

Three New Species of *Collocheres* (Copepoda, Siphonostomatoida, Asterocheridae) Associated with Crinoids and Ophiuroids from Korea

Sook Shin and Il-Hoi Kim*

Department of Biology, Shamyook University, Seoul 139-742, Korea;

Department of Biology, College of Natural Sciences, Kangnung National University, Kangnung 210-702, Korea

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Three new species of *Collocheres* are described as associates of crinoid and ophiuroid echinoderms from Cheju Island, Korea: *Collocheres brevipes* n. sp. from the crinoids *Comanthus solaster* A. H. Clark and *Decametra tigrina* (A. H. Clark); *C. solidus* n. sp. from two species of the crinoids *Comanthus solaster* and *Comanthus japonicus* (Müller) and one species of ophiuroid-*Ophiomastax mixta* (Lütken); and *C. tamladus* n. sp. from the crinoid *Catoptometra rubroflava* (A. H. Clark). The three species are distinguished from one another and other congeners by the body size, dimension of caudal ramus and free segment of leg 5, and shape and ornamentation of urosome.

The genus *Collocheres* is quite a homogenous group of copepods associated mainly with the crinoid and ophiuroid echinoderms. Eighteen species of the genus are known, including the most recently recorded *C. lunulifer* and *C. vervoorti*, both by Humes (1998) from the West Indies. In the Far Eastern seas, only one species, *C. inaequalis*, is recorded by Ho (1982) from the crinoid *Comanthus japonicus*. Although Kim (1998) reported the same species from the same crinoid species from Korea, this species from Korea appears to be an unknown species different from *C. inaequalis*.

Recently, one of the authors (S. Shin) searched crinoids and ophiuroids collected from shallow depths of Cheju Island, Korea for the associated copepods, and found three species of *Collocheres*, all new to science. This work deals with the descriptions of these three new species.

Descriptions of Species

Order Siphonostomatoida
Family Asterocheridae

Collocheres brevipes n. sp.
(Figs. 1-3)

Material examined: 50 ♀♀, 15 ♂♂ from washings of *Comanthus solaster* A. H. Clark, Munsom in Cheju

Island, in 25-40 m, 27 April 2004, collected by S. Shin. Holotype (♀), allotype (♂) and paratypes (30 ♀♀, 7 ♂♂) will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected paratypes (1 ♀, 1 ♂) are kept in the collection of the junior author.

Additional material examined: 220 ♀♀, 30 ♂♂ from washings of *Comanthus solaster* A. H. Clark, Munsom in Cheju Island, in 25 m, 22 April 2004, collected by S. Shin; 4 ♀♀, 2 ♂♂ from washings of *Decametra tigrina* (A. H. Clark), Munsom in Cheju Island, in 25-40 m, 23 April 2004, collected by S. Shin.

Female: Body (Fig. 1A) slender. Length 789 µm (785-800 µm), based on 10 specimens. Prosome dorsoventrally deeper rather than laterally wider. Cephalothorax 250×182 µm. Urosome (Fig. 1B) 5-segmented. Fifth pedigerous somite 92 µm wide, each side tapering but with rounded tip. Genital double-somite expanded laterally in middle, 124 µm long and 84 µm wide at widest area; lateral margins weakly serrate, with 6 thorn-like processes on each side; posterolateral corners produced posteriorly, but without dentiform processes; genital area located at anterior 37% of somite. Posteroventral margin of genital double-somite and first 2 abdominal somites straight and unornamented (Fig. 1C). Three abdominal somites from anterior to posterior 41×47, 28×38, and 29×41 µm. Anal somite with 2 patches of 3 minute spinules on ventrodistal area. Caudal ramus 46×20 µm, ratio 2.30:1, with 6 setae, hairs on inner margin, and minute spinules on produced distal margin; 2 dorsal setae small and

*To whom correspondence should be addressed.
Tel: 82-33-640-2312, Fax: 82-33-641-6124
E-mail: ihkim@kangnung.ac.kr

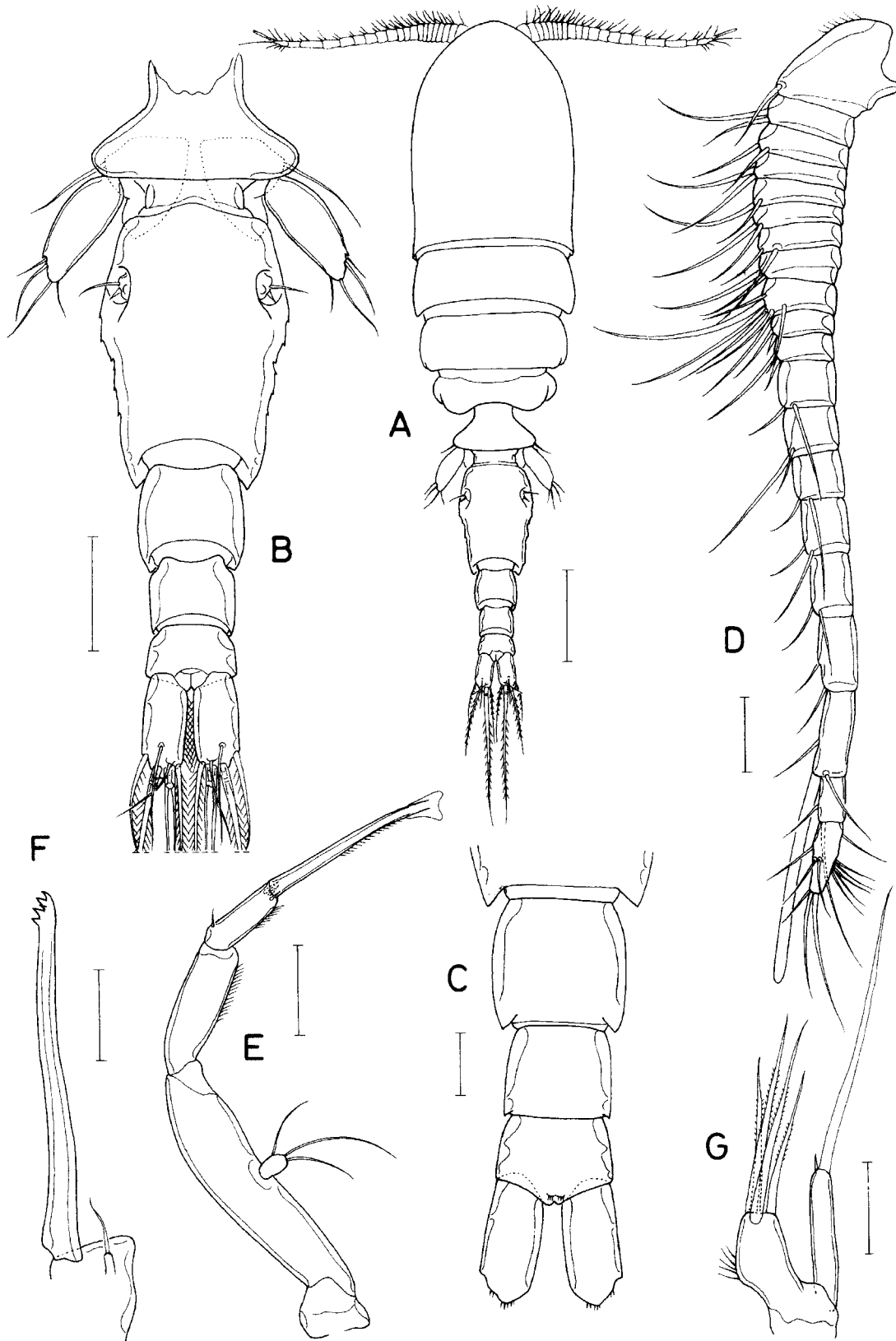


Fig. 1. *Collocheres brevipes* n. sp., female. A, Habitus, dorsal. B, Urosome, dorsal. C, Abdomen, ventral. D, Antennule. E, Antenna. F, Mandible. G, Maxillule. Scale bars=100 μ m (A), 50 μ m (B), and 20 μ m (C-G).

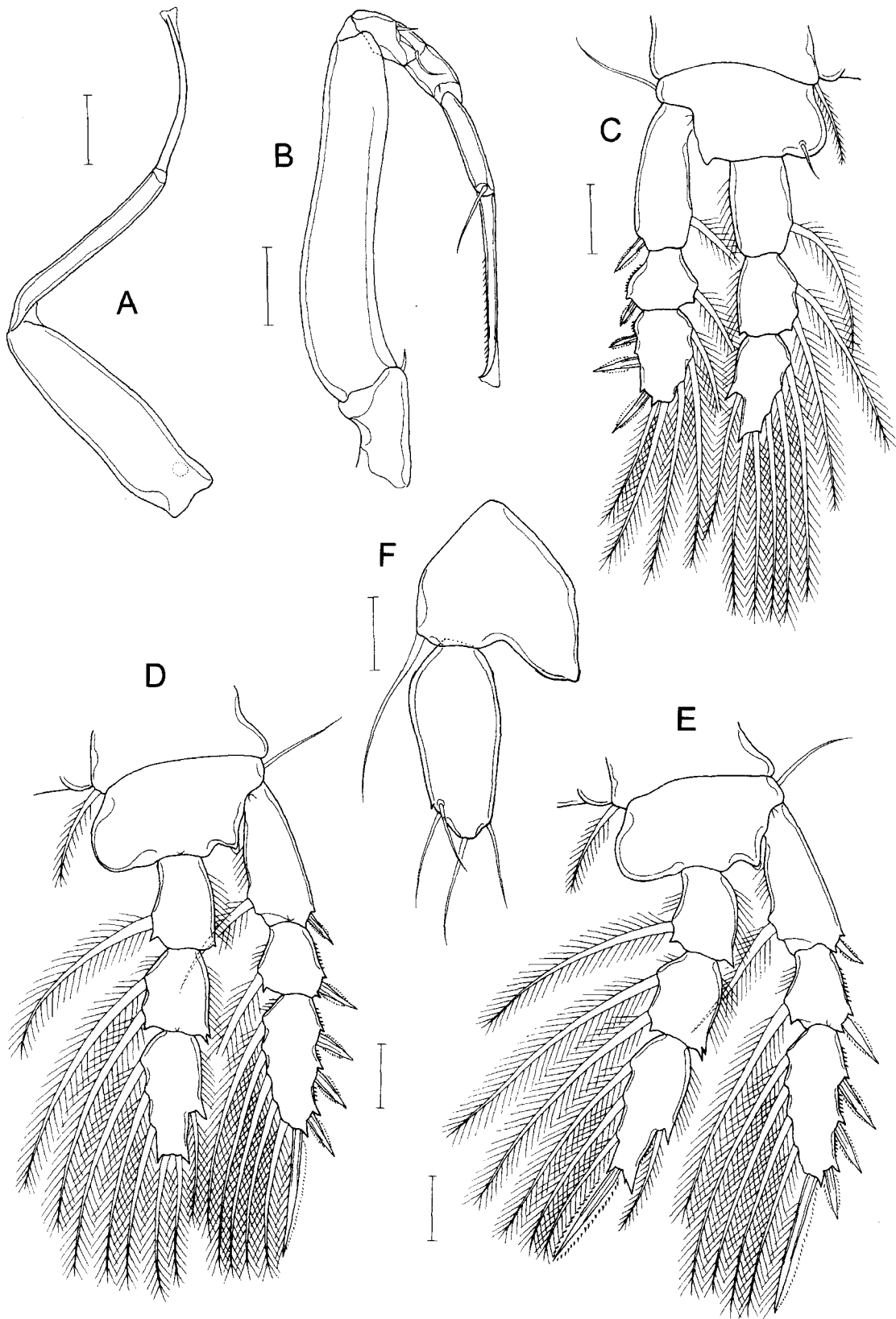


Fig. 2. *Collocheres brevipis* n. sp., female. A, Maxilla. B, Maxilliped. C, Leg 1. D, Leg 2. E, Leg 3. F, Leg 5. Scale bars=20 μ m.

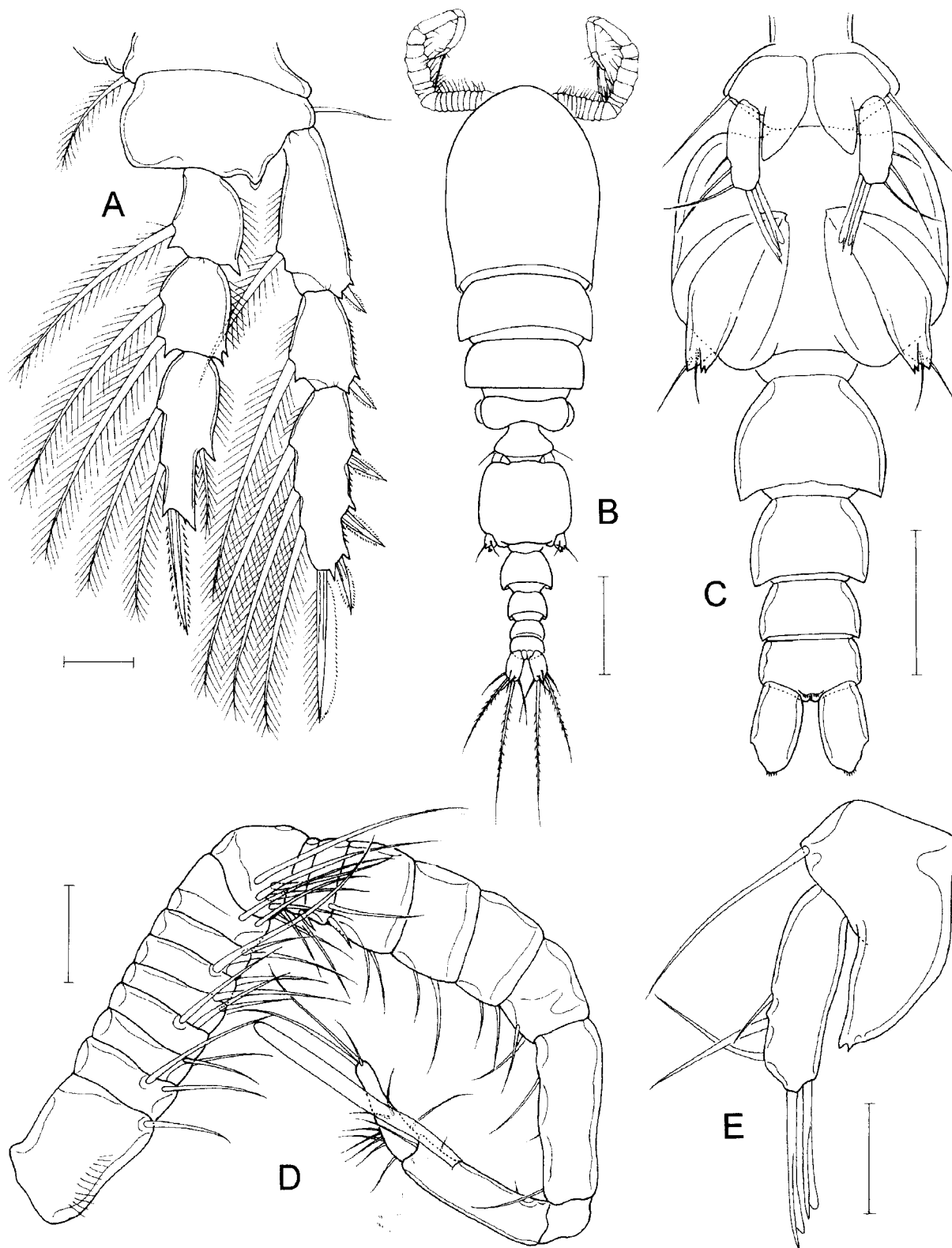


Fig. 3. *Collocheres brevipes* n. sp. Female. A, Leg 4. Male. B, Habitus, dorsal. C, Urosome, ventral. D, Antennule. E, Leg 5. Scale bars=50 μ m (A, C), 100 μ m (B), and 20 μ m (D, E).

smooth; outermost terminal seta with hairs on inner side; other 3 setae plumose on both sides. Egg sac not seen.

Rostrum as small conical process in lateral view. Antennule (Fig. 1D) 20-segmented, 240 μm long. Armature: 1, 2, 2, 2, 2, 2, 2, 2, 7, 2, 2, 2, 2, 2, 2, 2, 2+aesthetasc, 2, and 12. First segment with hairs on anterior margin. All setae smooth. Aesthetasc about twice as long as 2 terminal segments combined. Antenna (Fig. 1E) with short coxa. Basis 57 μm long. Exopod small, approximately $7 \times 4 \mu\text{m}$, bearing 2 terminal and 1 lateral setae. Endopod with first segment 30 μm long. Second segment 12 μm long, with 1 proximal and 3 minute terminal setae. Terminal claw 43 μm long, with spatulate hyaline tip and minute setules on distal half of outer margin.

Oral cone prominent in lateral view. Mandible (Fig. 1F) distally armed with 4 teeth and 1 small subsidiary denticle. Palp small, bearing 1 small seta (Fig. 1F). Maxillule (Fig. 1G) bilobed; outer lobe 27 μm long, distinctly longer than inner lobe, armed terminally with 1 long setae 67 μm and 1 minute seta; inner lobe expanded in middle with several lateral setules and terminally 4 setae. Maxilla (Fig. 2A) 2-segmented, bearing terminal claw; both segments unarmed; terminal claw with hyaline tip. Maxilliped (Fig. 2B) 5-segmented. First segment with small inner distal seta. Second segment elongate, slender, and unarmed. Third segment with 3 setae. Fourth segment with 1 minute, hardly visible, seta. Fifth segment with 1 terminal seta. Terminal claw with minute spinules on inner margin and spatulate hyaline tip.

Legs 1-4 (Figs. 2C-E, 3A) biramous with 3-segmented rami. Armature formula as follows:

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

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

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

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

Distal outer spiniform process on second endopod segment of legs 2 to 4 bifurcate.

Leg 5 (Fig. 2F) 2-segmented. Proximal segment $40 \times 51 \mu\text{m}$, bearing 1 outer seta. Inner flap smooth, usually terminated simply, but occasionally bifurcate, with 4 setae. Distal segment $54 \times 24 \mu\text{m}$, ratio 2.25:1, armed with 4 equal, smooth setae. Leg 6 represented by seta and spine on genital area (Fig. 1B). Color of specimens in alcohol pale yellow.

Male: Body (Fig. 3B) resembling that of female in general form. Length 649 μm (638-654 μm), based on 10 specimens. Cephalothorax $197 \times 162 \mu\text{m}$.

Urosome (Fig. 3C) 6-segmented. Fifth pedigerous

somite 62 μm wide. Genital somite $88 \times 98 \mu\text{m}$, with rounded corners in dorsal view. Abdominal somites from anterior to posterior 42×54 , 30×42 , 21×36 , and $21 \times 36 \mu\text{m}$. Caudal ramus $30 \times 16.5 \mu\text{m}$, ratio 1.82:1.

Rostral area like that of female. Antennule 18-segmented, geniculate, with 17th segment bearing large aesthetasc. Armature formula: 1, 2, 2, 2, 2, 2, 2, 2, 7, 2, 2, 2, 2, 2, 3, 2+aesthetasc, and 12. Antenna as in female.

Oral cone, mandible, maxillule, maxilla, maxilliped, and legs 1-4 similar to those of female. Leg 5 (Fig. 3E) resembling that of female. First segment $31 \times 45 \mu\text{m}$, with more prominent inner flap bearing bifurcate tip. Second segment $37 \times 13 \mu\text{m}$, ratio 2.85:1, with 1 smaller proximal and 2 larger distal setae on outer margin, and 2 terminal broad hyaline setae (29 and 25 μm , respectively). Leg 6 represented by 2 setae and 2 processes (inner process bifurcate) on posteroventral flap on genital somite (Fig. 3C).

Etymology: The specific name *brevipes* is a combination of the Latin *brevis* (short) and *pes* (foot). It alludes to the relatively short leg 5.

Remarks: In *Collocheres* eight species are known to have relatively short caudal rami of female bearing less than three times as long as wide, like *C. brevipipes* n. sp.: *C. giesbrechti* Thompson & Scott, 1903; *C. inflatiseta* Humes, 1987; *C. marginatus* Humes, 1987; *C. parvus* Humes, 1987; *C. prionotus* Humes, 1990; *C. thysanotus* Humes, 1987; *C. titillator* Humes, 1987; and *C. uncinatus* Stock, 1966. Of these, two species, *C. inflatiseta* and *C. parvus*, both associated also with the crinoids in the Moluccas (Humes, 1987), have short distal segment of leg 5 as well which is less than three times as long as wide, as in *C. brevipipes* in which the ratio being 2.25:1. These two species may be easily distinguished from *C. brevipipes* by lack of serration on the lateral margins of the female genital double-somite. Further differences are recognized in *C. inflatiseta* in the palp which is nearly as long as the mandible (distinctly shorter in *C. brevipipes*) and in the maxillule in which the outer lobe is shorter than the inner lobe (longer in *C. brevipipes*). In *C. parvus* the body is very small, only 0.47 mm long in the female and 0.34 mm in the male (Humes, 1987), in contrast to 0.79 mm and 0.65 mm, respectively, in *C. brevipipes*.

Collocheres solidus n. sp.
(Figs. 4-6)

Material examined: 40 ♀♀, 20 ♂♂ from washings of *Comanthus solaster* A. H. Clark, Munsom in Cheju Island, in 25-40 m, 27 April 2004, collected by S. Shin. Holotype (♀), allotype (♂) and paratypes (20 ♀♀, 11 ♂♂) will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C.

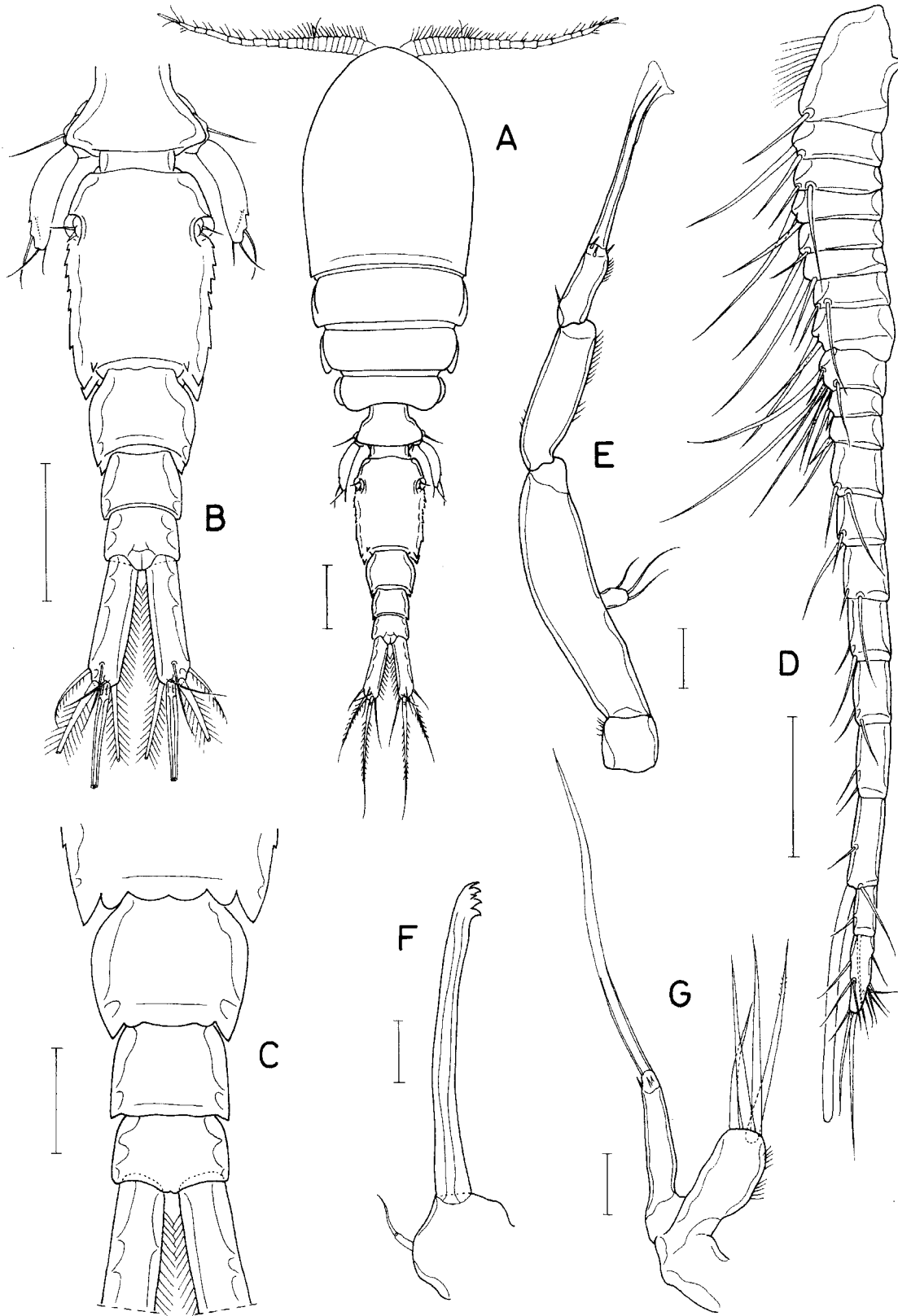


Fig. 4. *Collocheres solidus* n. sp., female. A, Habitus, dorsal. B, Urosome, dorsal. C, Abdomen, ventral. D, Antennule. E, Antenna. F, Mandible. G, Maxillule. Scale bars=100 μm (A, B), 50 μm (C, D), and 20 μm (E-G).

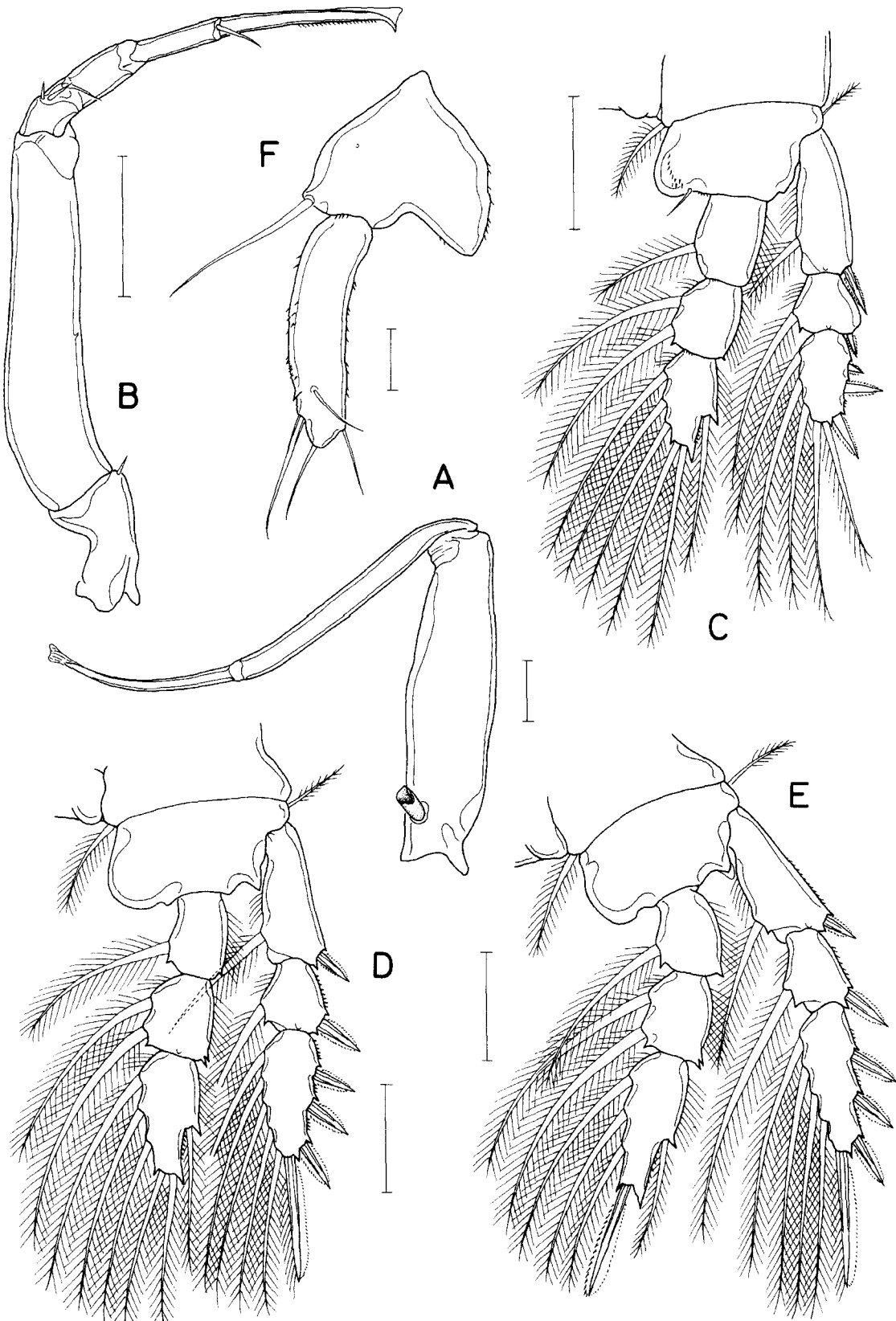


Fig. 5. *Collocheres solidus* n. sp., female. A, Maxilla. B, Maxilliped. C, Leg 1. D, Leg 2. E, Leg 3. F, Leg 5. Scale bars=20 μ m (A, F), and 50 μ m (B-E).

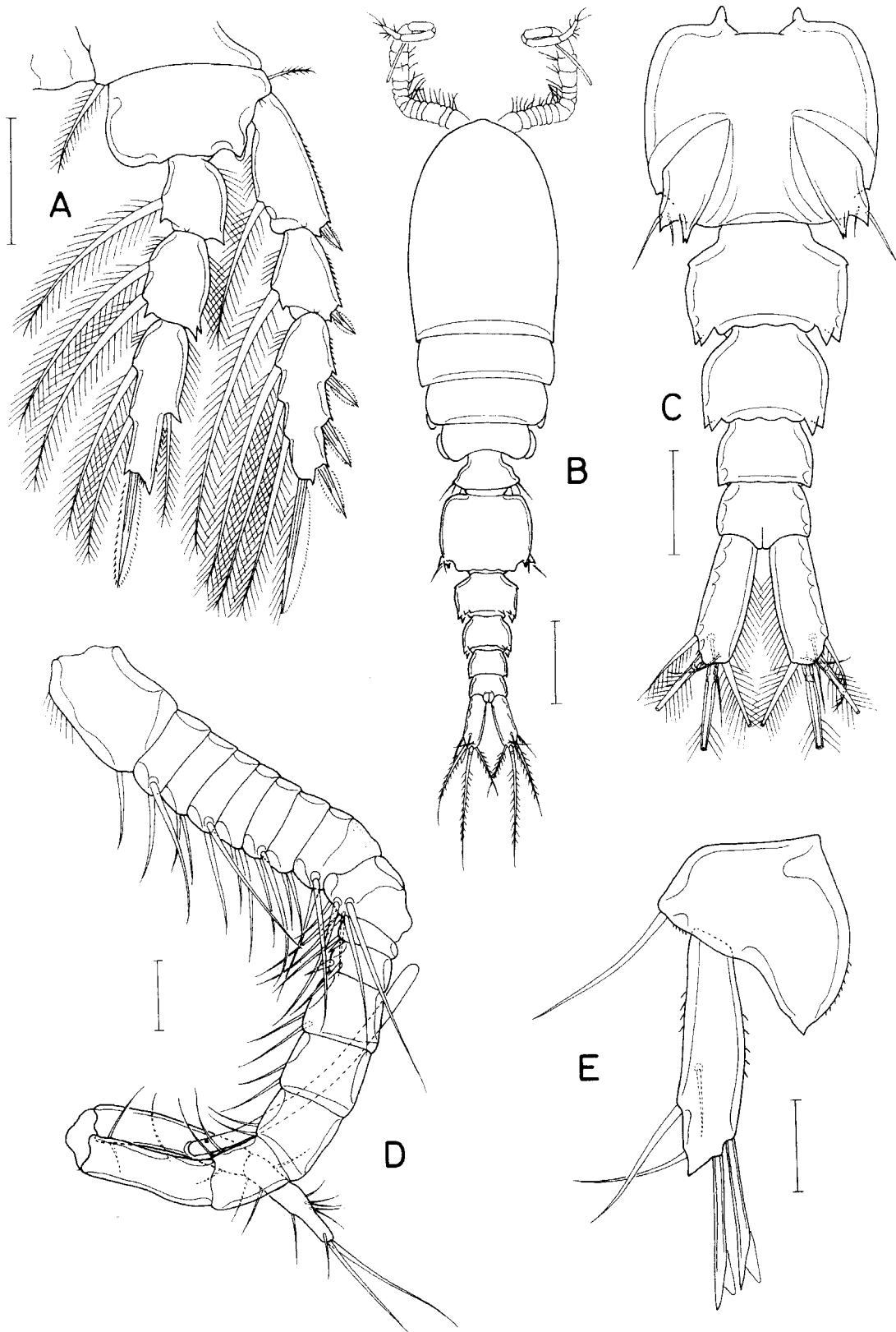


Fig. 6. *Collocheres solidus* n. sp. Female. A, Leg 4. Male. B, Habitus, dorsal. C, Genital somite and abdomen, ventral. D, Antennule. E, Leg 5. Scale bars=50 μ m (A, C), 100 μ m (B), and 20 μ m (D, E).

Additional material examined: 60 ♀♀, 35 ♂♂ from washings of *Comanthus solaster* A. H. Clark, Munsom in Cheju Island, depth unknown, 21 May 2004, collected by S. Shin; 20 ♀♀, 7 ♂♂ from washings of *Comanthus japonicus* (Müller), Munsom in Cheju Island, in 25 m, 21 May 2004, collected by S. Shin; 27 ♀♀, 38 ♂♂ from washings of *Comanthus solaster* A. H. Clark, Munsom in Cheju Island, in 25 m, 24 April 2004, collected by S. Shin; 8 ♀♀, 3 ♂♂ from washings of the ophiuroid *Ophiomastax mixta* Lütken, Mosulpo in Cheju Island, depth unknown, 21 May 2004, collected by S. Shin.

Female: Body (Fig. 4A) slender with thick, firm exoskeleton. Length 1.04 mm (1.02-1.06 mm), based on 10 specimens. Prosome dorsoventrally deeper rather than laterally wider. Cephalothorax 350×271 µm. Urosome (Fig. 4B) 5-segmented. Fifth pedigerous somite 104 µm wide, each side tapering with an angular tip. Genital double-somite 167×107 µm wide, 1.56 times longer than wide; lateral margins parallel, and serrated with 6 thorn-like processes on each side; posterolateral corners produced and pointed, bearing 2 additional dentiform processes on each corner; genital area located at anterior 1/3 length of somite. Posteroventral margin of genital double-somite and first abdominal somite wavy, but not serrated (Fig. 4C). Three abdominal somites from anterior to posterior 58×71, 35×57, and 42×56 µm. Caudal ramus variable in size, 93×25 µm, ratio 3.72:1, in dissected specimen; in other specimens ratio being 3.48-4.00:1; hairs on whole inner margin, and minute spinules on produced distal margin; 2 dorsal setae small and smooth; outermost terminal seta with hairs on inner side; other 3 setae plumose on both sides. Egg sac not seen.

Rostrum as small conical process in lateral view. Antennule (Fig. 4D) 20-segmented, 364 µm long. Armature: 1, 2, 2, 2, 2, 2, 2, 2, 7, 2, 2, 2, 2, 2, 2, 2, 2+aesthetasc, 2, and 12. First segment with hairs on anterior margin. All setae smooth. Aesthetasc about twice as long as 2 terminal segments combined. Antenna (Fig. 4E) with short coxa. Basis 82 µm long. Exopod small, approximately 9×6 µm, bearing 2 terminal and 1 lateral setae. Endopod with first segment 47 µm long. Second segment 28 µm long, with 1 proximal and 3 minute terminal setae. Terminal claw 60 µm long, with spatulate hyaline tip.

Oral cone prominent in lateral view. Mandible (Fig. 4F) distally armed with 4 teeth and 1 small subsidiary tooth. Palp small, bearing 1 small seta (Fig. 4F). Maxillule (Fig. 4G) bilobed; outer lobe 43 µm long, distinctly longer than inner lobe, armed terminally with 1 long setae of 118 µm and 3 minute spinules; inner lobe with lateral setules on inner margin and terminally 4 setae, longest one of them 67 µm. Maxilla (Fig. 5A) 2-segmented, bearing terminal claw; first segment with short, duct-like process; distal segments slender; terminal claw with hyaline tip. Maxilliped (Fig. 5B) 5-segmented. First segment with

small inner distal seta. Second segment elongate and unarmed. Third segment with 3 setae. Fourth segment distally with 1 minute, hardly visible, seta. Fifth segment with 1 terminal seta. Terminal claw with minute spinules on inner margin and spatulate hyaline tip.

Legs 1-4 (Figs. 5C-E, 6A) biramous with 3-segmented rami. Armature formula as follows:

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

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

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

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

Distal outer spiniform process on second endopod segment of legs 2 to 4 bifurcate.

Leg 5 (Fig. 5F) 2-segmented. Proximal segment 54×58 µm, bearing 1 outer seta. Inner flap with minute spinules on margins and blunt tip. Distal segment 77×19 µm, ratio 4.05:1, with spinules on both margins and 4 smooth setae, subdistal outer one of them distinctly larger than other three; one cusp-like acute process present on outer margin proximal to largest seta. Leg 6 represented by seta and spine on genital area (Fig. 4B). Color of specimens in alcohol blackish brown.

Male: Body (Fig. 6B) resembling that of female in general form. Length 844 µm (808-887 µm), based on 10 specimens. Cephalothorax 351×271 µm.

Urosome (Fig. 6C) 6-segmented. Genital somite 105×113 µm, roughly quadrangular. Four abdominal somites from anterior to posterior 50×79, 45×61, 31×47, and 32×46 µm. First abdominal somite with angular anterolateral corners. Caudal ramus 64×22 µm, ratio 2.91:1.

Rostral area like that of female. Antennule 18-segmented, geniculate, with 17th segment bearing large aesthetasc. Armature formula: 1, 2, 2, 2, 2, 2, 2, 7, 2, 2, 2, 2, 2, 3, 2+aesthetasc, and 12. Antenna as in female.

Oral cone, mandible, maxillule, maxilla, maxilliped, and legs 1-4 similar to those of female. Leg 5 (Fig. 6E) with first segment 35×44 µm, bearing bifurcate tip. Second segment 53×14 µm, ratio 3.79:1, terminated by pointed tip, with 1 smaller proximal and 2 similar distal setae on outer margin, and 2 terminal broad hyaline setae (33 and 32 µm, respectively). Leg 6 represented by 2 setae and 2 spiniform processes (inner process bifurcate) on posteroventral flap on genital somite (Fig. 6C).

Etymology: The specific name *solidus*, meaning "solid" in Latin, is derived from the firm exoskeleton of the new species.

Remarks: *Collocheres solidus* n. sp. may be confused with *C. inaequalis* Ho, 1982, known from Japanese waters. They have similar body forms and in particular almost identical shape of genital double-somite in the female. The differences between these species are in the body length, the size of caudal rami, and the armature state of female leg 5. Ho (1982) recorded the body length of the female *C. inaequalis* with a range of 605-921 μm (mean 824 μm), whereas in *C. solidus* the fully grown female is not less than 1.0 mm. The caudal ramus of *C. inaequalis* is recorded as 3.1 times as long as wide in the female, compared to 3.7 times as long (with a range of 3.5-4.0) in *C. brevipes*.

Until now, five species of *Collocheres*, including *C. inaequalis*, are known to have serrate lateral margins of the female genital double-somite, as in *C. solidus*. Four species, excluding *C. inaequalis* mentioned above, can be differentiated from *C. solidus* by the following features.

Collocheres marginatus Humes, 1987 has a terminal process on the caudal ramus and a transformed terminal seta (marginated with a hyaline membrane) on the outer lobe of maxillule. *Collocheres prionotus* Humes, 1990 has only three thorn-like processes on the lateral margins of female genital double-somite and apparently no palp (Humes, 1990). *Collocheres serrulatus* Humes, 1987 has the shorter caudal rami (ratio of length to width being 3.21:1 according to Humes, 1987), the maxillule in which the outer lobe is shorter than the inner lobe, and the tapering female genital double-somite. *Collocheres uncinatus* Stock, 1966 has the caudal rami which do not exceed three times as long as wide, according to Fig. 1b of Stock (1966), and the distinctly tapering distal segment of leg 5.

Collocheres tamladus n. sp.
(Figs. 7-9)

Material examined: 15 ♀♀, 5 ♂♂ from washings of *Catoptometra rubroflava* (A. H. Clack), Munsom Islet in Cheju Island, depth unknown, 22 April 2004, collected by S. Shin. Holotype (♀), allotype (♂) and paratypes (13 ♀♀, 3 ♂♂) will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C.

Female: Body (Fig. 7A) slender, similar to *C. brevipes* described above. Length 768 μm (750-804 μm), based on 10 specimens. Prosome dorsoventrally deeper rather than laterally wider. Cephalothorax 265 \times 203 μm . Urosome (Fig. 7B) 5-segmented. Fifth pedigerous somite 81 μm wide, each side tapering with pointed lateral tips. Genital double-somite 121 \times 80 μm wide, 1.51 times longer than wide, slightly expanded laterally near middle; lateral margins serrate with 6 faint serrations on area posterior to genital area; posterolateral corners produced posteriorly and pointed, bearing 1 larger and 1 small additional

dentiform processes on each corner; genital area located at anterior 1/3 length of somite. Posteroventral margin of genital double-somite and first 2 abdominal somites delicately serrated (Fig. 7C). Three abdominal somites from anterior to posterior 38 \times 48, 25 \times 41, and 33 \times 39 μm . Caudal ramus 58 \times 18 μm , ratio 3.22:1, with hairs along distal half of inner margin, and minute spinules on produced distal margin; 2 dorsal and outermost terminal setae smooth; other 3 setae plumose. Egg sac (Fig. 7D) containing only 2 eggs, each egg 154 μm thick.

Rostrum as small conical process in lateral view. Antennule (Fig. 7E) 20-segmented, 271 μm long. Armature: 1, 2, 2, 2, 2, 2, 2, 2, 7, 2, 2, 2, 2, 2, 2, 2, 2+ aesthetasc, 2, and 11. First segment with hairs on anterior margin. All setae smooth. Antenna (Fig. 7F) with short coxa. Basis 60 μm long. Exopod small, 7 \times 5 μm , bearing 2 terminal and 1 lateral setae. Endopod with first segment 32 μm long. Second segment 19 μm long, with 1 proximal and 3 minute terminal setae. Terminal claw 53 μm long, with spinules along distal half of inner outer margin, and spatulate hyaline tip.

Oral cone prominent in lateral view. Mandible (Fig. 7G) distally armed with 9 minute teeth. Palp small, bearing 1 small seta extending to middle of mandible. Maxillule (Fig. 7H) bilobed; outer lobe 25 μm long, extending over inner lobe, armed terminally with 1 long setae of 63 μm and 1 minute spinule; inner lobe with 4 terminal setae, longest one of them 53 μm . Maxilla (Fig. 8A) 2-segmented, bearing terminal claw; first segment with hyaline, duct-like process; distal segments slender; terminal claw with hyaline tip. Maxilliped (Fig. 8B) 5-segmented. First segment with small inner distal seta. Second segment elongate and unarmed. Third segment with 3 setae. Fourth segment distally with 1 minute, hardly visible, seta. Fifth segment with 1 terminal seta. Terminal claw with minute spinules on inner margin and spatulate hyaline tip.

Legs 1-4 (Figs. 8C-E, 9A) biramous with 3-segmented rami. Armature formula as follows:

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

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

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

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

Basis of leg 1 with several spinules near inner distal corner. Distal outer spiniform process on second endopod segment of legs 2 to 4 bifurcate.

Leg 5 (Fig. 8F) 2-segmented. Proximal segment 42 \times 42 μm , bearing 1 outer seta. Inner flap with minute spinules on inner margin and blunt tip. Distal segment slender, 62 \times 14 μm , ratio 4.43:1, with spinules on inner margin and 3 identical, 1 rudimentary inner setae. One cusp-like process present near base of proximalmost

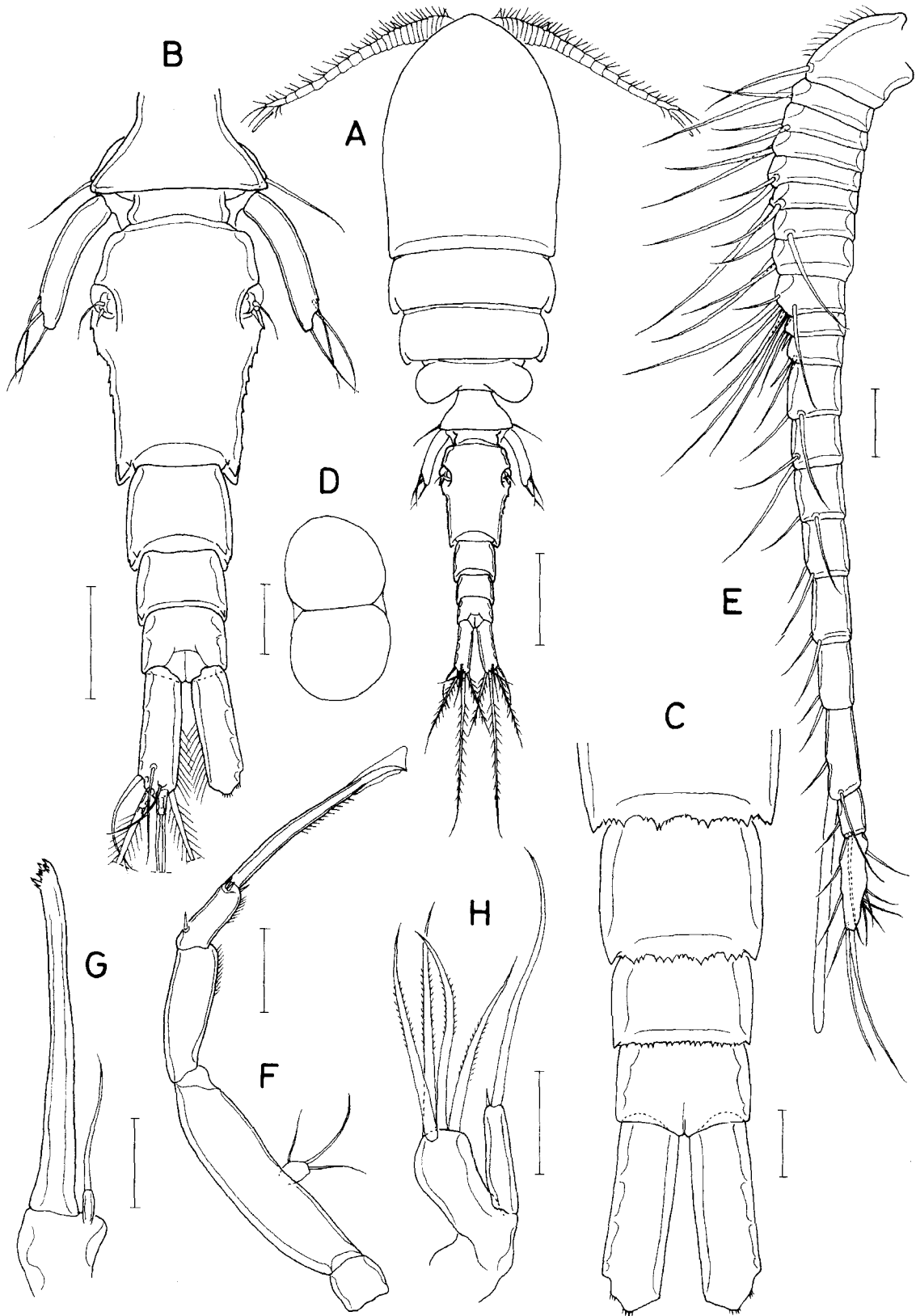


Fig. 7. *Collocheres tamladus* n. sp., female. A, Habitus, dorsal. B, Urosome, dorsal. C, Abdomen, ventral. D, Egg sac. E, Antennule. F, Antenna. G, Mandible. H, Maxillule. Scale bars=100 μ m (A, D), 50 μ m (B), and 20 μ m (C, E-H).

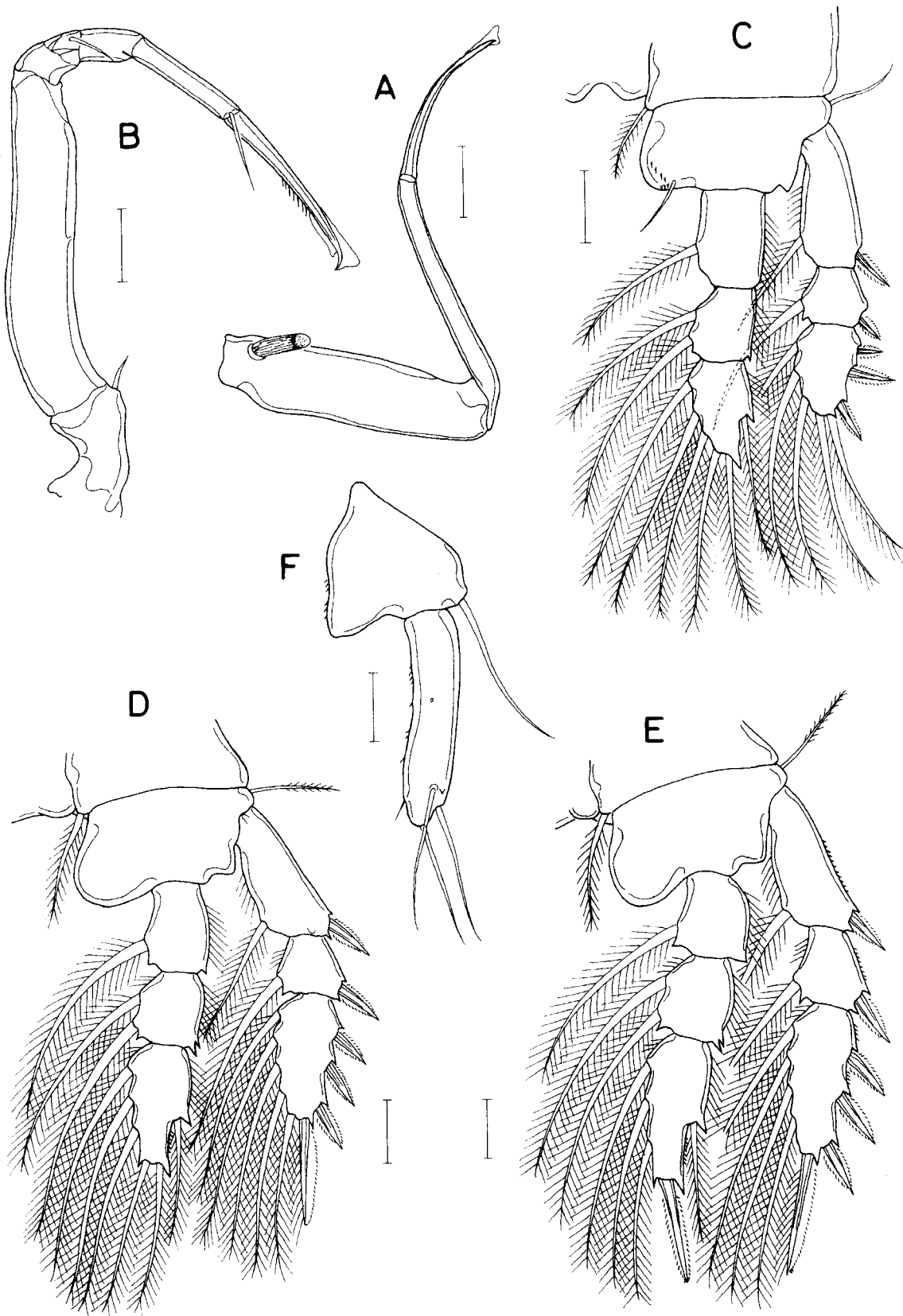


Fig. 8. *Collocheres tamladus* n. sp., female. A, Maxilla. B, Maxilliped. C, Leg 1. D, Leg 2. E, Leg 3. F, Leg 5. Scale bars=20 μ m.

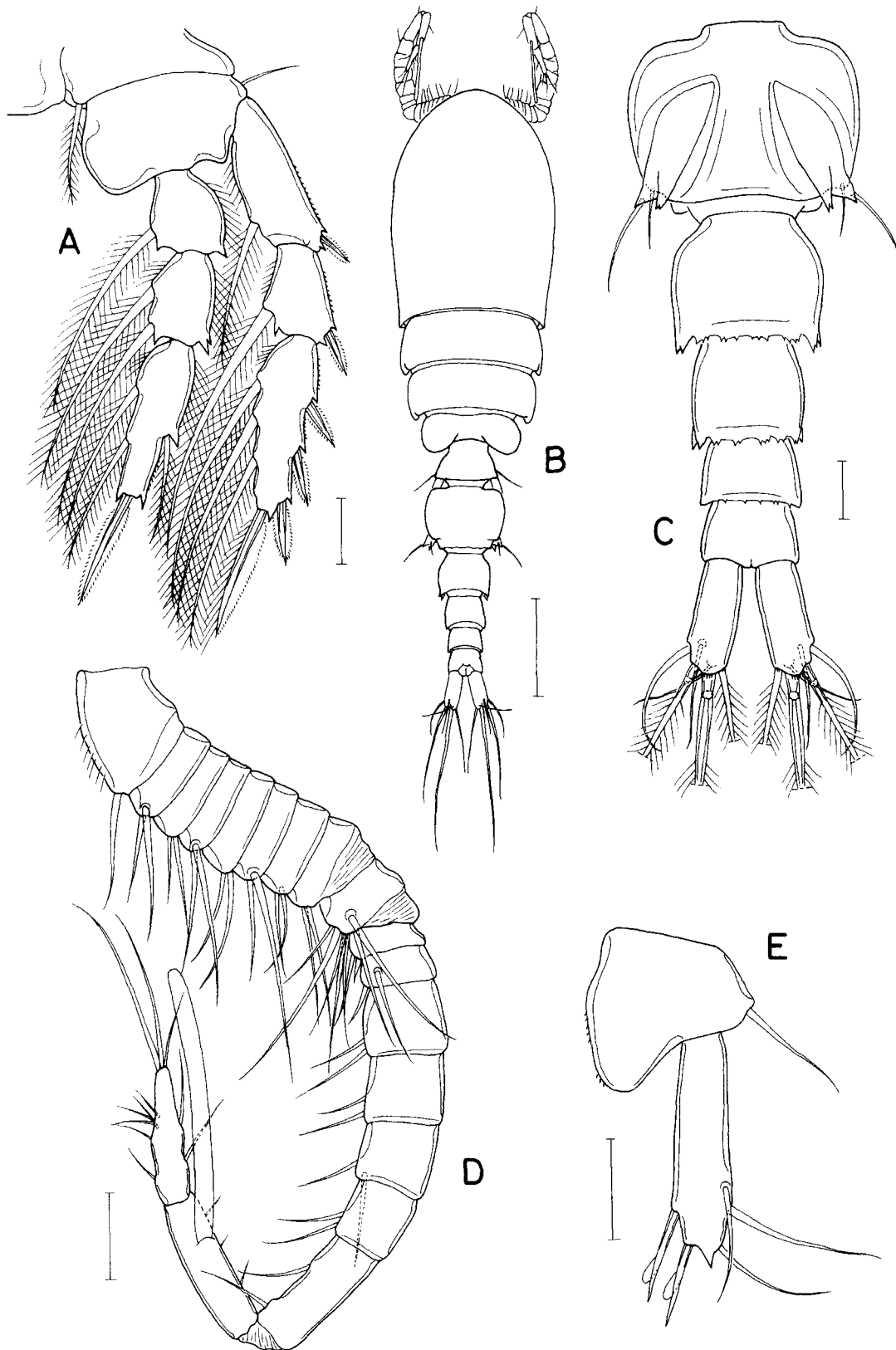


Fig. 9. *Collocheres tamladus* n. sp. Female. A, Leg 4. Male. B, Habitus, dorsal. C, Genital somite and abdomen, ventral. D, Antennule. E, Leg 5. Scale bars=20 μm (A, C-E) and 100 μm (B).

seta. Leg 6 represented by seta and spine on genital area (Fig. 7B). Color of specimens in alcohol pale yellow.

Male: Body (Fig. 9B) resembling that of female in general form. Length 657 μm (635-676 μm), based on 5 specimens. Cephalothorax 226 \times 170 μm .

Urosome (Fig. 9C) 6-segmented. Fifth pedigerous somite 65 μm wide. Genital somite 67 \times 82 μm , with rounded corners. Four abdominal somites from anterior to posterior 44 \times 54, 35 \times 40, 21 \times 36, and 23 \times 35 μm . First three abdominal somites with serrate posteroventral margin. Caudal ramus 40 \times 16 μm , ratio 2.50:1.

Rostral area like that of female. Antennule 18-segmented, geniculate, with 17th segment bearing large aesthetasc. Armature formula: 1, 2, 2, 2, 2, 2, 2, 7, 2, 2, 2, 2, 2, 3, 2+aesthetasc, and 11. Antenna as in female.

Oral cone, mandible, maxillule, maxilla, maxilliped, and legs 1-4 similar to those of female. Leg 5 (Fig. 9E) with first segment 26 \times 39 μm , bearing rounded tip. Second segment 46 \times 12 μm , ratio 3.83:1, terminated by pointed tip, with 3 outer setae and 2 inner distal spiniform setae bearing hyaline process (17 and 19 μm , respectively). Leg 6 represented by 2 setae and 2 spiniform processes (inner process bifurcate) on posteroventral flap on genital somite (Fig. 9C).

Etymology: The specific name *tamladus* is originated from "Tamlado", the old name of Cheju Island where the type locality is located in.

Remarks: The mandible of *Collocheres* is usually armed distally with 4 or 5 teeth, or 4 teeth and 1 or 2 subsidiary teeth. The deviations from these mandibular armatures having more than 6 teeth, like *C. tamladus* n. sp., are observable in *C. breei* Stock, 1966, *C. lunulifer* Humes, 1998, and *C. titillator* Humes, 1987. These three species can be distinguished from *C. tamladus* by the absence of serration along the lateral margins of female genital double-somite and by the following features.

In *Collocheres breei* the caudal rami are elongated, more than six times as long as wide, the outer lobe of

maxillule is shorter than the inner, and the body (1.11 mm long in the female) is relatively large.

In *Collocheres lunulifer* the genital double-somite in the female evenly tapers from anterior to posterior and the distal segment of male leg 5 is armed with 4 setae and 2 terminal hyaline setae.

In *Collocheres titillator* the terminal seta of palp extends over the end of mandible, and the outermost seta on the distal segment of female leg 5 is rudimentary (innermost seta is rudimentary in *C. tamladus*).

Collocheres tamladus resembles *C. brevipes* in body size and the shape of female genital double-somite, but can be distinguished by its shorter caudal rami, broader distal segment of female leg 5, and the absence of serration on the posteroventral margins of the genital and anterior abdominal somites.

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References

- Ho J-S (1982) Copepoda associated with echinoderms of the Sea of Japan. *Ann Rep Sado Mar Biol Stat, Niigata Univ* 12: 33-61.
- Humes AG (1987) Copepoda associated with crinoid echinoderms in the western Pacific. *Publ Seto Mar Biol Lab* 32: 63-108.
- Humes AG (1998) Copepoda (Siphonostomatoida) associated with Ophiuroidea in Jamaica, Puerto Rico, and Barbados. *Zool Verh* 323: 365-382.
- Humes AG (1990) *Collocheres* (Copepoda: Siphonostomatoida) associated with the crinoid *Capillaster multiradiatus* in the Indo-Pacific. *Trans Am Microsc Soc* 109: 61-68.
- Kim I-H (1998) Illustrated Encyclopedia of Fauna and Flora of Korea. Vol 38. Cirripedia, Symbiotic Copepoda, Pycnogonida. Ministry of Education of Korea, Seoul, pp 1-1038.
- Stock JH (1966) On *Collocheres* Canu, 1893, and *Leptomyzon* Sars, 1915, two synonymous genera of Copepoda. *Beaufortia* 13: 221-239.

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