

TAXONOMIC STUDIES ON DOGIELINOTIDAE
(CRUSTACEA-AMPHIPODA) FROM THE KOREAN COASTS *

by

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ABSTRACT

Of forty-eight sandy beach samples from the Korean coasts, twenty-two contained dogielinotid Amphipoda, including four new species of the genus *Haustorioides* Oldeveg, 1958: *H. koreanus* n. sp., *H. latipalpus* n. sp., *H. nesogenes* n. sp., and *H. indivisus* n. sp. A key to this genus, notes on morphology, distribution and ecology of these four species, and a reconsideration of the genus *Eohaustorioides* Bousfield & Tzvetkova, 1982 are provided.

Characters considered of major diagnostic importance are found in maxilliped, maxilla 1, gnathopods, pereopods 5, 6 and 7, pleopods, uropods, epimeral plates, oostegites, and telson.

RÉSUMÉ

Vingt-deux sur quarante-huit échantillons prélevées sur des plages de sable des côtes de Corée contenaient des Amphipodes Dogielinotidés, y compris quatre espèces nouvelles du genre *Haustorioides* Oldeveg, 1958: *H. koreanus* n. sp., *H. latipalpus* n. sp., *H. nesogenes* n. sp., et *H. indivisus* n. sp. On donne une clé de détermination de ce genre et des notes sur la morphologie, distribution et écologie des quatre espèces nouvelles. En plus, on reconsidère le genre *Eohaustorioides* Bousfield & Tzvetkova, 1982.

Des caractères considérés comme ayant une importance diagnostique majeure sont fournis par le maxillipède, la maxille 1, les gnathopodes, les péréiopodes 5, 6 et 7, les pléopodes, les uropodes, les plaques épimérales, les oostégites et le telson.

INTRODUCTION

Of the world's nearly 4,000 described marine gammaridean species (Bousfield, 1981), only 19 species representing 8 families have been reported from Korean waters (Kim & Kim, 1987). Due to lack of taxonomic data, biologists and ecologists wishing to identify marine gam-

marids of the area often encounter difficulties with their specimens. As a result, field reports and surveys frequently leave gammarids largely unidentified.

Recently (1982-1986) extensive collections of shallow-water gammaridean amphipods have been made by the author throughout the southern half of the Korean peninsula. The samples were taken from sandy beaches, mud flats, gravelly beaches, and rocky shores, varying in depth from medio- to infralittoral (up to 5 m deep). Among 48 sandy beaches visited, dogielinotid amphipods were found at 22 localities (fig. 1).

Members of the family Dogielinotidae are sand-burrowing amphipods endemic to the North Pacific region (Bousfield, 1970). The family is confirmed as a member of the gammaridean superfamily Talitroidea (Barnard, 1972; Bousfield, 1982). A total of 7 species in 5 genera has been described from the North American Pacific and from the Far Eastern seas of the U.S.S.R. (Bousfield & Tzvetkova, 1982). It is remarkable that the diversity of the family is so high in the western Pacific (10 species including 4 new species), as against only one species (*Probosciniotus loquax* Barnard, 1967) in the eastern Pacific. The proliferation of sand-burrowing dogielinotids in the western Pacific seems analogous to the proliferation of the Haustoriidae sensu stricto in the western Atlantic, with few species along European shores (Bousfield, pers. comm.).

In the present study four species of *Haustorioides* Oldeveg, 1958 have been recognized, all of them apparently new to science. The large species *H. koreanus* n. sp. is most common on intertidal sandy beaches throughout the

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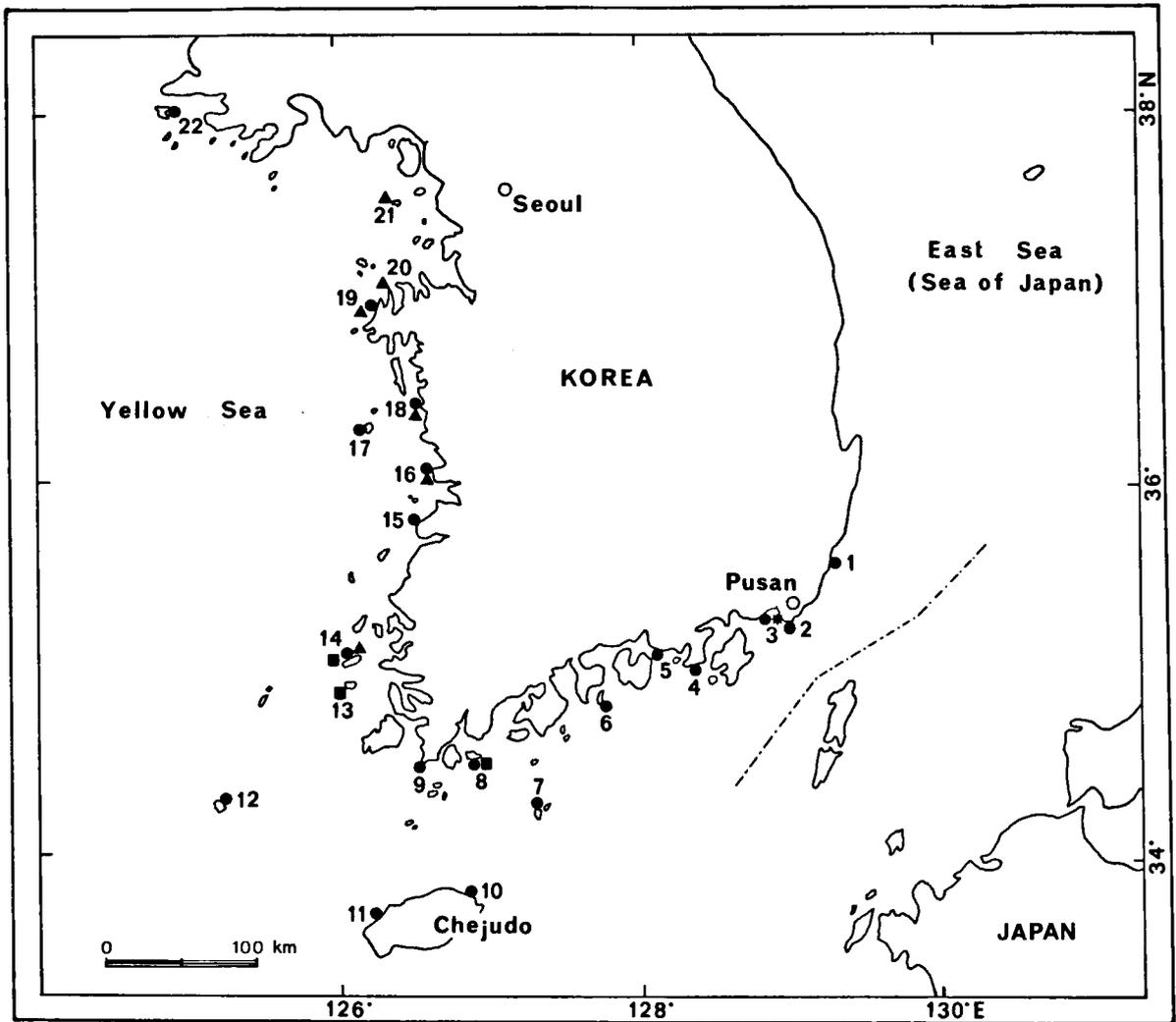


Fig. 1. Distribution of four species of *Haustorioides* in South Korea (● = *H. koreanus* n. sp.; * = *H. latipalpus* n. sp.; ■ = *H. nesogenes* n. sp.; ▲ = *H. indivisus* n. sp.): 1, Ilkwang; 2, Dadaepo; 3, Nakdong estuary; 4, Chungmu; 5, Samcheonpo; 6, Dolsando; 7, Geomundo; 8, Sinjido; 9, Songhori; 10, Samyang; 11, Hyeopjae; 12, Dochodo; 13, Bigumdo; 14, Byeonsan; 15, Osikdo; 16, Eyeondo; 17, Daecheon; 18, Malipo; 19, Hakampo; 20, Yongyoodo; 21, Baekryeongdo.

southern half of the Korean peninsula except the east coast, while the other three small species of the genus are allopatric in distribution; *H. latipalpus* n. sp. is found only in the Nakdong estuary, *H. indivisus* n. sp. is limited to the west coast, and *H. nesogenes* n. sp. is distributed in the region between the two species (southwestern islands of Korea).

The material is preserved in the Zoölogisch Museum, Amsterdam (ZMA) and the Institute of Marine Sciences, Pusan (IMS).

TAXONOMIC PART

Superfamily TALITROIDEA Bulycheva, 1957

Family DOGIELINOTIDAE Gurjanova, 1953

Genus *Haustorioides* Oldevig, 1958

Oldevig, 1958: 343; Gurjanova, 1962: 429 (in part); Barnard, 1967: 287; 1969: 209; 1972: 178; Bousfield & Tzvetkova, 1982: 87.

Species content. — *H. munsterhjelmii* Oldevig, 1958
H. japonicus Kamihira, 1977
H. magnus Bousfield, 1982

- H. gurjanovae* Bousfield, 1982
- H. koreanus* n. sp.
- H. latipalpus* n. sp.
- H. nesogenes* n. sp.
- H. indivisus* n. sp.

Diagnosis. — Rostrum distinct, medium small. Eye medium or medium small, ovoid. Antenna 1 shorter than 2, peduncle of both antennae short. Mandibular molar strongly triturating, incisor well toothed, left lacinia 4-5 dentate. Labium with small inner lobes. Inner lobe of maxilla 1 short and small, bearing 2-3 plumose setae on apex, outer lobe with 9 long pectinate spines, palp minute and 1-segmented. Dactylus of maxillipedal palp with modified or lacking unguis.

Coxal plates moderately large, first not reduced, fourth excavate posteriorly. Male gnathopod 2 larger than 1 and sexually dimorphic, female gnathopod 2 subequal to gnathopod 1 and scarcely different in structure. Pereiopods 5-7 increasing in length consecutively, medium or strongly spinose and setose, segments 2, 4, 5 of P5-P6 strongly expanded posteriorly.

Posterodistal corner of epimeral plate 2 slightly or strongly produced, that of plate 3 strongly produced. Rami of uropods 1 and 2 unarmed. Uropod 3 minute, with 1-3 apical setae, lacking rami. Urosomites free, 1 dorsally overhanging 2 and 3. Telson entire or slightly cleft medially.

KEY TO THE WORLD SPECIES OF THE GENUS *HAUSTORIOIDES*

1. Uropod 2, margin of peduncle with stout spines only; pereopod 6, segment 5 sublinear, slightly wider than segment 6; maxilliped, claw of palp with thick spine, inner margin of palp segment 2 convex; maxilla 1, palp lacking apical seta 2
- Uropod 2, margin of peduncle with slender spines and stout spine(s); pereopod 6, segment 5 more or less broadened; maxilliped, claw of palp lacking unguis, with numerous slender setae, inner margin of palp segment 2 vertically straight; maxilla 1, palp with an apical seta 3
2. Gnathopod 1, basis with anteroproximal and anterodistal setae; pereopod 5, dactylus normal; pereopod 7, segment 5 shorter than segment 6; uropod 1, peduncle with 3-4 short spines; telson

- uncleft, tapering distally; maxilliped, outer lobe not reaching outer tip of palp segment 1, palp normal *H. indivisus* n. sp.
- Gnathopod 1, basis with 2-3 anterodistal setae only; pereopod 5, dactylus short; pereopod 7, segment 5 longer than segment 6; uropod 1, peduncle with 3 tall spines; telson cleft about 1/4 at apex; maxilliped, outer lobe long, extending to outer tip of palp segment 1, palp short and wide *H. latipalpus* n. sp.
- 3. Pereiopods 6 and 7, segment 6 with 2-3 clusters of setae posteriorly; pereopod 7, posterior margin of segments 4 and 5 weakly setose; uropod 1, peduncle with 5-6 tall spines 4
- Pereiopods 6 and 7, segment 6 with 5-7 clusters of setae posteriorly; pereopod 7, posterior margin of segments 4 and 5 strongly setose; uropod 1, peduncle with 9-15 tall spines 6
- 4. Gnathopods weakly sexually dimorphic (in male little longer than in female); pereiopods 6 and 7, dactylus weakly setose (3-5 setae); epimeral plate 2, posterodistal corner slightly acute, much shorter than that of epimeral plate 3; telson lobes apically separated by distinct notch *H. gurjanovae* Bousfield, 1982
- Gnathopods strongly sexually dimorphic; pereiopods 6 and 7, dactylus strongly setose (more than 8 setae); epimeral plate 2, posterodistal corner strongly or moderately produced, as in epimeral plate 3; telson hardly cleft 5
- 5. Pereiopods 6 and 7, dactylus with 7-16 setae anteriorly; pereopod 7, segment 4 distinctly shorter than segment 5; uropod 2, peduncle with 2 slender spines and 2 stout spines; pleopods, peduncle with 5-6 retinacula; telson slightly cleft .. *H. nesogenes* n. sp.
- Pereiopods 6 and 7, dactylus with 20-50 setae anteriorly; pereopod 7, segments 4 and 5 subequal; uropod 2, peduncle with 5-6 slender spines only; pleopods, peduncles with 10-13 retinacula; telson lobes fused entirely *H. japonicus* Kamihira, 1977
- 6. Coxal plates 1-4, lower margins with long setae; pereopod 6, segment 5 sublinear (width = 1/2 length); uropod 2, peduncle with 1 stout spine and 5-6 slender spines; epimeral plate 3, posterodistal corner moderately produced *H. koreanus* n. sp.
- Coxal plates 1-4, lower margins with mainly short setae; pereopod 6, segment 5 broadly expanded proximally (width about 2/3 of length or more); uropod 2, peduncle with 8-12 slender spines only; epimeral plate 3, posterodistal corner strongly produced, length of process greater than basal width 7
- 7. Pereiopod 6, segment 5 broadly expanded proximally, width about 2/3 of length; uropod 1, peduncle with 14-15 slender spines; gnathopod 2, posterodistal angle of palm with 7 spine-teeth; pleopods, peduncle with 14-17 retinacula; oostegites on gnathopod 2 subquadrate *H. magnus* Bousfield, 1982
- Pereiopod 6, segment 5 very broadly expanded, subquadrate, length equals width; uropod 1, peduncle

with 9-12 slender spines; gnathopod 2, posterodistal angle of palm with few weak spines; pleopods, peduncle with 10 retinacula; oostegites on gnathopod 2 subtriangular *H. munsterhjelmii* Oldevig, 1958

***Haustorioides koreanus* n. sp.**

(Figs. 2-4)

Material examined. — Pusan, Dadaepo; 5 Apr. 1985, 1 ♂ holotype (ZMA Amph. 108.331a), 1 ovigerous ♀ allotype (ZMA Amph. 108.331b), 43 ovigerous ♀♀ and 44 ♂♂ paratypes (ZMA Amph. 108.331c), 20 ovigerous ♀♀ and 22 ♂♂ paratypes (IMS); 17 Dec. 1982, 67 specimens; 4 Mar. 1983, 118 specimens; 17 Apr. 1983, 79 specimens; 11 Oct. 1984, many specimens; 22 Dec. 1984, 170 specimens; 7 Mar. 1985, 42 specimens.

Pusan, Nakdong estuary, Okryudeung; 16 Nov. 1983, 4 specimens; 20 Jan. 1984, 2 ♂♂; 12 Apr. 1984, 2 ♂♂ and 3 ovigerous ♀♀.

Prov. Kyeongnam, Ilkwang; 23 Mar. 1986, 1 ♂ and 1 ovigerous ♀.

Prov. Kyeongnam, Chungmu; Sept. 1986, 5 specimens.

Prov. Kyeongnam, Samcheonpo, Namildae, 26 May 1986, 5 ♂♂ and about 600 juvs.

Prov. Cheonnam, Dolsando, Bangjukpo; 6 Aug. 1986, about 320 juvs.

Prov. Cheonnam, Geomundo, Seodori; 23 July 1986, 46 juvs.

Prov. Cheonnam, Sinjido, Myeongsasimri; 11 May 1986, 8 ♂♂, 16 ♀♀ (13 ovigerous) and 138 juvs.

Prov. Cheonnam, Haenam, Songhori; 8 Aug. 1986, 19 juvs.

Prov. Cheonnam, Huksando, Jinri; 22 July 1986, 106 juvs.

Prov. Cheonnam, Bigumdo, Gurimri; 19 Oct. 1986, 181 specimens.

Prov. Cheju, Samyang; 7 Aug. 1986, 10 juvs.

Prov. Cheju, Hyeopjae; 8 Aug. 1986, 153 juvs.

Prov. Cheonbuk, Byeonsan; 19 Oct. 1986, 3 ♀♀.

Prov. Cheonbuk, Okgu, Osikdo; 24 July 1986, 162 juvs.

Prov. Chungnam, Boryeong, Eyeondo; 4 Feb. 1983, many specimens.

Prov. Chungnam, Daechon; 4 Feb. 1983, 2 ♂♂ and 3 ♀♀; 9 May 1986, 26 ♂♂ and 20 ♀♀ (18 ovigerous).

Prov. Chungnam, Malipo; 21 Oct. 1986, 33 ♂♂ and 3 ♀♀.

Prov. Kyeongki, Baekryeongdo, Gobongpo; 18 Nov. 1986, 3 ♂♂ and 4 ♀♀.

Description. — Body length (without antennae and telson): male 11.0-12.0 mm, female 12.5-14.0 mm. Male habitus as in fig. 2a.

Male: Lateral cephalic lobes (fig. 2b) acute. Eyes of medium size, ovoid.

Peduncle segment 1 of antenna 1 (fig. 2c) twice as long and twice as wide as segment 2; segments 2 and 3 with bundles of long and thick (sub)distal setae. Flagellum 10- to 11-segmented; each segment posterodistally armed with bundle of setae; 1 or 2 aesthetascs on each segment except first and last one.

Antenna 2 (fig. 2d) with rather slender peduncle. Flagellum of 9-10 segments; each segment distally armed with long setae.

Labrum (fig. 2e) with 2 groups of mid-medial setae; free margin rounded, with setules.

Mandible (fig. 2f): Right with 6 strong and many fine teeth on lacinia mobilis, followed proximad by 4 plumose setae; pars molaris with two long setae. Left lacinia robust, armed with 5 teeth, followed proximad by 6 plumose setae; pars molaris with 2 setae.

Labium (fig. 2g) with small, but distinct inner lobes; anterior side of left outer lobe with groove on outer margin.

Palp of maxilla 1 (fig. 2h) 1-segmented, with 1 apical seta, which is longer than palp itself. Outer lobe with 9 denticulate spines. Inner lobe slender, armed with 2-3 plumose setae.

Maxilla 2 (fig. 2i) of the usual structure. Inner and outer lobes armed with distal and mediobasal setae; inner margin of inner lobe with 4 strong plumose setae.

Inner lobe of maxilliped (fig. 2j) distally with three robust dentiform spines, placed at regular intervals; inner margin with 5 plumose setae. Outer lobe short, not reaching outer tip of palp segment 1. Palp segment 2 with an additional row of submarginal setae vertically, inner margin vertically straight; dactylus linear, with slender apical setae, lacking unguis.

Coxal plates 1-4 (figs. 3a-d) with numerous longish setae on lower margin.

Gnathopod 1 (fig. 3a), carpus with posterior lobe; base of lobe lined with heavy setae. Palmar angle of propodus with 4-5 spine-teeth. Dactylus short, stout.

Gnathopod 2 (fig. 3b) strongly subchelate; length of propodus about 1.8 times that of gnathopod 1. Carpus with long posterior lobe; base of lobe with row of dense, short setae.

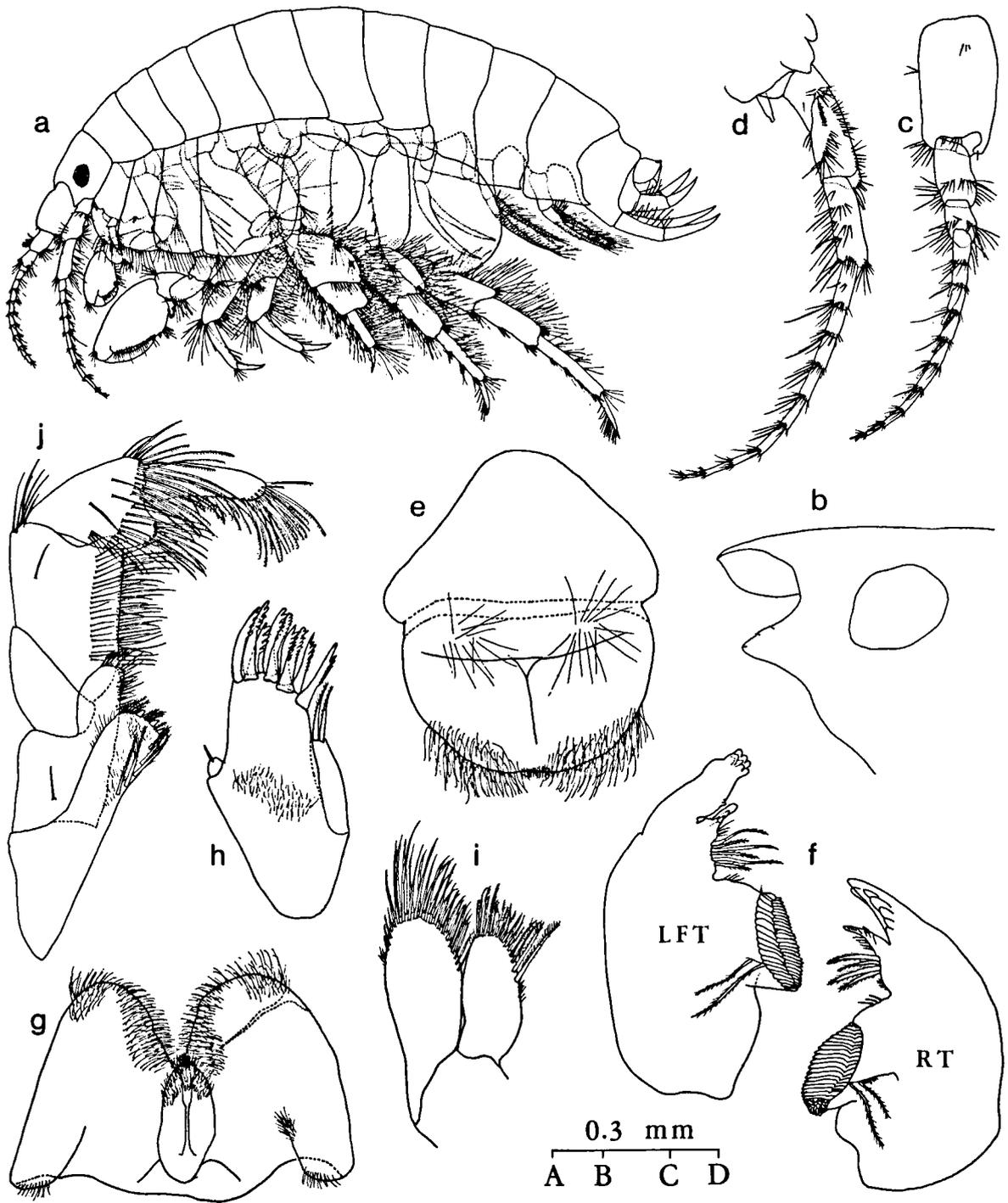


Fig. 2. *Haustorioides koreanus* n. sp. (♂ holotype 11.5 mm from Dadaepo): a, lateral aspect of habitus; b, head (scale AC); c, antenna 1 (AB); d, antenna 2 (AB); e, labrum (AD); f, left and right mandible (AD); g, labium (AD); h, maxilla 1 (AD); i, maxilla 2 (AD); j, maxilliped (AC).

Pereiopods 3 and 4 (figs. 3c, d), merus and carpus heavily setose posteriorly. Propodus armed with 3-4 pairs of thick setae on posterodistal half.

Pereiopod 5 (fig. 3e) densely setose; merus slightly longer than wide; propodus with numerous setae along posterior margin; dactylus with 0-1 seta on anterior margin.

Pereiopod 6 (fig. 3f), merus and carpus densely setose, not heavily expanded (carpus about twice as long as wide); carpus shorter than propodus. Propodus armed with 6 groups of setae on posterior margin; dactylus with 8-11 setae on anterior margin.

Pereiopod 7 (fig. 3g) moderately setose; carpus shorter than propodus; posterior margin of propodus armed with 5-6 bundles of setae; dactylus with 21-22 anteromarginal setae.

Pleopodal peduncles (fig. 3h) each with 9-10 retinacula; exopodite of first pleopod 26- to 28-segmented.

Epimeral plates 1 and 2 (fig. 3i) with fine setules on their anteroventral part. Plate 1 with slightly rounded posterodistal corner; plate 2 with small point; plate 3 with medium-sized point.

Uropod 1 (fig. 3j) with 14-17 slender peduncular spines (9-10 on outer margin).

Uropod 2 (fig. 3k) with 5-7 longish peduncular spines, but the most distal one on outer margin short and stout.

Apex of uropod 3 (fig. 3-l) with a single seta; length of apical seta much shorter than half of peduncle.

Telson (fig. 4f) wider than long, cleft for about 1/4 of its length; each lobe with 4 laterodistal setae, three of which feathered.

Female: Lower margin of coxal plates 1-4 (figs. 4a, b) more strongly setose than in male.

Gnathopod 1 (fig. 4a), propodus relatively small, with 2 slender spine-teeth on palmar angle; dactylus slender, long, with 2 blades on the tip.

Gnathopod 2 (fig. 4b) subequal to the first. Lobe of carpus more elongate; propodus much smaller than in male.

Oostegites on gnathopod 2 (fig. 4b) tapering distally, subtriangular; those on P3-P5 (figs. 4c-e) subquadrate, distally widened.

Remarks. — This species is closely related to the large species *H. munsterhjelmii* Oldevig, 1958, from the Island of Sachalin, U.S.S.R., but it differs from it in the carpus of P6 (sublinear in *H. koreanus*, subquadrate in *H. munsterhjelmii*), the number of spines on the peduncle of uropod 1 (14-17 in *H. koreanus*, 9-12 in *H. munsterhjelmii*), the less strongly produced posterodistal point of epimeral plate 3, and the absence of antero-distal setae on the basis of gnathopods 1 and 2 in both sexes.

From *H. magnus* Bousfield, 1982, the present species differs in the less strongly produced posterodistal point of epimeral plate 3, the sublinear carpus of P6, the number of retinacula on the peduncles of the pleopods (9-10 in *H. koreanus*, 14-17 in *H. magnus*) and the shape of the oostegite on gnathopod 2 (subtriangular in *H. koreanus*, subquadrate in *H. magnus*).

Morphological differences among populations of this species are very small. However, juveniles show less strong setation on the appendages, feeble subchelation of gnathopod 2 in the male, a wide merus of P5, and a more irregular arrangement of the three robust teeth-spines on the inner lobe of the maxilliped, as in the three small species of Korean *Haustorioides*. But juveniles of this species can be distinguished from other Korean species of *Haustorioides* by the shape of the telson, the presence of a dense row of setules at the base of the carpal lobe of gnathopods 1 and 2, the slight acumination of the posterodistal corner of epimeral plate 2, and the additional row of submarginal setae on palp segment 2 of the maxilliped.

Etymology. — The specific name *koreanus* refers to the peninsula of Korea where this species is widely and abundantly distributed.

Distribution and ecology. — This species is one of the most common amphipods on inter-

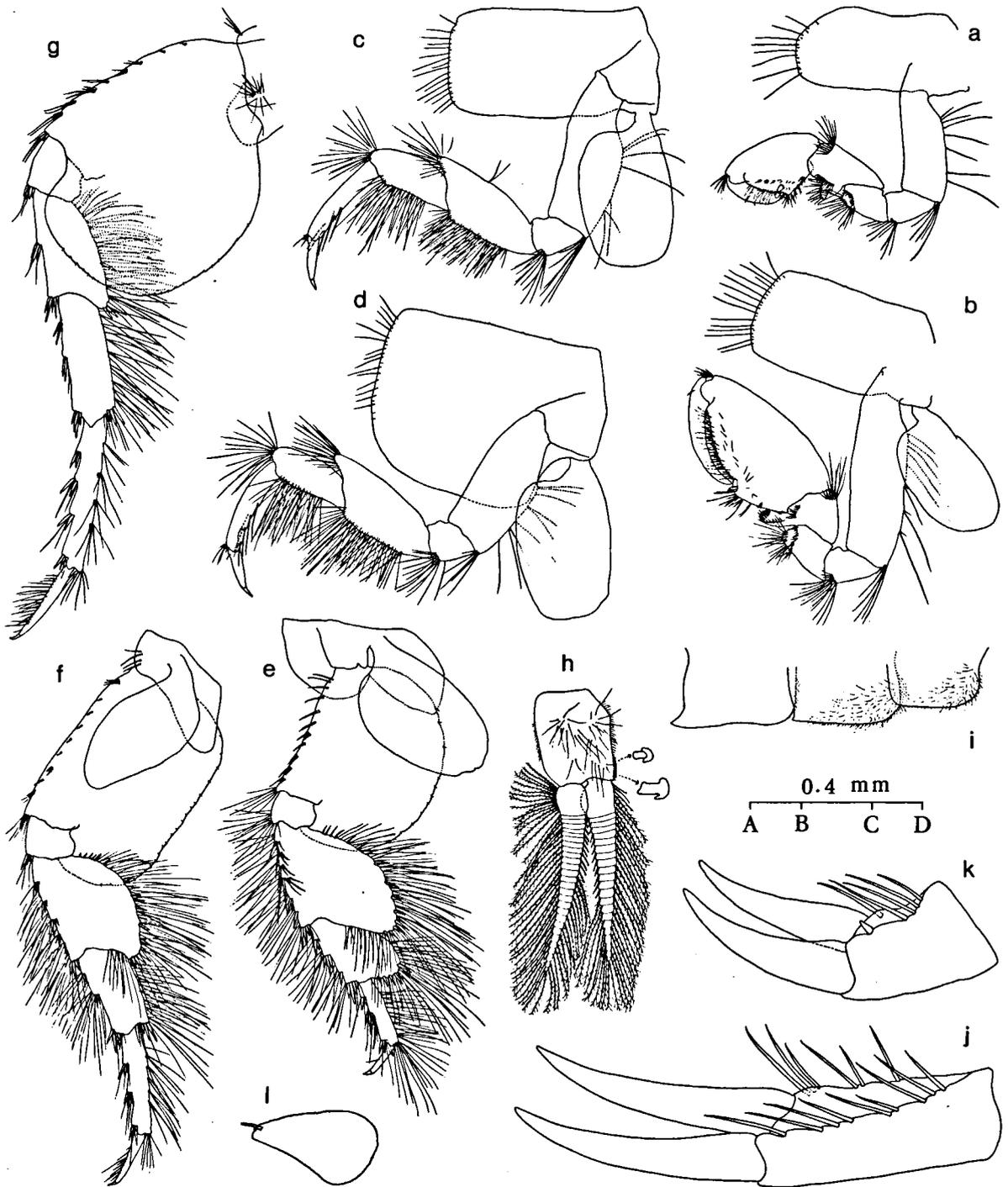


Fig. 3. *Haustorioides koreanus* n. sp. (♂ holotype 11.5 mm from Dadaepo): a, gnathopod 1 (scale AB); b, gnathopod 2 (AB); c, pereopod 3 (AB); d, pereopod 4 (AB); e, pereopod 5 (AB); f, pereopod 6 (AB); g, pereopod 7 (AB); h, pleopod 1 (AB); i, epimeral plates 1 to 3 (AB); j, uropod 1 (AC); k, uropod 2 (AC); l, uropod 3 (AD).

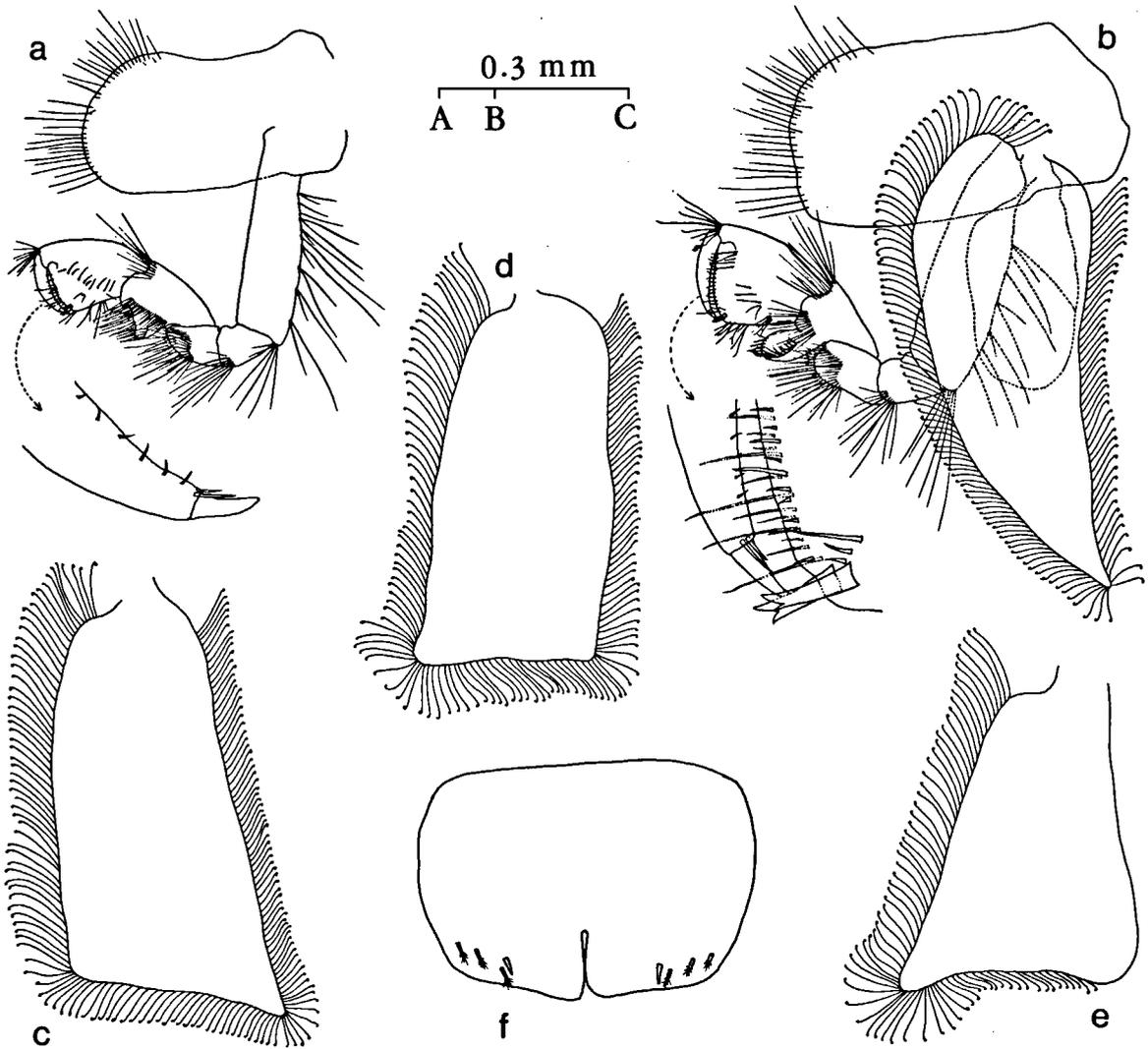


Fig. 4. *Haustorioides koreanus* n. sp. (a-e, ♀ allotype 13.0 mm; f, ♂ holotype 11.5 mm, from Dadaepo): a, gnathopod 1 ♀ (scale AB); b, gnathopod 2 with oostegite ♀ (AB); c, oostegite of pereiopod 3 ♀ (AB); d, oostegite of pereiopod 4 ♀ (AB); e, oostegite of pereiopod 5 ♀ (AB); f, telson ♂ (AC).

tidal sandy beaches throughout the southern half of the Korean peninsula (fig. 1) except the east coast (Sea of Japan), where wave action is strong and the tidal range is very small (20-30 cm at spring tide). In Chejudo this species is found only in the sheltered northern part of the island, indicating that the animal prefers protected areas. In most sampling localities the substratum consists of fine to medium sands (but in Daechon and Baekryeongdo the sand is

medium-coarse with shell debris).

At the type-locality, Dadaepo, the highest density ($359/m^2$) was reached around the midlittoral zone and the monthly fluctuation of salinity was 2.73-33.34‰ (Jo, 1983). From year-round sampling this species seems to have a life span of one year, ovigerous females being found in spring (March-June), with a large number of eggs. The allotype (body length 13.0 mm) carried 181 eggs, egg size 0.37×0.44 mm.

***Haustorioides latipalpus* n. sp.**

(Figs. 5-7)

Material examined. — Pusan, Nakdong estuary, Baekhabdeung; 3 Apr. 1984, 1 ♂ holotype (ZMA Amph. 108.332a), 1 ovigerous ♀ allotype (ZMA Amph. 108.332b), and 1 ovigerous ♀ paratype (ZMA Amph. 108.332c); 19 Jan. 1984, 5 ♂♂, 6 ♀♀, and 3 juvs. paratypes (ZMA Amph. 108.333a); 7 Jan. 1985, 3 ♂♂ and 1 ♀ paratypes (IMS).

Pusan, Nakdong estuary, Okryudeung; 12 Apr. 1984, 1 ♀; 25 Oct. 1984, 2 ♀♀ (1 ovigerous); 7 Jan. 1985, 6 ♂♂ and 11 ♀♀.

Pusan, Nakdong estuary, Myeongji; 1 May 1984, 1 ovigerous ♀; 8 Jan. 1985, 1 ♀.

Pusan, Nakdong estuary, Eulsukdo; 13 Aug. 1984, 3 ♀♀ (1 ovigerous); 23 Oct. 1984, 1 ♂.

Pusan, Nakdong estuary, Jinwoodo; 21 Jan. 1985, 1 ♂ and 1 ♀.

Description. — Small species; largest male 6.6 mm long, largest female 7.8 mm.

Male: Lateral cephalic lobes (fig. 5a) rounded triangular, not exceeding tip of rostrum. Eyes small, ovoid.

Antenna 1 (fig. 5b), peduncle segments 2 and 3 with bundles of long setae on their distal margin. Flagellum 7- to 8-segmented; each segment short and wide, with few short setae; 1 or 2 aesthetascs on each segment except first and last one.

Antenna 2 (fig. 5c) with slender gland cone. Flagellum 8- to 9-segmented, poorly setose.

Labrum (fig. 5d) without mid-medial setae; free margin slightly emarginate.

Mandibles (fig. 5e) asymmetrical; right mandible with finely toothed lacinia mobilis; left lacinia mobilis with 4-5 robust teeth.

Labium (fig. 5f) with distinct inner lobes; left outer lobe without groove.

Palp of maxilla 1 (fig. 5g) vestigial, 1-segmented, without apical seta; inner lobe armed with 2-3 plumose setae on apex.

Maxilla 2 (fig. 5h) of the usual structure; inner margin of inner lobe with 1 strong plumose seta.

Maxilliped (fig. 5i) with 3 strong dentiform spines of inner lobe arranged irregularly (first

and second one from the inside close together, the lateral one apart from the others); inner margin with 3 plumose setae. Outer lobe distally tapering, extending to level of outer tip of palp segment 1. Palp short, wide; inner margin of segment 2 convex; unguis very thick and long.

Coxal plates 1-4 (figs. 6a-d) sparsely setose on lower margin; anterodorsal corner of plate 1 convex.

Gnathopod 1 (fig. 6a), anterior margin of basis with 2 distal setae. Base of carpal lobe with two setules only. Palmar angle of propodus with 2 slender, bifid spine-teeth.

Gnathopod 2 (fig. 6b), anterior margin of basis with 3 distal setae. Base of carpal lobe with two setules as in gnathopod 1. Length of propodus about 1.4 times that of gnathopod 1.

Pereiopods 3 and 4 (figs. 6c, d), merus and carpus moderately setose posterodistally.

Pereiopod 5 (fig. 6e) moderately setose; merus wider than long; posterior margin of propodus with a single seta; dactylus short.

Pereiopod 6 (fig. 6f), carpus linear, about of equal length as propodus; posterior margin of propodus with a single seta; dactylus with 1-2 setae on anterior margin.

Pereiopod 7 (fig. 6g) poorly setose; merus distinctly shorter than carpus; carpus slightly longer than propodus; posterior margin of propodus with two groups of setae; dactylus with 4-6 anteromarginal setae.

Pleopodal peduncles (fig. 5j) each with 5-6 retinacula; exopodite of first pleopod 18-segmented.

Epimeral plate 1 (fig. 6h) with small posterodistal point; plates 2 and 3 each with medium-sized point.

Peduncle of uropod 1 (fig. 5k) with 3 slender spines.

Uropod 2 (fig. 5l) with 4 stout peduncular spines only.

Apex of uropod 3 (fig. 5m) with 2-3 setae; length of setae about half that of peduncle.

Telson (fig. 5n) cleft for about 1/4 of its length; each lobe with 4 laterodistal setae, three of which feathered.

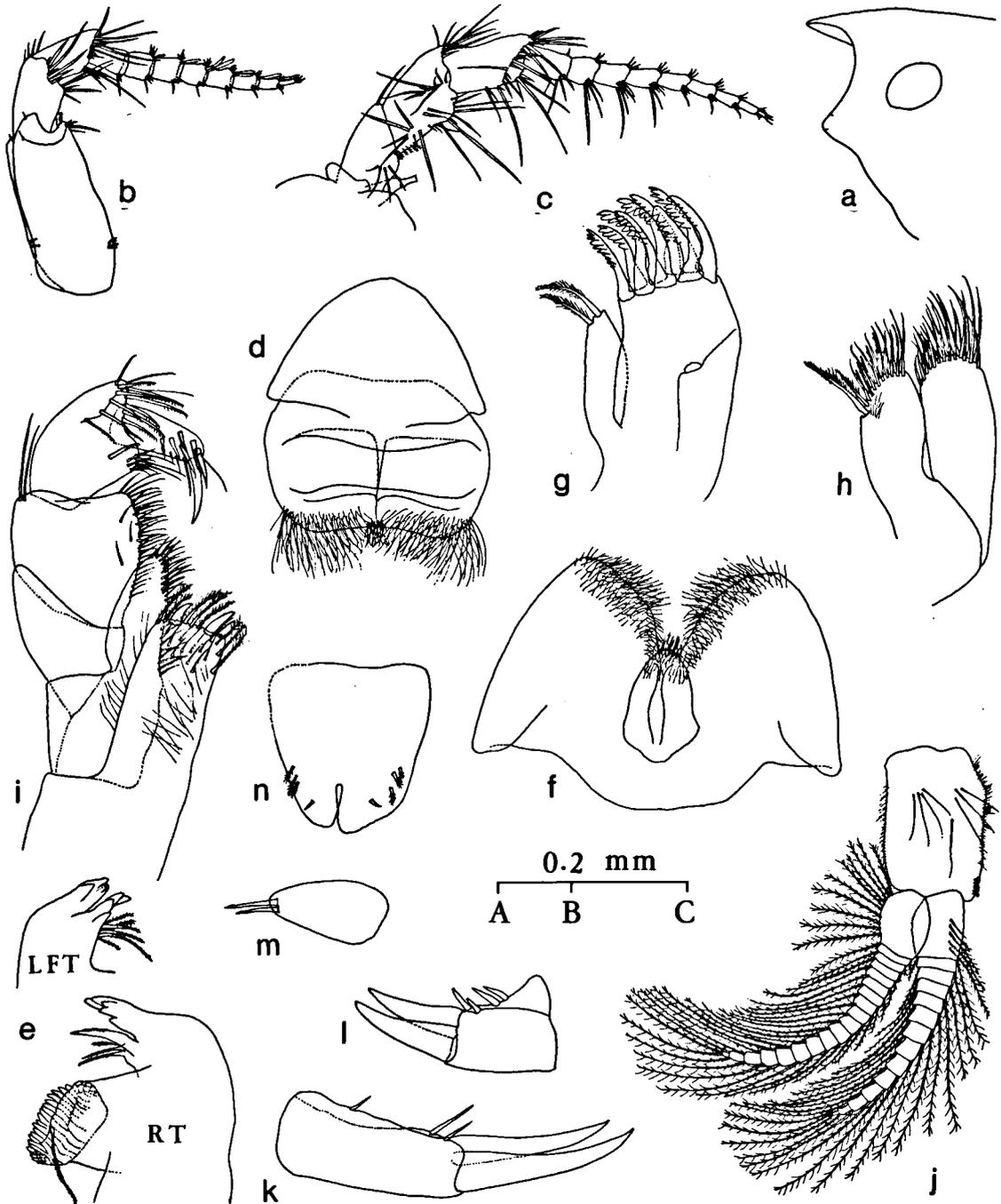


Fig. 5. *Haustorioides latipalpus* n. sp. (♂ holotype 6.6 mm from Baekhabdeung, Nakdong estuary): a, head (scale AB); b, antenna 1 (AB); c, antenna 2 (AB); d, labrum (AC); e, mandibles (AC); f, labium (AC); g, maxilla 1 (AC); h, maxilla 2 (AC); i, maxilliped (AC); j, pleopod 1 (AB); k, uropod 1 (AB); l, uropod 2 (AB); m, uropod 3 (AC); n, telson (AC).

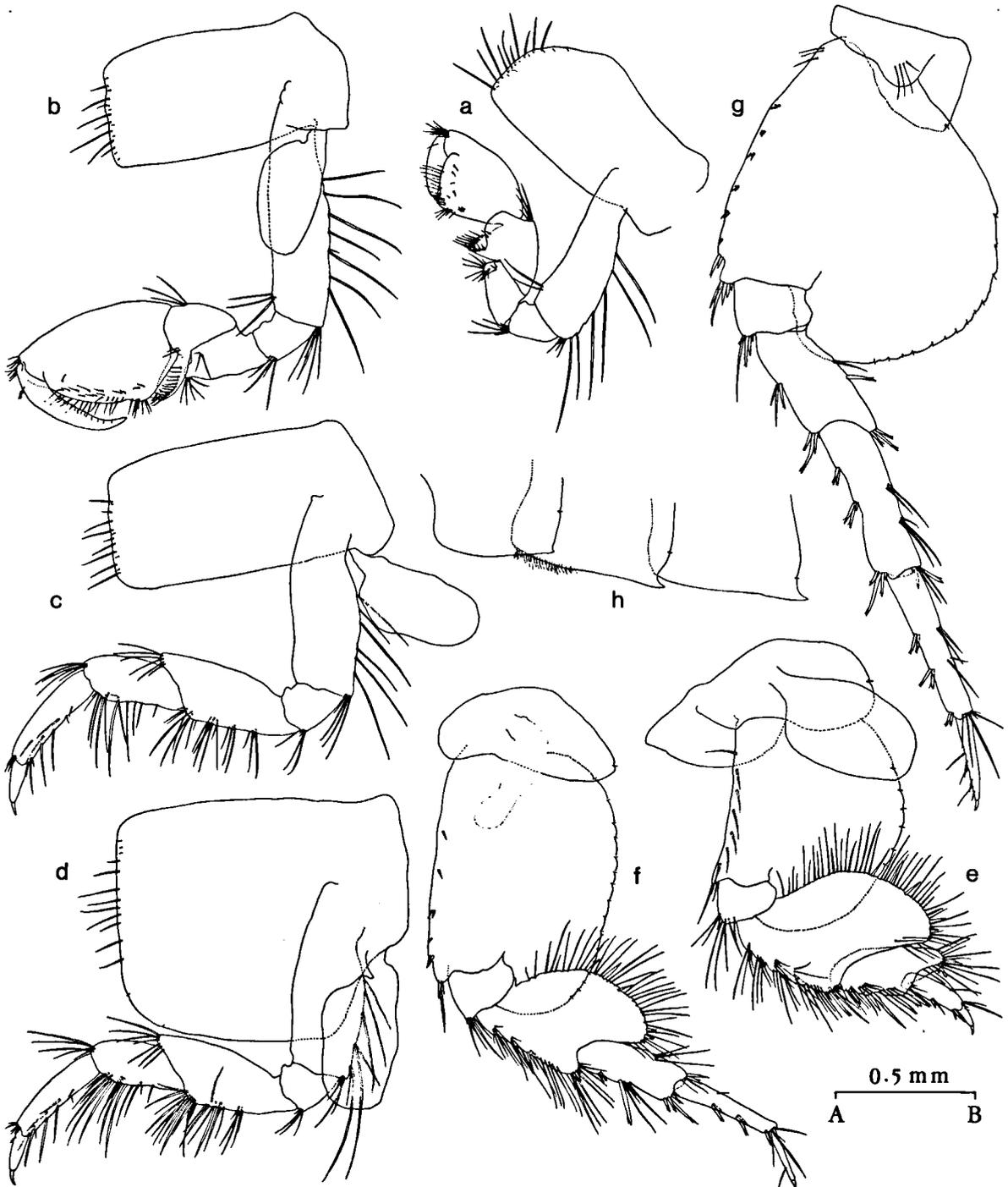


Fig. 6. *Haustorioides latipalpus* n. sp. (♂ holotype 6.6 mm from Baekhabdeung, Nakdong estuary): a, gnathopod 1; b, gnathopod 2; c, pereopod 3; d, pereopod 4; e, pereopod 5; f, pereopod 6; g, pereopod 7; h, epimeral plates 1 to 3. Scales: all AB.

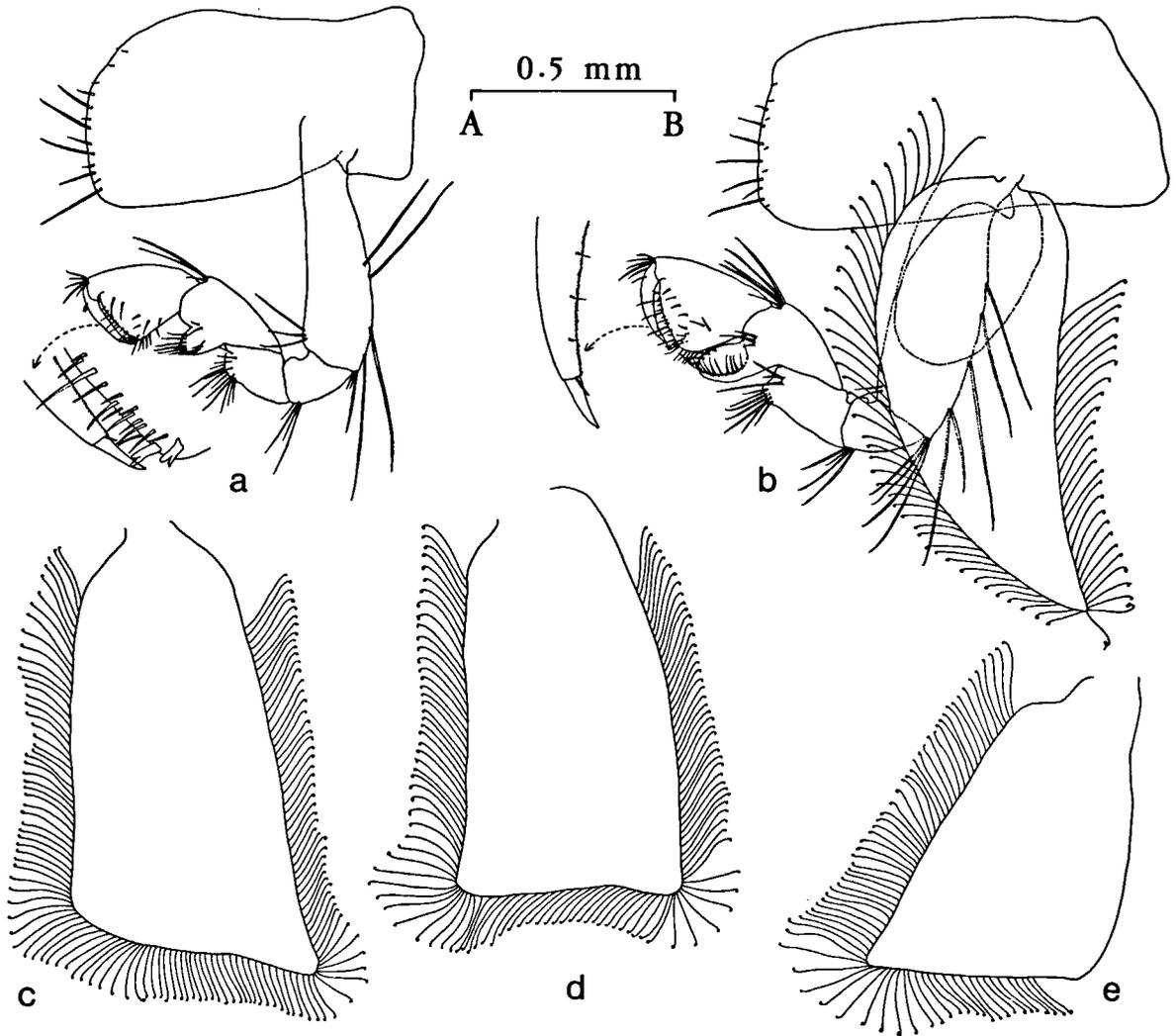


Fig. 7. *Haustorioides latipalpus* n. sp. (♀ allotype 7.8 mm from Baekhabdeung, Nakdong estuary): a, gnathopod 1; b, gnathopod 2 with oostegite; c, oostegite of pereopod 3; d, oostegite of pereopod 4; e, oostegite of pereopod 5. Scales: all AB.

Female: Gnathopod 1 (fig. 7a) similar to that of male, but propodus and dactylus thinner; dactylus long, unguis with a minute blade.

Gnathopod 2 (fig. 7b) similar to gnathopod 1; propodus triangular; dactylus slender.

Oostegites on P3-P5 (figs. 7c-e) subquadrate, distally widened; that of gnathopod 2 (fig. 7b) tapering, pointed.

Remarks. — This species is similar to *H. nesogenes* and *H. indivisus* in the relatively poor setation of the appendages, about equal size of

the posterodistal point of epimeral plates 2 and 3, and the longish setae on uropod 3.

In particular, the present species shares the following characters with *H. indivisus*: peduncle of uropod 2 with stout spines only, unguis of maxillipedal palp and palp of maxilla 1 bare. However, the present species is well-characterized by its cleft telson (about 1/4), absence of anteroproximal setae on the basis of gnathopod 1, and the peculiar structure of the maxilliped (elongated outer lobe, short and wide palp).

Etymology. — The proposed specific name, *latipalpus* (from the Latin, meaning “wide palp”), alludes to the palp of the maxilliped (especially segment 2) which is rather short and wide.

Distribution and ecology. — The species, probably a brackish-water endemic, was collected in the Nakdong estuary (fig. 1). Five sand dunes where the species occurs are all situated within a radius of 3 km. In Okryudeung, with the purest sandy bottom, this species was accompanied by *H. koreanus*.

The animal inhabits intertidal sand or muddy sand. The salinity of the interstitial water fluctuates extremely during the tides and by outflowing river water. During the study period ovigerous females were found in April, May, August, and October 1984, with a small number of eggs. The allotype (body length 7.8 mm) carried 18 eggs, egg size 0.29×0.37 mm.

***Haustorioides nesogenes* n. sp.**

(Figs. 8-10)

Material examined. — Prov. Cheonnam, Sinjido, Myeongsasimri; 11 May 1986, 1 ♂ holotype (ZMA Amph. 108.334a), 1 ovigerous ♀ allotype (ZMA Amph. 108.334b), 4 ♀♀ (3 ovigerous) and 4 ♂♂ paratypes (ZMA Amph. 108.334c), 4 ♀♀ (3 ovigerous) and 4 ♂♂ paratypes (IMS).

Prov. Cheonnam, Dochodo, Simok; 6 Oct. 1986, 4 ♂♂ and 3 ♀♀.

Prov. Cheonnam, Bigumdo, Gurimri; 19 Oct. 1986, 322 specimens.

Description. — Body length: male 6.7 mm, female 9.2 mm.

Male: Lateral cephalic lobes (fig. 8a) rounded triangular, extending to about the tip of the rostrum. Eyes of medium size, ovoid.

Antenna 1 (fig. 8b) quite setose on peduncle and flagellum; flagellum 7- to 8-segmented, 1 or 2 aesthetascs on each segment except first, second and last.

Antenna 2 (fig. 8c), flagellum 9- to 10-segmented, heavily setose.

Labrum (fig. 8d) with slightly emarginate free margin.

Mandible (fig. 8e): Right lacinia mobilis bifid, with fine teeth, followed proximad by 4 plumose blades. Left lacinia mobilis armed with 4 robust teeth, followed by 6 plumose blades.

Labium (fig. 8f) with inner lobes; left outer lobe grooved.

Maxilla 1 (fig. 8g), palp 1-segmented, with 1 apical seta; inner lobe with 2-3 plumose setae.

Maxilla 2 (fig. 8h), setation on inner and outer lobes extended to lower half of each lobe; inner margin of inner lobe with 3 strong plumose setae.

Maxilliped (fig. 8i) with 3 robust dentiform spines of inner lobe arranged irregularly; inner margin with 4 plumose setae. Outer lobe not reaching distal outer end of palp segment 1. Inner margin of palp segment 2 straight; dactylus linear, with a bundle of slender setae.

Coxal plates 1-4 (figs. 9a-d) poorly setose on lower margin; proximal part of plate 4 excavate posteriorly and sloped anteriorly.

Gnathopod 1 (fig. 9a), anterior margin of basis with 3 long setae and 6 small distal setae. Carpal lobe with 2-3 basal setules only. Palmar angle of propodus swollen, armed with 2 slender, bifid spine-teeth; claw short, stout, without unguis.

Gnathopod 2 (fig. 9b), anterior margin of basis with 3 distal setae; carpal lobe with 2 basal setules; length of propodus 1.5 times that of gnathopod 1.

Pereiopods 3 and 4 (figs. 9c, d), merus and carpus moderately setose posterodistally.

Pereiopod 5 (fig. 9e) moderately setose; merus much wider than long; posterior margin of propodus with a single seta; dactylus with 0-2 anterior setae.

Pereiopod 6 (fig. 9f), merus expanded; carpus sublinear, about as long as propodus; posterior margin of propodus with 3 setae; dactylus with 7-9 setae on anterior margin.

Pereiopod 7 (fig. 9g) poorly setose; merus shorter than carpus; carpus shorter than propodus; propodus with 2 groups of posterior setae; dactylus armed with 14-16 anterior setae.

Pleopodal peduncles (fig. 10h) each with 5-6 retinacula; exopodite of first pleopod 16-segmented.

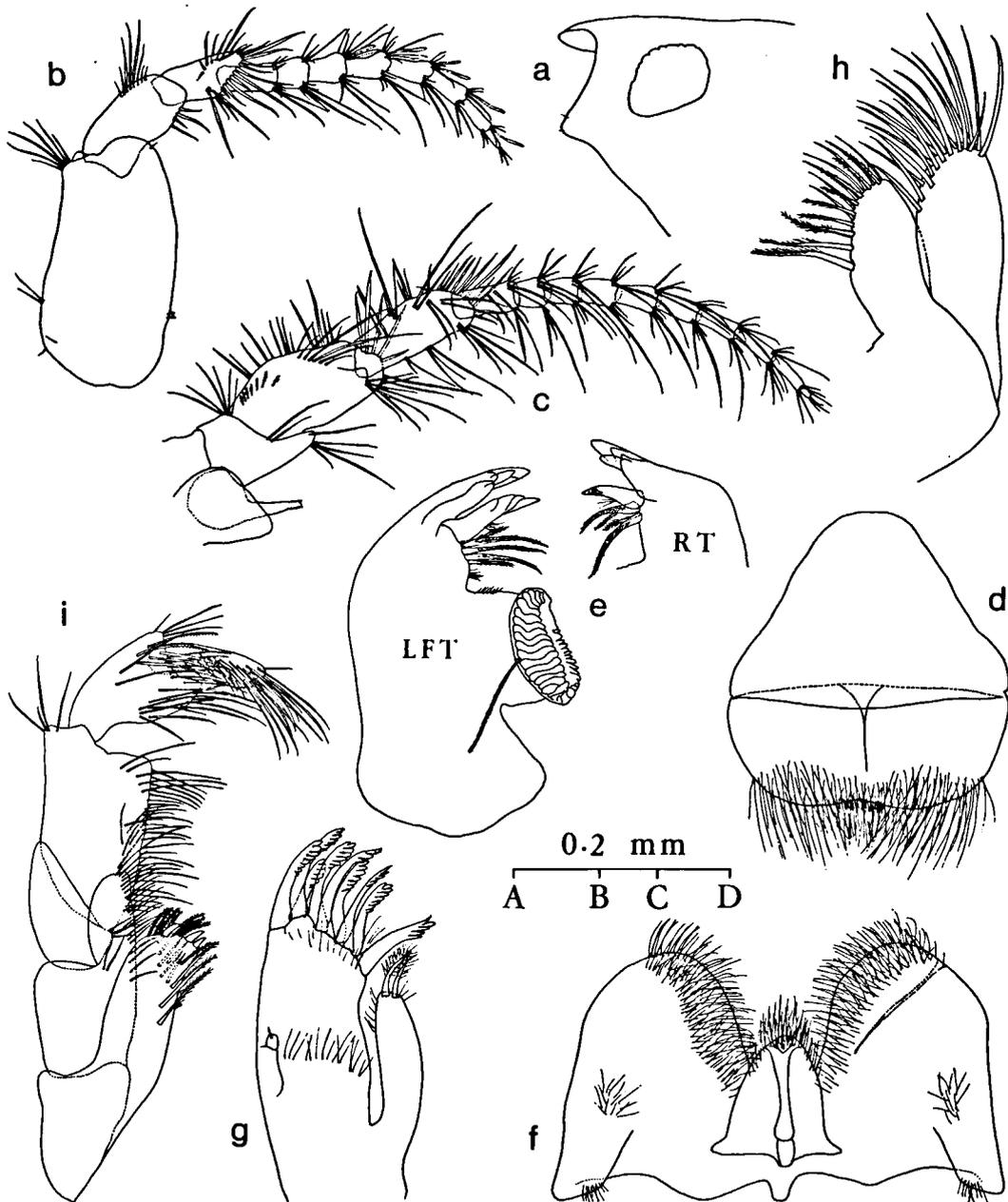


Fig. 8. *Haustorioides nesogenes* n. sp. (♂ holotype 6.7 mm from Myeongsasimri, Sinjido): a, head (scale AB); b, antenna 1 (AB); c, antenna 2 (AB); d, labrum (AD); e, mandibles (AD); f, labium (AD); g, maxilla 1 (AD); h, maxilla 2 (AD); i, maxilliped (AC).

Epimeral plate 1 (fig. 9h) with blunt posterodistal corner; plates 2 and 3 with medium-small point.

Uropod 1 (fig. 10i), peduncle with 5-6 spines.

Uropod 2 (fig. 10j) with 4 peduncular spines

(two of which short and stout).

Apex of uropod 3 (fig. 10k) with 2-3 setae; length of longest seta about half that of peduncle.

Telson slightly longer than wide, cleft very shallow.

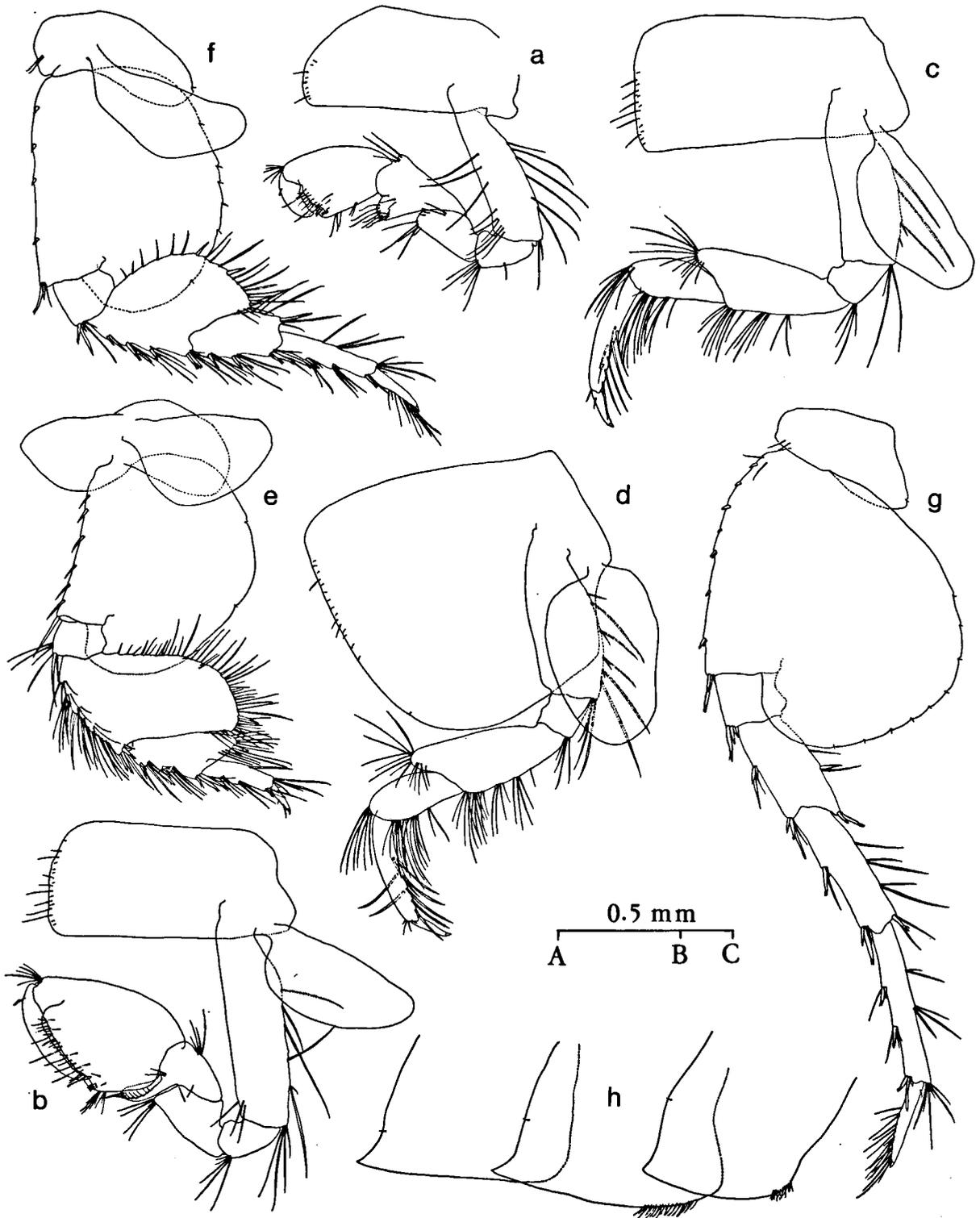


Fig. 9. *Haustorioides nesogenes* n. sp. (♂ holotype 6.7 mm from Myeongsasimri, Sinjido): a, gnathopod 1 (scale AB); b, gnathopod 2 (AB); c, pereiopod 3 (AB); d, pereiopod 4 (AB); e, pereiopod 5 (AB); f, pereiopod 6 (AB); g, pereiopod 7 (AB); h, epimeral plates 1 to 3 (AC).

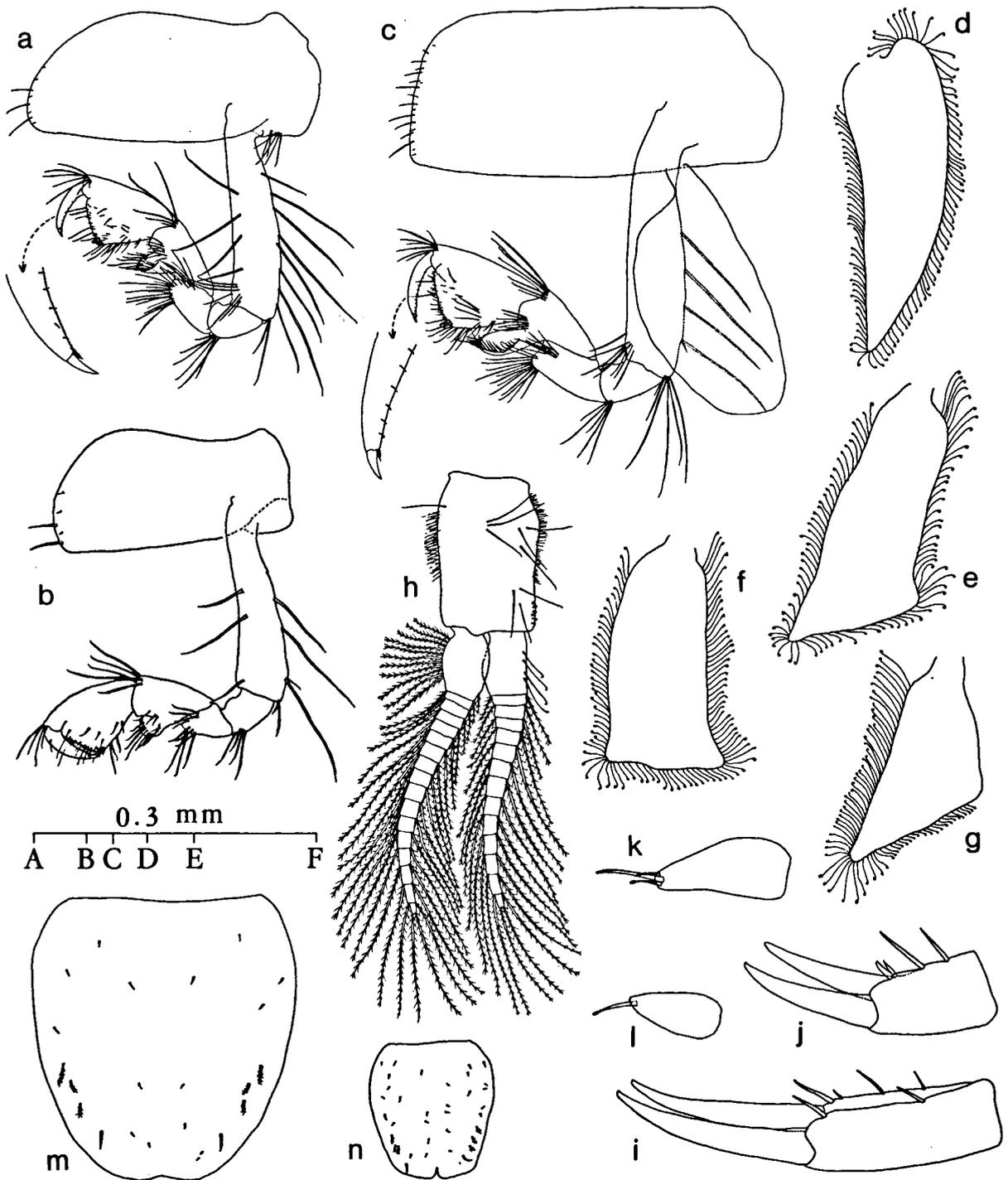


Fig. 10. *Haustorioides nesogenes* n. sp. (a, c-g, m, ♀ allotype 9.2 mm from Myeongsasimri, Sinjido; b, ♀ 3.3 mm from Simok, Dochodo; h-k, ♂ holotype 6.7 mm from Myeongsasimri, Sinjido; l, n, ♂ 4.1 mm from Simok, Dochodo): a, gnathopod 1 ♀ (scale AC); b, gnathopod 1 ♀ (AE); c, gnathopod 2 ♀ (AC); d, oostegite of gnathopod 2 ♀ (AB); e, oostegite of pereopod 3 ♀ (AB); f, oostegite of pereopod 4 ♀ (AB); g, oostegite of pereopod 5 ♀ (AB); h, pleopod 1 ♂ (AD); i, uropod 1 ♂ (AD); j, uropod 2 ♂ (AD); k, uropod 3 ♂ (AF); l, uropod 3 ♂ (AF); m, telson ♀ (AF); n, telson ♂ (AF).

Female: Coxal plate 1 (fig. 10a) anterodistally sloping.

Gnathopods 1 and 2 (figs. 10a, c) more setose than in male.

Gnathopod 1, anterior margin of basis with 4 longer setae and 7 small distal setae; basal part of carpal lobe with line of 7 setae; tip of dactylus with 2 minute blades, unguis present.

Gnathopod 2 (fig. 10c), anterior margin of basis with 7-8 distal setae; propodus and dactylus as in gnathopod 1 in shape and size; carpal lobe with row of 7 basal setae.

Oostegites on gnathopod 2 and P5 (figs. 10d, g) subtriangular, distally narrowing; those on P3 and P4 (figs. 10e, f) distally widened.

Remarks. — By the hardly emarginate telson, the present species differs from all other Korean *Haustorioides* species.

From *H. koreanus* the species can be distinguished by the poor setation on the posterior margin of P7, the small number of spines on the peduncle of uropod 1, the long apical seta on uropod 3, the equal acumination of the posterodistal corner of epimeral plates 2 and 3, the presence of anterior marginal setae on the basis of gnathopod 1, and the lack of an additional row of submarginal setae on maxillipedal palp segment 2.

From *H. latipalpus* and *H. indivisus* this species differs in the dense setation of the antennae and of the dactylus of P6-P7, the numerous slender terminal setae on the dactylus of the maxilliped, and the presence of an apical seta on the palp of maxilla 1. The oostegites on P5 resemble those of *H. indivisus* but differ from *H. latipalpus*.

Variations are found between the populations of this species. Preadults (body length 3.3-4.6 mm) from Dochodo and Bigumdo have a slightly deeper telson cleft (about 1/16 of telson length, fig. 10n) and a single apical seta on uropod 3 (fig. 10-l), while adults from the type-locality, Sinjido, show a barely cleft telson (fig. 10m) and 2-3 apical setae on uropod 3 (fig. 10k). Another variation can be seen in the shape of the female coxal plate 1 (fig. 10a) which is more strongly pointed posterodistally

in the type-locality but less so in Dochodo (fig. 10b) and Bigumdo.

Etymology. — The proposed specific name *nesogenes* is derived from the Greek, meaning "archipelago" (= Dadohae in Korean) where the animal is found.

Distribution and ecology. — The species was found in the southwestern islands of the Korean peninsula (fig. 1).

Ecologically this species occupies the upper part of the tidal zone. In Bigumdo (maximum tidal range ca. 4.0 m), it was collected above the mean tide level together with *H. koreanus*, while *H. indivisus* occupies the whole tidal range of the sandy beach. The same zonal distribution of the species was observed in Dochodo.

In May 1986, ovigerous females were found in the type-locality. The allotype (body length 9.2 mm) carried 111 eggs, egg size 0.26 × 0.31 mm.

Haustorioides indivisus n. sp.

(Figs. 11-13)

Material examined. — Prov. Kyeongki, Yongyodo, Eulwangri; 27 Apr. 1986, 1 ♂ holotype (ZMA Amph. 108.335a), 1 ovigerous ♀ allotype (ZMA Amph. 108.335b), 8 ♀♀ (6 ovigerous) and 7 ♂♂ paratypes (ZMA Amph. 108.335c), and 7 ovigerous ♀♀ and 7 ♂♂ paratypes (IMS).

Prov. Chungnam, Seosan, Hakampo; 19 Oct. 1986, 4 ♂♂ and 2 ♀♀.

Prov. Chungnam, Malipo; 21 Oct. 1986, 1 ♂.

Prov. Chungnam, Daecheon; 9 May 1986, 2 ♂♂ and 5 ovigerous ♀♀.

Prov. Cheonbuk, Okgu, Osikdo; 24 July 1986, 5 juvs.

Prov. Cheonnam, Bigumdo, Gurimri; 19 Oct. 1986, 380 specimens.

Description. — A small species (adult male 5.9-6.3 mm, ovigerous female 6.3-6.5 mm).

Male: Lateral cephalic lobes (fig. 11a) rounded triangular, not reaching end of rostrum. Eyes medium small, ovoid.

Antenna 1 (fig. 11b), flagellum 7-segmented, with relatively short, scarce setae; each segment with 1 or 2 aesthetascs except first and last one.

Antenna 2 (fig. 11c) with slender peduncle; flagellum 8- to 9-segmented, each segment distally with 2 long and some short setae.

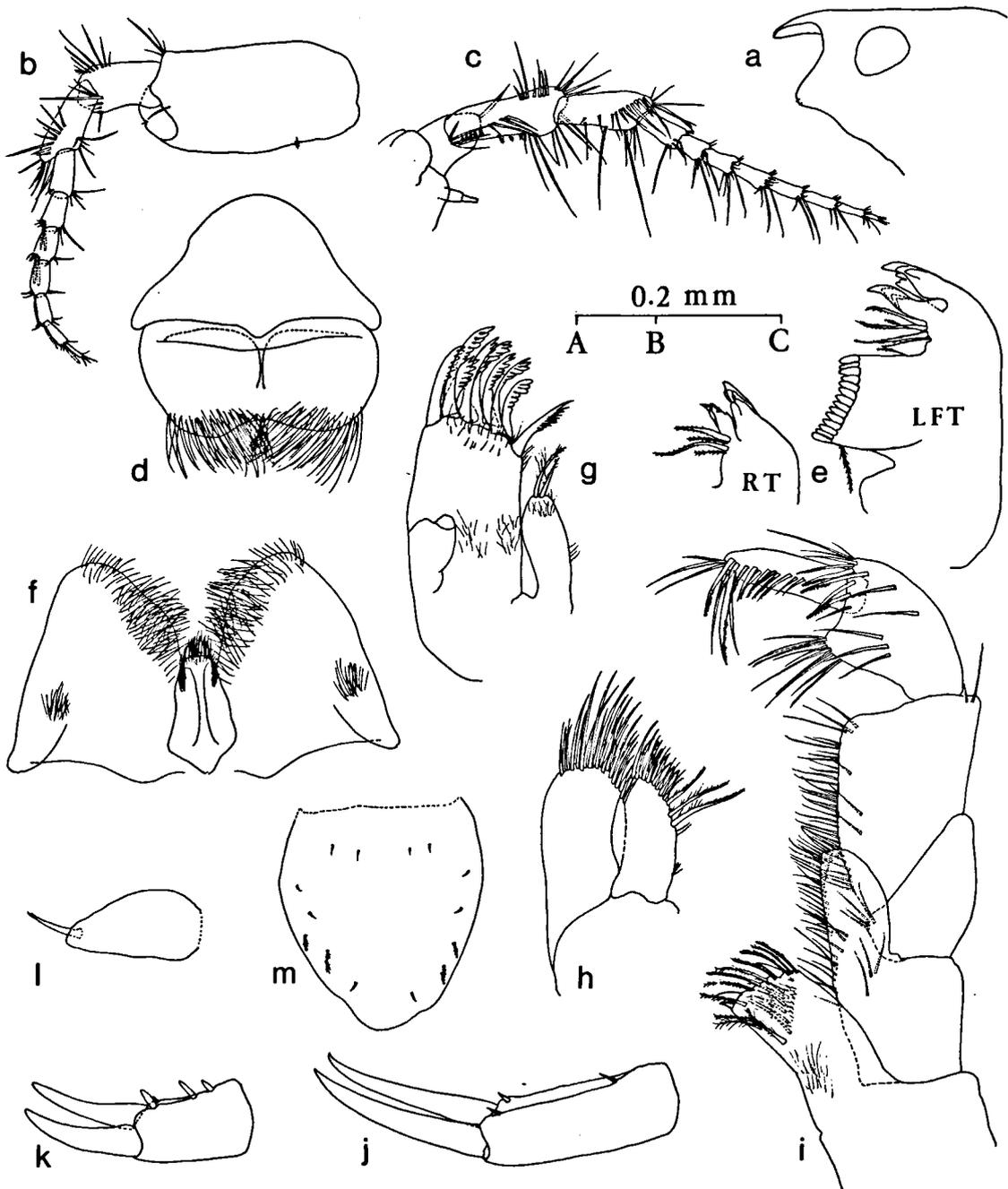


Fig. 11. *Haustorioides indivisus* n. sp. (♂ holotype 5.9 mm from Eulwangri, Yongyodo): a, head (scale AB); b, antenna 1 (AB); c, antenna 2 (AB); d, labrum (AC); e, mandibles (AC); f, labium (AC); g, maxilla 1 (AC); h, maxilla 2 (AC); i, maxilliped (AC); j, uropod 1 (AB); k, uropod 2 (AB); l, uropod 3 (AC); m, telson (AC).

Labrum (fig. 11d) emarginate at free margin.

Mandible (fig. 11e): Right lacinia mobilis with 3-4 medium-sized and 4-5 fine teeth; left lacinia mobilis with 4 robust teeth.

Labium (fig. 11f) of the usual structure; left outer lobe without groove.

Palp of maxilla 1 (fig. 11g) 1-segmented, without apical seta. Inner lobe short, with two plumose setae on apex.

Maxilla 2 (fig. 11h) of the usual structure; inner margin of inner lobe with 3 strong plumose setae.

Maxilliped (fig. 11i), arrangement of 3 dentiform spines on inner lobe irregular; inner margin with 4 plumose setae. Outer lobe medium short, not extending to outer tip of palp segment 1. Inner margin of palp segment 2 somewhat convex; dactylus linear; one of the apical spines on dactylus thicker and serrate.

Coxal plates 1-4 (figs. 12a-d) sparsely setose on lower margins.

Gnathopod 1 (fig. 12a), basis with 3 setae medioproximally, and 3 small setae anterodistally; carpal lobe with 2 small basal setules; palmar angle of propodus with 2 slender, bifid spine-teeth; dactylus short, stout, without unguis.

Gnathopod 2 (fig. 12b), carpal lobe with single basal setule only; length of propodus about 1.8 times that of gnathopod 1.

Pereiopods 3 and 4 (figs. 12c, d), posterior margin of merus and carpus relatively poorly setose.

Pereiopod 5 (fig. 12e) moderately setose; merus wider than long; posterior margin of propodus with single seta; dactylus with 0-1 anterior seta.

Pereiopod 6 (fig. 12f) less setose; carpus linear, shorter than propodus; posterior margin of carpus and propodus armed with 1-2 setae; dactylus with 3-4 setae anteriorly.

Pereiopod 7 (fig. 12g) sparsely setose; carpus shorter than propodus; posterior margin of propodus armed with single bundle of setae; dactylus with 7-8 anterior setae.

Pleopodal peduncles (fig. 12h) each with 5-6 retinacula; exopodite of first pleopod 15- to 16-segmented.

Epimeral plate 1 (fig. 12i) with medium-small posterodistal point; plates 2 and 3 with acute medium-large point.

Uropod 1 (fig. 11j) with 3-4 short, slender spines on peduncle.

Uropod 2 (fig. 11k) with 3 stout and 1 small peduncular spines only.

Apex of uropod 3 (fig. 11-l) with 1-2 setae; length of setae about half that of peduncle.

Telson (fig. 11m) never cleft; tapering distally; slightly longer than wide.

Female: Gnathopod 1 (fig. 13a), basis with 3 medioproximal and 4 anterodistal setae; basal part of carpal lobe with row of 5 setae; dactylus with unguis and 3 additional blades.

Gnathopod 2 (fig. 13b), anterior margin of basis with 2 distal setae; shape and size of propodus and dactylus similar to those in gnathopod 1; carpal lobe with 4 basal setules.

Oostegites on gnathopod 2 and pereiopod 5 (figs. 13b, e) subtriangular, distally narrowing.

Remarks. — From other Korean species of *Haustorioides* this species can be easily distinguished by its entire and distally tapering telson. The species resembles *H. latipalpus* and *H. nesogenes*, see remarks under these taxa for their morphological differences.

Etymology. — The specific name *indivisus* (from the Latin, meaning "not cleft"), alludes to the uncleft telson of the animal.

Distribution and ecology. — The species is widely distributed throughout the west coast of Korea (fig. 1). For its zonal distribution on intertidal sandy beaches, see the remarks under *H. nesogenes*.

Ovigerous females were found in April 1986 in the type-locality (Yongyoodo) and in May 1986 in Daecheon, with a small number of eggs. The allotype (body length 6.3 mm) carried 21 eggs, egg size 0.25 × 0.32 mm.

GENERAL REMARKS

Outside Korea, *Haustorioides japonicus* Kami-hira, 1977 seems to be very closely related to the three small Korean species of *Haustorioides* (*H. nesogenes*, *H. indivisus*, and *H. latipalpus*). Similarities between the three Korean species and *H. japonicus* are: Equal length of posterodistal point on epimeral plates 2 and 3; small but distinct inner lobe of labium; irregular intervals of three dentiform spines on inner lobes of maxilliped (two inner ones closely together and another one apart from them); relatively long apical seta on uropod 3.

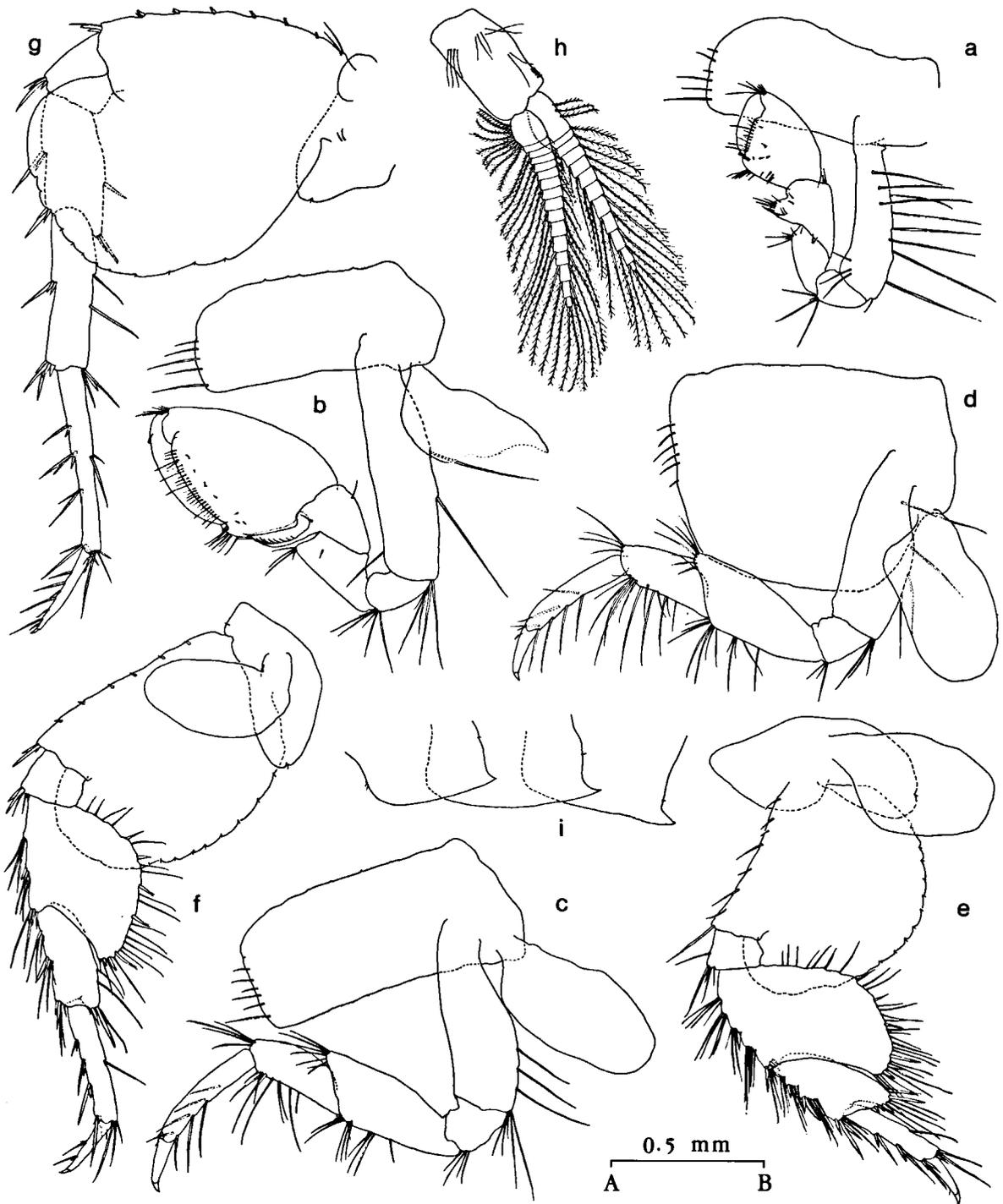


Fig. 12. *Haustorioides indivisus* n. sp. (♂ holotype 5.9 mm from Eulwangri, Yongyodo): a, gnathopod 1; b, gnathopod 2; c, pereopod 3; d, pereopod 4; e, pereopod 5; f, pereopod 6; g, pereopod 7; h, pleopod 1; i, epimeral plates 1 to 3. Scales: all AB.

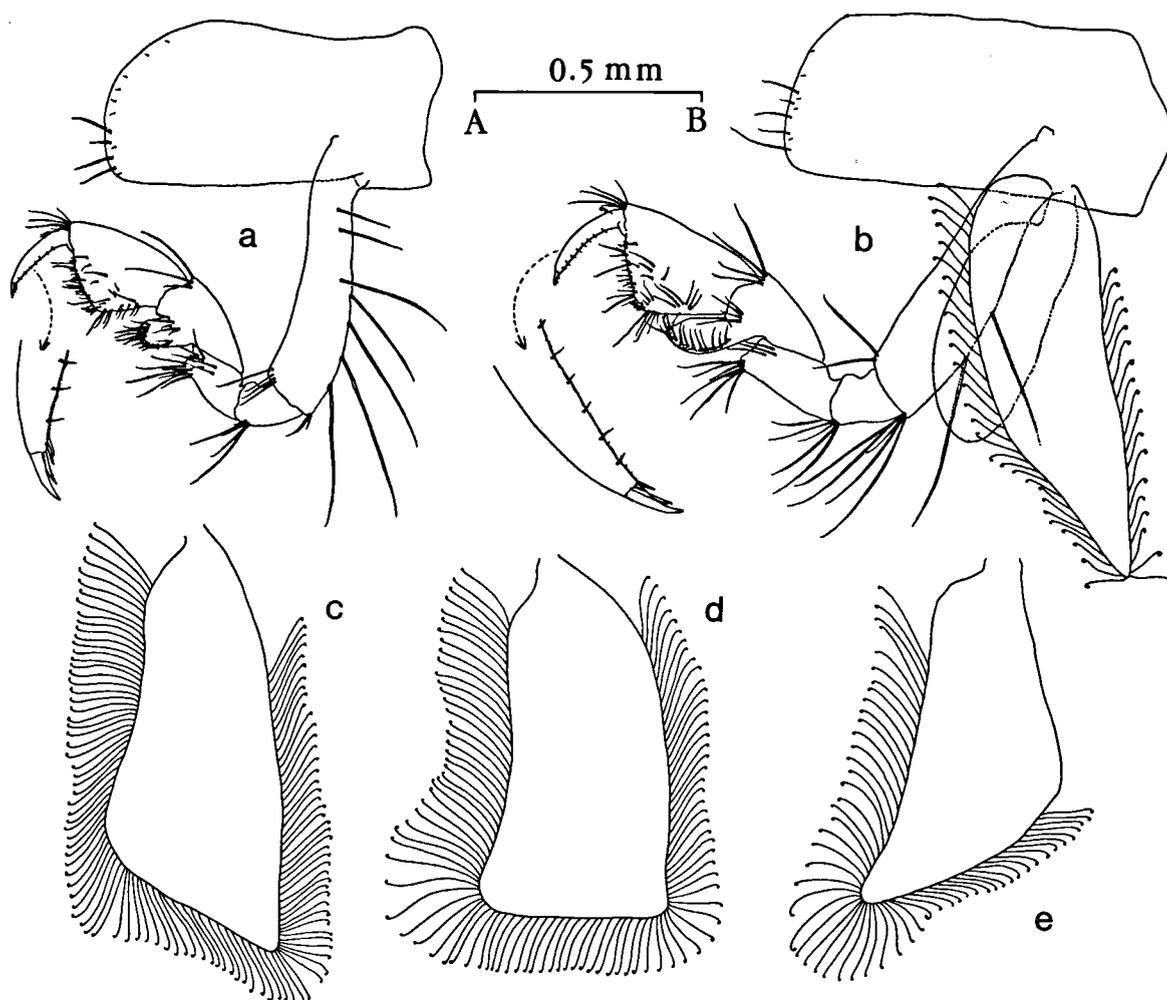


Fig. 13. *Haustorioides indivisus* n. sp. (♀ allotype 6.3 mm from Eulwangri, Yongyodo): a, gnathopod 1; b, gnathopod 2 with oostegite; c, oostegite of pereopod 3; d, oostegite of pereopod 4; e, oostegite of pereopod 5. Scales: all AB.

In his original description, Kamihira (1977) wrote that “*H. japonicus* does not have inner lobes of labium and has proboscoïd epistome.” But a topotype has distinct inner lobes of the labium and a normal epistome. He figured three regularly implanted dentiform spines on the inner lobes of the maxilliped, but a topotype shows irregular intervals of the dentiform spines as in the three small species of *Haustorioides*.

However, several marked differences are present in *H. japonicus*: Uncleft but not distally tapering telson, peduncle of uropods 2 and 3

with long spines only, and densely setose dactylus of P5-P7 (5-7, 20-25, and 40-50 setae, respectively).

Bousfield & Tzvetkova (1982) have separated *Eohaustorioides japonicus* from the genus *Haustorioides*. The criteria on which the new genus was established are not clear. However, if grounds exist in the shape of the telson and in the strong process of epimeral plate 2, this must be reconsidered, because the cleft of the telson is quite variable as seen in the three Korean species of *Haustorioides* (all three species have equal size of epimeral corners 2 and 3, but *H.*

indivisus has an uncleft telson, *H. nesogenes* has a hardly cleft telson, and *H. latipalpus* has a cleft telson).

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