe small, not seen from anterior view of leg, but tipped with 1 small seta. Inner lobe (posterior lobe) prominent and blunt. Legs 3-6 absent.

Male. Body shape and size similar to those of female, distinguishable from female only by presence of genital slits and spermatophores. Mean body length 693 μm (653-747 μm), based on 10 specimens. Spermatophore (Fig. 61F) elongated, 225 × 36 μm. Appendages, including legs 1 and 2, not different from those of female.

Etymology. The specific name *grandisetigerum* is derived from the Latin words *grandis* (large), *saeta* (seta), and *gero* (to carry). It alludes to the possession of large setae on leg 2.

Remarks. In the genus *Enalcyonium* the armature formula of the exopod of leg 1 is various with species. It is II (in 1 species), III (in 3 species), 1,II (in 7 species), IV (in 5 species), 1,III (in 2 species), I,1,II (in 3 species), 2,II (in 7 species), 3,II (in 1 species), and 1,I,1,II (in 1 species). Therefore, with the

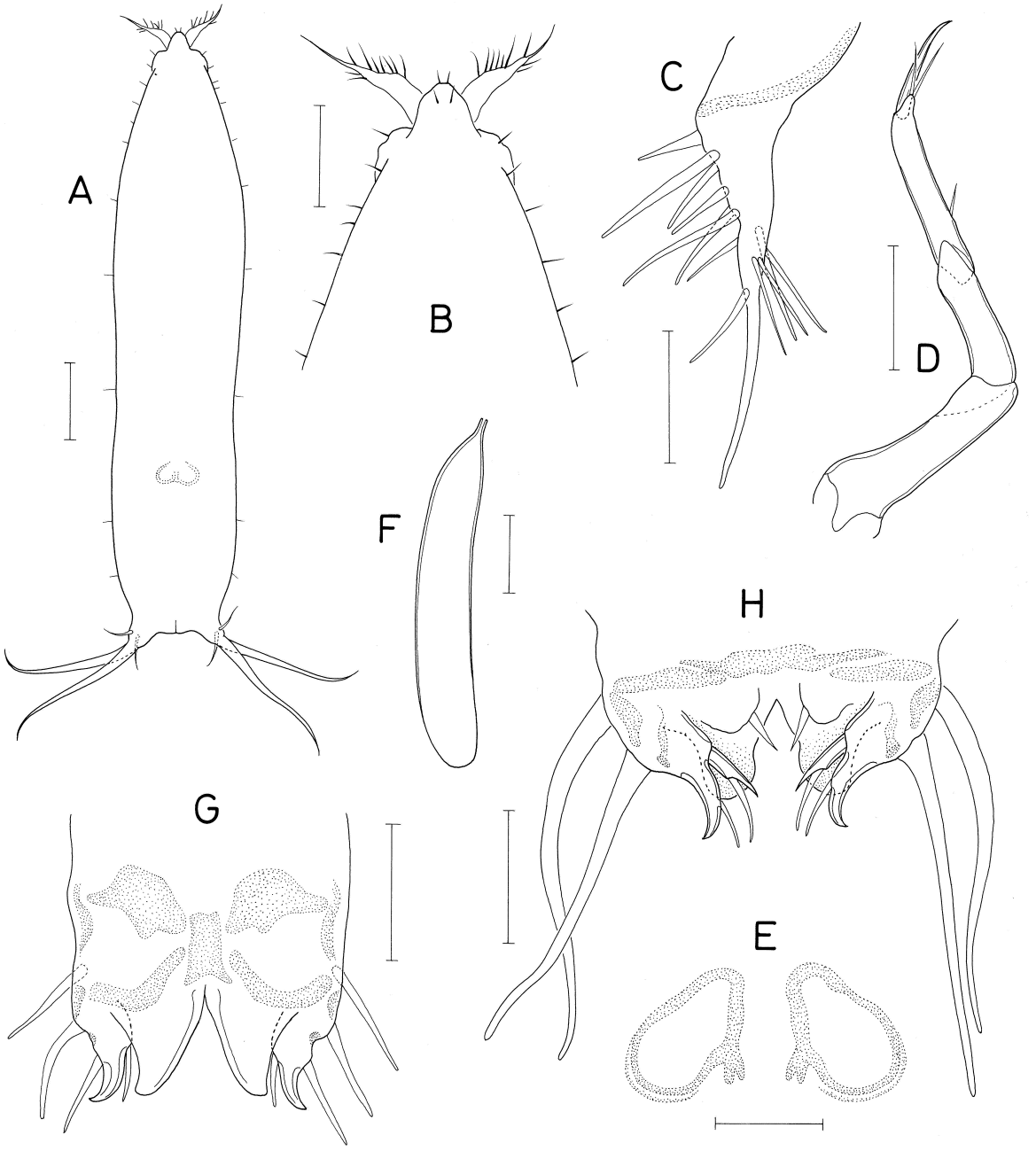

Fig. 61. *Enalcyonium gradisetigerum* n. sp. Female: A, habitus, dorsal; B, cephalic area, dorsal; C, antennule; D, antenna; E, genital areas; G, leg 1; H, leg 2. Male: F, spermatophore. Scales: A, 0.1 mm; B, F, 0.05 mm; C-E, G, H, 0.02 mm.

formula 2,I,1 on the exopod of the same leg, the new species can be distinguished from all congeners. The following combination of characters also may be helpful in identification of the new species: the caudal ramus bears 2 large and 2 small setae; the exopod of leg 2 is armed with 1 proximal seta and 2 distal spines (formula 1, II); the body is slender and slightly constricted, with minute sensillae (or setules) on the body surface; and the terminal segment of antenna bears 1 inner and 2 distal setae.

Family Myicolidae Yamaguti, 1936
Genus *Ostrincola* C. B. Wilson, 1944
***Ostrincola breviseti* Ho and Kim, 1990 (Figs. 62, 63)**
Ostrincola breviseti Ho and Kim, 1990, p. 91, figs. 1-24.

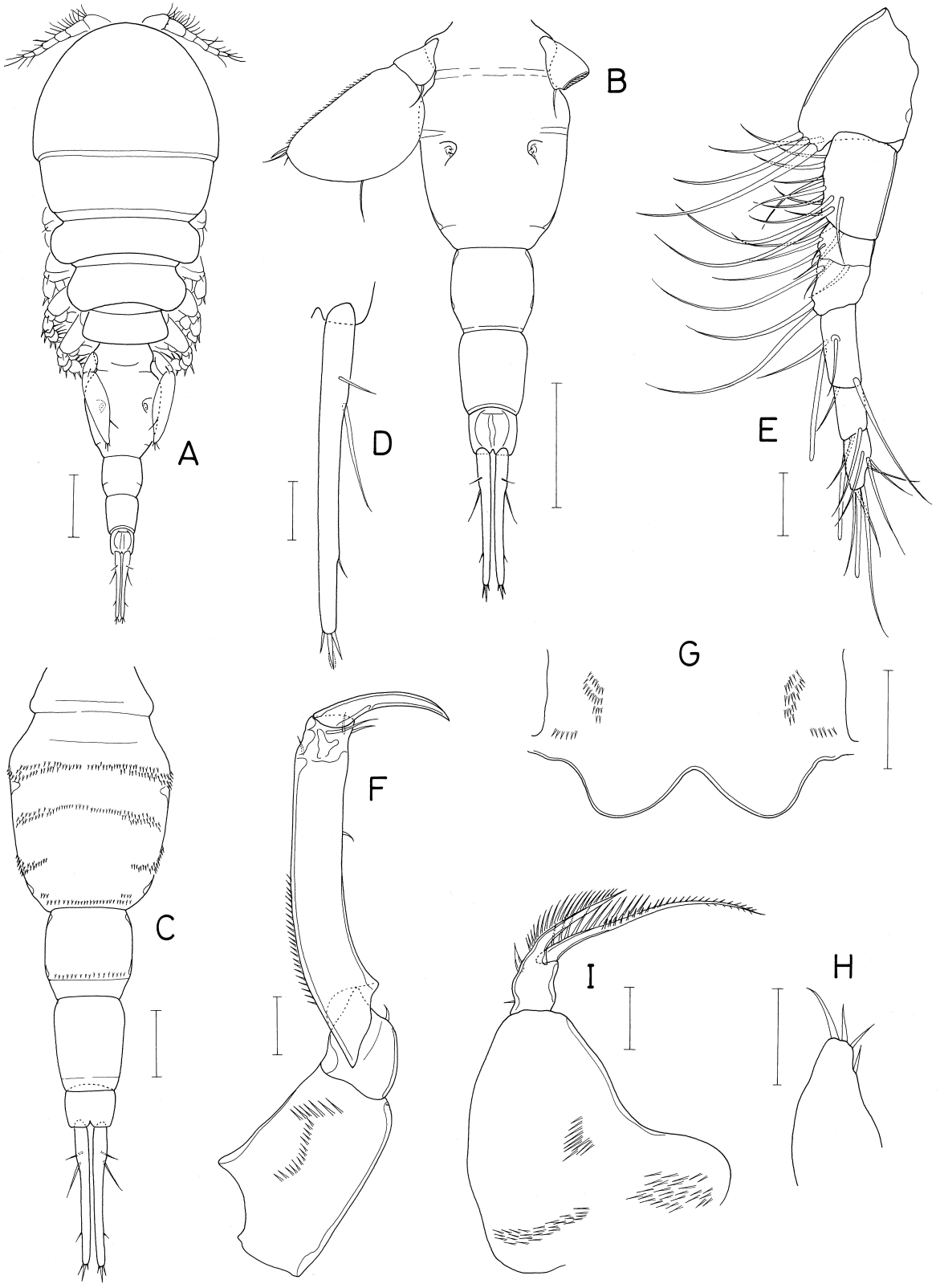

Fig. 62. *Ostrincola breviseti* Ho and Kim, female. A, habitus, dorsal; B, urosome, dorsal; C, urosome, ventral; D, right caudal ramus, dorsal; E, antennule; F, antenna; G, labrum; H, maxillule; I, maxilla. Scales: A, B, 0.1 mm; C, G, 0.05 mm; D-F, H, I, 0.02 mm.

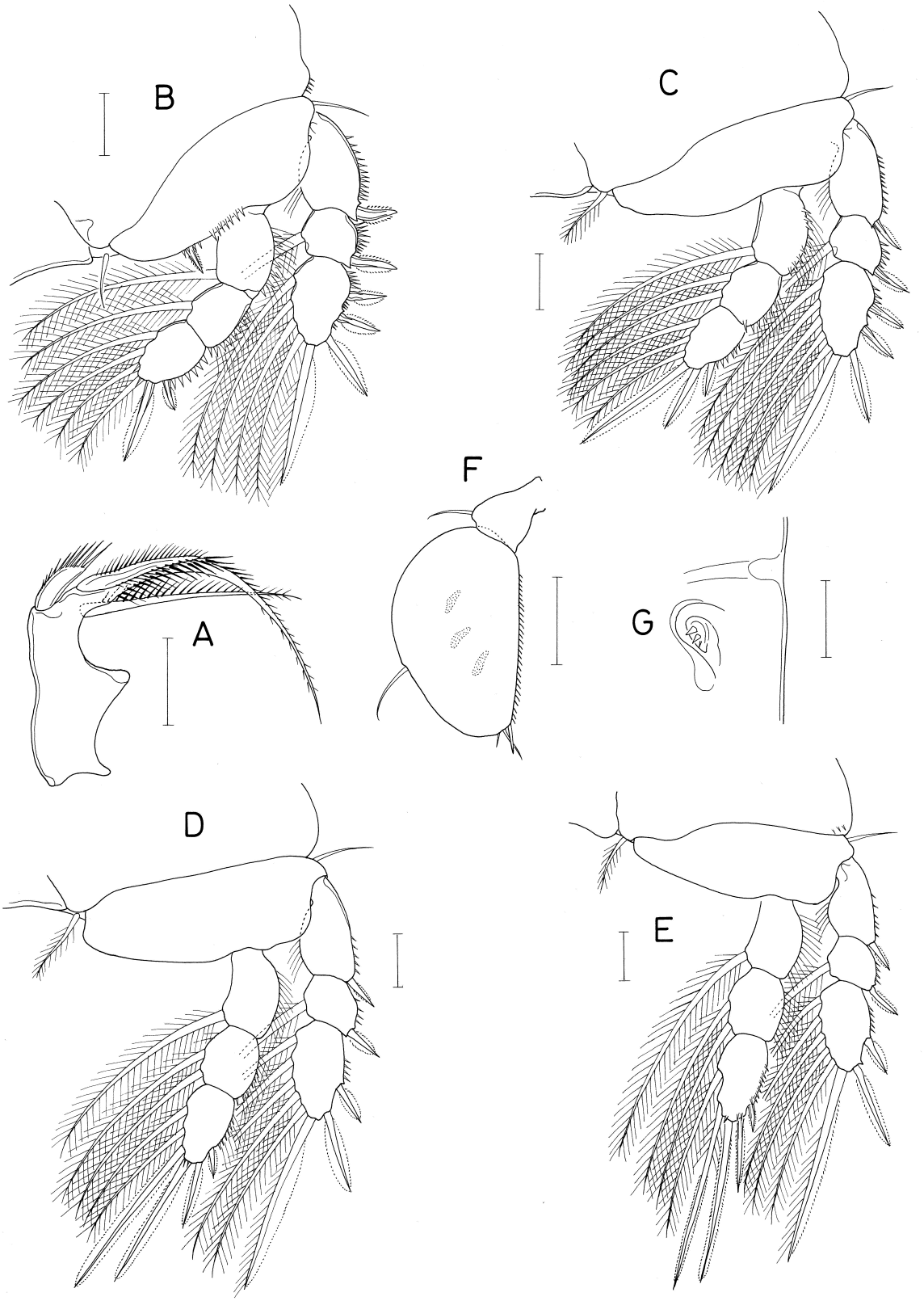

Fig. 63. *Ostrincola breviseti* Ho and Kim, female. A, mandible; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5; G, right genital area. Scales: A-E, G, 0.02 mm; F, 0.05 mm.

Material examined. Four ♀♀ from a bivalve of *Ostrea* sp., Nosy Bé, Madagascar, 13 June 1955, collected along with *Ostrincola binoviger* n. sp. by A. G. Humes.

Female. Body (Fig. 62A) moderately narrow. Body length of dissected specimen 957 μm (other 3 specimens 915, 930, and 954 μm, respectively). Maximum width 300 μm. Prosome 519 μm long, tapering posteriorly, and consisting of cephalosome and 4 pedigerous somites. Urosome (Fig. 62B) 5-segmented and tapering posteriorly. Fifth pedigerous somite 105 μm wide, distinctly narrower than next somite. Genital double-somite 149 × 121 μm, gradually narrowed posteriorly; Genital areas small and located dorsally at 42% region of somite, ventrally with 4 transverse rows of spinules (third row incomplete and restricted laterally, and fourth row on posteroventral margin) (Fig. 62C). Three free abdominal somite 67 × 66, 70 × 53, and 33 × 38 μm, respectively. First free abdominal somite with row of spinules near posteroventral margin. Caudal ramus (Fig. 62D) slender, 108 × 11 μm (9.82 : 1), with 6 small naked setae; 2 proximal setae located at 23% and 38% region of ramus; small subdistal seta at 78% region; middle one of 3 terminal setae spiniform and 12 μm. Egg sac not seen.

Rostrum lacking. Antennule (Fig. 62E) 155 μm long and 7-segmented, with armature formula 4, 14, 5, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; segmentation between third and fourth segment obscure; first segment distinctly broader than other segments. Antenna (Fig. 62F) 3-segmented; first segment with 2 rows of spinules; small second segment with 1 small inner distal seta; third segment elongated, 108 × 22 μm (4.91 : 1), with spinules on outer margin, 1 small seta at 64% region of inner margin, and distally with 4 obscure setae; terminal claw 46 μm long and acute.

Labrum (Fig. 62G) with broad posterior lobe, shallow median incision, and lateral spinules. Mandible (Fig. 63A) armed distally with 2 plate-like elements on convex side, 1 large inner seta, and elongated distal lash. Maxillule (Fig. 62H) tapering and armed with 3 apical and 1 subapical setae. Maxilla (Fig. 62I) 2-segmented; basal segment large, with 3 patches of spinules; distal segment with 3 setae: minute proximal, small, spiniform subdistal, and large inner ones; large inner seta about twice as long as distal lash, both spiniferous along distal margin. Maxilliped lacking.

Legs 1-4 (Fig. 63B-E) with 3-segmented rami. Leg 1 with small, naked inner seta on coxa and small inner spine on basis. Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-1; basis 1-I; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,I,4
Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,3
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. 0-1; 0-2; I,II,I+2
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. 0-1; 0-2; I,II,I+1

Leg 5 (Fig. 63F) 2-segmented and extending to near posterior margin of genital double-somite. First segment narrow, with 1 naked dorsal seta. Second segment semicircular, tapering distally, 120 × 72 μm (1.67 : 1), with expanded dorsal margin, 3 pale speckles, spinules on straight ventral margin, and 4 setae; dorsal one of latters largest, 36 μm, located at 68% region of length of segment, and isolated from remaining 3 terminal, aggregated setae (lengths 8, 20, and 17 μm, respectively, from dorsal to ventral); ventralmost seta spiniform. Leg 6 represented by 3 small spinules in genital area (Fig. 63G).

Male. Not discovered.

Remarks. All the morphological traits of the present specimens, especially the forms of the urosome, antenna, and free segment of leg 5 and the positions of setae and setules on the urosome and appendages are not different from those of *Ostricola breviseti* which was described by Ho and Kim (1990) from the oyster *Saccostrea cucullata* (Born) in Malaysia. As notable differences, the caudal ramus was recorded as 8.5 times as long as wide in type specimens but is 9.82 times in Madagascan specimens and the free segment of female leg 5 was recorded as 1.75 times as long as wide in the type specimens but is 1.67 times in Madagascan specimens. However, these differences seem not significant enough to recognize them as different species.

Ostrincola binoviger n. sp. (Figs. 64, 65)

Material examined. Three ♀♀ from a bivalve of *Ostrea* sp., Nosy Bé, Madagascar, 13 June 1955, collected along with *Ostrincola breviseti*, by A. G. Humes. Holotype (♀) and paratype (1♀) have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratype (1♀) is retained in the collection of the author.

Female. Body (Fig. 64A) similar to that of preceding species *Ostrincola breviseti*. Body length of dissected specimen 1.01 mm (other 2 specimens 938 and 908 μm, respectively). Maximum width 288 μm. Prosome 500 μm long. Urosome (Fig. 64B, C) 5-segmented. Fifth pedigerous somite 94 μm wide. Genital double somite nearly ovoid, 153 × 113 μm, with same ventral ornamentation as in *O. breviseti*. Three abdominal somites 96 × 60, 84 × 46, and 26 × 33 μm, respectively. Anal somite less than 1/3 length of preceding somite. Caudal ramus (Fig. 64D) slender, 128 × 11 μm (11.6 : 1), with 6 setae; proximalmost seta located at 20% region of ramus; largest second proximalmost seta 46 μm long and located at 32% region; subdistal seta at 78% region; three terminal setae very small, middle one of them 10 μm long. Egg sac con-

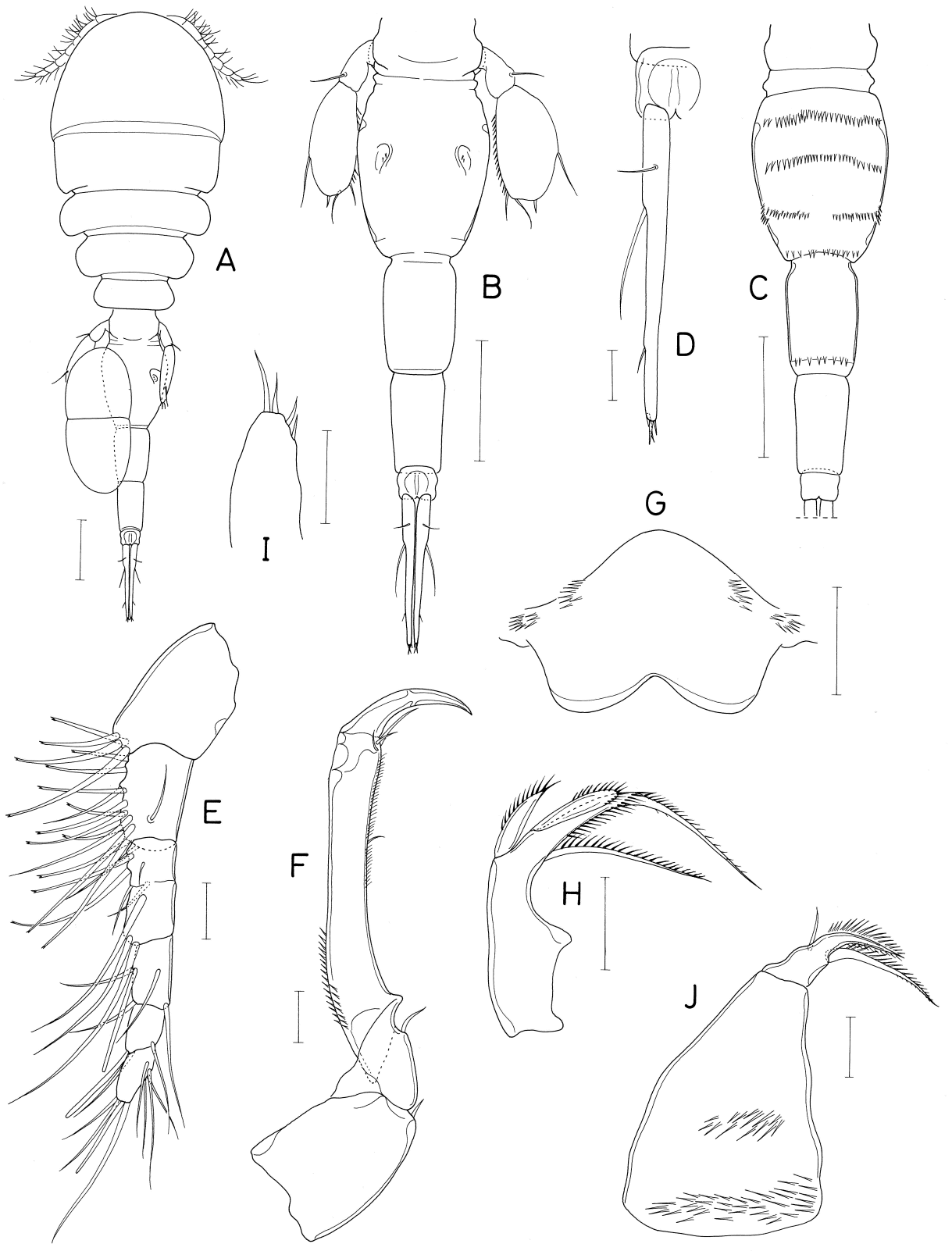

Fig. 64. *Ostrincola binoviger* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, urosome, ventral; D, left caudal ramus, dorsal; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scales: A-C, 0.1 mm; D-F, H-J, 0.02 mm; G, 0.05 mm.

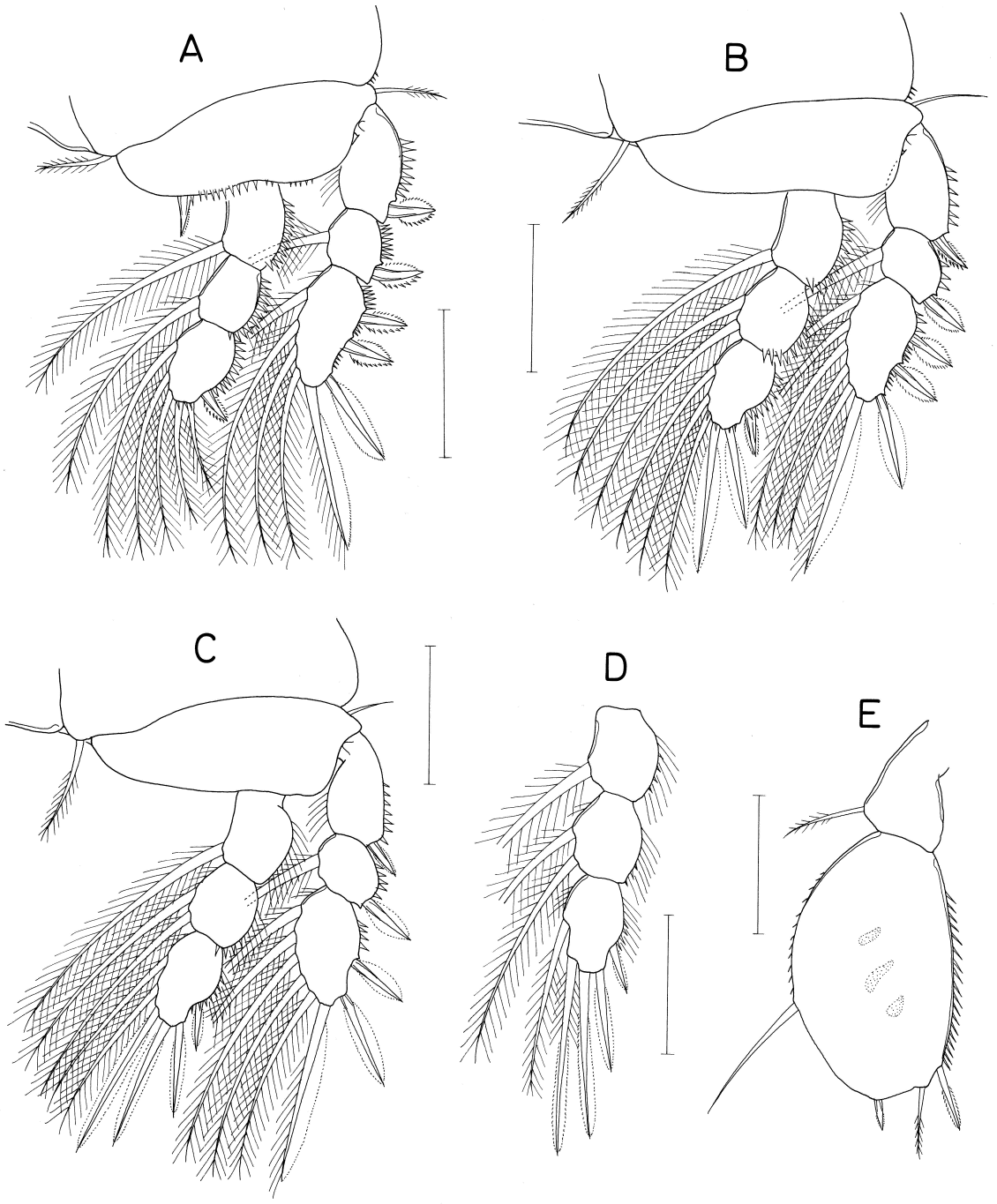

Fig. 65. *Ostrincola binoviger* n. sp., female. A, leg 1; B, leg 2; C, leg 3; D, endopod of leg 4; E, leg 5. Scales: 0.05 mm for all.

taining only 2 eggs, each egg 111 μm in diameter.

Rostrum lacking. Antennule (Fig. 64E) 175 μm long and 7-segmented, with armature formula 4, 14, 5, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; most of setae on first to third segments delicately bifurcate at tip; segmentation indistinct between third and fourth segments. Antenna (Fig. 64F) 3-segmented; first and second segments each with inner distal seta; third segment elongated, 125 × 25 μm (5.0 : 1), with spinules on proximal part of outer margin, minute setules on distal half of inner margin, 1 small seta on 66% region of inner margin, and 3 small setae on inner distal corner; terminal claw strong, arched, and sharply pointed.

Labrum (Fig. 64G), mandible (Fig. 64H), and maxillule (Fig. 64I) similar to those of *O. breviseti*. Maxilla (Fig. 64J)

2-segmented; large first segment with 2 patches of spinules; second segment with small outer distal and larger inner distal setae; distal lash much shorter than inner distal seta. Maxilliped lacking.

Legs 1-4 with 3-segmented rami (Fig. 65A-D). These legs with plumose inner seta on coxa and following armature formula:

Leg 1: coxa 0-1; basis 1-I; exp. I-0; I-1; III,I,4;
enp. 0-1; 0-1; I,5
Leg 2: coxa 0-1; basis 1-0; exp. I-0; I-1; III,I,5;
enp. 0-1; 0-2; I,II,3
Leg 3: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. 0-1; 0-2; I,II,I+2
Leg 4: coxa 0-1; basis 1-0; exp. I-0; I-1; II,I,5;
enp. 0-1; 0-2; I,II,I+1

Leg 5 (Fig. 65E) 2-segmented. First segment narrow, with 1 plumose dorsal seta. Second segment nearly ovoid, 96 × 59 μm (1.63 : 1), with spinules on ventral margin and on proximal half of dorsal margin, and 2 spines and 2 setae; dorsal seta 50 μm and isolated from other 3 elements; three terminal elements (spine, seta, and spine from dorsal to ventral) separated from each others, 11, 25, and 23 μm, respectively. Leg 6 represented by 2 small spinules in genital area.

Male. Unknown.

Etymology. The specific name *binoviger* is originated from the Latin *bini* (twofold), *ovum* (egg), and *gero* (to carry) and alludes to the possession of only a couple of eggs in an egg sac.

Remarks. The genus *Ostricola* comprises 10 described species, all associated with bivalves. *Ostrincola binoviger* n. sp. differs from *O. breviseti* Ho and Kim, 1990 and *O. clavator* Humes, 1959 by having one spine and five setae (armature formula I,5) on the third endopodal segment of leg 1 (II,4 in the latter two species); from *O. gracilis* Wilson, 1944, *O. humesi* Ho and Yoosukh, 1994, *O. koe* Tanaka, 1961, and *O. patagonianus* Humes, 1988 by having the first and second abdominal somites each distinctly longer than wide (wider than long in four species); and from *O. falcatus* Humes, 1984 and *O. portonoviensis* Reddiah, 1962 by having setae or spines on the free segment of female leg 5, which are at most half as long as free segment (largest seta at least 0.83 times as long as free segment in O. *falcatus* and longer than free segment in *O. portonoviensis*).

The remaining two species, *O. similis* Lin and Ho, 1999 and *O. japonicus* Tanaka, 1961 need careful comparisons with *O. binoviger* n. sp. for distinguishing. In *O. similis*, two proximal setae on the caudal ramus are closely set, positioned on the almost same plane, but isolated from each other in *O. binoviger* n. sp.; the inner margin of the third segment of antenna is unornamented in *O similis*, but ornamented with setules on the distal half of the inner margin in *O. binoviger*; and the innermost spine of the third endopodal segment of leg 4 is setiform and proximally plumose according to the figure of Lin and Ho (1999), but it is a distinct spine without plumosity in *O. binoviger*.

Ostrincola binoviger is closer to *O. japonicus* than to any other known species. In particular, they share almost identical forms of the caudal ramus and free segment of leg 5. However, *O. japonicas* is different from *O. binoviger* in having a ventrodistal row of spinules on the second abdominal somite (see Ho and Kim, 1991), which it is lacking in *O. binoviger*, an unornamented inner margin of the third antennary segment, and a different position of the inner seta on the same segment of antenna (the seta is positioned at 82% region of inner margin, whereas it is positioned at about 66% region in *O. binoviger*).

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