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Three New Species of *Critomolgus* (Copepoda, Poecilostomatoida, Rhynchomolgidae) Associated with Sea Anemones in Korea

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Three new copepod species of *Critomolgus* are described from the Korean coast of the Sea of Japan. They were found in association with the sea anemones of intertidal and shallow water, one of them from *Anthopleura japonica* Verrill and the remaining two from *Anthopleura midori* Uchida and Muramatsu. The described three new copepods are sympatric and very closely related to one another, though they are easily distinguished from other known species of the same genus. This is the first record on the sea anemone-associated copepods in the Far East.

KEY WORDS: New Species, *Critomolgus*, Rhynchomolgidae, Sea Anemones, Korea

Various copepods live in association with sea anemones. Humes (1982) listed 42 copepod species known untill that time to be associated with Actiniaria and Corallimorpharia. About one-fourth of these copepods belong to the genus *Critomolgus*. More than one-third species of the latter are associated with the sea anemones, with remaining two-thirds with other marine invertebrates such as echinoderms, nudibranchs and other cnidarians (Humes and Boxshall, 1996). Most species of this genus were formerly included in the genus *Doridicola* until Humes and Stock (1983) incorporated them into the genus *Critomolgus*.

In the Far East, only two species of this genus were reported. They are *C. brevipes* (Shen and Lee, 1966) from planktons in China and *C. isoawamochi* (Ho, 1981) collected from a nudibranch in the Japanese side of the Sea of Japan (Ho, 1981). Therefore none of the members of this genus has been reported from the sea anemones in this region.

On the Korean coast of the Sea of Japan, *Anthopleura japonica* Verrill and *A. midori* Uchida and Muramatsu, from which the new copepods were collected, are the most common sea anemones. The former species, usually occurring on the rocky shores openned to the sea, is found in the shallow subtidal depth of about 20-50 cm. On the other hand, the latter, *A. midori*, is usually found in the low intertidal protected shores such as the tidal pools and semi-closed areas, but frequently occurs together with *A. japonica* in the same place. Three new species of copepods dealt in this report were discovered from these sea anemones, one of them from *A. japonica* and the remaining two from *A. midori*. The type locality, Aninjin (approximately 37°44′ N, 128°59′ E), is located at about 10 km south of Kangreung.

The copepod material examined were collected using a large pipette with which the copepods were sucked up from the tentacles and gastrovascular cavity of the sea anemones. The sucked materials were filtered with a fine net and then the copepods were sorted out under the microscope. The specimens were fixed in 10 % formalin for about a couple of hours before

soaking in lactic acid for the microscopic examination.

Description

Critomolgus malmizalus, n. sp. (Figs. 1-3)

Type specimens 13 ♀♀, 8 ♂♂ from the actiniarian, *Anthopleura japonica* Verrill, at Aninjin on the Korean coast of the Sea of Japan (shallow sublittoral, depth about 20-50 cm), on 24 May 1996. Holotype ♀, allotype, and 15 paratypes (10 ♀♀, 5 ♂♂) will be deposited in the U. S. National Museum of Natural History, Smithsonian Institution, Washington D. C. The remaining paratypes (dissected) are kept in the collection of the author.

Female Body (Fig. 1A) moderately slender. Length 1.91 (1.82-2.03) mm and greatest width 0.85 (0.80-0.88) mm, based on 10 specimens. First pedigerous somite separated dorsally from cephalosome by indistinct line.

Fifth pedigerous somite 254 μm wide. Genital double somite elongate and 308 × 204 μm; anterior half slightly broader than posterior half (Fig. 1B), with 2 slightly broader portions each in anterior 0.17 and 0.55. Genital areas located dorsolaterally in anterior 44 % length of genital double somite. Three postgenital somites 96 × 154, 69 × 146, 96 × 154 μm, respectively, from anterior to posterior. Posteroventral border of anal somite fringed with minute spinules.

Caudal ramus 117 × 68 μm, ratio 1.72:1, with 6 setae. Outer lateral and dorsal setae naked. Four terminal setae plumose. Egg sac nearly ovoid, 500 × 370 μm.

Rostrum with hemicircularly rounded posterior margin. Antennule (Fig. 1C) 524 μm long. Armature formula 4, 13, 6, 3, 4+1 aesthetasc, 2+1 aesthetasc, and 7+1 aesthetasc. Several larger setae on first, second and fourth segments armed with fine setules.

Antenna (Fig. 1D) 4-segmented. Armature formula 1, 1, 3, and 5+2 claws. Second segment with minute spinules on inner surface. Fourth segment about 3.5 times as long as wide. Two terminal claws almost equal in size.

Labrum (Fig. 1E) with 2 posteroventral lobes. Mandible (Fig. 1F) with convex side of base having row of small spines and followed by serrated fringe. Concave side of base beyond indentation bearing setules of 2 different sizes. Lash long and barbed. Paragnath a small hairy lobe. Maxillule (Fig. 1G) with 3 weakly spinulated terminal setae and smooth subterminal setiform process. Maxilla (Fig. 2A) 2-segmented, with unornamented first segment. Second segment with posterior smooth seta, inner barbed spine, and small outer proximal setule; lash long with spines. Maxilliped (Fig. 2B) 3-segmented with unarmed first segment. Second segment with 1 large distal and 1 small proximal setae. Third segment with 2 naked setae of unequal size and terminating in blunt process.

Leg 1 (Fig. 2C), leg 2 (Fig. 2D), leg 3 with 3-segmented rami. Leg 4 (Fig. 2F) with 3-segmented exopod and 2-segmented endopod. These legs armed as follows (Roman numerals indicating spines, and Arabic numerals, setae):

P1 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,4
enp 0-1; 0-1; I,5
P2 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,5
enp I,II,3
P3 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,5
enp 0-1; 0-2; I,II,2
(Fig. 2E)
P4 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,5
enp 0-1; II

Coxa of leg 1 with weak outer posterior prominence. Outer seta on basis of all biramous legs naked. Inner coxal seta of leg 4 naked. Two terminal spines of leg 4 58-65 μm (outer) and 105-109 μm (inner) long.

Leg 5 with slender free segment (Fig. 2G) of 188-216 × 33-34 μm, ratio about 6.0:1 (5.52-6.52:1), and ornamented with small spines along outer side and armed with 2 terminal setae of 79 μm and 125 μm respectively.

Leg 6 represented by 2 small setae on genital area (Fig. 1B).

Male Body (Fig. 3A) nearly similar to that of female. Length 1.44 mm and greatest width 0.64 mm. Urosome (Fig. 3B) 6-segmented. Genital somite 250 × 243 μm, nearly long as wide. Third postgenital somite distinctly shorter than the others. Caudal ramus resembling, but shorter than,

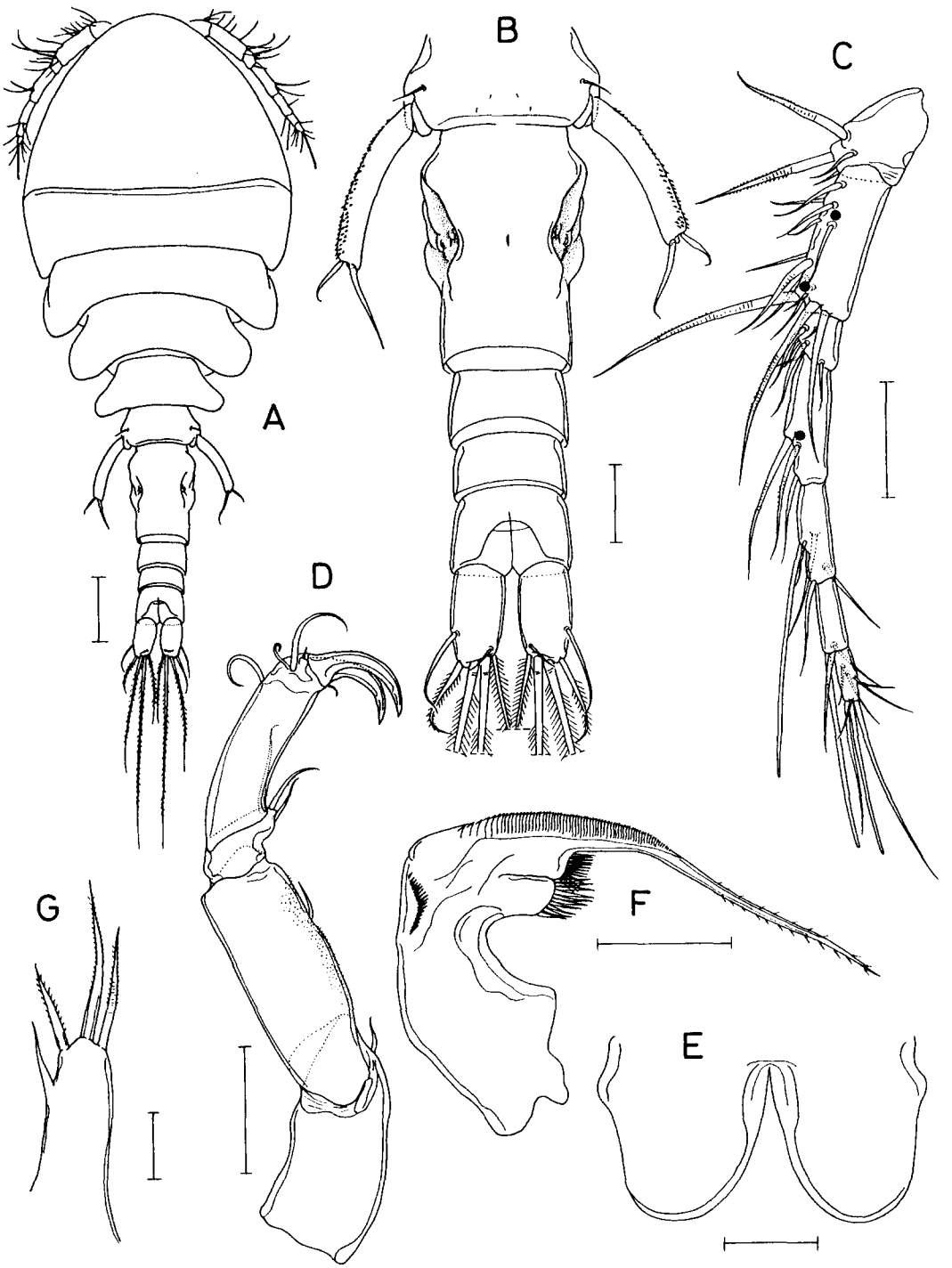

Fig. 1. *Critomolgus malmizalus* n. sp., female: A, habitus, dorsal; B, urosome, dorsal; C, antennule (black dots indicating positions of aesthetascs added in male); D, antenna; E, labrum; F, mandible; G, maxillule. Scales: A= 0.2 mm; B-D= 0.1 mm; E, F= 0.05 mm; G= 0.02 mm.

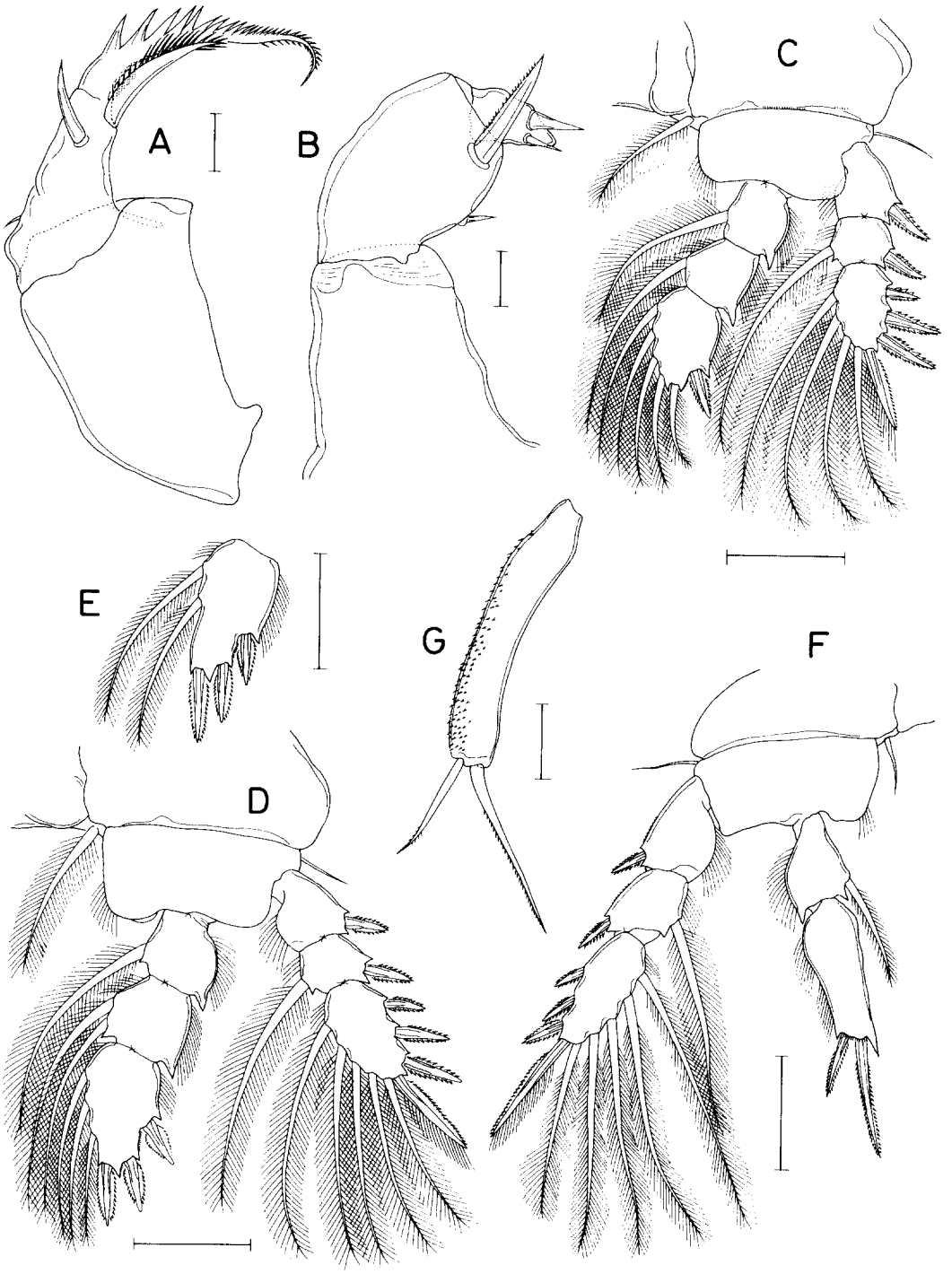

Fig. 2. *Critomolgus malmizalus* n. sp., female: A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, terminal segment of endopod of leg 3; F, leg 4; G, free segment of leg 5. Scales: A, B= 0.02 mm; C-F= 0.1 mm; G= 0.05 mm.

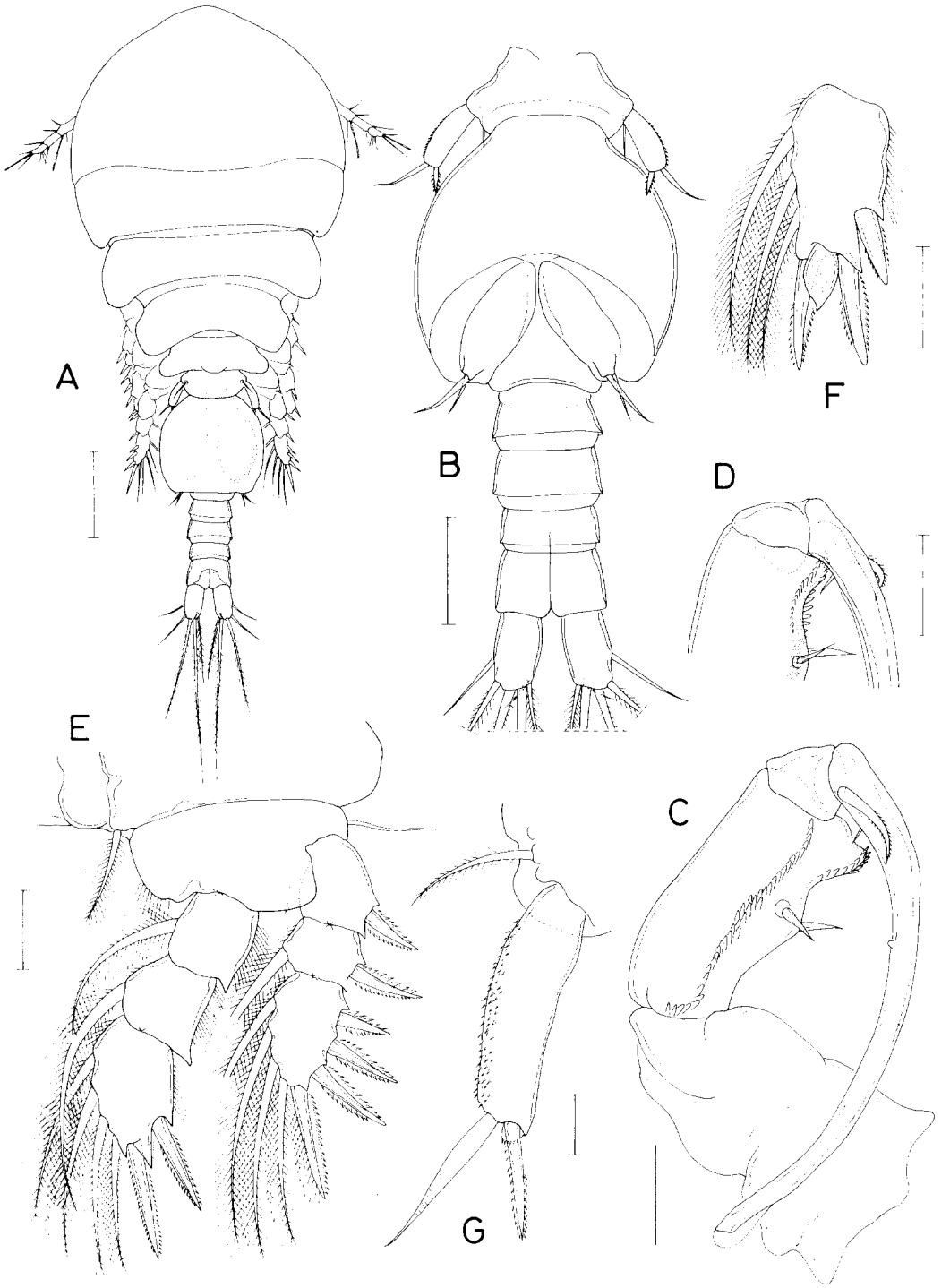

Fig. 3. *Critomolgus malmizalus* n. sp., male: A, habitus, dorsal; B, urosome, dorsal; C, maxilliped; D, Distal area of second segment of maxilliped; E, leg 1; F, terminal segment of endopod of leg 2; G, leg 5. Scales: A= 0.2 mm; B= 0.1 mm; C-F= 0.05 mm; G= 0.02 mm.

that of female, 75 × 43 μm, ratio 1.74:1.

Rostrum as in female. Antennule similar to that of female but added by 3 aesthetascs (at positions indicated by dots in Fig. 1C). Antenna as in female but with more distinct spinulation on second segment.

Labrum, mandible, paragnath, maxillule, and maxilla as in female. Maxilliped (Fig. 3C, D) 4-segmented (assuming that proximal part of claw represents fourth segment). First segment unarmed. Second segment with longitudinal row of spinules, 2 sub-identical setae near weak prominence in midlength and serrated crest distally on inner margin. Third segment unarmed. Claw long, with small tubercle in proximal third on concave side and proximally 2 extremely unequal setae, the longer seta finely spinulated along both sides of distal half.

Legs 1-4 segmented and armed as in female except for endopod third segment of leg 1 (I, I, 4 instead of I, 5 in female). Other sexual dimorphism present in endopod third segment of leg 2 in which terminal spiniform process of female is replaced by foliaceous plate in male (Fig. 3F). This plate armed with minute granules on surface.

Leg 5 with free segment of 81 × 24 μm, ratio 3.38:1, avoid of proximal swelling. Two terminal elements, inner one serrated spine of 40 μm and outer one smooth seta of 56 μm.

Leg 6 a posteroventral flap on genital somite, bearing 2 naked setae of unequal size.

Etymology The specific name *malmizalus* is a modification of *malmizal* ("sea anemone" in Korean) which is the most preferred host animal of *Critomolgus*.

Critomolgus anthopleurus, n. sp. (Figs. 4-6)

Type specimens 23 ♀♀, 9 ♂♂ from actiniarian, *Anthopleura midori* Uchida and Muramatsu, at Aninjin on the coast of the Sea of Japan (intertidal), on 21 June 1992. Holotype ♀, allotype, and 26 paratypes (20 ♀♀, 6 ♂♂) will be deposited in the U. S. National Museum of Natural History, Smithsonian Institution, Washington D.C. The remaining paratypes (dissected) are kept in the collection of the author.

Female Body (Fig. 4A) moderately slender. Length 2.29 (1.88-2.70) mm and greatest width 1.01 (0.85-1.13) mm, based on 10 specimens. First pedigerous somite separated from cephalosome by weak dorsal line. Epimeral area of prosomal somites rounded posteriorly.

Urosome (Fig. 4B) 5-segmented. Fifth pedigerous somite 325 μm wide. Genital double somite 365 × 313 μm, ratio 1.17:1; maximum width measured across the middle roundly expanded laterally (Fig. 4B). Genital areas located dorsolaterally in anterior 35 % of length. Second postgenital somite shortest among 3 postgenital somites. Posteroventral border of anal somite fringed with row of minute spinules (not illustrated in Fig. 4B).

Caudal ramus 125 × 75 μm, ratio 1.67:1, with 6 setae. Outer lateral and dorsal setae naked. Four terminal setae plumose. Egg sac 845 × 420 μm, kidney-shaped.

Rostrum with hemicircularly rounded posterior margin. Antennule (Fig. 4C) 7-segmented, 533 μm long. Segments gradually narrower from proximal to distal ones, with armature formula 4, 13, 6, 3, 4+1 aesthetasc, 2+1 aesthetasc, and 7+1 aesthetasc, respectively. Several larger setae on first and second segments armed with minute setules. Antenna (Fig. 4D) 4-segmented. Armature formula 1, 1, 3, and 5 + 2 claws. Fouth segment about 4 times as long as wide. All setae smooth. Two terminal claws almost equal in size.

Labrum (Fig. 4E) with 2 posteroventral lobes. Mandible (Fig. 4F) with convex side of base having row of small spines and followed by serrated fringe. Concave side of base beyond indentation bearing setules of 2 different sizes. Lash moderately long and barbed. Paragnath a small hairy lobe. Maxillule (Fig. 4G) with 3 terminal setae and 1 subterminal setiform process. Maxilla (Fig. 5A) and maxilliped (Fig. 5B) as in preceding species.

Leg 1 (Fig. 5C), leg 2 (Fig. 5D), leg 3 with 3-segmented rami. Leg 4 (Fig. 5F) with 3-segmented exopod and 2-segmented endopod. These legs armed as follows (Roman numerals indicating spines, and Arabic numerals, setae):

P1 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,4
enp 0-1; 0-1; I,5

P2 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,5

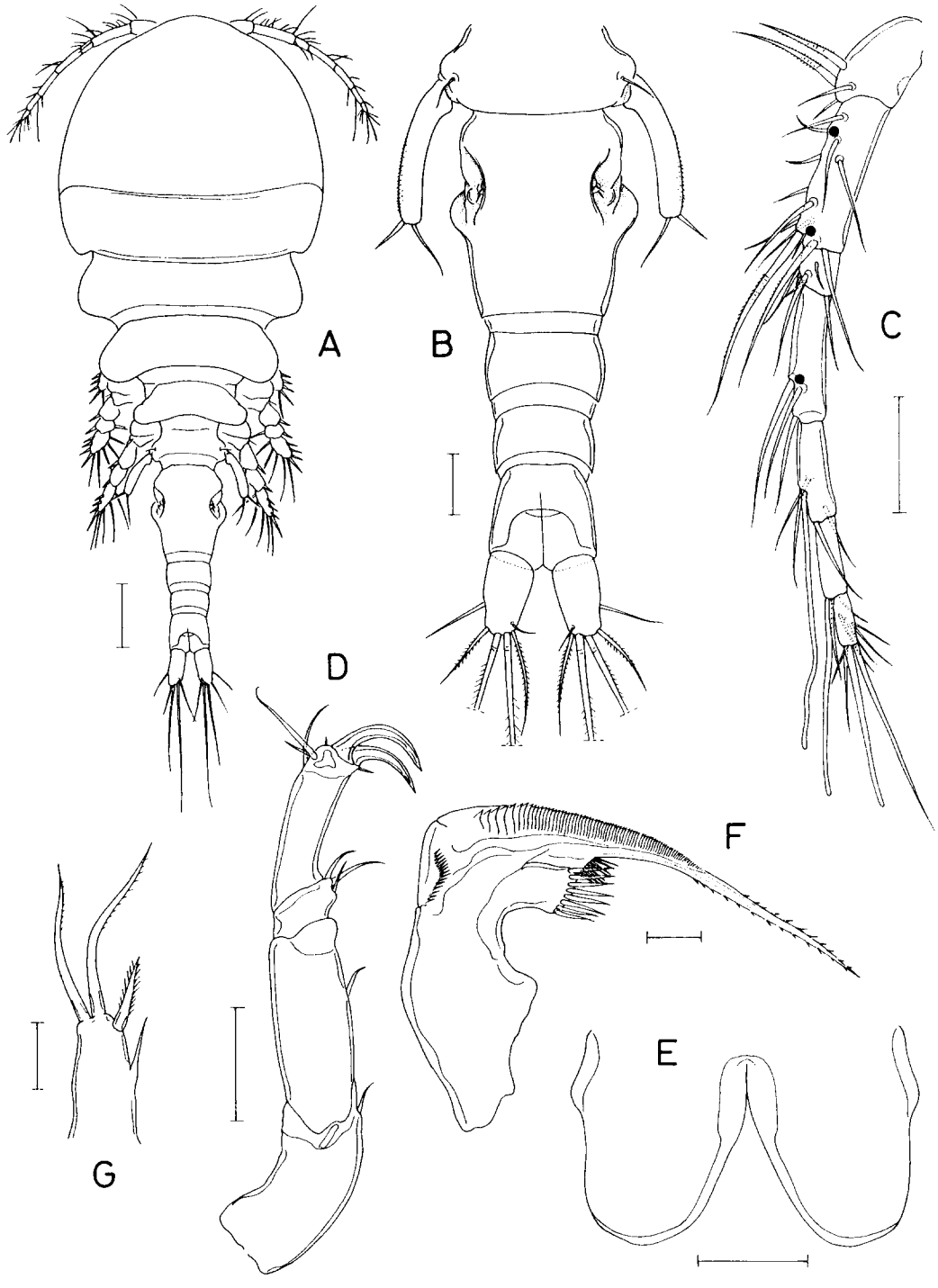

Fig. 4. *Critomolgus anthopleurus* n. sp., femlae: A, habitus, dorsal; B, urosome, dorsal; C, antennule (black dots indicating positions of aesthetascs added on opposite side in male); D, antenna; E, labrum; F, mandible; G, maxillule. Scales: A= 0.2 mm; B-D= 0.1 mm; E= 0.05 mm; F, G= 0.02 mm.

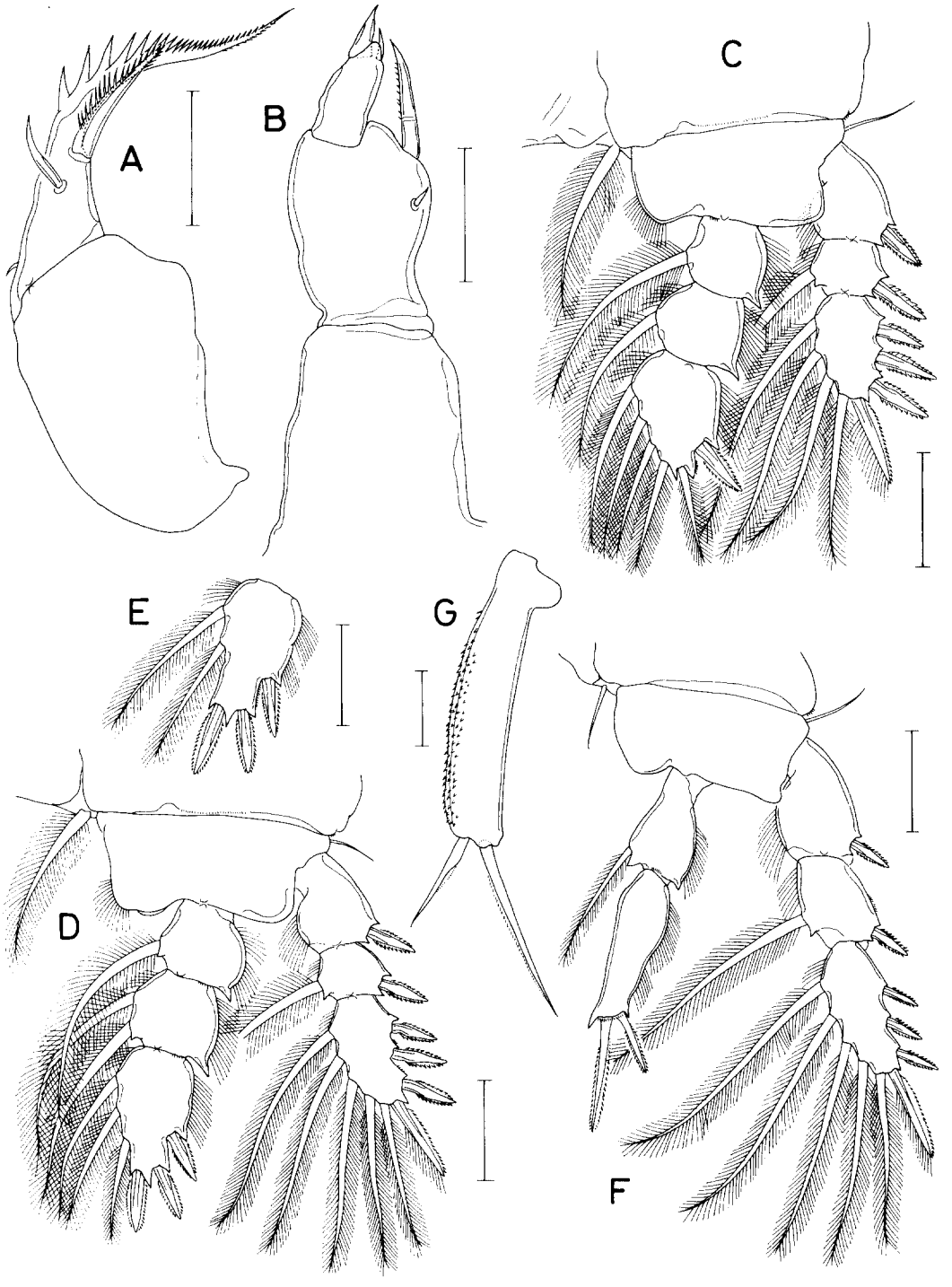

Fig. 5. *Critomolgus anthopleurus* n. sp., female: A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, terminal segment of endopod of leg 3; F, leg 4; G, free segment of leg 5. Scales: A, B, G= 0.05 mm; C-E= 0.1 mm.

enp I,II,3
P3 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,5
enp 0-1; 0-2; I,II,2
(Fig. 2E)
P4 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,5
enp 0-1; II

Outer seta on basis of all biramous legs naked. Inner coxal seta of leg 4 naked. Two terminal spines of leg 4 56 μm (outer) and 119 μm (inner).

Leg 5 with slender free segment of 209 μm long, bearing distinct proximal expansion (Fig. 5G), and ornamented with small spinules along outer side and armed with terminal setae of 67 μm (outer) and 119 μm (inner), respectively. Maximum width across proximal expansion of free segment 44 μm (ratio 4.75:1). Width in the middle 35 μm (ratio 5.97:1).

Leg 6 represented by 2 small setae on genital area.

Male Body (Fig. 6A) similar to that of female. Length 1.58 mm (1.48-1.68 mm) and greatest width 0.60 mm (0.57-0.62 mm), based on 7 specimens.

Urosome (Fig. 6B) 6-segmented. Fifth pedigerous somite 153 μm wide. Genital somite 249 × 212 μm, longer than wide. Four postgenital somites 53 × 98, 51 × 93, 40 × 86, and 58 × 100 μm. Caudal ramus 74 × 42 μm, ratio 1.76:1.

Rostrum as in female. Antennule similar to that of female but added by 3 aesthetascs (at positions indicated by dots in Fig. 3C). Antenna as in female but with more distinct spinulation on inner side of second segment.

Labrum, mandible, paragnath, maxillule, and maxilla as in female. Maxilliped (Fig. 6C) 4-segmented (assuming that proximal part of claw represents fourth segment). First segment unarmed. Second segment with longitudinal row of spinules, 2 identical setae near midlength and serrated crest distally. Third segment unarmed. Claw long, with small tubercle near proximal third on concave side and proximally 2 extremely unequal setae, the longer seta finely spinulated along both sides of distal half.

Legs 1-4 segmented and armed as in female except for endopod third segment of leg 1 (I, I, 4 instead of I, 5 in female). Endopod third segment of leg 2 with foliaceous plate between 2 terminl spines (Fig. 6D). Legs 3 and 4 as in female.

Leg 5 (Fig. 6E) with free segment of 108 × 25 μm, ratio 4.32:1, avoid of proximal expansion, but ornamented as in female. Two terminal elements, inner one being serrated spine of 45 μm and outer one, a smooth seta of 61 μm.

Leg 6 a posteroventral flap on genital segment bearing two naked setae of extremely unequal size.

Etymology The specific name *anthopleurus* is a modification of the generic name of the host.

Critomolgus vicinus, n. sp. (Figs. 7-9)

Type specimens 16 ♀♀, 9 ♂♂, together with *Critomolgus anthopleurus* n. sp., from actiniarian, *Anthopleura midori* Uchida and Muramatsu, at Aninjin on the coast of the Sea of Japan (intertidal), on 21 June 1992. Holotype ♀, allotype, and 19 paratypes (13 ♀♀, 6 ♂♂) will be deposited in the U. S. National Museum of Natural History, Smithsonian Institution, Washington D.C. The remaining paratypes (dissected) are kept in the collection of the author.

Other material examined 23 ♀♀, 34 ♂♂ collected from *Anthopleura midori*, at Byonsan (approximately 35°40′ N, 126°21′ E) on the coast of the Yellow Sea, on 22 May 1993.

Female Body (Fig. 7A) moderately slender. Length 1.73 (1.54-1.89) mm, and greatest width 0.80 (0.68-0.91) mm, based on 10 specimens. First pedigerous somite separated from cephalosome by weak dorsal line. Epimeral areas of prosomal somites rounded posteriorly.

Urosome (Fig. 7B) 5-segmented. Fifth pedigerous somite 229 μm wide. Genital double somite 271 × 224 μm, ratio 1.21:1. Maximum width measured in anterior 0.25 where is distinctly expanded laterally. Remaining portion behind anterior expansions gradually narrowed, with posterior third bearing nearly parallel lateral margins. Genital areas located dorsolaterally in anterior 0.4 length of genital double somite. Second postgenital somite shortest among 3 postgenital somites. Posteroventral border of anal somite with row of minute spinules (Fig. 7C). Caudal ramus 108 × 57 μm, ratio 1.89:1, with 6 setae. Outer lateral seta naked. Other setae

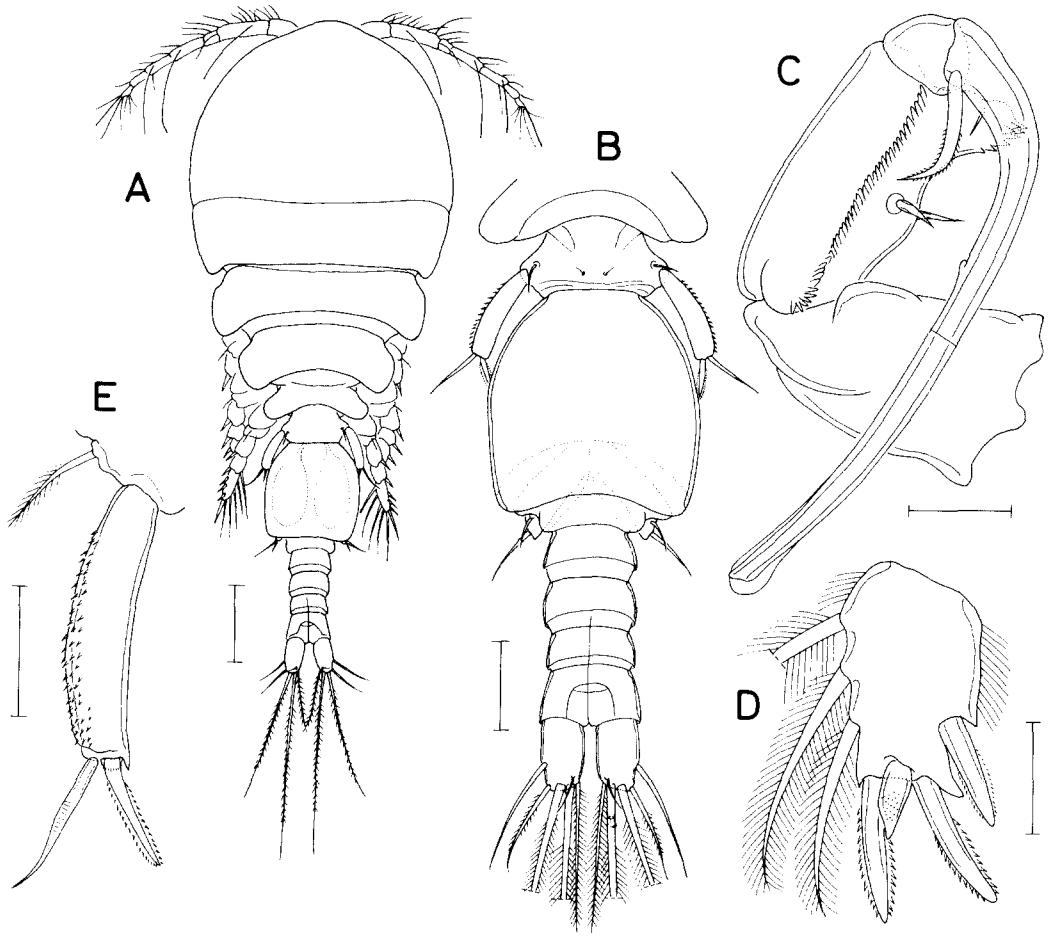

Fig. 6. *Critomolgus anthopleurus* n. sp., male: A, habitus, dorsal; B, urosome, dorsal; C, maxilliped; D, terminal segment of endopod of leg 2; E, leg 5. Scales: A= 0.2 mm; B= 0.1 mm; C-E= 0.05 mm.

plumose. Egg sac 680 × 382 μm.

Rostrum with hemicircularly rounded posterior margin. Antennule (Fig. 7D) 525 μm long. Segments becoming gradually narrower from proximal to distal ones. Armature formula 4, 13, 6, 3, 4+1 aesthetasc, 2+1 aesthetasc, and 7+1 aesthetasc, respectively. Antenna (Fig. 7E) 4-segmented. Armature formula 1, 1, 3, and 5 + 2 claws. Second segment with minute spinules on inner surface. Fouth segment about 4 times as long as wide. All setae smooth. Two terminal claws almost equal in size.

Labrum (Fig. 7F) with 2 posteroventral lobes. Mandible (Fig. 7G), maxillule (Fig. 8A), maxilla (Fig. 8B) and maxilliped (Fig. 8C) not different from those of preceding species.

Leg 1 (Fig. 8D), leg 2 (Fig. 8E), leg 3 with 3-segmented rami. Leg 4 (Fig. 8G) with 3-segmented exopod and 2-segmented endopod. These legs armed as follows (Roman numerals indicating spines, and Arabic numerals, setae):

P1 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,4
enp 0-1; 0-1; I,5

P2 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,5
enp I,II,3

P3 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,5
enp 0-1; 0-2; I,II,2
(Fig. 8F)

P4 coxa 0-1 basis 1-0 exp I-0; I-1; III,I,5

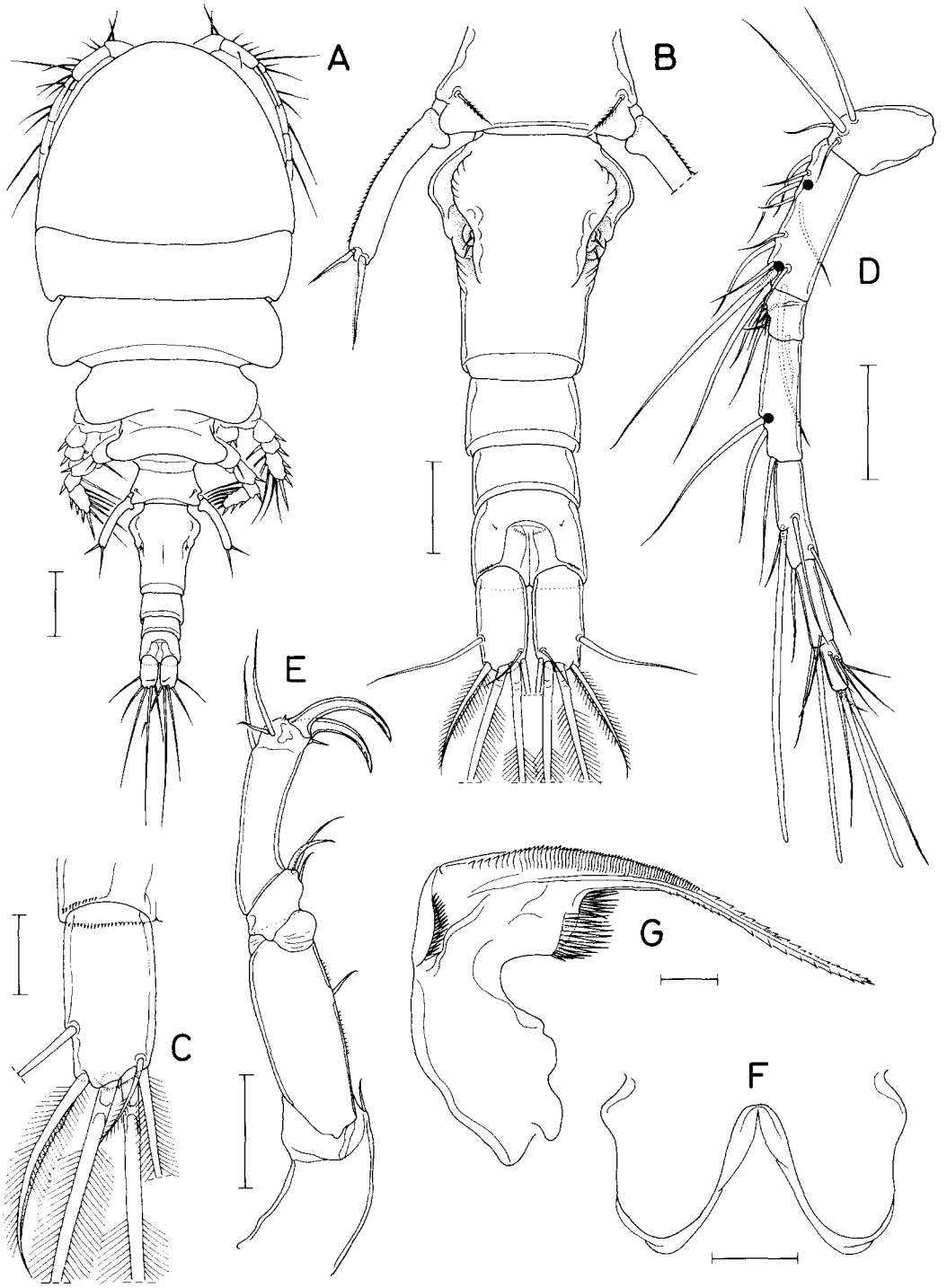

Fig. 7. *Critomolgus vicinus* n. sp., female: A, habitus, dorsal; B, urosome, dorsal; C, caudal ramus, dorsal; D, antennule (black dots indicating positions of aesthetascs added in male); E, antenna; F, labrum; G, mandible. Scales: A= 0.2 mm; B, D, E= 0.1 mm; C, F= 0.05 mm; G= 0.02 mm.

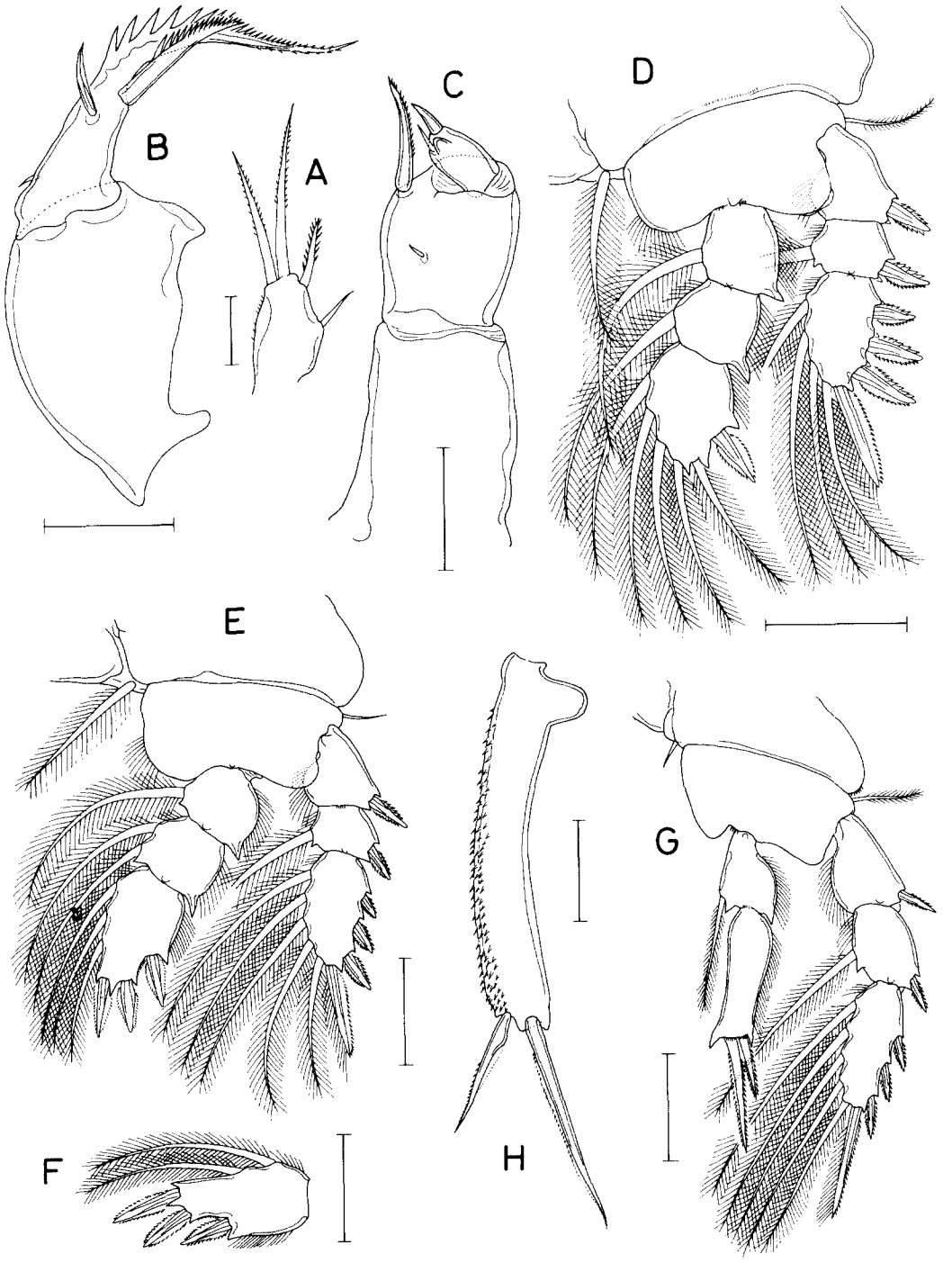

Fig. 8. *Critomolgus vicinus* n. sp., female: A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, terminal segment of endopod of leg 3; G, leg 4; H, free segment of leg 5. Scales: A, B= 0.02 mm; B, C, H= 0.05 mm; D-G= 0.1 mm.

enp 0-1; II

Two terminal spines of endopod second segment of leg 4 58 μm (outer) and 108 μm (inner) long.

Leg 5 (Fig. 8H) with slender free segment of 185 μm long, bearing distinct proximal expansion (45 μm across this region), and ornamented with small spinules along outer side and armed with terminal setae of 65 μm and 112 μm long, respectively. Width of free segment in distal area 31 μm.

Leg 6 represented by 2 small setae on genital area.

Male Body (Fig. 9A) similar to that of female.

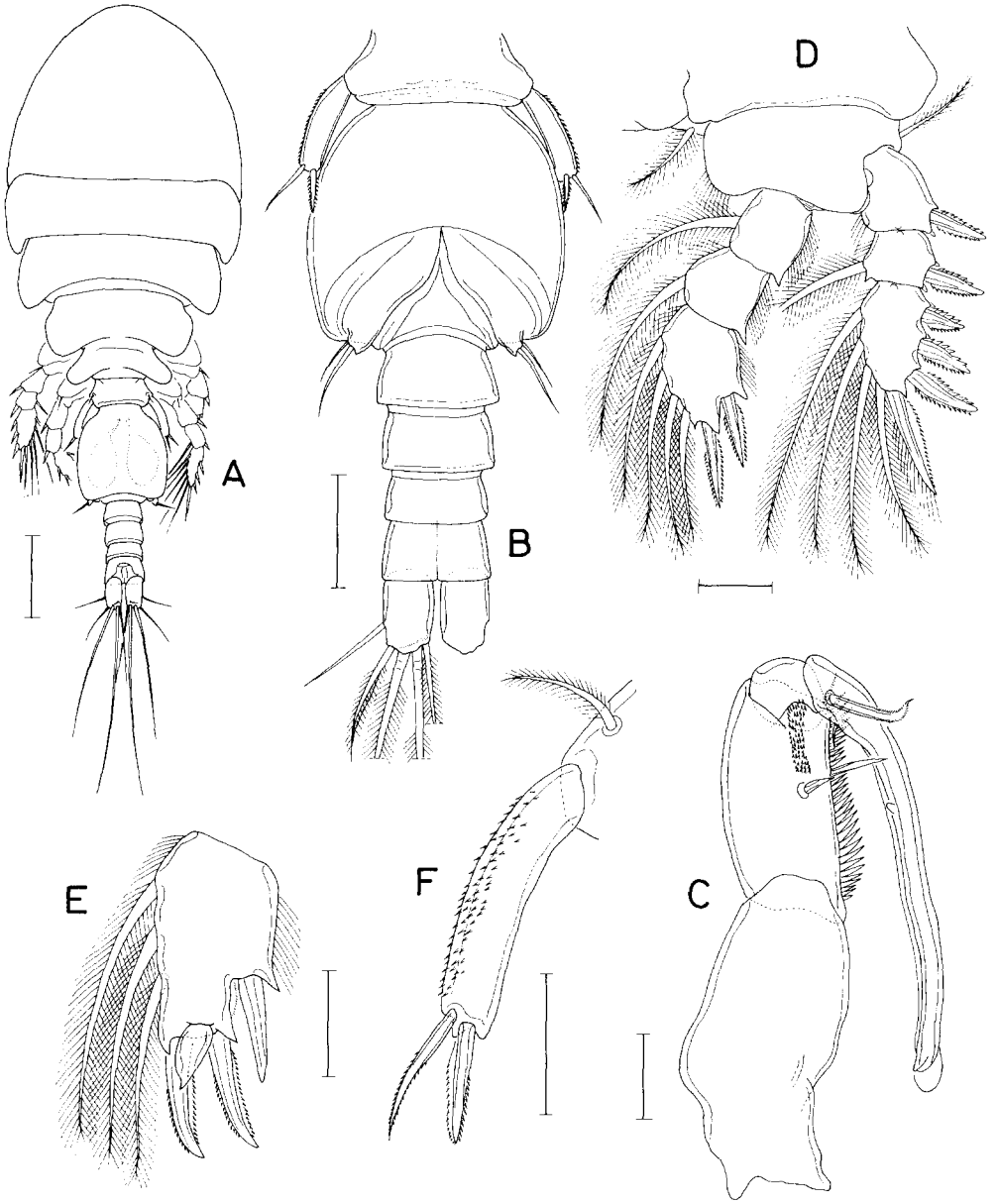

Fig. 9. *Critomolgus vicinus* n. sp., male: A, habitus, dorsal; B, urosome, ventral; C, maxilliped; D, leg 1; E, terminal segment of endopod of leg 2; F, leg 5. Scales: A= 0.2 mm; B= 0.1 mm; C-F= 0.05 mm.

Length 1.46 mm (1.21-1.74 mm) and greatest width 0.58 mm (0.51-0.64 mm), based on 8 specimens.

Urosome (Fig. 9B) 6-segmented. Fifth pedigerous somite 167 μm wide. Genital somite 218 × 225 μm, nearly as long as wide. Four postgenital somites 60 × 105, 57 × 98, 40 × 90, and 50 × 95 μm. Caudal ramus 65 × 45 μm, ratio 1.44:1.

Rostrum as in female. Antennule similar to that of female but added by 3 aesthetascs (at positions indicated by dots in Fig. 7D). Antenna as in female but with more developed spinulation on second segment.

Maxilliped (Fig. 9C) 4-segmented (assuming that proximal part of claw represents fourth segment). First segment unarmed. Second segment with longitudinal row of spinules, 2 identical setae near midlength and patch of minute spinules near inner distal area. Third segment unarmed. Claw long, with small tubercle near proximal third on concave side and proximally 2 extremely unequal setae, the longer seta finely spinulated along both sides of distal third.

Legs 1-4 segmented and armed as in female except for endopod third segment of leg 1 (I, I, 4 instead of I, 5 in female). Other sexual dimorphism present in endopod third segment of leg 2 in which terminal spiniform process of female replaced by foliaceous plate in male (Fig. 9E). Legs 3 and 4 as in female.

Leg 5 (Fig. 9F) with free segment of 105 × 22 μm, ratio 4.77:1, avoid of proximal expansion, ornamented with spinules on outer side as in female. Two terminal elements, inner one being serrated spine of 43 μm long and outer one, a barbed seta of 52 μm long.

Leg 6 a posteroventral flap on genital segment bearing 2 naked setae of unequal size (Fig. 9B).

Etymology The specific name *vicinus* ("neighbor" in Latin) alludes the co-occurence of the new species with *C. anthopleurus* n. sp. on the same host species.

Discussion

It is apparent from the above descriptions that the three new species are closely related in most morphological features. They have almost identical body forms, overlapped range of body lengths (more or less than 2 mm), and almost identical caudal rami in which the ratio of length to width being more or less than 1.7, in contrast to the various range of this ratio in other known species from 0.8 in *C. cladiellae* Humes, 1990 to 7.8 in *C. maginificus* (Humes, 1964). The similarity of these species can also be observed in the maxillule which has four elements, not two or three as in many other species, and in the female maxilliped.

In the species of *Critomolgus* the endopod of leg 2 is frequently sexually dimorphic: the mid-terminal spiniform process on the third segment in male is more prominent in general than in female and bears minute spinules or granules on surface. In the males of the three Korean species, this process is replaced uniquely by a leaf-like plate. It is interesting to note that other example of such sibling species were found on the American shore of Pacific where Lonning and Vader (1984) reported four closely related species of *Doridicola* on the sea anemones, a genus closely related to *Critomolgus*.

The three Korean species can be distinguished from the known species by the following ways. Eight species are known to have their caudal ramus bearing the ratio of length to width being 1.5-2.0 as in the three new species: *C. antennulatus* Humes, 1990, *C. dunnae* (Humes, 1982), *C. gemmatus* (Humes, 1964), *C. hispidulus* (Humes, 1982), *C. patellaris* (Humes, 1982), *C. ptilosarci* (Humes and Stock, 1973), *C. scyphulanus* (Humes, 1982), and *C. virgulariae* (Humes, 1978). Among these eight only three species, *C. antennulatus*, *C. gemmatus*, *C. ptilosarci*, have three elements on the maxaillule as in the three Korean species, and thus comparable.

The body of *C. antennulatus* described from an alcyonacean in New Caledonida is very small, not over 1 mm (0.73-0.81 mm in females, according to Humes, 1990). The female genital double somite is circular and as long as wide. There is no sexual dimorphism in the third segment of the endopod of leg 2. These features can not be observed in the three Korean species

Table 1. Distinguishing features of three new species of *Critomolgus*

Characters		*C. malmizalus*	*C. anthopleurus*	*C. vicinus*
Body length	Female	1.91 (1.82-2.03)	2.29 (1.88-2.70)	1.73 (1.54-1.89)
	Male	1.44	1.58 (1.48-1.68)	1.46 (1.21-1.74)
Proximal inner expansion of free segment of female leg 5		absent	present	present
Crenate inner distal expansion on second segment of male maxilliped		present	present	absent
Broadest part of female genital double somite		0.17 and 0.55	0.50	0.25
Hosts		*Anthopleura japonica*	*A. midori*	*A. midori*

C. gemmatus, an associate of a sea anemone in Madagascar, has also a small body which is 1.14 mm (1.06-1.19 mm in female, according to Humes, 1964). Its free segment of female leg 5 bears no proximal inner expansion. Moreover the third segment of the endopod of male leg 1 bears three spines and three setae (I,II,3), not II, 4 as in other species including the three new species.

C. ptilosarci, known from a pennatulacean in the American Pacific, can not be confused with the Korean species, because it has rather tapering free segment of female leg 5 (as shown in Fig 99b of Humes and Stock, 1973), no sexual dimorphism in the third segment of the endopod of leg 2, unequal size of terminal claws of antenna.

Although the three new species are very alike, they can be separated from one another by several morphological differences. *C. malmizalus* differs from other two in having no proximal inner expansion of the free segment of female leg 5. The genital double somite is broadest in the middle in *C. anthopleurus*, while it is anteriorly broadest in *C. vicinus*. In addition to these, the crenate inner distal expansion of the male maxilliped is found in *C. malmizalus* and *C. anthopleurus*, but not in *C. vicinus*. The differences among these three new species are summarized in Table 1.

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한국산 말미잘에 공생하는 *Critomolgus*속의 요각류 3신종

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동해에서 발견된 *Critomolgus*속의 요각류 3신종을 기재하였다. 이들은 조간대의 말미잘에 공생하는 것들로서, 1종은 갈색꽃해변말미잘(*Anthopleura japonica* Verrill)에, 나머지 2종은 풀색꽃해변말미잘(*A. midori* Uchida and Muramatsu)에 공생한다. 지금까지 기록된 동일 속의 다른 종들과는 확연히 구별되지만, 이들 3신종은 동소적이며 형태적으로 서로 매우 유사하다. 이 논문은 극동 해역의 말미잘에서 발견된 요각류에 대한 최초의 기록이다.