A New Species of the Genus *Sarsiella* Norman from Hokkaido, with Reference to the Larval Stages (Ostracoda: Myodocopina)[1)]

By

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(With 12 Text-figures and 1 Plate)

Our knowledge on the developmental stages of the *Sarsiella*-species is still poor, though several investigators have so far reported some of the larval stages of several species. The second to fourth larval stages (N–3∼N–1 instars) of *S. zostericola* Cushman, 1906 were precisely described by Kornicker (1967), and the later larval stages (N–1, N–2 instars) of some other congeneric species, were also reported by Jones (1958), Poulsen (1965) and Kornicker (1962, 1974, 1975).

In the present paper, all the successive stages of a *Sarsiella*-species, which is new to science, are described based upon the specimens collected from Oshoro on the Japan Sea coast of Hokkaido. Some problems in the differentiation process of particular structures found in the present new species are also discussed in comparison with some other congeneric species as well as *Spinacopia sandersi* Kornicker, 1969, whose larval stages have already been well examined by Kornicker (1969).

The seasonal distribution of all successive developmental stages, life cycle will be reported in another paper.

The specimens were collected from bottom sediment of muddy sand (3–5 m depths) sampled at Oshoro Bay by means of the decanting and sieving method. The type specimens are deposited in the Zoological Institute, Faculty of Science, Hokkaido University.

Before going further I would like to express my sincere thanks to Professor Mayumi Yamada of Hokkaido University for his guidance and reading the manuscript. Cordial thanks are also due to Dr. N. Minoura of Geological Institute, Hokkaido University and Mr. N. Kouyama of Zoological Institute, Hokkaido University, who gave me the facilities to examine the carapace structure of the present new species with a scanning electron microscope.

1) Studies on the recent marine Ostracoda from Hokkaido, V.

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Sarsiella japonica n. sp.

(Figs. 1~12; Plate IV)

Female. *Carapace* (Fig. 1-1~5; Plate IV-1~5) 1.36 mm long, round in lateral view with greatest height middle and about six-sevenths the length of carapace and with projecting subtriangular caudal process which is not extending to posterodorsal edge of carapace; left valve overlapping right valve along anterodorsal margin; dorsal margin joining posterior margin at an obtuse angle; hingement not distinct; carapace with a continuous ridge covered with many tubercles, which is approximately parallel to outer margin of valve except for posteroventral portion; anterior part of ridge connected with outer margin at two places; ventral part of ridge thickened, sinuate midst; surface of valve with shallow oval fossae containing short small processes, and with several setae and numerous small pits in the area

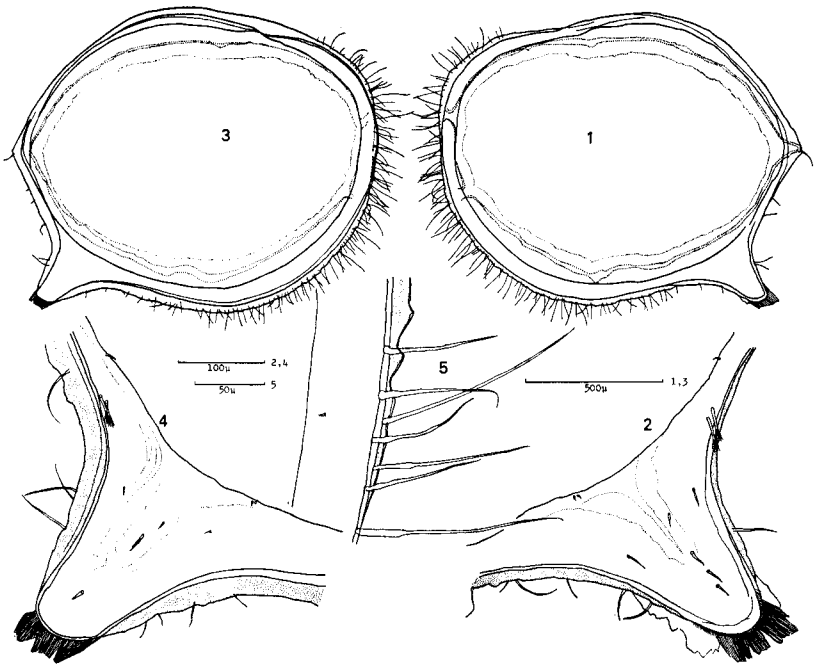

Fig. 1. *Sarsiella japonica* n. sp. Female (Holotype). 1. inside view of right valve; 2. ditto, caudal process; 3. inside view of left valve; 4. ditto, caudal process; 5. ditto, middle of anterior infold.

between fossae except for region of adductor muscle scars; anterior to ventral margin carapace with numerous long setae and posteroventral to posterior margin with several setae; area of adductor muscle scars divided into about twenty parts by thin low ribs. Middle of anterior infold with minute seta near inner margin; posterior

infold dorsal to caudal process with one small seta near inner margin and two juxtaposed setae of which each apex ends in a hairy tuft; caudal process with five to six short setae and two juxtaposed minute setae near inner margin; distal edge of caudal process with a thin lamellar prolongation and two setae of an equal length.

First antenna (Fig. 2–1). First segment stouter and longer than second; second segment with one dorsal bristle and two groups of hairs on dorsal and ventral margins respectively; third segment with one dorsal and one long ventral bristle and without suture separating it from fourth one; fourth segment with one

Fig. 2. *Sarsiella japonica* n. sp. Female (Holotype; 2, 5. paratype). 1. first antenna; 2. second antenna; 3. endopodite of second antenna; 4. rod-shaped organ; 5. median eye, lateral eye and rod-shaped organ; 6. mandible.

dorsal bristle and two long ventral bristles; fifth segment as long as preceding two segments combined, with one long ventral bristle; end segments not clearly defined from each other, with eight bristles, one of which is very short (arising from sixth segment), one short (a-bristle), one medium (b-bristle) and five long (c-, d-, e-, f-, g-bristles), all without filaments.

Second antenna (Fig. 2–2, 3). Exopodite nine-segmented; first one slightly longer than following segments combined, with some clusters of hairs on anterior margin; second to ninth segments tapering distally, with long bristles; bristles on second to eighth segments with natatory hairs; end segment with a long natatory bristle and a short hairy bristle. Endopodite one-segmented, with one short bristle on proximal portion and small thin lamellar protuberance on distal portion.

Rod-shaped organ (Fig. 2–4, 5) indistinctly two-segmented; distal segment thin lamellar, swelling.

Mandible (Fig. 2–6). Coxale with short stiff hairs along ventral margin and some clusters of hairs on lateral surfce; basale with six short spines on ventral surface (only one of paratypes desected has five short spines on corresponding position). Endopodite three-segmented; first one about three times as long as following segments combined, with stout curved ventral claw and three groups of spinules on medial surface; second one with a short terminal dorsal spine and stout curved ventral claw which is longer than preceding one; third one small, with a short slender spine on dorsodistal edge, one short spine on ventral margin and strong terminal claw which is longer than preceding claws.

Maxilla (Fig. 3–1, 2). Protopodite with one short anterior bristle; basale with a bristle close to exopodite. Exopodite small, with two hairy bristles of different lengths. Endopodite: first segment with terminal α- and β-bristles, which are furnished with spinules laterally; second segment with five stout terminal bristles, one of which is annulated along distal half and denticulated along the whole length, others are strong, furnished with rows of secondary teeth laterally, two a-bristles of subequal lengths on posterior surface and one c-bristle on anterior surface. Endites with sixteen bristles.

Fifth limb (Fig. 3–3). Epipodial appendage with about thirty pulmose bristles. Endite with one short bristle. Exopodite: first segment with two bristles one of which is two-thirds the length of the other; end segment (or segments) with fine hairs on central area, long haris on posterior surface and seven bristles of different lengths, three of which arise from anterodistal margin, three, one of which is very short, from posterodistal margin and short one from near posterior inner surface.

Sixth limb (Fig. 3–4). Endite with one long annulate and two short bristles. End segment with clusters of hairs on broad surface, row of long hairs along posterior margin, ten bristles along anterior to ventral margin and two juxtaposed pulmose bristles on posterior margin. Three juxtaposed pulmose bristles on posterior margin and abnormal bristle, which forms a single forked bristle, on ventral margin, are recognized in only one of paratypes (Fig. 4–1).

Seventh limb (Fig. 4–2). Terminal end smooth without opposing combs; six cleaning bristles of different length, three on each side in distal group, two of equal length in proximal group; each bristles with three to six bells distally.

Fig. 3. *Sarsiella japonica* n. sp. Female (Holotype). 1. right maxilla, all endite bristles not shown; 2. endite of left maxilla; 3. fifth limb; 4. sixth limb.

Furca (Fig. 4–3). Each lamella with five claws, decreasing in length proximally; claw 1 continuous with lamella, others separated from lamella by suture; each claw furnished with a row of secondary teeth and/or spinules; lamella near base of claw 1 with cluster of hairs.

Brush-shaped organ (Fig. 4–3,4) consisting of five annulate bristles situated near genital opening. *Genitalia* (Fig. 4–4): reniform spermatophore present on each side in the vicinity of genital opening. *Eggs* about 0.25 mm in diameter; fourteen individuals examined with 8 to 13 eggs in brood pouch. *Eyes*: median eye (Fig. 2–5) large and lateral eyes small, oval, both with dark brown pigments.

Male. Carapace (Fig. 5–1～5) 1.28 mm long, more weakly developed than

that of female, with prominent rostrum, deep rostral incisure and truncate caudal process which is extending beyond posterodorsal edge of carapace; greatest height near middle and about three-fifths the length; left valve overlapping right

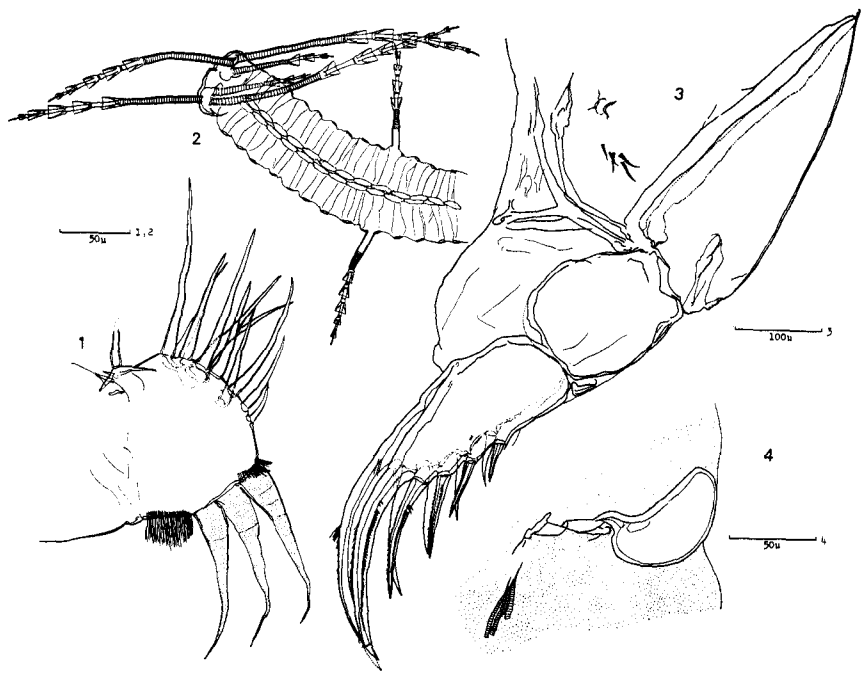

Fig. 4. *Sarsiella japonica* n. sp. Female (Holotype; 1, 4. paratype). 1. sixth limb; 2. seventh limb; 3. furca; 4. brush-like organ and spermatophore.

valve along anterodorsal margin; hingement not distinct; carapace with continuous ridge which is covered with a number of close tubercles and connected with outer margin of carapace at ventral portion of rostrum and anteroventral corner; dorsal and ventral portion of ridge sinuate; of ridge posterodorsal edge with long seta, projecting posteriorly; surface of valve with some indistinct oval fossae and short setae, both scattering over nearly whole surface; anterior to ventral margin of valve with many long setae. Anterior infold below rostral incisure with minute seta near inner margin; posterior infold dorsal to caudal process with one small seta and two juxtaposed setae of which each apex ends in a hairy tuft; caudal process with four to five short setae and some minute setae near inner margin; distal edge of caudal process with thin lamellar prolongation and two setae of an equal length.

First antenna (Fig. 6–1). First segment bare, slightly longer than second;

second segment with dorsal bristle; third segment with one dorsal bristle and five ventral spinule and without suture separating it from fourth one; fourth segment with one short dorsal bristle and two long ventral bristles; fifth segment inserted ventrally between fourth and sixth segment, with long filamentous bristle and

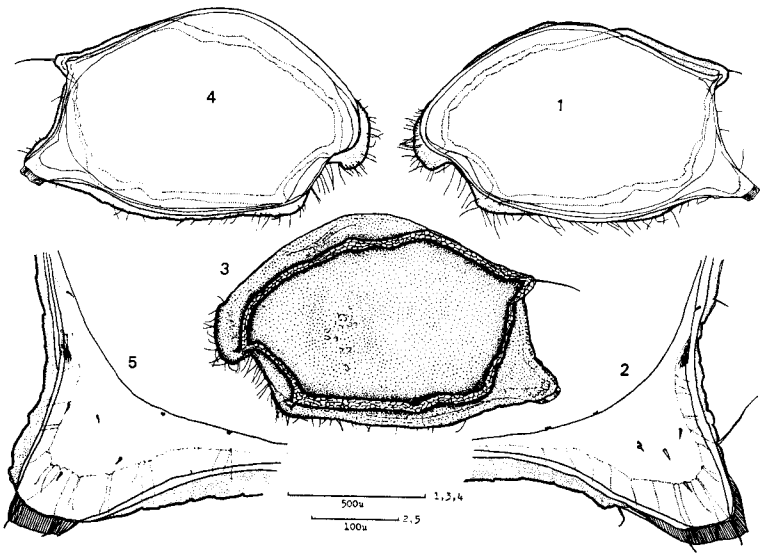

Fig. 5. *Sarsiella japonica* n. sp. Male (Allotype). 1. inside view of right valve; 2. ditto, caudal process; 3. lateral view of left valve; 4. ditto, inside view; 5. ditto, caudal process.

numerous long sensory filaments, which are as long as preceding bristle; sixth segment as long as third and fourth segments combined, with short bristle on distal margin; end segments with seven bristles, of which one short (a-bristle), one medium (b-bristle) and five long (c-, d-, e-, f- and g-bristles), three of which are furnished with filaments.

Second antenna (Fig. 6–2, 3). Exopodite similar to that of female, without clusters of hairs on anterior margin of first segment. Endopodite three-segmented; first one one-half the length of second, with one short bristle on proximal part; second one with two juxtaposed hairy bristles on middle of anterior margin; third one recurved, with two short subterminal bristles and some ridges on terminal part.

Rod-shaped organ (Fig. 6–4) elongate, indistinctly two-segmented.

Mandible (Fig. 6–5). Coxale bare without endite. Basale with six bristles ventrally, two of which are thick and longer than others, and two dorsodistal bristles of an equal length. Endopodite: first segment subquadrate and hursute on broad surface, with one long distoventral bristle wreathed by long stiff hairs;

second segment with three bristles, one of which arises from distoventral edge, others from middle of dorsal margin; end segment with two distoventral bristles and terminal claw. Exopodite slightly shorter than dorsodistal bristles of basale, tapering distally with numerous thin filaments.

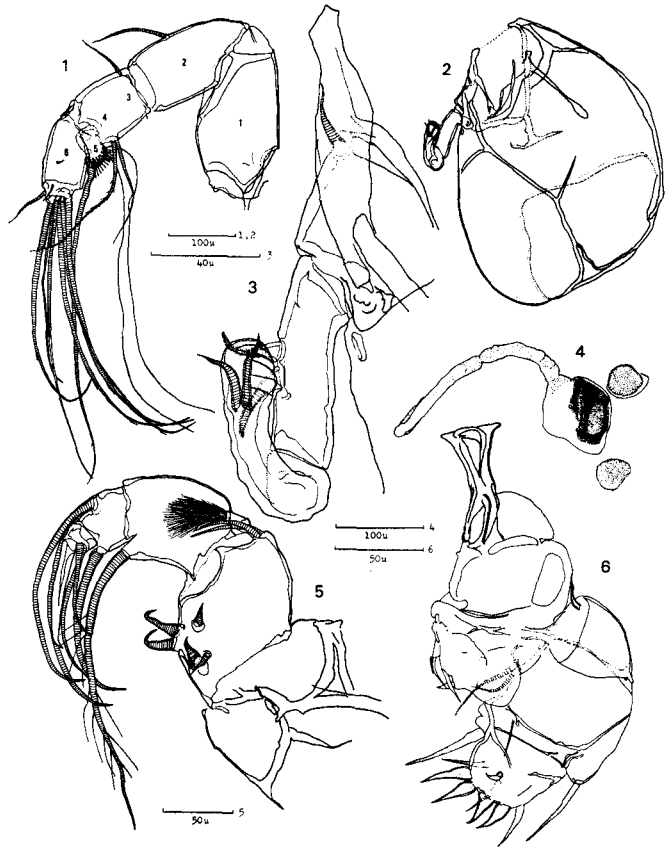

Fig. 6. *Sarsiella japonica* n. sp. Male (Allotype). 1. first antenna; 2. second antenna, exopodite not shown; 3. ditto, endopodite; 4. eyes and rod-shaped organ; 5. mandible; 6. maxilla.

Maxilla (Fig. 6–6) smaller than of female; segments and bristles weakly developed; endopodite and exopodite having the same bristle formulae as in female.

Fifth limb (Fig. 7–1) smaller than of female, having the same bristle formula as in female; bristles weakly developed.

Sixth limb (Fig. 7–2). Endite with one long and two short bristles. End

segment with twelve pulmose bristles, two on posterior margin, the rest on anterior to ventral margin, three of which are much shorter than others; surface of near ventral to posterior margin covered with short hairs; ventral to posterior margin with long hairs.

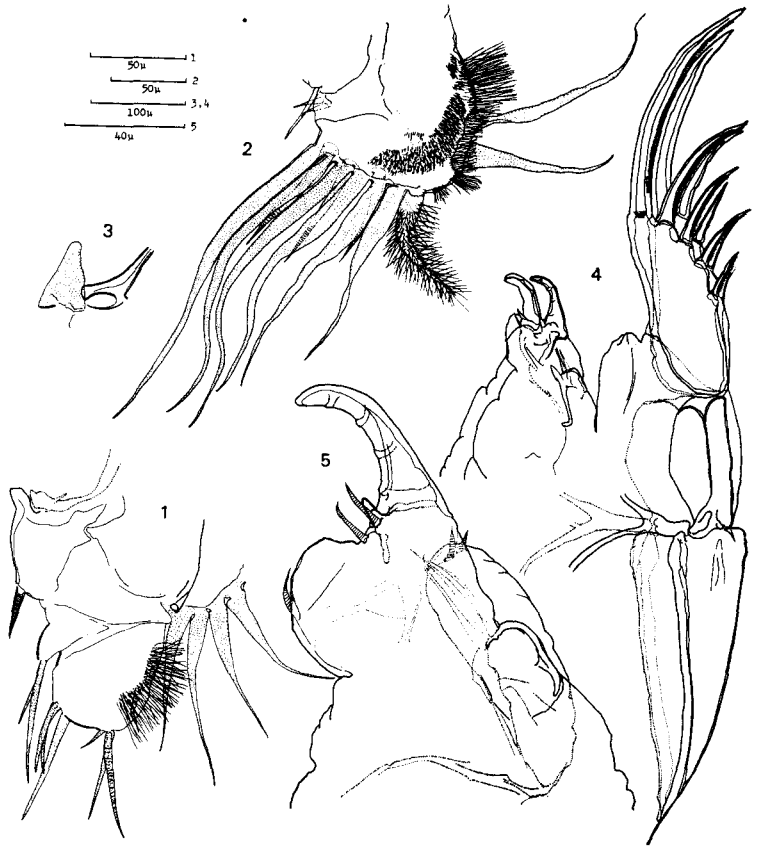

Fig. 7. *Sarsiella japonica* n. sp. Male (Allotype). 1. fifth limb; 2. sixth limb; 3. seventh limb; 4. furca and copulatory limb; 5. ditto, copulatory limb.

Seventh limb (Fig. 7–3) forming short, bare, bud-like process.

Furca (Fig. 7–4). Each lamella with five claws, decreasing in length proximally; claw 1 continuous with lamella, others separated from lamella by suture; each claw furnished with a row of spinules; lamella near base of claw 1 with cluster of hairs.

Copulatory limb (Fig. 7–4,5) consisting of three lobes; small proximal lobe with three long slender bristles on distal edge; next one long, with two short

annulate bristles near distal edge; main lobe terminating in a sclerotized hook, which has three to four transversal ridges along the whole length, and short stout tooth, with one anterior bristle and two bristles near base of hook.

Eyes (Fig. 6–4): median eye large and lateral eyes small, round, both with dark brown pigments.

Remarks. The present new species is easily discernible from the other congeneric species so far known in the characteristics such as the outline of the carapace with subtriangular caudal process and the posterodorsal corner terminating in an obtuse angle and the shape of the rather simple continuous ridge covered with many tubercles on the shell surface. This new species somewhat resembles *Sarsiella maculata* Poulsen, 1965 and *S. verae* Poulsen, 1965, both from Thailand, in the general appearance of the carapace in the both sexes, but clearly differes from both species in the structure of the ridge on the shell surface as described below. The ridge of *S. maculata* is clearly interrupted at an anterior portion, while in the other two species it is entirely continuous. The continuous ridge in female of *S. japonica* n. sp. is connected with the outer margin of the shell at the anterior portion, whilst no such connection is present in female of *S. verae.* The posterodorsal edge of the ridge in female of *S. verae* is much more prominent and protruded rather than in *S. japonica* n. sp.. In addition, *S. verae* has the ridge (♀) or ridges (♂) located ventrally inside the continuous ridge, though the present new species in the both sexes has no ridges on the corresponding area.

Apart from the characters of the carapace, this new species is alike to *S. sculpta* Brady, 1890 reported by Darby (1965) from Sapelo Island, Georgia and *S. ovalis* Poulsen, 1965 from Virgin Islands, West Indies in the structure of the endopodite of the second antenna in female which has only one bristles on the proximal portion, but is easily discernible from *S. sculpta* in the setal formulae of the first antenna and the seventh limb. The terminal end of the seventh limb is entirely smooth in *S. japonica,* though the corresponding part in *S. sculpta* and *S. ovalis* is furnished with some opposing combs and a pair of pincers, respectively. Such the same structure of the seventh limb (smooth end and setal number) found in the present new species, is also detected in the following species reported by Poulsen (1965) from Thailand: *S. armata, S. longicornis, S. verae, S. maculata, S. parvispinosa* and *S. multispinosa.* The present new species is, however, easily descernible from them here enumerated by the characteristic of the second antenna, of which the endopodite has two bristles on the proximal portion in these six species, while in the present new species the endopodite has only one bristle on the corresponding position.

Specimens examined. Holotype ♀ (11–VIII–'75); allotype ♂ (6–VII–'76); paratypes 1♀ and 1♂ (6–VII–'76), 1♂ (10–VI–'76), 1♀ (11–VIII–'75), 1♀ (26–VIII–'75) and 2♀♀ (17–VII–'76) Sh. Hiruta leg.

Larval development

First larval stage (N–4 instar; sex undetermined)

Carapace (Fig. 8–1) about 0.55 mm in length, caudal process included, about 0.40 mm in greatest height, oval in lateral view with prominent caudal process; continuous ridge present on each shell surface. *First antenna* (Fig. 9–1) similar to adult female but with no bristles on second and fourth segments; bristles on fifth segment and c-, f- and g-bristles annulated along distal half the length. *Second antenna* (Fig. 9–2). Endopodite without bristle; bristles of second to fourth exopodite segments with stiff hairs on proximal part. *Rod-shaped organ* (Fig. 9–3) similar to adult female without segmentation.

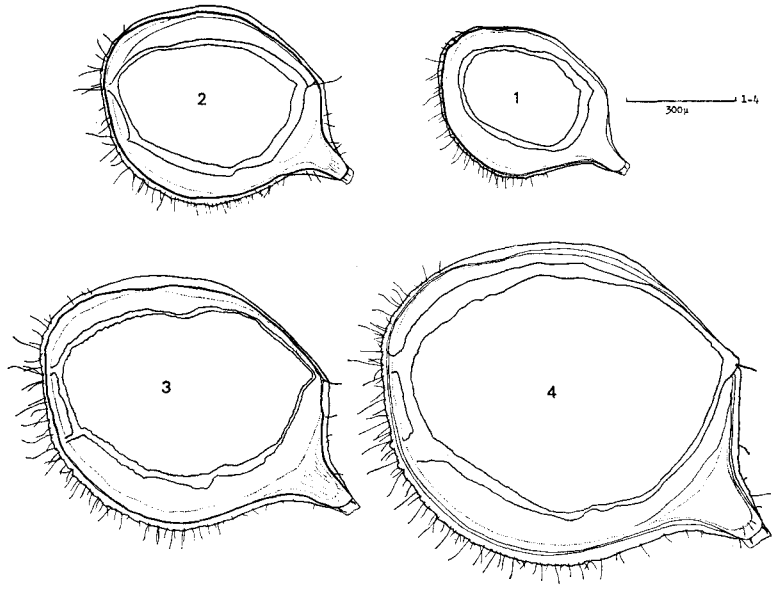

Fig. 8. *Sarsiella japonica* n. sp. 1～4. first to fourth larval stages. 1. sex unknown; 2～4. female.

Mandible (Fig. 9–4) and *fifth limb* (Fig. 9–7) similar to adult female in general appearance. *Maxilla* (Fig. 9–5, 6) similar to adult female in total appearance but second endopodite segment with only three teeth and two short bristles. *Sixth limb* (Fig. 9–8) leaf-like, with marginal hairs. *Seventh limb* (Fig. 9–7) forming small, bare bud-like process at the site above fifth limb.

Furca (Fig. 9–9). Each lamella with two claws and three hairy protuberances decreasing in size proximally; distalmost claw and three protuberances continuous with lamella; anterior margin of lamella with some spinules; lamella near base of distalmost claw with cluster of long hairs.

Second larval stage (N–3 instar)

Female. Carapace (Fig. 8–2) about 0.70 mm in length, caudal process included, about 0.52 mm in greatest height, similar to adult female except that caudal process is extending beyond posterodorsal edge of carapace. No sexual dimorphism was recognized in carapace structure. *First antenna* (Fig. 10–1) similar to previous stage except for having one dorsal bristle on second and fourth segments. *Second antenna* similar to adult female; endopodite (Fig. 10–2) with one small proximal bristle.

Mandible, maxilla, fifth limb and *furca* similar to adult female. *Sixth limb* (Fig. 10–3) leaf-like, with two hairy protuberances and one spinulose bristle on

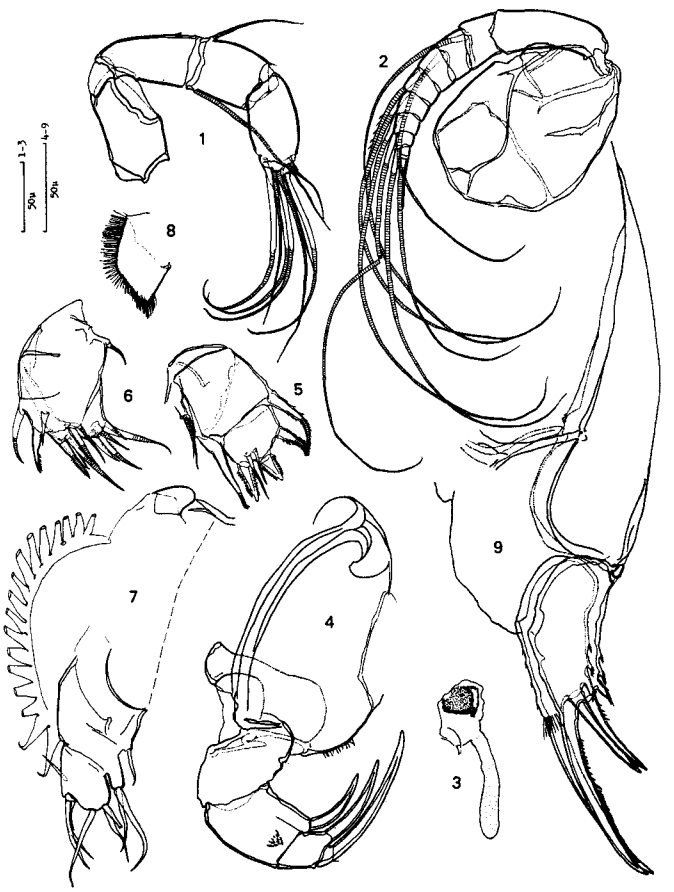

Fig. 9. First larval stage (N-4 instar). 1. first antenna; 2. second antenna; 3. median eye and rod-shaped organ; 4. mandible; 5. endopodite and exopodite of maxilla; 6. endite of maxilla; 7. fifth and seventh limb; 8. sixth limb; 9. furca.

anterodistal margin and several clusters of hairs along posterior margin. *Seventh limb* (Fig. 10–4) similar to previous stage.

Male. Endopodite of *second antenna* (Fig. 10–5) two-segmented; first one with one proximal bristle; second one round, with small distal spine. Other structures same as in female of N–3 instar.

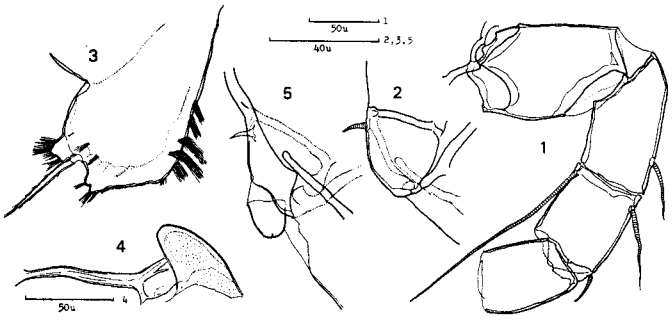

Fig. 10. Second larval stage (N-3 instar). Female. 1. first antenna; 2. endopodite of second antenna; 3. sixth limb. Male. 4. seventh limb; 5. endopodite of second antenna.

Third larval stage (N–2 instar)

Female. Carapace (Fig. 8–3) about 0.75 mm in length, caudal process included, about 0.65 mm in greatest height, similar to previous stage. No

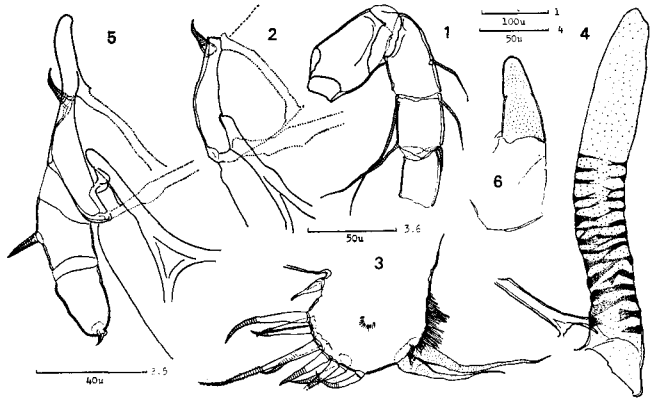

Fig. 11. Third larval stage (N-2 instar). Female. 1. first antenna; 2. endopodite of second antenna; 3. sixth limb; 4. seventh limb. Male. 5. endopodite of second antenna; 6. seventh limb.

sexual dimorphism was recognized in carapace structure. *First antenna* (Fig. 11–1). One ventrodistal bristle added to fourth segment. *Second antenna* (Fig. 11–2) similar to previous stage and adult female. *Mandible, maxilla, fifth limb* and

furca similar to adult female. *Sixth limb* (Fig. 11–3) similar to adult female in general appearance with two bristles of different lengths on endite. *Seventh limb* (Fig. 11–4) bare, elongate, with striations along proximal half.

Male. Second antenna. Endopodite (Fig. 11–5) three-segmented; first one with proximal bristle; second one as long as third, with one bristle on middle of anterior margin; third one with short bristle on distal edge. *Seventh limb* (Fig. 11–6) similar to previous stage. Other structures same as in female of N–2 instar.

Fig. 12. Fourth larval stage (N-1 instar). Female. 1. first antenna; 2. endopodite of second antenna; 3, 4. sixth limb; 5. seventh limb. Male. 6. endopodite of second antenna; 7. seventh limb; 8. copulatory limb.

Fourth larval stage (N–1 instar)

Female. Carapace (Fig. 8–4) about 0.96 mm in length, caudal process included, about 0.87 mm in greatest height, similar to adult female, but caudal

process still extending beyond posterodorsal edge of carapace. No sexual dimorphism was recognized in carapace structure. *First antenna* (Fig. 12–1) similar to adult female, adding one ventrodistal bristle to fourth segment. *Second antenna* (Fig. 12–2), *mandible, maxilla, fifth limb* and *furca* similar to adult female. *Sixth limb* (Fig. 12–3, 4). Three juxtaposed pulmose bristles on posterior margin are sometimes recognized. *Seventh limb* (Fig. 12–5) terminating in a round process; four cleaning bristles of subequal lengths, with one or two bells in distal group, two of an equal length with one bell in proximal group, all tapering distally.

Male. Second antenna. Endopodite (Fig. 12–6) elongate, three-segmented; second segment as long as third, with two juxtaposed bristles on middle of anterior margin; third one with two distal bristles. *Seventh limb* (Fig. 12–7) similar to previous stage and adult male. *Copulatory limb* (Fig. 12–8) composed of three weakly developed lobes on each side; each lobe with three to four short bristles. Other structures same as in female of N–1 instar.

Specimens examined. N–4 instars (18–IX–'74); N–3 instars (18–IX–'74 and 26–VIII–'75); N–2 instars (29–II–'76); N–1 instars (18–IX–'74, 29–II–'76 and 17–VII–'76) Sh. Hiruta leg.

Discussion

The present new species, as described above, has four different larval stages. The same number of larval stages is also known in some other species within the family Sarsiellidae reported by Kornicker (1969): *Sarsiella zostericola, Spinacopia sandersi* and *Sp. variabilis.*

The appendages, except for the maxilla and the seventh limb, in the first larval stage of the present new species almost accord with those of *Sp. sandersi* in the principal structures, such as the setal formula of the first antenna, female-like endopodite of the second antenna without any proximal bristles, the mandible and the fifth limb developed well as in adult female, the leaf-like sixth limb without bristles and the structure of the furca. With regard to the maxilla, *Sp. sandersi* has well-developed adult female-like one, namely the second endopodite segment is furnished with five terminal bristles, two a-bristles and one c-bristle, while in *S. japonica* n. sp. it is still undeveloped, only having three terminal bristles and two a-bristles on the corresponding segment.

All the first larval stages of myodocopid ostracods so far known are lacking in the seventh limb and, further, Kornicker (1969) adopted this characteristic together with the structure of the sixth limb for the first larval stage in the key to each stage of early myodocopid instars. In the present new species, however, the seventh limb is clearly recognizable at the site above the fifth limb even in the first larval stage. The specimens here reported as the first larval stage (N–4 instar) of *S. japonica* are certainly of N–4 instar, as far as judging from its shell size, morphology of the sixth limb without bristles and the setal formula of the first antenna.

The differentiation process of all the appendages through the last four stages, whose sex is easily determinable by the endopodite of the second antenna, entirely accords with that of *S. zostericola*, except for the following two points. In *S. zostericola* the endopodite of the second antenna of the male third larval stage is two-segmented, while that of *S. japonica* in the same stage is three-segmented. In the adult male of the former species, the seventh limb is not observable (Kornicker, op. cit.). The metamorphosis of *S. japonica* is also similar to that of *Sp. sandersi* except for the condition of a characteristic. The seventh limb in the later stages of the male in *Sp. sandersi* does not remain undeveloped, while the limb in question persists in the characteristic found in early larval stages even in the adult in *S. japonica* and also probably most of the other *Sarsiella*-species.

On the other hand, Kornicker and Wise (1962: p. 69) said about the development of the endopodite of the second antenna, "Observations made in the present study suggest that the secondary appendage of the female *S. texana* is elongate in the juvenile stage and then becomes rudimentary in a late instar stage (probably N–1 stage)". However, as far as judging from the present investigation and the previous studies on *S. zostericola* by Jones (1958) and Kornicker (1967) and on *Sp. sandersi* by Kornicker (1969), it is possible to conclude that the reduction of the endopodite of the second antenna does not occur in *S. texana* and, further, its metamorphosis is not so different from the preceding species, as already discussed by Kornicker (1969: p. 36).

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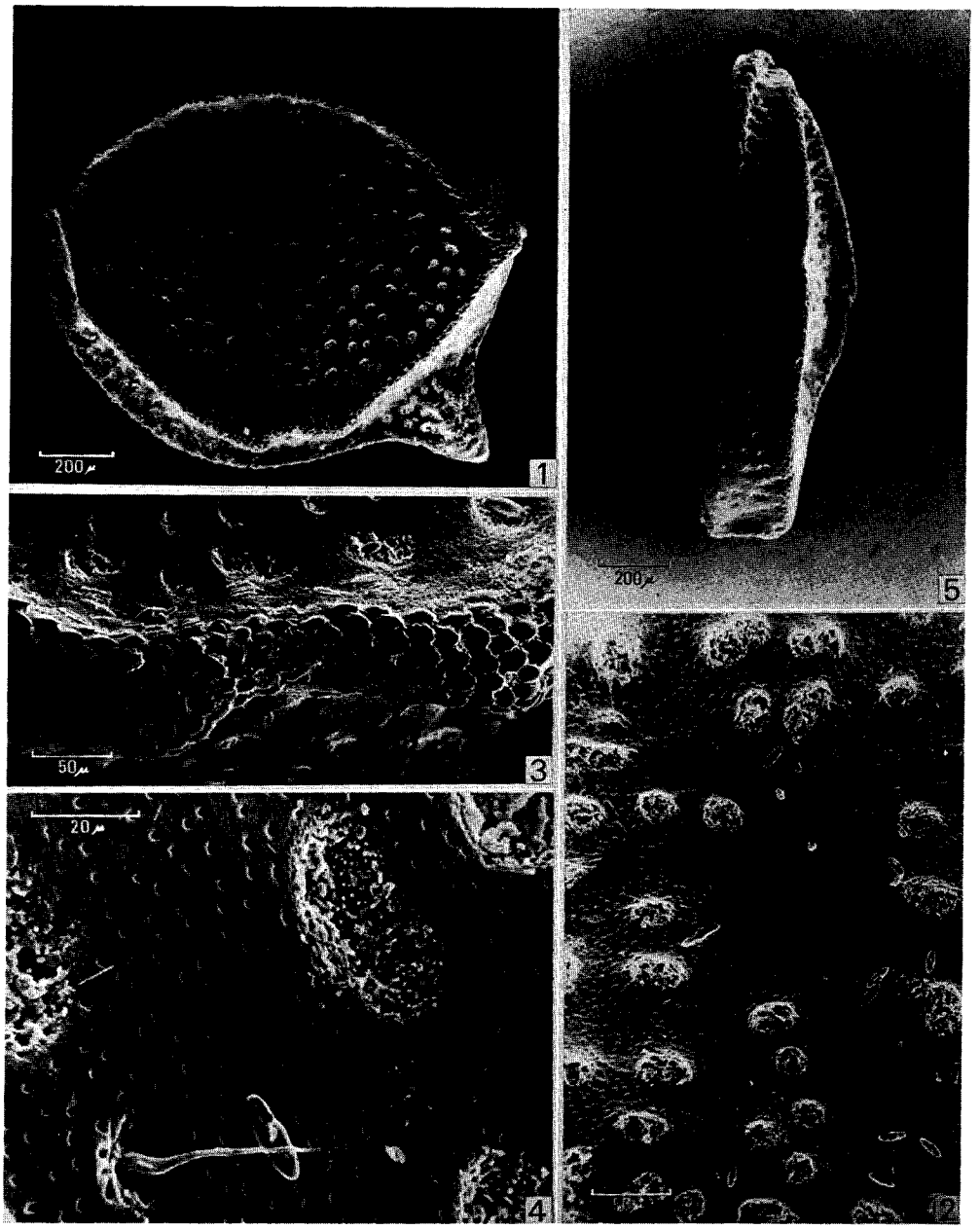
Explanation of Plate IV

Female (Paratype).
Fig. 1. Lateral view of left valve.
Fig. 2. Ditto, area of adductor muscle scars.
Fig. 3. Ditto, ventral part of ridge.
Fig. 4. Ditto, detail of surface structure.
Fig. 5. Dorsal view of right valve.



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