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The first record of *Cyproidea liodactyla* (Crustacea: Amphipoda: Cyproideidae) from Korean waters

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The first record of Korean cyproideid amphipod, *Cyproidea liodactyla* Hirayama, 1978 is reported here with description and illustrations. This species has the following characteristics: the presence of dorsal keel of peduncle 2 on antenna 1, posterodistal process of ischium on gnathopod 1 and carpal process on gnathopod 2. In this study, the minor differences between the original description and our Korean specimens of *Cyproidea liodactyla* are discussed and a brief comparison to other related species such as *C. serratipalma* Schellenbeg, 1938 and *C. robusta* Ren, 2006 are suggested. In addition, a key to Korean species belonging to the family Cyproideidae is provided.

Keywords: amphipod, *Cyproidea liodactyla*, cyproideids, Korea, taxonomy

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Introduction

Among diverse amphipod species, cyproideids are grouped together based on the following common characteristics: peduncular article 2 of antenna 1 is crested dorsally, coxae of gnathopods are rudimentary, immensely enlarged and broadened coxae of pereopods 3 and 4 occupy lower half of lateral surface, uropod 3 is biramus and has elongate peduncle, and they often has developed dorsal keel on urosomites (Barnard and Karaman, 1991; Azman, 2009; Jung *et al*., 2015). The genus *Cyproidea* Haswell, 1879 can be discriminated from others by the presence of carpochelate gnathopod 2, the recolinear basis of pereopods 5-7, and shorter telson. This genus are constituted of eight valid species distributed around the West Pacific Ocean: *C. cobia* Azman, 2009 and *C. ornata* Haswell, 1879 from Australia; *C. marmorata* Moore, 1981 from Tasmania; *C. liodactyla* Hirayama, 1978 and *C. okinawensis* Ariyama, 2016 from Japan; *C. robusta* Ren, 2006 from China; *C. excavate* Myers, 2012 from Micronesia; and *C. serratipalma* Schellenbeg, 1938 from Gilbert Islands (Haswell, 1879; Schellenbeg, 1938; Hirayama, 1978; Moore, 1981; Ren, 2006; Azman, 2009; Myers, 2012; Ariyama, 2016).

Up to date, only one species, *Terepeltopes dolichorhunia* Hirayama, 1983, belonging to the family Cyproideidae has been reported by Jung *et al*. (2015) in Korea. Here, the first record of the genus *Cyproidea* is reported by the discovery of *C. liodactyla*. We re-described *C. liodactyla* based on the Korean specimens with detailed description and illustrations. In addition, we provided a key to the Korean species belonging to the family Cyproideidae.

Materials and Methods

Samples were collected from the sub-tidal zone by using a sledge net (mesh size 300 μm, mouth 79 size 120 × 45 cm). They were preserved directly in 95% ethyl alcohol after sorting in the laboratory. Before identification, they were stained by lignin pink dyes and the appendages were dissected in a Petri dish filled with glycerol using dissection forceps and needle under stereomicroscope (SZH10; Olympus, Tokyo, Japan). They were mounted on a temporary slide using a glycerol-ethanol mixed solution or on a permanent slide using polyvinyl lactophenol solution. Drawings were performed by light microscope (LABOPHOT-2; Nikon, Tokyo) with the aid of a drawing tube.

Description

Order Amphipoda Latreille, 1816
Suborder Gammaridea Latreille, 1816
Family Cyproideidae Barnard, 1974
Genus *Cyproidea* Haswell, 1879
참넓은마디옆새우속 (신칭)

***Cyproidea liodactyla* Hirayama, 1978**
참넓은마디옆새우 (신칭) (Figs. 1-4)
Cyproidea liodactyla Hirayama, 1978: 245, figs. 1-3; Hirayama, 1983: 124; Barnard and Karaman, 1991: 259; Ishimaru, 1994: 53; Ariyama, 2016: 303, figs. 2-6.

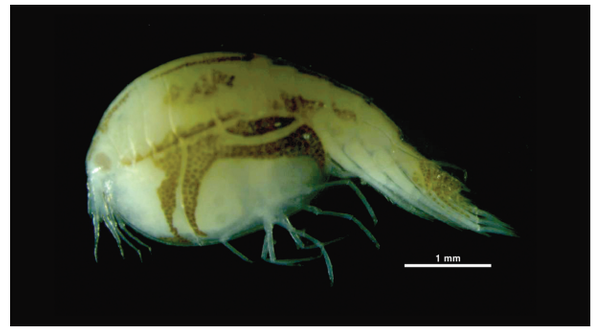

Fig. 1. *Cyproidea liodactyla* Hirayama, 1978, male, habitus, lateral view.

Material examined. 5 specimens; cat No. NIBRIV0000 332004; Udo Island, Jeju-do, Korea, 33°29′12″N 126° 57′17″E, average depth 33 m; coll. H-.Y. Soh.

Male. Body (Fig. 1): about 3.0 mm long; pereonites 3-7 more swollen; coxae 1-2 vestigial and hidden by coxa 3, coxae 3-4 extremely broaden and occupying lower half of lateral surface.

Head (Figs. 1, 2A): compact, slightly shorter than pereonites 1-2 combined; rostrum indistinct; anterior cephalic lobe weak, apex convexly oblique posteroventrally; eyes large, ovoid.

Antennae 1 (Fig. 2A): with stout peduncular articles 1-2; peduncular article 1 short; peduncular article 2 with developed-keel anterodistally bearing acute apex; peduncular article 3 slightly shorter than peduncular article 1; accessory flagellum vestigial; flagellum 6-articulate, distal 3 articles with aesthetascs.

Antenna 2 (Fig. 2A): slender, longer than antenna 1; with peduncular articles 3-5 in length ratio of 1.0 : 2.4 : 2.2; flagellum short, 3-articulate.

Left mandible (Fig. 2B): with 8-dentate incisor and 4-dentate lacinia mobilis; accessory setal row composed of 12 slender setae; molar process conical, not triturative; palp slender, 3-articulate and their length ratio of 1.0 : 1.4 : 1.0, distal article with 1 long seta apically.

Maxilla 1 (Fig. 2C): inner plate small, subovoid, with 4 minute setae apically; outer plate with 1 seta and 2 stout spines on medial margin distally, lined with 8 stout spines on obliquely truncated apex; palp stout, biarticulate, article 1 short, article 2 with 6 serrations bearing 1 minute seta on medial margin distally, apex beyond distal spines on outer plate and with 1 simple and 1 pair of dentate spines.

Maxilla 2 (Fig. 2D): inner plate broaden, with 5 submarginal and 3 facial setae, apex slightly oblique with weak protrusion bearing 1 spine; outer plate longer than inner plate, lined with 14 submarginal setae on distal half of lateral margin, with 1 pair of setae on medial margin distally, apex with 2 stout spines and 1 weak protrusion.

Maxilliped (Fig. 2E): inner plate subrectangular, with acute protrusion and 1 submarginal spine mediodistally; outer plate covered with minute setae and with 1 row of 4 long setae on lateral surface, medial margin serrated distally and with 1 sub-marginal low of 5 setae proximally, apex reaching distal 2/3 of article 1 of palp with 1 weakly plumose spine and 1 subapical seta; palp elongate, article 1 with minute setae along lateral margin and with 3 elongate submarginal setae on medial margin distally, article 2 with 4 pairs of elongate setae on medial margin, article 3 without setae and with small protrusion bearing 1 elongate seta on lateral margin distally, medial margin slightly dilated and with 1 pair of setae distally, with 1 dentate spine at distal corner, article 4 falcate, slightly shorter than article 3, with minute setae along medial margin.

Gnathopod 1 (Fig. 2F, G): subchelate; basis stout, somewhat curved, slightly shorter than carpus and propodus combined, anterior lobation indistinct, lined with minute setae on anterior margin, with 3 setae on posterior margin; ischium short, with small anterior lobe, convex posteriorly, lined with minute setae on distal 2/3 of posterior margin; merus slightly longer than ischium, with developed-protrusion distally; carpus subtrapezoidal, convergence proximally and gradually widening distally, anterior margin without setae, distal 1/3 of posterior margin lined with minute setae, posterodistal corner weakly produced with 5 elongate setae; propodus 0.7 times as long as basis, with 1 minute seta at anterodistal corner, posterior margin and palm gradually widening and convex, lined with serrations; dactylus elongate and slender, with 8 serrations on inner margin proximally, slightly lurched apically.

Gnathopod 2 (Fig. 3A, B): carpochelate; basis stout, subtrapezoidal, gradually widening distally in width, lined with 8 minute setae on proximal half of anterior margin, posterior margin straighten, lined with 17 minute setae, posterodistal corner weakly produced with 1 minute seta; ischium rectangular, anterior lobe weak,

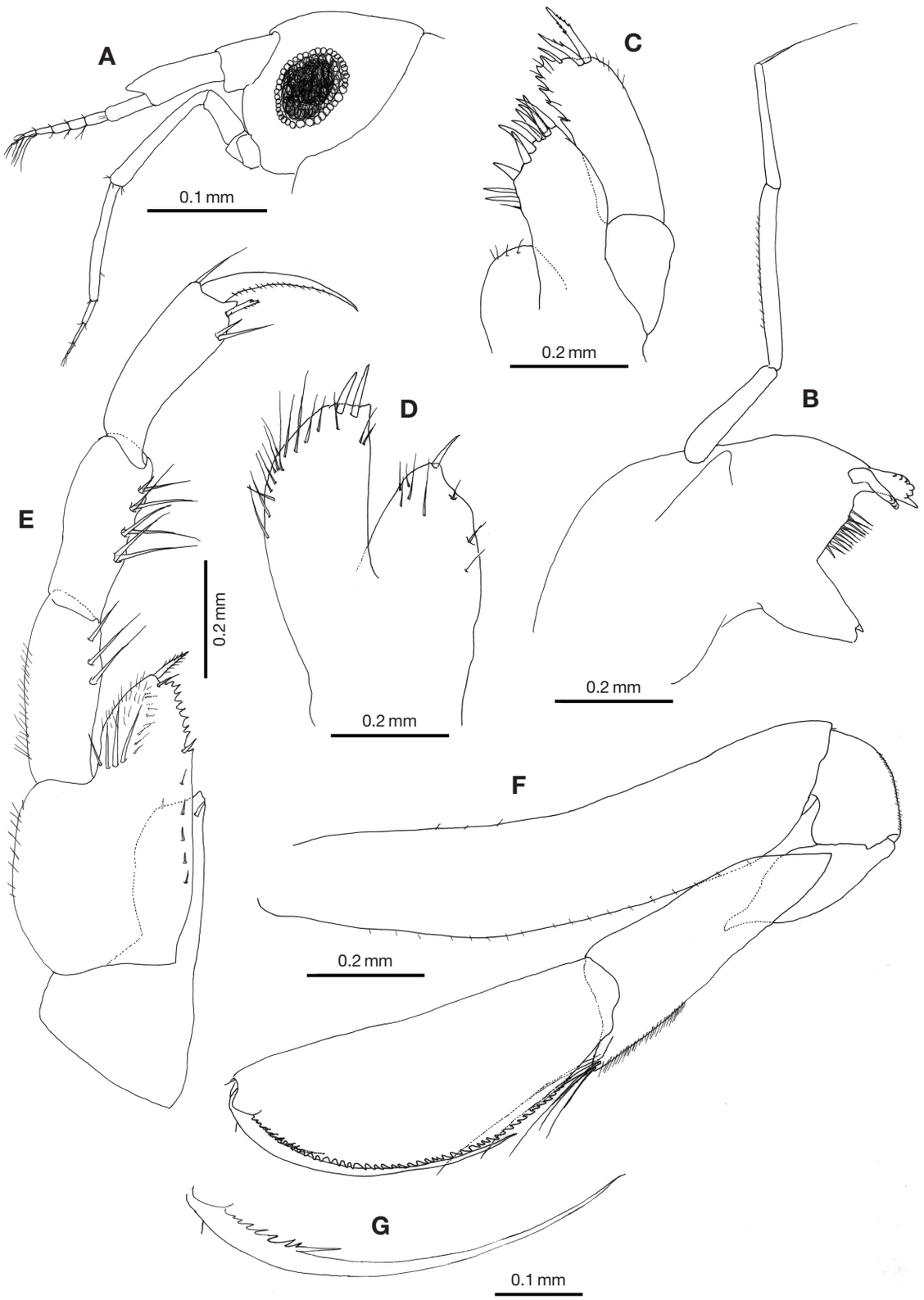

Fig. 2. *Cyproidea liodactyla* Hirayama, 1978, male. A. head and antennae 1-2. B. left mandible. C. maxilla 1. D. maxilla 2. E. maxilliped. F. gnathopod 1. G. dactylus of gnathopod 1, enlarged.

posterodistal process developed and lined with setae anteriorly, with 3 elongate setae on apex; merus longer than ischium, with developed-process at anterodistal corner medially, posterior margin slightly convex with minute setae distally, weak posterodistal protrusion with setae; carpus stout, anterior margin short and without setae, posterior margin and carpal process as long as basis, posterodistal carpal process stout, developed, slightly curved and fitting well to proximal 3/4 of posterior margin of propodus, with stout setae medially; propodus 0.7 times as long as basis, with 1 seta at anterodistal corner, posterior margin and palm gradually widening and convex, lined with serrations; dactylus elongate and slender, shorter than that of gnathopod 1, with 8 serrations on inner margin proximally, apex overlapping carpal process.

Pereopod 3 (Fig. 3C): slender; coxa largely broadened, subtriangular, anterior and ventral margins convex; posterior margin slightly concave and fitting to anterior margin of coxa 4; basis rectolinear, shorter than coxa, lined with minute setae on anterior margin; with 5 setae on posterior margin centrally; ischium with small anterior lobe; merus less than half length of basis, anterior margin slightly sinuous, anterodistal corner weakly produced and with 1 seta subdistally; carpus slender and linear, 0.9 times as long as merus; propodus also linear, with 4 small spines on posterior margin; dactylus falcate, elongate, 0.4 times as long as propodus.

Pereopod 4 (Fig. 3D): coxa also broadened massively, covering basis and ischium, posterior margin expanded backward, narrowly excavate proximally and receiving coxa of pereopod 5; basis rectolinear, with 4 minute setae on anterior margin and 5 minute setae on posterior margin; other articles of pereopod 4 similar to those of pereopod 3.

Pereopod 5 (Fig. 3E): coxa unilobate, produced anteriorly but apex round, ventral margins smooth, posterior margin expanded backward and acute; basis rectolinear, with several setae along anterior and posterior margins; ischium elongate, with weak posterior lobe; merus 0.5 times as long as basis, anterodistal corner with 1 minute seta, posterior margin slightly sinuous, posterodistal corner weakly produced with 1 seta subdistally; carpus slender and linear, 0.9 times as long as merus; propodus also linear, lined with 3 small spines on anterior margin; dactylus falcate, elongate, 0.5 times as long as propodus.

Pereopod 6 (Fig. 4A): coxa unilobate, sublozenge, smaller than coxa 5; basis rectolinear, with several setae along anterior margin; ischium elongate, with weak posterior lobe; merus 0.5 times as long as basis, anterodistal corner with 1 minute seta, posterior margin slightly sinuous, posterodistal corner weakly produced and with 1 spine subdistally; carpus slender and linear, as long as merus; with 1 small spine on anterior margin; propodus also linear, lined with 4 small spines on anterior margin; dactylus falcate, elongate, 0.5 times as long as propodus.

Pereopod 7 (Fig. 4B): coxa unilobate, smaller than coxa 6; basis rectolinear, with several setae along anterior and posterior margins; merus and carpus shorter than those of pereopod 6; propodus lined with 3 small spines on anterior margin.

Pleon and urosome (Fig. 4F): pleonal epimera 1-2 with acutely produced posterodistal corners and that of epimeron 2 larger, epimeron 3 smooth posteroventrally; urosomite 1 longer than pleonite 1, urosomite 2 short, urosomite 3 with dorsal keel produced backwardly.

Pleopod 1 (Fig. 4C): peduncle subquadrate, gradually diminished distally in width, with 1 pair of retinaculae mediodistally; rami longer than peduncle, inner ramus 10-articulate and outer ramus 11-articulate, all articles with plumose setae distally.

Pleopod 2 (Fig. 4D): inner ramus 11-articulate and outer ramus 12-articulate.

Pleopod 3 (Fig. 4E): shortest; peduncle quadrate; inner ramus 10-articulate and outer ramus 12-articulate.

Uropod 1 (Fig. 4G): elongate; peduncle slender, longer than rami, pectinate on distal half of dorsomedial margin; rami lanceolate, ramus equal each other, pectinate on dorsal margins.

Uropod 2 (Fig. 4H): similar but shorter than uropod 1.

Uropod 3 (Fig. 4I): shortest; peduncle 0.6 times as long as that of uropod 2; rami lanceolate, inner ramus longer than outer ramus.

Telson (Fig. 4J): entire, ovate oblongly, shorter than peduncle of uropod 3.

Female. Similar to males.

Remarks. In the original description of the species, Hirayama (1978) mentioned that *Cyproidea liodactyla* is very similar to *C. serratipalma* Schellenberg, 1938, the type species of the genus *Cyproidea* Haswell, 1879. However, *C. liodactyla* can be discriminated readily by the following characteristic features: anterior margin of peduncle 2 on antenna 1 has developed-keel bearing acute distal end, palp of maxilla 1 is elongate and has 3 distal spines, inner plate of maxilla 2 is broader than outer, posterodistal process of ischium on gnathopod 1 is largely developed and carpal process is reaching distal end of propodus on gnathopod 2. The Korean specimens of cyproideids examined in this study also showed the above features and they were readily assigned as *C. liodactyla*. However, the following minor differences are found between Korean materials and the original description by Hirayama (1978): 1) antenna 1, peduncular article 1 is as long as peduncular article 2 in the original description (vs. peduncular article 1 is shorter than peduncular article 2 in Korean specimens); 2) antenna 1, peduncular article 2 has two pointed processes distally in the original description (vs. only one process in revision of Ariyama (2016) and our Korean specimens); 3) antenna 1, flagel-

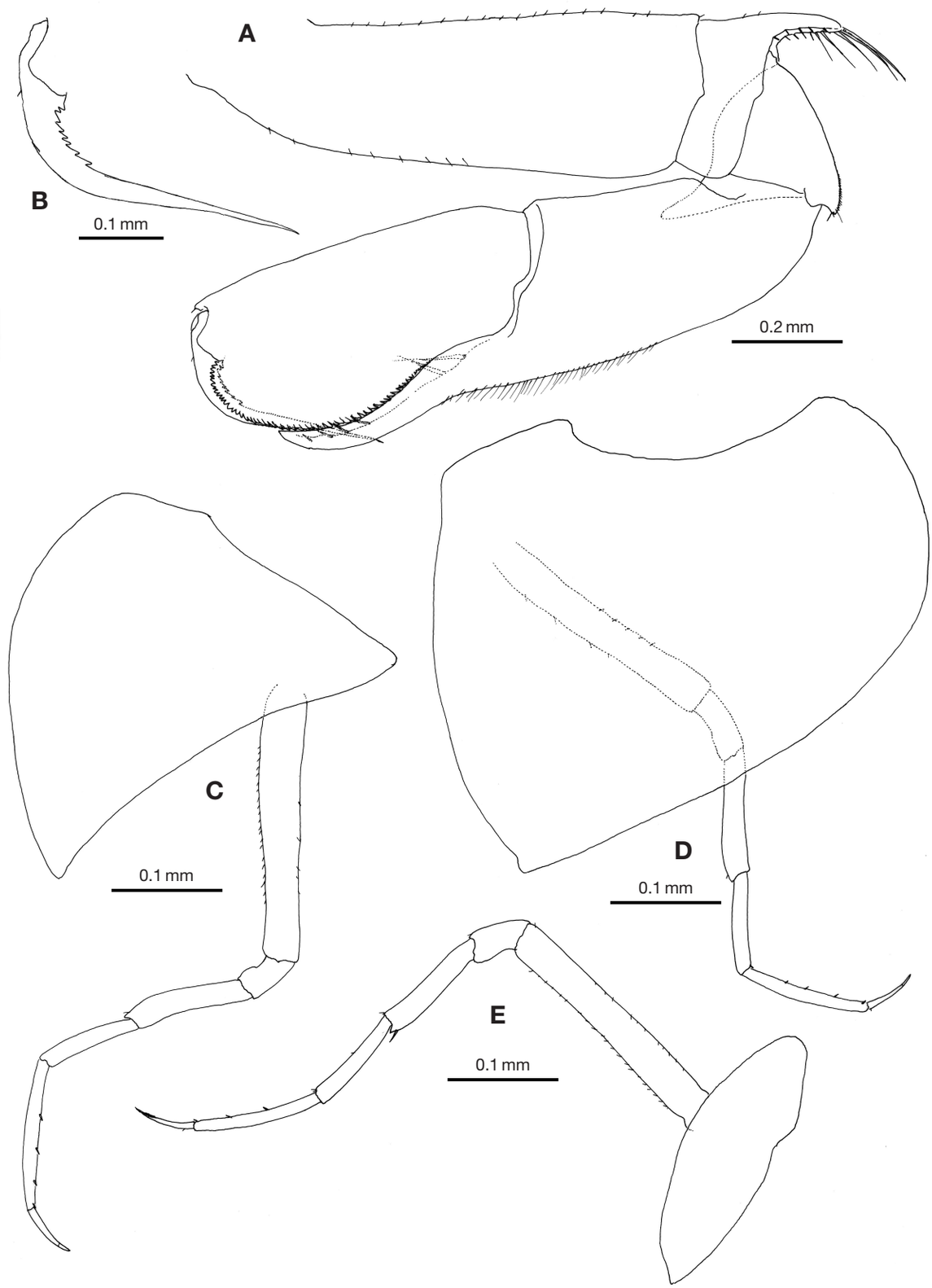

Fig. 3. *Cyproidea liodactyla* Hirayama, 1978, male. A. gnathopod 2. B. dactylus of gnathopod 2, enlarged. C. pereopod 3. D. pereopod 4. E. pereopod 5.

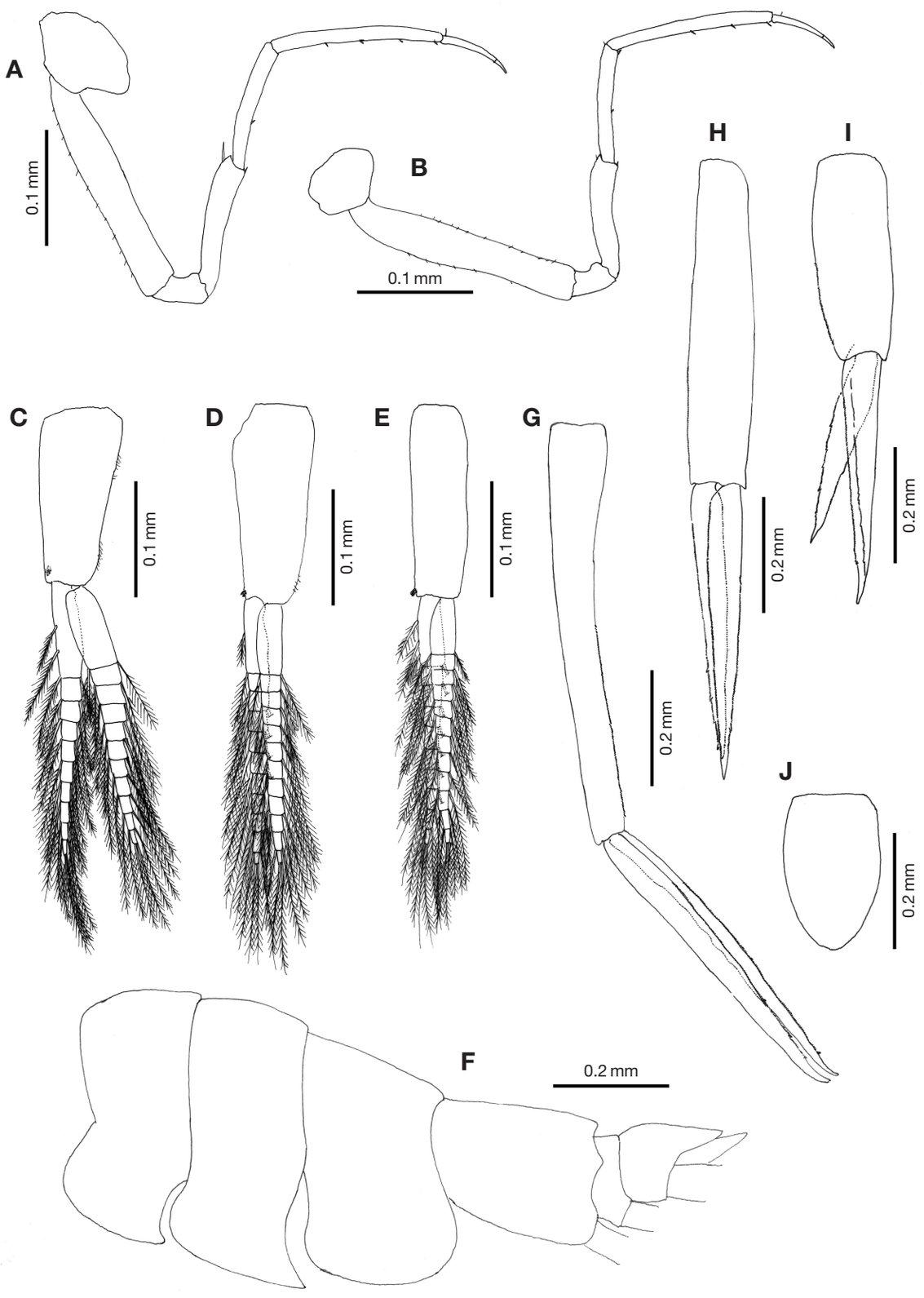

Fig. 4. *Cyproidea liodactyla* Hirayama, 1978, male. A. pereopod 6. B. pereopod 7. C. pleopod 1. D. pleopod 2. E. pleopod 3. F. pleon and urosome, lateral view. G. uropod 1. H. uropod 2. I. uropod 3. J. telson.

lum is 4-articulate in the original description (vs. 6-articulate in Korean specimens); 4) left mandible, accessory setal row is composed of 6 setae in the original description (vs. composed of 12 setae in Korean specimens); 5) mandibular palp, article 2 has two or three setae in the original description (vs. 16 setae in Korean specimens); 6) pleonal epimeron 2 is not produced posteroventrally in the original description (vs. acutely produced in the revision of Ariyama (2016) and our Korean specimens); and 7) telson is more swollen laterodistally in the original description (Hirayama, 1978; Ariyama, 2016).

The Korean specimens are very similar to *C. robusta* Ren, 2006 reported from Hainan Province, China. However, they showed some differences from the latter and more close to *C. liodactyla* in that they have serrations of palp on maxilla 1, longer article 2 of palp on mandible, and mediodistal stout spine at article 3 of palp on maxilliped. However, they share several common features of the original description of *Cyproidea liodactyla* Hirayama, 1978. Therefore, we are confident in the validity of *Cyproidea liodactyla* in Korean waters, but the relationship between *C. liodactyla* and *C. robusta* is in need of further study.

Key to Korean species belonging to the family Cyproideidae Barnard, 1974

− Pereopod 7, basis expanded posteriorly; urosomite 3, dorsal keel well developed; telson as long as peduncle of uropod 3 ····· *Terepeltopes dolichorhunia* Hirayama, 1983

− Pereopod 7, basis rectolinear; urosomite 3, dorsal keel week; telson shorter than peduncle of uropod 3 ····· *Cyproidea liodactyla* Hirayama, 1978

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