



Title	Redescription of <i>Sarsiella misakiensis</i> Kajiyama from Hokkaido, with Reference to the Larval Stages (Ostracoda; Myodocopina) (With 15 Text-figures)
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**Redescription of *Sarsiella misakiensis* Kajiyama  
from Hokkaido, with Reference to the Larval  
Stages (Ostracoda; Myodocopina)<sup>1)</sup>**

By

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(With 15 Text-figures)

The present paper deals with the morphology of all the successive stages of *Sarsiella misakiensis* Kajiyama, 1912, as the second report on the ontogeny of myodocopid ostracods. The specimens were collected from bottom sediment of muddy sand (3–5 m depths) sampled at Oshoro, on the Japan Sea coast of Hokkaido (larvae and adults) and at the type locality, Misaki, Kanagawa Pref. (adults) by means of the decanting and sieving method.

Before going further I would like to express my sincere gratitude 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 for his kind advices in using a scanning electron microscope.

***Sarsiella misakiensis* Kajiyama, 1912**

(Figs. 1~15)

*Sarsiella misakiensis* Kajiyama, 1912, p. 615, pl. 9, figs. 23~28.

*Female. Carapace* (Fig. 1-1~4; Fig. 2-1~4) round in lateral view, with greatest height middle and about six-sevenths the length of carapace and with small subtriangular caudal process which is not extending to posterior end of carapace; left valve overlapping right valve along middle to anterior dorsal margin. Each valve with two dorsal ridges, upper one running near dorsal margin of carapace without bulges, lower one, which extends along anterior margin of valve forming relatively narrow anterior ridge, sinuate with large three swellings, a ventral ridge sinuate in the vicinity of caudal process, terminating in a large posterior bulge and two horizontal ridges, of which upper one is short, arising from one-third the distance from dorsal end of anterior ridge and lower one arises from

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

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ventral end of anterior ridge, extending to area of adductor muscle scars; lower dorsal ridge joining ventral ridge between posterior bulges of both ridges; one bulge present near middle of posterior margin of valve. Surface of carapace, which is covered with fibroid structure (see Fig. 1-3), with many shallow oval hollows

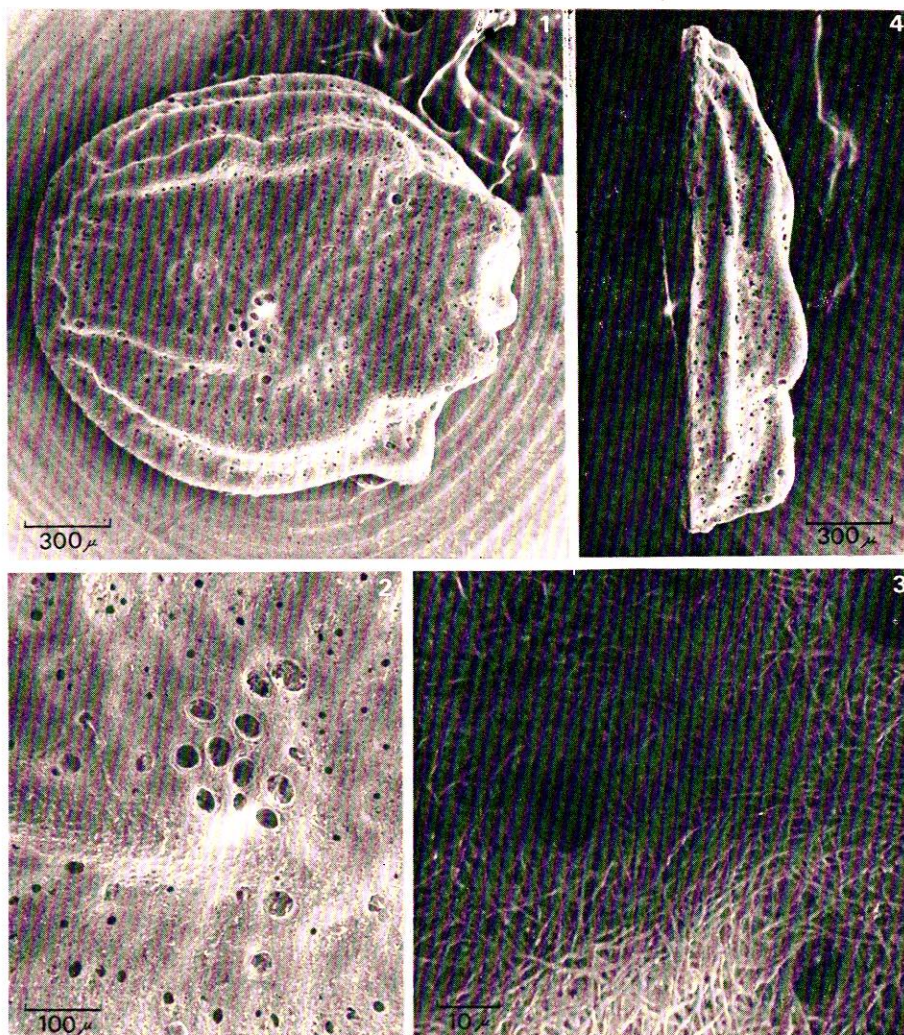


Fig. 1. *Sarsiella misakiensis*. Female. 1. lateral view of left valve; 2. ditto, area of adductor muscle scars; 3. ditto, detail of surface structure; 4. dorsal view of right valve.

containing one to four holes; adductor muscle scars consisting of about twelve individual muscle scars locating somewhat below anterior middle of valve. Middle of anterior infold with a minute seta near inner margin; posterior infold dorsal to

caudal process with one short seta and two juxtaposed setae, of which each apex ends in a hairy tuft; caudal process with one or two short setae distally, five to eight short setae proximally and two juxtaposed minute setae near inner margin; distal edge of caudal process with a thin lamellar prolongation and two setae.

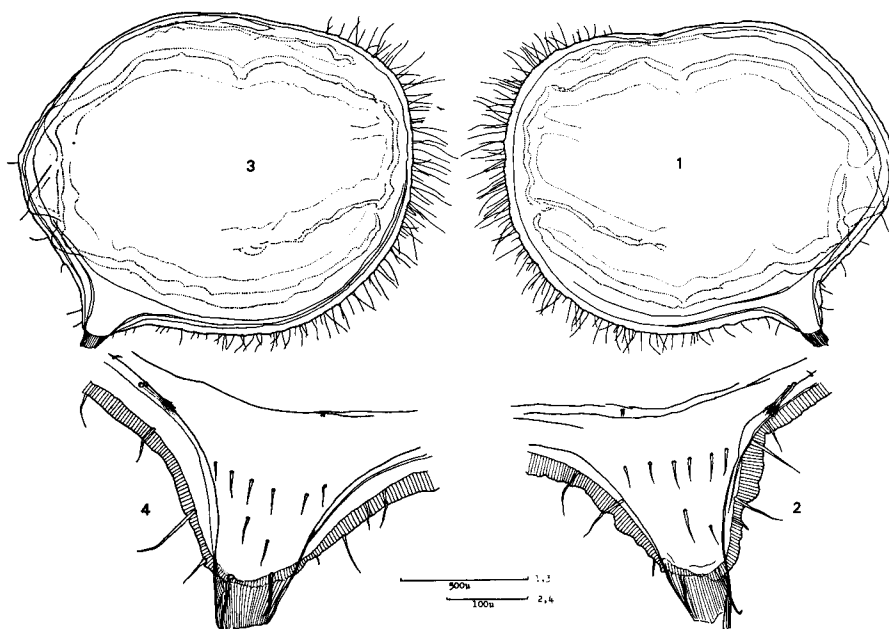


Fig. 2. *Sarsiella misakiensis*. Female. 1. inside view of right valve; 2. ditto, caudal process; 3. inside view of left valve; 4. ditto, caudal process.

*First antenna* (Fig. 3-1). First segment about 1.3 times as long as second, with some clusters of hairs on dorsal surface; second segment with one dorsal bristle; cuticle of distal half of dorsal margin of second segment and dorsal margins of third and fourth segments thickened; third segment with one dorsal and one long ventral bristle and without suture separating it from fourth one; fourth segment with one dorsal bristle and two or three 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- and g-bristles).

*Second antenna* (Fig. 3-2, 3). Protopodite oval. Exopodite nine-segmented; first one bare, slightly longer than following segments combined; second to eighth segments tapering distally, with long bristles, all with natatory hairs; end

segment with one long natatory bristles and one short slender bristle. Endopodite one-segmented, with two short bristles on proximal portion (three short bristles are recognized on the corresponding position in only one of endopodites of specimens from Misaki) and a small thin lamellar protuberance on distal portion.

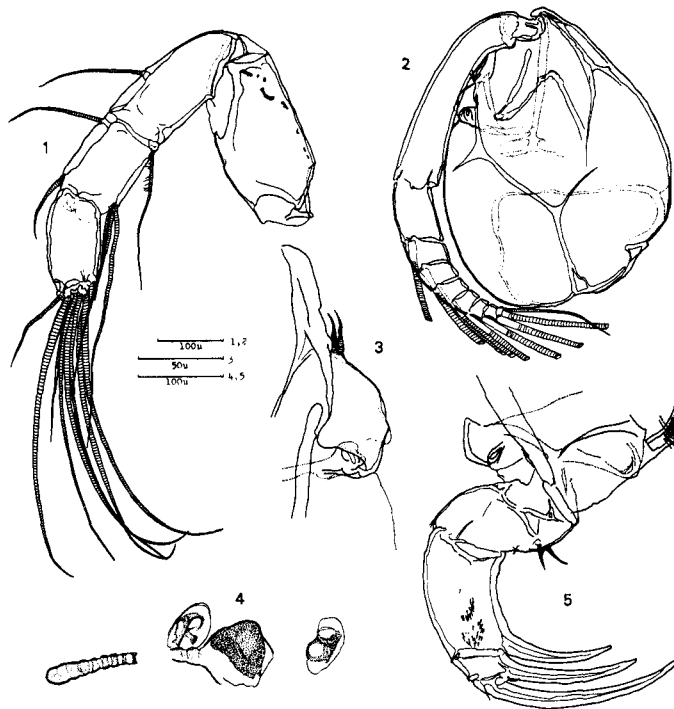


Fig. 3. *Sarsiella misakiensis*. Female. 1. first antenna; 2. second antenna; 3. endopodite of second antenna; 4. rod-shaped organ, median eye and lateral eyes; 5. mandible.

*Rod-shaped organ* (Fig. 3-4) elongate, terminating in a widened round tip, with several constrictions along the whole length.

*Mandible* (Fig. 3-5). Coxale with stiff hairs on middle of ventral margin; basale with one or two short spinules on dorsodistal edge, three annulate bristles, one of which is shorter than others, on middle of ventral margin and one to four minute spines near distoventral edge. Endopodite three-segmented; first one about three times as long as following segments combined, with stout curved ventral claw and two or three groups of spinules on medial surface; second one with a short subterminal dorsal spinule and a 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 edge and a strong terminal claw which is longer than preceding claws.

*Maxilla* (Fig. 4-1). Protopodite with one short anterior bristle; basale with a bristle close to expodite. Exopodite small, with two bristles, one is less than half

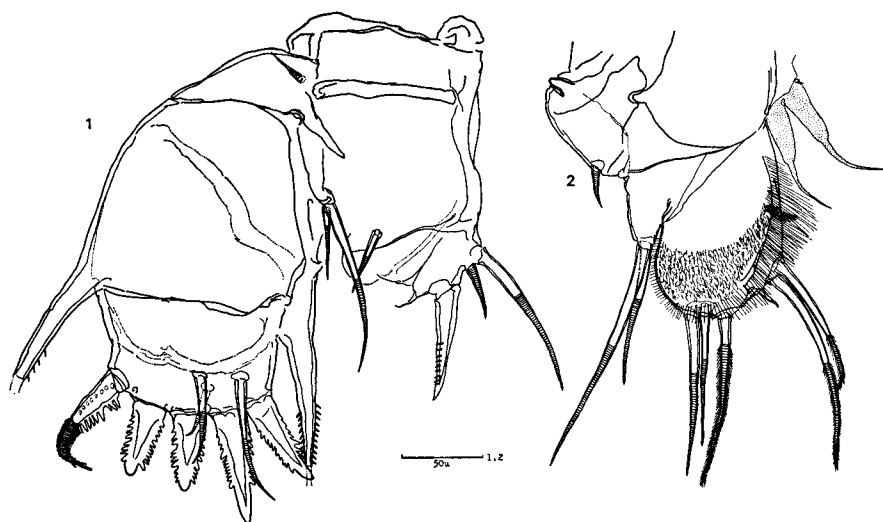


Fig. 4. *Sarsiella misakiensis*. Female. 1. maxilla, all endite bristles not shown; 2. fifth limb.

the length of the other. Endopodite: first segment with terminal  $\alpha$ - and  $\beta$ -bristles, which are furnished with spinules laterally; second segment with five stout terminal bristles, one of which is annulated along distal half, 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 about sixteen bristles.

*Fifth limb* (Fig. 4-2). Epipodial appendage with about 32 pulvose bristles. Endite with one short bristle. Exopodite: first segment with two bristles of different length; end segment (or segments) hirsute, with long hairs along ventral to posterior surface and seven bristles of different lengths, three of which arise from ventral margin, three, of which one is very short, from posteroventral margin and short one from near posterior inner surface.

*Sixth limb* (Fig. 5-1) round in lateral view. Endite with one long annulate and two short bristles. End segment with clusters of hairs on broad surface, eleven or twelve bristles along anterior to ventral margin and two juxtaposed pulvose bristles on posterior margin.

*Seventh limb* (Fig. 5-2). Terminal end smooth without opposing combs; six cleaning bristles of different lengths, three on each side, in distal group, two of an

equal length in proximal group (three cleaning bristles in one of the specimens from Misaki are recognized in proximal group.); each bristle with three to six bells distally.

*Furca* (Fig. 5-3). Each lamella with five claws, decreasing in length

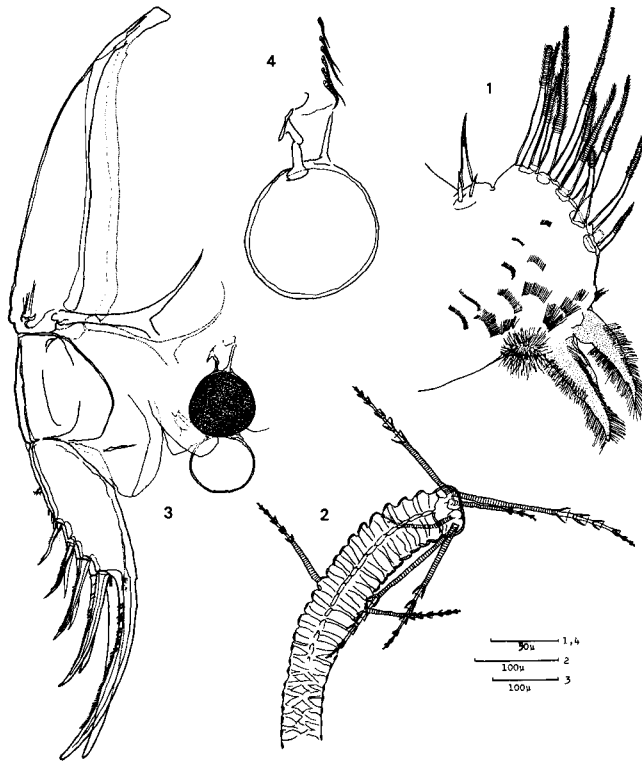


Fig. 5. *Sarsiella misakiensis*. Female 1. sixth limb; 2. seventh limb; 3. furca and spermatophores; 4. brush-like organ and spermatophore.

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. 5-4) consisting of six annulate bristles situated near genital opening. *Genitalia*: round spermatophore (Fig. 5-3, 4) present in the vicinity of genital opening. *Eggs* about 0.25 mm in diameter; specimens examined with 8 to 13 eggs in brood pouch. *Eyes* (Fig. 3-4): median eye and lateral eyes with dark brown pigments.

*Male*. *Carapace* (Fig. 6-1~4; Fig. 7-1~5) with prominent rostrum, deep rostral incisur and wide round caudal process which is extending beyond posterior



end of carapace; greatest height middle and about two-thirds the length; dorsal margin evenly arched; anteroventral margin joining ventral margin in an obtuse angle; ventral margin approximately straight; left valve overlapping right valve along middle to anterior dorsal margin. Each valve with two dorsal ridges, upper

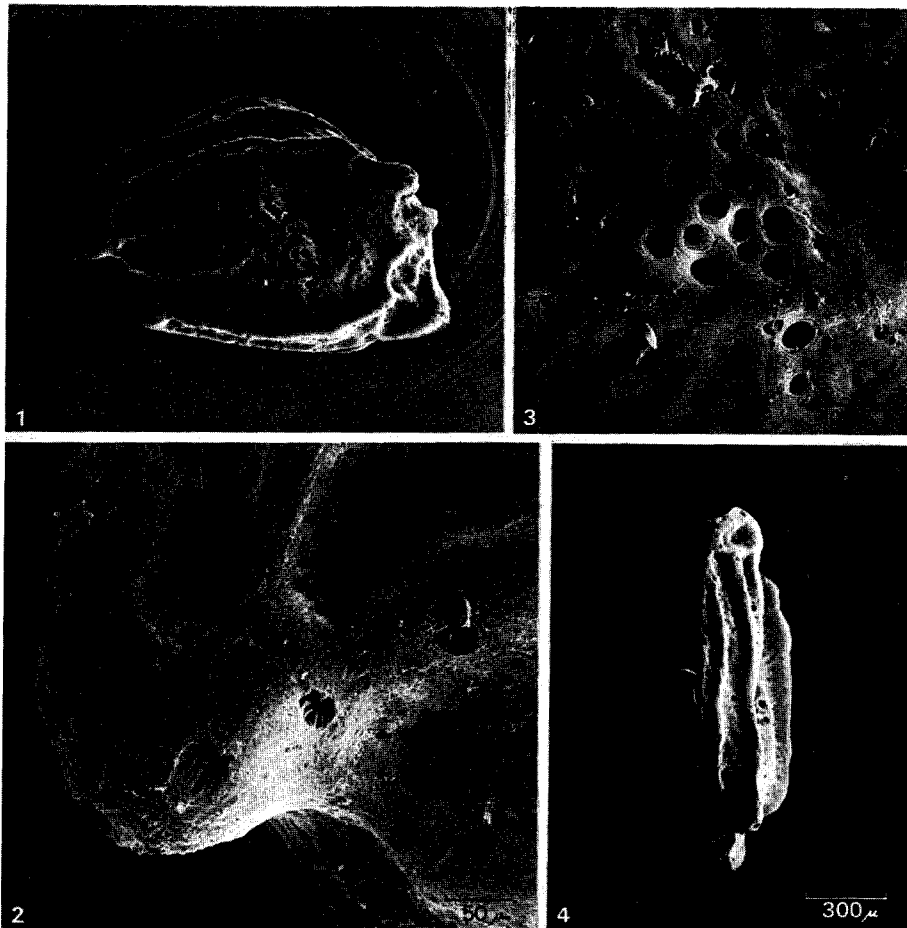


Fig. 6. *Sarsiella misakiensis*. Male. 1. lateral view of left valve; 2. ditto, area of rostrum; 3. ditto, area of adductor muscle scars; 4. dorsal view of right valve.

one running near dorsal margin of carapace, lower one sinuate, with a round posterior bulge, a ventral to posterior ridge with two posterior bulges and two ridges between preceding ridges, both extending to middle of carapace and connected with lower dorsal ridge at ventral area of rostrum; one bulge present near postero-dorsal corner of valve. Surface of carapace almost same as in female; large holes



on rostrum with one seta respectively (see Fig. 6-3). Middle of anterior infold with a minute seta near inner margin; posterior infold dorsal to caudal process with one short seta and two juxtaposed setae, of which each apex ends in a hairy tuft; caudal process with one seta distally, one to five setae proximally and three juxt-

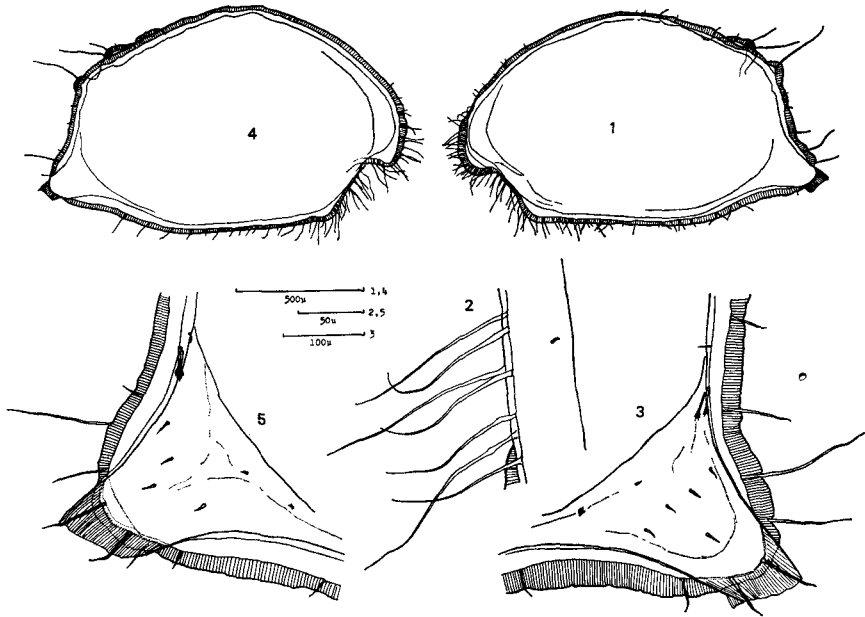


Fig. 7. *Sarsiella misakiensis*. Male. 1. inside view of right valve; 2. ditto, middle of anterior infold; 3. ditto, caudal process; 4. inside view of left valve; 5. ditto, caudal process.

aposed minute setae and no or one seta near inner margin; distal edge of caudal process with a thin lamellar prolongation and two setae.

*First antenna* (Fig. 8-1). First segment bare, somewhat longer than second; second segment with some clusters of hairs and one dorsal bristle; third segment with one dorsal bristle 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 segments, with long bristles and 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).

*Second antenna* (Fig. 8-2, 3). Protopodite and exopodite similar to those of female. Endopodite three-segmented; first one with two (sometimes three) bristles

on proximal portion; second one with two (sometimes three) bristles on anterior margin; third one recurved, with two short subterminal bristles and several serrate ridges on terminal portion.

*Rod-shaped organ* (Fig. 8-4) almost same as in female.



Fig. 8. *Sarsiella misakiensis*. Male. 1. first antenna; 2, 3. endopodite of second antenna; 4. rod-shaped organ, median eye and lateral eye; 5. mandible.

*Mandible* (Fig. 8-5). Coxale bare, without endite. Basale with six bristles ventrally, two of which are spine-like and two dorsodistal bristles of subequal lengths. Endopodite; first segment quadrate in lateral view and hirsute on broad surface, with two ventral bristles, one very short, the other long, wreathed by long stiff hairs; second segment with three long bristles, one of which arises from distoventral edge, others of an equal length from middle of dorsal margin; end segment small, with two distoventral bristles, one of which is very short and a

strong terminal claw. Exopodite slightly shorter than dorsodistal bristles of basale, tapering distally with numerous long filaments.

*Maxilla* (Fig. 9-1) smaller than of female; segments and bristles weakly developed; exopodite with two bristles.

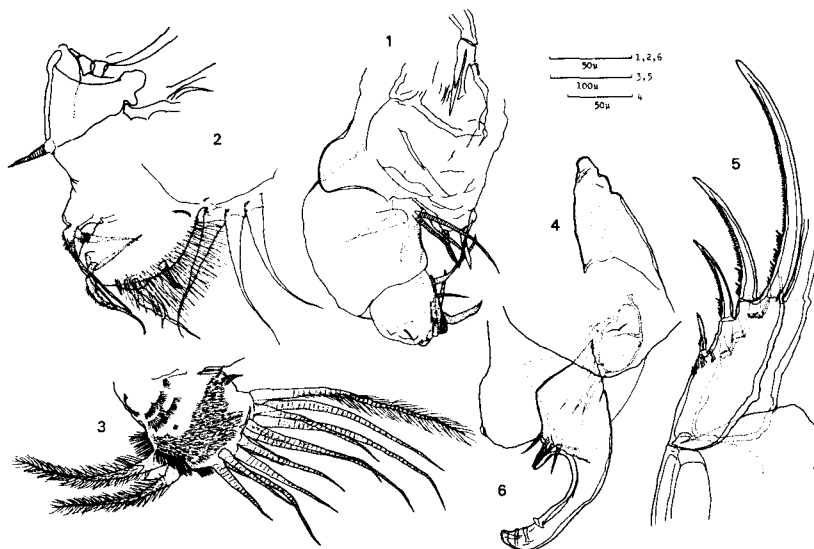


Fig. 9. *Sarsiella misakiensis*. Male. 1. maxilla; 2. fifth limb; 3. sixth limb; 4. seventh limb; 5. furca; 6. copulatory limb.

*Fifth limb* (Fig. 9-2) smaller than of female, having the same bristle formula as in female; bristles weakly developed.

*Sixth limb* (Fig. 9-3). Endite with generally three short bristles of subequal lengths (four and five bristles are recognized on the corresponding area in the specimen from Misaki). End segment hirsute, with several clusters of hairs on proximal area, long hairs along posterior surface, eleven or twelve pulvose bristles along anterior to ventral margin and two juxtaposed pulvose bristles on posterior margin. Three juxtaposed pulvose bristles on posterior margin are recognized in only one of specimens from Oshoro.

*Seventh limb* (Fig. 9-4) forming short, bare, bud-like process.

*Furca* (Fig. 9-5). Each lamella with five (sometimes four) claws, decreasing in length proximally; claw 1 continuous with lamella, others separated from lamella by suture; each claw furnished with a row of spinules.

*Copulatory limb* (Fig. 9-6) consisting of three lobes; main lobe terminating in a sclerotized hook, which has three to four transversal ridges along distal half the length, and short tooth, with one anterior bristle and four annulate bristles of an equal length near base of hook.

*Eyes* (Fig. 8-4): Median eye and lateral eye as shown in figure.

*Measurement* (in mm)

		length	height	width
female	Oshoro	1.54-1.70	1.35-1.40	0.39-0.42
	Misaki	1.68, 1.70	1.40	0.40, 0.41
male	Oshoro	1.40-1.49	0.90-0.96	0.26
	Misaki	1.50	0.98	0.28

*Remarks.* The present specimens, both male and female, from Oshoro and the type locality, Misaki are quite identical with *S. misakiensis* originally described by Kajiyama (1912) in the outline and ornamentation of the shell and the structure of the endopodite of the second antenna, while the carapace size in male reported by Kajiyama seems to be too large in contrast with that of the present male specimens. Namely, he reported that female and male are 1.8 mm and 2 mm long respectively. Since that the present male and female specimens are certainly conspecific was confirmed by the observation of the molting from N-1 instar to adult, using the individuals from Oshoro, his report on the shell size is maybe an error (with respect to the specimens described by Kajiyama, see Hanai, 1974).

*S. misakiensis* resembles the following species reported by Poulsen (1965) from Thailand, *S. maculata*, *S. multispinosa*, *S. parvispinosa* and *S. verae*, in the several appendage structures described below. 1) The endopodite of the second antenna in female is furnished with two proximal bristles. 2) The bristle number of the fifth limb in both sexes is ten except for the bristles on the epipodial appendage. 3) The bristle number of the seventh limb is six in the distal group and two in the proximal group. 4) The terminal end of the seventh limb in female is entirely smooth and without any opposing combs or a pair of pincers. 5) The mandible in male has only one claw on the endopodite. The present species is, however, easily discernible from them by the structure of the shell.

*Specimens examined.* Oshoro: four females (11-VIII-'75, 6-VII-'76, 2-VIII-'76 and 29-VII-'77), three males (24-VII-'75 and 11-VIII-'75) and one male which was collected as an individual of N-1 instar (3-VI-'77) and then molted (7-VII-'77). Misaki: two females and one male (12-IV-'77). Sh. Hiruta leg.

### Larval development

*First larval stage* (N-4 instar; sex undetermined)

*Carapace* (Fig. 10-1) about 0.69 mm in length, caudal process included, about 0.50 mm in greatest height, oval in lateral view, with prominent caudal process; ridges on shell surface weakly developed except for posterior part of dorsal ridge, forming a relatively large swelling. *First antenna* (Fig. 11-1) similar to adult female but with no bristles on second and fourth segments; bristle on fifth segment and c-, f- and g-bristles annulated along distal three-fifths the length. *Second antenna*

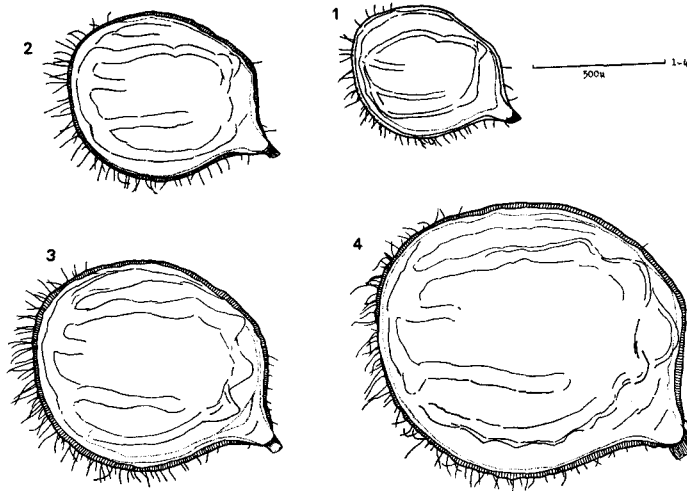


Fig. 10. *Sarsiella misakiensis*. 1~4. first to fourth larval stages. 1. sex unknown; 2~4. female.

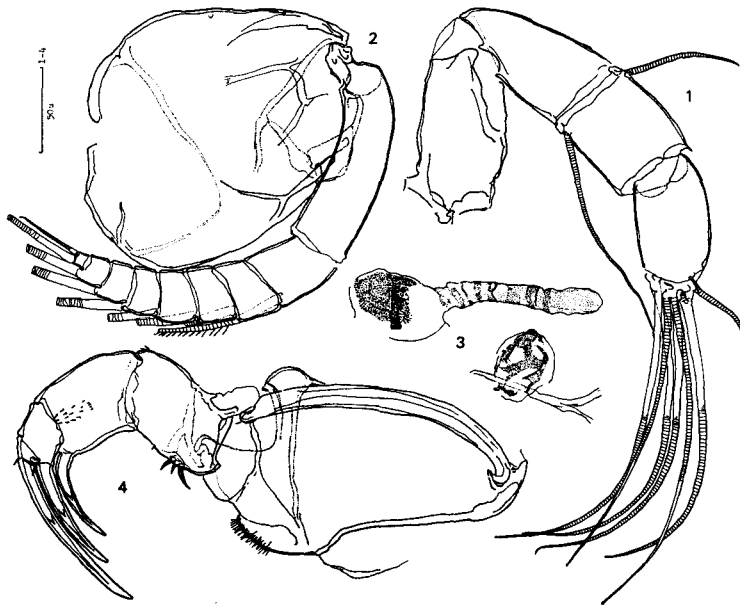


Fig. 11. First larval stage (N-4 instar). 1. first antenna; 2. second antenna; 3. rod-shaped organ, median eye and lateral eye; 4. mandible.

(Fig. 11-2) similar to adult female but without bristles on endopodite. *Rod-shaped organ* (Fig. 11-3) similar to adult female; constrictions weakly developed.

*Mandible* (Fig. 11-4) and *fifth limb* (Fig. 12-2) similar to adult female. *Maxilla* (Fig. 12-1) similar to adult female in total appearance but second

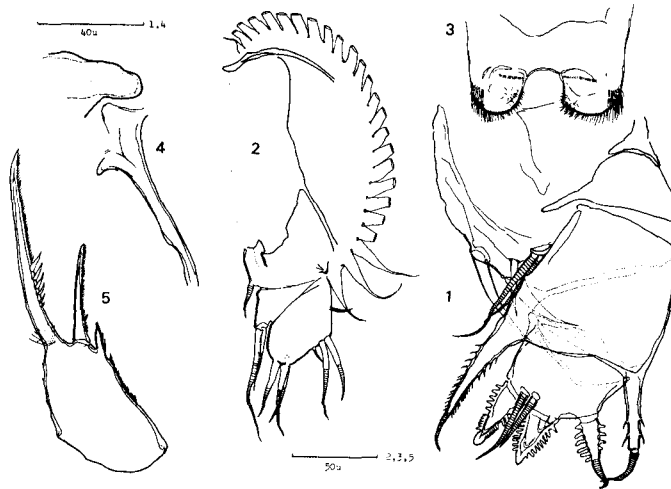


Fig. 12. First larval stage (N-4 instar). 1. maxilla, all endite bristles not shown; 2. fifth limb; 3. sixth limb; 4. seventh limb; 5. furca.

endopodite segment with only three terminal bristles, of which middle one has three bristles of next stage in its cuticle, and two short subterminal bristles. *Sixth limb* (Fig. 12-3) round, leaf-like, with marginal hairs. *Seventh limb* (Fig. 12-4) forming small, bare, bud-like process. *Furca* (Fig. 12-5): each lamella with three claws, of which only middle one is separated from lamella; distalmost claw with a row of several secondary teeth, which are decreasing in length proximally, along proximal half and a row of fine spinules along distal half; posterior margin of proximalmost claw with some spinules; anterior and posterior margins of lamella with some spinules and short hairs respectively; lamella near base of distalmost claw with a cluster of long hairs.

#### *Second larval stage (N-3 instar)*

*Female*. *Carapace* (Fig. 10-2) about 0.78 mm in length, about 0.68 mm in greatest height, round in lateral view, with prominent caudal process; ridges on shell surface recognized more clearly. No sexual dimorphism was detected in carapace structure. *First antenna* (Fig. 13-1) similar to previous stage except for having one dorsal bristle on second and fourth segments respectively. *Second antenna* (Fig. 13-2): endopodite with one short proximal bristle. *Rod-shaped organ* (Fig. 13-1), *maxilla*, *fifth limb* and *furca* similar to adult female. *Sixth limb*

(Fig. 13-3) leaf-like, with two hairy protuberances on ventral margin, one spinulose bristle between preceding protuberances and several clusters of hairs on surface. *Seventh limb* (Fig. 13-4) similar to previous stage.

*Male*. Endopodite of *second antenna* (Fig. 13-5) two-segmented; first one



Fig. 13. Second larval stage (N-3 instar). Female. 1. first antenna, rod-shaped organ and median eye; 2. endopodite of second antenna; 3. sixth limb; 4. seventh limb. Male. 5. endopodite of second antenna; 6. seventh limb.

with one proximal bristle; second one terminating in a round tip. *Seventh limb* (Fig. 13-6) similar to previous stage but shorter than of female of N-3 instar. Other structures same as in female of N-3 instar.

#### *Third larval stage (N-2 instar)*

*Female*. *Carapace* (Fig. 10-3) about 0.98 mm in length, about 0.84 mm in greatest height, with prominent caudal process; bulges on posterior shell surface more and more conspicuous. No sexual dimorphism was recognized in carapace structure. *First antenna* (Fig. 14-1). One ventrodistal bristle added to fourth segment. *Second antenna* (Fig. 14-2) similar to adult female, adding one bristle on proximal portion of endopodite. *Mandible*, *maxilla*, *fifth limb* and *furca* similar to adult female. *Sixth limb* (Fig. 14-3) similar to adult female in general appearance but with only one bristle on endite. *Seventh limb* (Fig. 14-4) bare, elongate.

*Male*. *Second antenna*. Endopodite (Fig. 14-5) indistinctly three-segmented; first one with two proximal bristles; second one about 2.5 times as long as third, with one short bristle on middle of anterior margin; third one with one short bristle on distal edge. *Seventh limb* (Fig. 14-6) similar to previous stage. Other structures same as in female of N-2 instar.

#### *Fourth larval stage (N-1 instar)*

*Female*. *Carapace* (Fig. 10-4) about 1.20 mm in length, about 1.06 mm in



greatest height, similar to adult female, but caudal process still extending beyond posterodorsal edge of carapace. No sexual dimorphism was detected in carapace structure. *First antenna* (Fig. 15-1) similar to adult female, adding one ventrodistal bristle to fourth segment. *Second antenna* (Fig. 15-2), *mandible*,

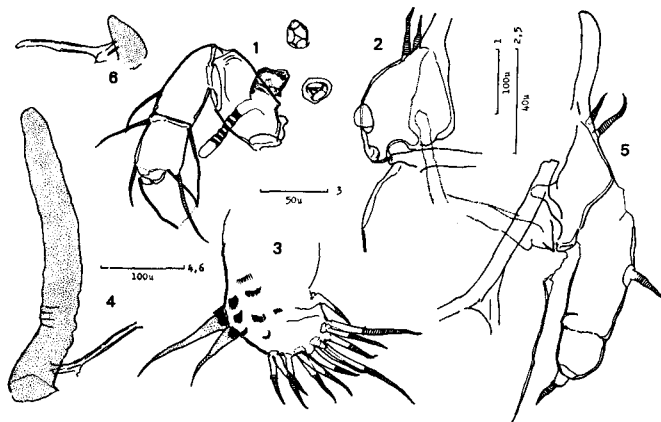


Fig. 14. Third larval stage (N-2 instar). Female. 1. first antenna, rod-shaped organ, median eye and lateral eyes; 2. endopodite of second antenna; 3. sixth limb; 4. seventh limb. Male. 5. endopodite of second antenna; 6. seventh limb.

*maxilla*, *fifth limb* and *furca* similar to adult female. *Sixth limb* (Fig. 15-4) almost same as in female, adding two short bristles to endite. *Seventh limb* (Fig. 15-5) terminating in a round process; four cleaning bristles of subequal lengths with three or four bells in distal group, two of an equal length with three bells in proximal group, all tapering distally.

*Male. Second antenna.* Endopodite (Fig. 15-6) elongate, three-segmented; second one as long as third, with two bristles on anterior margin; third one with two distal bristles. *Seventh limb* (Fig. 15-7) similar to previous stage and adult male. *Copulatory limb* (Fig. 15-8) composed of three lobes on each side; each lobe with one or two short bristles. Other structures same as in female of N-1 instar.

*Specimens examined.* N-4 instars (26-VIII-'75); N-3 instars (11-VIII-'75, 29-IX-'75 and 10-VI-'76); N-2 instars (27-X-'75, 19-XII-'75 and 9-IX-'77); N-1 instars (9-V-'75, 27-V-'75, 24-VII-'75 and 6-VII-'77) Sh. Hiruta leg.

### Notes on the development

In the previous paper (Hiruta, 1977) some knowledge of the differentiation process of particular structures found in *Sarsiella*-species was reported, together with the description of *S. japonica* Hiruta, 1977 and its successive larval stages.

The present species here described has four larval stages and nearly accords with *S. japonica* in the metamorphosis of appendages through all the successive stages. Above all, it is noticeable that in the first larval stage, the seventh limb, which forms a bare, small bud-like process, is also recognized in *S. misakiensis* as in *S.*

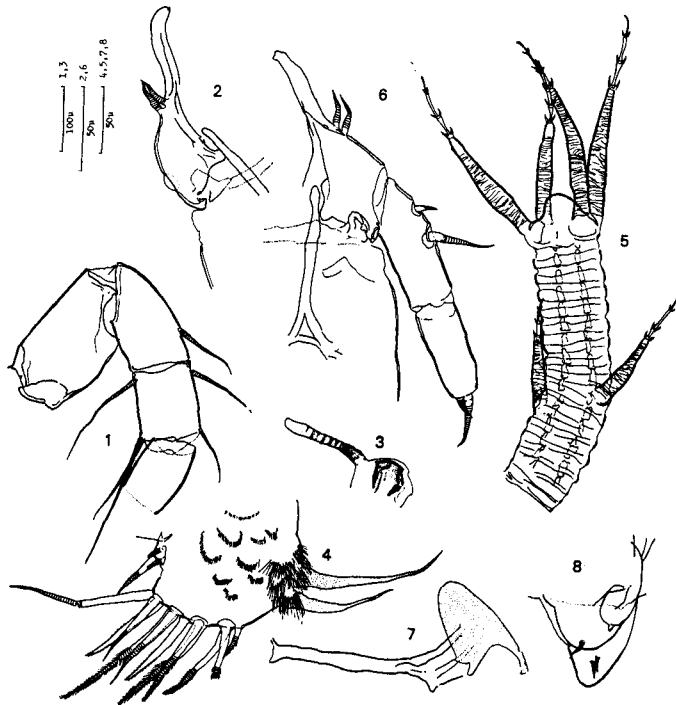


Fig. 15. Fourth larval stage (N-1 instar). Female. 1. first antenna; 2. endopodite of second antenna; 3. rod-shaped organ and median eye; 4. sixth limb; 5. seventh limb. Male. 6. endopodite of second antenna; 7. seventh limb; 8. copulatory limb.

*japonica* and, further, the maxilla in the former shows the same structure as in the latter, having three terminal bristles and two a-bristles on the second endopodite segment. The segmental differentiation in the endopodite of the second antenna in male, however, shows a difference between them. Namely, in the third larval stage, the segmentation between the second and third segments of the endopodite in *S. misakiensis* is ambiguous, while in *S. japonica* the endopodite is distinctly three-segmented, though the bristle formula of the endopodite in the stage is the same in both species. In this connection, the two-segmented endopodite of the second antenna in the male third larval stage is found in *S. zostericola* Cushman, 1906 reported by Kornicker (1967).

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