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Copepod Parasites of Gastropoda from Korea

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Five species of poecilostomatoid copedods are reported as parasites of 8 species of gastropod molluscs in Korea: *Anthessius longipedis*, n. sp., *Panaietis yamagutii* Izawa, *Parapanaietis tegulae* Hoshina & Sugiura, *Philoblenna bupulda*, n. sp., and *Mytilicola orientalis* Mori.

KEY WORDS: Copepoda, *Anthessius*, *Panaietis*, *Parapanaietis*, *Philoblenna*, *Mytilicola*, Gastropoda, Korea.

Inasmuch as copepod associates of Korean marine invertebrates have rarely been investigated, one of us (IHK) made in recent years a series of collections of symbiotic copepods from many parts of Korea, particularly for those associated with the molluscs. Most of the molluscan symbionts were found from bivalves; nevertheless, the collections contain materials from 8 species of gastropods. In this paper we shall deal with the gastropod symbionts, which include 5 species in 4 familes, with 2 species being new to science. Although *Panaietis yamagutii* and *Parapanaietis tegulae* were thoroughly redescribed by Ho (1981) based on the materials found in the Sea of Japan, they, together with the other 3 species, are again fully treated in this report, because they are new to Korean waters. These 5 species of symbiotic copepods and their gastropod hosts are as follows:

Family Anthessidae

1. *Anthessius longipedis*, n.sp. from *Thais bronni* (Dunker)
2. *Panaietis yamagutii* Izawa, 1976 from *Batillus cornutus* (Lightfoot)

Family Lichomolgidae

3. *Parapanaietis tegulae* Hoshina & Sugiura, 1953 from *Chlorostoma xanthostigma* (A. Adams) and *C. argyrostoma lischkei* (Tapparone-Canefri)

Family Philoblennidae

4. *Philoblenna bupulda*, n.sp. from *Ocenebra japonica* (Dunker), *Fusitriton oregonensis* (Redfield) and *Ceratostoma burnetti* (Adams & Reeve)

Family Mytolicolidae

5. *Mytilicola orientalis* Mori, 1935 from *Umbonium costatum* (Kiener)

All the specimens dealt in the present paper had been collected by the junior author. The copepods were measured and dissected in lactic acid. All figures were drawn with the aid of camera lucida.

1. *Anthessius longipedis*, n. sp. (Figs. 1, 2)

Material Examined.-Six ♀♀, 4♂♂ from washings of 8 specimens of *Thais bronni* (Dunker) collected from intertidal zone near Sokcho (Sea of Japan, 38°10′N, 128°37′E) by the junior author on Nov. 1, 1987. Holotype ♀, allotype, and paratypes (3♀♀, 1♂) will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C. Other dissected specimens (2♀♀, 2♂♂) are being retained in the personal collections of the junior author.

Female.-Body (Fig. 1A) 1.64 mm long. Maximum width 0.69 mm. Ratio of length to width of body 2.38 : 1. Prosome flat and broad, 924 μm long.

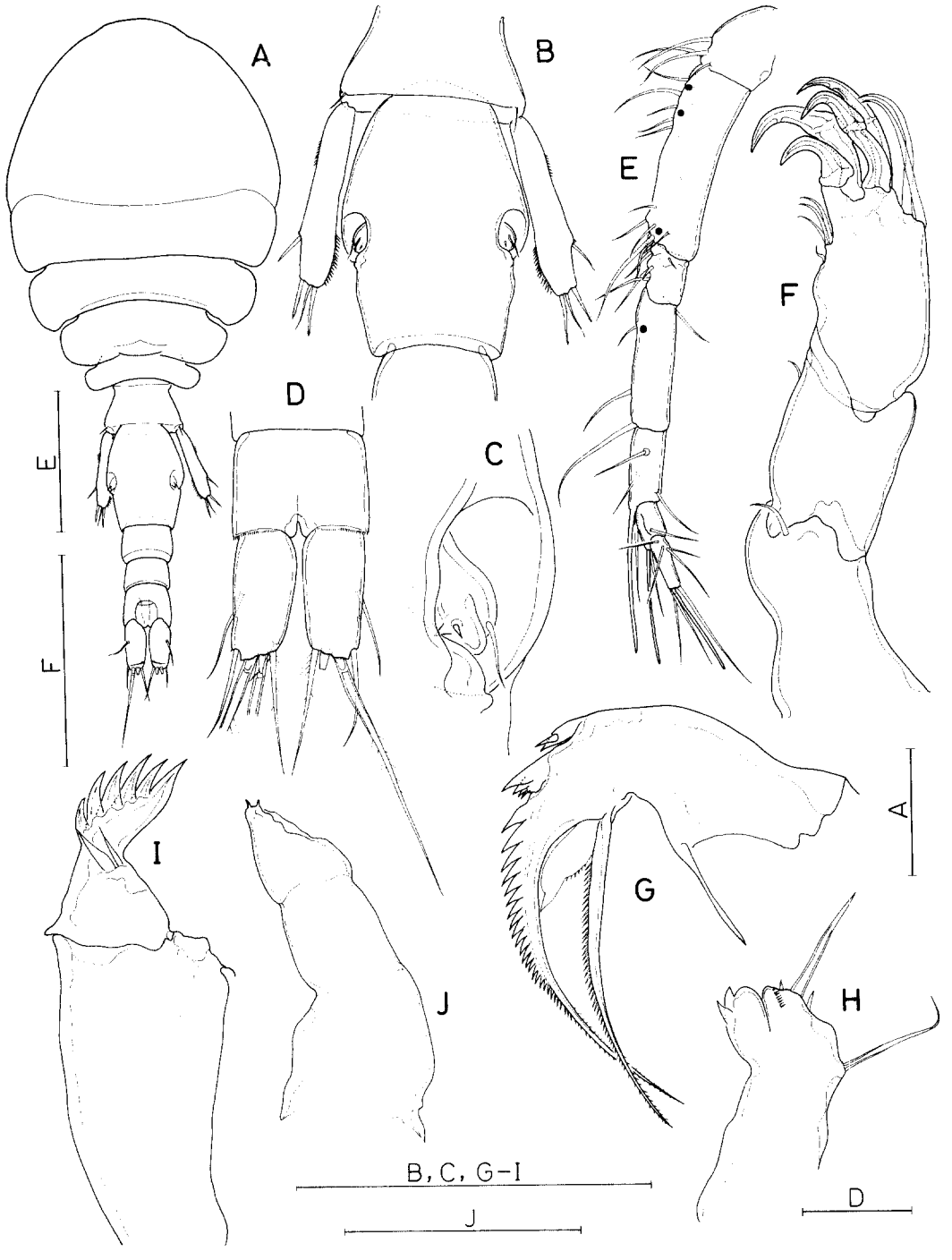

Fig. 1. *Anthessius longipedis*, n.sp. Female: A, habitus, dorsal; B, First two urosomites, dorsal; C, Genital area; D, Anal somite and caudal rami, ventral; E, antennule (dark circles represent the place of added aesthetes in male); F, antenna; G, mandible; H, maxillule; I, maxilla; J, maxilliped. Units of scales: A = 0.3 mm; B = 0.25 mm; C-J = 0.1 mm.

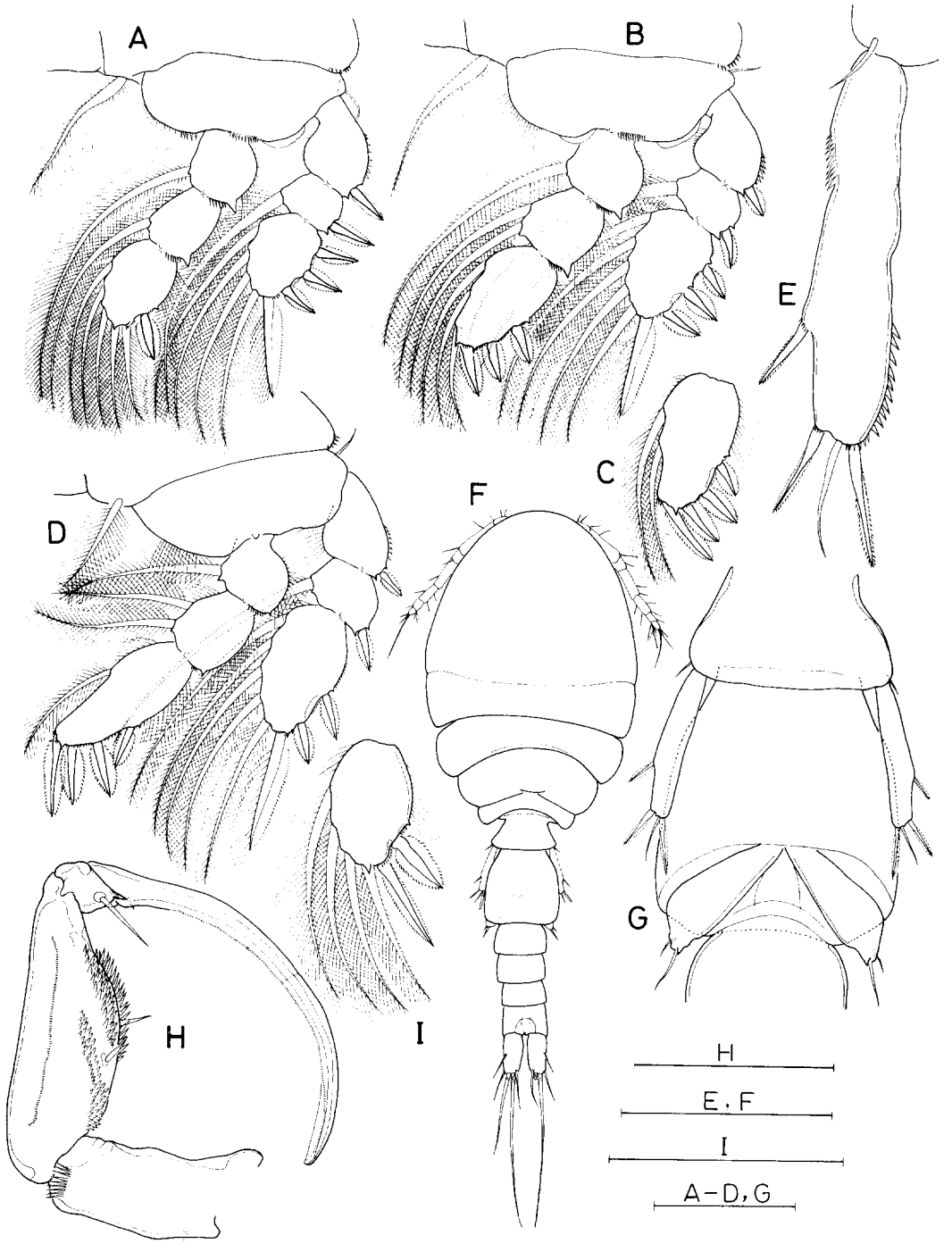

Fig. 2. *Anthessius longipedis*, n.sp. Female: A, leg 1; B, leg 2; C, third segment of leg 3 endopod; D, leg 4; E, leg 5. Male: F, habitus, dorsal; G, first two urosomites, ventral; H, maxilliped; I, third segment of leg 1 endopod. Units of scales: A-E, G-I = 0.1 mm; F = 0.5 mm.

Ratio of length to width of prosome 1.34 : 1. Urosome 5-segmented. Genital complex 1.35 times longer than wide (Fig. 1B). Genital area (Fig. 1C) located slightly posterior to midpoint of length. Three postgenital somites each wider than long. Anal somite about 1.2 times wider than long, with fine spinules on disteroventral border (Fig. 1D). Caudal ramus 2.03 times longer than wide, with 6 fragile setae.

Antennule (Fig. 1E) 7-segmented, with setal formula: 4, 15, 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete.

Antenna (Fig. 1F) 3-segmented, segments subequal in length. First and second segment each with 1 inner distal seta. Terminal segment about 1.5 times longer than wide, with 4 strong hooks, 4 inner setae (one of them minute), 1 lateral seta and 2 outer distal setae.

Mandible (Fig. 1G) with a membraneous lamella between apical lash and setiform element. First two teeth on apical lash armed with 1 and 3 subsidiary denticles, respectively. Maxillule (Fig. 1H) bilobate distally. Inner lobe with 2 denticular processes (proximal one fleshy). Outer lobe with 2 long and 2 short setae, and terminally ornamented with 1 row of spinules. Maxilliped (Fig. 1J) indistinctly 3-segmented. Third segment tapering, with 2 small terminal setules.

Leg 1 (Fig. 2A), leg 2 (Fig. 2B), leg 3 and leg 4 (Fig. 2D) with following formula of armature:

P1:	Prp 0-1; 2-0	Exp I-0; I-1; III, I, 4
		Enp 0-1; 0-1; I, 5
P2:	Prp 0-1; 1-0	Exp I-0; I-1; III, I, 5
		Enp 0-1; 0-2; III, 3
P3:	Prp 0-1; 1-0	Exp I-0; I-1; III, I, 5
		Enp 0-1; 0-2; IV, 2
P4:	Prp 0-1; 1-0	Exp I-0; I-1; II, I, 5
		Enp 0-1; 0-2; IV, 1

Leg 3 differs from leg 2 only in armature of third endopod segment (Fig. 2C).

Leg 5 (Fig. 2E) long, extend beyond genital area, 4.4 times longer than wide, with row of spines on outer basal margin and inner distal margin, and 3 spines and 1 seta. Longest distal spine less than 1.3 length of leg 5. Leg 6 represented by 2 spinular processes and 1 seta in genital area (Fig. 1C).

Male.-Body (Fig. 2F) generally as that in female, 1.35 mm long and 0.51 mm wide. Prosome 733 μm. Urosome 6-segmented. Genital somite (Fig. 2G) 1.1 times longer than wide. Four postgenital somites each wider than long. Caudal ramus as in female.

Antennule with 4 more aesthetes than that of female: 3 on second and 1 on fourth segments (Fig. 1E). Antenna as in female.

Mandible, maxillule and maxilla as in female. Maxilliped (Fig. 2H) 4-segmented including claw. First segment with 1 row of spinules distally. Second segment with a pair of equal setae, 3 patches of spinules on median surface, and 1 longitudinal row of minute spinules close to lateral margin. Third segment shortest, distally with 1 naked seta and 1 pointed process. Claw long and arched, with spinulated medial margin and 1 basal setule.

Armature of third segment on leg 1 endopod (II, 4) different from that of female (Fig. 2I). Legs 2-4 same as those of female. Leg 5 without marginal spinules. Leg 6 represented by 2 unequal setae (Fig. 2G) and 1 small process on posterolateral corners of genital somite.

Etymology.-The specific name *longipedis* refers to the elogated state of the free segment of leg 5 in the new species.

Remarks.-At present the genus *Anthessius* comprises 37 known species, including recently recorded *A. atrinae* discovered from a bivalve in Korean waters by Suh & Choi (1991). *A. longipedis* has long leg 5. This state of character is shared with 6 other species (with ratio of length to maximum width more than 3.5 : 1). They are: *A. lighti* Illg, 1960, *A. sensitivus* Stock *et al.*, 1963, *A. stylocheili* Humes & Ho, 1965, *A. teissieri* Bocquet & Stock, 1958, *A. arenicolus* (Brady, 1872) and *A. solenocurti* Della Valle, 1880. The former four species are known to be associated with gastropod and the latter two, with bivalves. Most of these six species differ from *A. longipedis* in having 3 outer spines on the third segment of leg 4 exopod (III, I, 5). *A. sensitivus* has 2 spines (II, I, 5) as in the new species. But this Caribbean species carries an extraordinary number of aesthetes (20 according to Stock *et al.*, 1963) on its antennule and bears angular lateral sides on its genital complex. Such features are absent in *A. longipedis*.

It is noted that *Anthessius* associated with pro-

sobranch gastropods generally have longer leg 5. The only exception is *A. navanacis* (Wilson, 1935) which has the moderately long leg 5 with a ratio of 1.8 (Illg, 1960).

2. *Panaietis yamagutii* Izawa, 1976 (Fig. 3)

Material Examined.-All from *Batillus cornutus* (Lightfoot). 3♀♀ and 2♂♂ from washings of 4 hosts, at Sogwipo in Cheju Island, on Nov. 1, 1986; 1♀, 1♂ from washings of 1 host, at Sogwipo, on Jun. 28, 1987; 2♀♀ from washings of 1 host, at Ullung Island, On Aug. 6, 1987.

Female.-Body (Fig. 3A) indistinctly 11-segmented, 7.12 mm long and 1.33 mm wide (across cephalic area). First pedigerous somite clearly defined from cephalosome by suture line. Other body segments vaguely demarcated. Genital somite expanded laterally, 1.08 mm wide. Four abdominal segments nearly cylindrical. Caudal ramus about 3.5 times longer than wide, with 6 short setae.

Antennule (Fig. 3B) 7-segmented, with formula of armature: 4, 14, 4, 4, 6 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. All setae and aesthetes small. Antenna strong, 4-segmented, with fomula of armature: 0, 1, 1, and 5 + 4 claws. Of four terminal claws inner one distinctly stronger than others (Fig. 3C).

Labrum (Fig. 3D) broadly incised medially, without ornamentation. Mandible (Fig. 3E) with a lamella between bases of terminal lash and setiform element. First two teeth of terminal lash with 1 and 2 subsidiary denticles, respectively. Maxillule (Fig. 3F) with 4 elements and a small inner protuberance. Maxilla (Fig. 3G) 2-segmented. First segment unornamented. Second segment armed with 2 setae and 3-5 terminal teeth. Maxilliped (Fig. 3H) 3-segmented, segmentation weak, terminally with 3 small setules.

Spines on legs 1-4 with membranes (Figs. 3I, J). All setae weakly plumose. Formula of armature of legs 1-4 as follows:

P1: Prp 0-0; 1-0 Exp I-0; I-0; IV, 3
Enp 0-0; 0-0; II, 4
P2: Prp 0-0; 1-0 Exp I-0; I-0; IV, 3
Enp 0-0; 0-0; III, 2
P3: Prp 0-0; 1-0 Exp I-0; I-0; IV, 3
Enp 0-0; 0-0; IV, 2
P4: Prp 0-0; 1-0 Exp I-0; I-0; IV, 3
Enp 0-0; 0-0; IV, 1

Leg 5 broadened distally, with 3 terminal spines and 1 seta. Leg 6 represented by 1 setule in genital area.

Male.-Body (Fig. 3K) generally as in female, 4.21 mm long and 11-segmented. Maximum width 0.91 mm. Segmentation of body more distinct than in female. Antennule and antenna as in female. Maxilliped (Fig. 3L) 3-segmented. Terminal claw strongly curved. Other oral appendages same as in female. Legs 1-4 as in female, but first and second segments of endopods with pointed outer distal corner. Leg 5 (Fig. 3M) shorter than that of female. Leg 6 represented by 2 equal setae on genital somite.

Remarks.-This is the fourth report of *P. yamagutii* from the commercial turban snail, *Batillus cornutus*. In Japan, it was reported from the Sea of Japan (Yamaguti, 1936; Ho, 1981) and Pacific coast (Izawa, 1976); therefore, it is not surprising to find it on the same host snail from Cheju Island and Ullung Island in Korea. As in the case reported by Ho (1981) for the specimens from Sado Island, we did not find sexual dimorphism in the antennule of our specimens. Izawa (1976) reported the presence of such dimorphism in the specimens from the pacific coast collected Kiinagashima (Mie Prefecture).

3. *Parapanaietis tegulae* Hoshina and Sugiura, 1953 (Fig. 4)

Material Examined.-1) from *Chlorostoma argyrostoma lischkei* (Tapparone-Canefri): 1♀ from washings of 15 hosts, at Songsanpo in Cheju Island, on Jun. 27, 1987; 2♀♀ from washings of 15 hosts, at Sokcho, Sea of Japan, on Oct. 10, 1987. 2) from *Chlorostoma xanthostigma* (A. Adams): 9♀♀ from washings of 50 hosts, at Sokcho, on Nov. 8, 1987.

Female.-Body (Fig. 4A) elongated, 2.14 mm long, with indistinct segmentation. Cephalothorax triangular in dorsal view, 463 μm long and 550 μm wide. Urosome (Fig. 4B) bent ventrad. Caudal ramus slightly more than twice as long as wide. One terminal seta distinctly larger than other five.

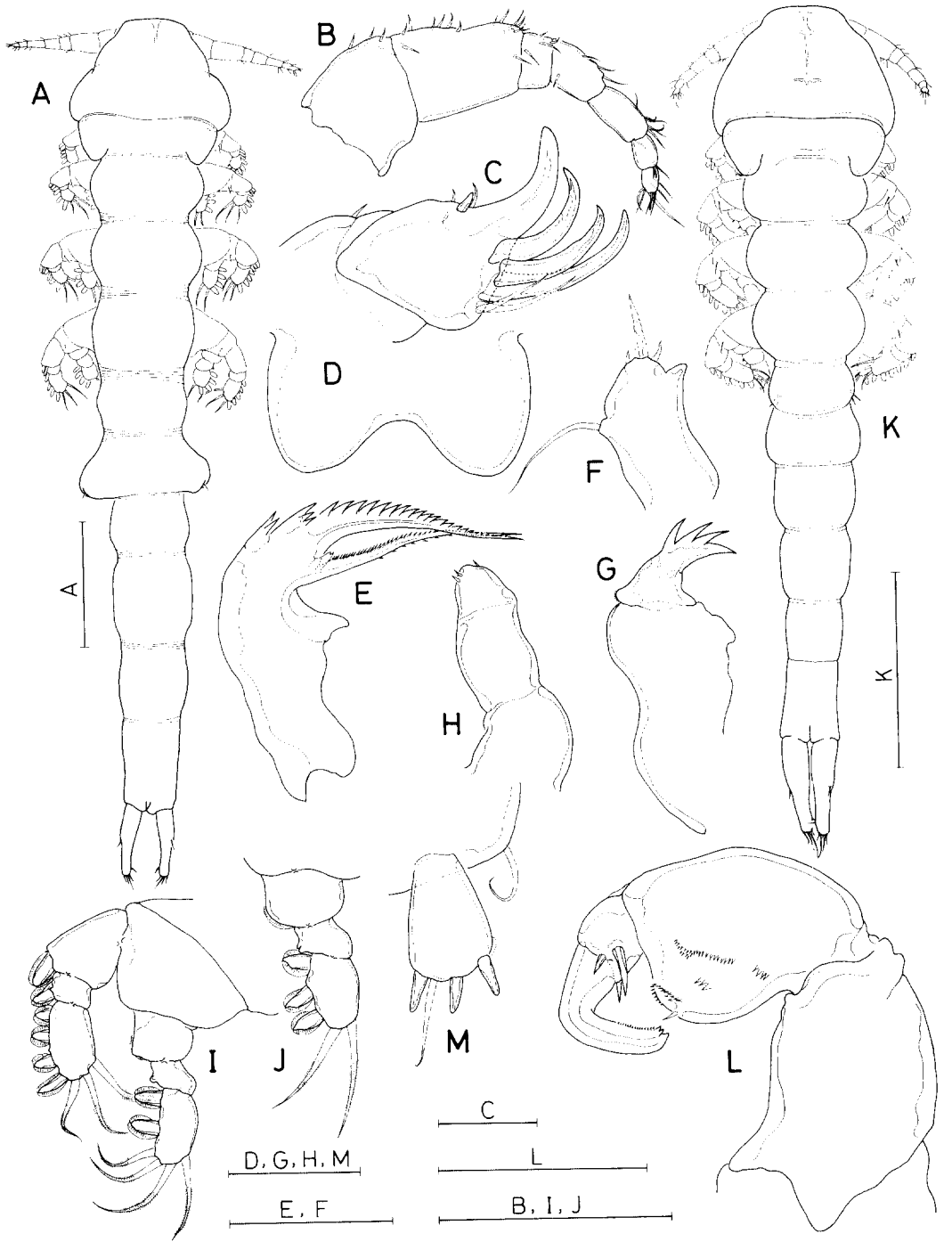

Fig. 3. *Panaietis yamagutii* Izawa. Female: A, habitus, dorsal; B, antennule; C, terminal portion of antenna; D, labrum; E, mandible, F, maxillule; G, maxilla; H, maxilliped; I, leg 1; J, endopod of second leg. Male: K, habitus, dorsal; L, maxilliped; M, leg 5. Units of scales: A, K = 1 mm; B, I, J = 0.5 mm; C-H, L, M = 0.1 mm.

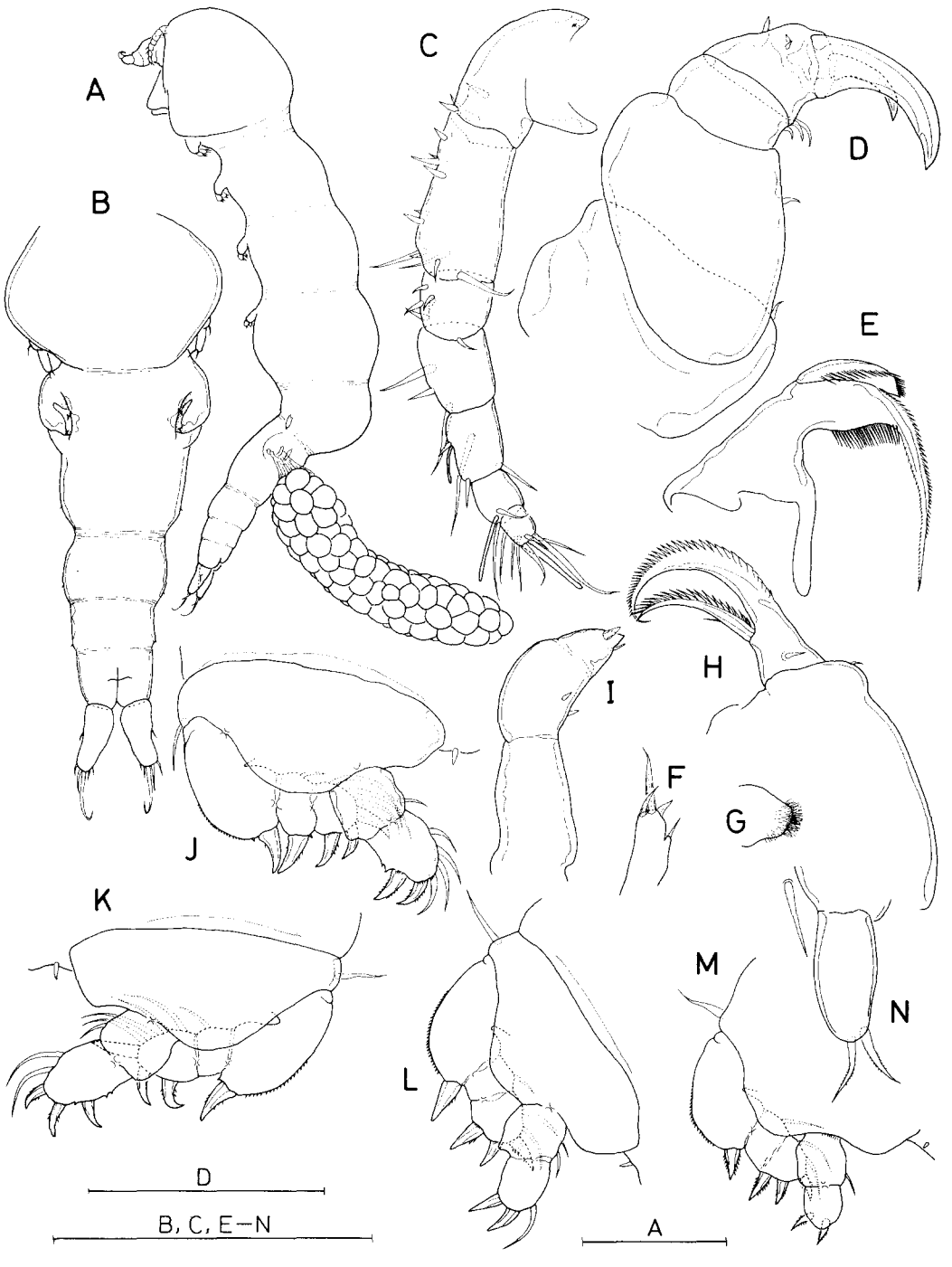

Fig. 4. *Parapanaietis tegulae* Hoshina & Sugiura. Female: A, habitus, lateral; B, urosome, dorsal, C, antennule; D, antenna; E, mandible; F, maxillule; G, palp; H, maxilla; I, maxilliped; J, leg 1; K, leg 2; L, leg 3; M, leg 4; N, leg 5. Units of scales: A, B = 0.5 mm; C-N = 0.1 mm.

Egg sac 944 × 242 μm.

Antennule (Fig. 4C) 7-segmented, with setal formula: 3, 11, 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. Antenna (Fig. 4D) 4-segmented, with formula of armature: 1, 1, 3, 4 + 2 claws. Terminal 2 claws extremely unequal.

Mandible (Fig. 4E) with a long lash. Palp (Fig. 4G) a small lobe bearing terminal setules. Maxillule (Fig. 4F) with 4 elements. Maxilla as shown in Fig. 4H. Maxilliped (Fig. 4I) indistinctly 3-segmented. Distal 2 segments each with a pair of setules.

Legs 1-4 (Figs. 4J-M) with 3-segmented exopod and 2-segmented endopod. Formula of armature of legs 1-4 as follows:

P1: Prp 0-1; 1-0 Exp I-0; I-1; III, 3
Enp 0-1; II, 4
P2: Prp 0-1, 1-0 Exp I-0; 0-1; III, 4
Enp 0-1; III, 2
P3: Prp 0-1; 1-0 Exp I-0; 0-1; III, 2
Enp 0-1; II, 1
P4: Prp 0-1; 1-0 Exp I-0; 0-1; III, 2
Enp 0-1; II

Leg 5 (Fig. 4N) with free segment armed with 2 termnal setae.

Male.-Not found.

Remarks.-As in the case of *Panaietis yamagutii*, this symbiotic copepod in Japan is also known from both Pacific coast (Hoshina & Sugiura, 1953) and Sea of Japan (Ho, 1981). The record from Cheju Island and Sokcho in Korea is the third report of this species. According to Ho (1981), *Parapanaietis* at this point of time is a monotypic genus and *P. turbo* Hoshina & Sugiura, 1958 should be removed.

4. *Philoblenna bupulda*, n. sp. (Figs. 5, 6)

Material Examined.-Two ♀♀ (1 ♀ holotype, 1 ♀ dissected), washed from 1 specimen of *Ceratostoma burnetti* (Adams et Reeve), collected from intertidal zone north of Kangreung (38°40′N, 128°37′E, Sea of Japan) on Nov. 11, 1990; 1 ♀ washed from 20 specimens of *Fusitriton oregonensis* (Redfield) bought from fish market at Sokcho (caught from the Sea of Japan), on Nov. 26, 1989; 1 ♀, 1♂ (all disscted) washed from about 50 specimens of *Ocenebra japonica* (Dunker) collected from Intertidal zone at Inchon (37°27′N, 126°37′E, Yellow Sea), on Apr. 28, 1990. Holotype will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Female.-Body (Figs. 5A, B) elongated with 10-segments, and 2.56 mm long. Prosome indistincly segmented, but each somite discernible by distinct lateral incisions. Cephalothorax wider posteriorly, with maximum width 0.66 mm. Fifth pediger broadest, 0.70 mm wide. Genital somite much narrower than fifth pediger, with genital area (Fig. 5C) located on posterolateral corner. Abdomen short, apparently 4-segmented. Each abdominal somite wider than long. Caudal ramus (Fig. 5D) 1.74 times longer than wide, with 6 naked setae.

Antennule (Fig. 5E) clearly 7-segmented, with setal formula: 3, 11, 3, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. Antenna (Fig. 5F) strong and 3-segmented, with formula of armature: 1, 1, and 6 + 2 claws. Two terminal claw unequal in size.

Mandible (Fig. 5G) with short blade. Ventral side of blade fringed with 1 row of denticles accompanied by another row of spinules. Opposite side with another row of spinules. Palp (Fig. 5H) a small lobe with distal hairs. Maxillule (Fig. 5I) with 3 terminal and 1 small, subterminal elements. Maxillule (Fig. 5I) with 3 terminal and 1 small, subterminal elements. Maxilla (Fig. 5J) 2-segmented. Second segment terminated in a claw, with 1 small outer proximal setule and 2 median setae. Claw accompanied by 1 small, subterminal spinule on inner side. Maxilliped (Fig. 5K) 2-segmented, with indistinct segmentation. Basal segment unarmed. Second segment with 2 robust setae and 2 extremely unequal claws. Larger claw accompanied basally by a small spinule.

Legs 1 and 2 (Figs. 6A, B) with 3-segmented exopod and 2-segmented endopod. Segments of leg 1 exopod and terminal 2 segments of leg 2 exopod weakly demarcated. Outer margin of endopods fringed with hairs. Setae on terminal segment of leg 2 plumose. Other setae naked. Formula of armature of legs 1 and 2 as follows:

P1: Prp 0-0; 1-0 Exp I-0; I-1; III, 3
Enp 0-1; I, 5
P2: Prp 0-0; 1-0 Exp I-0; I-1; III, 3

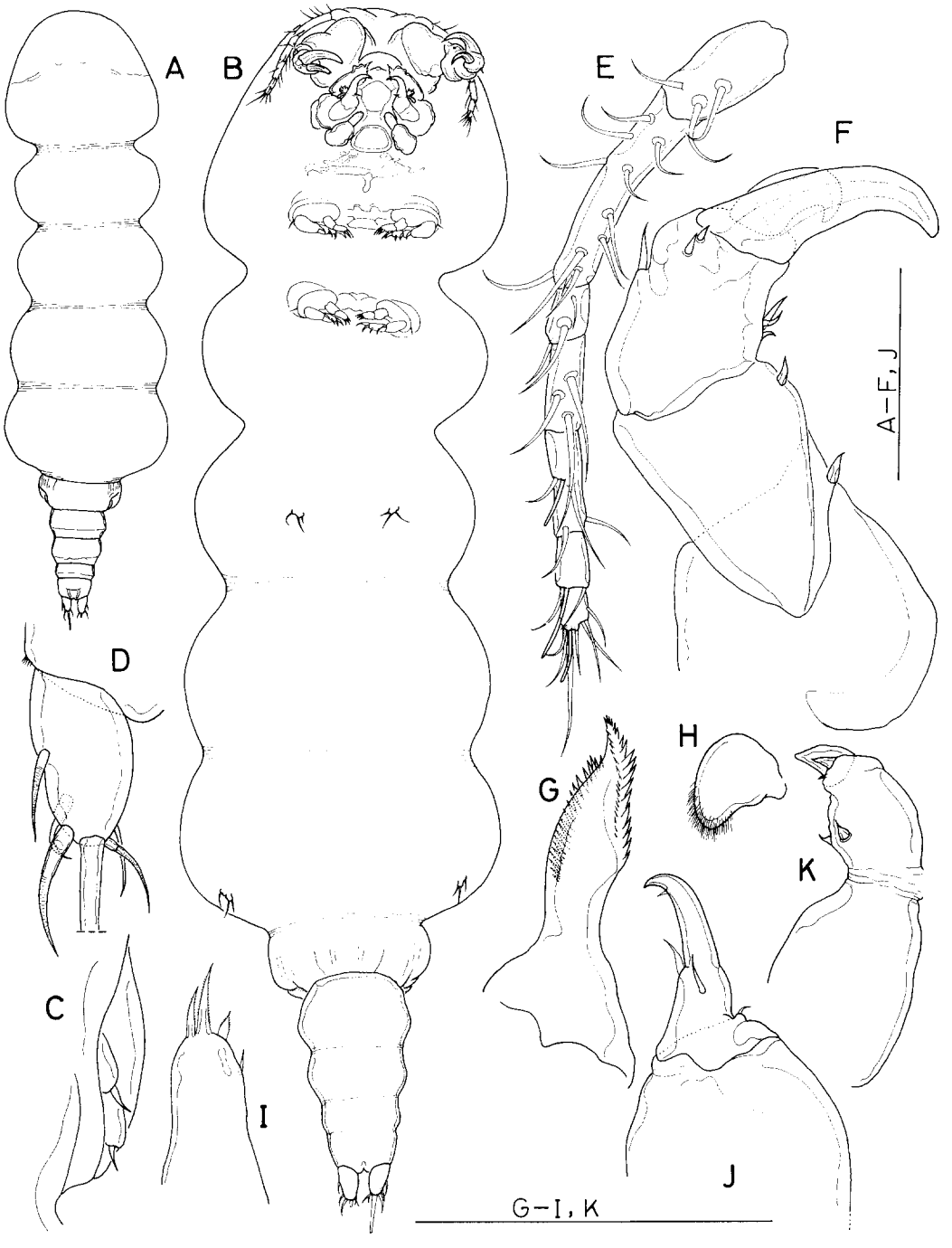

Fig. 5. *Philoblenna bupulda*, n.sp. Female: A, habitus, dorsal; B, habitus, ventral; C, genital area; D, caudal ramus, ventral; E, antennule; F, antenna; G, mandible; H, palp; I, maxillule; J, maxilla. Units of scales: A = 1 mm; B = 0.5 mm; G-K = 0.1 mm.

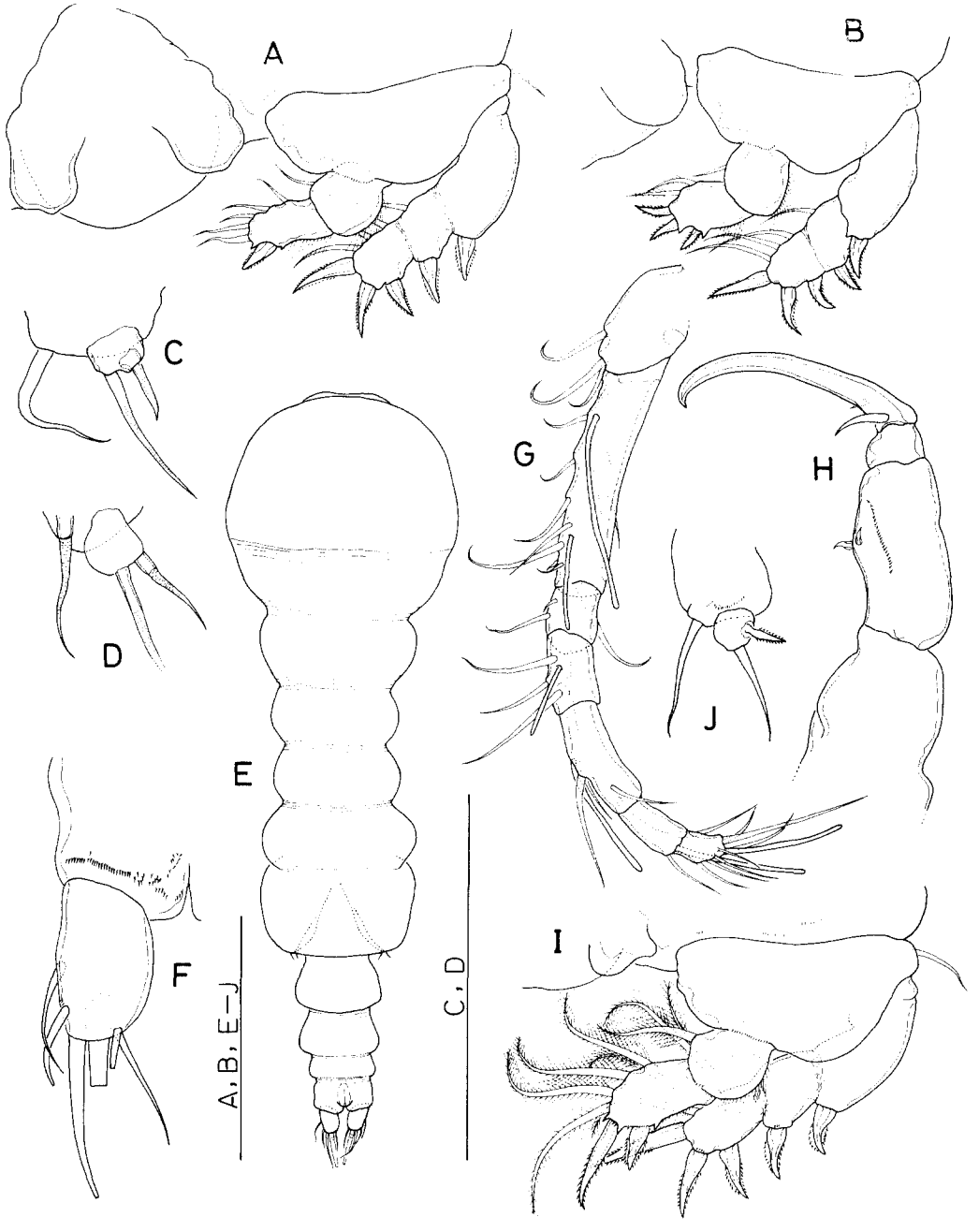

Fig. 6. *Philoblenna bupulda*, n.sp. Female: A, leg 1; B, leg 2; C, leg 3; D, leg 5. Male: E, habitus, dorsal; F, caudal ramus, ventral; G, antennule; H, maxilliped; I, leg 1; J, leg 3. Units of scales: A-D, F-J = 0.1 mm; E = 0.5 mm.

Enp 0-1; III, 2

Legs 3 and 5 (Figs. 6C, D) with 1 naked seta and a lobe armed terminally with 2 naked, unequal setae. Leg 4 absent. Leg 6 represented by 2 setae in genital area (Fig. 5C).

Male.-Body (Fig. 6E) with 11 segments and 1.52 mm long. Cephalothorax circular in dorsal view, 0.48 mm wide. First pedigerous somite faintly defined from cephalon. Third and fourth pedigerous somites narrower than other metasomal somites. Genital somite 0.32 mm wide, narrower than cephalothorax. Abdomen 4-segmented, occupying 0.24 of body length. Caudal ramus (Fig. 6F) as in female.

Antennule (Fig. 6G) with setal formula: 3, 11 + 2 aesthetes, 3, 3 + 1 aesthete, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. Antenna same as that of female.

Maxilliped (Fig. 6H) 3-segmented. Basal segment unarmed. Second segment with 2 setae and 1 longitudinal row of spinules on inner side. Third segment unarmed. Claw as long as terminal 2 segments combined, basally with 2 extremely unequal setae. Other oral appendages same as those of female.

Leg 1 (Fig. 6I) with 2 spines and 4 setae (II, 4) on distal segment of endopod. Leg 2 as in female. All setae on rami of legs 1 and 2 plumose and longer than those of female. Leg 3 (Fig. 6J) with 1 spine and 1 seta on terminal lobe. Leg 4 absent. Leg 5 as in female.

Etymology.-The specific name *"bupulda"* mean "swell" in Korean alluding to the tumid appearance of the body.

Remarks.-Three species of copepods are currently known in genus *Philoblenna* Izawa, 1976, all of them were recovered from the gastropods in the Far Eastern seas: *P. arabici* Izawa, 1976 from the Pacific coast of Japan and *P. tumida* Ho, 1981 and *P. littorina* Adveev *et al.*, 1986 from the Sea of Japan. *P. bupulda* can be distinguished from these 3 species by the following combination of characters: 4-segmented abdomen (3-segmented in *P. arabici* and *P. tumida*); 7-segmented first antenna (6-segmented in *P. tumida* and *P. littorina*); first endopod segment of leg 1 with 1 inner seta (no such element on this segment in *P. arabici* and *P. littorina*).

5. *Mytilicola orientalis* Mori, 1935 (Figs. 7-9)

Material Examined.-Four ♀♀ and 3 ♂♂ from washings of about 150 specimens *Umbonium costatum* (Kiener), collected near Pusan, on April 24, 1991.

Female.-Body (Figs. 7A, B) cylindrical and vermiform, without any trace of body segmentation. Largest specimen 4.44 mm long. Greatest width (across genital area) 0.45 mm. Cephalosome (Figs. 7C-E) nearly trapezoid, 0.31 mm long (from anterior margin to level of posterior corners), with angular posterior corners, not protruded into process. Maximum width of cephalosome 0.35 mm (across posterior corners). Rostrum not discernible (see Fig. 7D). Pedigerous somites grdually longer toward posterior one. Each pediger armed with a pair of tapering dorsolateral processes, with first pair being smallest and fourth pair largest. Abdominal part of body (From genital area to tip of caudal rami) 1,150 μm long, slightly longer than distance from leg 5 to genital area (975 μm). Genital area (Fig. 7E) unarmed. Egg sac (Fig. 7G) 2.95 × 0.29 mm in size, consisting of 3 rows of eggs.

Caudal ramus (Fig. 8A) about 140 μm long, with 4 processes (or setae), outer lateral one accompanied basally by a setule. Two rami almost parallel to each other.

Antennule (Fig. 8B) 4-segmented, with incomplete segmentation. First segment very stout, enlarged at base. Setal formula: 15, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete (for stout setae: 7 on first, 2 on second, and 1 on third segments).

Antenna (Fig. 8C) 3-segmented, excluding terminal claw. Segments with no armature or ornamentation.

Labrum without ornamentation, posterior margin pointed or notched, depending length of time immersed in lactic acid. Maxillule (Fig. 8D) with 2 stout setae. Maxilla (Fig. 8E) 3-segmented. First segment large, with 2 kinds of spinules basally. Unarmed second segment slightly longer than wide. Third segment with spinulated distal margins. Mandible and maxilliped absent.

Legs 1-4 (Figs. 8F-I) with 2-segmented rami.

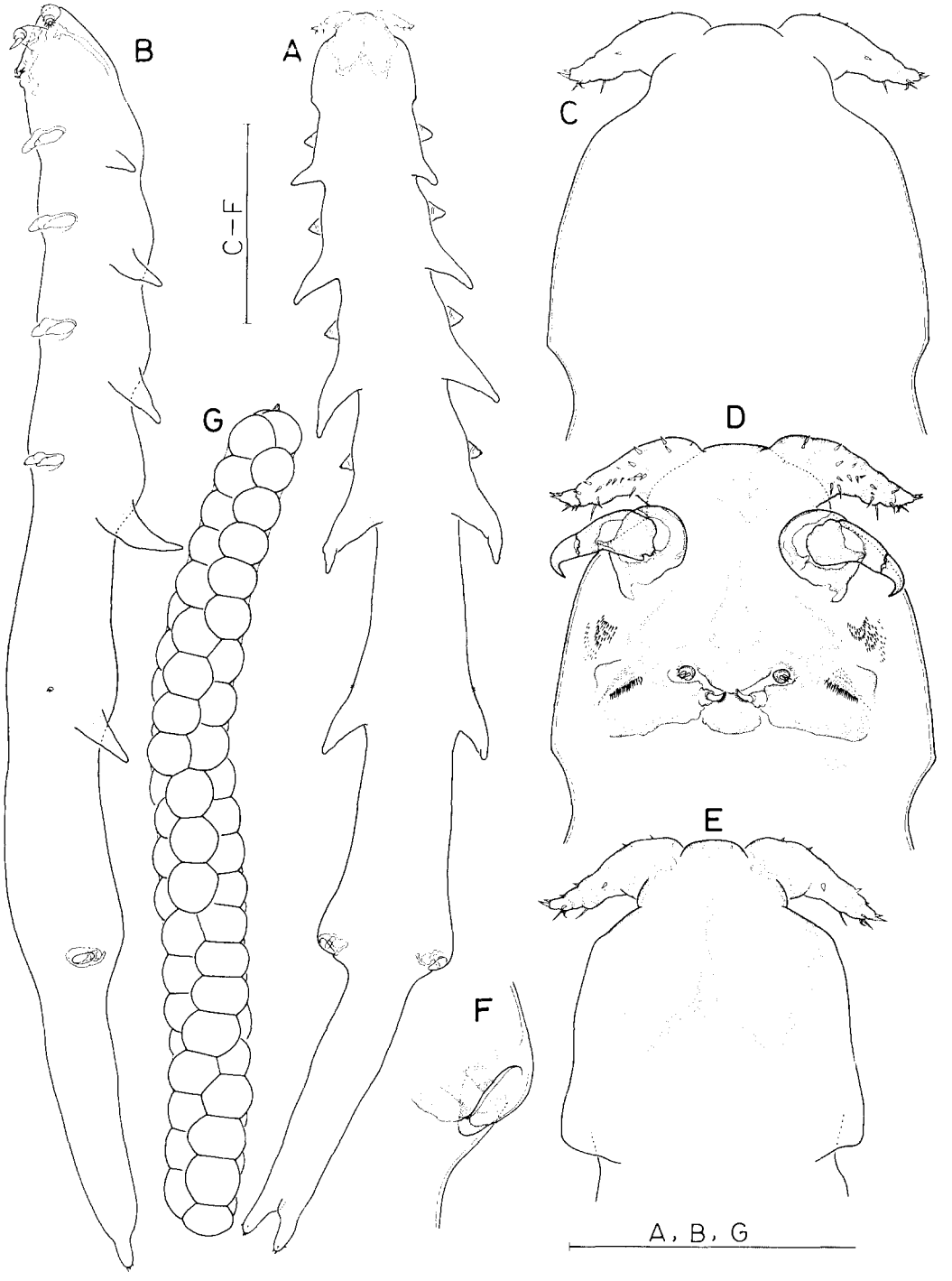

Fig. 7. *Mytilicola orientalis* Mori. Female: A, habitus, dorsal, B, habitus, lateral; C, E, cephalosome, dorsal; D, cephalosome, ventral; F, genital area; G, egg sac. Units of scales: A, B, G = 1 mm; C-F = 0.2 mm.

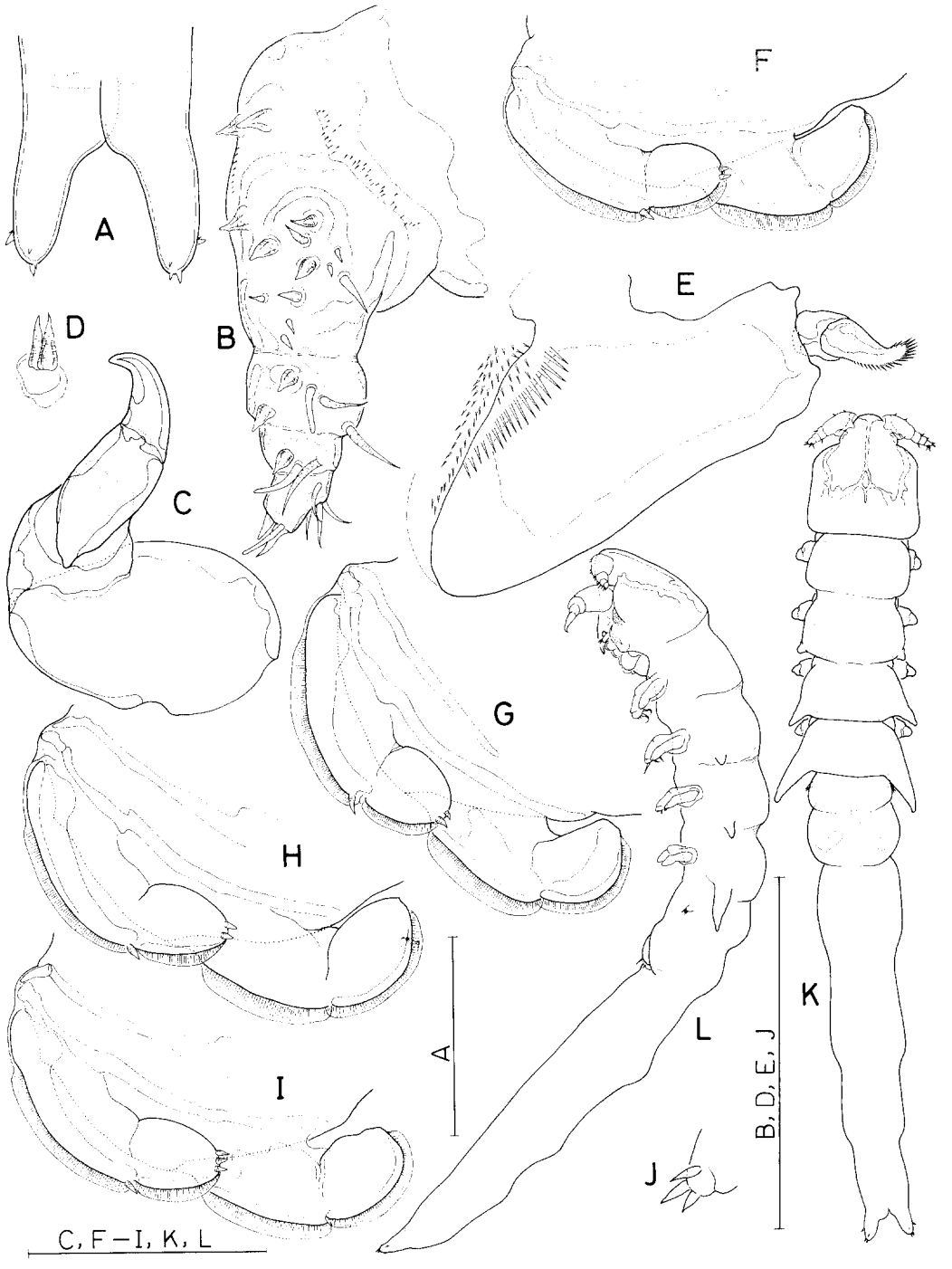

Fig. 8. *Mytilicola orientalis* Mori. Female: A, caudal rami, dorsal; B, antennule; C, antenna; D, maxillule; E, maxilla; F, leg 1; G, leg 2; H, leg 3; I, leg 4: J, leg 5. Male: K, habitus, dorsal; L, habitus, lateral. Units of scales: A = 0.2 mm; B-J = 0.1 mm; K, L = 0.5 mm.

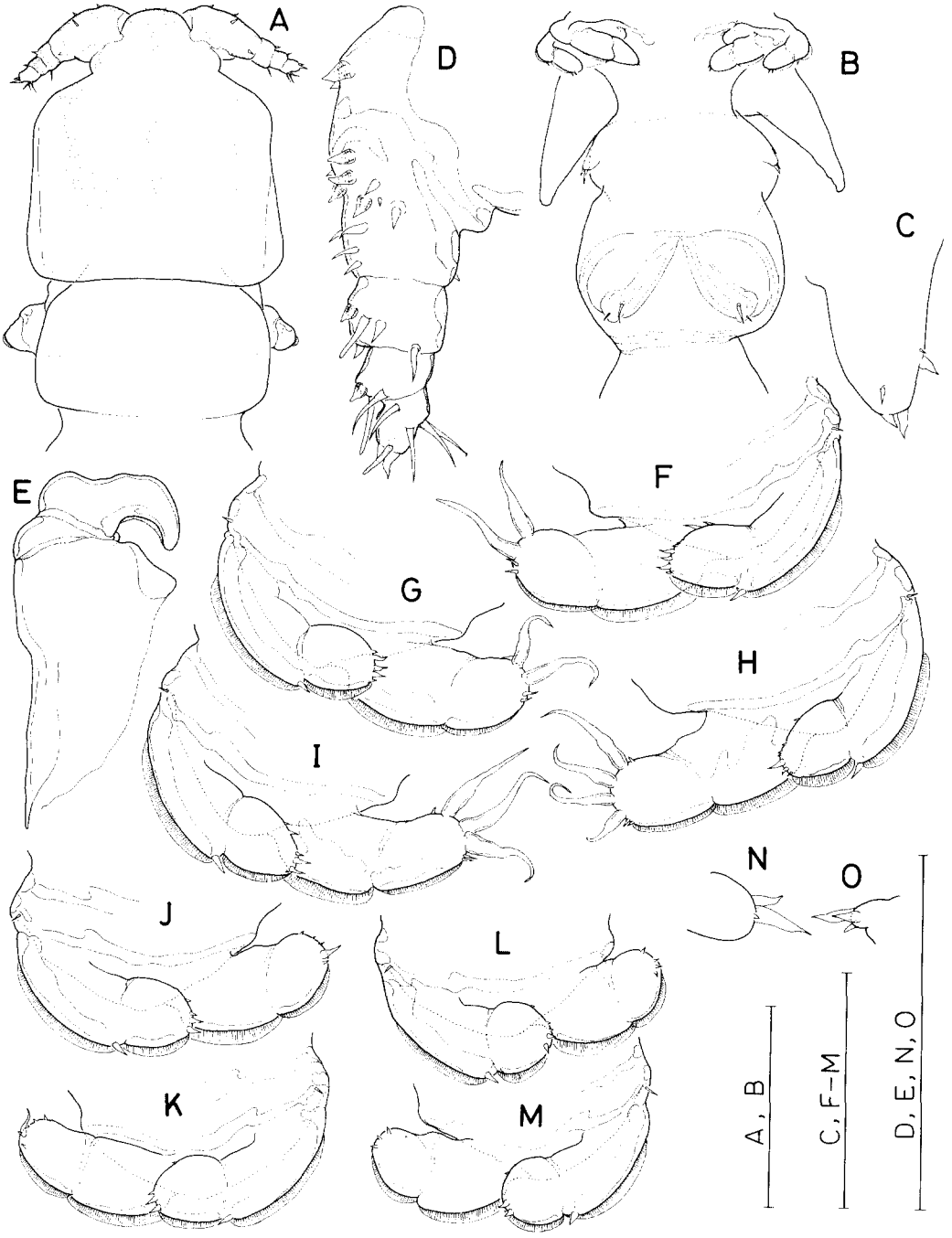

Fig. 9. *Mytilicola orientalis* Mori. Male: A, cephalosome, dorsal; B, pedigers 4 and 5, and genital somite; C, caudal ramus, dorsal; D, antennule; E, maxilliped; F, G. leg 1; H, I, leg 2; J, K, Leg 3; L, M, leg 4; N, O, leg 5. Units of scales: A, B = 0.2 mm; C-O = 0.1 mm.

Both rami of legs 1-4 with outer margin fringed with membrane. Endopods without seta. First segment of all exopods armed with 1 small seta on outer distal corner. Second segment of these legs with 2-4 small terminal setae, its setal formula variable among specimens and between left and right of same leg. Leg 5 (Fig. 8J) a small lobe tipped with 3 foliaceous setae. Leg 6 not discernible.

Male.-Body (Figs. 8K, L) 1.75 mm long. Prosome about 0.80 mm long, rather well-segmented dorsally. Cephalosome slightly longer than wide (Fig. 9A), 0.27 mm × 0.25 mm. First pediger without dorsolateral process. Second to fourth pedigers each with a pair of posterolateral processes, those on second pedigerous somite being smallest and these on fourth, largest. First 2 urosomal somites indistinctly demarcated. Genital somite 205 μm wide (Fig. 9B). Abdomen cylindrical, 0.81 mm long, without segmentation, but lateral and dorsal margins bearing curvatures suggestive of 4 somites.

Caudal ramus (Fig. 9C) 75 μm long, with armature as in female.

Antennule (Fig. 9D) 4-segmented, with setal formula same as that of female. Number of stout setae: 6 on first and 1 each on second and third segments.

antenna, labrum, maxillule and maxilla as those of female. Maxilliped (Fig. 9E) 3-segmented, including terminal claw. All segments unarmed. First segment stout. Second segment short. Claw stout, with thin inner membrane.

Legs 1-4 (Figs. 9F-M) segmented as in female. Basis of all legs with small seta on outer distal corner. Terminal segments of endopods of first 2 legs armed with rather well-developed setae (numbered 2 in leg 1 and 3 or 4 in leg 2), with 2 or 3 more minute setules. Number of setules on terminal segment of exopods more variable than in female. Leg 5 (Figs. 9N, O) a small lobe bearing 3 unequal-sized, terminal setae. Leg 6 represented by 1 seta and 1 minute setule on ventral ridge of genital somite (Fig. 9B).

Remarks.-The general body form of our specimens appears like that of *Mytilicola mactrae* described by Hoshina & Kuwabara (1959) from Japan, but unlike the latter species, our Korean specimens have no posterolateral processes on the cephalosome. In the absence of this pair of processes in both sexes and the similar processes on the male first pediger, our specimens are identified as *M. orientalis* Mori, 1935.

We agree with Humes (1954) to treat *M. ostreae* Wilson, 1959 as a junior synonym of *M. orientalis*, but disagree with Humes and Ho (1970) in suspecting a conspecificity between *M. mactrae* and *M. orientalis*. *M. mactrae* is a good species and can be distinguished from *M. orientalis* by the possession of cephalic processes in both sexes and a pair of similar processes on male first pediger. In his report on *M. porrecta*, Humes (1954, Figs. 31, 32) illustrated a female *M. orientalis* for comparison. However, a close examination of those figures revealed that he was dealing with *M. mactrae* and not *M. orientalis*. His specimen shows a pair of cephalic processes, which is characteristically absent in *M. orientalis* (Mori, 1935; Wilson, 1938; Do & Kajihara, 1986). Below is a key to identify the five species of *Mytilicola* considered valid by us:

1. Body with 5 or 6 pairs of lateral processes ··· 2
   Body without lateral processes ····· *fimbriata*
2. Body with 6 pairs of lateral processes, with one of them located on cephalosome ····· *mactrae*
   Body with 5 pairs of lateral processes; none of cephalosome ····· 3
3. Caudal rami divergent, with their tips pointing away from each other····· *intestinalis*
   Caudal rami parallel to nearly parallel to each other ····· 4
4. Caudal ramus long; egg sac long, reaching far beyond caudal rami; male with lateral processes on pedigers 2, 3 and 4····· *orientalis*
   Caudal ramus short; egg sac short, reaching only a short distance beyond caudal rami ····· *porrecta*

As in *Mytilicola*, *Trochicola* and *Piratasta* also known to have vermiform body with 5 or 6 pairs of lateral processes. The female *Trochicola* are distinguishable from *Mytilicola* only by their rather unmodified male, but as to the species of *Piratasta*, due to insufficiently documented information, their true distinction from *Mytilicola* is unclear. It is interesting to point out that in a brackish-water lake, Lake Hamanaki, in Japan both *Trochicola* and *Piratasta* are known. From Shimura and

Kuwabara's (1984) report, one can tell their *T. japonicus* is a valid species, but, based on Yamaguti's (1939) description, *P. brachidontis* does not differ from *M. orientalis*. However, since the male of *P. brachidontis* is unknown, further judgement on the true identity of this species can not be made at this point of time.

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한국산 복족류에 기생하는 요각류

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한국산 복족류 8종에 기생하는 요각류 5종을 기록한다. 이 요각류는 다음과 같다. *Anthessius longipedis*(신종), *Panaietis yamagutii* Izawa, *Parapanaietis tegulae* Hoshina & Sugiura, *Philoblenna bupulda*(신종), *Mytilicola orientalis* Mori.