

Four Species of the Family Diastylidae (Crustacea: Cumacea) from the Yellow Sea

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Four species of the family Diastylidae (Crustacea: Cumacea) are redescribed based on the samples collected in the Yellow Sea. They are *Leptostylis hexaspinula* (Liu and Liu, 1990), *Dimorphostylis brevicaudata* (Zimmer, 1903), *Dimorphostylis asiatica* Zimmer, 1920 and *Dimorphostylis hirsuta* Gamo, 1960. Except *Dimorphostylis asiatica* the three species are new to the Korean fauna.

INTRODUCTION

The family Diastylidae (Crustacea: Cumacea) is one of the oldest of all cumacean families, having been established by Bate in 1856 and currently contains about 258 species assigned, occasionally with doubt, to those 19 genera (Bacescu, 1992). They are relatively predominant in the Pacific coasts (Hale, 1953).

However, the cumacean fauna in the Yellow Sea is not well known. Lomakina (1955, 1958, 1960) described six species in the intertidal zones of the Bohai Sea and Shan-Tung Peninsula, China. Recently, Liu and Liu (1990) and Kang and Lee (1995a, 1995b, 1996, 1997) newly recorded ten and seven species respectively, so that at present a total of 23 species are found in the Yellow Sea. Of the 23 cumacean species, five species represent family Diastylidae, and they are *Diastylis tricincta* (Zimmer, 1903), *Diastylis paratricincta* Kang and Lee, 1996, *Dimorphostylis asiatica* Zimmer, 1920, *Dimorphostylis valida* Harada, 1960 and *Dimorphostylis acroplicata* Harada, 1960.

This paper redescribes four species of diastylid cumaceans collected in the Yellow Sea, three of which are newly found in Korean waters: *Leptostylis hexaspinula* (Liu and Liu, 1990), *Dimorphostylis brevicaudata* (Zimmer, 1903), *Dimorphostylis hirsuta* Gamo, 1960.

MATERIALS AND METHODS

Most of the cumacean specimens were obtained during the oceanographic cruise of September—

October in 1992 conducted by the research vessel of the Korea National Fisheries Research and Development Agency. The cruise was organized within the framework of Korea-China International Cooperative Project of the Yellow Sea between Inha University, Korea and Institute of Oceanology, Academia Sinica, Qingdao, China. Some other materials were collected from the cruise carried out in August 1982 by the Korea Ocean Research and Development Institute (Fig. 1). The samples in 1992 were collected by van Veen grab, and those in 1982 by rectangular dredge (type Charcot with mouth of 50 × 23 cm) of which the sampling volume was limited to 100 l.

Additional samples were collected in the intertidal and the subtidal areas around Incheon (Fig. 1) from February 1995 to August 1996. For the subtidal samplings, van Veen grab was used. Six replicates were made with metallic can corer (15 × 20 × 30 cm) for the intertidal sampling. All the biological samples were sieved on a screen of 1 mm mesh and the retained material was fixed with 10% formaline. After examination, specimens were preserved in 70% ethanol.

Measurements for the total length were made from the anterior tip of the carapace to the posterior edge of last pleonite, but siphons and uropods were excluded. Morphological descriptions are mainly based on the female specimens and those of the males are done only for the sexually dimorphic characters. Material examined has been deposited in the Benthic Ecology Laboratory, Department of Oceanography, Inha University, Korea.

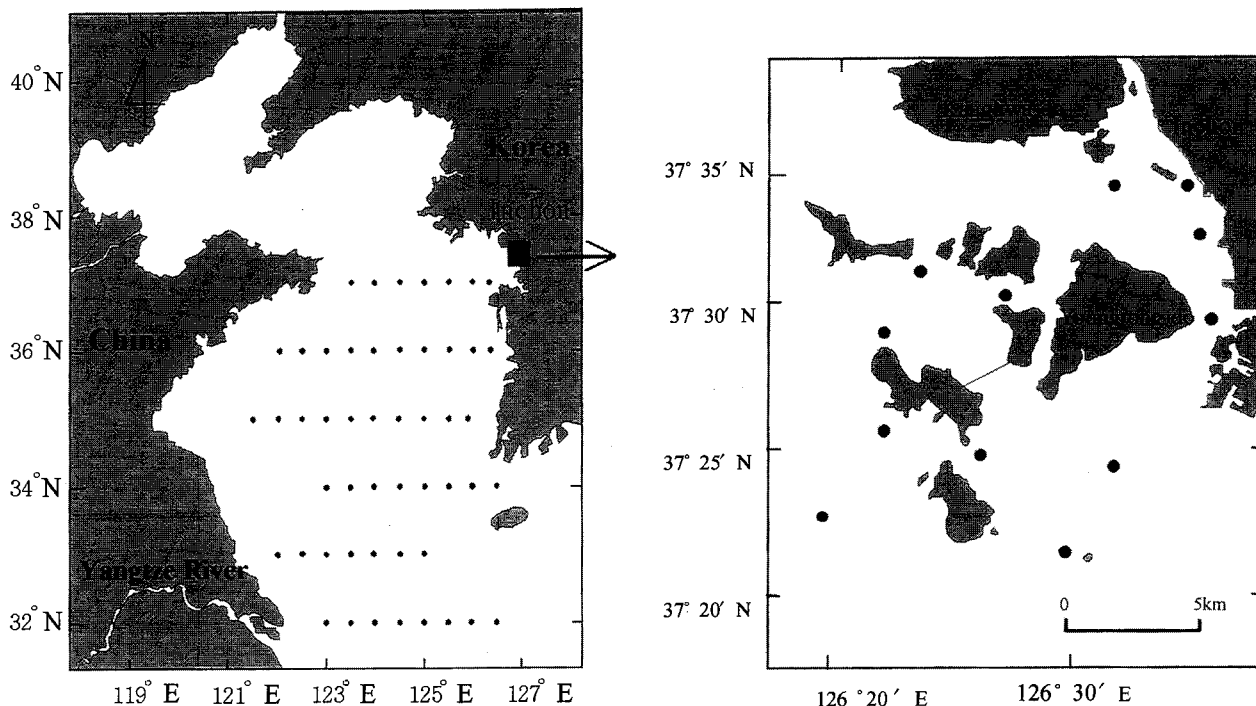


Fig. 1. Location of sampling stations in the Yellow Sea and in the coastal waters off Inchon, Korea.

SYSTEMATICS

Order Cumacea Kröyer, 1846

Family Diastylidae Bate, 1856

Genus *Leptostylis* Sars, 1869

짧은꼬리올챙이새우 (신칭)

Diagnosis. (modified from Day, 1980; Watling and McCann, 1997) Carapace usually tumescent posteriorly. Pereonites 3 and 4 may be coalesced or not; fifth pereonite not produced posteriorly. Male antenna 1 with club-shaped article 3, with dense array of sensory setae distally. Male antenna 2 not extending beyond pereonite 5. Basis of pereopods in male not widened and pereopods 2 and 3 not widely separated in ovigerous female. Pereopods 3 and 4 with rudimentary exopods or exopods absent in female, fully developed in male. Male with 2 pairs of pleopods. Post-anal part of telson shorter than pre-anal; with single pair of lateral setae sub-terminally. Uropod endopod 3-segmented.

1. *Leptostylis hexaspinula* (Liu and Liu, 1990)

(Figs. 2 and 3) 여섯가지짧은꼬리올챙이새우 (신칭)

Lamprops hexaspinula Liu and Liu, 1990, p. 211, fig. 13.

Material examined. 1 ♀, Yellow Sea (36°00'N, 126°30'E), Aug. 1982; 5 ♀♀, Yellow Sea (37°00'N, 126°00'E), 35 m, sand, Aug. 1982.

Description. Adult female with marsupium. Body 4.4 mm long and whitish-brown, somewhat opaque. Carapace rather depressed dorso-ventrally and slightly longer than one-third of total length. Dorso-median carina and 3 oblique ridges well developed, and the latter finely serrated. Frontal lobe with 2 transverse carinae. Antennal notch wide-open and lower margin below sinus finely serrated (Figs. 2A and 2B).

Pereon somewhat shorter than one-third of total length. Pereonite 2 denticulate and pereonite 4 fringed with hairs. Pereonite 5 with fine serrations and postero-lateral angles acutely protruded (Figs. 2A and 2B). Pleon shorter than half of total length. Pleonites 2 to 4 with plumose hairs on dorsum and naked hairs on each sternite (Figs. 2A and 2B).

Telson rather broad and flattened, somewhat longer than half of uropod peduncle and subequal to last pleonite. Post-anal portion narrow toward rear and with no lateral spines, but characteristic 6 apical spines present (Fig. 2J).

Antenna 1 rather slender. Segment 1 of peduncle with strong plumose hair on distal portion and segment 2 shortest. Main flagellum 4-segmented and subequal among one another. Accessory flagellum 3-segmented, slightly longer than segment 1 of the main (Fig. 2C).

Basis of maxilliped 3 curved and distal portion

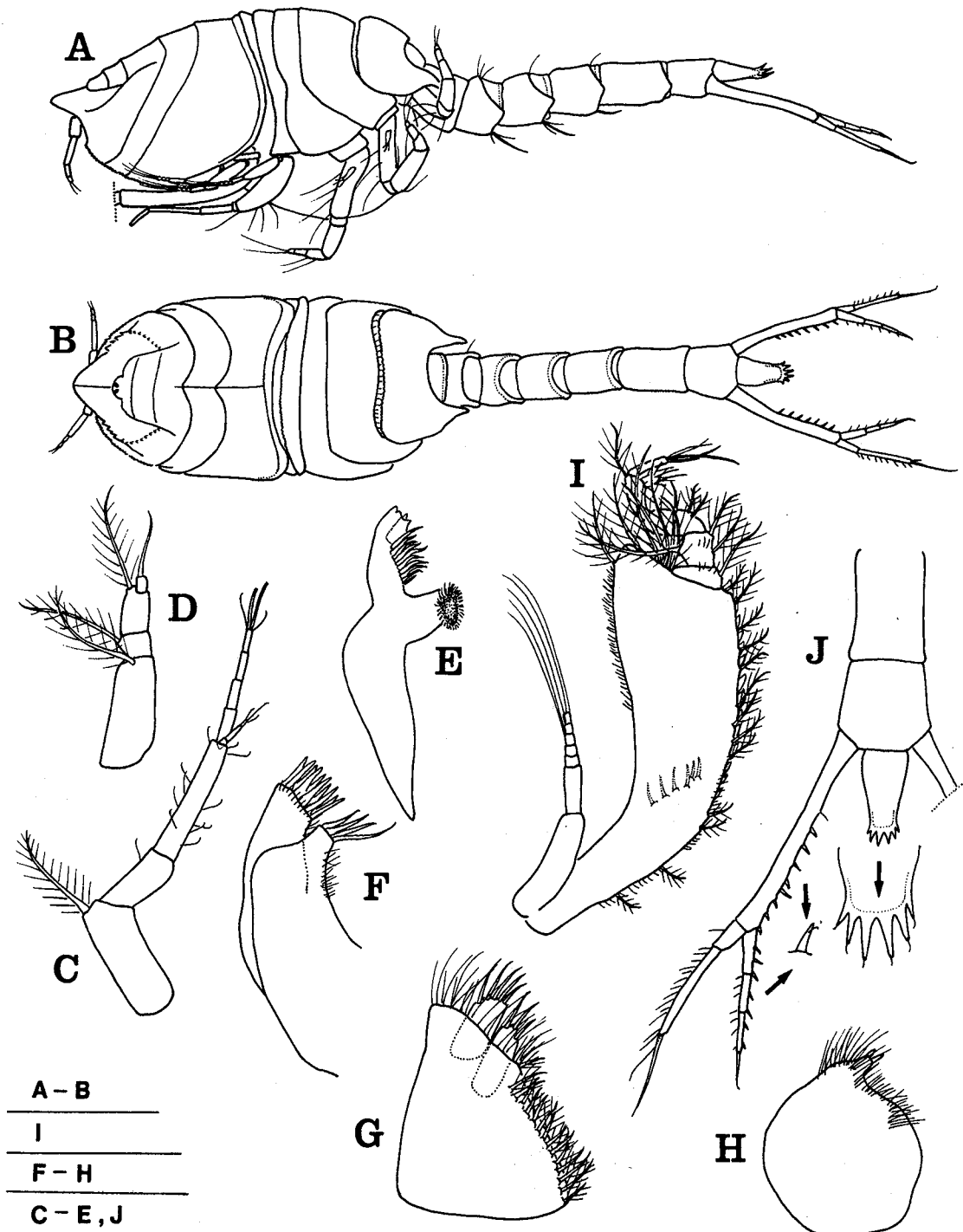


Fig. 2. *Leptostylis hexaspinula* (Liu and Liu, 1990), adult female: (A) lateral view, (B) dorsal view, (C)(D) antennae 1 and 2, (E) mandible, (F)(G) maxillae 1 and 2, (H) labium, (I) maxilliped 3, (J) pleon and uropods. Scale=1 mm for (A), (B), (J); 0.5 mm for (C)–(E), (I); 0.2 mm for (F)–(H).

broad and roundly produced as far as half of merus, with plumose hairs. Basis having row of teeth and plumose hairs on lateral margin. Ischium broad and dactyl very slender and with naked hairs (Fig. 2I).

Pereopod 1 incomplete. Basis of pereopod 2 elbow-

ed and stout, with numerous plumose hairs. Ischium and propodus short, carpus nearly twice merus. Dactyl slender and having long naked hairs on distal portion (Fig. 3C). Pereopods 3 and 4 with rudimentary exopod. Pereopods 3 to 5 resembling

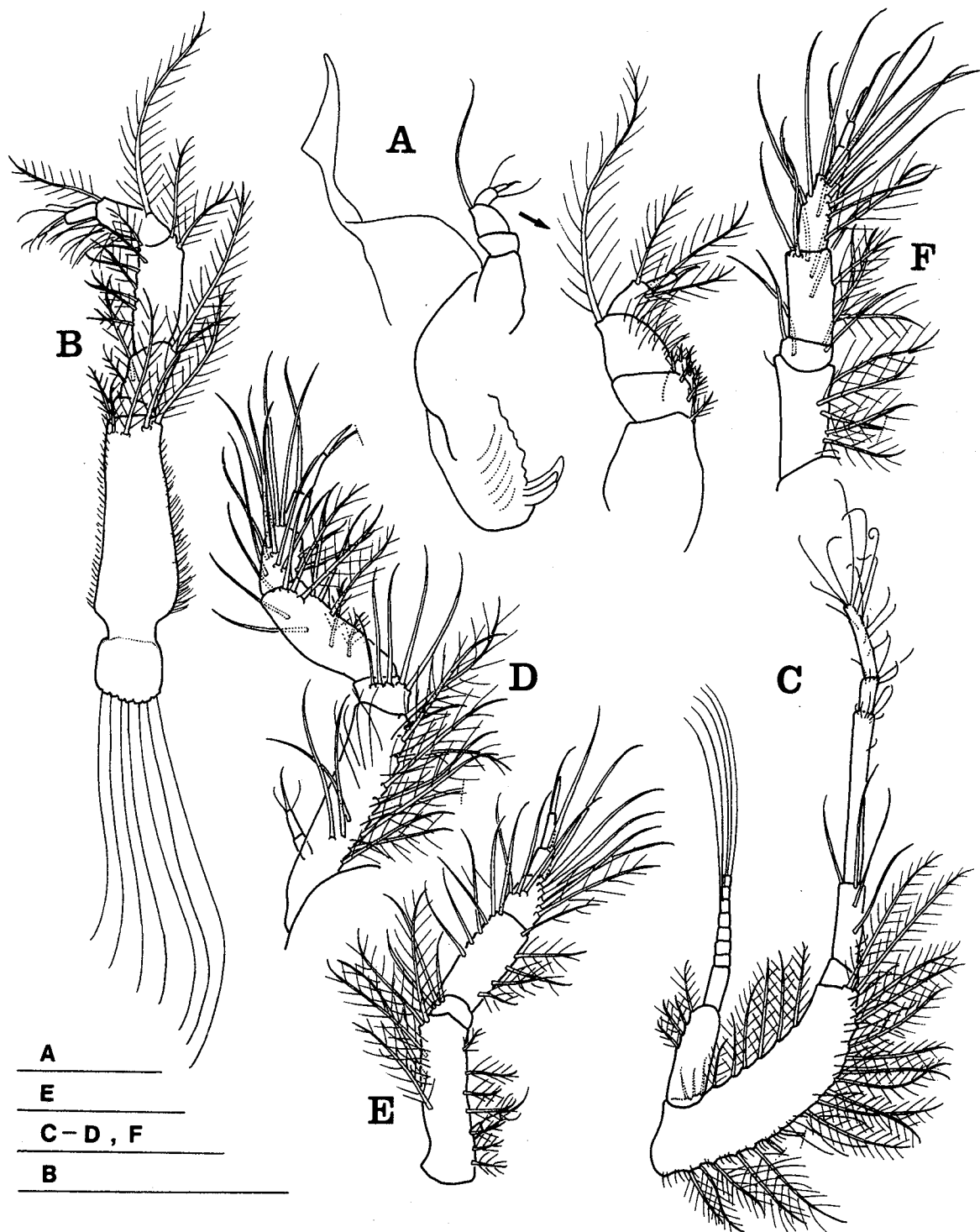


Fig. 3. *Leptostylis hexaspinula* (Liu and Liu, 1990), adult female: (A)(B) maxillipeds 1 and 2, (C)—(F) pereopods 2 to 5. Scale=0.5 mm for all.

one another. Carpus of these with a row of long naked hairs and dactyl having a short, stout spine (Figs. 31D—3F).

Uropod peduncle slender and about 2.5 times as long as last pleonite, with 8 or 10 spines on inner

margin. Endopod 3-segmented, narrow, somewhat shorter than exopod, and with 7 spines on inside (3 on segment 1; 2, 2 on each of the last 2 segments) and 1 stout apical spine. Exopod 2-segmented, proximal segment one-third of the distal, and with

lateral hairs (Fig. 2J).

Distribution. East China Sea from 13 to 41 m in muddy bottom; Yellow Sea, 35 m.

Remarks. This species is first described by Liu and Liu (1990) based on the females collected in the East China Sea at depths of 13—41 m. Our specimens were sampled in the eastern part of the Yellow Sea at a depth of about 35 m.

Liu and Liu (1990) described and placed this species within genus *Lamprops*, but here it is referred tentatively to *Leptostylis* by the following characters as defined by Jones (1969) and Day (1978), even though the general form is very close to *Diastylis*: (1) the pseudorostrum is a fifth of the length of carapace in the species of *Leptostylis*, but it is distinctly shorter in *Lamprops* (Day, 1978); (2) the segment 3 on the antenna 1 is about twice as long as the segment 2 in *Leptostylis*, but it is not much longer than the segment 2 in *Lamprops* (Day, 1978); (3) the peduncle of uropod is at least 2.5 times the length of the telson in the species of *Leptostylis*, but the telson is distinctly longer than pleonite 6 and at least half the length of peduncle of uropod in *Lamprops* (Day, 1978); (4) the eye is wanting in the species of *Leptostylis*, but it is present in *Lamprops* (Stebbing, 1913; Day, 1978). However, unavailability of the male specimen in this study makes it impossible to assign this species with certainty to the genus *Leptostylis*.

Moreover, this species is characterized not only by the telson decorated with 6 apical spines, of which terminal ones are longest, but also by 2 transverse carinae in the frontal lobe. In this species, the post-lateral angles of the pereonite 5 are produced posteriorly and the post-anal portion of the telson is wider than that of the other species belonging to the genus *Leptostylis*. No species has similar apical spines on the telson in this genus. In addition, *L. hexaspinula* differs from other species of *Leptostylis* by the exopod of the uropod longer than the endopod.

So far no male has been found, and further study is needed to complete the description of this species.

Genus *Dimorphostylis* Zimmer, 1921

이형올챙이새우屬

Key to Korean species of *Dimorphostylis*

- 1. Frontal lobe with transverse carina 2
Frontal lobe without transverse carina 4
- 2. Telson with lateral spines in nuptial male *D. asiatica*
Telson with lateral bristles in nuptial male 3

- 3. Nuptial male telson with median apical spine much longer than the outer pair *D. hirsuta*
Nuptial male telson with median apical spine not longer than the outer pair (*D. valida*)
- 4. Frontal lobe with 2 strong, clear-cut teeth arranged antero-posteriorly *D. brevicaudata*
Anterior portion of carapace with clear ridge terminating posteriorly in free end at base of frontal lobe (*D. acroplicata*)

2. *Dimorphostylis brevicaudata* (Zimmer, 1903)

(Figs. 4—6) 주름뺨이형올챙이새우 (신칭)

Leptostylis brevicaudata Zimmer, 1903, p. 685, figs. W—Y.

Paradiastylis brevicaudatus Stebbing, 1913, p. 121.

Dimorphostylis brevicaudata Gamo, 1968, p. 182, fig. 36.

Material examined. 1 ♀, 4 ♂♂, Yellow Sea (36°00'N, 125°00'E), 87 m, sandy silt, Aug. 1982; 1 ♀, Yellow Sea (37°00'N, 123°30'E), 72 m, sandy silt, Sept. 1992; 1 ♀, subtidal, Songdo, mud, Feb. 1995; 1 ♂, subtidal, Yomha channel, mud, July 1995.

Description. Adult female. Body 8.4 mm long. Carapace about two-fifths of total length and with 3 pairs of ridges. These oblique ridges finely denticulate and with 2 strong teeth arranged antero-posteriorly on frontal lobe. Pseudorostral lobe rather acute and horizontally projected. Antero-lateral corner deep and sinus well marked. Ocular lobe with 1 pair of denticles (Figs. 4A—4C).

Pereon about one-fifth of total length and depth of segments successively decreased posteriorly (Fig. 4A). Pleon about two-fifths of total length and pleonite 5 longest (Fig. 4A).

Telson shorter than last pleonite and with lateral bristles and 1 pair of small apical spines (Fig. 4F).

Segment 1 of peduncle of antenna 1 stout and as long as segments 2 and 3 combined. Main flagellum 2-segmented and accessory flagellum 2-segmented (Fig. 3H).

Basis of maxilliped 3 very broad and rather curved, with long plumose hairs on distal flattened portion. Ischium and merus relatively elongated and massive. Dactyl with naked hairs (Fig. 5C).

Basis of pereopod 1 curved, about half of remaining segments together. Merus massive and about 3 times ischium. Carpus and propodus very elongated and slender (Fig. 5D). Basis of pereopod 2 very broad and with plumose hairs, subequal to remaining segments combined. Ischium short and

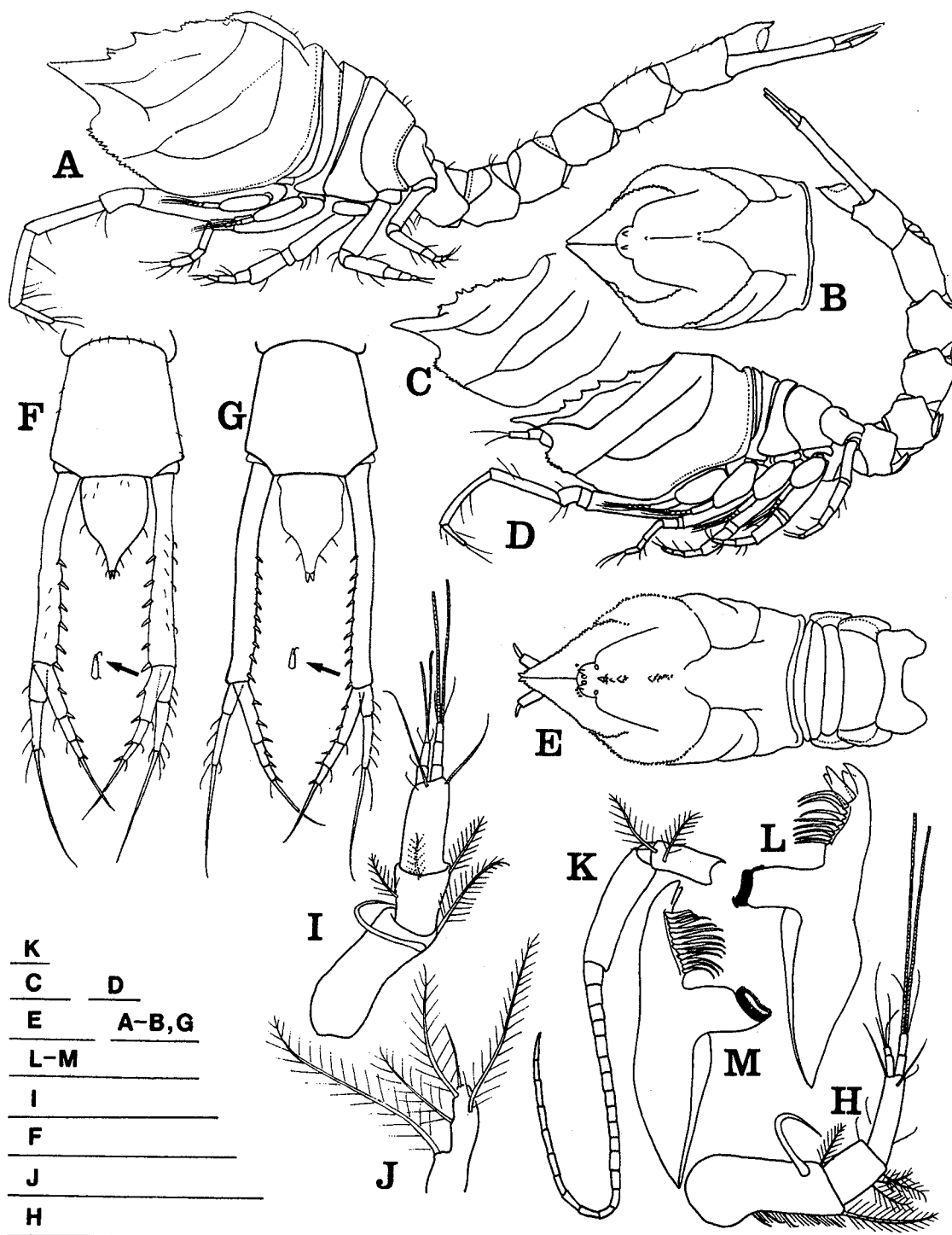


Fig. 4. *Dimorphostylis brevicaudata* (Zimmer, 1903): (A) adult female in lateral view, (B) adult female carapace in dorsal view, (C) adult female carapace, (D) subadult male in lateral view, (E) subadult male carapace and pereon in dorsal view, (F) adult female pleon and uropods, (G) subadult male pleon and uropods, (H) adult female antenna 1, (I) subadult male antenna 1, (J) adult female antenna 2, (K) subadult male antenna 2, (L)(M) subadult male mandible. Scale=1 mm for (A)–(C), (E), (G), (K); 0.5 mm for (D), (F), (H)–(J), (L), (M).

stout. Distal 3 segments rather elongated and with naked hairs (Fig. 5E). Pereopods 3 to 5 relatively stout and massive. Dactyl of these bearing a short,

strong spine (Figs. 5F–5H).

Uropod peduncle about twice telson and with 6 spines in inner margin. Endopod slightly longer

than exopod and 3-segmented, with 4 lateral spines. Exopod 2-segmented and with lateral and apical hairs (Fig. 4F).

Subadult male. Body 6.2 mm long and depressed dorso-ventrally in comparison with the form of female (Fig. 4D).

Pereon about one-seventh of total length and narrow from dorsal, with developed side plates. Pereonite 5 with postero-lateral corners roundly protruded (Figs. 4D and 4E). Pleon slightly half of total length (Fig. 4D).

Segment 1 of peduncle of antenna 1 little shorter

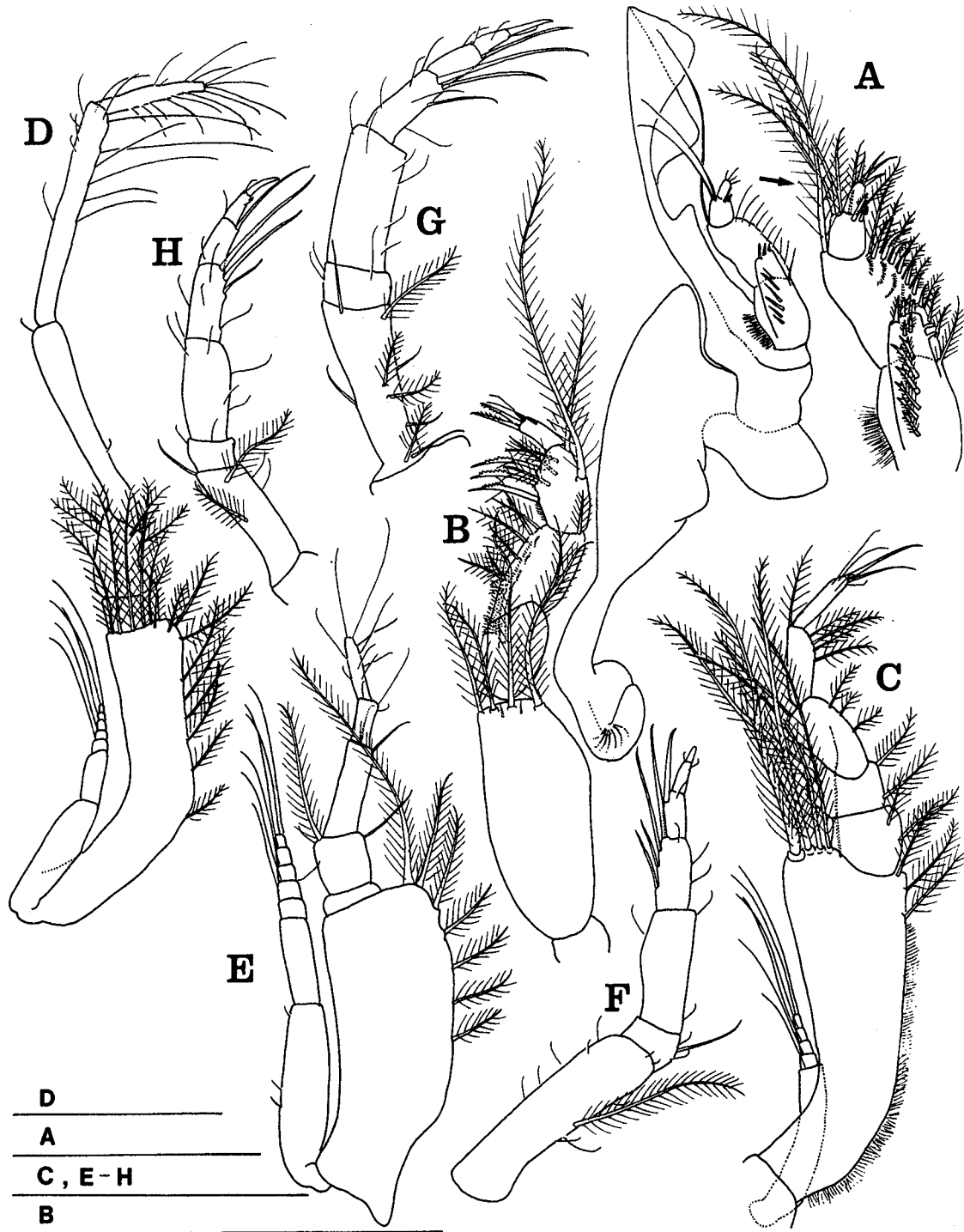


Fig. 5. *Dimorphostylis brevicaudata* (Zimmer, 1903), adult female: (A)—(C) maxillipeds 1 to 3, (D)—(H) pereopods 1 to 5. Scale=0.5 mm for all.

than the other 2 segments combined and all 3 segments robust. Main flagellum with 3 segments. The accessory 2-segmented and relatively large (Fig. 4I).

Basis of maxilliped 3 elongated and with long

plumose hairs on distal portion. Ischium, merus and carpus subequal in length and stout. Distal 2 segments slender (Fig. 6B).

Basis of pereopod 2 fairly curved, broad distally and with its distal end well produced as far as half

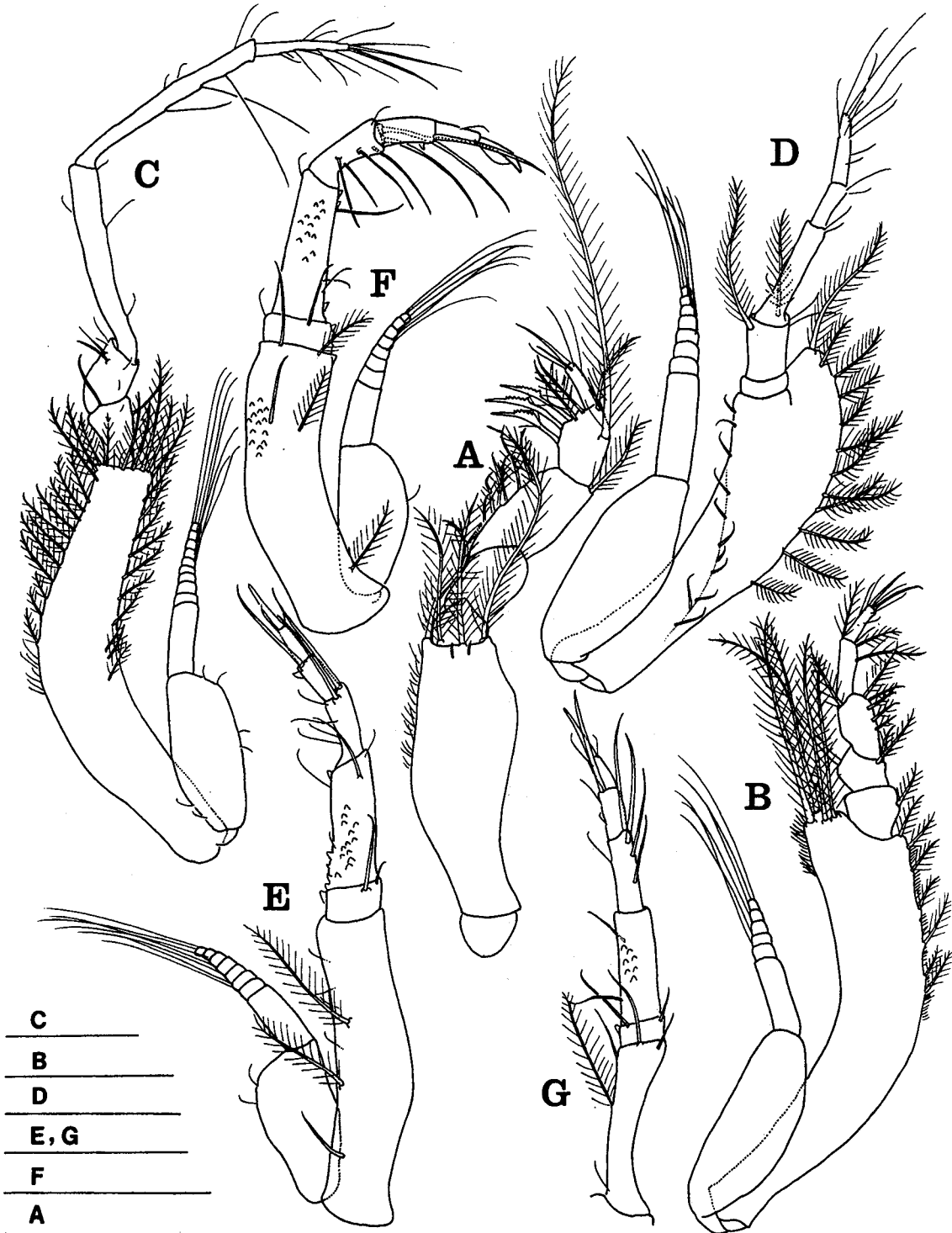


Fig. 6. *Dimorphostylis brevicaudata* (Zimmer, 1903), subadult male: (A)(B) maxillipeds 2 to 3, (C)—(G) pereopods 1 to 5. Scale=0.5 mm for all.

of merus. Ischium short and distal 3 segments elongated and slender (Fig. 6D).

Distribution. Japan (Sagami Bay; Amakusa, sand, shallow depth, night surface tow); Korea (off Inchon, 10 m); Yellow Sea, 72—87 m.

Remarks. In Stebbing (1913) and Gamo (1968), one pair of lateral spines is present in telson, but they are not found in our materials. The eyelobes consist of 3—4 small lenses above the orange color pigmented area. In addition, we observed that several specimens were found to attach fine sands between maxilliped 3 and antenna 1.

3. *Dimorphostylis asiatica* Zimmer, 1920

보통이형올챙이새우

Dimorphostylis asiatica Fage, 1945, p. 220, fig. 43; Lomakina, 1955, p. 153; Lomakina, 1958, p. 169, fig. 100; Lomakina, 1960, p. 94, fig. 2; Gamo, 1960, p. 387; Harada, 1960, p. 203, fig. 2; Gamo, 1962, p. 200; Gamo, 1963, p. 59; Gamo, 1965, p. 217; Gamo, 1968, p. 179; Liu and Liu, 1990, p. 207, fig. 11; Kang and Lee, 1995a, p. 168, figs. 2—4.

Material examined. 1 ♀, Yellow Sea (36°00'N, 124°30'E), 85 m, silt, Aug. 1982; 1 ♂, 2 ♀♀, Yellow Sea (36°30'N, 126°00'E), Aug. 1982; 3 ♀♀, Yellow Sea (34°30'N, 125°00'E), 60 m, silty sand, Aug. 1982; 1 ♀, Yellow Sea (36°00'N, 125°00'E), 80 m, silty sand, Aug. 1982; 1 ♀, Yellow Sea (34°30'N, 125°00'E), 80 m, Aug. 1982; 3 ♀♀, Yellow Sea (35°30'N, 125°00'E), 56 m, Aug. 1982; 1 ♀, 2 ♂♂, Yellow Sea (36°30'N, 125°00'E), Aug. 1982; 2 ♀♀, Yellow Sea (37°00'N, 123°30'E), 72 m, sandy silt, Sept. 1992; 1 ♀, 1 ♂, subtidal, Songdo, mud, Feb. 1995; 1 ♀, subtidal, Youngjong-do, Apr. 1995; 1 ♀, subtidal, Yomha channel, May 1995; 1 ♂, subtidal, Songdo, Feb. 1996; 1 ♀, subtidal, Songdo, Aug. 1996; 2 ♂♂, subtidal, Yomha channel, Aug. 1996.

Distribution. Japan (Hokkaido, Sado Is., Shinzi Lake, Tokyo Bay, Sagami Bay, Izu Peninsula, Kii Peninsula, Kochi, Tamano, Nagasaki, Amami-Oshima Is.); South Kuril (Zaliv Petra Velikogo, Shikotan Is.), usually 0—100 m, sand, night surface plankton; Vietnam; Formosa; China (Bohai Sea, Yangtze River estuary, southern part of the Shan-Tung Peninsula), 9—18 m; Korea (West Sea, South Sea, East Sea); Yellow Sea, 56—85 m.

Remarks. This species is one of the commonest cumaceans found in Korean waters (Kang and Lee, 1995a) and the Japanese coasts (Gamo, 1968). Kang and Lee (1995a) described that the spines of the basis, ischium, and merus of maxilliped 3 were present on the distal margin, but our specimens are

not provided with those spines. Number of spines on uropod varies. Uropod peduncle bears 3—12 spines in female, and 6—22 spines in male, but 7 spines are common in both sexes.

This species is somewhat allied to *D. brevicaudata*. But, *D. asiatica* is easily distinguished from *D. brevicaudata* by having the following characters: (1) the frontal lobe with the transverse carina, (2) four oblique lateral ridges clear and well developed, (3) the telson in adult male with three apical spines.

4. *Dimorphostylis hirsuta* Gamo, 1960

(Figs. 7 and 8) 꼬리긴가시이형올챙이새우 (신칭)

Dimorphostylis hirsuta Gamo, 1960, p. 107, fig. 8; Gamo, 1968, p. 180.

Dimorphostylis exigua Harada, 1960, p. 207, fig. 4.

Material examined. 1 ♂, Yellow Sea (36°30'N, 125°00'E), Aug. 1982.

Description. Adult male. Body 4.8 mm long and depressed dorso-ventrally. Carapace elongated, slightly less than two-fifths of total length and rather slender from dorsal. A dorso-median carina developed, a frontal and 3 oblique ridges with fine serrations, that is, anterior, middle and posterior ridges. Frontal and anterior ridges converging anteriorly on side of pseudorostrum. These 3 oblique ridges running almost parallel with one another on side of carapace. Antennal notch deep and antero-lateral margin finely serrated (Figs. 7A—7D).

Pereon about one-six of total length. Pereonite 5 with postero-lateral corners protruded out, which surmounted with row of plumose hairs (Figs. 7A, 7B). Pleon about half of total length and pleonite 5 longest (Fig. 7B).

Telson longer than last pleonite. Post-anal portion of telson relatively long, with lateral bristles and 3 apical spines, the middle of which longest and marked U-shaped dorsal depression on pre-anal portion (Figs. 7B and 7E).

Segment 1 of peduncle of antenna 1 stout and a little longer than distal remaining segments together and segment 3 with brush of long hairs. Main flagellum 4-segmented and accessory flagellum 3-segmented (Fig. 7F).

Basis of maxilliped 3 curved and less twice distal remaining segments combined. Its outer distal angle rather inflated and with long plumose setae. Ischium, merus and carpus subequal in length and stout. Distal 2 segments elongated and slender (Fig. 8C).

Basis of pereopod 1 elbowed, massive and about five-sevenths of distal remaining segments together. From carpus to dactyl slender and with long naked

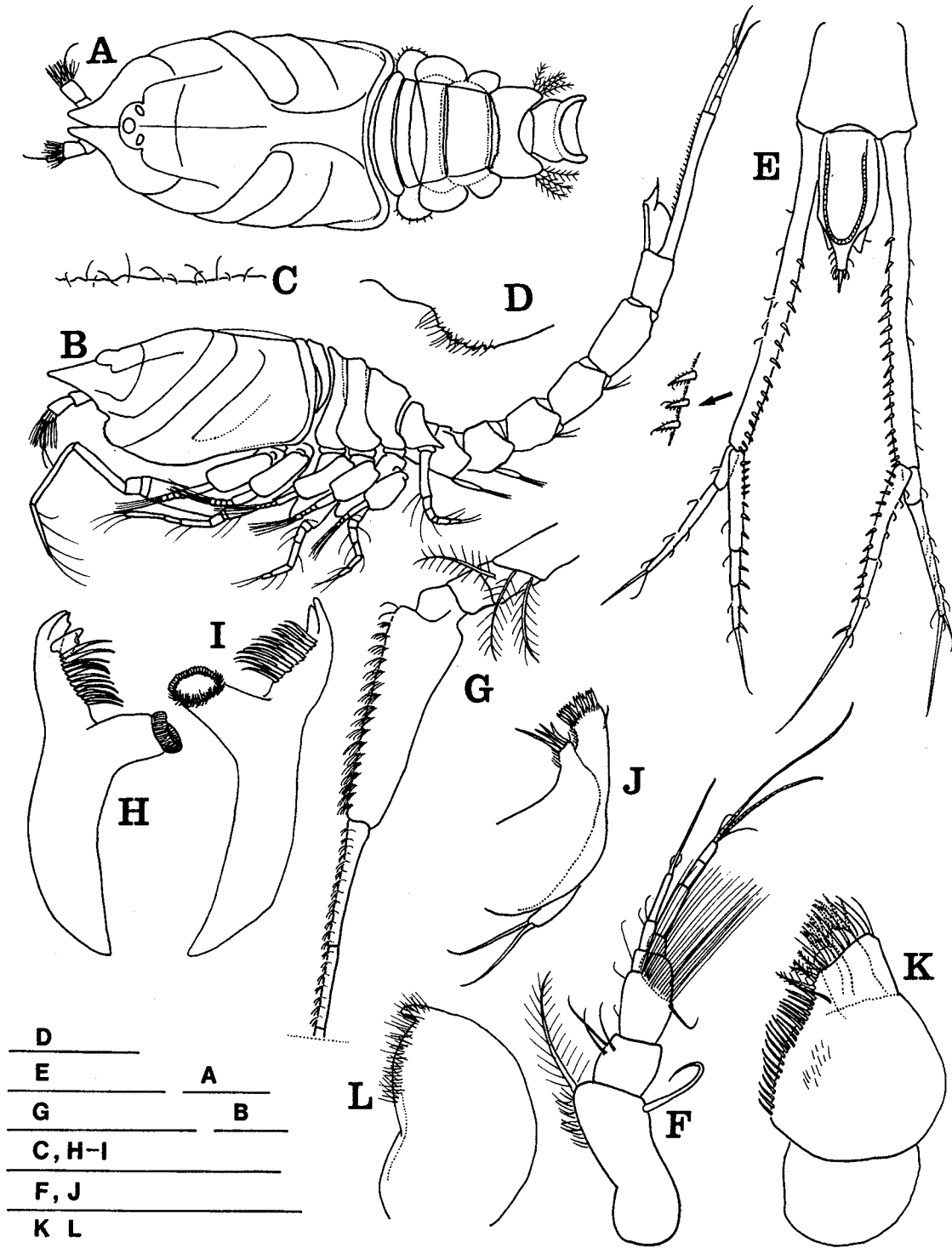


Fig. 7. *Dimorphostylis hirsuta* Gamo, 1960, adult male: (A) carapace and pereon in dorsal view, (B) lateral view, (C) a part of the oblique ridge magnified, (D) antero-lateral margin of carapace, (E) last pleonite and uropods, (F)(G) antennae 1 and 2, (H)(I) mandible, (J)(K) maxillae 1 and 2, (L) labium. Scale=0.5 mm for (A), (B), (E); 0.2 mm for (C), (D), (F)—(L).

hairs (Fig. 8D). Basis of pereopod 2 curved, robust and with its distal end well produced as far as half of merus. Ischium short and distal 3 segments elongated and slender (Fig. 8E).

Uropod peduncle slender and less than 2.5 times as telson and with 14 or 18 spines on inner margin. Endopod a little longer than exopod, 3-segmented. Segment 1 slightly longer than distal 2 segments

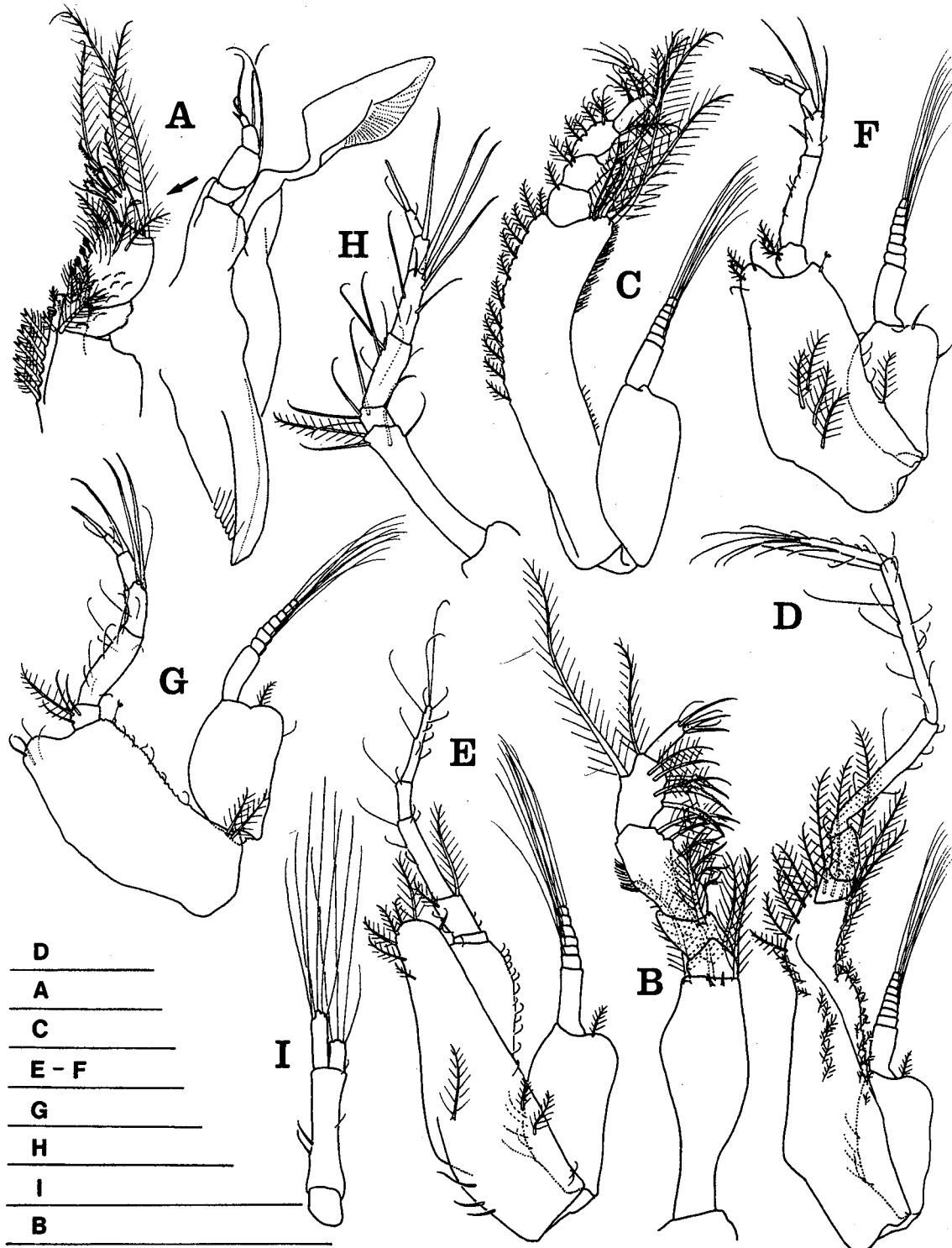


Fig. 8. *Dimorphostylis hirsuta* Gamo, 1960, adult male: (A)—(C) maxillipeds 1 to 3, (D)—(H) pereopods 1 to 5, (I) pleopod 1. Scale=0.5 mm for all.

combined, each of which subequal in length. Exopod 2-segmented and with lateral and apical hairs (Fig. 7E).

Distribution. Japan (off Yoshihama; Sagami Bay,

30 m; Honshu; Shizuura); Yellow Sea.

Remarks. This species is very close to *D. asiatica*, but *D. hirsuta* is distinguished from *D. asiatica* by the following characters of the male: (1) the post-

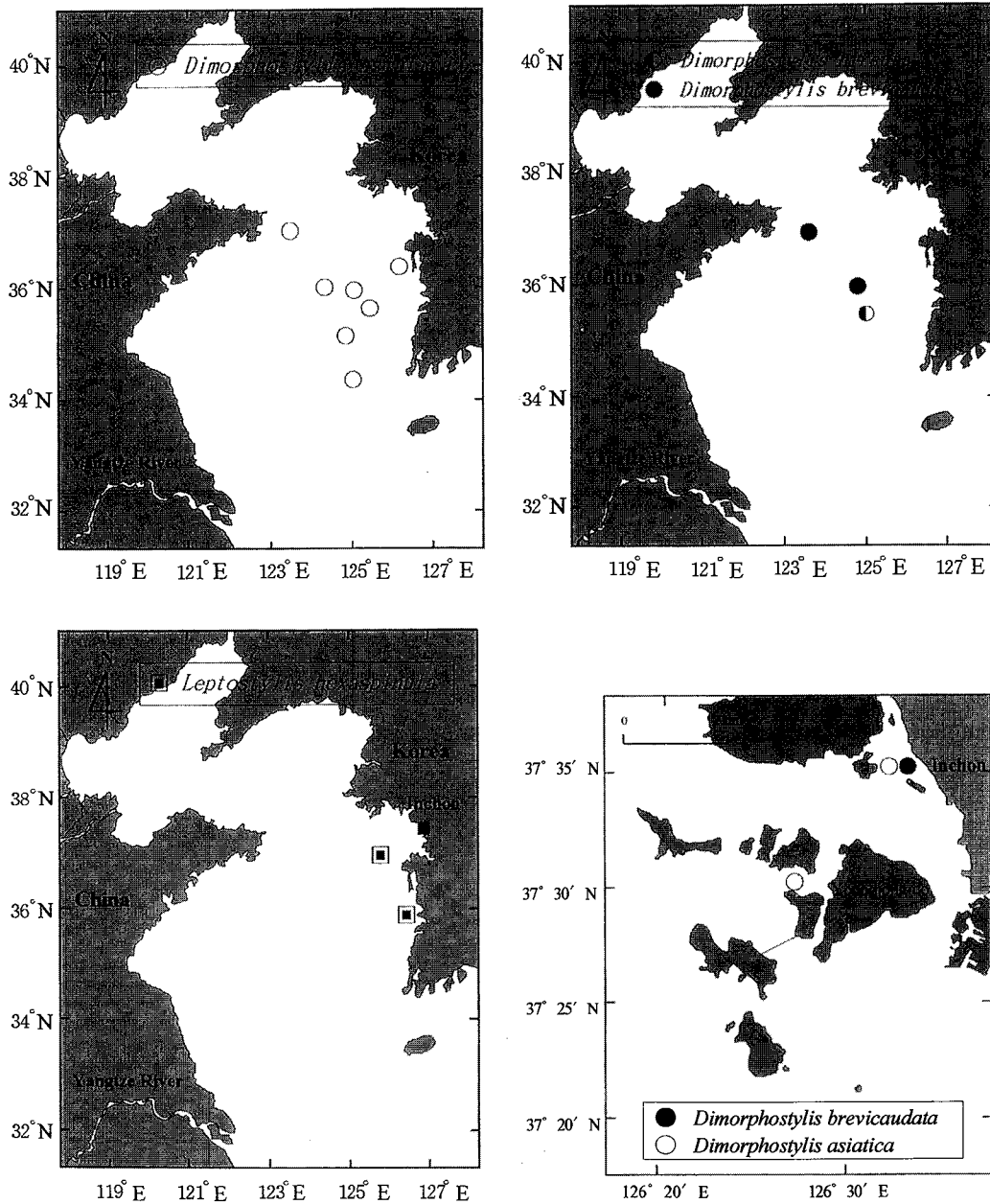


Fig. 9. Map showing distribution of four species of the family Diastylidae in the Yellow Sea.

anal portion of the telson is gradually tapered posteriorly and provided with two pairs of lateral bristles and three apical spines, the middle of which is very long and attaining beyond three times the length of the outer pair; (2) the telson is composed of the subcylindrical anal portion, in which U-shaped hyaline ridge is enclosed with the depression in dorsum. At present, no females have yet been found.

ACKNOWLEDGEMENTS

This study was supported in part by the 1996

Research Fund Program of the Inha University granted to Jae-Sang Hong. We gratefully acknowledge the thoughtful comments of Dr. Les Watling, Department of Oceanography and Darling Marine Center, University of Maine, USA.

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Manuscript received January 8, 1998

Revision accepted July 13, 1998