

The Bodotriid Cumacea (Crustacea: Malacostraca) from the Yellow Sea

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The present study dealt with cumaceans (Cumacea: Bodotriidae) collected from the Yellow Sea. Specimens were sampled using a van Veen grab in the Yellow Sea and in Kyonggi Bay surrounding Incheon, Korea. New figures and redescrptions of the four bodotriid cumaceans are presented, including *Bodotria ovalis* Gamo, 1965, *Iphinoe tenera* Lomakina, 1960, *Eocuma* cf. *hilgendorfi* Marcusen, 1894, and *Heterocuma sarsi* Miers, 1879. They are newly added in the Korean fauna.

Key words: Cumacea, Crustacea, Taxonomy, Bodotriidae, Yellow Sea, Korea, *Bodotria*, *Iphinoe*, *Eocuma*, *Heterocuma*

Introduction

The family Bodotriidae (Cumacea: Crustacea) was created by Scott in 1901 and presently reported 285 species in the world (Bacescu, 1988). In number of species the Bodotriidae outstrip two families, Nannastacidae and Diastylidae, on the Indian Ocean and southern Australian coasts, but on the Pacific side the family Diastylidae are equally well represented (Hale, 1953). However, very little is known of the Cumacea of Korea.

Ten species of the family Bodotriidae have been recorded in Korean waters and its neighboring waters by Lomakina (1955, 1958, 1960), Liu and Liu (1990), Kang and Lee (1995a, 1995b) and Lee and Lee (1997). However, the examination of the Yellow Sea collections together with the other cumaceans from the surrounding areas of Incheon, has resulted in the finding of four unrecorded cumaceans in Korean waters: *Bodotria ovalis* Gamo, 1965, *Iphinoe tenera* Lomakina, 1960, *Eocuma* cf. *hilgendorfi* Marcusen, 1894, and *Heterocuma sarsi* Miers, 1879. They are redescribed with illustrative figures.

Materials and Methods

Specimens were obtained during August in 1982 by the Korea Ocean Research & Development Institute in the Yellow Sea (Fig. 1). The benthic samples of

1982 were collected by trawling rectangular dredge (type Charcot, mouth 50×23 cm) of which their sampling volume was limited to 100 l. Another cruise was organized in September 1992 as the Korea-China Yellow Sea Research Program between Inha University and Institute of Oceanology, Academia Sinica, China. During this survey three replicates were made using a van Veen grab (0.1 m²) at each station. Additional subtidal specimens were collected around the Incheon coastal areas (Fig. 1) using a van Veen grab between August 1994 and October 1996.

The samples were sieved through a 1.0 mm mesh screen and fixed in 10% formalin. After examination, specimens were preserved in 70% ethanol. The measurements for the total length were made from the anterior tip of the carapace to the posterior edge of last pleonite, but exhalent siphons and uropods were excluded. Morphological descriptions are mainly based on the female specimens and the description of male is done only for the sexually dimorphic characters.

Systematic Account

Order Cumacea Kröyer, 1846
Family Bodotriidae Scott, 1901
Subfamily Bodotriinae Hale, 1944
Genus *Bodotria* Goodsir, 1843
Bodotria ovalis Gamo, 1965

Figs. 2~4

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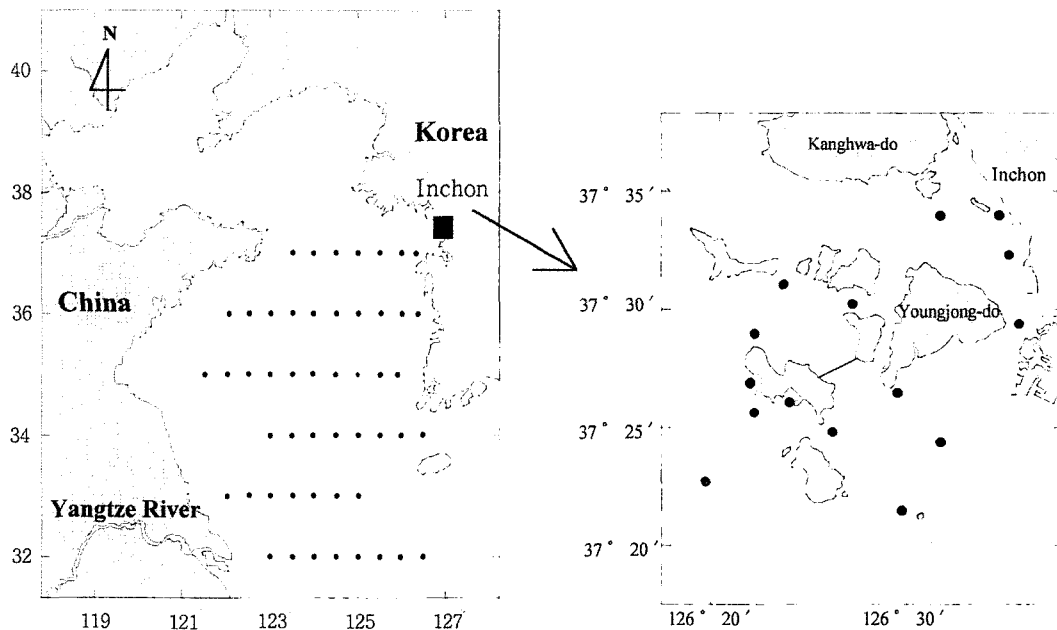


Fig. 1. Location of sampling stations in the Yellow Sea and in shallow waters off Incheon, Korea.

Bodotria ovalis Gamo, 1965a, p. 2, figs. 2-4; Gamo, 1967, p. 138, fig. 3; Liu and Liu, 1990, p. 197, figs. 2-3.

Type locality. Akkeshi Bay, Japan, depth about 8~12 m, sandy mud bottom.

Material examined. 2♀, Yellow Sea (37° 00'N, 126° 00'E), 35 m, sand, Aug. 1982; 1♂, Yellow Sea (36° 50'N, 126° 00' E), Aug. 1982; 1♂, subtidal, Yongjong-do, Apr. 1995; 1♀, subtidal, Yomha channel, mud, May 1995; 1♀, 1♂, subtidal, Yongjong-do, mud, Apr. 1996.

Description. Adult female. Length 5.1 mm. well-developed marsupium. Body well-calcified, very hardened and covered with small reticulate sculpture with fine pitted background (Fig. 2A). Carapace almost ovoid from dorsal view and widest across to posterior portion. Longitudinal median and a pair of lateral carina continued to the end of pereonite 4. Dorso-lateral margin much expanded laterally and forming very strong keeled carina. Antennal notch deeply concave and V-shaped with a subacute anterolateral angle (Fig. 2A, B).

Pereon slightly shorter than carapace. Dorsum of pereonite 1 almost concealed. Dorsal surface rather flattened with exception of longitudinal dorso-median carina. Dorso-median carina distinct on all the segments (Fig. 2A, B). Pleon slender and subequal to half of total length. Dorso-median carina distinct on first 5 segments (Fig. 2A, B).

Segment 1 of antenna 1 much expanded, longer than remaining segments combined with short hairs

on distal portion. Main flagellum 2-segmented, accessory very minute (Fig. 2G).

Basis of maxilliped 3 strongly geniculate, external angle developed into a prolongation with plumose hairs on inner border reaching level of about half of merus. Ischium narrowed, merus expanded slightly externally, but carpus expanded internally (Fig. 3C).

Basis of pereopod 1 curved, stout, and narrowed distally with rather long plumose hairs on distal portion and about 1.3 times length of remaining segments combined. From ischium to carpus stout, inner edge of carpus expanded laterally. Distal 2 segments slender, each subequal in length (Fig. 3D). Pereopod 2 with coalesced basis and ischium. Basis slightly curved, 1.4 times length of remaining segments combined. Carpus and dactyl subequal in length, each with characteristic 2 and 3 spines (Fig. 3E). Pereopods 3 to 5 slender, dactyl of these with a short and stout spine (Fig. 3F, G, H).

Uropod peduncle exceeding last 2 pleonites combined. Endopod 1-segmented, equal to exopod with 8 spines on inner margin, a long spine together with a short spine on distal end. Exopod 2-segmented, segment 2 with plumose hairs on inner border and unequal spines on distal end (Fig. 2E).

Adult male. Length 5.1 mm. Carapace and pereon depressed dorso-ventrally. Carapace nearly a quarter of total length (Fig. 2C).

Pereon about one-fifth of total length. Pereonite 1 concealed with carapace, each segment with a strong median carina. Prominent lateral carina formed by

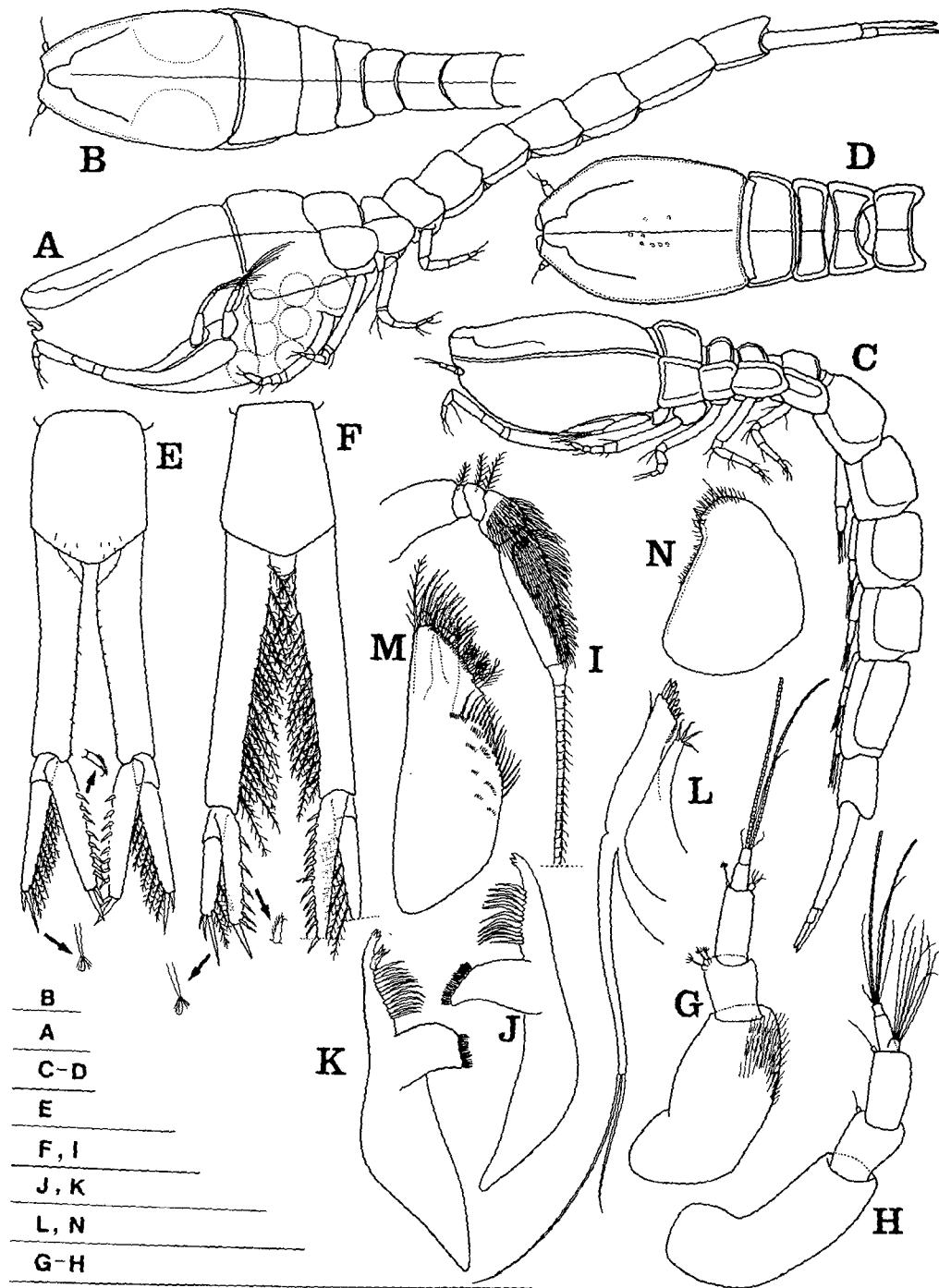


Fig. 2. *Bodotria ovalis* Gamo: A, adult female, lateral view; B, adult female, carapace and pereon, dorsal view; C, adult male, lateral view; D, adult male, carapace and pereon, dorsal view; E, adult female, pleon and uropods; F, adult male, pleon and uropods; G, adult female, antenna 1; H-I, adult male, labium. Scale=0.5 mm.

upper edge of pronounced subquadrangular area on lower half (Fig. 2C). In lateral view, pereon and pleon with mid-dorsal line irregular and faintly arched posteriorly (Fig. 2C).

Antenna 1 rather elongated and slender. Segment 1 of antenna 1 longest, without short hairs on distal portion. Segments 2 and 3 subequal in length, about 7/10 length of segment 1. Main flagellum 2-

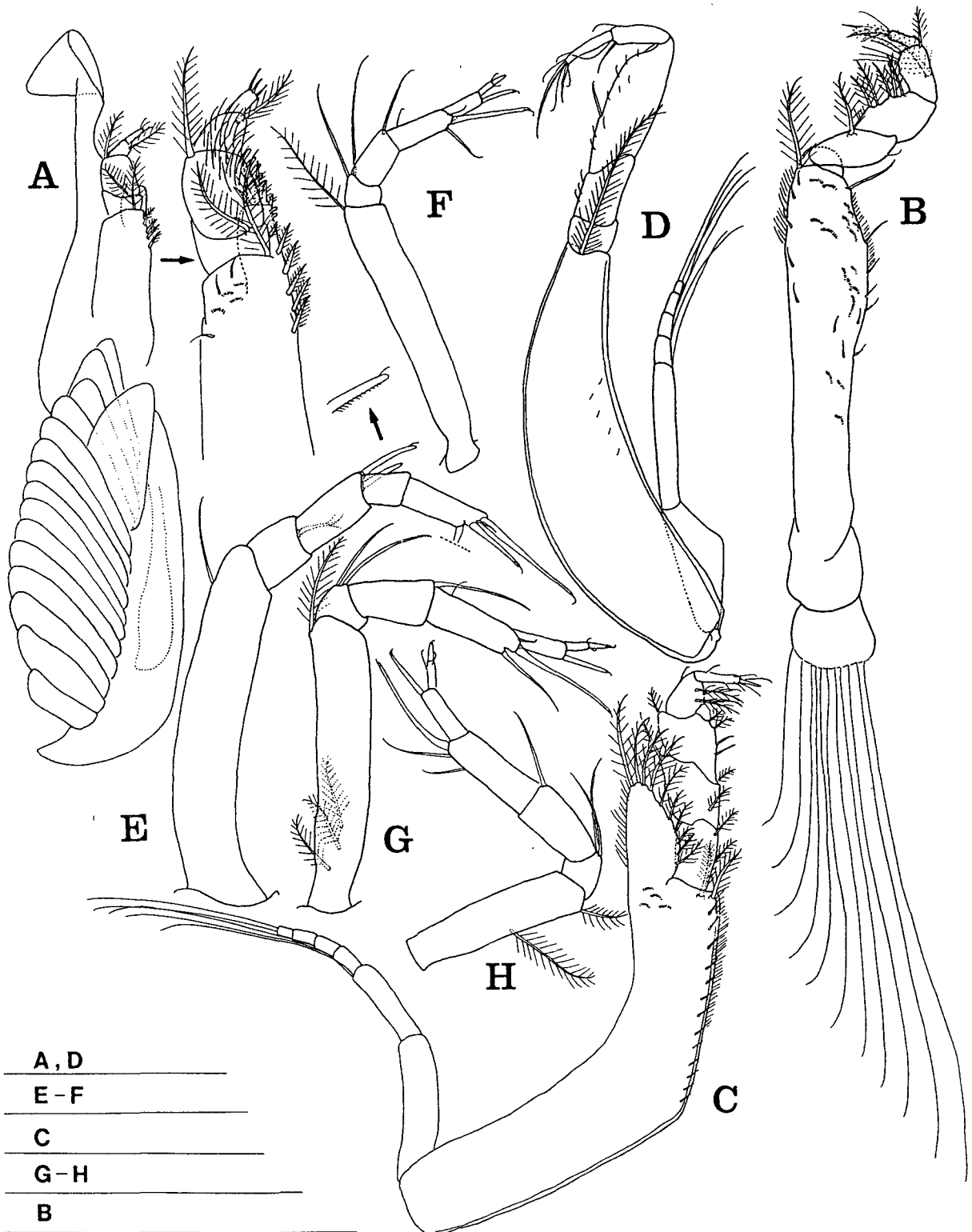


Fig. 3. *Bodotria ovalis* Gamo, adult female: A-C, maxillipeds 1 to 3; D-H, pereopods 1 to 5. Scale=0.5 mm.

segmented, with subequal aesthetascs. Accessory flagellum 1-segmented, minute with a bundle of long hairs (Fig. 2H).

Basis of maxilliped 3 straight, twice length of

remaining segments together. Distal portion of basis and merus broader, carpus somewhat expanded, dactyl slender (Fig. 4C).

Uropod peduncle more than 1.5 times pleonite 6.

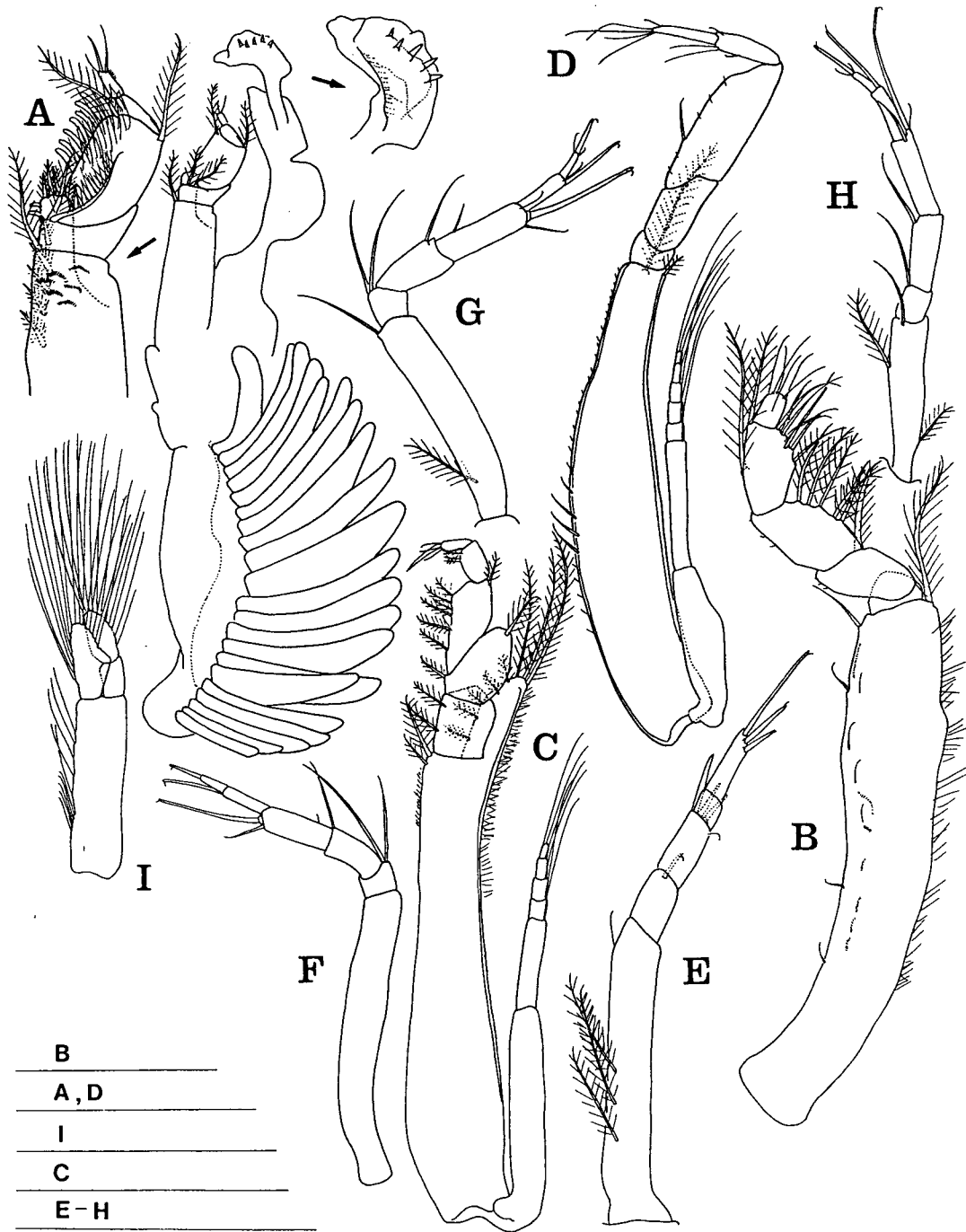


Fig. 4. *Bodotria ovalis* Gamo, adult male: A-C, maxillipeds 1 to 3; D-H, pereopods 1 to 5; I, pleopod 1. Scale=0.5 mm.

bearing a number of plumose setae on inner margin. Endopod with each 5 and 13 spines on inner margin and a long apical spine and a short apical spine at apex. Exopod 2-segmented, with

plumose hairs on inner margin, unequal 3 apical spines. Right endopod and exopod longer than those of the left (Fig. 2F).

Distribution. Akkeshi Bay, Japan, sandy mud,

8~12 m; Yangtze River estuary (30° 30' – 32° 00'N, 122° 10' – 123° 30'E), 9~64 m; southern part of the Shan-Tung Peninsula, China, 5 m; coastal areas around Inchon, Korea, 10 m; Yellow Sea, 35 m.

Remarks. Gamo's (1965) original description is well accorded with the present specimen. However, the present materials differ in the following features: 1) the posterior portion of the dorso-median carina of pereonite 4 is not so raised dorsally as in Gamo (1965); 2) the present specimens lack teeth in the middle portion of the inner border of the basis of maxilliped 3, but they are present in Gamo's materials; 3) our specimens have rather a long plumose hair on the distal portion of the basis of pereopod 1, but Gamo's has no hairs.

In addition, this species resembles *Bodotria arenosa* Goodsir, 1843. The major difference is, however, that in the male of *B. arenosa*, the endopod of the uropod has three spines and a pair of long hairs on the terminal portion of the last pleonite (Sars, 1900; Jones, 1976).

Genus *Iphinoe* Bate, 1856

Iphinoe tenera Lomakina, 1960

Figs. 5~8

Iphinoe tenera Lomakina, 1960, p. 98, fig. 4; Liu and Liu, 1990, p. 199, fig. 4.

Type locality. Qingdao, China, depth 25 m.

Material examined. 1♀, Yellow Sea (32° 00'N, 124° 30' E), 35 m, sandy silt, Sept. 1992; 1♀, 1♂, subtidal, Yongjong-do, mud, Oct. 1996.

Description. **Adult female.** Length 6.9 mm. Body extremely elongated, lightly calcified and whitish (Fig. 5A). Carapace slightly longer than one-fifth of total length, dorsal edge faintly arched, subtriangular from dorsal view; the upper edge is somewhat elevated in the middle part with 12 forward pointed teeth. Sinus wide and rather deep. Antero-lateral corner triangular with teeth at apex and on lower margin (Fig. 5A).

Pereon rather longer than carapace. Pereonite 1 dorso-laterally visible, about half as long as pereonite 2; pereonite 2 longer than pereonite 3. Segments of pereonite 3 to 5 produced posteriorly (Fig. 5A). Pleon stout, a little longer than two-fifths of the total length. Pleonite 6 with a pair of hairs on terminal portion (Fig. 5A).

Antenna 1 nearly straight and slender, segment 3 1.5 times length of segment 2. Main flagellum 2-segmented, rather large. Accessory 2-segmented, short

(Fig. 5E).

Basis of maxilliped 3 excluding distal prolongation, about twice length of remaining segments together. Prolongation of basis narrow, not extended to the distal end of merus. Merus expanded externally, slightly longer than ischium. Distal 3 segments rather elongated and slender (Fig. 6B).

Pereopod 1 slender and elongated, basis about 1.3 times the length of remaining segments together with teeth on lateral edge. Carpus equal to ischium plus merus. Propodus and dactyl elongated with long naked hairs, subequal in length (Fig. 6C). Pereopod 2 stout with basis shorter than remaining segments combined. Merus coalesced with ischium. Merus and carpus with a strong spine. Dactyl setiferous with stout 2 terminal spines, a little shorter than the merus plus carpus (Fig. 6D). Carpus of pereopods 3 to 5 with subequal hairs, dactyl of these very short with a long spine (Fig. 6E, F, G).

Uropod peduncle rather stout with 9 spines and 4 plumose hairs on inner margin. Endopod 2-segmented, slightly shorter than exopod. Proximal segment of endopod short and thick with 4 spines; outermost segment longest; distal segment slender and linear with 8 spines on inner margin and plumose hairs on outer margin. Exopod 2-segmented with plumose hairs on both margins (Fig. 5D).

Subadult male. Length 6.0 mm. Carapace one-fourth of total length with forward directed 10 teeth on anterior portion (Fig. 7A, B).

Pereon about one-fifth of total length. Pereonite 1 obscured laterally by anterior projection of pereonite 2. Sideplates of pereon produced backwards, pereonite 4 also produced forwards to overlap pereonite 3 (Fig. 7A, B). Pleon about half of total length, sideplates defined ventrally. Pleonite 6 bearing a pair of hairs (Fig. 7A).

Antenna 1 elongated, rather stout. Segments 1 and 3 subequal in length, segment 2 a little short. Main flagellum 2-segmented. Accessory 2-segmented, minute (Fig. 7E).

Basis of maxilliped 3 more than twice the length of remaining segments combined; distal prolongation not greatly expanded, reaching the junction between merus and carpus (Fig. 8B).

Pereopod 1 slender; basis 1.4 times length of remaining segments combined with 2 teeth on distal portion. Propodus and dactyl subequal in length with long naked hairs (Fig. 8C).

Uropod peduncle stout with 5 or 6 spines and 6

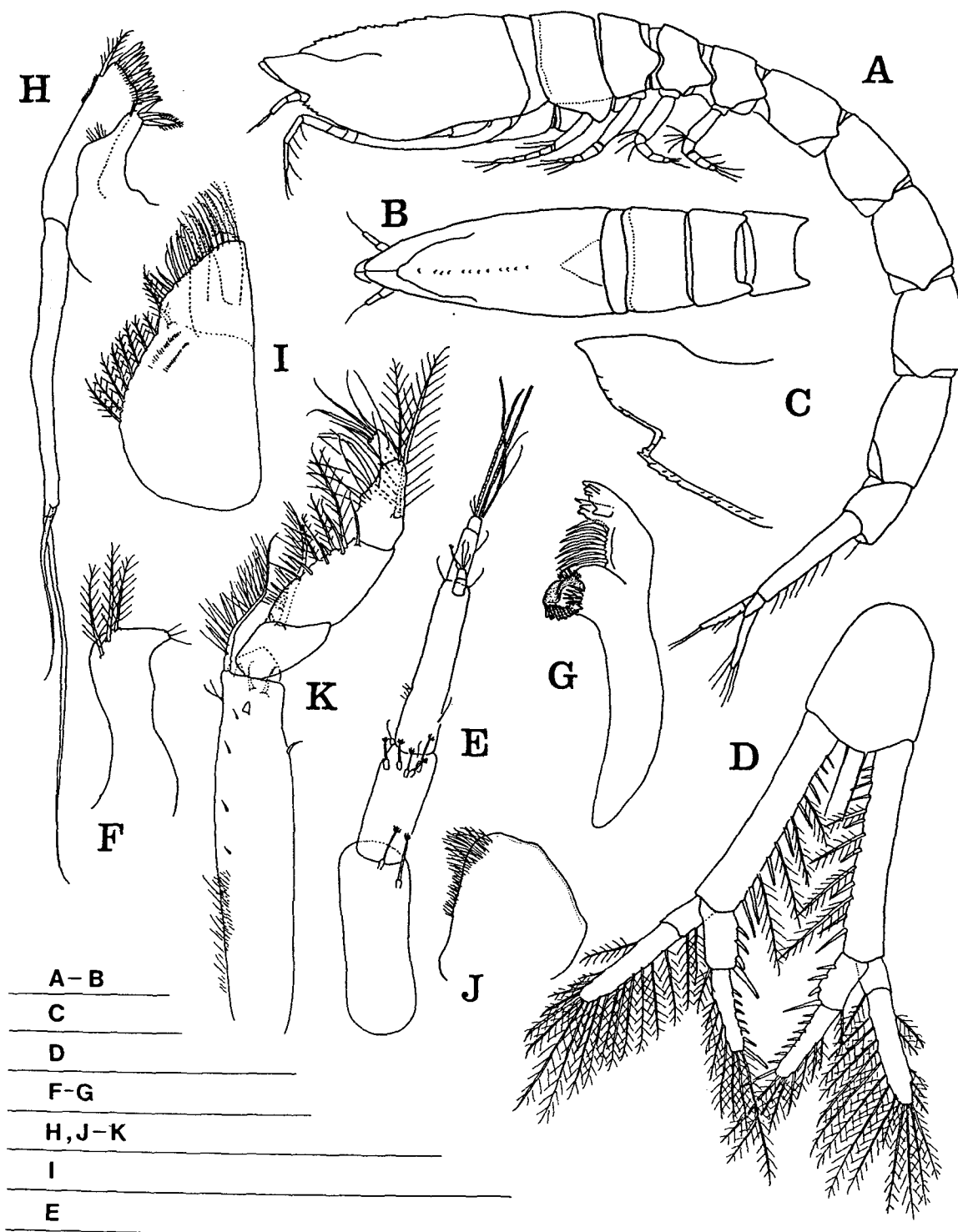


Fig. 5. *Iphinoe tenera* Lomakina, adult female: A, lateral view; B, carapace and pereon, dorsal view; C, antero-lateral margin of carapace; D, last pleonite and uropods; E-F, antennae 1 and 2; G, mandible; H-I, maxillae 1 and 2; J, labium; K, maxilliped 2. Scale, A-B, D=1.0 mm, C, E-K=0.5 mm.

or 7 plumose hairs on inner margin. Endopod 2-segmented with 3 or 4, 5 or 6 strong spines each on inner margin. Exopod 2-segmented with dense plumose hairs on both margins (Fig. 7D).

Distribution. Bohai Bay, Jiazhou Bay, Qingdao, Huanghe River estuary, Yangtze River estuary, China, 4~37 m; coastal seas off Inchon, Korea, 10 m; Yellow Sea, 35 m.

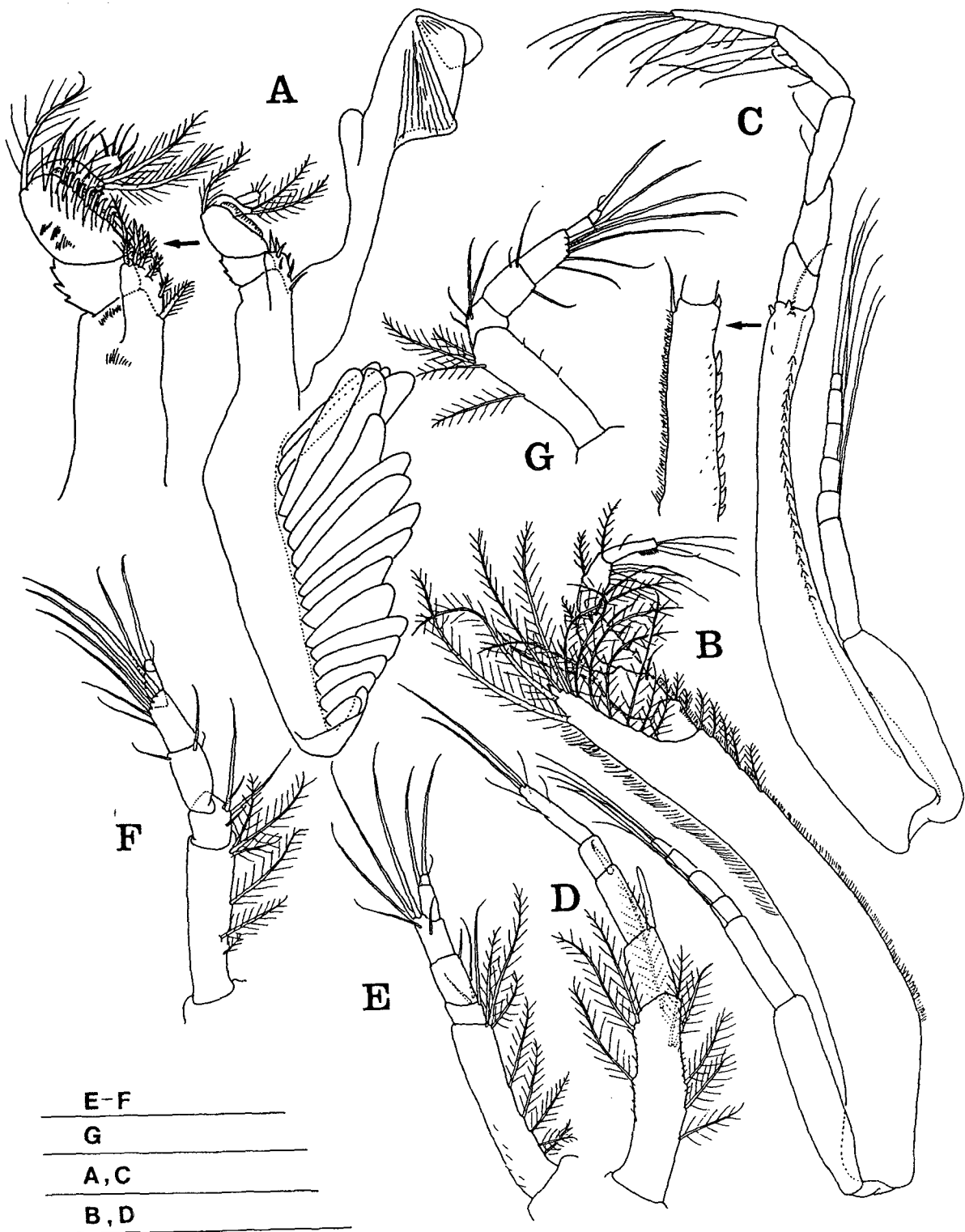


Fig. 6. *Iphinoe tenera* Lomakina, adult female: A, maxilliped 1; B, maxilliped 3; C-G, pereopods 1 to 5. Scale=0.5 mm.

Remarks. A single subadult male specimen was sampled from the present study areas. However, Lomakina (1960) and Liu and Liu (1990) described the mature adult male. The morphological

differences between the subadult and adult stages are as follows: 1) the carapace is decorated with forward directed teeth on anterior portion in the subadult stage; however, in the adult stage no

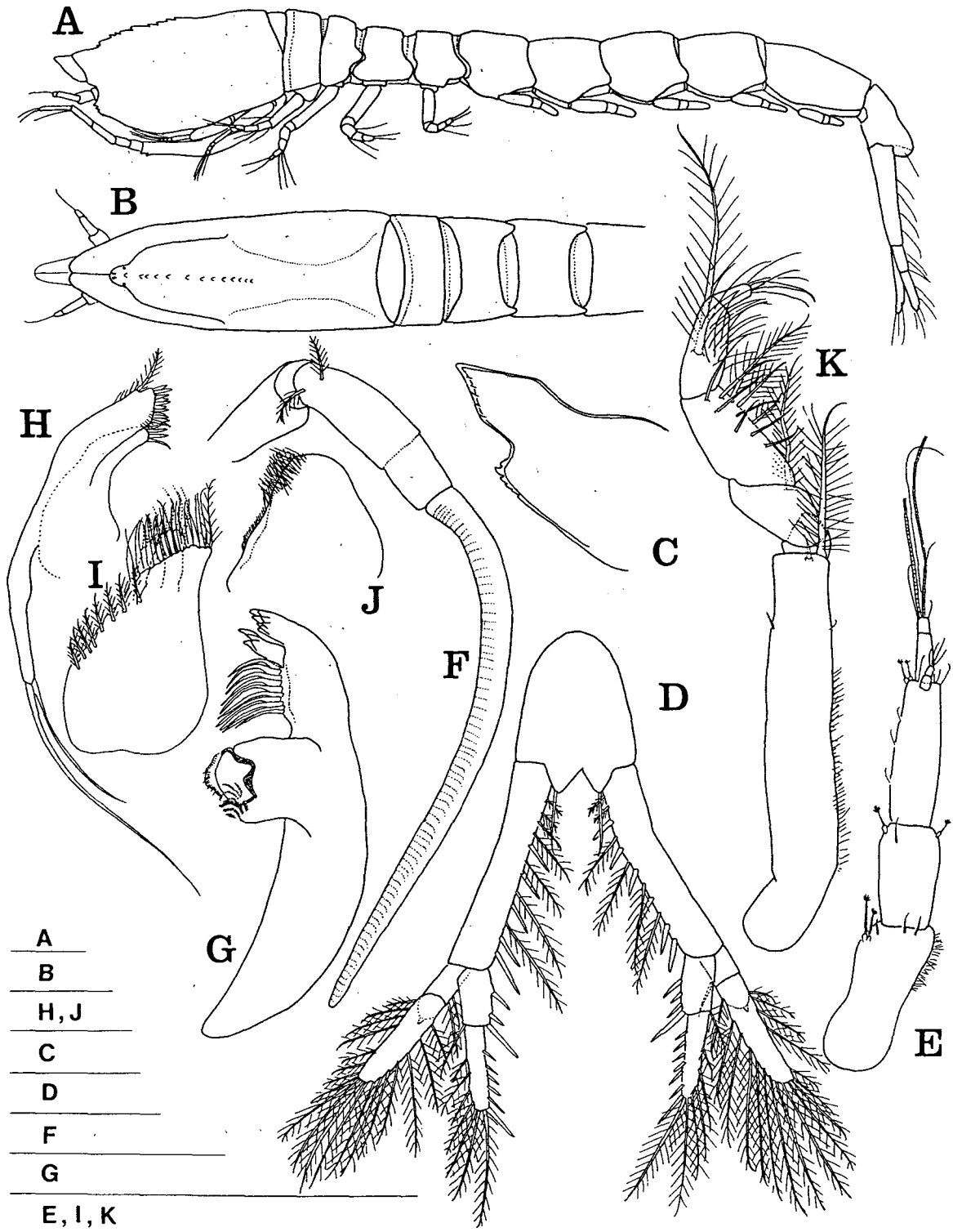


Fig. 7. *Iphinoe tenera* Lomakina, subadult male: A, lateral view; B, carapace and pereon, dorsal view; C, antero-lateral margin of carapace; D, last pleonite and uropods; E-F, antennae 1 and 2; G, mandible; H-I, maxillae 1 and 2; J, labium; K, maxilliped 2. Scale, A-G, I, K=0.5 mm, H, J=0.2 mm.

teeth are seen, so it is smooth; 2) the antero-lateral corners of the carapace have teeth at the apex, and the lower margin of the carapace is serrated on

the anterior portion in the subadult, but the antero-lateral corners and the lower margin have no tooth in the adult stage.

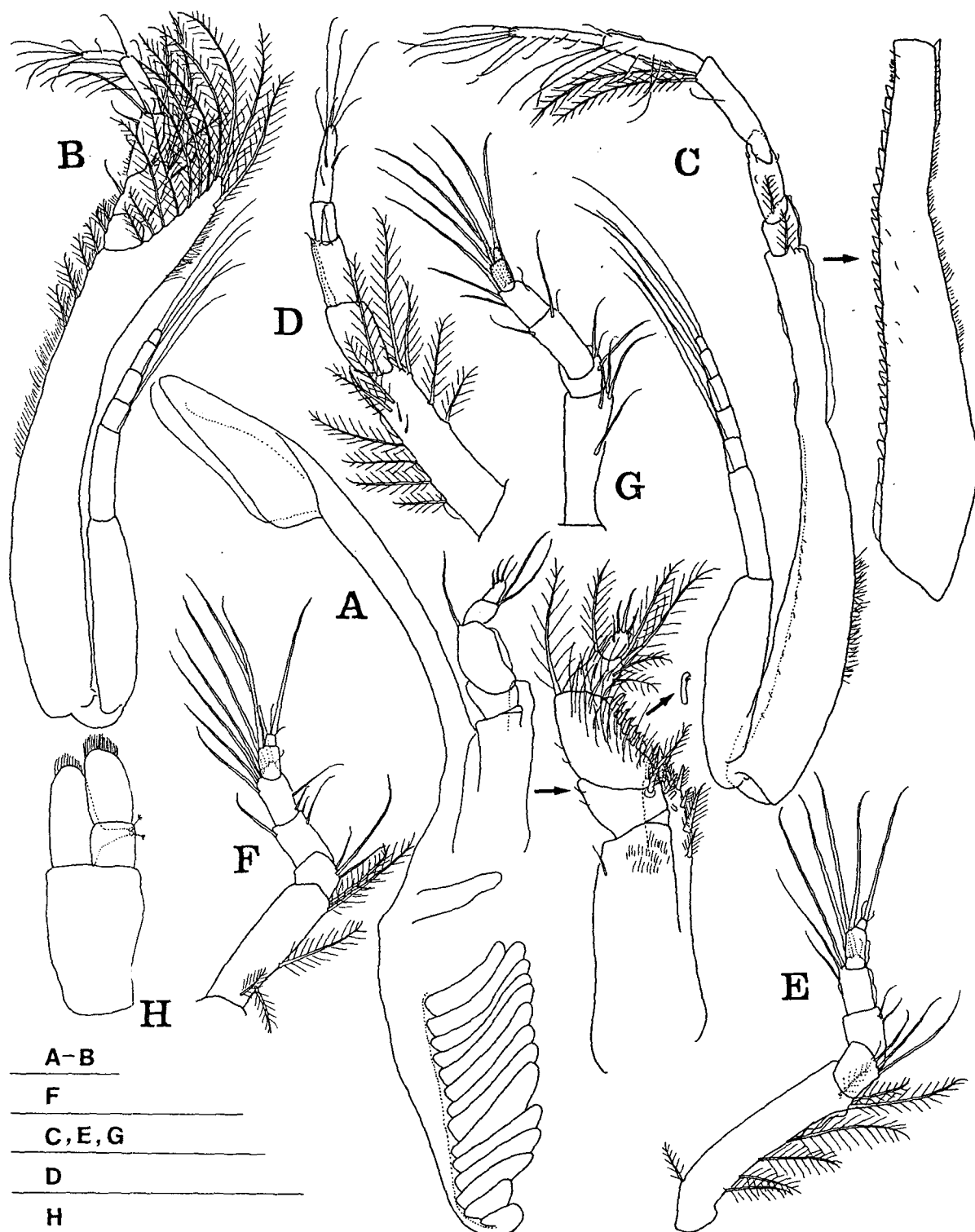


Fig. 8. *Iphinoe tenera* Lomakina, subadult male: A, maxilliped 1; B, maxilliped 3; C-G, pereopods 1 to 5; H, pleopod 1. Scale=0.5 mm.

Genus *Eocuma* Marcusen, 1894

Eocuma cf. *hilgendorfi* Marcusen, 1894
Figs. 9~12

Eocuma hilgendorfi Marcusen, 1894, p. 170;
Zimmer, 1903, p. 669, textfigs. D-H; Stebbing, 1913,
p. 21; Kurian, 1963, p. 186, fig. 1; Day, 1978, p. 169;
Gamo, 1967, p. 140.

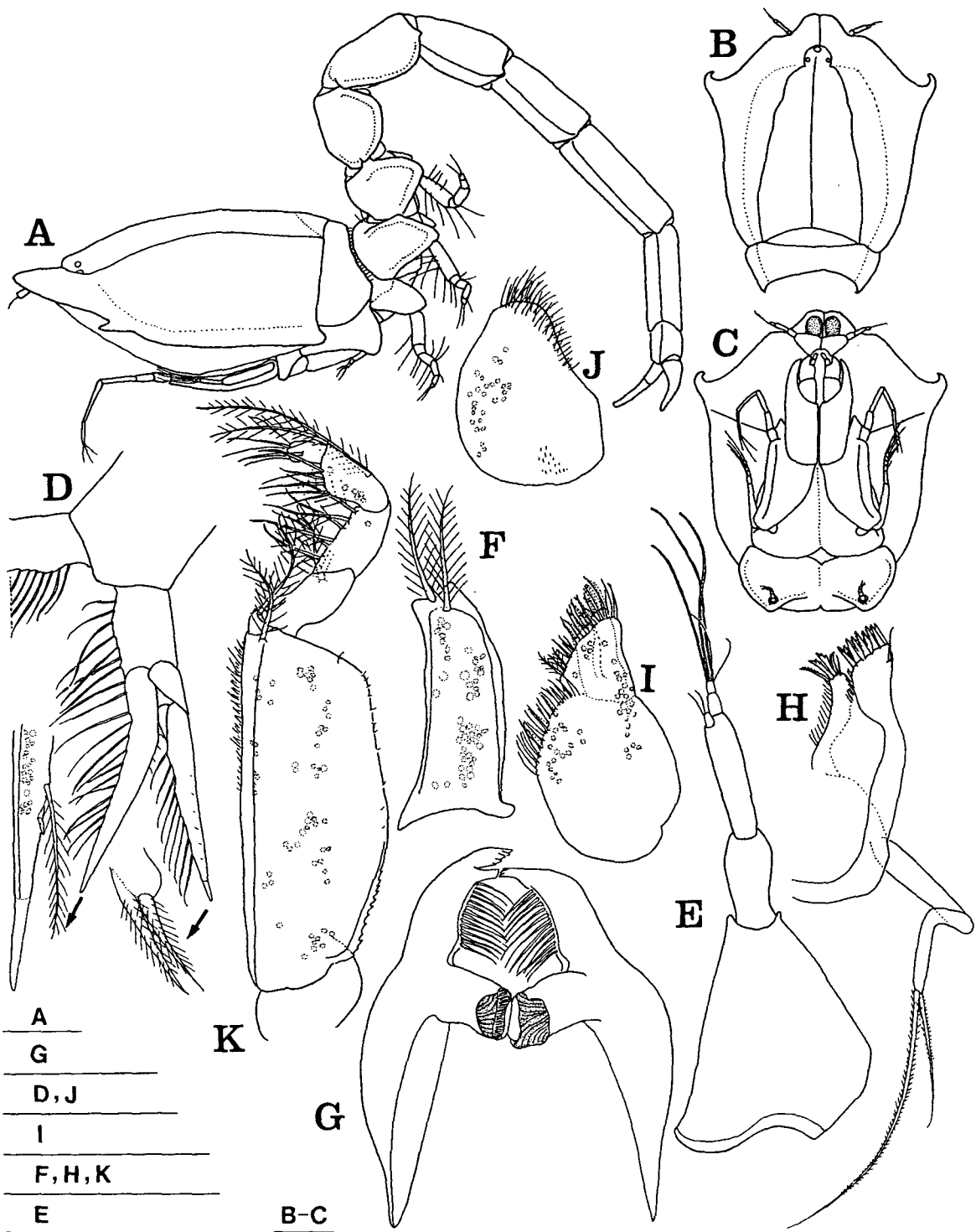


Fig. 9. *Eocuma cf. hilgendorfi* Marcusen, adult female: A, lateral view; B, carapace, dorsal view; C, carapace, below view; D, last pleonite and uropods; E-F, antennae 1 and 2; G, mandibles; H-I, maxillae 1 and 2; J, labium; K, maxilliped 2. Scale, A-C=1.0 mm, D-K=0.5 mm.

Eocuma lata Gamo, 1958, p. 383 (♀ part), fig. 1; Gamo, 1965b, p. 533, fig. 694.

Type locality. Enoshima, Sagami Bay, Japan.

Material examined. 5 ♀♀, 1 ♂, Yellow Sea (33°

00' N, 122° 00' E), 32 m, sandy silt, Sept. 1992; 1 ♀, Yellow Sea (33° 00' N, 122° 20' E), 29 m, silt, Sept. 1992; 3 ♀♀, subtidal, Yongjong-do, Aug. 1994; 1 ♀, subtidal, Yongjong-do, Feb. 1995; 1 ♀, subtidal,

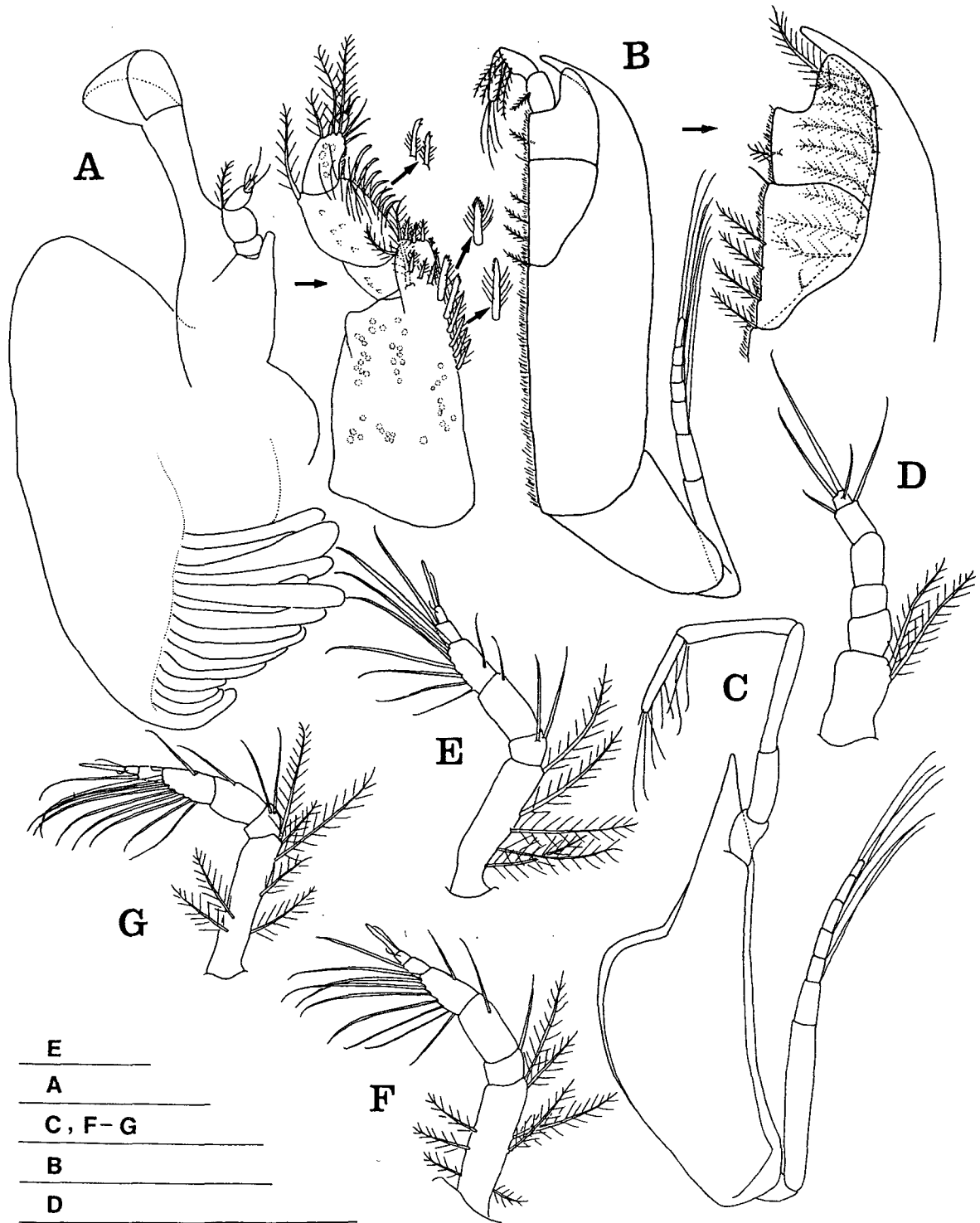


Fig. 10. *Eocuma* cf. *hilgendorfi* Marcusen, adult female: A, maxilliped 1; B, maxilliped 3; C-G, pereopods 1 to 5. Scale, A-C, F-G=1.0 mm, D-E=0.5 mm.

Yongjong-do, Oct. 1995; 1♀, subtidal, Yongjong-do, mud, Apr. 1996.

Description. Adult female. Length 13.6 mm. Body white, faintly shiny, reticulate, brittle and

opaque. Carapace strongly depressed dorso-ventrally, about one-fourth of total length. Sinuous side rather wide, this and pseudorostrum each slightly horizontal. Pseudorostrum produced forward, longer

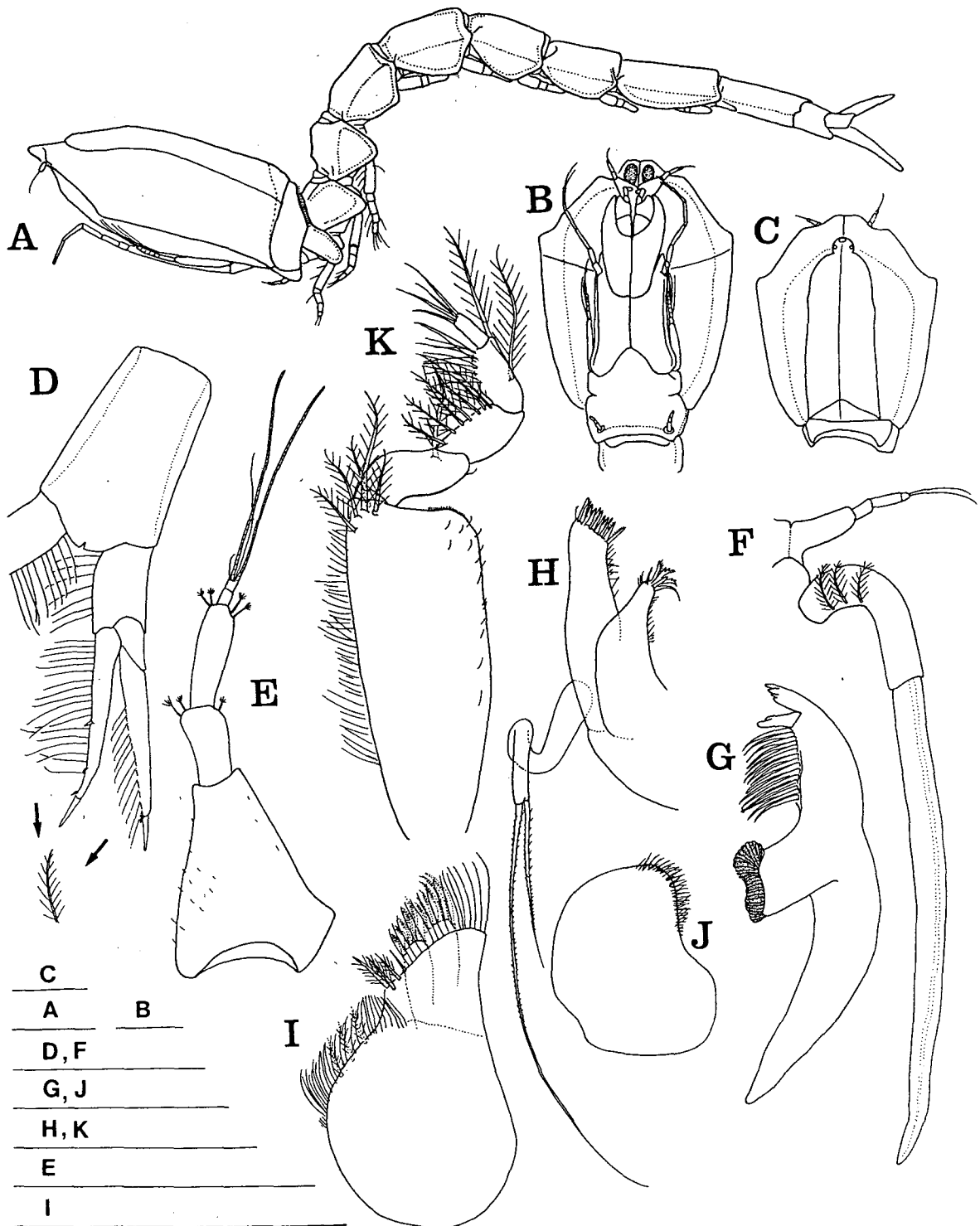


Fig. 11. *Eocuma cf. hilgendorfi* Marcusen, subadult male: A, lateral view; B, carapace, below view; C, carapace, dorsal view; D, last pleonite and uropod; E-F, antennae 1 and 2; G, mandible; H-I, maxillae 1 and 2; J, labium; K, maxilliped 2. Scale, A-D, F=1.0 mm, E, G-K=0.5 mm.

than the ocular lobe with 3 clear lenses. Lateral edges of carapace with a single pair of forward-pointing horns. In dorsal view, lateral horns marked widest part of carapace, breadth of carapace

subequal to its length. Mid-dorsal carina and a pair of lateral ridges well marked (Fig. 9A, B, C).

Pereonite 2 fused with pereonite 1; pereonite 1 firmly united with carapace. In lower view, sternites

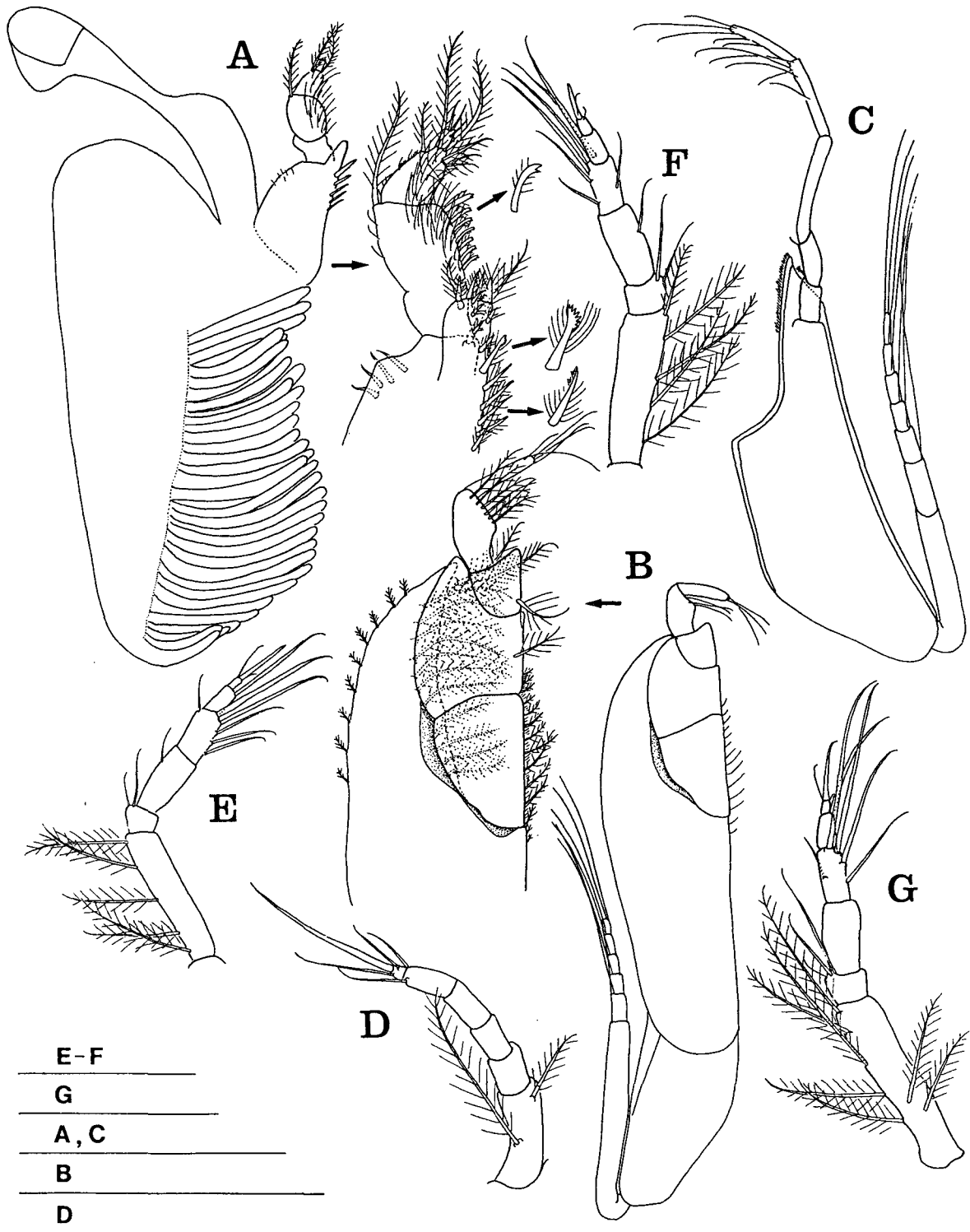


Fig. 12. *Eocuma* cf. *hilgendorfi* Marcusen, subadult male: A, maxilliped 1; B, maxilliped 3; C-G, pereopods 1 to 5. Scale, A-C, F-G=1.0 mm, D-E=0.5 mm.

1 and 2 fused with each other, sideplates of these rather developed and grooved. Pereonite 2 wider; pereonite 3 very small, visible laterally as a small flattened sideplate only (Fig. 9A). Pleon much

more slender and cylindrical, sideplates of pereonite 3 to pleonite 2 well developed and subtriangular (Fig. 9A).

Segment 1 of antenna 1 wide and triangular;

segments 2 and 3 slender. Main flagellum 2-segmented. Accessory 1-segmented, minute (Fig. 9E).

Maxilliped 3 large and stout; basis flattened, almost 1.5 times length of remaining segments combined; distal prolongation strongly developed reaching distal tip of carpus. Ischium large, longer than merus. Merus expanded distally, reaching articulation of carpus and propodus. Propodus slightly expanded towards mid-line, dactyl slender (Fig. 10B).

Basis of pereopod 1 produced distally and acutely forward, slender process reaching end of merus, but broad in the middle of basis. From ischium to dactyl elongated, slender (Fig. 10C). Pereopod 2 minute, but relatively stout; basis slightly shorter than ischium, merus and carpus combined (Fig. 10D). Pereopods 3 to 5 similar, carpus of these with long and naked hairs (Fig. 10E, F, G).

Uropod peduncle short, very stout with plumose hairs on inner margin, less than half of pleonite 6. Endopod 1-segmented, nearly 3 times as long as uropod peduncle with plumose hairs on inner margin with a protuberance at apical end. Exopod subequal to endopod with many plumose hairs on inner margin, 2 protuberances at apical end (Fig. 9D).

Subadult male. Length 11.4 mm. Carapace with a pair of lateral horns, each having a rather obtuse point directed forward. Sinus slightly concave, pseudorostrum rather obtuse (Fig. 11A, B, C).

Pereon more depressed than that of female. Pereonites 1 and 2 fused. In lateral view, pleon also more depressed than that of female, sideplates of pereonite 3 to pleonite 5 well developed, grooved and subtriangular (Fig. 11A). Cephalothorax slightly shorter than abdomen. Sideplates of pleon strongly defined ventrally (Fig. 11A).

Uropod peduncle less than half of pleonite 6. Endopod nearly twice as long as uropod peduncle with 3 spaced teeth on inner margin. Exopod having teeth at apical end (Fig. 11D).

Distribution. Southern India; Sagami Bay, Kii Peninsula (Shirahama), Amakusa, Japan; coastal seas off Inchon, Korea, 10 m; Yellow Sea, 29~32 m.

Remarks. The present specimen is very closely allied to *Eocuma hilgendorfi* Marcusen, by bearing well-developed lateral horns. However, the following differences should be noted between two species: 1) the carapace margins bearing the lateral horns in Zimmer's figures (1903) are very vertically deep, while in the present specimens they are not so vertical but rather diagonal; 2) Zimmer's figures showed that the

sinuous sides are broad and they have a forward point on the distal portion. But, they are narrow and have no distinct point in the present materials; 3) Zimmer's pseudorostrum is so obtuse that the pseudorostrum and sinus are not easily distinguishable from each other. In contrast, the pseudorostrum of the present materials is rather acute, so the sinus is quite distinct; 4) the breadth and length of the carapace are almost equal to each other in the present specimens, while in Zimmer's specimens, the breadth is longer than the length of the carapace; 5) segment 2 of antenna 1 is subequal to segment 3 in Zimmer's specimen, while in the present specimens, segment 2 is 1.4 times the length of segment 3; 6) the ischium of pereopod 1 in the female is about one-third of the merus, but the carpus is slightly 1.5 times as long as the merus in Zimmer's specimen. The length of the ischium is about seven-tenths of the merus, and the carpus is about twice the length of the merus in the present material; 7) the uropod peduncle on the inner margin of the male in the present specimens is densely fringed with plumose hairs, but it is not in Zimmer's figures; 8) pereonites 1 and 2 in the male are fused in the present specimens, but they are separated in Zimmer's.

Genus *Heterocuma* Miers, 1879

Heterocuma sarsi Miers, 1879

Figs. 13, 14

Heterocuma sarsi Miers, 1879, p. 57, pl. 3, fig. 3; Stebbing, 1913, p. 49; Zimmer, 1944, p. 130; Gamo, 1958, p. 386; Gamo, 1967, p. 149; Harada, 1964, p. 97 (part); Liu and Liu, 1990, p. 201, fig. 6.

Heterocuma sarsi var. *costata* Lomakina, 1960, p. 101, fig. 6.

Type locality. The Goto Islets, west of Kyushu, Japan, depth 70~90 m.

Material examined. 1 ♀, Yellow Sea (37° 00' N, 126° 00' E), 35 m, sand, Aug. 1982; 1 ♀, subtidal, Yongjong-do, mud, Aug. 1994; 1 ♀, Daechun Beach, sand, Nov. 1994; 1 ♀, subtidal, Songdo, mud, May 1995.

Description. Adult female. Length 24.3 mm. Carapace with a mid-dorsal carina, about one-fourth of total length. In the lateral view, mid-dorsal line irregular, faintly arched posteriorly. Pseudorostrum blunt, reaching slightly beyond the eyelobe. Eyelobe longer than broad with a large dark eye. Antero-

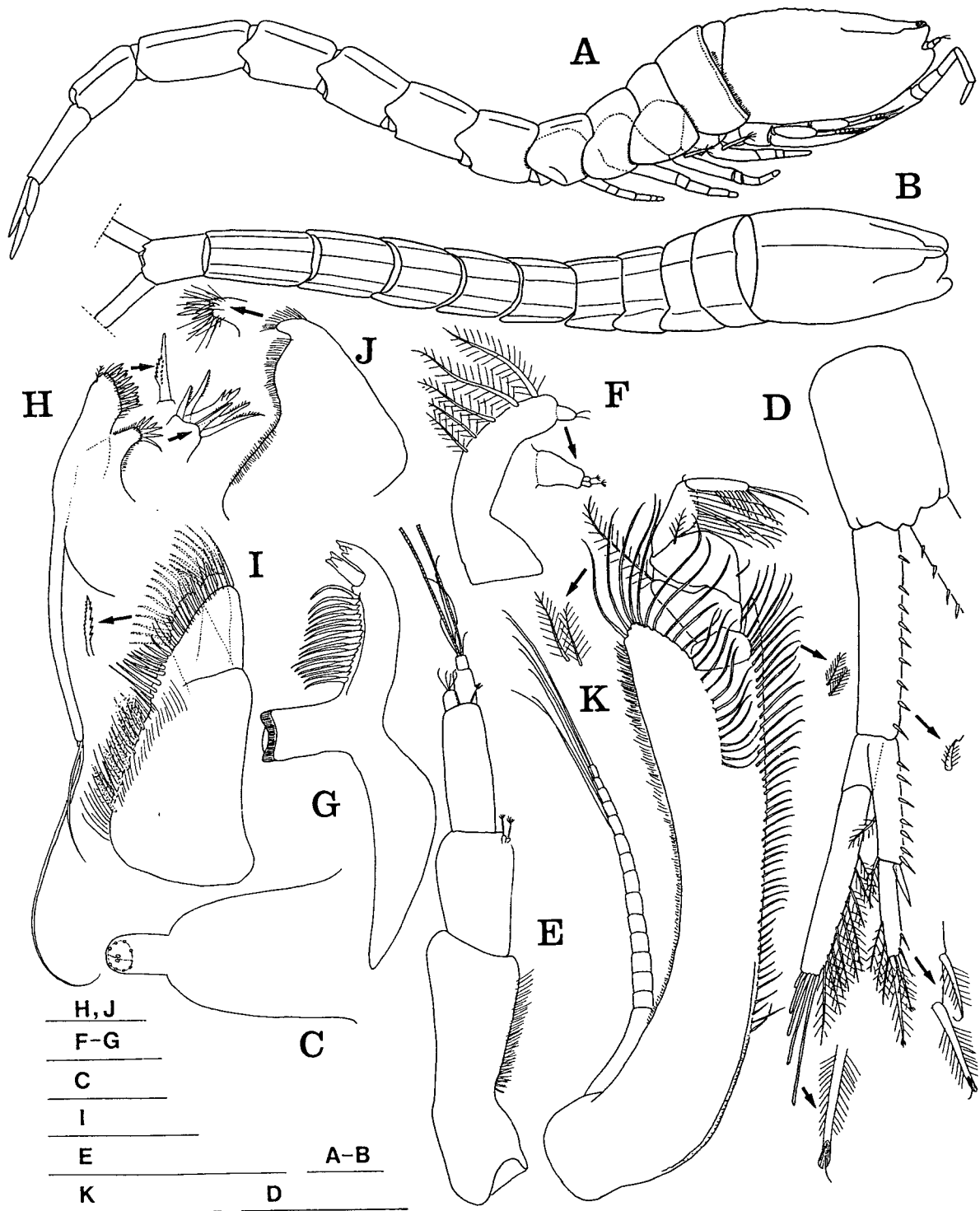


Fig. 13. *Heterocuma sarsi* Miers, adult female: A, lateral view; B, dorsal view; C, ocular lobe; D, last pleonite and uropod; E-F, antennae 1 and 2; G, mandible; H-I, maxillae 1 and 2; J, labium; K, maxilliped 3. Scale, A-B=2.0 mm, C, K=1.0 mm, D-J=0.5 mm.

lateral corners rather deep and obtuse at the distal portion (Fig. 13A, B).

Pereonites 2 to 5 with dorso-medial carina and lateral carina. Sideplates of pereon well developed

(Fig. 13A, B). Pleon with dorsal depression except pleonite 6; pleonite 6 without dorso-medial carina or lateral one (Fig. 13A, B).

Antenna 1 stout and elongated, segment 1 as

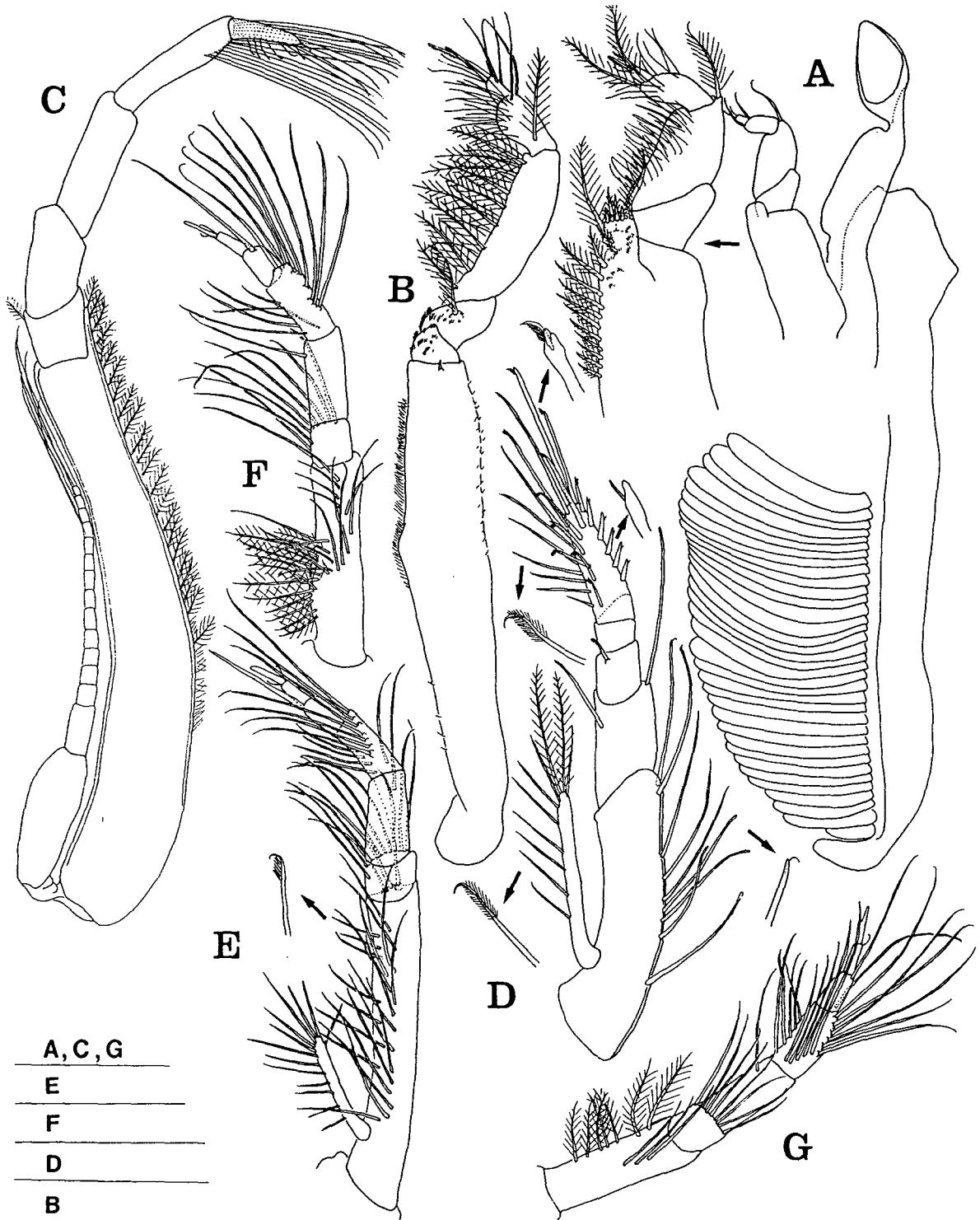
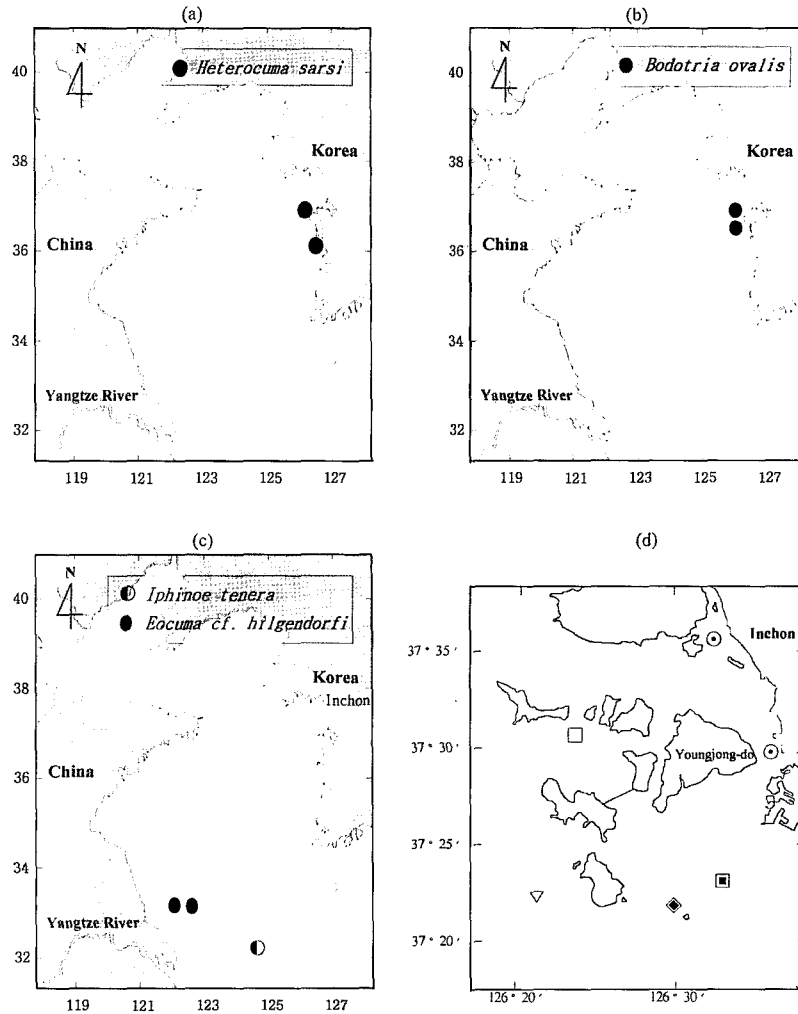


Fig. 14. *Heterocuma sarsi* Miers, adult female: A-B, maxillipeds 1 and 2; C-G, pereopods 1 to 5. Scale, A-E, G=1.0 mm, F=0.5 mm.

long as segments 2 and 3 combined. Main flagellum 2-segmented, segment 1 twice as long as segment 2. Accessory 1-segmented, minute (Fig. 13E).

Basis of maxilliped 3 with a distal prolongation

well-developed and broad. Ischium normal, merus dilated externally but carpus dilated internally. Propodus and dactyl subequal in length (Fig. 13 K).



Legends for (d): \odot . *Bodotria ovalis*
 ∇ . *Eocuma cf. hilgendorfi*
 \blacksquare . *Eocuma cf. hilgendorfi* and *Bodotria ovalis*
 \blacklozenge . *Bodotria ovalis*, *Iphinoe tenera*, *Eocuma cf. hilgendorfi* and *Heterocuma sarsi*

Fig. 15. Distribution of four species of the family Bodotriidae in the Yellow Sea.

Pereopod 1 stout and elongated, basis longer than remaining segments together with plumose setae on lateral margin. Carpus and propodus subequal in length. Propodus and dactyl bearing a number of long naked setae (Fig. 14C). Pereopod 2 very stout, basis about as long as remaining segments together with stiliformal setae. Basis and ischium coalesced. Dactyl about 4.5 times as long as propodus with characteristic spines and stiliformal setae (Fig. 14D). Pereopods 2 and 3 carrying imperfectly developed exopods (Fig. 14D, E).

Uropod peduncle twice as long as pleonite 6 with a row of 9 small spines on the inner edge. Endopod 2-segmented, rather shorter than the exopod.

Segment 1 with 7 spines on the inner edge, a large spine on the distal portion, segment 2 with characteristic hairs. Exopod 2-segmented, its segment 2 bearing plumose hairs on the inner margin and characteristic hairs on the distal portion (Fig. 13D).

Distribution. Persian Gulf; Southern India; Jiazhou Bay, Qingdao, China, 7~14 m; Izu Peninsula, Sagami Bay, Amakusa, the Goto Islets, Japan, 20~200 m; Korea Strait; coastal seas off Inchon, Korea, 10 m; Yellow Sea, 35 m.

Remarks. The present specimens come closest to the species described by Liu and Liu (1990) in general form. The endopod and the exopod of the uropod in Liu and Liu's figures are a little more

densely fringed with plumose hairs and spines than in the present materials. In our specimens, the absence of spines or teeth on the basis of maxilliped 3 and pereopod 1 should be noted.

Lomakina (1960) reported *Heterocuma sarsi* var. *costata* Lomakina as a new variety from the neritic zone of the Yellow Sea, Qingdao at a depth of 25 m. *H. sarsi* differs from this variety in that it has a rather slender uropod and two rami of uropod beset with strong apical spines. Liu and Liu (1990) and we do not separate this variety from *Heterocuma sarsi* Miers and considered it to be synonymous. In addition, the present species is similar to *H. sarsi* var. *granulata* Miers, 1879, which has been found in Sagami Bay, Amakusa, the Goto Islets, the Korea Straits, and Japan (Gamo, 1967). However, *H. sarsi* var. *granulata* can be recognized by a dorsal surface with small tuberculiform granules on the carapace and strong carination on the pleon.

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References

- Bacescu, M. 1988. Crustaceorum Catalogus. Pars 7, Cumacea I (Fam. Archaeocumatidae, Lampropidae, Bodotriidae, Leuconidae). Gruner, H.E. and L.B. Holthuis (ed.), SPB Academic Publishing, The Hague, pp. 1~173.
- Day, J. 1978. Southern African Cumacea. Part 2. Family Bodotriidae, subfamily Bodotriinae. Ann. S. Afr. Mus., 82, 187~285.
- Gamo, S. 1958. On some species of cumacean Crustacea from Sagami Bay. Zool. Mag. Tokyo, 67, 383~389.
- Gamo, S. 1965a. On Three Species of Cumacea. Crustacea, from Akkeshi Bay. Publ. Akkeshi Mar. Biol. Sta., (14), 1~21.
- Gamo, S. 1965b. Cumacea In: New Illustrated Encyclopedia of the Fauna of Japan, II, Hokuryukan Co., Ltd., Tokyo, Japan, pp. 531~536.
- Gamo, S. 1967. Studies on the Cumacea (Crustacea, Malacostraca) of Japan. Part I. Publ. Seto Mar. Biol. Lab., 15 (2), 133~163.
- Harada, I. 1964. Cumacean fauna of Japan. III. Family Bodotriidae. pt. 1. Genus *Heterocuma* Miers and *Sympodomma* Stebbing. Jap. J. Zool., 14, 97~346.
- Hale, H.M. 1944. Australian Cumacea. No. 8. the family Bodotriidae. Trans. Roy. Soc. S. Aust., 68 (2), 225~282.
- Hale, H.M. 1953. Australian Cumacea. No. 18. Notes on distribution and night collecting with artificial light. Trans. Roy. Soc. S. Aust., (18), 70~76.
- Jones, N.S. 1976. British Cumaceans. Synopses of the British Fauna (New Series), No. 7, The Linnean Society of London. Academic Press. pp. 1~63.
- Kang, B.J. and K.S. Lee. 1995a. Three species of the genus *Dimorphostylis* (Crustacea, Cumacea, Diastylidae) new to Korea. Korean J. Syst. Zool., 11, 167~183.
- Kang, B.J. and K.S. Lee. 1995b. Two species of the family Bodotriidae (Crustacea, Malacostraca, Cumacea) from Korea. Korean J. Syst. Zool., 38 (4), 531~541.
- Lee, C.M. and K.S. Lee. 1997. Two species of the genus *Bodotria* (Cumacea, Bodotriide) from Korea. Korean J. Syst. Zool., 13 (3), 259~267.
- Liu, H. and R. Liu. 1990. Study on Cumacea (Crustacea Malacostraca) of the offshore waters on North China. Stud. Mar. Sinica, (31), 195~205. (In Chinese with English summary).
- Lomakina, N.B. 1955. Cumacea from far-eastern seas. Trav. Zool. Acad. Sci. U.S.S.R., T., 18, pp. 112~165. (In Russian).
- Lomakina, N.B. 1958. Cumacea of the seas of the U.S.S.R., U.S.S.R. Acad. Sci. Publ. House, Moscow, pp. 3~301. (In Russian).
- Lomakina, N.B. 1960. To the fauna Cumacea (Crustacea Malacostraca) in the neritic zone of fauna of the Yellow Sea. Oceanol. Limnol. Sinica, 3 (2), 94~114. (In Chinese with Russian summary).
- Marcusen, J. 1894. Umber ein neuen Cumaceen genus *Eocuma*, Fam. Cumidae. sus Japan. SB. Ges. naturf. Fr. Berlin, 170~171.
- Miers, E.J. 1879. On a collection of Crustacea made by Capt. H. C. St. John R. N., in the Corean and Japanese Seas. Part I. Podophthamia. Proc. Zool. Soc. London, 18~61.
- Sars, G.O. 1900. Cumacea. An account of the Crustacea of Norway. Bergen Museum, pp. 1~114.
- Stebbing, T.R.R. 1913. Cumacea (Symphoda). Das Tierreich. Berlin, pp. 1~210.
- Watling, L. and L.D. McCann. 1997. 2. Cumacea. In: Taxonomic Atlas of the Benthic Fauna of the Santa Maria Basin and Western Santa Barbara Channel. vol. 11, The Crustacea. Part 2. the Isopoda, Cumacea and Tanaidacea, (ed. J.A. Blake and P.H. Scott), pp. 121~180. Santa Barbara Museum of Natural History, Santa Barbara, California.
- Zimmer, C. 1903. Die Cumaceen des Museums für Naturkunde in Berlin. Zool. Jahrb. Syst., Bd., 17, 665~694.
- Zimmer, C. 1944. Cumacean des tropischen Westatlantiks. Zoologischer Anzeiger Bd., 144, 121~137.