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Descriptions and Records of Marine Harpacticoid Copepods from Hokkaido I[1)2)]

By

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(With 8 Text-figures)

The harpacticoid fauna of Japan has so far relatively been ignored. Up to the present, about 40 species have been recorded from terrestrial, freshwater and marine planktonic habitats, but no species from interstitial habitats. Since 1967, faunistic and ecological studies of interstitial animal communities in littoral zones of Hokkaido have been carried out in the author's laboratory. As a member of this comprehensive work, the author has participated in the study of harpacticoid copepods, which were one of the most predominant members of the interstitial fauna. In this first report of serial taxonomic work, four species, all new to the interstitial fauna of Hokkaido, two of which new to science, are recorded.

Most specimens were sampled from Bannagro near Ishikari, on Japan Sea Coast, but some from Oshoro, Ranshima (both on Japan Sea Coast) and Hama-Koshimizu (on Okhotsk Sea Coast). The specimens were rinsed from fresh sand, filtrated with a plankton net of mesh number 116. The total slide preparation was mounted by using Neo-Shigaral medium. All specimens examined are deposited in the Zoological Institute, Faculty of Science, Hokkaido University.

The author expresses his sincere gratitude to Prof. M. Yamada for his guidance, and to Dr. Sh. F. Sakagami and Mr. H. Fukuda for their valuable helps to the present study.

Microsetella norvegica (Boeck)

(Fig. 1.)

Setella norvegica Boeck, 1864.
Microsetella norvegica, Breemen, 1908; Marukawa, 1921; Kokubo & Tamura, 1931; Yamazi, 1950.

In all previous records this species is known as a pelagic species, but the author collected some specimens from sandy beaches of several localities as given below. These specimens are similar to the variant of *M. norvegica* described by

1) Contribution No. 804 from the Zoological Institute, Faculty of Science, Hokkaido University, Sapporo, Japan.

2) Studies on marine harpacticoid copepods from Hokkaido I
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Tanaka (1965), except for the slender seta on the surface of expodite-segment of leg 5 is very long. In the specimens from Hama-Koshimizu, this seta is especially long, much longer than the outer seta of the same segment.

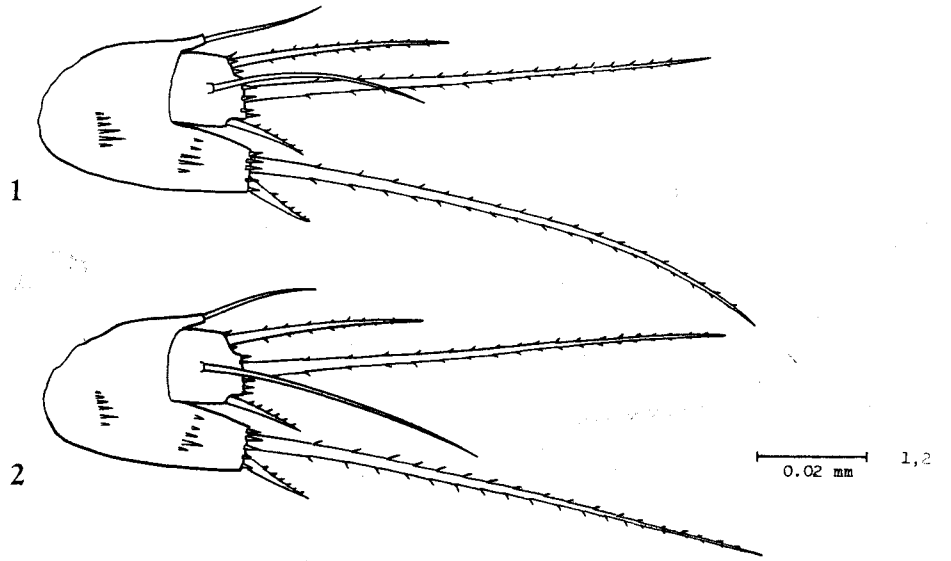

Fig. 1. *Microsetella norvegica*. 1. Leg 5 of ♀ from Bannaguro; 2. Leg 5 of ♀ from Hama-Koshimizu.

Specimens examined: Bannagro near Ishikari, 4 ♀♀, 23-VI-1967; 1 ♂, 27-I-'68, from fine sand; 2 ♂♂, 27-I-'68, as plankton. Hama-Koshimizu near Abashiri, 2 ♀♀, 9-VIII-'67, from coarse sand. Ranshima near Otaru, 1 ♀, 18-X-'67, from fine sand. Oshoro near Otaru, 9 ♀♀, 1 ovigerous ♀ and 3 ♂♂, 17-X-'67, from coarse sand.

Remarks: The capture of this pelagic species from interstitial habitat may mean a mere occasional admixture at sampling. But, as this species frequently reaches the intertidal zone, it is not always impossible that it might stay in the interstitial spaces for a brief time. Further studies are required concerning its dispersal.

***Leptastacus japonicus* n. sp.**
(Figs. 2, 3.)

Female (Fig. 2–1): Length, rostrum and furcal setae excluded, about 0.3 mm. Body cylindrical, white in colour; each segment, last somite excluded, furnished with a hyaline membrane along posterior end. Cephalic segment with one red nauplius eye. Rostrum prominent, extending beyond first segment of antennule. Genital double somite without any trace of subdivision, but with a pair of leg 6 on genital area. Last somite with spinules rows along ventro-posterior

edges. Anal operculum bare. Furcal ramus (Fig. 2–2) about 2.5 times as long as the greatest width, inner edge moderately curved, with one long branched terminal seta, about 1.5 times as long as furcal ramus, outer branch slender, inner one thickened near the base, with one short slender seta just inside, three setae, one outer, one dorsal and one inner marginal and two spinules near inner distal end.

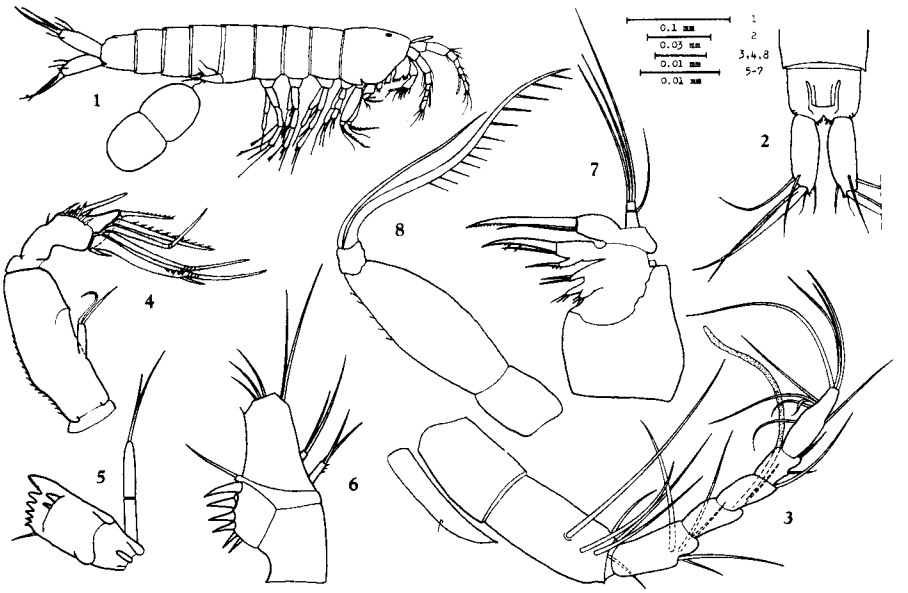

Fig. 2. *Leptastacus japonicus* n. sp. 1. ♀, lateral; 2. ♀, anal segment and furcal rami; 3. ♀, antennule and rostrum; 4. ♀, antenna; 5. ♀, mandible; 6. ♀, maxillula; 7. ♀, maxilla; 8. ♀, maxillipede.

Antennule (Fig. 2–3): 7-segmented, second segment longest. Fourth segment furnished with one long slender aethetasc. *Antenna* (Fig. 2–4): Coxa small and bare. Allobasis with some hairs along anterior edge, much longer than endopodite. Exopodite 1-segmented, with two terminal setae. Endopodite with two spinulose spines and three geniculate setae along distal edge, the posterior one irregular in form as shown in figure; anterior edge with one spine and two spinules; one row of spinules on the surface obliquely. *Mandible* (Fig. 2–5): Praecoxa with six teeth along cutting edge, two teeth just inside and one seta at corner. Palp 2-segmented, second segment with two terminal setae, first segment bare. *Maxillula* (Fig. 2–6): Arthrite of praecoxa with four claws and two spines. Coxa with one apical seta. Basis with three terminal setae, two long jaxtaposed setae near the end of outer edge and one hair-like seta at inner edge. Endopodite with two terminal setae, exopodite with two terminal setae and three hair-like setae along outer margin. *Maxilla* (Fig. 2–7): Syncoxa with three endites, proximal and distal ones bilobuled,

Basis with one strong, along distal part of inner edge pectinate, claw accompanied with a slender seta. Endopodite 2-segmented, second segment with three long terminal setae, first segment with one short seta at outer distal edge. *Maxillipede* (Fig. 2–8): Basis bare. Endopodite 2-segmented; first segment with some hairs along outer edge; second segment short and armed as shown in figure.

Leg **1** (Fig. 3–1): Coxa bare. Basis with one outer marginal seta. Exopodite 3-segmented, first segment longest; thrid segment with two geniculate terminal setae and one unilaterally spinulose outer seta; second segment with one unilaterally spinulose outer seta; first segment with one unilaterally spinulose outer seta at distal corner and one short outer seta at middle margin. Endopodite 2-segmented, second segment shorter than first one, and each segment with a row of spinules along outer margin; second segment with two geniculate setae at distal end, inner one about two times as long as outer one; first segment with one inner seta at middle margin. *Leg* **2** (Fig. 3–2): Coxa bare. Basis with one short outer marginal seta. Exopodite 3-segmented; third segment with three setae at distal end, inner one longest and outer one shortest, and inner two hairly; second and first segments

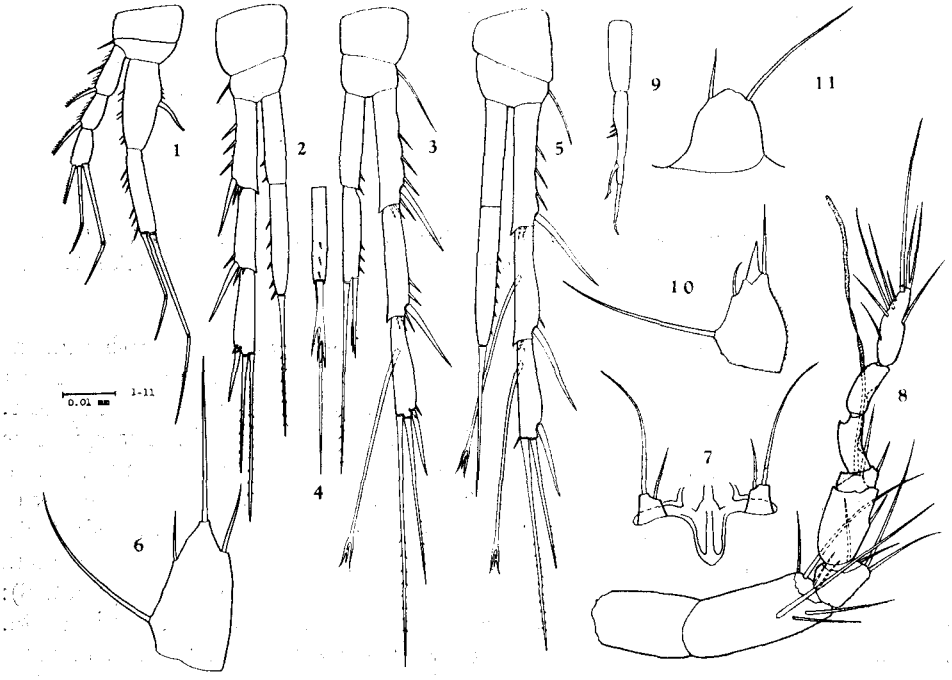

Fig. 3. *Leptastacus japonicus* n. sp. 1. ♀, leg 1; 2. ♀, leg 2; 3. ♀, leg 3; 4. ♀, second endopodite-segment of leg 3; 5. ♀, leg 4; 6. ♀, leg 5; 7. ♀, genital area and a pair of leg 6; 8. ♂, antennule; 9. ♂, second endopodite-segment of leg 3; 10. ♂, leg 5; 11. ♂, leg 6.

with one outer marginal seta at each distal corner. Endopodite 2-segmented; second segment with one terminal seta, first segment without seta. Each segment of exopodite and second segment of endopodite with spinules at distal end or outer margin. *Leg* **3** (Fig. 3–3, 4): Coxa bare. Basis with one long outer marginal seta. Exopodite 3-segmented; third segment with three setae at distal end, inner most one longest, outer one shortest, and one modified seta on posterior surface near inner margin; second and first segments with one outer marginal seta. Endopodite 2-segmented; second segment with one hairly terminal seta and one pectinate outer spine; first segment without seta. Each segment of exopodite and endopodite with spinules at distal end or outer margin. *Leg* **4** (Fig. 3–5): Coxa bare. Basis with one outer marginal seta. Exopodite 3-segmented; third segment with two terminal setae, one outer marginal seta, and one modified seta on posterior surface near proximal end; second segment with one outer marginal seta and one modified seta on posterior surface about middle; first segment with one outer marginal seta. Endopodite 2-segmented; second segment longer than first one; second segment with one terminal seta; first segment without seta. Each segment with spinules along outer margin or distal end. *Leg* **5** (Fig. 3–6): Length about 1.5 times as long as the greatest width; with one long proximal outer seta, one short outer marginal seta, one long terminal seta and one inner marginal seta; inner seta about 1.5 times as long as outer one. *Leg* **6** (Fig. 3–7): Small, with one long terminal seta and one inner seta; terminal seta about 2.5 times as long as inner one.

Male: Length, rostrum and furcal setae excluded, about 0.28 mm. *Antennule* (Fig. 3–8) 8-segmented, second segment longest and fifth one shortest; fourth segment furnished with a long slender aethetasc.

Leg 3 (Fig. 3–9): Endopodite 2-segmented, second segment about 1.5 times as long as first one; second segment with one terminal seta and one inner marginal seta modified at tip; first segment without seta. *Leg* **5** (Fig. 3–10): With one terminal seta, one outer marginal spine, one short outer marginal seta and one long outer proximal seta; the base of outer marginal spine marked with a V-shaped groove vestigially; inner margin hairly. *Leg* **6** (Fig. 3–11): A pair of legs separated; with one inner marginal seta and one long outer marginal seta; outer seta three times as long as inner one.

Remarks: This species is closest to *L. constrictus* Lang from California, especially in the structure of leg 5 of female, but differs in following features: The presence of one spine on leg 5 of male; furcal ramus with a branched seta instead of two setae; exopodite of leg 1 with unilaterally spinulose outer setae; maxillula with exopodite; the presence of spinules row on the last somite. The ratio of furcal ramus, length: width, is 2:1 in *L. constrictus*, but 2.5:1 in *L. japonicus*, although the armature is almost similar. Lang (1965) did not refer to leg 6, in female of *L. constrictus*. If this means the absence of leg 6, it could be regarded as a very reliable distinctive character. In leg 5 of male, *L. japonicus* is almost similr to *L. wieseri* Chappuis (1957) from Puget Sound of California, but differs from the latter in the following

features: Furcal ramus with one inner marginal and one dorsal seta, and with one branched terminal seta instead of two; rostrum extending beyond the distal end of first antennule-segment; outer margin of leg 5 in female with two setae instead of four. The terminal spiniform process of leg 5 in the male of *L. wieseri* seemingly corresponds to the outer marginal spine of *L. japonicus*.

The legs of six females and seven males have been dissected. There were two specimens without short outer seta of the first exopodite-segment of leg 1 (aborted ?). In the other features, they agree to the specimens used for description.

Type-specimens: Holotype, 1 ♀; 26-XI-1967. Allotype, 1 ♂; data same as holotype. Many specimens were obtained in May, June and September 1967, and January 1968. All collected from Bannaguro near Ishikari. Some ovigerous females were discovered among June specimens, when temperature of habitat was 16°C at about 30 cm below sand surface.

Arenopontia ishikariana n. sp.

(Figs. 4, 5.)

Female (Fig. 4–1). Length, furcal setae excluded, about 0.28 mm. Body cylindrical, white in colour; abdominal segments furnished with very thin hyaline frills along posterior end. Nauplius eye entirely wanting. Rostrum very small. Genital double-somite without any trace of subdivision. Anal operculum bare. Furcal ramus (Fig. 4–3) more than three times as long as the greatest width; inner posterior end sharpened in a spiniform process; inner surface with one slender seta about middle; dorsal surface with two setae, anterior one accompanied

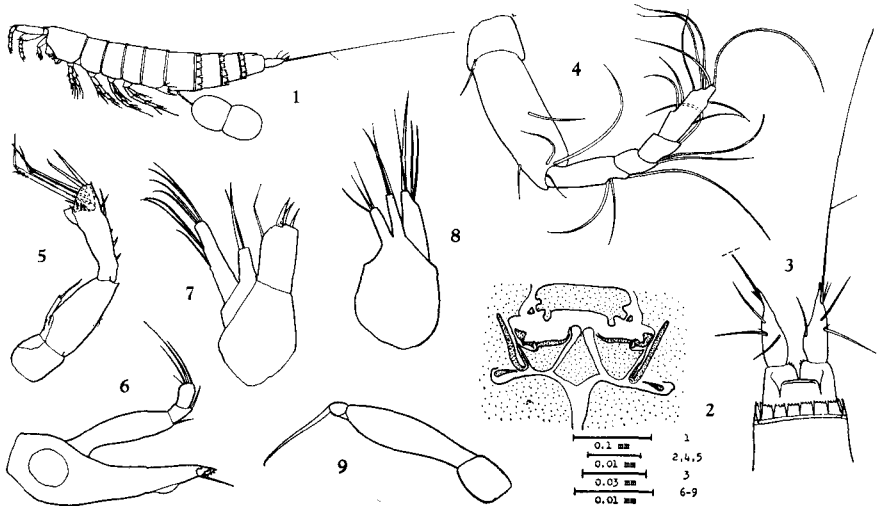

Fig. 4. *Arenopontia ishikariana* n. sp. 1. ♀, lateral; 2. ♀, genital area; 3. ♀, anal segment and furcal rami; 4. ♀, antennule; 5. ♀, antenna; 6. ♀, mandible; 7. ♀, maxillula; 8. ♀, maxilla; 9. ♀, maxillipede.

with a short hair-like seta; outer distal end with one long branched seta accompanied with two short hair-like setae.

Antennule (Fig. 4–4): 6-segmented, first segment shortest, second one longest; fourth segment furnished with one slender aethetasc. *Antenna* (Fig. 4–5): Coxa small and bare. Allobasis bare. Exopodite slender, with one seta at distal end. Endopodite about as long as allobasis; distal end with five setae in total, the longest one with few spinules and one basal seta; some spinules along anterior and distal margins. *Mandible* (Fig. 4–6): Praecoxa broad near proximal end, about 3.5 times as long as the greatest width; cutting edge with four small teeth and one seta, and three teeth just inside. Palp 3-segmented; first segment longest, with one short seta near distal margin; second segment shortest, with one slender seta; third segment with three setae and one hair-like seta at distal end. *Maxillula* (Fig. 4–7): Arthrite of praecoxa with three spines at distal end and one seta at margin. Coxa with one long spiniform seta accompanied with one slender seta. Basis with four terminal setae. Exopodite represented by one seta, endopodite two jaxtaposed setae. *Maxilla* (Fig. 4–8): Syncoxa with two endites; proximal endite with three setae at distal end, distal one with one spiniform seta accompanied with one slender seta. Endopodite represented by two slender setae. *Maxillipede* (Fig. 4–9): Basis short and bare. First segment of endopodite long, bare and thickened near middle; second segment very small, with one slender claw.

Leg **1** (Fig. 5–1): Coxa bare, basis with one short outer seta. Exopodite 3-segmented; last segment reaching to middle of last endopodite-segment; thrid segment with three geniculate setae and one spine at distal end, inner one longer than expodite proper and outer one shortest; second segment without seta; first segment with one outer marginal spine; each segment with some spinules along outer margin. Endopodite 2-segmented; second segment with two setae at distal end, inner one longer than endopodite proper; first segment with one inner seta at middle margin and some spinules along outer margin. *Leg* **2** (Fig. 5–2): Coxa bare. Basis with one slender outer seta. Exopodite 3-segmented; thrid segment with two setae at distal end, one seta at outer distal margin, inner one longest; second and first segments with one spiniform seta at each outer margin; each segment with some spinules along outer margin. Endopodite 2-segmented; last segment reaching about middle of second expodite-segment; second segment with two terminal setae, inner one longer than outer one and exceeding beyond last expodite-segment, and with one inner marginal seta, branched near distal end; each segment with spinules along outer margin. *Leg* **3** (Fig. 5–3): Coxa bare. Basis with one long slender outer seta. The armature of exopodite same as in leg 2. Endopodite 2-segmented, first segment two times as long as second one; second segment with one terminal seta and one outer marginal seta near distal end, terminal seta more than two times as long as outer one; first segment without seta; each segment with spinules along outer margin. *Leg* **4** (Fig. 5–4): Coxa bare. Basis with one short outer seta. Exopodite 3-segmented; third segment with two terminal setae, one outer marginal seta and one long inner

marginal seta; second and first segments same as in leg 2. Endopodite 2-segmented; second segment with one long terminal seta and one outer marginal seta; first segment about five times as long as second one, and without seta, but with some spinules along outer margin. *Leg* **5** (Fig. 5–5): Inner corner produced into one strong spur-shaped process; one long seta at outer distal corner, about 1.5 times as long as the inner process; two spinules between the process and seta; one long slender seta at outer margin, about two times as long as the inner process.

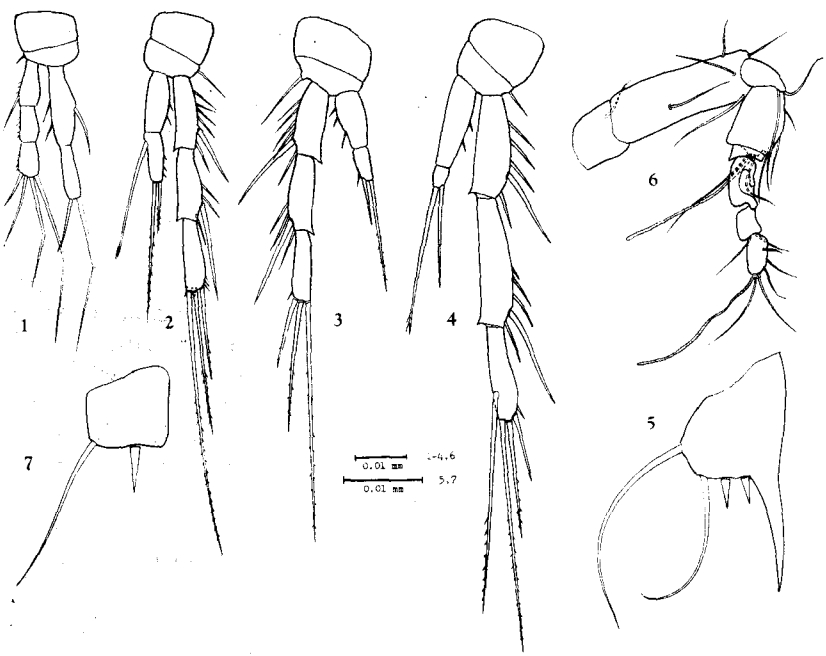

Fig. 5. *Arenopontia ishikariana* n. sp. 1. ♀, leg 1; 2. ♀, leg 2; 3. ♀, leg 3; 4. ♀, leg 4; 5. ♀, leg 5; 6. ♂, antennule; 7. ♂, leg 6.

Male: Body slightly smaller than female. *Antennule* (Fig. 5–6): 8-segmented; second segment longest, fifth one shortest; fourth and last segments furnished with a slender aethetasc. *Leg* **5** as in female. *Leg* **6** (Fig. 5–7): Forming a small quadrangular plate, with one spine at distal end and one slender seta at outer corner.

Remarks. This new species is very similar to *A. acantha* Chappuis from the Mediterranean Sea, in the general armature of legs, but differs from the latter in the following features: Anal segment without corniform projections; the longest furcal seta with a branch and attaching at outer side of the spiniform projection. The new species is also similar to *A. secunda* (=*Neoleptastacus secundus* Krishnaswamy, 1957) in the leg 5 of male. However, as far as judged from the

original description and figures of *N. secundus*, *A. ishikariana* is distinguished from *A. secunda* in the following characters: No distinction in the armature of leg 5 between sexes; antennule of male 8-segmented; furcal ramus with two dorsal setae, the one accompanied with a hair-like seta, and one inner seta instead of two lateral ones. In addition, Krishnaswamy's description of the terminal endopodite-segment of leg 4 is apparently deals with exopodite. Moreover, his figure shows one inner seta on the first endopodite-segment of leg 2, neverthless, all other so far known species of *Arenopontia* are characterized by the possession of such seta on the second segment. In this aspect and in illustrations of certain oral appendages, his species is dubious and required a further critical study.

This species shows a distinct size dimorphism. The description was made using the minor form. The major form is about 0.33 mm in the length. There is no structural differences between two forms except size.

Type-specimens: Holotype, 1 ♀ from Bannaguro; 23-XII-'67. Allotype, 1 ♂; data same as holotype. Numerous specimens of both sexes were obtained from Bannaguro almost monthly in 1967, and 1 ovigerous and 7 non-ovigerous ♀♀, and 11 ♂♂ were obtained from Oshoro, 17-X-'67.

Laophonte cornuta Philippi

(Figs. 6, 7, 8.)

Laophonte cornuta Philippi, 1840; Brady, 1910; Douwe, 1929; Lang, 1965.

Female: Length, rostrum included and furcal setae excluded, about 0.8 mm. Body light brown in colour, moderatly tapering behind. Cephalothroax about as long as the combined lengths of the succeeding three somites. Thoracic and abdominal somites furnished with some small chitinous projections and sensillae along the dorso-posterior edge. Nauplius eye red, well developed. Rostrum (Fig. 6–1) prominent, acutly rounded at tip, with a relatively short seta on each side of the tip. Genital double-somite subdivided by a chitinous stripe. Epimeral plates of double-somite distinctly produced laterally. Anal operculum (Fig. 7–5) ending in a strong spiniform projection. Furcal ramus (Fig. 6–2) slightly tapering behind, about two times as long as the greatest width, and with one strong middle seta accompanied with a slender short seta on each side; two setae on outer margin, distal one slender; one slender seta on dorsal surface.

Antennule (Fig. 6–3): 4-segmented, third segment longest and fourth one shortest. First segment with a small projection and second one furnished with a very strong spiniform projection. Third segment with one broad and long aethetasc. *Antenna* (Fig. 6–4): Coxa bare. Allobasis about three times as long as coxa; anterior margin with one pulmose seta, and some minute spinules behind the seta. Exopodite with four pulmose setae. Endopodite slightly shorter, than allobasis, and with one spine on anterior margin, one relatively slender spine on surface; two strong terminal spines and three geniculate setae, the shrotest seta accompanied with a very short seta at base; a row of some slender spinules along

anterior margin and the opposite distal margin. *Mandible* (Fig. 6–5): Praecoxa more than two times as long as the greatest width, with five strong teeth and one seta; inner corner produced into a blunt projection. Palp with one terminal and three marginal setae. *Maxillula* (Fig. 6–6): Arthrite of praecoxa with two dorsal setae and a transverse row of slender long spinules; five strong claws and some hairs on distal end; one spine at dorso-distal corner. Coxa with one strong pectinate spine. Basis with some hairs along ventro-distal margin, one pectinate spine and two slender setae at distal end. Exopodite with one long terminal seta,

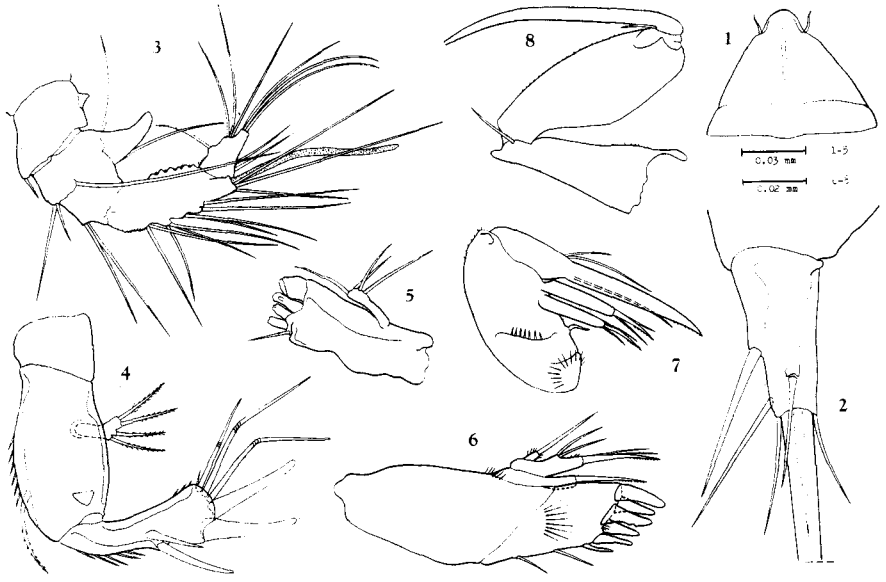

Fig. 6. *Laophonte cornuta*. 1. ♀, rostrum; 2. ♀, furcal ramus; 3. ♀, antennule; 4. ♀, antenna; 5. ♀, mandible; 6. ♀, maxillula; 7. ♀, maxilla; 8. ♀, maxillipede.

some hairs along inner margin. Endopodite represented by a small projection, with two slender setae. *Maxilla* (Fig. 6–7): Syncoxa with a transverse row of spinules on surface and a semi-circular row near proximal end, and with three endites. Proximal endite represented by one short seta. Middle and distal endites with one terminal pectinate spine and two setae. Basis with one strong pectinate claw accompanied with one slender seta. Endopodite represented by two slender setae. *Maxillipede* (Fig. 6–8): Large and prehensile. Basis with a few spinules along outer margin near proximal end; slender seta at inner distal part. First endopodite-segment longer than basis, and with some spinules along inner margin. Second endopodite-segment represented by a strong claw, somewhat longer than first endopodite-segment, and accompanied with a short seta at the base.

Leg 1 (Fig. 7–1): Coxa scarcely longer and broader than basis, and with three

spinules rows along outer margin and just inside. Basis with two longitudinal rows of spinules, one outer marginal seta and one inner spiniform seta at some distance from inner distal corner. Exopodite 2-segmented, second segment about two times as long as first one; second segment with two geniculate terminal setae, one geniculate and two spiniform outer marginal setae, and with some small spinules along outer margin; first segment with one outer spiniform seta near distal end.

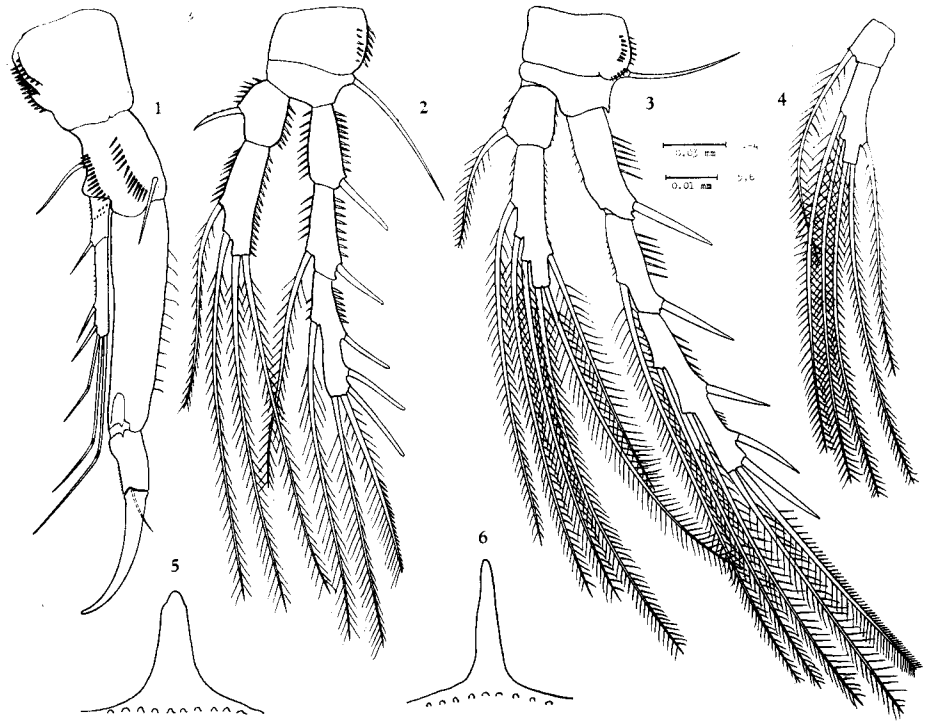

Fig. 7. *Laophonte cornuta*. 1. ♀, leg 1; 2. ♀, leg 2; 3. ♀, leg 3; 4. ♀, endopodite of leg 4; 5. ♀, anal operculum; 6. ♂, anal operculum.

Endopodite 2-segmented; second segment with one strong terminal claw accompanied with one slender seta at base, claw more than two times as long as second segment; first segment about five times as long as second one, with some hairs along inner margin. *Leg* **2** (Fig. 7–2): Coxa with two spinules rows along outer margin and just inside. Basis with one long outer seta near proximal end. Exopodite 2-segmented, thrid segment longest, and second one scarcely longer than first one; third segment with three outer marginal spines, two plumose terminal setae, and one pulmose inner marginal seta; second segment with one outer marginal

spine near distal end and one inner pulmose seta; first segment with one outer marginal spine near distal end. Endopodite 2-segmented; distal end of second segment not reaching second exopodite-segment; second segement about two times as long as first one, and with two terminal and two inner marginal plumose setae;

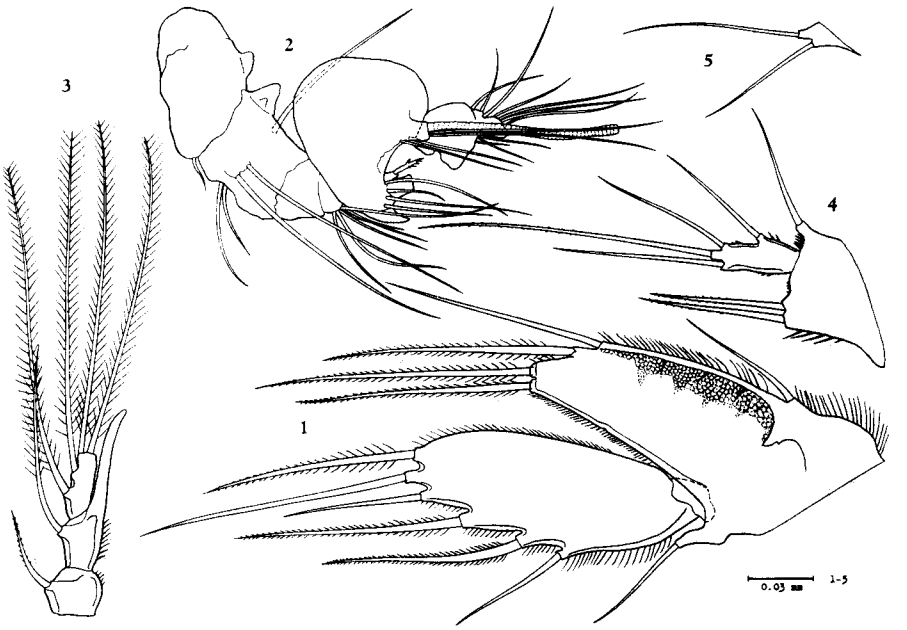

Fig. 8. *Laophonte cornuta*. 1. ♀, leg 5; 2. ♂, antennule; 3. ♂, endopodite of leg 3; 4. ♂, leg 5; 5. ♂, leg 6.

first segment with one short inner marginal seta. Each segment of endo- and exopodite with a spinules row along each margin. *Leg* **3** (Fig. 7–3): The armature of coxa and basis, and the segmentation of exo- and endopodite same as in leg 2. Third exopodite-segment with two pulmose inner marginal setae; terminal setae and outer marginal spines as in leg 2. Second endopodite-segment with six plumose setae in total, one outer marginal, two terminal and three inner marginal. The plumose inner seta of first endopodite-segment exceeding beyond the half of the second one. *Leg* **4** (Fig. 7–4): The armature of coxa, basis and exopodite same as in leg 2 and 3. Second endopodite-segment with five pulmose setae in total, one outer marginal, two terminal and two inner marginal. The inner plumose seta of first endopodite-segment about two times as long as the second segment. *Leg* **5** (Fig. 8–1): Inner expansion of basoendopodite triangularly tapering distally; distal end with two plumose setae; inner margin with three setae, the most distal one plumose and the most proximal one widely separated from the other two; outer

seta slender and bare. Exopodite elliptical; distal and outer margins six-loubled, each lobule with one seta; seta 1 bare and short, seta 2 and 3 plumose, seta 4 bare and short, seta 5 bare and about as long as exopodite-segment, and seta 6 plumose, counting from outer proximal seta. Basoendopodite and exopodite with many hairs along each margin.

Male:. Length about 0.85 mm. Anal operculum (Fig. 7–6) very acutely produced into a spiniform process. *Antennule* (Fig. 8–2): Subchirocer, 6-segmented; fifth segment swollen with one very strong aethetasc; first segment with a superficial groove transversely, (it is uncertain whether the groove represents the subdivision of this segment). *Leg* **3** (Fig. 8–3): Endopodite 3-segmented; third segment with two terminal and two inner marginal plumose setae; second segment produced into a long spiniform process at outer distal end, and with one plumose inner seta; first segment with one short outer seta. *Leg* **5** (Fig. 8–4): Inner expansion of basoendopodite with two apical setae. Exopodite more than two times as long as the greatest width, and with one inner marginal, one terminal and two outer marginal setae. All margins of each segment with some small spinules. *Leg* **6** (Fig. 8–5): Small and two-lobuled, with two setae, outer one longer.

Specimens examined: Oshoro, 1 ♀, 5-XI-'67, 1 ♂, 29-II-'68, both from moderately coase sand.

Remarks: These two specimens almost completely agree with description and figures by Lang (1948), except some minor differences in the armature of maxillula; arthrite of praecoxa with five claws instead of four; exopodite with only one seta instead of two; endopodite-segment very short. The shape of anal operculum is very similar to one of the specimens from Dillon Beach of Claifornia (Lang, 1965).

This is the first record of the species from Japan.

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