

First Record of the Genus *Halectinosoma* (Copepoda: Harpacticoida: Ectinosomatidae) with Redescription of *H. perforatum* from Korea

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Abstract - The genus *Halectinosoma* Vervoort, 1962 is first reported from Korean waters by the discovery of *H. perforatum* Itô, 1981. This species, previously recorded only from Japan, is collected from the sandy beach on the south coast of Korea, and is well distinguished from other congeners by the combination of following morphological characteristics: the elongate caudal ramus; the remarkably bilobated exopod of female P5; the small innermost seta on the distal margin of female P5 exopod; the presence of three setae on the distal exopodal segment in P4; and the presence of scale-like spinules on the ventral surfaces of urosomite. We herein provide detailed description and illustrations of this species.

Key words: *Halectinosoma*, Ectinosomatidae, harpacticoid, Korea, taxonomy

INTRODUCTION

The family Ectinosomatidae Sars, 1903 shows high diversity and abundance in most marine habitats (Galassi *et al.* 1999; Seifried *et al.* 2007), and is composed of 236 species/subspecies belonging to 21 valid genera (Wells 2007; Sönmez *et al.* 2012). The genus *Halectinosoma* Vervoort, 1962 is one of the largest groups of 66 species in the family (Suárez-Morales and Fuentes-Reinés 2015). However, many taxonomists and ecologists have been trouble to identify the members of *Halectinosoma* because of the minor differences of morphological characters between them, the scarcity of adequate descriptions, and the absence of male records (Clément and Moore 2007; Kihara and Huys 2009).

To resolve this problem, Clément and Moore (1995, 2000, 2007) had tried to revise this genus, and they consequently redescribed nine reported species and erected 14 new species with detailed descriptions and figures of mouth parts and body surfaces in their revisions.

From the Korean coast, only two planktonic species included in the family Ectinosomatidae, *Microsetella norvegica* (Boeck, 1865) and *M. rosea* (Dana, 1847), have been known taxonomically (Lee *et al.* 2012), while Back *et al.* (2009) found the members of this family to be frequently occurred in sandy sediments during their investigation of marine meiobenthic communities in Yellow Sea. In the present study, we report *Halectinosoma perforatum* Itô, 1981 with detailed description and illustrations as a first report of the genus *Halectinosoma* from the south coast of Korea.

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MATERIALS AND METHODS

Samples were collected from sandy sediments using sieve of 212 μm mesh. Specimens were fixed initially with 5% formaldehyde-seawater solution, and preserved with 85% ethyl alcohol after sorting in the laboratory. Harpacticoid specimens were dissected and mounted on polyvinyl lactophenol or lactophenol solutions using tungsten needles under stereomicroscope (Discovery, V8; Carl Zeiss, Göttingen, Germany). All drawings were prepared on an aluminum hole slide adhered with a coverslip to prevent the compression of specimens, and were performed by light microscope (ECLIPSE 80i; Nikon, Tokyo, Japan) with the aid of a drawing tube. The examined materials were deposited in Chosun University and the National Institute of Biological Resources (NIBR) in Korea. The terminology of body and appendage morphology follows that of Huys and Boxshall (1991). Abbreviations used in the text and figures are: A1, antennule; A2, antenna; ae, aesthetasc; exp, exopod; enp, endopod; P1-P5, the first to the fifth thoracic legs; exp (enp)-1 (2, 3) to denote the proximal (middle, distal) segment of a three-segmented ramus.

RESULTS AND DISCUSSION

Order Harpacticoida Sars, 1903 갈고리노벌레 목
Family Ectinosomatidae Sars, 1903 날씬장수노벌레 과
Genus *Halectinosoma* Vervoort, 1962
모래날씬장수노벌레 속 (신칭)

Halectinosoma perforatum Itô, 1981 (Figs. 1-4)

구멍모래날씬장수노벌레 (신칭)

Synonym: *Halectinosoma perforatum* Itô, 1981, p. 431, figs. 7-11.

Material examined: Korea: 4♀♀, Sangju beach, Sangju-ri, Sangju-myeon, Namhae-gun, Gyeongsangnam-do (34°43'15"N, 127°59'21"E), 3 Oct. 2013. Kim J.G.

Description: Female. Body (Fig. 1A) fusiform, greatest width 206~216 μm (mean = 210 μm , n = 4) at second free somite, without boundary between prosome and urosome;

total length 1,146~1,212 μm (mean = 1,190 μm , n = 4) measured from distal margin of rostrum to posterior margin of caudal rami; surfaces of all somites and thoracic legs densely perforated (omitted in figure). Rostrum (Fig. 1A) well-developed, subtriangular in shape, fused to cephalothorax.

Prosome (Fig. 1A) 4-segmented, comprising cephalothorax and 3 free pedigerous somites. Cephalothorax as long as 3 succeeding somites combined; surface and posterior border with 22 sensilla dorsally; posterior border with row of fine setules. Each free prosomite with row of vertical creases, 1~3 rows of setules and 4~6 sensilla on dorsal surface.

Urosome (Fig. 1A, B) 5-segmented, comprising P5-bearing somite, genital double-somite, 3 postgenital somites. P5-bearing somite with 2 rows of setules dorsally; posterior border serrated. Genital double-somite (Fig. 1A, B) subdivided ventrally by transverse chitinous stripe, with 4 rows of setules, 4 pairs of sensilla on dorsal and lateral surfaces; ventral surface with row of setae and row of conspicuous scales; genital field with copulatory pore located in median and common plate bearing pair of setae (represented P6). Urosomite 4 with 4 rows of setules on dorsal margin, 2 rows of ventral setae and row of conspicuous scales. Posterior borders of genital double-somite and urosomite 4 serrated. Urosomite 5 with 2~4 rows of setules on surface; dorsal posterior margin with row of spinules laterally; pseudopericulum semicircular, reaching to end of anal somite, with row of vertical creases along posterior margin. Anal somite (Fig. 1B, C) cleft medially, with row of delicate setules proximally and 2 pairs of sensilla on dorsal margin; posterior margin with row of spinules laterally; cleft part with 2 rows of setules.

Caudal rami (Fig. 1A-C) longer than anal somite, with dorsal and ventral lappets, furnished with 7 setae: seta I stout; seta II and III short and slender, latter longer than former; setae IV well-developed, spinulose along its outer margin; seta V also well-developed, longer than seta IV (not exceeding total body length); seta VI stout, as long as caudal rami in length, spinulose along its inner margin; seta VII short and slender, issuing from inner distal corner dorsally.

Antennule (Fig. 1D) 5-segmented, short; segment 1 short with spinule on anterior margin; segment 2 thickest; segments 3 and 5 with aesthetasc fused with seta at its base, respectively; setal formula as follows: 1-[1], 2-[10], 3-[8+ae],

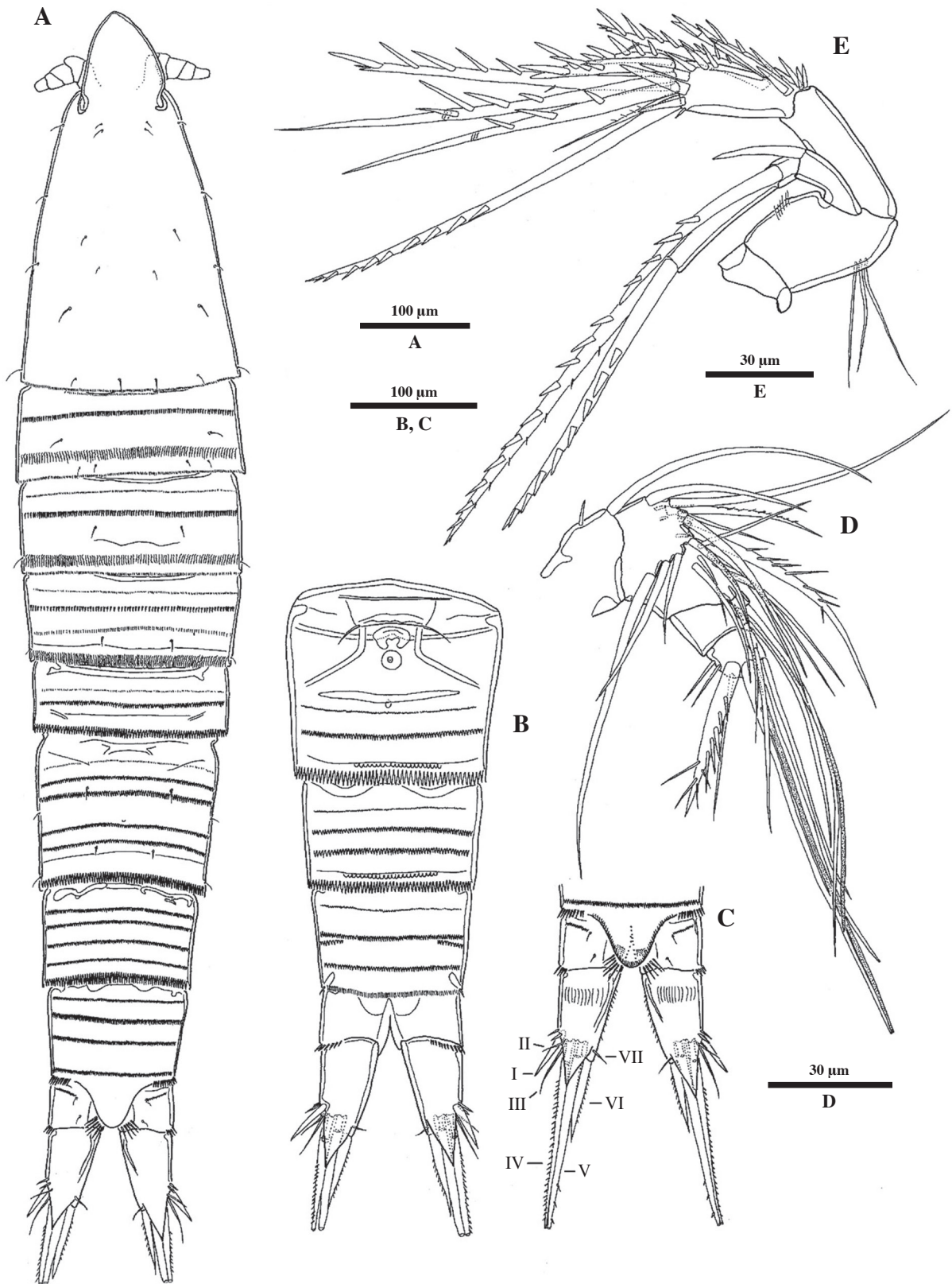


Fig. 1. *Halectinosoma perforatum* Itô, 1981, female. A, habitus, dorsal; B, urosome, ventral; C, anal somite and caudal rami, dorsal; D, antennule; E, antenna.

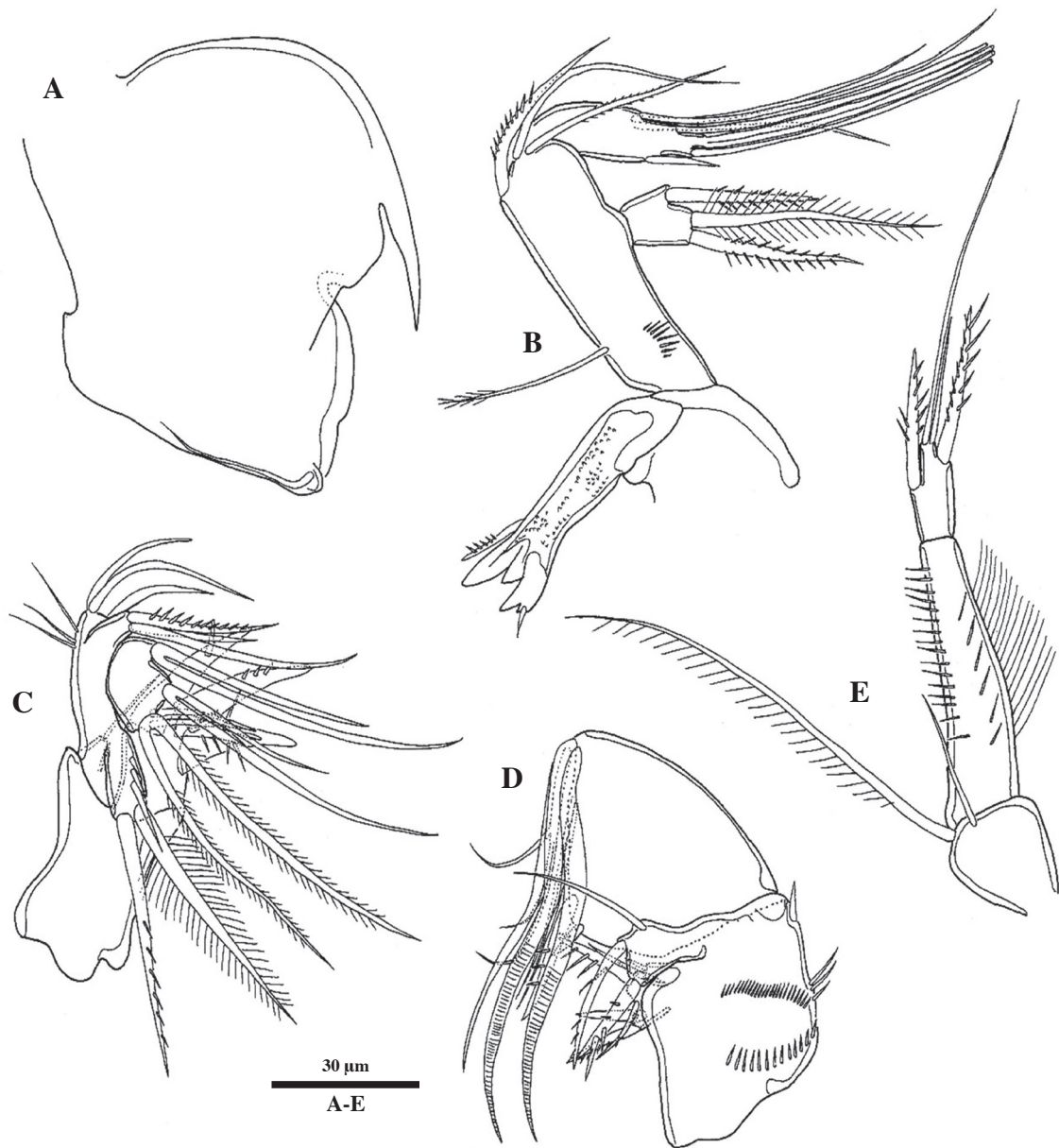


Fig. 2. *Haectinosoma perforatum* Itô, 1981, female. A, labrum; B, mandible; C, maxillule; D, maxilla; E, maxilliped.

4-[1], 5-[9 + ae].

Antenna (Fig. 1E). Coxa short. Basis with set of long setules and row of small setules. Exopod 3-segmented; proximal segment with bare stout seta; middle segment shortest, with spinulose seta; distal segment longest, longer than proximal and middle segments combined, with 2 long spinulose setae apically. Endopod 2-segmented; proximal segment longer and slender than basis in length; distal segment shorter than proximal segment, abexopodal margin furnished with 2 rows

of spinules and 2 spinulose setae, distal margin furnished with 2 short, 4 long spinulose and 1 short, slender plumose setae and row of spinules.

Labrum (Fig. 2A) well developed, with spinous projection.

Mandible (Fig. 2B). Gnathobase with 2 uicuspid and 1 tricuspid stout teeth on cutting edge and 1 spinulose seta at ventral corner; surface ornamented with small papillae. Basis 3 times as long as greatest width, with row of setules

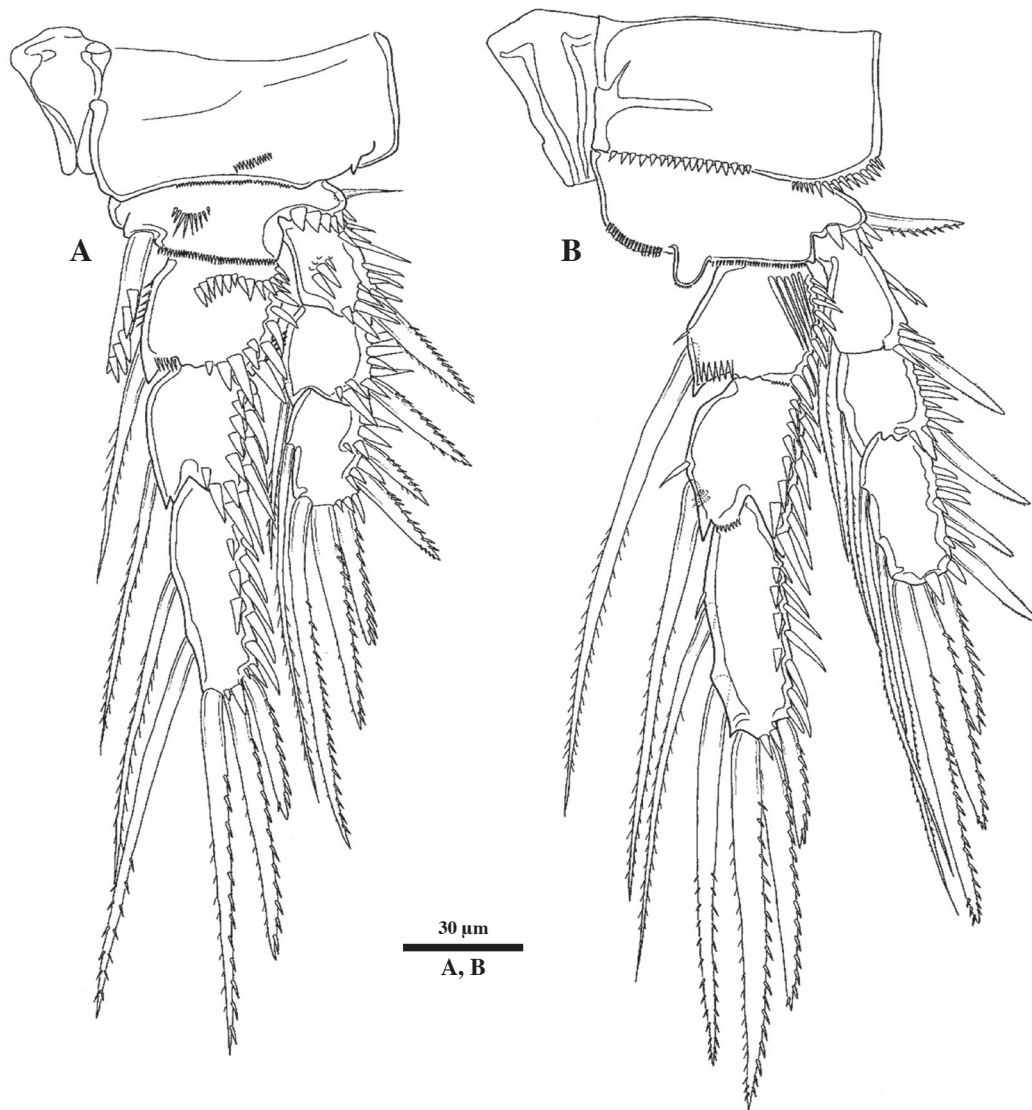


Fig. 3. *Halectinosoma perforatum* Itô, 1981, female. A, P1; B, P2.

and long seta proximally; distal corner with 1 spinulose, 1 pinnate and 1 naked setae. Exopod 1-segmented, short, with 2 spinulose and 1 plumose setae. Endopod 1-segmented, elongate, with 7 long and 1 short setae.

Maxillule (Fig. 2C). Praecoxal arthrite with 3 stout, spinulose claws on distal margin and 2 naked parallel and 1 spinulose setae on surface. Coxa small, with naked seta. Basis with long spinular set and 2 endites, each represented by 3 setae, respectively. Exopod 1-segmented, with row of spinules along lateral margin, and 1 spinulose and 1 plumose setae terminally. Endopod 1-segmented, with 3 pairs of long setae fused at base.

Maxilla (Fig. 2D). Syncoxa with 1 spinule, 3 rows of spinules, and 3 endites; proximal one with 2 spinulose and 2 bare setae, middle one with 2 bare setae, distal one with 2 spinulose and 1 naked setae. Allobasis swollen medially, longer than basis, with 2 spinulose setae. Endopod composed of 2 geniculate and 1 smooth long setae, with 2 slender, 1 three-forked setae.

Maxilliped (Fig. 2E). Syncoxa short, with 1 long, plumose and 1 short, bare setae. Basis elongate furnished with spinules and setules. Endopod as long as syncoxa in length, length ratio to greatest width 1.5 : 1, and with 2 stout spinulose setae on lateral margin and 2 naked apical setae.

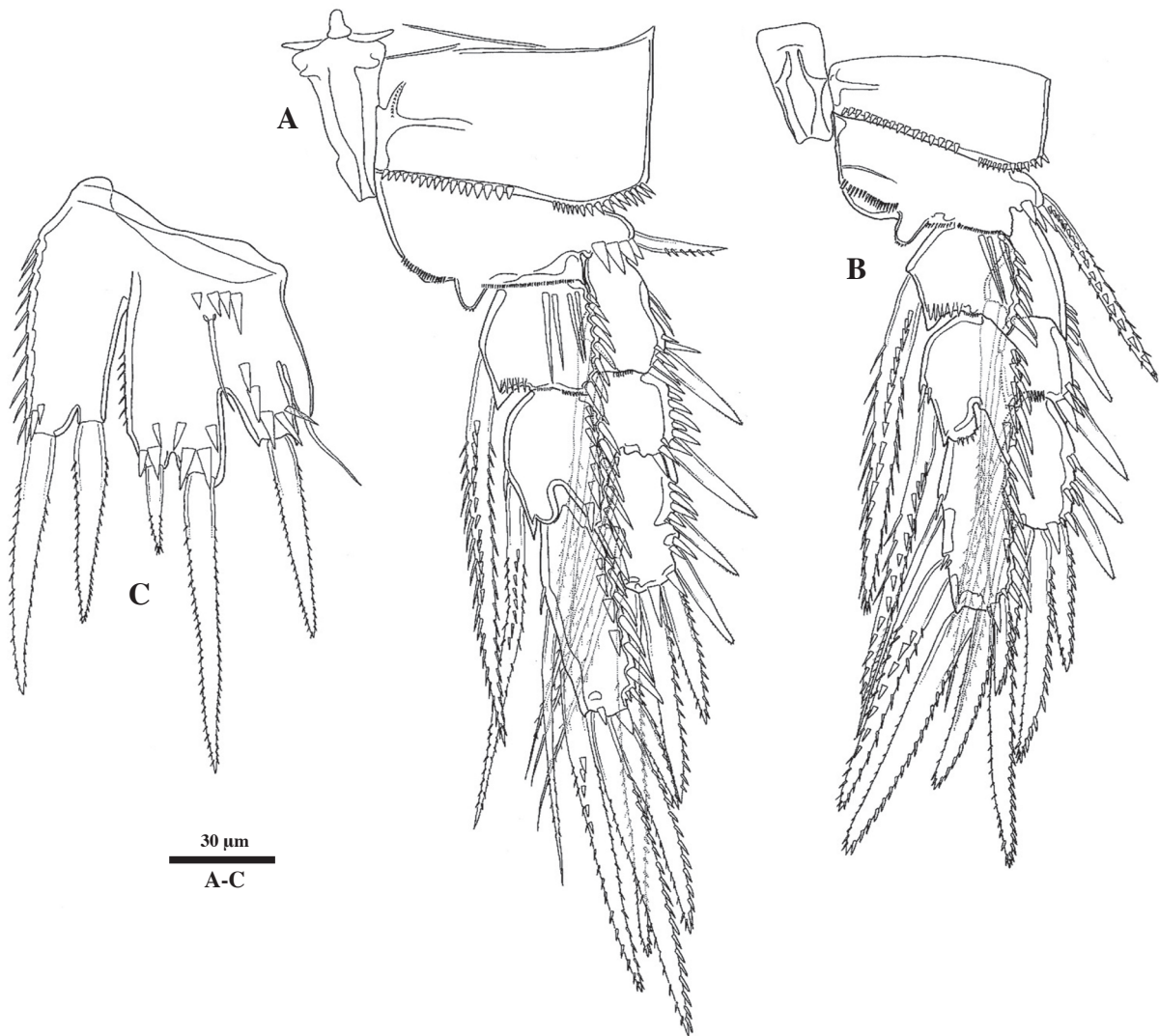


Fig. 4. *Halectinosoma perforatum* Itô, 1981, female. A-C, P3-P5.

P1 (Fig. 3A). Coxa subrectangular, with row of delicate spinules on distal margin and anterior surface, respectively. Basis with small outer seta and spinulose inner spine and set of spinules on surface; distal margin with row of delicate setules behind endopod and row of stout spinules behind exopod. Both rami 3-segmented, endopod longer and wider than exopod; outer margin of each segment with row of spinules, respectively; exp-1 and enp-1 with row of spinules on surface, respectively; exp-1 without inner seta.

P2~P4 (Figs. 3B, 4A, B). Coxa subrectangular, with 2 rows of spinules on distal margin and distal edge. Basis subrectangular, wider than that of P1; outer seta on P4 stout and elongate, reaching end of exp-2; ornamentation similar

to that of P1 except presence of protrusion on distal margin. Both rami 3-segmented, endopod longer than exopod; outer margin of each segment with row of spinules; enp-1 with row of long spinules on anterior surface; distal inner setae on enp-3 of P3 and P4 stout, spinulose and spine-like; exp-1 with inner seta.

Setal formula as follows:

	Exopod	Endopod
P1	0.1.123	1.1.221
P2	1.1.223	1.1.221
P3	1.1.323	1.1.221
P4	1.1.323	1.1.221

P5 (Fig. 4C). Baseoendopod shorter than width, with

outer peduncle bearing slender naked seta; endopodal lobe reaching 3/4 of exopod, with 2 spinulose setae apically, inner one of which longer than outer one; inner margin with row of spinules. Exopod longer than width, confluent with baseopod anteriorly, with 3 spinulose apical and 1 surface setae; among 3 apical setae, innermost one short, 1/3 of outermost one in length; surface seta slender, inserted near basal margin, bearing 4 stout spinules on its base; distal margin with deep incision between outermost and middle setae; anterior surface covered with stout spinules distally.

Male: Unknown.

Remarks: *Halectinosoma perforatum* Itô, 1981 of the present study is the first record of the genus *Halectinosoma* Vervoort, 1962 from Korean waters. Unfortunately, we could find only female specimens from the materials collected from Sanju beach on the south coast of Korea, but we are confident in the validity of identification based on the comparison with original description of Itô (1981) at characteristic features as follows: the antennule is five-segmented; the first segment of antennal exopod is not furnished with a row of spinules; the outer distal seta among three setae on the mandibular exopod is similar to the others in shape; the maxillipedal syncoxa is furnished with two setae; the third segment on P4 exopod has three inner setae; the exopod of female P5 is remarkably biobated with a small innermost seta on the distal margin; genital double-somite is ornamented with a row of conspicuous scales on the ventral surface; and the caudal ramus is 1.5 times as long as broad. However, the Korean specimens show some minor differences in that the anterior margin of rostrum is triangular (like male of Japanese materials), the antennary basis is ornamented with a set of long setules and the anal somite is furnished with spinular rows on dorsal cleft, while those features are not found in the original description (Itô 1981).

Halectinosoma perforatum has some affinities with *H. brunneum* (Bardy, 1905), *H. canaliculatum* (Por, 1964), *H. crenulatum* Clément and Moore, 1995, and *H. denticulatum* Clément and Moore, 1995 in that the presence of scale-like spinules on the urosomites ventrally and the shape of female P5 (Clément and Moore 1995). However, *H. perforatum* is easily distinguished from them by the following morphological characteristics: the P5 exopod is remarkably bilobated by a deep incision; the length ratio to the width of caudal ramus (1.5 : 1) is larger than those of other four spe-

cies (1.0 : 1 in *H. brunneum* and below 1.0 : 1 in remaining species); and the mandibular basis is furnished with a long seta instead of a set of long setules.

In the original description of *H. perforatum*, Itô (1981) mentioned that the scientific name of this species was derived from the perforated body ornamentation. However, this feature is occasionally ignored in many other species before the revision of Clément and Moore (1995) who paid attention to the detailed morphological features of body and appendages in *Halectinosoma* species. According to their revision, most species related with *H. sarsi* Boeck, 1873 have the similar perforations on the body surface. Thus, this perforated body ornamentation of *H. perforatum* seems not to be a key characteristic feature in spite of its scientific name.

Habitat: Sandy sediments, depth of 0~25 m.

Distribution: Pacific Ocean (Japan, Korea).

Deposition: NIBR No. NIBRIV0000307842, NIBRIV0000307843.

Identifiers: Jong Guk Kim, Seong Myeong Yoon.

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