

Two New Species of *Orecturus* (Copepoda: Siphonostomatoida: Asterocheridae) Associated with Octocorals from Korea

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ABSTRACT

Two new species of the genus *Orecturus* are described as associates of octocorals in Cheju Island, Korea. *Orecturus longicaudatus* n. sp. associated with a gorgonacean coral differs from its congeners by having a large body and a long anal somite. *Orecturus similis* n. sp., associated with an alcyonacean coral, is similar to *O. excavatus* but can be distinguished from it by possessing a single seta on the second segment of maxilla, the terminal claw of maxilliped which is evenly tapering, and the different ornamentation in legs 1 and 4.

Key words: *Orecturus*, new species, Copepoda, association, octocoral, Korea

INTRODUCTION

While describing *Orecturus grandisetiger* as new species, Humes (1992) made a new genus *Orecturus* and transferred to this genus two other species those had been placed in the genus *Acontiophorus*, *A. bracatus* Stock and Kleeton, 1963 and *A. excavatus* Humes, 1989. He distinguished this genus from other copepods of the family Asterocheridae by having a much elongated anal somite in relation to the previous somite. Since then, five more species have been recorded in this genus: *O. finitimus* and *O. forticulus* by Humes (1993) from Moluccas, *O.*

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sakalavicus Humes, 1994 from Madagascar, *O. amplus* Humes, 1996 from New Caledonia, and *O. bahiensis* Johnsson, 1998 from Brazil. These species of *Orecturus* have been found as associates of the octocorals in the Indo-Pacific and Mediterranean, except for *O. bahiensis* that was found in association with the asteroid, sponges and algae in Brazil (Johnsson, 1998).

While taking a field survey in the recent in Cheju Island, the largest southern island in Korea, we could collect a small colony of a gorgonacean coral with a height of about 15 cm. An examination of washings of this coral colony resulted in the recovery of 2 copepods belonging to *Orecturus*, which turned out to be a new species. Through a close comparison of this copepods with records on other species in the same genus, we became to recognize that the differences between the known species are very slight. In addition, a reexamination of the specimens that Kim (1998) assigned to *O. excavatus* resulted in a decision that they are a different and unknown species. In this paper, these two new species are described.

Before dissection and microscopic observation, copepod specimens were soaked in lactic acid for at least 30 minutes. Dissection were done using the reversed slide method (Humes and Gooding, 1964). The intact type specimens will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Dissected specimens are retained in the collection of the senior author. The body lengths were measured from the apex of the cephalothorax to the posterior margin of the caudal rami.

Family Asterocheridae Giesbrecht, 1899

Genus *Orecturus* Humes, 1992

****Orecturus longicaudatus* n. sp. (Figs. 1, 2)**

Type series. Holotype (♀) from washings of the coral *Calicogorgia granulosa* Kükenthal and Gorzawsky from off Biyang-do (approximately 33°22'N, 126°19'E), in Cheju Island, in about 10 m depth, on 19 April 2003. Holotype will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C., USA. Dissected paratype (1 ♀) is kept in the collection of the senior author.

Female. Body (Fig. 1A) with broad prosome. Length of dissected specimen 1.53 mm. Greatest width 771 µm. First pedigerous somite completely fused with cephalosome, forming cephalothorax. Cephalothorax 635 µm long, with angular posterolateral corners. Posterolateral corners of second and third pedigerous somites pointed. Fourth pedigerous somite much smaller than preceding somites, with deeply excavated posterior margin. Ratio of length of prosome to urosome 1.59 : 1.

Urosome (Fig. 1B) 4-segmented. Fifth pedigerous somite (Fig. 1C) 219 µm wide, with scales along lateral margins; its posteroventral margin W-shaped due to presence of 2 pointed posterior extensions. Genital double-somite 131 × 192 µm (ratio 1 : 1.47), with pointed posterolateral corners. Genital areas located dorsolaterally, anterior to middle of somite. First abdominal segment 35 × 127 µm. Anal somite 210 × 121 µm, ratio 1.74 : 1, with scales on all surfaces. Caudal ramus wider than long, 52 × 58 µm (ratio 1 : 1.12), with 6 setae; smallest dorsal seta naked and mounted on digitiform process. Outer lateral seta naked and located dorsally and subterminally; other 4 setae

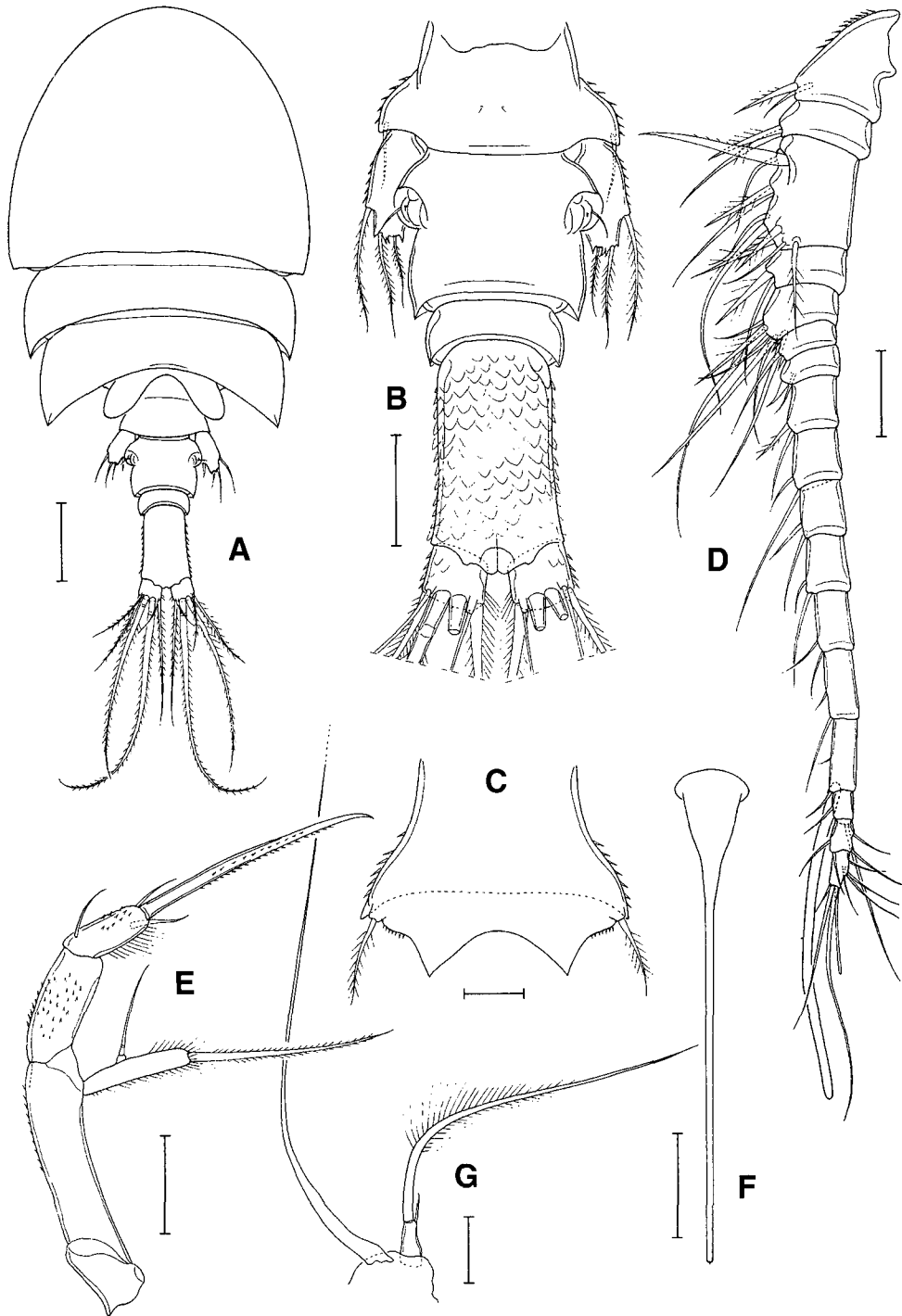


Fig. 1. *Orecturus longicaudatus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, fifth pedigerous somite, ventral; D, antennule; E, antenna; F, siphon; G, mandible. Scale bars = 0.05 mm (C-E, G), 0.1 mm (B), 0.2 mm (A, F).

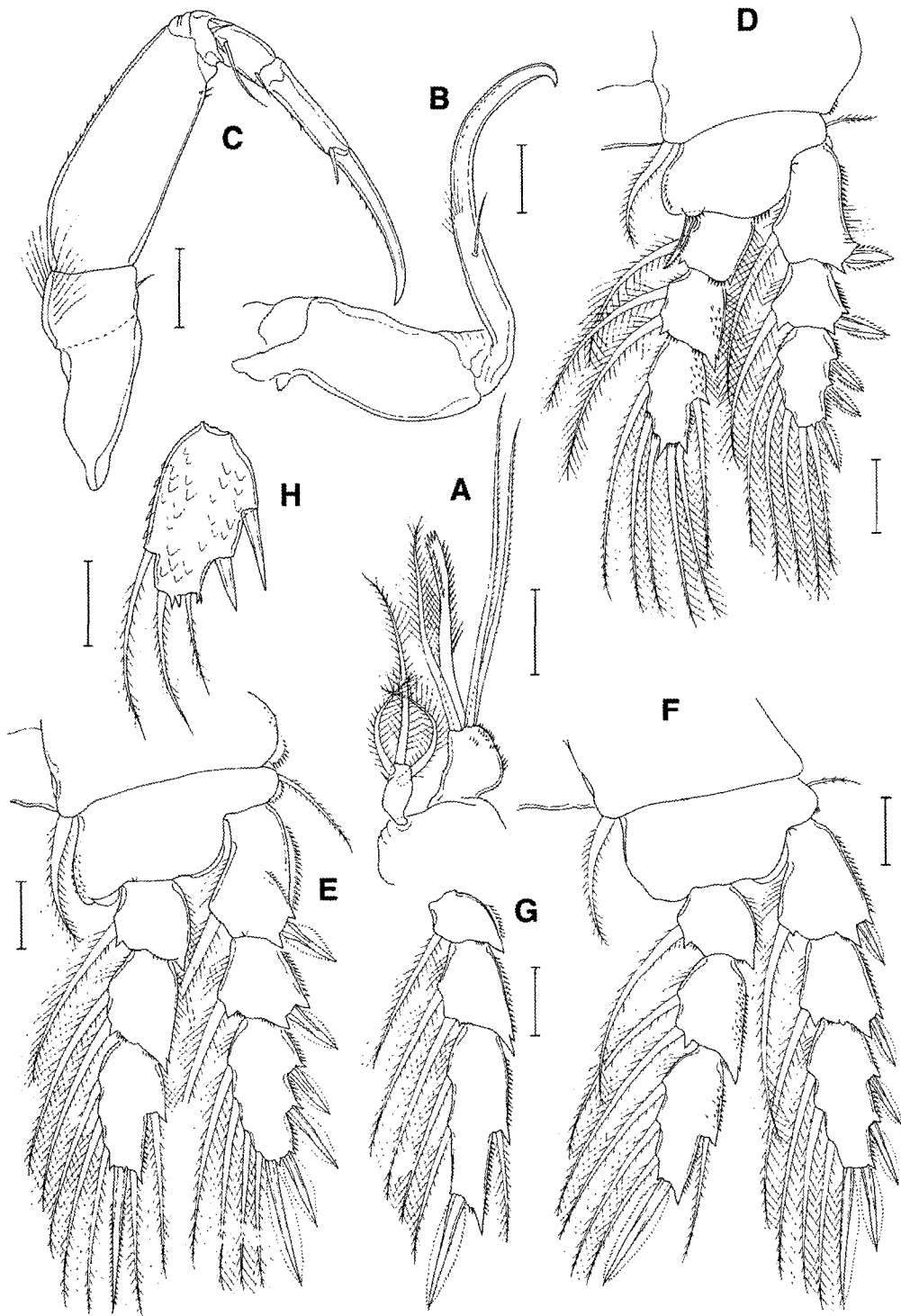


Fig. 2. *Orecturus longicaudatus* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4 endopod; H, free segment of leg 5. Scale bars = 0.05 mm (A-H).

plumous. Inner one of two median terminal setae swollen basally. Egg sac not seen.

Rostrum not prominent, represented by tapering ridge. Antennule (Fig. 1D) 519 μm long and 17-segmented; armature formula 2, 2, 10, 2, 8, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2+1 aesthetasc, 2, 4, and 7+1 aesthetasc. Some setae on first to fifth and eighth segments sparsely plumous, other setae naked; first segment with small spinules along anterior margin. Enlarged seta on third segment 87 μm long, longer than segment. Antenna (Fig. 1E) with short coxa of about 33 μm long; basis 102 μm long (measured along midline), with small spinules along inner margin. Exopod 1-segmented, 56 \times 12 μm , armed with 1 lateral seta (naked and based on elevation), 1 terminal seta (106 μm), and many setules on margins. Endopod 2-segmented; first segment 58 μm long, with small spinules on surfaces; second segment 40 μm long, with setules on outer margin, spinules on inner surface, 1 proximal seta, 1 outer seta, 1 small terminal seta, and 1 large claw-like terminal seta (128 μm long).

Siphon (Fig. 1F) 920 μm long and very slender, reaching fifth pedigerous somite. Mandible (Fig. 1G) with 1-segmented palp bearing terminally 1 small and 1 long plumous setae; masticatory part of mandible longer than palp including terminal longer seta, thin, needle-shaped. Maxillule (Fig. 2A) with 2 lobes; outer lobe with 3 setae and 1 minute setule; larger inner lobe with 4 setae: 1 thick, 1 plumous, 2 longer setae. Maxilla (Fig. 2B) 2-segmented; first segment unarmed and thick; second segment claw-like, with 1 seta and setules at basal third and minute spinules distally. Maxilliped (Fig. 2C) 5-segmented; first segment delimited into proximal and distal parts by suture line on one side, with small inner distal seta and setules on outer margin of distal part; second segment longest, with spinules on outer margin and near inner distal corner; shortest third segment with 2 small setae; fourth segment with 1 longer proximal and 1 smaller distal setae; fifth segment with 1 distal seta truncated distally; claw elongate, with few spinules along inner margin.

Legs 1-4 biramous, with 3 segmented rami. Armature formula of these legs as follows:

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

Leg 1 (Fig. 2D) with basis bearing barbed spine slightly extending over posterior margin of first endopodal segment; outer distal part of first exopodal segment lightly protruded; outer margin of first exopodal segment with spinules proximally and setules distally; outer margin of 2 distal exopodal segments with spinules. Outer margin of endopodal segment of legs 1 and 2 (Figs. 2D, E) with setules. Outer margin of 2 distal segments of leg 3 endopod and all segments of leg 4 endopod with spinules (Fig. 2F, G). Outer seta on basis of legs 1 and 3 small; this seta in other 2 legs larger.

Leg 5 consisting of plumous lateral seta on fifth pedigerous somite and free segment. Free segment (Fig. 2H) 101 \times 61 μm (ratio 1.66 : 1), armed with 2 inner spines, and 1 outer and 2 distal plumous setae; inner one smallest. Distal margin of free segment with 2 dentiform spinules on both sides of inner one of distal setae. Proximal spine located proximal to middle of inner margin.

Leg 6 represented by 1 seta and 1 minute spinule in genital area (Fig. 1B).

Color of specimens preserved in alcohol blackish brown, as that of host.

Male. Unknown.

Etymology. The specific name *longicaudatus* is a combination of the Latin *longus* (long) and *cauda* (tail). It alludes to the relatively long and slender anal somite.

Remarks. According to Humes (1996), the species of *Orecturus* known until that time seldom exceeded the length of 1.25 mm, except for *O. amplus* Humes, 1996, having the length of 1.50–1.56 mm. *Orecturus bahiensis* recorded later either not exceeds the length of 1.25 mm (Johnsson, 1998). Having the length of 1.53 mm, *O. longicaudatus* n. sp. is, therefore, comparable only with *O. amplus*. Features of *O. longicaudatus* different from those of *O. amplus* are as follows. In Korean species, the inner lobe of the maxillule is armed with four setae (five setae in *O. amplus*), the anal somite bearing a size $210 \times 121 \mu\text{m}$ (ratio 1.74 : 1) is distinctly longer and slender than that of *O. amplus* ($180 \times 160 \mu\text{m}$, ratio 1.13 : 1) and other congeners, and the enlarged seta on the third segment of the antennule is longer than segment (shorter in *O. amplus*).

O. longicaudatus can be further differentiated from its other congeners by the following ways. From *O. excavatus* and *O. longicaudatus* n. sp. by the weak distal projection of the first exopodal segment of leg 1 (strongly projected in these two species); from *O. bahiensis* by the 17-segmented antennule (16-segmented in *O. bahiensis*) and the presence of two setae on the exopod of the antenna (three setae in *O. bahiensis*); from *O. braccatus* (Stock and Kleeton, 1963) by having five setae on the inner lobe (4 in *O. braccatus*) and three large setae on the outer lobe (two large and one small in *O. braccatus*) of the maxillule; from *O. grandisetiger* Humes, 1992 and *O. finitimus* Humes, 1993 by the presence of two spines and three setae on the free segment of leg 5 (five setae in *O. grandisetiger* and *O. finitimus*); from *O. forticulus* Humes, 1993 by having short setae on the second endopodal segment of the antenna (one of setae on this segment is enlarged in *O. forticulus*); and from *O. sakalavicus* Humes, 1994 by the presence of the enlarged seta on the third segment of the antennule (no enlarged seta on this segment in *O. sakalavicus*).

****Orecturus similis* n. sp. (Figs. 3–5)**

Synonym: *Orecturus excavatus*, Kim, 1998, p. 640, figs. 300, 301.

Type series. Holotype (♀), allotype (♂), and paratypes (12 ♀ ♀, 5 ♂ ♂) from washings of the alcyonacean coral *Dendronephthya* sp. taken from a fishing net towed off Seogwipo (approximately 33° 15'N, 126° 35'E) in Cheju Island, depth unknown, on 24 August 1982. Type specimens will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C., USA. Dissected paratypes (1 ♀, 1 ♂) are kept in the collection of the senior author.

Female. Body (Fig. 3A) with broad prosome. Length 1.26 mm (1.19–1.34 mm), based on 9 specimens. Dissected specimen 1.34 mm long, with greatest width 694 μm . First pedigerous somite completely fused with cephalosome, forming cephalothorax. Cephalothorax 606 μm long, with angular posterolateral corners. Posterolateral corners of second and third pedigerous somites pointed. Fourth pedigerous somite much smaller than preceding somites and rounded laterally. Ratio of length of prosome to urosome 1.82 : 1.

Urosome (Fig. 3B) 4-segmented. Fifth pedigerous somite (Fig. 3C) 238 μm wide, with tapering

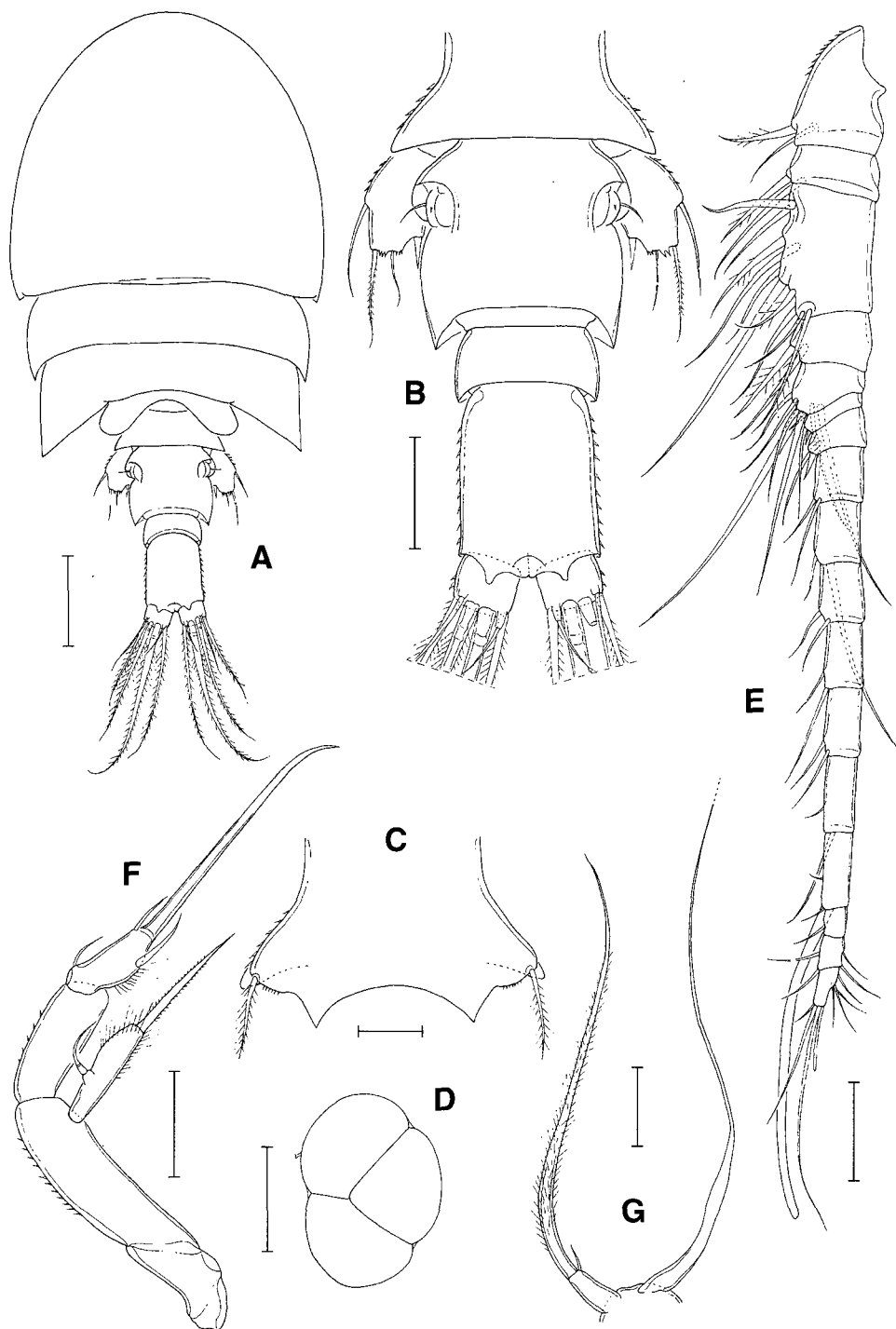


Fig. 3. *Orecturus similis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, fifth pedigerous somite, ventral; D, egg sac; E, antennule; F, antenna; G, mandible. Scale bars = 0.05 mm (C, E-G), 0.1 mm (B), 0.2 mm (A, D).

posterolateral corners and scales on lateral margins; its posteroventral margin W-shaped due to presence of 2 pointed posterior extensions. Genital double-somite $169 \times 196 \mu\text{m}$ (ratio 1 : 1.16), with pointed posterolateral corners. Genital areas located dorsolaterally in front of middle of somite. First abdominal segment $50 \times 129 \mu\text{m}$. Anal somite $173 \times 125 \mu\text{m}$, ratio 1.38 : 1, with scales along lateral margins. Caudal ramus wider than long, $46 \times 56 \mu\text{m}$ (ratio 1 : 1.22), with 6 setae; smallest dorsal seta naked and mounted on digitiform process. Outer lateral seta naked and located dorsally and subterminally; other 4 setae plumous. Inner one of two median terminal setae swollen basally.

Egg sac (Fig. 3D) $365 \times 260 \mu\text{m}$, containing 3 eggs based on 2 specimens.

Rostrum not prominent, represented by tapering ridge. Antennule (Fig. 3E) $495 \mu\text{m}$ long and 17-segmented; armature formula 2, 2, 10, 2, 8, 2, 2, 2, 2, 2, 2, 2, 2, 2+1 aesthetasc, 2, 4, and 7+1 aesthetasc. Some setae on first to fourth segments with lateral setules; other setae naked; first segment with small spinules along anterior margin. Antenna (Fig. 3F) with short coxa of about $41 \mu\text{m}$ long; basis $94 \mu\text{m}$ long (measured along midline), with small spinules along inner margin. Exopod 1-segmented, $53 \times 13 \mu\text{m}$, armed with 1 lateral curved seta (naked and based on elevation), 1 terminal seta ($63 \mu\text{m}$), and many setules distally. Endopod 2-segmented; first segment $58 \mu\text{m}$ long, with several small spinules on inner margin; second segment $40 \mu\text{m}$ long, with setules on outer margin, 1 proximal seta, 1 outer seta, 1 small terminal seta, and 1 large claw-like terminal seta ($125 \mu\text{m}$).

Siphon $633 \mu\text{m}$ long and very slender, reaching insertion of leg 3. Mandible (Fig. 3G) with 1-segmented palp bearing terminally 1 small and 1 long plumous setae; masticatory part of mandible longer than palp including terminal longer seta, thin, needle-shaped. Maxillule (Fig. 4A) with 2 lobes; outer lobe with 3 setae; larger inner lobe with 5 setae: 1 thick, 1 plumous, 2 longer, and 1 smaller naked seta. Maxilla (Fig. 4B) 2-segmented; first segment unarmed and thick; second segment claw-like, with 1 seta and setules at basal third. Maxilliped (Fig. 4C) 5-segmented; first segment delimited into proximal and distal parts by suture line on one side, with small inner distal seta and setules on distal part of outer margin; second segment longest, with spinules on outer margin and inner side; shortest third segment with 1 small seta; fourth segment with 1 longer proximal and 1 smaller distal setae; fifth segment with 1 distal seta; claw elongate, as long as distal three segments combined, with few spinules on distal part of inner margin.

Legs 1-4 biramous, with 3-segmented rami. Armature formula of these legs as follows:

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

Leg 1 (Fig. 4D) with basis bearing barbed spine slightly extending over posterior margin of first endopodal segment; outer distal part of first exopodal segment distinctly protruded; outer margin of first exopodal segment with setules; outer margin of 2 distal exopodal segments with spinules. Outer margin of endopodal segment of legs 1-3 (Figs. 2D-F) with setules. Outer margin of endopodal segments of leg 4 with spinules (Fig. 4G). Outer seta on basis of leg 3 small and naked; this seta in other 3 legs larger and plumous.

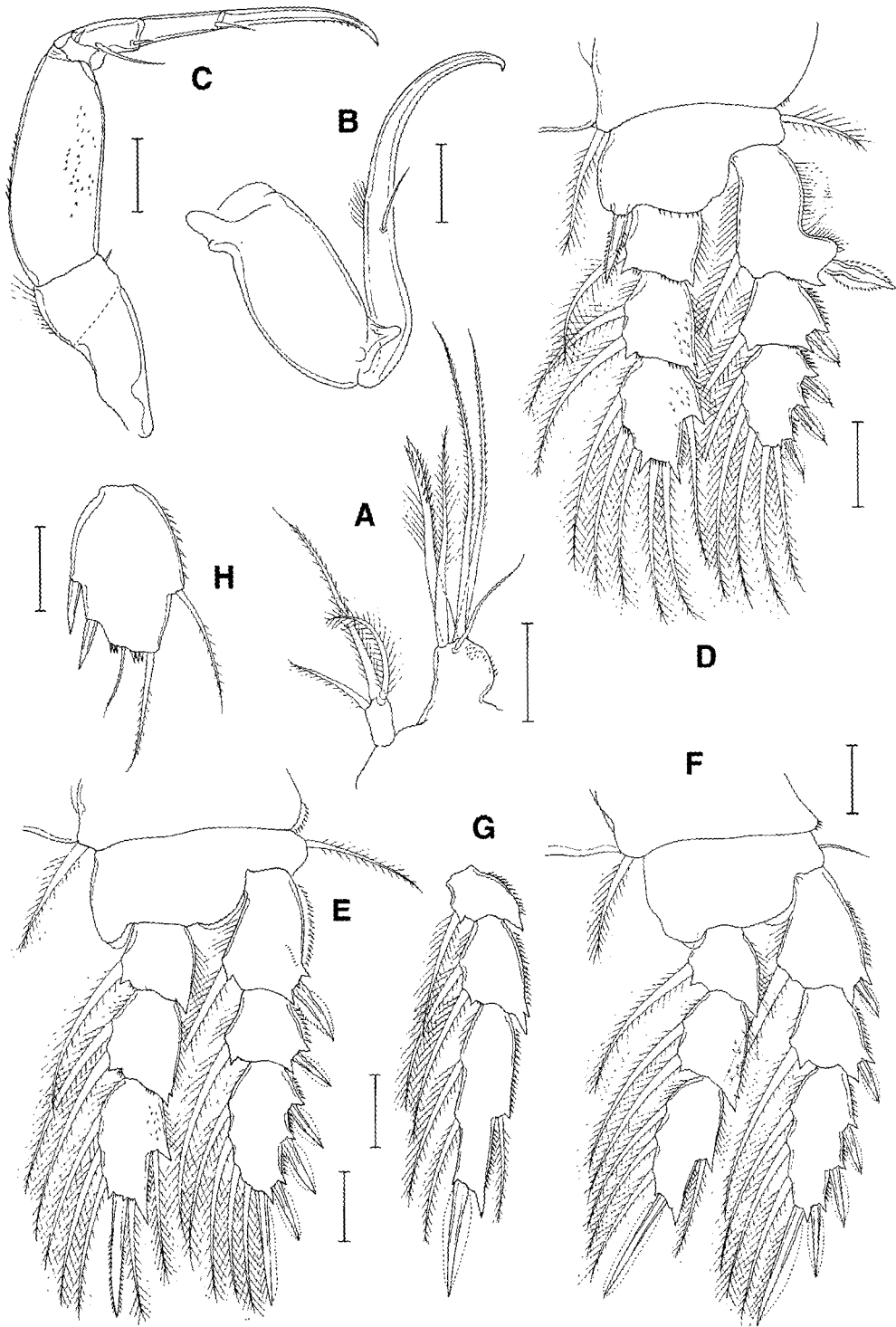


Fig. 4. *Orecturus similis* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4 endopod; H, free segment of leg 5. Scale bars = 0.05 mm (A-H).

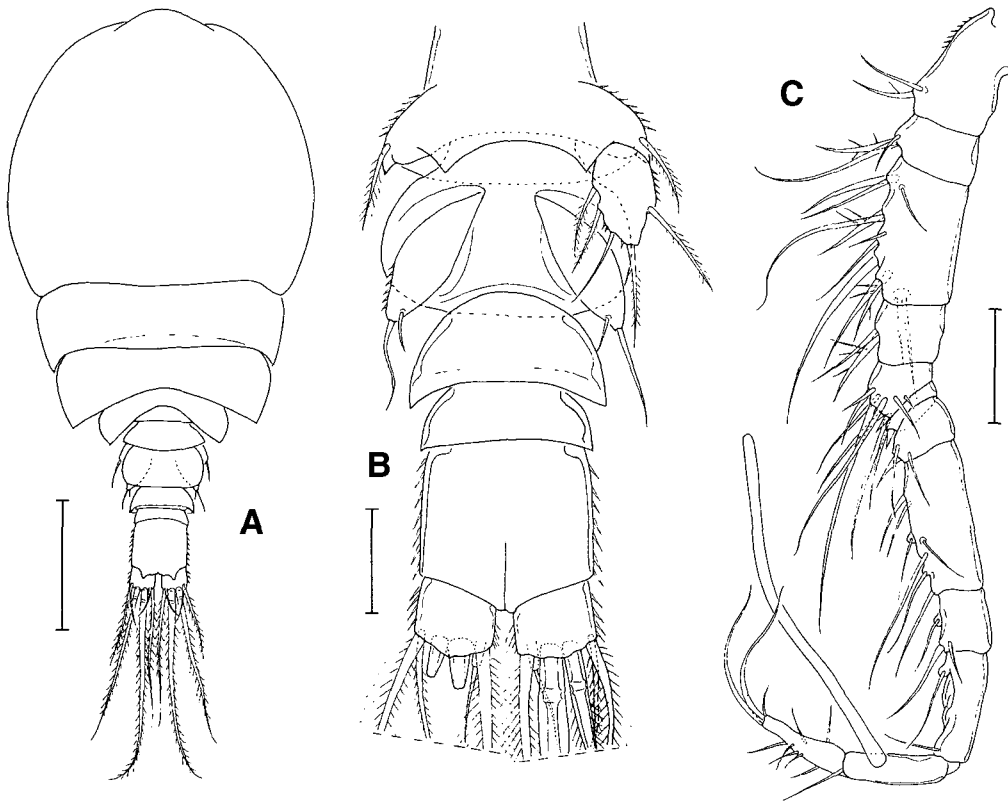


Fig. 5. *Orecturus similis* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antennule. Scale bars = 0.05 mm (B, C), 0.2 mm (A).

Leg 5 consisting of lateral seta on fifth pedigerous somite and free segment. Free segment (Fig. 4H) $96 \times 66 \mu\text{m}$ (ratio 1.45 : 1), armed with 2 inner spines, and 1 outer and 2 distal setae; inner one of distal setae naked and smaller; other 2 longer setae weakly plumous. Distal margin of free segment with 2 or 3 dentiform spinules on both sides of inner one of distal setae. Proximal spine located near middle of inner margin.

Leg 6 represented by 1 seta and 1 minute spinule in genital area (Fig. 3B).

Color of specimens preserved in alcohol white.

Male. Body (Fig. 5A) narrower than in female. Length 0.91 mm. Greatest width of prosome 475 μm . Cephalothorax 430 μm long, with delimited rostral area. Urosome (Fig. 5B) 5-segmented. Fifth pedigerous somite 129 μm wide. Genital somite $67 \times 120 \mu\text{m}$, with rounded lateral margins. Three abdominal somites 38×94 , 28×83 , and $81 \times 85 \mu\text{m}$. Caudal ramus $32 \times 38 \mu\text{m}$ (ratio 1 : 1.19).

Rostrum, antenna, mouth parts not different from those of female. Antennule (Fig. 5C) 12-segmented; armature formula: 2, 3, 12, 2, 10, 2, 3, 7, 3, 2, 1+aesthetasc, and 10.

Legs 1-4 as in female. Free segment of leg 5 $50 \times 31 \mu\text{m}$ (ratio 1.61 : 1), armed with 5 setae, 4 plumous and 1 naked. Leg 6 represented by genital flap bearing 1 distal and 1 small subdistal

naked setae.

Etymology. The specific name *similis*, the Latin meaning “similar”, refers to the similarity of the new species to *O. excavatus* (Humes).

Remarks. In most respects, the new species resembles *Orecturus excavatus* known from Madagascar, Moluccas and the Philippines (Humes, 1989). Bearing the distal protrusion in the first segment of the exopod of leg 1 by both species is, in particular, a remarkable resemblance. Moreover, these two species share similar body size (1.27-1.35 mm in *O. excavatus*, according to Humes, 1994) and similar dimensions in the genital double-somite, anal somite and caudal ramus. Although the differences between the two species are very slight, they can be differentiated from each other by the following ways:

Orecturus excavatus possesses two setae on the distal segment of maxilla (Humes, 1989). In *O. similis*, the same segment has only a single seta. In *O. excavatus* the terminal claw of maxilliped is abruptly narrowed from the proximal third on (Humes, 1989, 1996) which is a characteristic not applicable to *O. similis*. According to Fig. 17 in Humes (1989), *O. excavatus* has leg 4 endopod bearing setules on outer margin. However, the same margin in *O. similis* is ornamented with spinules. Lastly, the outer margin of the first exopodal segment of leg 1 in *O. excavatus* is ornamented with spinules, unlike *O. similis* in which it is ornamented with setules.

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한국의 팔방산호류에 공생하는 넓은가슴노벌레속
(대롱입요각목: 불가사리이과)의 요각류 2신종

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요 약

제주도 해역의 팔방산호에 공생하는 *Orecturus*속의 요각류 2신종을 기재하였다. 별산호류에 공생하는 신종 긴꼬리넓은가슴노벌레 (*Orecturus longicaudatus*)는 동일 속의 다른 종과는 달리 몸이 크고 항문절이 길다. 바다맨드라미류에 공생하는 신종 넓은가슴노벌레 (*Orecturus similis*)는 *O. excavatus*와 유사하지만 제2소악 둘째 마디에 1개의 강모만 소유하며, 턱다리의 말단발톱이 완만하게 가늘어지고, 첫째와 넷째 다리의 장식이 다른 종의 것과 다르다.