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The Larval Development of *Canthocamptus mirabilis* Štěrba (Copepoda, Harpacticoida), with Reference to the Bionomics

By

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(*With 17 Text-figures and 1 Table*)

Although we reported the occurrence of *Canthocamptus mirabilis* Štěrba, 1968 (Copepoda, Harpacticoida, Canthocamptidae) in a stream at Sapporo, Hokkaido, together with a full re-description of the adults (Itô and Takashio, 1980), the publication of the knowledge about its larval development and bionomics was postponed. The naupliar development of Canthocamptidae was already intensively reviewed by Sarvala (1977b) who also described the nauplius stages of six species belonging to the five Canthocamptidae genera, *Canthocamptus*, *Attheyella*, *Moraria*, *Bryocamptus*, and *Paracamptus*. Among these genera the first two are especially important for the present study because *Canthocamptus mirabilis* resembles certain *Attheyella* species, and a comparative study of the larval development of the present species and other species of these genera seems to be significant for further phylogenetic and taxonomic considerations. On the other hand, the copepodid development of Canthocamptidae species has been poorly known (see Itô and Burton, 1980). The present paper, as the second report on *Canthocamptus mirabilis*, deals with the larval development including the whole of the nauplius and copepodid stages and the bionomics studied at Sapporo, Hokkaido.

Some ovigerous females were obtained from the organic debris deposited in the stream running through the Maruyama Park, Sapporo, Hokkaido, in April 1978. They were individually reared at a temperature of 6°C, and nauplii hatched out were cultured in small dishes; dry yeast was used as a diet. Exuviae and dissected appendages and somites of fixed specimens were mounted onto slide glasses with gum-chloral medium and examined with a phase-contrast microscope. Although figures of nauplius stages were based upon a series of exuviae obtained from a single individual, those of copepodid stages were based upon some fixed specimens selected from mass-reared individuals.

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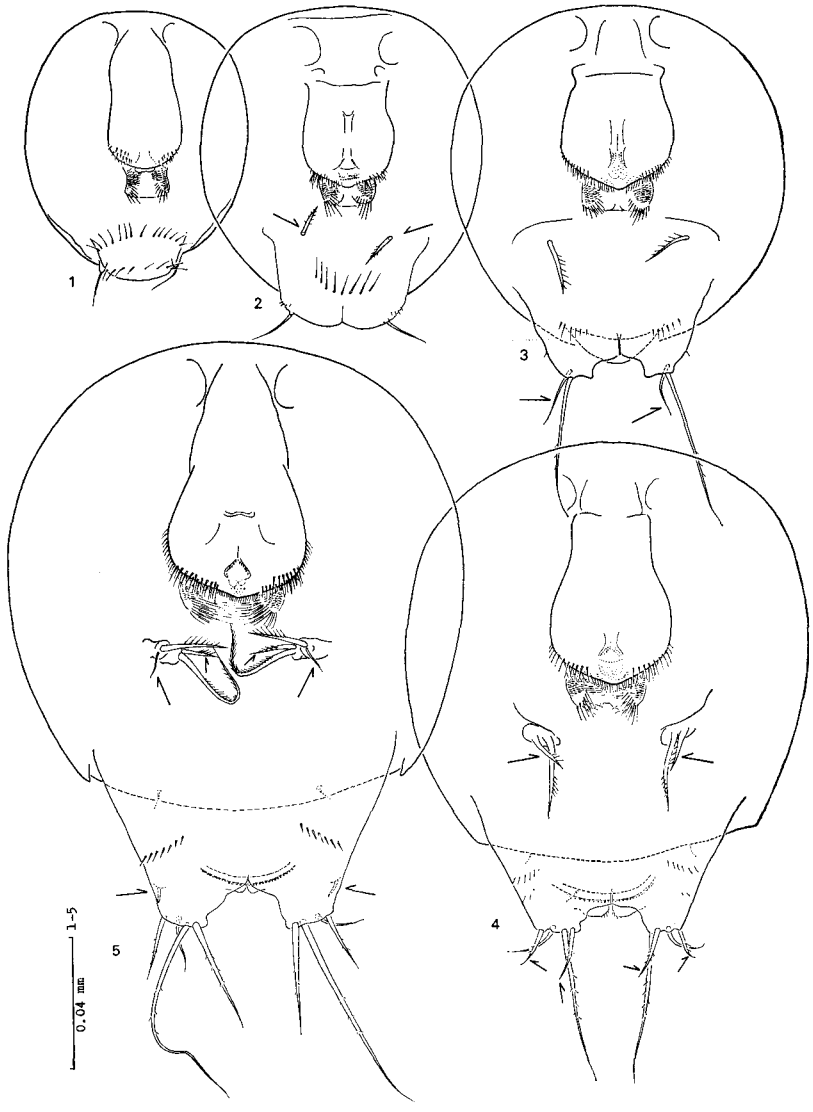

Fig. 1. Nauplius of *Canthocamptus mirabilis* (antennules, antennae, and mandibles are omitted; each newborn seta indicated by an arrow). 1–5. first to fifth stages.

1. Description of nauplius stages

1–1. *First nauplius stage.* Body (Fig. 1–1) oval in outline, 0.082 mm long, 0.068 mm wide. Labrum approximately twice as long as wide, furnished with short spinules at both sides of its round apex. Paragnaths with numerous short spinules, which are directed medially, and some longer spinules, which are oriented postero-medially. Hind body short, with two transverse rows of fine spinules ventrally. Furcal ramus represented by a small protuberance which bears a naked setula apically. *Antennule* (Fig. 3–1) consisting of three segments; first segment shortest, unornamented; second segment longest, armed with an arched row of spinules on ventral (inner) face of its proximal half, two spinulose setae each located ventrally or posteriorly, and a long seta which arises from its ventro-distal end and bears some long hairs subapically; third segment tapering apically, armed

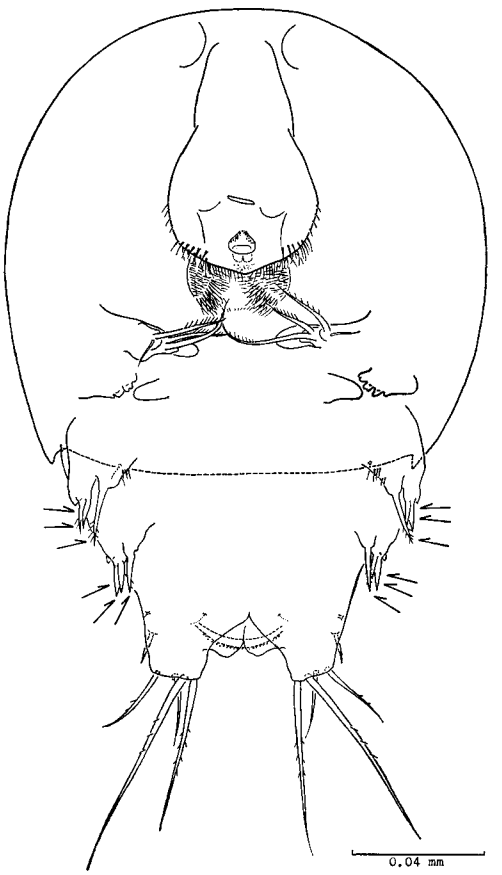

Fig. 2. Nauplius of *Canthocamptus mirabilis.* **Sixth stage.**

with sharp spinules on about the middle of its posterior face, one sparsely spinulose seta subapically, and one bifurcate seta (aesthetasc) terminally. *Antenna* (Fig. 4–1). Coxa with a row of short spinules on its antero-ventral face; gnathobase well developed, armed with dents and spines. Basis wider than long, with a short row of spinules ventrally and a few spinules on outer edge; two somewhat hairy setae and two very fine setulae arising from inner edge. Endopodite consisting of a cylindrical segment with a seta at about the middle of its ventral face, a few spinules subapically, and armed with one strong terminal claw which is accompanied with a bare setula. Exopodite three-segmented, the first about as long as the other two segments combined; each segment armed with two, one, and two more or less spinulose setae. Setal ornamentation of the right antenna illustrated (Fig. 3–1) is aberrant. *Mandible* (Fig. 6–1). Coxa represented by a triangular segment with a short bare seta on its inner edge. Basis wider than long, armed with a thick spinulose seta on inner edge. Endopodite consisting of a small segment armed with two thick comb-like claws apically and a seta at the middle of its outer edge; two geniculate setae arising from a dorso-lateral outgrowth. Exopodite two-segmented, the first about 2.5 times as long as the second; first segment armed with a subproximal outer seta and an inner terminal seta, second segment with a subapical outer seta and a long terminal seta; all exopodal setae spinulose.

1–2. *Second nauplius stage.* Body (Fig. 1–2) 0.100 mm long, 0.087 mm wide. Hind body more developed, slightly bipartite, ornamented with a transverse row of spinules ventrally and a few fine spinules near each base of caudal setae. *Antennule* (Fig. 3–2). A row of spinules added onto subapical dorsal face of second segment. A short spinulose seta added onto third segment near its tip. *Antenna* (Fig. 4–2). A short spinulose seta added onto mid-outer edge of first exopodite segment. *Mandible* (Fig. 6–2). A spinulose thick seta added onto inner edge of basis. A very fine setula arising from dorso-terminal edge of endopodite. Three setae added onto dorso-lateral outgrowth of endopodite. *Maxillula* (Fig. 1–2) represented by a short spinulose seta arising from anterior border of hind body.

1–3. *Third nauplius stage.* Body (Fig. 1–3) 0.115 mm long, 0.110 mm wide. Hind body clearly bipartite, forming furcal rami, each of which bears two setae, the longer spinulose. Transverse row of spinules on ventral face of hind body medially interrupted and separated into two rows. Anal operculum represented by a smooth flap-like outgrowth. *Antennule* (Fig. 3–3). Two spinulose setae added onto anterior face of third segment. *Antenna* (Fig. 4–3). A thick hairy seta added onto the middle of posterior edge of gnathobase. A narrow bare seta added onto a subapical portion of third exopodite segment. *Mandible* (Fig. 6–3). No seta is added. Outer seta of endopodite somewhat thickened. *Maxillula* (Fig. 1–3) as in the previous stage.

1–4. *Fourth nauplius stage.* Body (Fig. 1–4) 0.150 mm long, 0.125 mm wide. Dorsal shield of fore body truncated posteriorly, with two widely separate

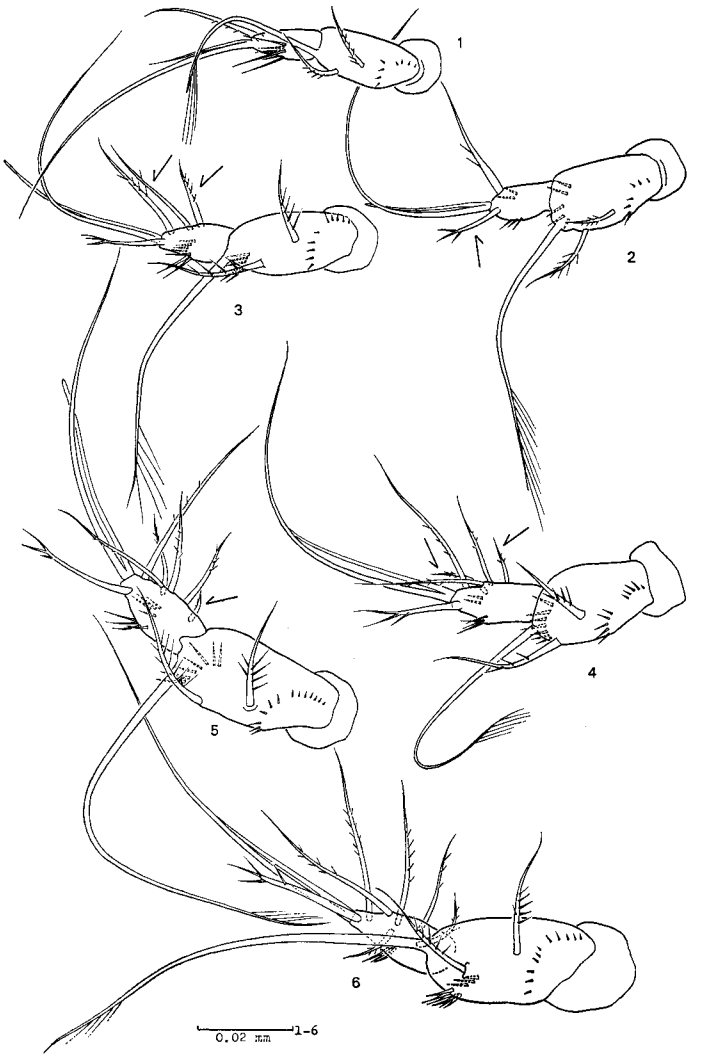

Fig. 3. Nauplius of *Canthocamptus mirabilis*. 1–6. antennule of first to sixth stages.

hairs near its posterior margin. Two short setae added onto each furcal ramus. Anal operculum finely serrate (spinules ?). *Antennule* (Fig. 3–4). Two spinulose short setae added onto anterior face of third segment. *Antenna* (Fig. 4–4). No seta is added. *Mandible* (Fig. 6–4) as in the previous stage. *Maxillula* (Fig. 1–4) represented by a small protuberance which bears two spinulose setae, one of which is new.

1–5. *Fifth nauplius stage.* Body (Fig. 1–5) 0.180 mm long, 0.140 mm wide. Each of lateral hind corners of dorsal shield forming a pointed protuberance. A short seta added onto outer face of furcal ramus. *Antennule* (Fig. 3–5). A short spinulose seta added onto subproximal antero-dorsal face of third segment. *Antenna* (Fig. 5–1) and *mandible* (Fig. 6–5) as in the previous stage. *Maxillula* (Fig. 1–5). A bare setula and a spinulose seta added.

Fig. 4. Nauplius of *Canthocamptus mirabilis.* 1–4. antenna of first to fourth stages.

1–6. *Sixth nauplius stage.* Body (Fig. 2) 0.209 mm long, 0.148mm wide. Hind body much more developed. *Antennule* (Fig. 3–5), *antenna* (Fig. 5–2), *mandible* (Fig. 6–5), and *maxillula* (Fig. 2) principally as in the previous stage. *Maxilla* represented by a four-lobular protuberance. *Maxillipede* represented by a smooth protuberance close to maxilla. *Leg 1* and *leg 2* each represented by a flap-like protuberance with three short setae, of which the outer two are close to each other. A few fine spinules attached onto inner edge of leg 1.

2. Description of copepodid stages

2–1. *First copepodid stage* (sex unknown). Body (Fig. 7–1 a, b) consisting of five somites, 0.41 mm long (mean: 0.41 mm). Rostrum not prominent, with two fine sensillae. First thoracic somite with pleurotergite. Penultimate somite (Fig. 8–6) with no ornamentation. Ultimate somite longer than previous somite, with a transverse row (medially interrupted) of numerous spinules on its ventral face; anal operculum well developed. Furcal ramus about 1.5 times as long as wide, with

Fig. 5. Nauplius of *Canthocamptus mirabilis*. 1–2. antenna of fifth to sixth stages.

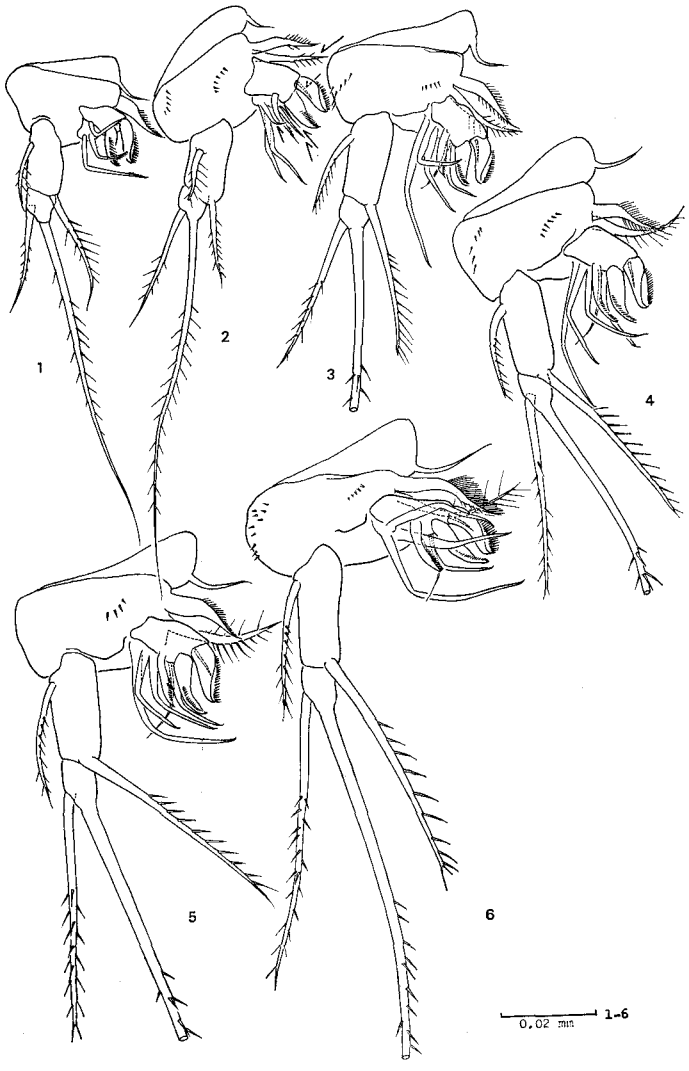

Fig. 6. Nauplius of *Canthocamptus mirabilis*. 1–6. mandible of first to sixth stages.

two separate fine setae on outer face, one basally geniculate dorsal seta; principal terminal setae basally fused to each other; a narrow seta arising from outer corner of posterior end. *Antennule* (Fig. 8–1) three-segmented, gradually tapering apically; first segment armed with three setae; second segment with four setae, one of which is the aesthetasc; third segment with nine (?) simple setae and one trifurcate apical seta. *Antenna* (Fig. 8–2). Allobasis with two separate setae on

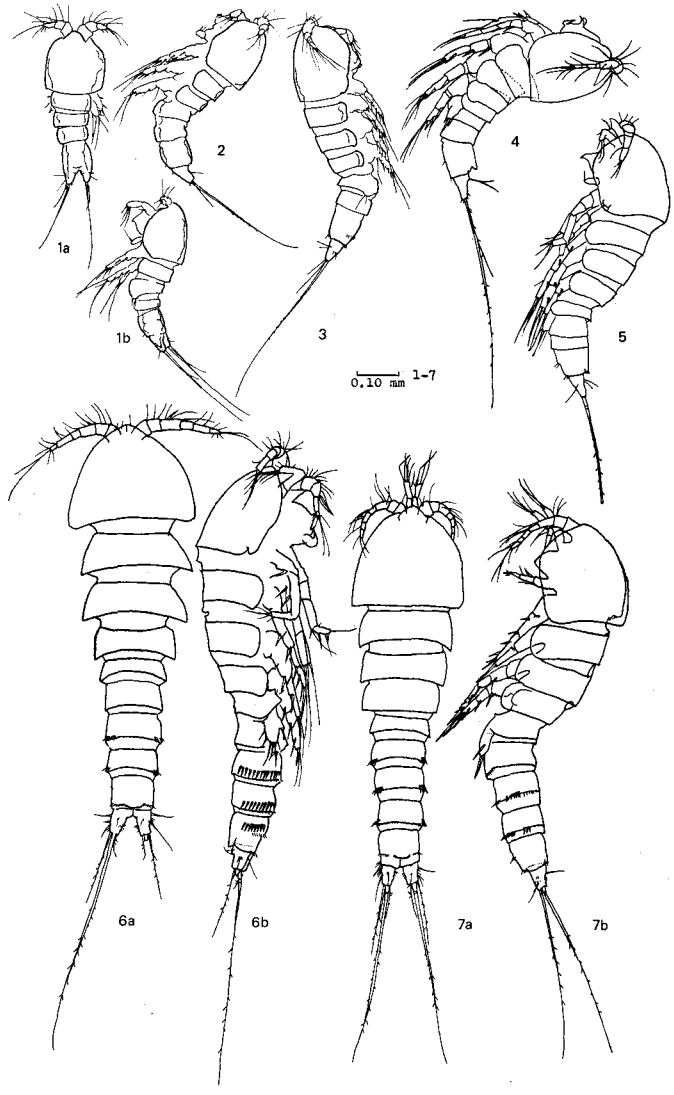

Fig. 7. Copepodite of *Canthocamptus mirabilis*. Habitus. 1. first stage (sex unknown); 2. second stage ♀; 3. third stage ♀; 4. fourth stage ♀; 5. fourth stage ♂; 6. fifth stage ♀; 7. fifth stage ♂.

anterior face. Exopodite represented by a short segment with four setae. Endopodite medially with two spines and one setula, apically or subapically with two simple spines, and two geniculate long spines, one of which (broken out in the illustrated specimen) is furnished with a basal branch.

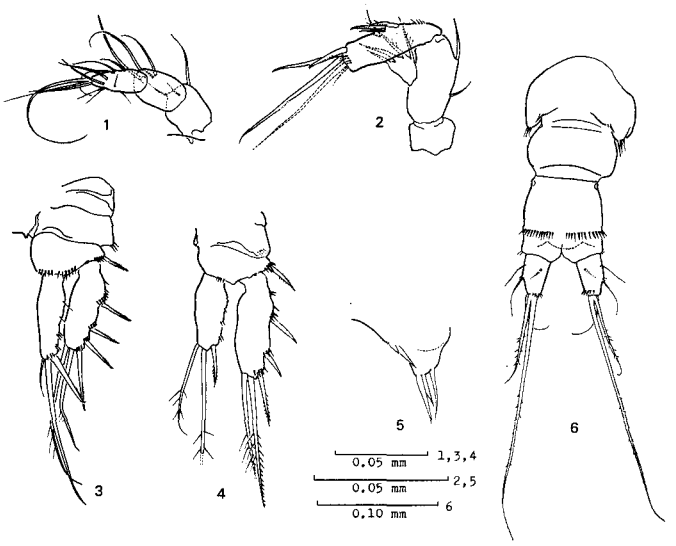

Fig. 8. First copepodite of *Canthocamptus mirabilis*. 1. antennule; 2. antenna; 3. leg 1; 4. leg 2; 5. leg 3; 6. leg 3 and abdomen, ventral.

Leg 1 (Fig. 8–3). Coxa and basis defined from each other. Basis with a spinulose outer spine. Exopodite and endopodite one-segmented, subequal in length. Exopodite about 2.5 times as long as wide, armed with three spines along outer margin, one simple spine, one medially geniculate spine and one long seta apically or subapically. Endopodite about three times as long as wide, narrower than exopodite segment, apically armed with one strong spine, one long spine, and a bare setula. *Leg 2* (Fig. 8–4). Coxa and basis defined from each other. Basis with a spinulose outer spine. Both rami one-segmented. Exopodite about three times as long as wide, armed with three outer spines and two apical setae. Endopodite shorter than exopodite, armed with one outer spine on a subapical ledge and two apical setae. *Leg 3* (Fig. 8–5) represented by a lobular protuberance with two close rudimental setae on its inner edge and three setae apically.

2–2. *Second copepodid stage. Female.* Body (Fig. 7–2) consisting of six somites, 0.52 mm long (mean: 0.51 mm). Pleurotergite differentiating on second thoracic somite. Penultimate and ultimate somites (Fig. 9–3) as in those of preceding stage. Principal terminal setae of furcal ramus not fused. *Antennule* (Fig. 9–1) six-segmented; first segment with one seta (two setae present in the previous stage are reduced); second segment longest, about 1.5 times as long as the first, armed with three setae on anterior face and one bifurcate aesthetasc which is accompanied with one separate seta close to its dorsal base; third segment short,

with one seta anteriorly; fourth segment a little longer than the third, with one long and two short setae anteriorly; fifth segment with two setae, one anteriorly, the other posteriorly; sixth segment about twice as long as the fifth, with one seta dorsally, four setae posteriorly, and one trifurcate seta apically. *Antenna* (Fig. 9–2). Exopodite consisting of two segments, the first armed with one seta,

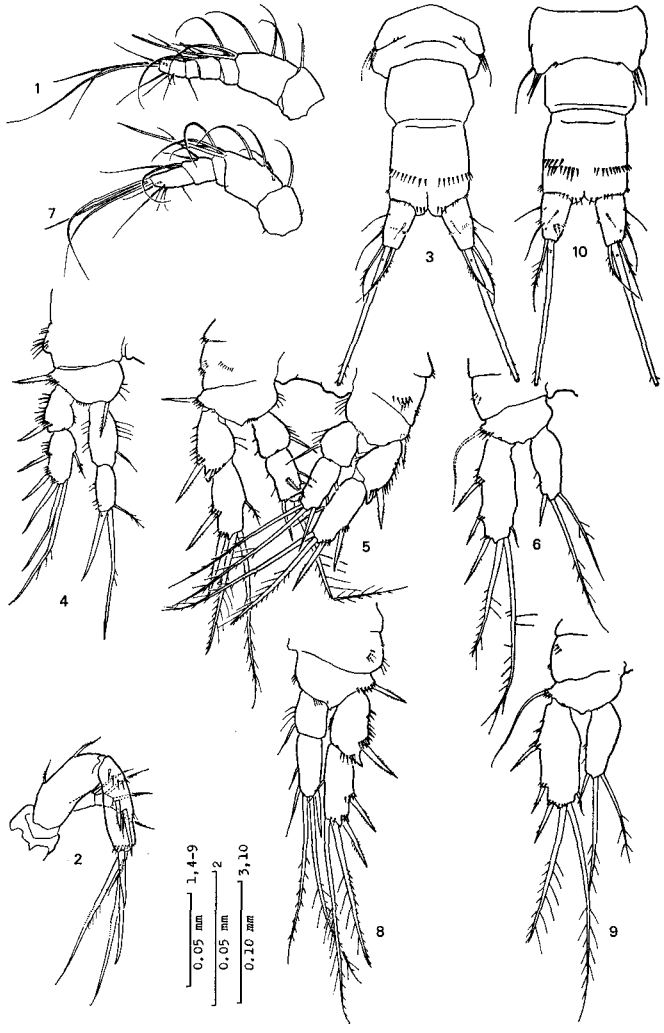

Fig. 9. Second copepodite of *Canthocamptus mirabilis*. (1–6, ♀) 1. antennule; 2. antenna; 3. leg 4 and abdomen, ventral; 4. leg 1; 5. a pair of leg 2; 6. leg 3. (7–10, ♂) 7. antennule; 8. leg 2; 9. leg 3; 10. leg 4 and abdomen, ventral.

the second with three setae. Spinal and setal ornamentation of endopodite as in the preceding stage.

Leg 1 (Fig. 9–4). A spinulose seta added onto inner distal corner of basis. Both rami two-segmented. Exopodite: segmentation occurred at a level just below the first outer spine in the previous stage; one short seta differentiating from inner edge of second segment. Endopodite: first segment longer than second segment, armed with one inner seta which is newborn. *Leg 2* (Fig. 9–5). Both rami two-segmented. Exopodite: segmentation occurred at a level just below the first outer spine in the previous stage; one short seta added onto inner edge of second segment. First endopodite segment with one newborn inner seta. Two inner setae differentiating from second endopodite segment (this segment of the specimen illustrated is aberrant in not only the left leg but also the right; the combination of one outer spine, two long terminal setae, and two short inner setae is normal: cf. Fig. 9–8). *Leg 3* (Fig. 9–6). Coxa and basis defined from each other. Basis armed with a long bare outer seta. Both rami one-segmented. Exopodite armed with three outer spines, one elongate spine and one seta terminally, and one short inner seta on a subapical ledge. Endopodite smaller than exopodite, armed with one outer spine and two terminal setae. *Leg 4* (Fig. 9–3) as in the leg 3 of the previous stage.

Male. Body length and ornamentation of each somite as well as furcal rami as in the female (spinular row of ultimate somite and a furcal seta are aberrant in the illustrated specimen). *Antennule* (Fig. 9–7) five-segmented; ornamentation of first four segments as in the female; ornamentation of last segment as in the ornamentation of the last two segments of the female. *Antenna* as in the female.

Leg 1, *leg 2* (Fig. 9–8), *leg 3* (Fig. 9–9), and *leg 4* (Fig. 9–10) principally as in the female.

2–3. *Third copepodid stage. Female.* Body (Fig. 7–3) consisting of seven somites, 0.64 mm long (mean: 0.57 mm). Pleurotergite differentiating on third thoracic somite. A fine setula arising from outer face of furcal ramus near base of the anterior one of lateral setae. *Antennule* (Fig. 10–1). Segmentation as in the previous stage. Second segment much elongated; four new setae differentiating from this segment. *Antenna* (Fig. 10–2). First exopodite segment elongated.

Leg 1 (Fig. 10–3). Setal and spinal ornamentation of exopodite as in the previous stage. Endopodite much longer than exopodite; one short seta arising from about the middle of inner edge of second segment. *Leg 2* (Fig. 10–4). One outer spine and one inner seta added onto second exopodite segment. One small inner seta differentiating from second endopodite segment. *Leg 3* (Fig. 10–5). Both rami two-segmented. Exopodite: segmentation ocurring at a level just below the first outer spine in the previous stage; one inner seta added onto second segment. One inner seta and two inner setae added onto first and second endopodite segments, respectively. *Leg 4* (Fig. 10–6) as in the leg 3 of the previous stage. *Leg 5* (Fig. 10–7) as in the leg 4 of the previous stage.

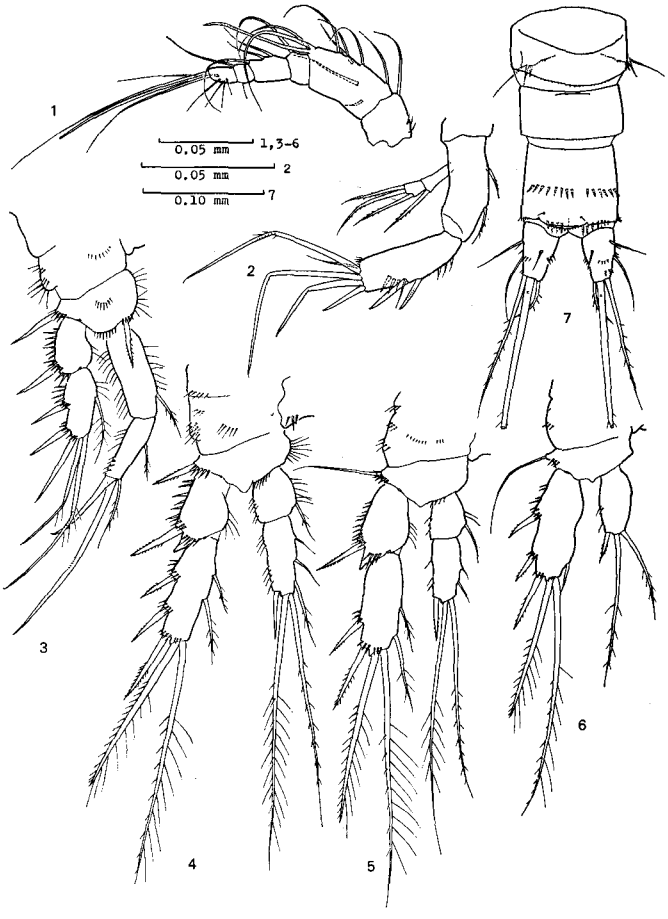

Fig. 10. Third copepodid female of *Canthocamptus mirabilis*. 1. antennule; 2. antenna; 3. leg 1; 4. leg 2; 5. leg 3; 6. leg 4; 7. leg 5 and abdomen, dorsal.

Male. Body as in the female, 0.63 mm long. *Antennule* (Fig. 11–1). Segmentation as in the previous stage. Four setae differentiating from second segment as in the female. *Antenna* as in the female.

Leg 1, *leg 2* (Fig. 11–2), *leg 3* (Fig. 11–3), *leg 4*, and *leg 5* (Fig. 11–4) as in the female.

2–4. *Fourth copepodid stage. Female.* Body (Fig. 7–6 a, b) consisting of eight somites, 0.66 mm long (mean: 0.72 mm). Pleurotergite differentiating on fourth thoracic somite. Penultimate and ultimate somites and furcal rami (Fig. 12–7) as in the previous stage. *Antennule* (Fig. 12–1) seven-segmented (the second

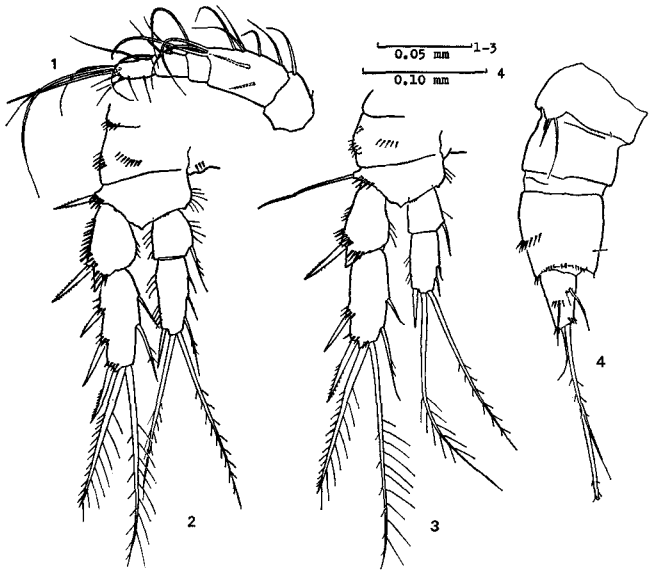

Fig. 11. Third copepodid male of *Canthocamptus mirabilis*. 1. antennule; 2. leg 2; 3. leg 3; 4. leg 5 and abdomen, lateral.

and third segments are derived from the second segment of the previous stage); second segment armed with seven setae in all (anterior three setae are new); third segment armed with an aesthetasc and five setae in all (the proximalmost is new); no seta added onto other segments. *Antenna* (Fig. 12–2). One short spine differentiating from distal end of endopodite.

Leg 1 (Fig. 12–3) and *leg 2* (Fig. 12–4). Setal and spinal ornamentation as in the previous stage. *Leg 3* (Fig. 12–5). One inner seta added onto second segment of each ramus. *Leg 4* (Fig. 12–6). Both rami two-segmented. Exopodite: segmentation occurring at a level just below the first outer spine in the previous stage; second segment with three outer spines, two terminal setae, and three inner setae, in which one outer spine and two inner setae are newborn. Endopodite much smaller than exopodite; first segment with one inner seta which is newborn; second segment about 1.5 times as long as the first, with one outer spine, two terminal setae, and two new inner setae. *Leg 5* (Fig. 12–7). Baseoendopodite and exopodite confluent. Inner expansion of baseoendopodite armed with six setae, of which the inner three are rudimentary. Exopodite with five setae. *Leg 6* (Fig. 12–7) represented by a low protuberance armed with two setae.

Male. Body 0.78 mm long, not differing from the female in segmentation of somites or shape of furcal rami (Fig. 13–4). *Antennule* (Fig. 13–1) six-segmented

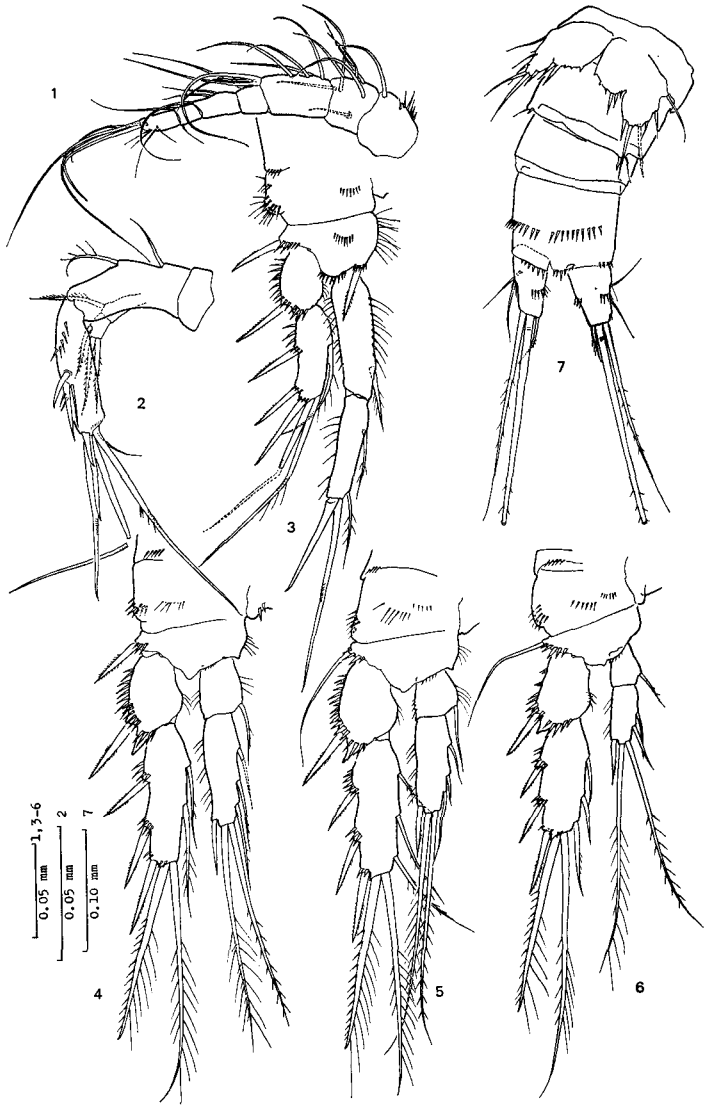

Fig. 12. Fourth copepodid female of *Canthocamptus mirabilis*. 1. antennule; 2. antenna; 3. leg 1; 4. leg 2; 5. leg 3; 6. leg 4; 7. leg 5 and abdomen, ventral.

(second and third segments deriving from the second in the previous stage); second segment with seven setae as in the female; third segment a little swelling, armed with seven setae on anterior face of its proximal half; setal ornamentation of last three segments as in the previous stage. *Antenna* as in the female.

Leg 1, *leg 2* (Fig. 13–2), and *leg 4* as in the female. *Leg 3* (Fig. 13–3). Setal and spinal ornamentation as in the female, but distal two inner setae of second endopodite segment rudimentary. *Leg 5* (Fig. 13–4). Both legs confluent to each other. Two setae arising from inner expansion of baseoendopodite. Exopodite not separating from baseoendopodite, armed with five setae. *Leg 6* (Fig. 13–4) as in the female.

1–5. *Fifth copepodid stage. Female.* Body (Fig. 7–6 a, b) consisting of nine somites, 0.95 mm long (mean: 0.91 mm). Antepenultimate and penultimate somites furnished with spinules along hind edge of each ventral face. Ultimate somite with a transverse row of spinules on ventral face as in the previous stage. *Antennule* (Fig. 14–1). Seta of first segment spinulose. Two setae and one seta added onto second and third segments, respectively. *Antenna* (Fig. 14–2) principally the same as that of adult.

Leg 1 (Fig. 14–3), *leg 2* (Fig. 15–1), *leg 3* (Fig. 15–2), *leg 4* (Fig. 15–3).

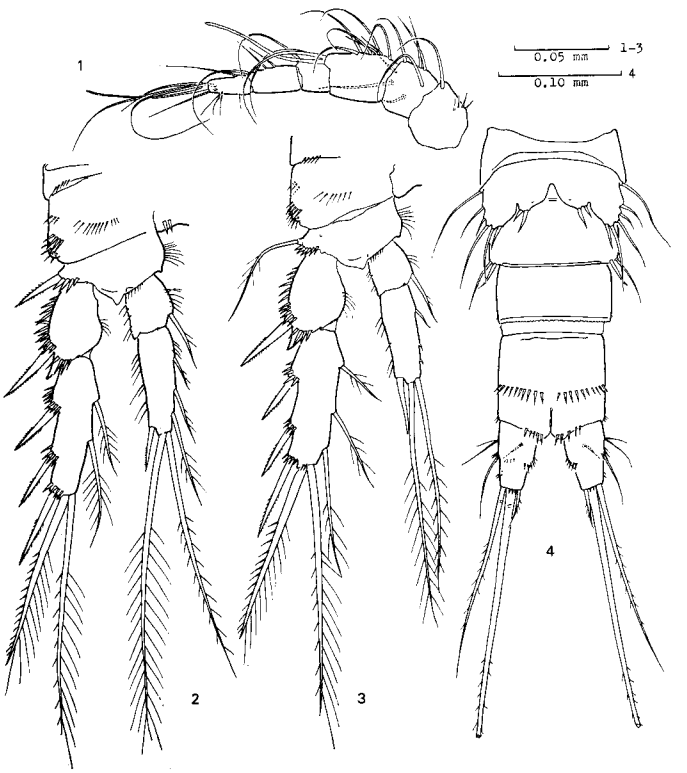

Fig. 13. Fourth copepodid male of *Canthocamptus mirabilis*. 1. antennule; 2. leg 2; 3. leg 3; 4. leg 5 and abdomen, ventral.

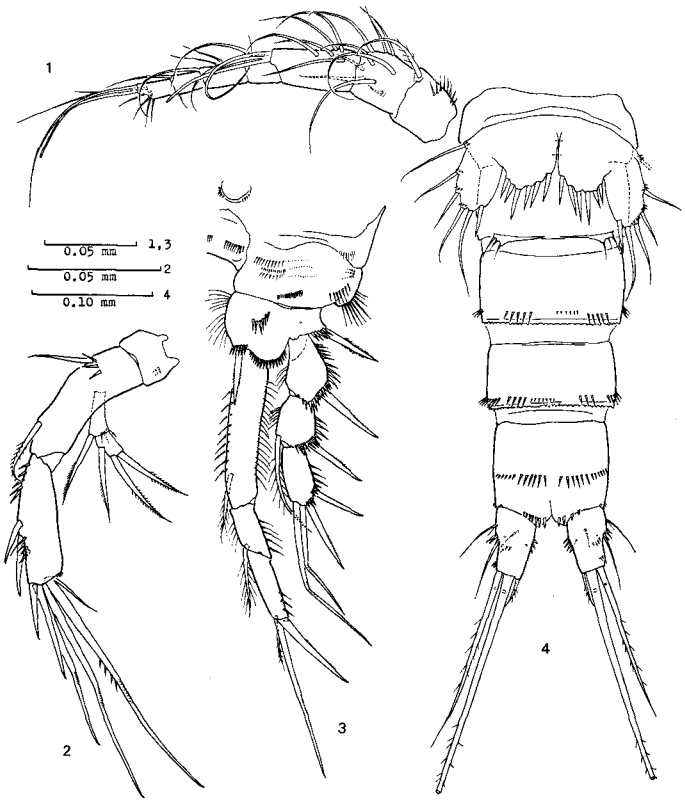

Fig. 14. Fifth copepodid female of *Canthocamptus mirabilis*. 1. antennule; 2. antenna; 3. leg 1; 4, leg 5 and abdomen, ventral.

Segmentation and principal setal and spinal ornamentation as in the adult. One outer spine added onto third exopodite segment of leg 2, leg 3, and leg 4. *Leg 5* (Fig. 14–4) similar to that of the adult. Segmentation of exopodite and baseoendopodite incomplete. All setae naked. *Leg 6* (Fig. 14–4) represented by a low protuberance with three setulae.

Male. Body (Fig. 7–7 a, b) consisting of nine somites, 0.95 mm long (mean: 0.95 mm). Antepenultimate somite ornamented with a transverse row of numerous spinules on ventral face along its hind edge. Furcal ramus as in the female (Fig. 16–4). *Antennule* (Fig. 16–1). Segmentation as in the previous stage. Most segments thicker than those of the female. Seta of first segment spinulose. Five (six ?) new setae differentiating from third segment. Fifth segment elongated. *Antenna* as in the female.

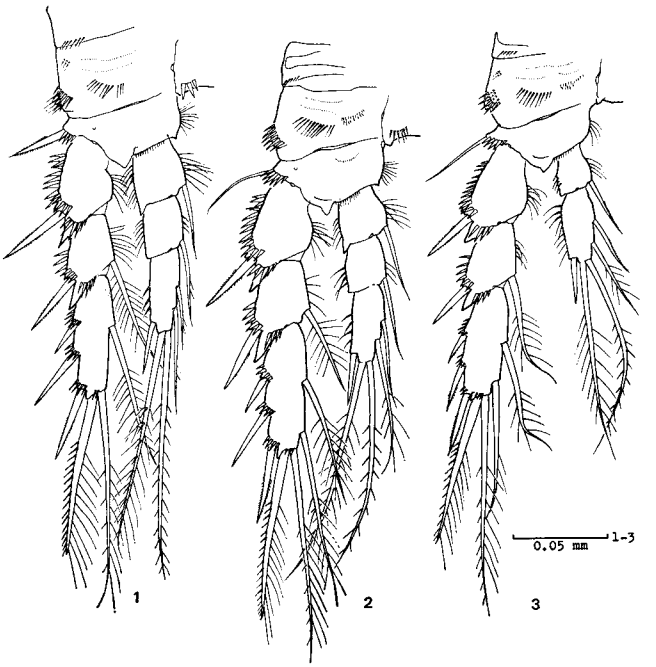

Fig. 15. Fifth copepodid female of *Canthocamptus mirabilis*. 1. leg 2; 2. leg 3; 3. leg 4.

Leg 1 as in the female. *Leg 2* (Fig. 16–2). Exopodite three-segmented; first outer spine of third segment newborn. Endopodite two-segmented; second segment about twice as long as first segment, with a notch at the middle of its outer edge. Setal and spinal ornamentation principally as in the adult. *Leg 3* (Fig. 16–3). Exopodite three-segmented; outer spine or second segment not particularly big; first outer spine of third segment newborn. Endopodite indistinctly three-segmented (segmentation between second and third segments incomplete); first and second segments each armed with one inner seta; third segment armed with one strong outer spine on a subapical ledge, two terminal setae, and two small inner setae. *Leg 4* as in the female. *Leg 5* (Fig. 16–4) similar to that of the adult. Exopodite and baseoendopodite not articulated. A rudimentary setula arising from inner edge of exopodite. *Leg 6* (Fig. 16–4) similar to that of the adult, armed with one spiniform seta and two narrow bare setae.

3. Notes on the larval development and bionomics

Although experiments of cultivation under controlled different temperatures were not attempted, the record of the single individual reared from the egg at a temperature of 6°C suggests the whole naupliar development required about one

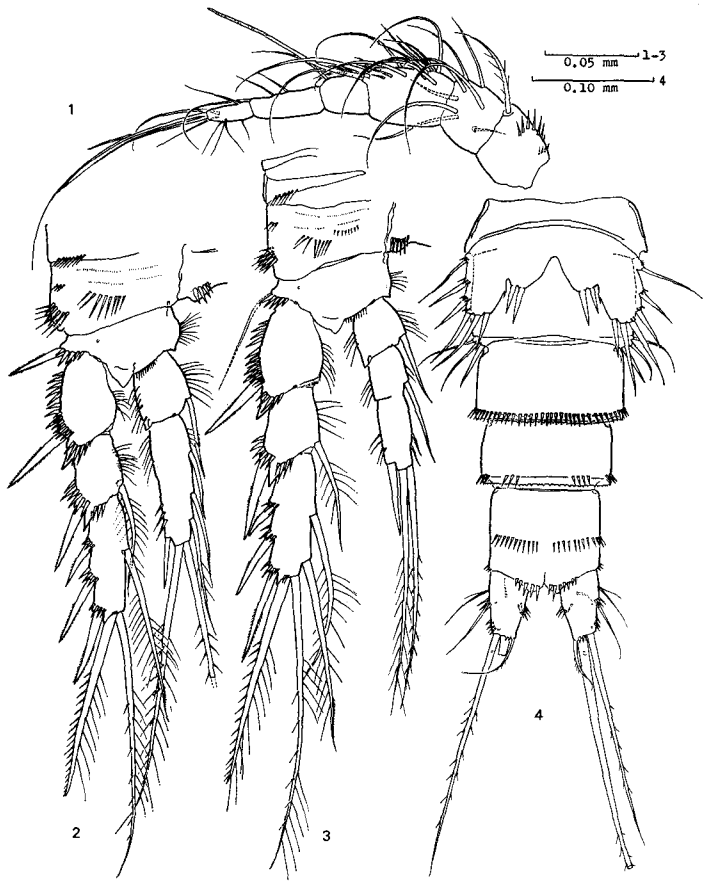

Fig. 16. Fifth copepodid male of *Canthocamptus mirabilis*. 1. antennule; 2. leg 2; 3. leg 3; 4. leg 5 and abdomen, ventral.

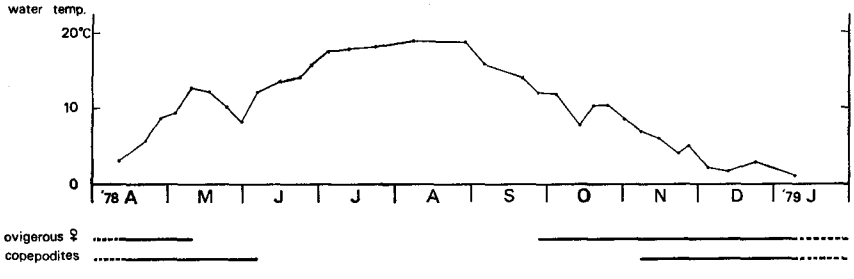

Fig. 17. Water temperature of the stream surveyed. Periods when ovigerous females and copepodites were found are indicated by transverse lines.

month (N1: 13 days; N2: 3 days; N3: 3 days; N4: 3 days; N5: 4 days; N6: 4 days). The copepodid development is also estimated to require one month since individuals which had became the first copepodid stage in some day between May 27 and May 30, 1978, developed to adults after June 22 by July 1, 1978.

According to the records of field samplings conducted at the stream in the Maruyama Park, Sapporo, almost weekly during a period from April 11, 1978, through January 9, 1979, ovigerous females were collected during periods from April 11 (water temperature: 3.0°C) through May 10 (12.5°C) and from September 23 (14.0°C) through January 9 (1.1°C). These records show that the reproduction of this species in this stream is conducted avoiding hot seasons. Incidentally, stream-sides were covered with snow when the first sampling was carried out. Seasonal fluctuation of the water temperature recorded is shown in Fig. 17 together with the periods when the occurrence of ovigerous females and copepodid larvae was confirmed. It is noteworthy that, after summer, ovigerous females were found at September 23 and the occurrence of copepodid larvae was confirmed about six weeks later, November 18.

No evidence of the encystment was obtained through the present study, though Sarvala (1979) clearly demonstrated the encystment of *Canthocamptus staphylinus* (Jurine, 1820) in Lake Pääjärvi, Finland.

4. Discussion

Some of the major characters useful for the identification of each nauplius stage are summarized in Table 1. It can be concluded that the present species well accords with *Canthocamptus staphylinus* as well as *C. microstaphylinus* Wolf, 1905 in the naupliar development, though some minor differences in size or spinular ornamentation are found among them (cf. Sarvala, 1977b). The nauplii of *Attheyella* species, on the other hand, are different from those of *Canthocamptus* species especially in the structure of rundimental thoracic legs of the sixth nauplius stage and, moreover, the shape of the labrum; the labrum of *Attheyella* nauplii so far known has a prominent apex or a bifid apex (cf. Ewers, 1930, for

Table 1. Major characters useful for the identification of each nauplius stage. (b: bifurcate seta located apically)

	N 1	N 2	N 3	N 4	N 5	N 6
number of setae of each caudal furca	1	1	2	4	5	5
number of setae of 3rd antennular segment	1b+1	1b+2	1b+4	1b+6	1b+7	1b+7
number of setae of rudimental maxillula	–	1	1	2	4	4
rudiments of maxilla, maxillipede, leg 1, and leg 2	–	–	–	–	–	present

A. dentata (Poggenpol, 1874); Cicchino, 1974 for *A. huaronensis* (Delachaux, 1917); Sarvala, 1977, for *A. crassa* (Sars, 1862)). With respect to these characteristics the nauplii of *C. mirabilis* are different from the known *Attheyella* nauplii. In the previous paper (Itô and Takashio, 1980) we pointed out the similarity of *C. mirabilis* to *Attheyella*[1)] in the adult morphology. The naupliar development of the present species, however, indicates no such a particular similarity to *Attheyella*. Incidentally, such the labrum with a pointed apex is also known in other genera of Canthocamptidae: *Elaphoidella* and *Moraria* (Carter and Bradford, 1972), *Bryocamptus* and *Antrocamptus* (Rouch, 1968). The apex of the naupliar labrum of *Bryocamptus zschokkei alleganiensis* Coker, 1934 reported by Carter and Bradford (op. cit.) is not so prominent (European *B. zschokkei* is thoroughly examined by Sarvala, 1977a).

Antennular segmentation through copepodid development traced in the present species resembles that found in a separate genus of Canthocamptidae, *Thermomesochra reducta* Itô et Burton, 1980 (Itô and Burton, 1980), especially in the sexual difference in the number of segments, which is confirmed in the second copepodid stage. Gurney (1932, p. 92) noticed a sexual difference present in the antennular segmentation in the fourth copepodid stage of *Canthocamptus staphylinus*, though he hesitated to declare it (see Itô and Burton, op. cit., p. 21). Carter and Bradford (op. cit.) described copepodites of some Canthocamptidae species, but they did not comment on the sex of these copepodites. The sexual dimorphism in the furcal ramus (see Itô and Takashio, 1980) of *C. mirabilis* is absent before the sixth copepodid stage. The formation of a new pair of thoracic legs lasts every copepodid molt through the third molt (to the fourth copepodid stage) when the pair of leg 6 appears. Such a sequence of the development of thoracic legs has already been reported by Rouch (1968, p. 131) for *Antrocamptus catherinae* Chappuis et Rouch, 1960. Carter and Bradford (op. cit.) described the fourth copepoodite of *Bryocamptus zschokkei alleganiensis*: This copepodite has the rudimental leg 6 as the case of the present material of *C. mirabilis*.

Summary

1. Morphology of six nauplius and five copepodid stages of *Canthocamptus mirabilis* Štěrba was described and illustrated on the basis of some reared larvae which were produced by females collected in a stream of Sapporo, Hokkaido, northern Japan.

2. Reproduction of *C. mirabilis* in this stream was found during cold seasons.

1) We discussed on the taxonomic situation of *Attheyella* (*Mrazekiella*) *amurenis* Borutzky, 1936 reported from China by Shen and Sung (1973) in connection with *C. mirabilis* and noted on the segmentation and ornamentation of the antennal exopodite of the species. Recently Tai and Song (1979) published another paper in which they amended the previous description about the antenna. According to their description and figure, the antennal exopodite consists of one segment with three setae.

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