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Descriptions and Records of Marine Harpacticoid Copepods from Hokkaido, VIII¹⁾

By

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(With 16 Text-figures)

The present paper deals with three species of marine harpacticoid copepods of the genera *Longipedia* Claus (Longipediidae), *Halectinosoma* Lang (Ectinosomatidae), and *Stenhelia* Boeck (Diosaccidae). These species, which are all new to science, were found in some samples of meiobenthos collected at a sandy bottom off Oshoro, Hokkaido (see Itô, 1978, 1979).

The type-series are deposited in the Zoological Museum, Faculty of Science, Hokkaido University.

Before going further, I would like to express my sincere thanks to Professor Mayumi Yamada, Hokkaido University, for reading the manuscript. This work was supported in part by a grant from the Itô Science Foundation.

Longipedia spinulosa n. sp.

(Figs. 1-6)

Female (holotype). Body (Fig. 1-1), rostrum and furcal setae excluded, about 1.05 mm long, colorless and semitransparent. Rostrum (Fig. 1-2) defined at base, well developed, 0.11 mm long, about 1.7 times as long as basal width, furnished with a few spinules on ventral face near its apex, and a pair of short sensillae on subapical rim. Cephalothorax as long as three succeeding somites, with numerous spinules along ventral (lateral) margins of its integument, of which hind edge very delicately serrated (Fig. 1-3). Pleurotergite of each thoracic somite furnished with numerous scattered spinules and spinular rows, finely serrated along hind edge (Fig. 1-4, 5, 6). Abdomen (Fig. 2-1, 2, 3) tapering behind, somewhat flattened dorso-ventrally, furnished with numerous scattered spinules dorsally, and interrupted or circumambient spinular rows. Genital double-somite approximately twice wider than anal somite, dorsally subdivided by a transverse

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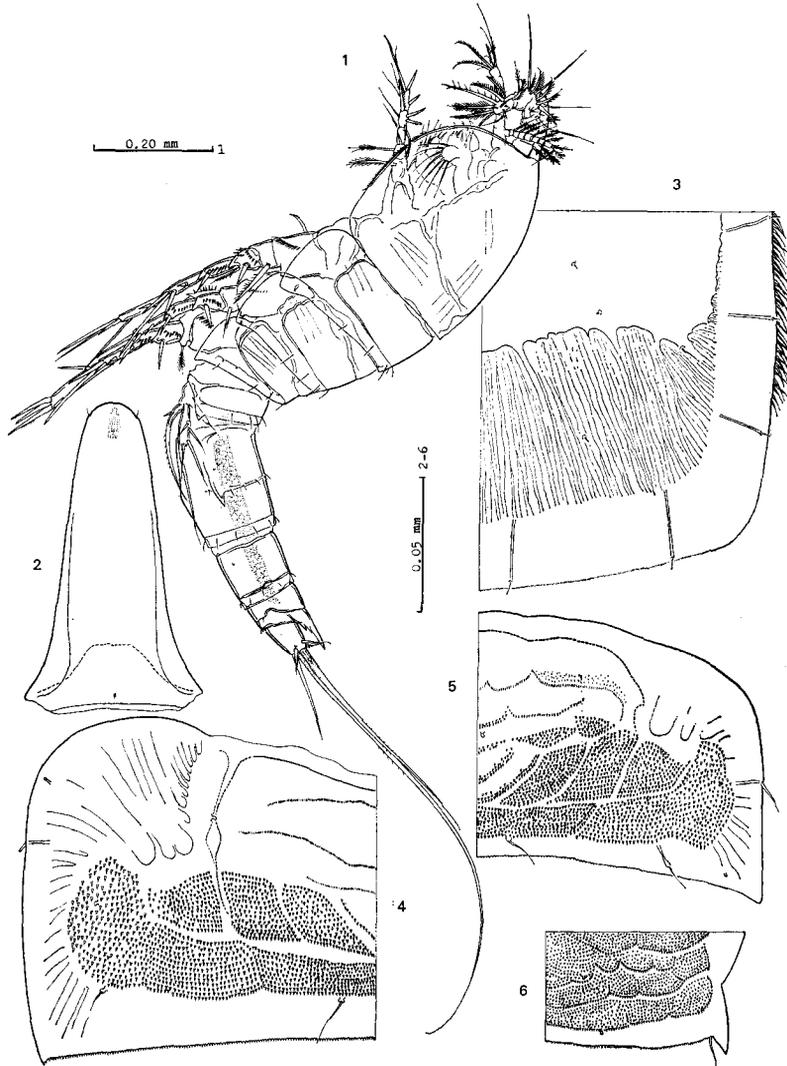


Fig. 1. *Longipedia spinulosa* n. sp. Female (holotype). 1. habitus, lateral; 2. rostrum; 3. integument of cephalothorax; 4. pleurotergite of first thoracic somite; 5. pleurotergite of third thoracic somite; 6. pleurotergite of fourth thoracic somite.

chitinous suture, on which no spinule occurs; anterior subdivision armed with a pair of well-developed lateral horns; posterior hyaline membrane incised finely. Antepenultimate somite a little longer than succeeding two somites combined; posterior hyaline membrane like that of genital double-somite. Penultimate

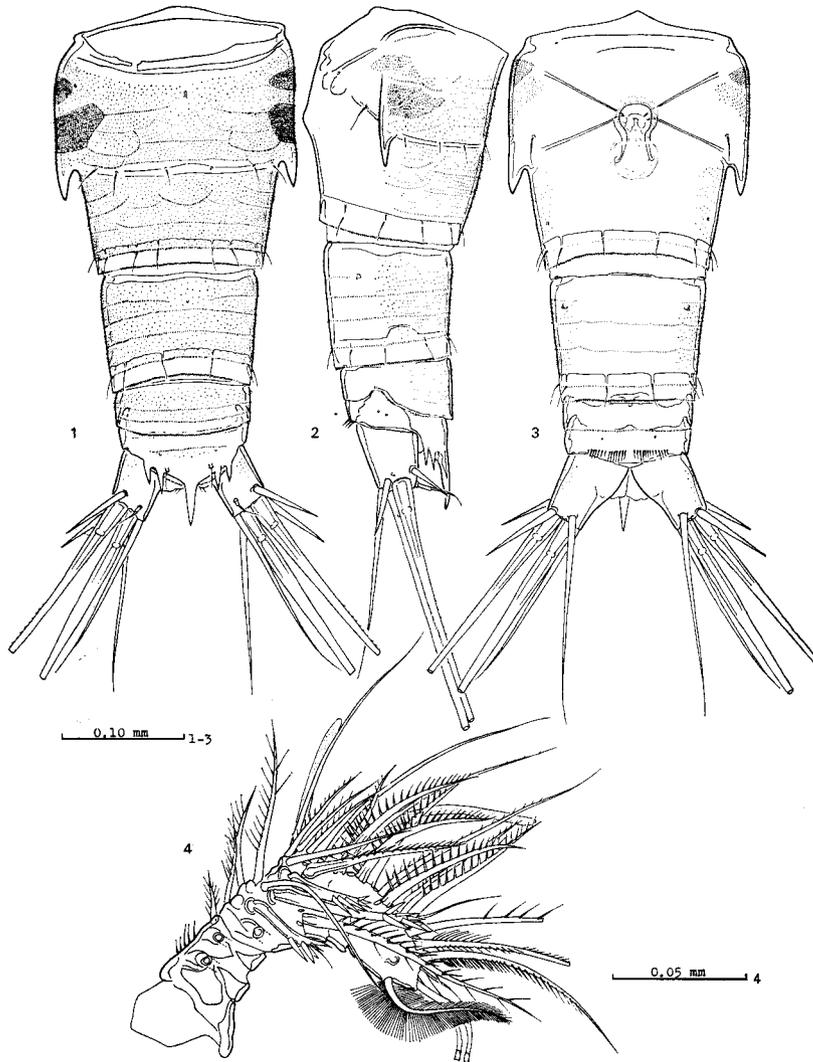


Fig. 2. *Longipedia spinulosa* n. sp. Female (holotype). 1. abdomen, dorsal; 2. abdomen, lateral; 3. abdomen, ventral; 4. antennule.

somite short, with no spinule on its ventral surface; posterior end (hyaline membrane less developed) finely incised. Anal somite furnished with a conspicuous transverse row of spinules ventrally; anal operculum with a well-developed median process, which reaches the posterior end of furcal ramus, and two pairs of short

side processes, all processes simply sharpening. Furcal ramus a little longer than wide; setal and spinal ornamentation as shown in figures; principal terminal setae tintured with pale brown proximally. *Antennule* (Fig. 2-4) seven-segmented (? six-segmented), armed with bare setae as well as spinulose setae; a plumose seta arising from apical segment. *Antenna* (Fig. 3-1). Coxa short, bare. Basis protruded outwards. Exopodite eight-segmented; second segment very short; each of first two segments armed with one plumose seta; each of third to seventh segments armed with one spinulose seta; apical segment with four spinulose setae terminally. Endopodite three-segmented; first segment about as long as two succeeding segments combined, with two setae subapically; second segment short, with five spinulose setae, two of which are small; third segment terminally with six spinulose setae and one bare setula. *Mandible* (Fig. 3-2, 3). Praecoxa much sclerotized, with a stumpy spinulose seta. Coxa-basis furnished with numerous hairs along inner margin and near outer edge, armed with two hairy setae near inner distal angle. Exopodite consisting of three segments, the middle longest; each of first two segments armed with two hairy setae along inner edge; third segment very short, with two well-developed plumose setae. Endopodite two-segmented; first segment twice longer than the second, widening distally, armed with two sparsely spinulose setae and one bare narrow seta on inner distal angle; second segment terminally with one bare, one sparsely spinulose, and four hairy or plumose setae. *Maxillula* (Fig. 3-4, 5). Arthrite of praecoxa with eight claws or spines along inner edge, two parallel setae on anterior face, one seta on posterior face near dorso-inner angle, and two closely set setae, one of which is markedly spinulose, on dorsal edge. Coxa armed with two spinulose spines and one spinulose seta on its inner process which reaches about the middle of arthrite of praecoxa; five plumose setae arising from outer edge. Basis widening inwards, with 12 more or less spinulose or hairy setae along inner edge; one bare setula arising from outer distal angle. Exopodite a little longer than wide, foliaceous, indistinctly two-segmented (a line of demarcation present on posterior face); first 'segment' armed with two narrow plumose setae on inner subapical edge, and ornamented with many scattered hairs on its anterior face and long hairs along inner margin; second 'segment' very short, armed with four long plumose setae and a short seta which locates near outer extremity. Endopodite represented by a small segment with five narrow setae. *Maxilla* (Fig. 3-6). Syncoxa with four endites; first (dorsal) endite with five hairy setae, dorsal two of which are distinctly longer than others (see Fig. 3-8); second to fourth endites each armed with three spinulose setae or spines apically or subapically. Basis forming a strong spiniform process accompanied by one spine and four setae. Endopodite consisting of two short segments, the first with four setae, two of which are spiniform, on and near inner edge and one seta, which bears very long spinules, near outer edge; second segment apically with three spiniform setae and one hairy seta. *Maxillipede* (Fig. 3-7). Coxa about twice longer than wide, armed with one big plumose seta on inner subproximal edge, eight spinulose setae along distal half of inner margin, and one long plumose seta on

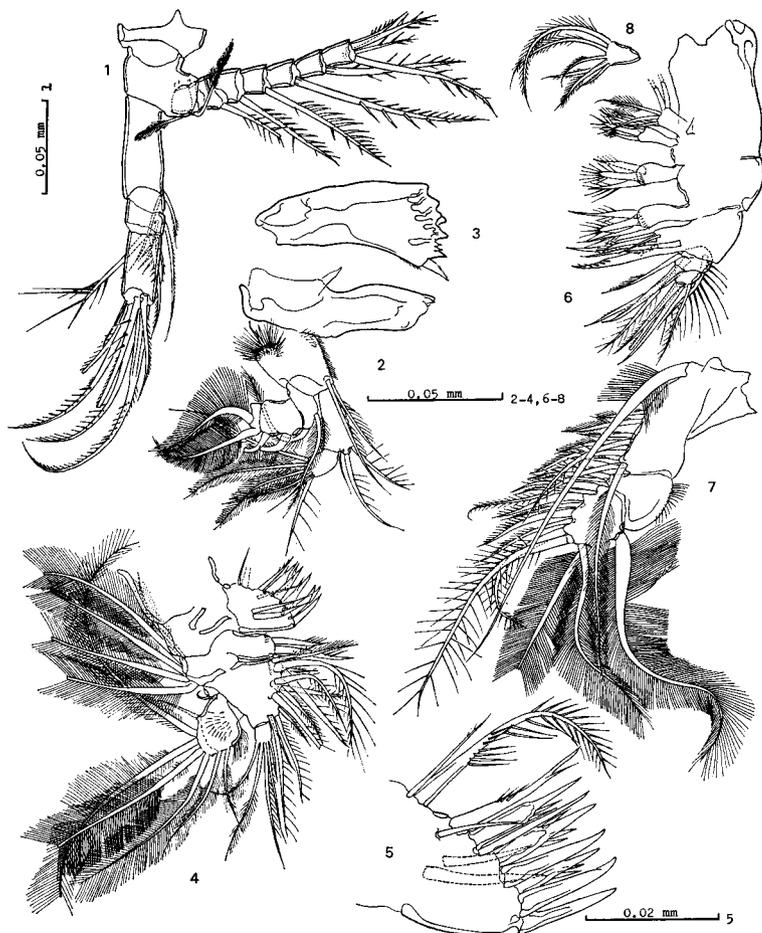


Fig. 3. *Longipedia spinulosa* n. sp. Female (1-7, holotype; 8, a paratype). 1. antenna; 2. mandible; 3. mandibular praecoxa; 4. maxillula; 5. arthrite of maxillular praecoxa; 6. maxilla; 7. maxillipe; 8. first endite of maxillary syncoxa.

inner distal angle. Basis triangular, armed with two spinulose setae on inner edge; outer margin hairy. Endopodite a little longer than wide, armed with eight spinulose inner marginal setae, distal two of which are long and sparsely spinulose, two plumose terminal setae, and one big plumose outer seta.

Leg 1 (Fig. 4-1). Segmentation and principal armature as shown in figure. Inner seta of first exopodite segment extending beyond second exopodite segment, hairy. Third exopodite segment armed with four spines and two setae in all. First endopodite segment furnished with a transverse row of long hairs on its

anterior face. *Leg 2* (Fig. 4-2). Segmentation and principal armature as shown in figure. Coxal inner seta stout, rather spiniform, with delicate spinules. Outer seta of basis thick, sparsely with long hairs. Anterior faces of both rami and posterior face of endopodite furnished with numerous delicate spinules. First endopodite segment forming a spiniform process on its outer distal angle, ornamented

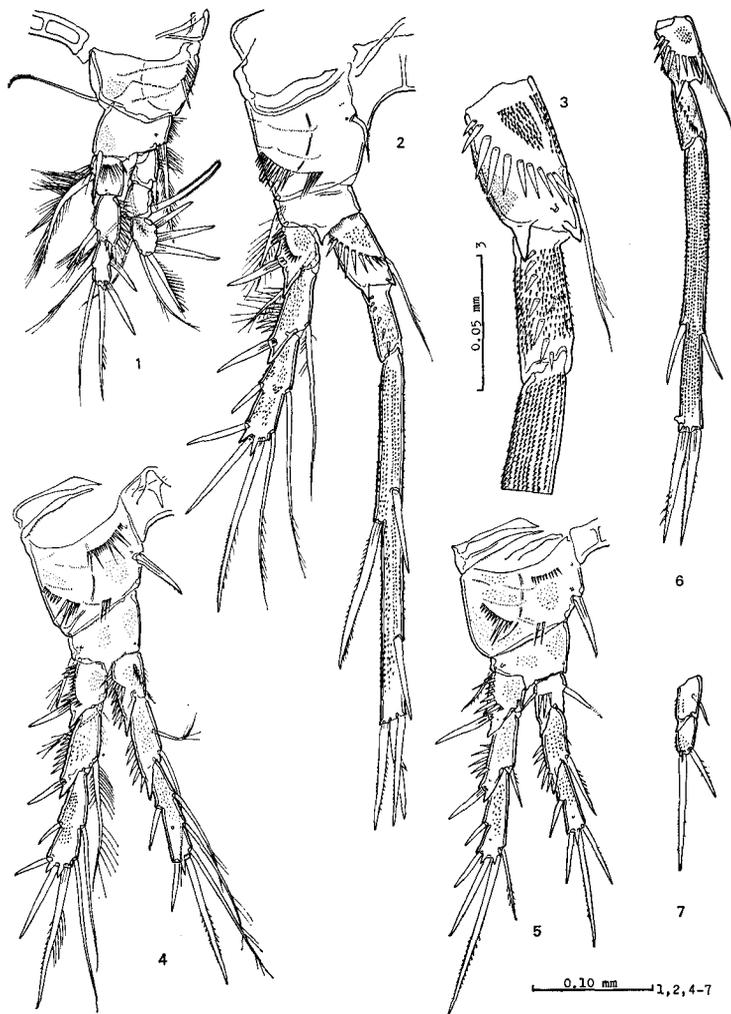


Fig. 4. *Longipeida spinulosa* n. sp. Female (1-5, holotype; 6-7, a paratype). 1. leg 1; 2. leg 2; 3. endopodite of leg 2; 4. leg 3; 5. leg 4; 6. abnormal endopodite of leg 2; 7. abnormal endopodite of leg 4.

with a conspicuous oblique row of spinules, which arises from outer proximal corner and extends toward the base of inner seta; very delicate short spinules scattered on and near outer edge. Second endopodite segment narrower than preceding segment, ornamented with a conspicuous vertical row of spinules on its anterior face, a fine setula (? hair) on the middle of posterior face (Fig. 4-3). Third endopodite segment about 2.5 times as long as preceding two segments combined; one stout spine arising from a ledge at the middle of outer margin, extending beyond the level of the base of second inner spine. *Leg 3* (Fig. 4-4). Anterior face of each ramus furnished with numerous fine spinules. Inner seta of first endopodite segment short. *Leg 4* (Fig. 4-5). Inner seta of first exopodite segment dwarfed. A setula arising from posterior surface of second endopodite segment near inner edge. *Leg 5* (Fig. 5-1). Bases represented by a common plate, with a long cylindrical process at each outer extremity; cylindrical process approximately as long as exopodite segment, terminating in a short hairy seta. Exopodite about three times longer than greatest width, apically truncated, furnished with numerous fine spinules on almost whole anterior (ventral) face, armed with six setae in all; first (counted from outer proximal) seta arising from a ledge (not a cylindrical process) at almost the middle of outer margin, short and hairy; second seta 2.5 times longer than first seta, arising from a ledge; third seta located at a subapical ledge of outer margin; fourth (terminal) seta arising from a very short cylindrical process, hairy; fifth seta short, not clearly articulated at its base; sixth (innermost) seta long, about three times as long as exopodite segment, furnished with a few hairs near its base. Endopodite represented by a subcylindrical segment which forms a very long spinulose seta without basal articulation; numerous fine spinules scattered on inner anterior face; a hairy seta arising from inner edge.

Male (allotype). Body (Fig. 5-2) about 0.8 mm long. Ornamentation of each somite almost as in the female described. Dorsal half of first abdominal somite (with leg 6) furnished posteriorly with a serrate hyaline membrane, of which each lateral extremity is connected with a spiniform process (Fig. 6-4, 5, 6). *Antennule* (Fig. 5-3) chirocer. *Antenna*, *mandible*, *maxillula*, *maxilla*, and *maxillipede* as in female.

Leg 1 as in female. *Leg 2* (Fig. 6-1). Basal segments and exopodite armed as in female. Endopodite: first segment with no spiniform process at its outer distal angle, furnished with two marked rows of long spinules on its anterior face; second segment with no vertical row of conspicuous spinules (cf. Fig. 4-3 and Fig. 6-2), armed with two fine setulae (? sensillae) on its posterior face; third segment medially with one outer spine as in female. *Leg 3* and *leg 4* as in female. *Leg 5* (Fig. 6-3). Bases represented by a common plate, furnished with a long cylindrical process at each outer extremity; cylindrical process a little tapering apically, sparsely spinulose, terminating in a seta (broken); some short spinules scattered on ventral face near exopodite and endopodite. Exopodite about 1.6 times as long as greatest width, furnished with numerous short spinules on whole anterior (ventral) surface, armed with eight setae in all; each of first three setae (counted from outer)

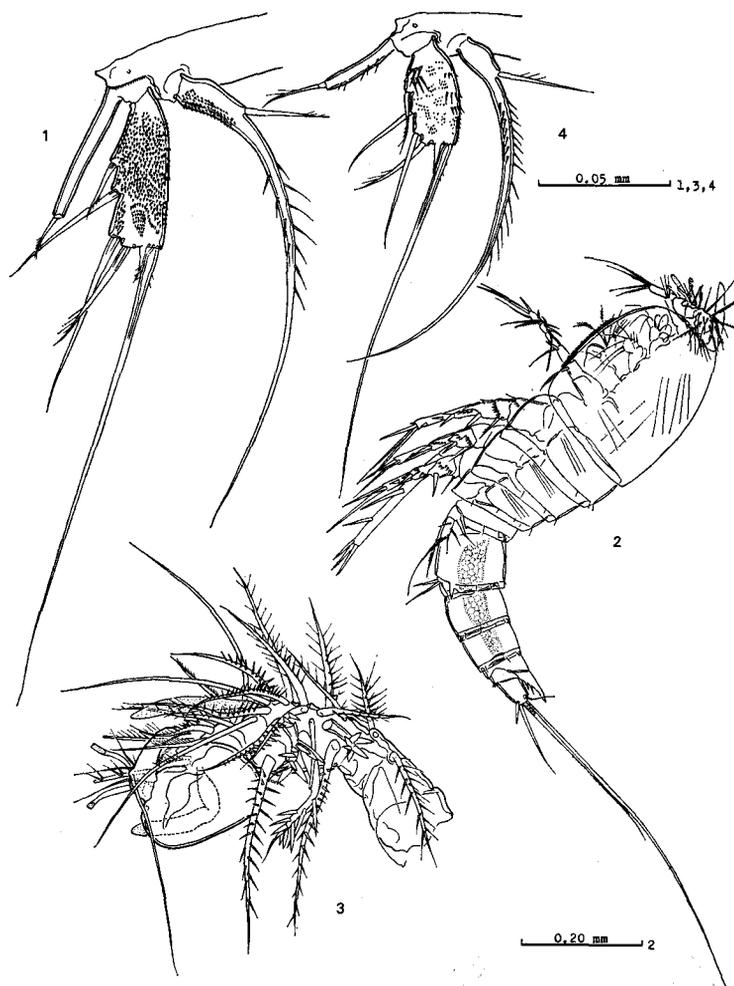


Fig. 5. *Longipedia spinulosa* n. sp. Female (holotype). 1. leg 5. Male (allotype). 2. habitus, lateral; 3. antennule. *Longipedia coronata* Claus from Banyuls-sur-Mer, France. Female. 4. leg 5.

arising from a ledge; third seta narrow and bare; fourth (terminal) seta with a few long hairs; fifth seta narrow and short, not clearly defined at base; sixth seta longest, 3.5 times as long as this exopodite segment, with a few minute spinules proximally; seventh and eighth setae set close to each other, bare and narrow, not clearly defined at base. Endopodite represented by a big seta which is about 2.5 times as long as exopodite segment, bilaterally spinulose; a setula arising from

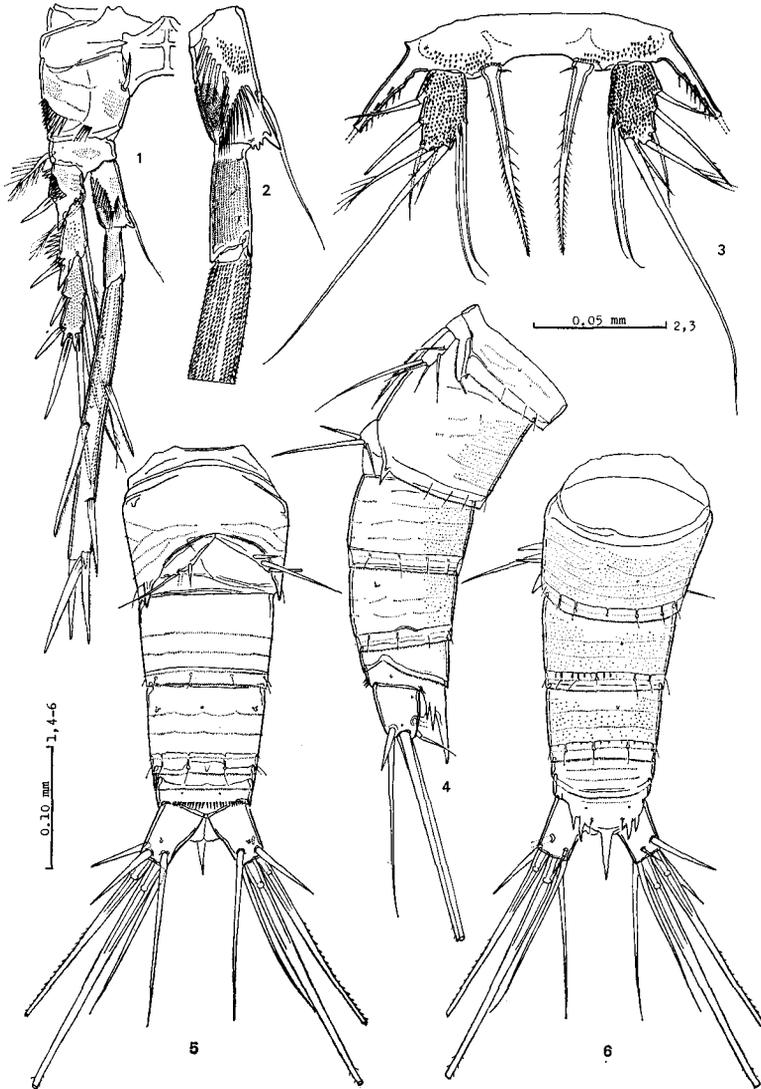


Fig. 6. *Longipedia spinulosa* n. sp. Male (allotype). 1. leg 2; 2. endopodite of leg 2; 3. leg 5; 4. leg 5 and abdomen, lateral; 5. abdomen, ventral; 6. abdomen, dorsal.

subproximal inner edge. *Leg 6* (Fig. 6-4, 5) represented by a simple plate armed with two spiniform setae and one narrow seta.

Variation and abnormality. Three females and two males, including the holotype and the allotype, were dissected and examined. No marked variation in

major characters is found among them, though a paratypic female shows some aberrant structures in the right leg 2 and the right leg 4 (Fig. 4-6, 7). A few minute spinules are detected on the basal cylindrical process of leg 5 in a paratypic female. No difference is detected between two males in the setal armature of the exopodite of leg 5.

Remarks. The present new species resembles *L. coronata* Claus, 1863, *L. weberi* A. Scott, 1909, and *L. kikuchii* Itô, 1980 in the structure of the anal operculum. *L. weberi* which was recently re-described by Itô (1980) is identical with the new species also in having eight setae on the exopodite of leg 5 of the male, but these two species are readily discernible from each other not only in the shape of the leg 5 but also in the ornamentation of abdominal somites, proportion of the rostrum, appearance of the coxal seta of leg 2, etc. The males of *L. coronata* and *L. kikuchii* have seven setae on the exopodite of leg 5 (see Sars, 1903, and Itô, 1980).

As was already stressed by Itô (op. cit.), many records of *L. coronata* are problematic, and a thorough re-examination is strongly necessary. In order to clear the difference between *L. coronata* and the present new species, I carefully examined a female specimen which was collected at Banyuls-sur-Mer, France, and was identifiable as *L. coronata* illustrated by Sars (1903) in every respect (but setal number of the last exopodite segment of leg 1 was different). The exopodite of leg 5 of this specimen (Fig. 5-4) closely resembles that of Sars's *L. coronata*. If this specimen is exactly of *L. coronata*, it is quite easy to distinguish *L. coronata* and the new species even in the female leg 5 only (cf. Fig. 5-1 and Fig. 5-4) because the proportion as well as general shape of the segment and, further, spinular ornamentation are clearly different between them.

Type-series. Holotype: adult female. Paratypes: two adult females and two adult males, one of which is the allotype. Type-locality: Oshoro, Hokkaido. All the specimens were collected from sandy bottom at a depth of about 25 m (11-VIII-1977, Itô leg.).

The specific name was chosen to denote the markedly spinulose exopodite of leg 5 of both sexes.

Halectinosoma perforatum n. sp.

(Figs. 7-11)

Female (holotype). Body (Fig. 7-1, 2), rostrum included, about 1.1 mm long, fusiform, colorless and opaque (due to rough surface). Integuments of all somites as well as thoracic legs densely perforated. Rostrum prominent, apically rounded in dorsal aspect, not defined at base. Cephalothorax as long as three succeeding thoracic somites combined; hind edge of integument finely serrated (Fig. 7-3). Each pleurotergite of first three thoracic somites finely serrated along posterior edge, furnished with two or three transverse rows of spinules (Fig. 7-4). Pleurotergite

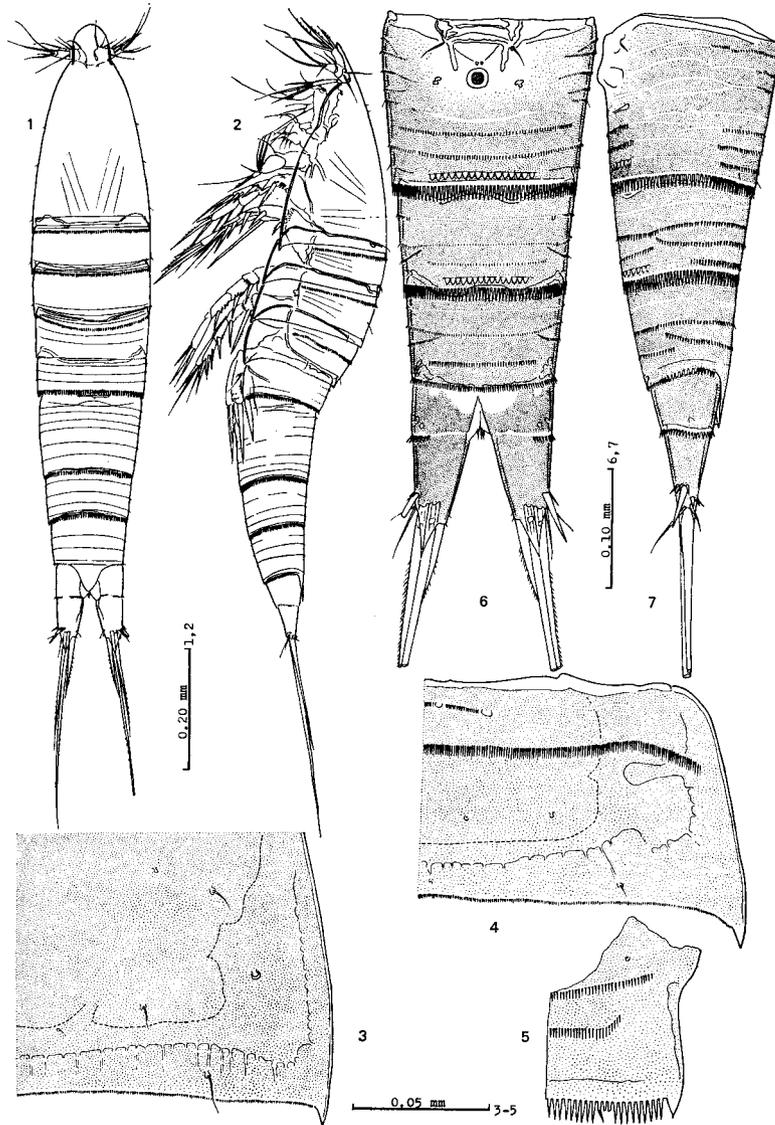


Fig. 7. *Halectinosoma perforatum* n. sp. Female (holotype). 1. habitus, dorsal; 2. habitus, lateral; 3. integument of cephalothorax; 4. pleurotergite of first thoracic somite; 5. pleurotergite of fourth thoracic somite; 6. abdomen, ventral; 7. abdomen, lateral.

of fourth thoracic somite coarsely serrated along its hind edge (Fig. 7-5), with two transverse rows of spinules. Genital double-somite partially subdivided into two parts by a smooth transverse stripe on ventral surface (Fig. 7-6); a pair of fine setulae attached onto genital area; a transverse row of scale-like spinules present on ventral surface along posterior edge; posterior hyaline membrane markedly serrated due to deep incisions. Antepenultimate somite ornamented ventrally with a transverse row of scale-like spinules as in genital double-somite. Penultimate somite forming a pseudopericulum which is very thin and tongue-shaped, furnished with a few transverse rows of fine spinules laterally and ventrally. Anal somite short, with smooth areas on its ventral face (Fig. 7-6). Furcal ramus seemingly confluent with anal somite, but demarcated by a smooth suture and a spinular row which lies on outer face (Fig. 7-6, 7, and Fig. 8-1), much longer than wide (about 1.5 times as long as wide, posterior hyaline lappets neglected), a little flattened dorso-ventrally, tapering posteriorly; setal and spinular ornamentation as shown in figures. *Antennule* (Fig. 8-2) consisting of five short segments. At least two setae of second segment and one thick seta of last segment spinulose. *Antenna* (Fig. 8-3). Coxa short, with no spinule. Basis longer than thick, with a few spinules and hairs. Endopodite two-segmented; first segment with neither spine nor seta; second segment as long as the first, furnished with conspicuous stout spinules proximally and distally, armed with two spinulose spines on anterior face at basal third of the length, three spinulose spines, two geniculate spiniform setae, and one long seta, which bears a narrow branch basally, on distal end. Exopodite as long as endopodite, consisting of three segments, the first armed with one short bare spine distally, the second very short, armed with one sparsely spinulose spine which extends beyond third segment; third segment a little longer than preceding two segments combined, armed with two long terminal setae which are stout and sparsely spinulose. Both rami and anterior surface of basis perforated. *Mandible* (Fig. 8-4). Praecoxa sparsely perforated, armed with a short spinulose seta at ventral base of unidentate (?) pars incisiva; lacinia four-dentate. Coxa-basis elongate, with a row of short spinules near base, one very narrow elongate spinule (? seta) on inner (dorsal) edge subproximally, and armed with three setae apically. Exopodite two-segmented; first segment armed with three setae on inner subapical edge, one seta on apical end close to second segment, and one short seta on subapical outer edge; second segment very short, armed with two terminal and two lateral setae, all not clearly defined at base. Endopodite represented by a small segment with one inner and two terminal setae. *Maxillula* (Fig. 9-1). Arthrite of praecoxa armed with three unguiform spines and one short seta on inner edge, two short parallel setae on anterior face. Coxa very short, with one bare seta on inner edge. Basis armed with two sets of three close setae, one set located at dorso-inner angle and the other located at ventro-inner angle; a few spinules attached onto dorsal margin. Exopodite (broken in this specimen; cf. Fig. 9-5) represented by a small segment armed with two bilaterally spinulose (? plumose) thick setae terminally, and fringed with spinules along its inner margin. Endopodite represented by a

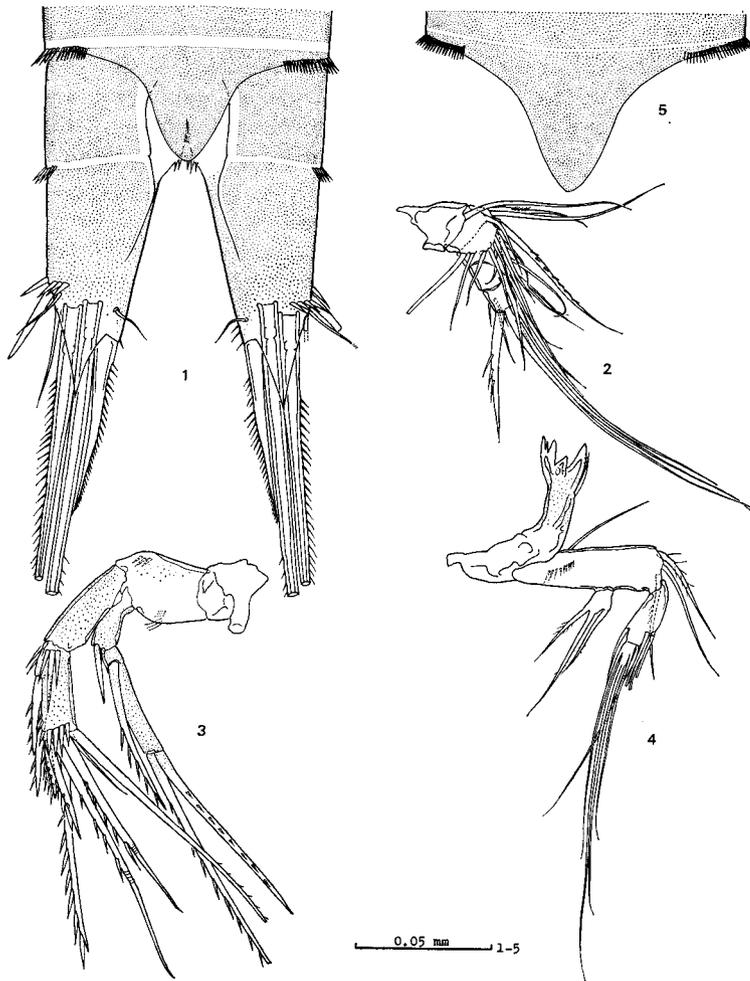


Fig. 8. *Halectinosoma perforatum* n. sp. Female (1-4, holotype; 5, a paratype). 1. posterior abdominal somites, dorsal; 2. antennule; 3. antenna; 4. mandible; 5. pseudo-periculum.

segment with two closely set setae on a ledge at about the middle of inner margin and four apical setae, outer two of which are bilaterally spinulose. *Maxilla* (Fig. 9-2). *Syncoxa* with three transverse rows of spinules and three endites; first endite short, widening apically, armed with four setae; second endite cylindrical, armed with two apical setae, one of which is dwarf; third endite longest, armed with three apical setae. *Basis* longer than *coxa*, swelling out inwards, armed with two

spinulose stout setae on about the middle of inner edge. Endopodite consisting of at least two rudimentary segments, the first armed with one thick geniculate seta and two small setae; second segment armed with two thick setae, one of which is geniculate and accompanied by a hair basally, and the other is smooth and rather rigid, subproximally with a bifurcate (? trifurcate) branch (Fig. 9-3; cf. Fig. 9-6). *Maxillipede* (Fig. 9-4). Basis (broken; cf. Fig. 9-7) short, armed with two setae,



Fig. 9. *Halectinosoma perforatum* n. sp. Female (1-4, holotype; 5-7, a paratype). 1. maxillula; 2. maxilla; 3. apical part of maxilla; 4. maxillipede; 5. maxillula, praecoxa omitted; 6. maxilla; 7. maxillipede.

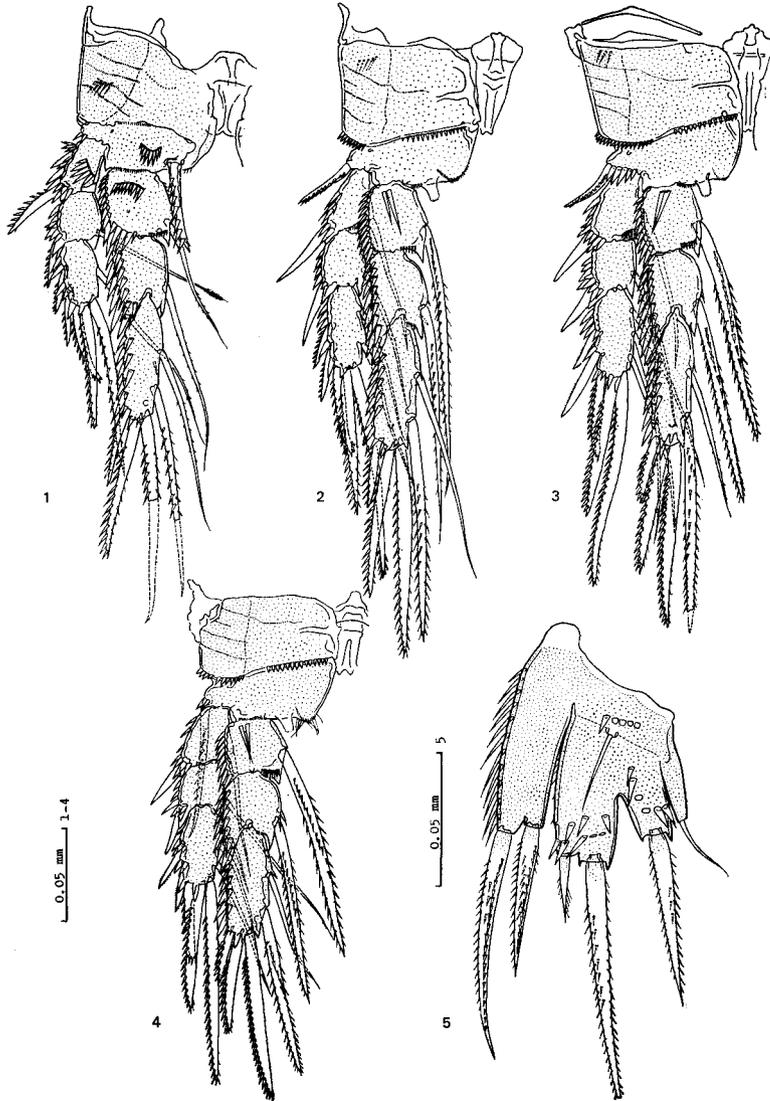


Fig. 10. *Haectinosoma perforatum* n. sp. Female (holotype). 1. leg 1; 2. leg 2; 3. leg 3; 4. leg 4; 5. leg 5.

one of which extended beyond succeeding segment. First endopodite segment long, gradually tapering apically, with vertical rows of spinules. Second endopodite segment short, armed with one sparsely spinulose spine on a ledge at about the

middle of inner edge, one bilaterally spinulose spine on a subapical outer ledge, and two narrow juxtaposed terminal setae.

Leg 1 (Fig. 10-1). All segments perforated. Intercoxal plate narrow, incised at the middle of free edge. Coxa with at least four horizontal or oblique rows of very minute spinules on anterior surface, one row of a few conspicuous spinules on posterior face. Basis armed with one short bare seta on outer edge, one stout spinulose spine on inner distal edge; a conspicuous row of spinules attached onto anterior surface above endopodite. Both rami three-segmented. Exopodite much shorter than endopodite, consisting of three segments of a subequal length; first segment armed with one spinulose outer spine, with no inner seta, and with an oblique row of closely set spinules on its anterior face; second segment armed with one spinulose outer spine and one narrow inner seta which is apically spinulose (? serrate); third segment armed with three outer spines, two long terminal spines, and one inner seta located medially. Endopodite three-segmented; first segment much wider than exopodite segments, about as long as wide, with a transverse row of closely set spinules on anterior face, armed with one inner seta which arises from base of a pointed protuberance at inner distal angle; second segment a little longer than wide, with two rows of spinules along outer margin, armed with one inner seta; third segment deeply inserted into an incision of preceding segment, about twice as long as first segment, with two spinular rows along outer margin, armed with one subapical outer spine, two long spinulose terminal spines, and two widely spaced inner setae, distal one of which is spiniform. *Leg 2* (Fig. 10-2). Coxa furnished with short stout spinules on anterior surface along its distal border. Basis with one spinulose outer spine; a prominent protuberance, which is apically serrate, arising from inner distal edge. Exopodite: first segment without an oblique row of spinules on anterior face, armed with one inner seta, third segment with two widely spaced inner setae, each other spine of first two segments less spinulose, third segment a little longer than preceding segments; otherwise as in leg 1. Endopodite: first segment with two long spinules on anterior face near base; each inner seta of first two segments stout, rather spiniform and with three rows of spinules as shown in figure; otherwise as in leg 1. *Leg 3* (Fig. 10-3). Coxa and basis as in leg 2. Third exopodite segment armed with three equally spaced inner setae. Endopodite armed as in leg 2. *Leg 4* (Fig. 10-4). Coxa as in leg 3. Outer spine of basis elongate, extending beyond second exopodite segment. Exopodite as in leg 3 but a little shorter. *Leg 5* (Fig. 10-5). Anterior surface perforated. Baseoendopodite forming a subcylindrical outer process terminating in a bare short seta; a transverse row of spinules attached onto anterior face near exopodite; inner expansion well developed, about twice longer than wide, not extending beyond exopodite segment, armed with two thick spinulose setae apically and subapically; inner margin fringed with long spinules. Exopodite confluent with baseoendopodite (but posteriorly demarcated by an obscure suture), bilobated by a deep incision; inner lobe armed with two setae, of which the inner is short and arises from a subapical ledge and the other is long, about twice as long as this

segment, furnished with two oblique rows of spinules on its anterior surface; outer lobe shorter and narrower than inner lobe, apically armed with one seta, with an arched row of spinules on anterior surface.

Male (allotype). Body (Fig. 11-1) 0.95 mm long. Integuments of all somites and thoracic legs perforated as in female. Rostrum as shown in figure (Fig. 11-4).

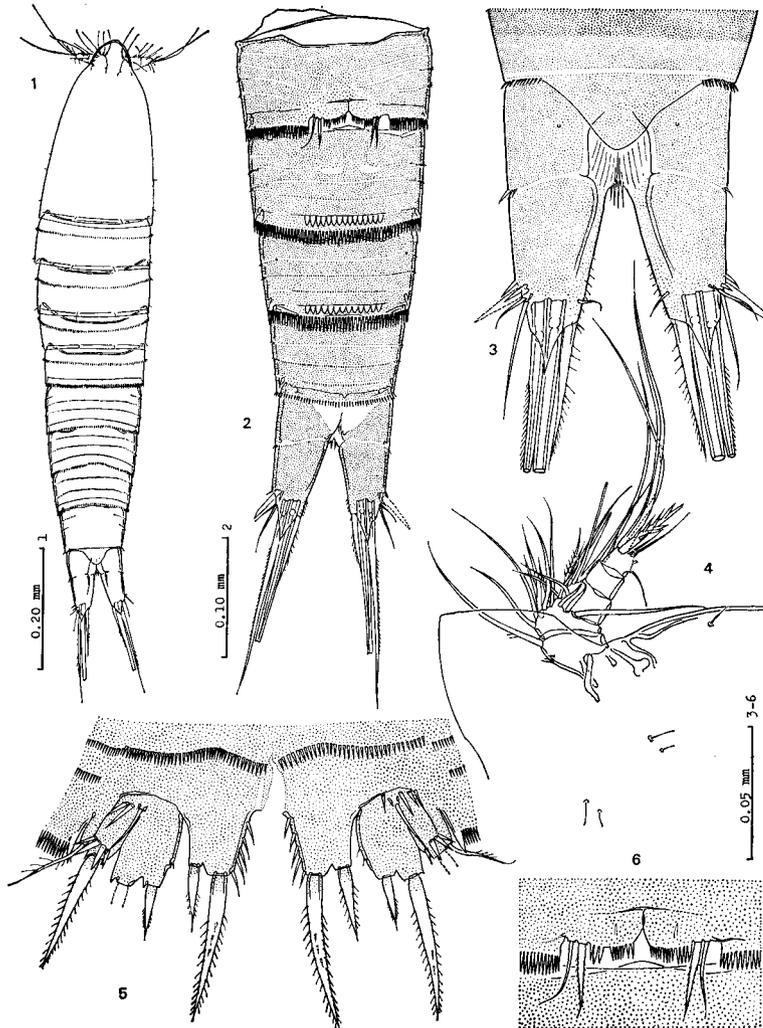


Fig. 11. *Haectinosoma perforatum* n. sp. Male (allotype). 1. habitus, dorsal; 2. abdomen, ventral; 3. posterior abdominal somites, dorsal; 4. rostrum and antennule; 5. leg 5; 6. leg 6.

Posterior hyaline membrane of first abdominal somite (Fig. 11-2) conspicuously serrated as in succeeding two somites. Pseudoperculum (Fig. 11-3) shorter than that of the holotype. *Antennule* (Fig. 11-4) five-segmented; ornamentation as in female. *Antenna*, *mandible*, *maxillula*, and *maxillipede* as in female in principal structures.

Leg 1, leg 2, leg 3, leg 4. Setal and spinal ornamentation as in female. *Leg 5* (Fig. 11-5). Baseopodite confluent with body integument, but basally demarcated by a transverse, somewhat sinuate, row of numerous spinules; a sparsely hairy seta arising from a cylindrical outer process; inner expansion furnished with spinules along inner edge, apically armed with two spinulose thick setae, of which the outer is much shorter than the other. Exopodite clearly demarcated at base, as long as wide, bilobated by a notch; inner lobe armed with two setae, outer lobe much longer than inner lobe; outer lobe armed with one thick seta; a bare narrow seta arising from a short cylindrical process on anterior surface near base above notch. *Leg 6* (Fig. 11-6) represented by a small plate which is partially confluent with body integument; inner half of distal edge serrate; one thick spinulose seta and one bare narrow seta arising from outer distal edge; a bare setula arising from a short cylindrical process at outer extremity.

Variability. Four females, including the holotype, were dissected and examined. Body length is not so different among them. The biggest specimen measures 1.16 mm long, the smallest is the holotype. The shape of pseudoperculum is also stable (pseudoperculum of a paratypic female is shown in Fig. 8-5). The pseudoperculum of the allotype is apparently shorter than that of the females, though it is uncertain whether this difference represents a sexual dimorphism because only one male was examined.

Remarks. The present new species resembles *Halectinosoma canaliculatum* (Por, 1964) reported from the Mediterranean Sea especially in having the perforated texture of integuments of body and legs (the specific name of this new species alludes this) and the setal armature of the maxillipede (apically with two juxtaposed setae). The new species, however, easily discernible from the latter by clear differences in the body color (dark yellowish-brown in *H. canaliculatum*), proportion of furcal rami, and shape of the leg 5 exopodite of the female. The leg 5 of the female of *H. canaliculatum* is similar to that of *H. sarsi* (Boeck, 1872) in the shape as well as relative lengths of setae (cf. Sars, 1903, pl. XVI, Lang, 1948, fig. 112, and Por, 1964, pl. 8, fig. 55), though the exopodite of *H. canaliculatum* is somewhat narrower than that of *H. sarsi*. The exopodite of leg 5 of the present new species is markedly bilobated by a deep incision as in *H. proximum* (Sars, 1919). The leg 5 exopodite of *H. canaliculatum* is lacking in such a deep incision.

Incidentally, the maxillipede of *H. inhacoe* Wells, 1967 from Mozambique bears two juxtaposed apical setae as in the present new species as well as *H. canaliculatum*.

Type-series. Holotype: adult female. Paratypes: three adult females and one adult male (allotype). Type-locality: Oshoro, Hokkaido. All the specimens were

collected from sandy bottom at a depth of about 25 m (11-VIII-1977, Itô leg.).

Stenhelia (Delavalia) latioperculata n. sp.

(Figs. 12-16)

Female (holotype). Body (Fig. 12-1, 2) 0.60 mm long, rostrum and furcal setae excluded; colorless and semitransparent. Rostrum (Fig. 13-1) clearly defined at base, triangular, extending beyond first antennular segment, with a fine sensory hair on both sides of bifid apex. Cephalothorax a little wider than long, longer than three succeeding somites combined. Thorax gradually tapering toward behind, with transverse wrinkles of superficial cuticular elevation on each pleurotergite. Genital double-somite (Fig. 12-3, 4, 5) dorsally subdivided by a transverse suture, armed with a bare setula at each outer extremity of wide genital area; some minute spinules attached onto lateral surface along hind edge of each anterior subdivision and posterior subdivision. Antepenultimate and penultimate somites with spinules along each latero-posterior edge; penultimate somite with no sensory hair. Genital double-somite and succeeding two somites dorsally with some interrupted transverse wrinkles as shown in Fig. 12-5. Anal somite with spinules along hind edge both laterally and ventrally. Anal operculum (Fig. 12-6) broad, a little wider than long, with a small outgrowth, which is accompanied by a well-developed hair near its base, at each lateral edge; posterior edge rounded. Furcal ramus subcylindrical, about three times as long as basal diameter, furnished with minute spinules on subproximal inner surface, armed with one spine and two setae on outer posterior end, two spinulose principal terminal setae, a fine setula on inner posterior edge; a basally geniculate short seta arising from inner dorsal surface near posterior end.

Antennule (Fig. 13-1) seven-segmented; a seta of first segment and at least two setae of second segment hairy; fourth segment bearing an aesthetasc; sixth segment about 1.5 times as long as fifth segment; seventh segment a little shorter and narrower than sixth segment. *Antenna* (Fig. 13-2). Coxa short, furnished with spinules on outer face and posterior face. Allobasis about twice longer than basal diameter, armed with a sparsely hairy seta on a point at two-thirds the length of anterior surface; spinules attaching onto subproximal anterior surface. Exopodite three-segmented, about as long as allobasis; first segment thickening distally, armed with a hairy seta subapically, with a transverse row of minute spinules near distal end; second segment very short, armed with a hairy seta; third segment as long as first segment, armed with a hairy seta on subproximal edge, three terminal (? juxtaposed) setae, and with minute spinules both medially and subapically. Endopodite about as long as allobasis, gradually thickening distally, armed with two spines and one narrow seta on anterior face at about two-thirds the length; four spinulose setae of different lengths, one bifurcate seta, and one narrow bare seta arising from distal end; a longitudinal row of stout spinules

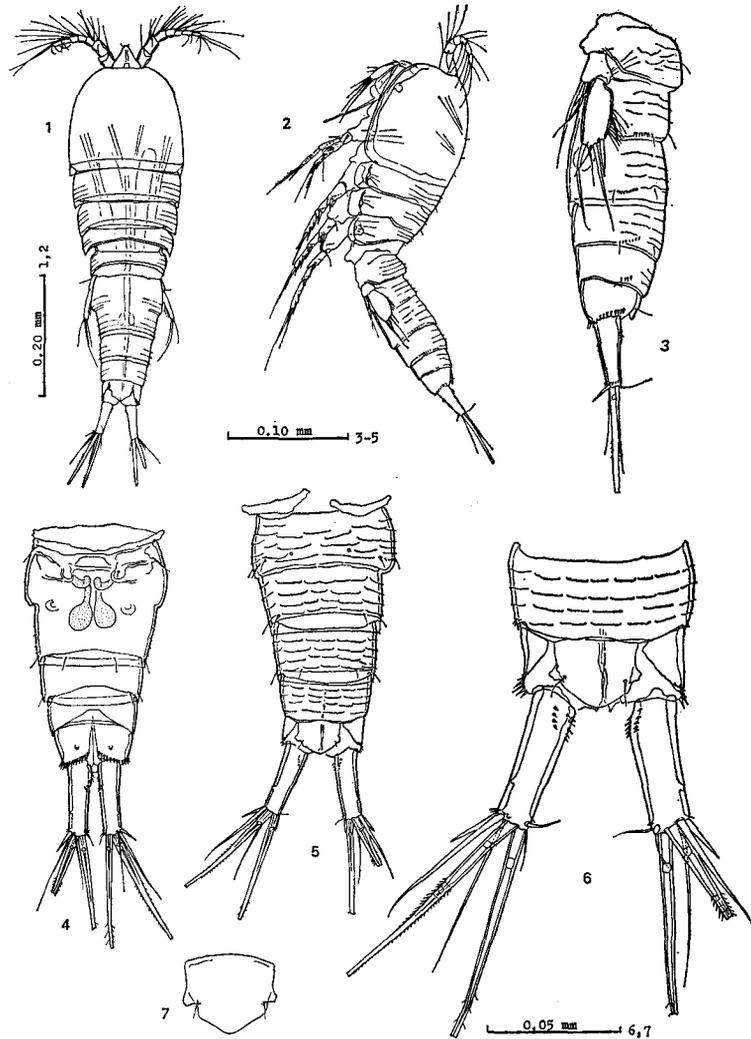


Fig. 12. *Stenhelia (D.) latioperculata* n. sp. Female (1-6, holotype; 7, a paratype).
 1. habitus, dorsal; 2. habitus, lateral; 3. leg 5 and abdomen, lateral; 4. abdomen, ventral; 5.
 abdomen, dorsal; 6. posterior abdominal somites, dorsal; 7. anal operculum.

attaching onto anterior surface. *Mandible* (Fig. 13-3, 4). Praecoxa furnished with a row of fine spinules near base of coxa-basis; pars incisiva short, bidentate (?); pars molaris represented by a low protuberance. Coxa-basis about twice longer than wide, furnished with hairs along outer margin, some rows of both short and long spinules on and near inner margin; three separate setae on subapical inner edge.

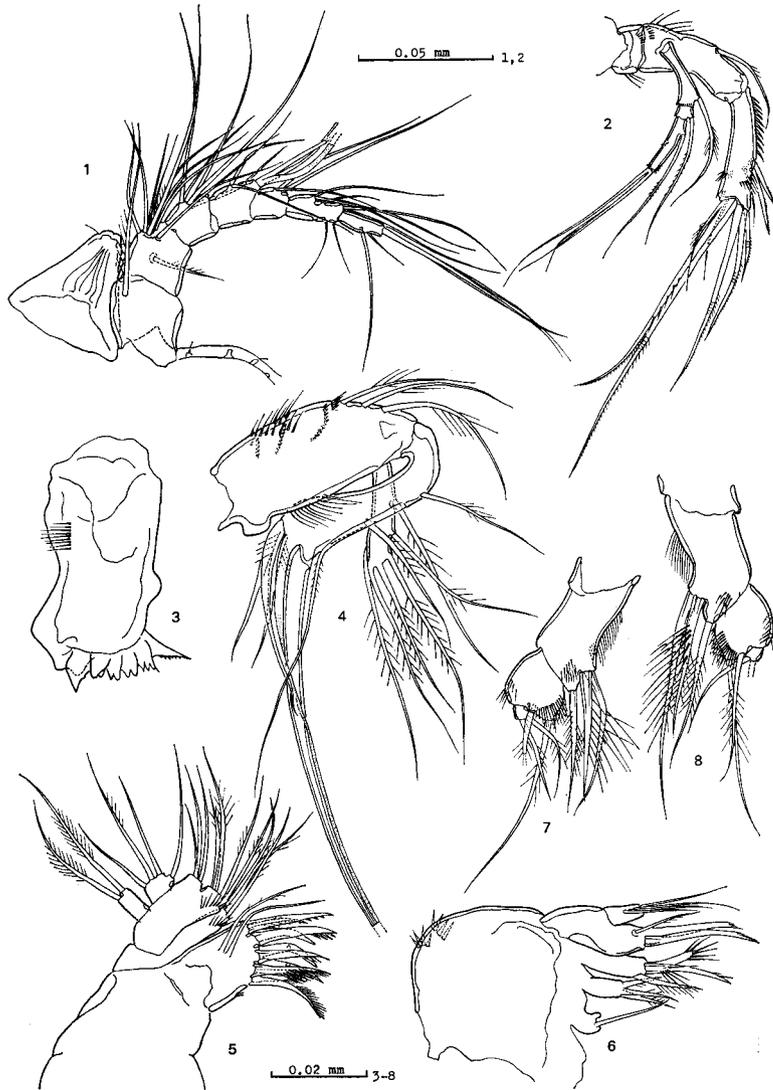


Fig. 13. *Stenhelea* (*D.*) *latioferculata* n. sp. Female (holotype). 1. rostrum and antennule, ventral; 2. antenna; 3. mandibular praecoxa; 4. coxa-basis, exopodite, and endopodite of mandible; 5. maxillula; 6. maxilla; 7. right maxillipede; 8. left maxillipede.

Exopodite represented by a small segment, armed with two widely spaced setae on inner (ventral) edge, three setae on distal end, and one seta on subapical outer (dorsal) edge; all setae sparsely hairy. Endopodite much bigger than exopodite,

markedly sinuate, widening distally, armed with two setae on posterior margin, and terminating in three setae and one very much elongate seta which is fringed with a hyaline membrane. *Maxillula* (Fig. 13-5). Arthrite of praecoxa armed with two parallel setae on anterior surface, and at least 10 spines and setae on inner edge. Inner process of coxa not reaching inner edge of arthrite of praecoxa, armed with three hairy apical setae and some spinules. Inner edge of basis separated into two lobules by a shallow incision; each lobule armed with three setae apically; a row of spinules attaching onto anterior surface near dorsal edge. Exopodite represented by a short segment, armed with two hairy setae. Endopodite short, a little wider than exopodite, armed with four setae, one of which arises from inner edge. *Maxilla* (Fig. 13-6). Syncoxa furnished with three endites, two short rows of spinules near ventro-outer edge; first (dorsal) endite small, armed with a bare seta; second endite armed with three apical setae, all sparsely spinulose; third endite longest, armed with one spinulose spine and two spinulose setae. Pasis forming an apically serrate claw which is accompanied by one spine and one narrow seta. Endopodite represented by a small segment with four bare setae. *Maxillipede* (Fig. 13-7, 8). Coxa short, unornamented. Basis furnished with hairs along inner margin, some spinules on anterior surface near distal end, armed with two closely set setae which locate at subapical inner edge and are equipped with long spinules; one hairy seta arising from inner distal angle. Basis truncate, about as long as wide, furnished with spinules along outer edge, a vertical row of long spinules on anterior surface near inner margin, and hairs along inner margin; two setae on distal edge, the one located at inner angle, the other close to endopodite. Endopodite represented by a small segment which arises from distal edge of basis near outer angle, armed with two apical setae.

Leg 1 (Fig. 14-1). Coxa much wider than long, furnished with spinular rows on its anterior surface as shown in figure. Basis armed with one spinulose outer seta and one strong inner spine; spinules attached onto anterior surface near both rami and inner spine; inner edge furnished with a few long spinules. Exopodite three-segmented; first segment about 1.5 times as long as wide, armed with one finely spinulose outer spine, and with a few hairs on inner edge; second segment shorter than preceding segment, armed with one finely spinulose outer spine and one hairy short inner seta; third segment about as long as first segment, armed with two finely spinulose spines on outer edge, one long spine, which is fringed with modified hairs, and one hairy seta on distal end. Endopodite about as long as exopodite, two-segmented; first segment thick, 1.5 times as long as wide, furnished with stout spinules along outer margin, an arched row of spinules on anterior surface near distal border, and a few long spinules on inner edge; armed with one long inner seta which is apically serrated; second segment narrow, about 1.3 times as long as preceding segment, forming a spiniform protuberance at inner distal edge, furnished with stout spinules along outer margin, armed with two widely spaced hairy setae on inner edge, one spinulose strong spine, which is almost as long as this segment, and one seta, which is fringed with modified hairs, on distal end. *Leg 2* (Fig. 14-2).



Fig. 14. *Stenhelia (D.) latioferculata* n. sp. Female (holotype). 1. leg 1; 2. leg 2; 3. leg 3; 4. leg 4; 5. middle endopodite segment of left leg 4.

Intercoxal plate furnished with a pair of spiniform protuberances on free edge. Coxa very wide, about 1.3 times wider than coxa of leg 1, furnished with spinular rows on anterior surface. Basis forming two stout spiniform protuberances, each

located between both rami and at inner distal angle; a bare short seta arising from outer edge; a horizontal row of a few long spinules on anterior surface near proximal inner edge. Both rami three-segmented. Exopodite: a serrate membrane attached onto inner distal edge of first segment; first two segments each armed with one finely spinulose outer spine and one short, sparsely hairy, inner seta; third segment armed with three finely spinulose spines along outer margin, one spine and one seta on distal end, and two setae, distal one of which is short and slender, on inner margin. Endopodite: first segment about as long as wide, forming a spiniform projection at both outer and inner distal angles, armed with one hairy short inner seta at dorsal base of inner projection; second segment much longer than first, forming a long spiniform projection, which reaches about the middle of succeeding segment, at outer distal angle and a short spiniform projection at inner distal angle, armed with two short inner setae, distal one of which is apically serrate; third segment narrower than preceding segment, forming a spiniform projection at subapical outer edge, armed with one outer spine, two stout terminal setae which are spinulose along outer margin and hairy along inner margin, and one hairy seta at about the middle of inner edge; outer margin of all segments furnished with spinules. *Leg 3* (Fig. 13-3). Intercoxal plate as in leg 2. Coxa narrower than that of leg 2, with spinular rows as shown in figure. Spiniform protuberance of inner distal angle of basis shorter than that of leg 2. Third exopodite segment armed with three inner setae, of which the distalmost is dwarf. Second endopodite segment armed with only one inner seta; no prominent projection on inner distal angle. Third endopodite segment armed with three inner setae, all delicately spinulose. Other ornamentation of both rami principally as in leg 2. *Leg 4* (Fig. 14-4). Intercoxal plate as in leg 3. Coxa narrower than that of leg 3. Spiniform protuberance of inner distal angle of basis rudimentary. Third exopodite segment armed with two outer spines which are located subapically, two terminal setae, and three inner setae, of which the distalmost is rudimentary, and the median one is long and stout, and is serrated along its distal half. Endopodite much shorter than exopodite. Second endopodite segment of right leg without spinules along outer margin, but corresponding segment of left leg (Fig. 14-5) furnished with spinules; inner seta stout. Third endopodite segment armed with two finely spinulose inner setae, distal one of which is much longer than the other. *Leg 5* (Fig. 15-1). Baseoendopodites represented by a wide common plate, protruding distally at each outer border; each inner expansion rudimentary, armed with four setae on distal edge, of which the innermost is stout and serrated, the others are delicately spinulose; a narrow hairy seta arising from outer edge. Exopodite arising from the protruding part of baseoendopodite, almost elliptical in outline, about twice as long as greatest width, armed with five setae of different lengths apically or subapically; first (counted from outer) seta stout and serrated along its outer margin, second and fifth setae well developed, third and fourth setae narrow and short; outer margin furnished with a number of long spinules.

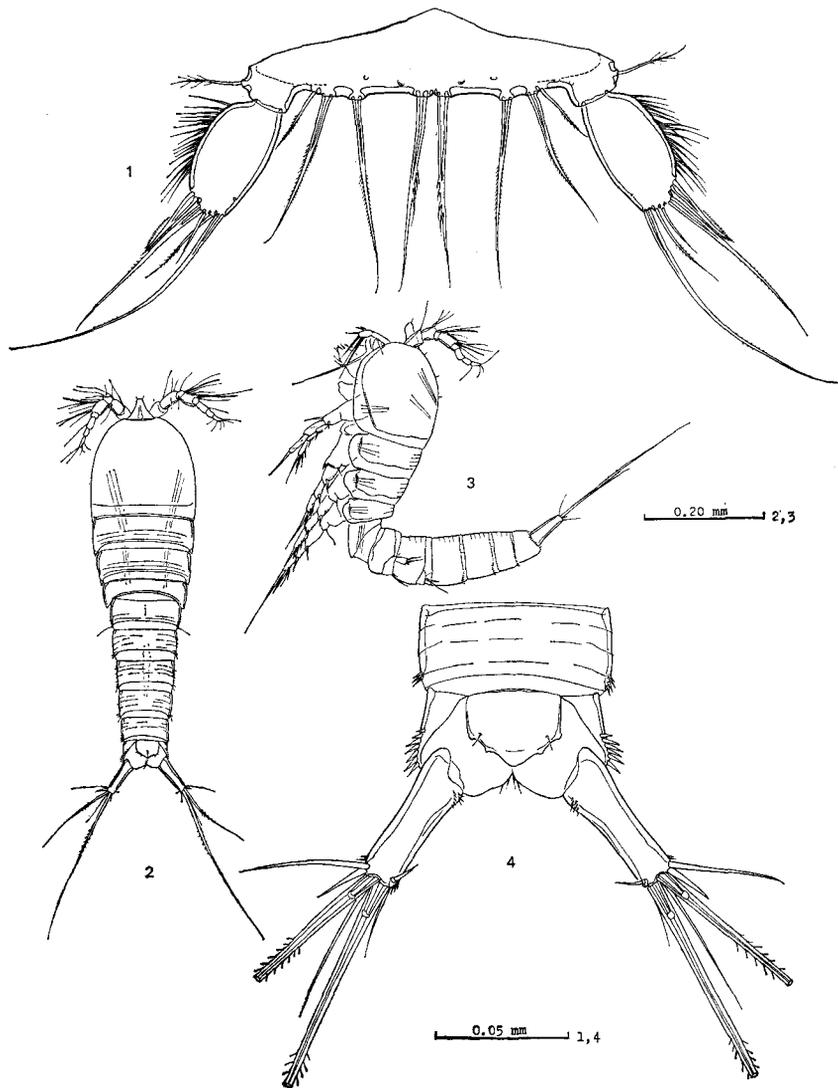


Fig. 15. *Stenhelia (D.) latioperculata* n. sp. Female (holotype). 1. leg 5. Male (allotype). 2. habitus, dorsal; 3. habitus, lateral; 4. posterior abdominal somites, dorsal.

Male (allotype). Body (Fig. 15-2, 3) about 0.6 mm long. Abdomen fairly narrower than that of female in appearance. Thoracic and abdominal somites dorsally with transverse wrinkles as in female. Last four abdominal somites (Fig. 16-5, 6) furnished with spinules on ventral and lateral surface near each posterior end. Anal operculum (Fig. 15-4) as shown in figure. Furcal ramus armed as in

female. *Antennule* (Fig. 16-1) haplocer. *Antenna*, *mandible*, *maxillula*, *maxilla*, and *maxillipede* principally as in female.

Leg 1 ornamented as in female. *Leg 2* (Fig. 16-2). Endopodite consisting of two segments. Distal endopodite segment (corresponding with second and third segments in female) apically forming a short spiniform projection, armed with one somewhat sinuate long spine, which is serrated along its outer margin, on outer edge close to base of the spiniform projection, one bilaterally spinulose straight

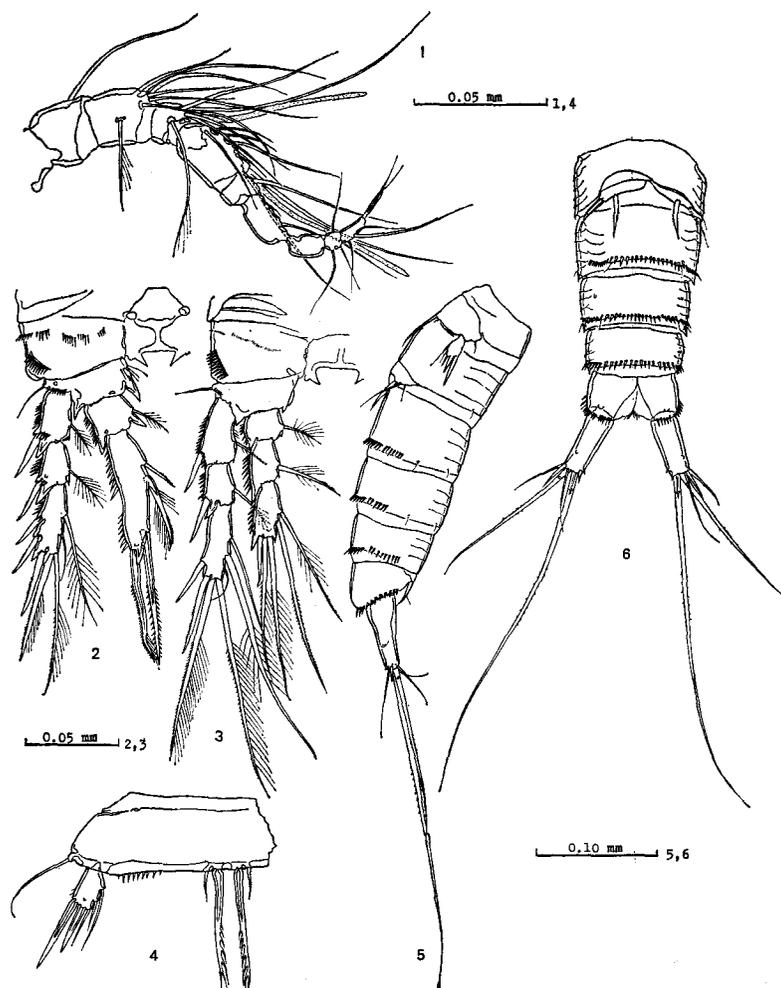


Fig. 16. *Stenelia* (*D.*) *latioperculata* n. sp. Male (allotype). 1. antennule; 2. leg 2; 3. leg 4; 4. leg 5; 5. leg 5 and abdomen, lateral; 6. abdomen, ventral.

spine on subapical inner edge; a sharp spiniform projection arising from about the middle of inner edge, accompanied by two inner setae; outer margin furnished with two groups of spinules. *Leg 3* principally as in female. *Leg 4* (Fig. 16-3) as in female. Middle segment of each endopodite furnished with spinules along outer margin. *Leg 5* (Fig. 16-4). Baseoendopodites represented by a wide common plate, armed with two sets of one serrate spine and one setula on distal edge near the middle; short spinules on outer half of distal edge; a bare seta arising from a short process at outer extremity. Endopodite represented by a small segment armed with two spines apically and two bare small setae along inner margin. *Leg 6* (Fig. 16-6) represented by a wide plate armed with one thick seta and two very narrow setae as shown in figure.

Variation and abnormality. Three females and two males, including the holotype and the allotype, were dissected and examined. Body length of each undescribed specimen is as follows: ♀, 0.58 mm, 0.68 mm; ♂, 0.50 mm. The middle endopodite segment of leg 4 of the paratypic females bears spinules along each outer margin. The shape of anal operculum is almost stable (cf. Figs. 12-6 and 12-7). No particular difference was noticed for other structures.

Remarks. Within the subgenus *Delavalia* the present new species resembles *S. elisabethae* Por, 1960, *S. normani* T. Scott *polluta* Monard, 1928 sensu Por (1964), *S. sp. aff. minuta* A. Scott, 1902 sensu Por (1964), *S. oblonga* Lang, 1965, *S. unisetosa* Wells, 1967, and *S. lima* Becker, 1972 in having a very broad anal operculum (the specific name of the new species alludes this). Among these species *Stenhelia sp. aff. minuta* reported from the eastern Mediterranean Sea by Por (1964) and the present new species from the Sea of Japan share a common characteristic, the female antennule seven-segmented (the antennule of other species is eight-segmented). This new species, however, differs from Por's species in the armature of the middle exopodite segment of leg 1, and again differs from Por's species as well as *S. minuta* known from Egypt and the Indian Ocean (Lang, 1948) in the shape and armature of the baseoendopodite of leg 5 in the female.

The maxillipede, on the other hand, provides good characters for the taxonomy within this subgenus. At least three major types are recognized; type-1 (so-called 'prehensile'): the first endopodite segment apparently longer than wide, the second endopodite segment armed with an arched spine (or claw); type-2: the first endopodite segment as long as wide, the second endopodite segment small and armed with setae; type-3: the first endopodite segment as long as wide, the second endopodite segment absent. The type-1 is clearly represented by *S. coineauae* Soyer, 1971, type type-2 by the present new species, and the type-3 by *S. oblonga* Lang, 1965. The maxillipedes of *S. ornamentalia* Shen et Tai, 1965 (redescribed by Tai and Song, 1979) and *S. bocqueti* Soyer, 1971 are no doubt of the type-2 (*S. arctica* T. Scott, 1898 and *S. inopinata* A. Scott, 1902 are also of this type but uncertain). *S. bocqueti* reported from the western Mediterranean Sea resembles the present new species also in having seven-segmented antennules in the female,

but clearly differs from the latter in the proportion of the furcal ramus as well as the shape of the baseoendopodite of leg 5.

Type-series. Holotype: adult female. Paratypes: two adult females and two adult males, one of which is the allotype. Type-locality: Oshoro, Hokkaido. All the specimens were collected from sandy bottom at a depth of about 25 m (allotype 9-IX-1977, others 15-V-1978, Itô leg.).

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Addendum

After the present paper was submitted for publication the following paper has come to hand:

Wells, J. B. J. 1980. A revision of the genus *Longipedia* Claus (Crustacea: Copepoda: Harpacticoida). Zool. J. Linn. Soc., 70: 103-189.

In this paper Wells described a new species from Australia and Fiji under the name *L. nichollsi*. It is apparent that *L. spinulosa* described in the present paper is close to *L. nichollsi*, though Dr. Wells kindly pointed out several differences; for example, the ornamentation of thorax and abdomen is composed of "pustules" in *L. nichollsi*, whereas in *L. spinulosa* it is of "spinules" (pers. comm.). Such the differences are actually present between them; nevertheless, I think further comparative study is necessary in order to clear the taxonomic status of *L. spinulosa*.
