

**ANOTHER CYPRIS Y FROM THE NORTH PACIFIC, WITH
REFERENCE TO THE BENDING BEHAVIOR EXHIBITED
BY A CYPRIS Y SPECIMEN OF THE FORMERLY
DESCRIBED TYPE (CRUSTACEA: MAXILLOPODA)¹⁾²⁾**

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With Text-figures 1-4

The cypris y (Crustacea: Maxillopoda) formerly described by Itô and Ohtsuka (1984) based upon a specimen from the North Pacific well accorded with the cypris y reported from the Atlantic Ocean by Bresciani (1965) and Schram (1970) in the general appearance of the body, though a few, rather minor, differences were present between them. In the present paper, I report another cypris y from the North Pacific, which clearly differs from any of the known cypris y in the appearance of the body and in the armature of the first antenna. A special posture exhibited by a cypris y specimen of the formerly described type is also reported together with a preliminary consideration on its phylogenetic meanings.

A specimen of cypris y of a previously unknown type collected in Tanabe Bay (33°42'N, 135°21'E) off the Seto Marine Biological Laboratory on the Pacific coast of the middle Honshu, the main island of Japan, was examined. The specimen was found in a sample of shallow water plankton (30-IX-1983, Ohtsuka leg.). Prior to dissection, careful inspection was made on the intact specimen which was mounted onto a slide glass with glycerin. The specimen dissected was mounted onto slide glasses with Gum-chroral medium, and was examined with the phase contrast microscope and the differential interference microscope. The data of a cypris y specimen of the formerly described type, of which a special posture is mentioned, will be given in the text.

Before going further, I would like to express my sincere thanks to Mr. S. Ohtsuka of the Seto Marine Biological Laboratory, who found this material in his plankton samples.

Cypris Y

Body (Figs. 1-A; 2-A, B) 0.38 mm long, transparent, almost fusiform in dorsal aspect, consisting of 11 separate somites: i.e., cephalothorax with the first pair of legs, five free thoracic somites which are pedigerous, and five abdominal somites, of which the last bears a pair of caudal rami. Cephalothorax tapering toward apical, forming frontally a prominent protrusion, of which integument

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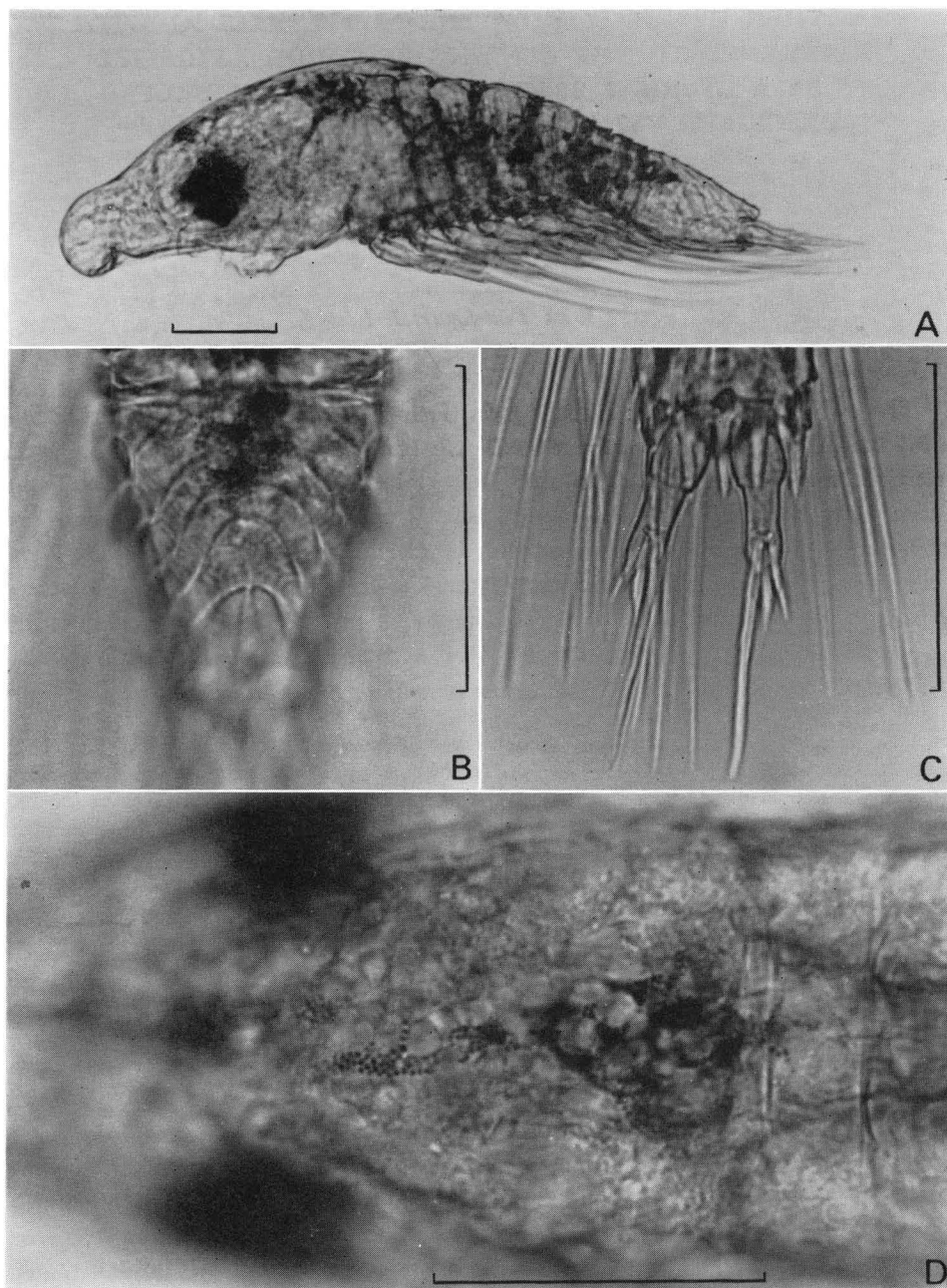


Fig. 1. Cypris y. A. Habitus, lateral; B. Fourth abdominal somite, dorsal; C. Caudal rami, dorsal; D. Dorsal view of cephalothorax, showing an aggregation of spherical cells and pigmental droplets. Scale bar 50 micra.

incurving ventrally (Fig. 2-C), with a small pigmental mass (? nauplius eye), which is reddish brown, just under dorsal integument between compound eyes which are tintured with reddish brown; carapace covering dorsally at least first two thoracic somites, laterally reaching third thoracic somite, decorated with chitinous stripes and mesh-like texture (both very faint) together with many pores (Fig. 2-D, E). Each tergite of first three thoracic somites forming no pleural extension. Each of fourth and fifth thoracic somites furnished with a well-developed tergite, which forms a pleural extension on both sides. Abdomen about as long as thorax, gradually tapering toward posterior in dorsal view, somewhat depressed dorsoventrally. First three abdominal somites short, each furnished with a well-developed tergite, which is decorated with chitinous transverse ridges (Fig. 2-F, H); ventral surface of each somite almost smooth (Fig. 2-G). Fourth abdominal somite ("furca" in the sense of Bresciani, 1965, and Schram, 1970) about twice as long as preceding three abdominal somites combined, serrated laterally, armed with five spiniform processes along ventroposterior edge (Figs. 1-C; 2-G); dorsal surface decorated with chitinous stripes which extend longitudinally and transversely; transverse chitinous stripes markedly arched; areas enclosed with chitinous stripes filled with obscure mesh-like texture (Figs. 1-B; 2-F); ventral surface with arched steps (Fig. 2-G). Fifth abdominal somite very short, inserted into the preceding somite, forming dorsoposteriorly a truncate process. Caudal ramus subcylindrical, about 2.5 times as long as wide, clearly tapering through distal half (see Fig. 1-C), armed with three apical setae, of which the innermost is longer than the ramus and very delicately serrated.

A longitudinal aggregation of cells (not a gut) is present through the body (see Figs. 1-A, D; 2-A, B): it consisting of colorless spherical cells (about 5 μm in diameter) which are enclosed with numerous lipid-like droplets (? small cells) trinctured with faint reddish brown or, rather, reddish purple, and arising as a thin string-like cellular row from the pigmental mass (? nauplius eye) between compound eyes, extending and thickening toward posterior, and finally penetrating into the fourth abdominal somite a little (Fig. 1-B).

F i r s t a n t e n n a (Fig. 2-I) arising from ventral face of cephalothorax below compound eyes, consisting of four segments; first segment cylindrical, about 1.5 times as long as thick, with no seta; second segment shorter than first segment, somewhat curving toward posterior, with no seta; third segment small, armed with two aesthetascs, which are very thin; fourth segment armed apically with a very short seta and a well-developed seta.

O r a l p y r a m i d (Fig. 2-C, J) armed with a single median claw and four spinules. No tubercle was detected. A few large cells filled with granular bodies occurring near the base of oral pyramid.

L e g 1 (Fig. 3-A), *l e g 2* (Fig. 3-B), *l e g 3* (Fig. 3-C), *l e g 4* (Fig. 3-D), *l e g 5* (Fig. 3-E), and *l e g 6* (Fig. 3-F). A few very delicate spinules attached onto posterior surface near outer proximal angle of each coxa. Segmentation and setal armature as in the cypris y formerly reported by Itô and Ohtsuka (1984).

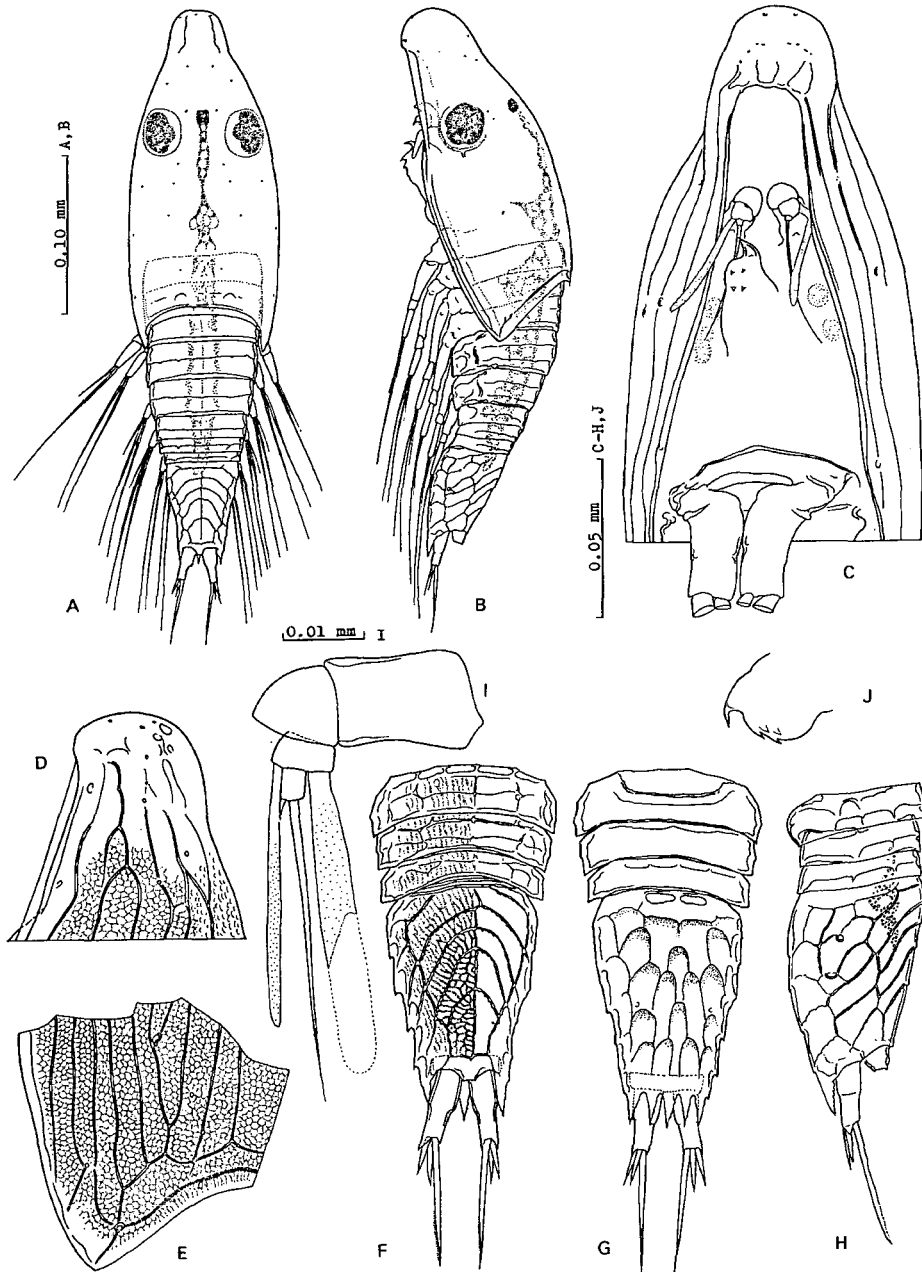


Fig. 2. Cypris y. A. Habitus, dorsal; B. Habitus, lateral; C. Ventral view of cephalothorax; D. Lateral view of frontal protrusion of cephalothorax; E. A posterolateral portion of carapace; F. Abdomen, dorsal; G. Abdomen, ventral; H. Abdomen, lateral; I. First antenna; J. Oral pyramid.

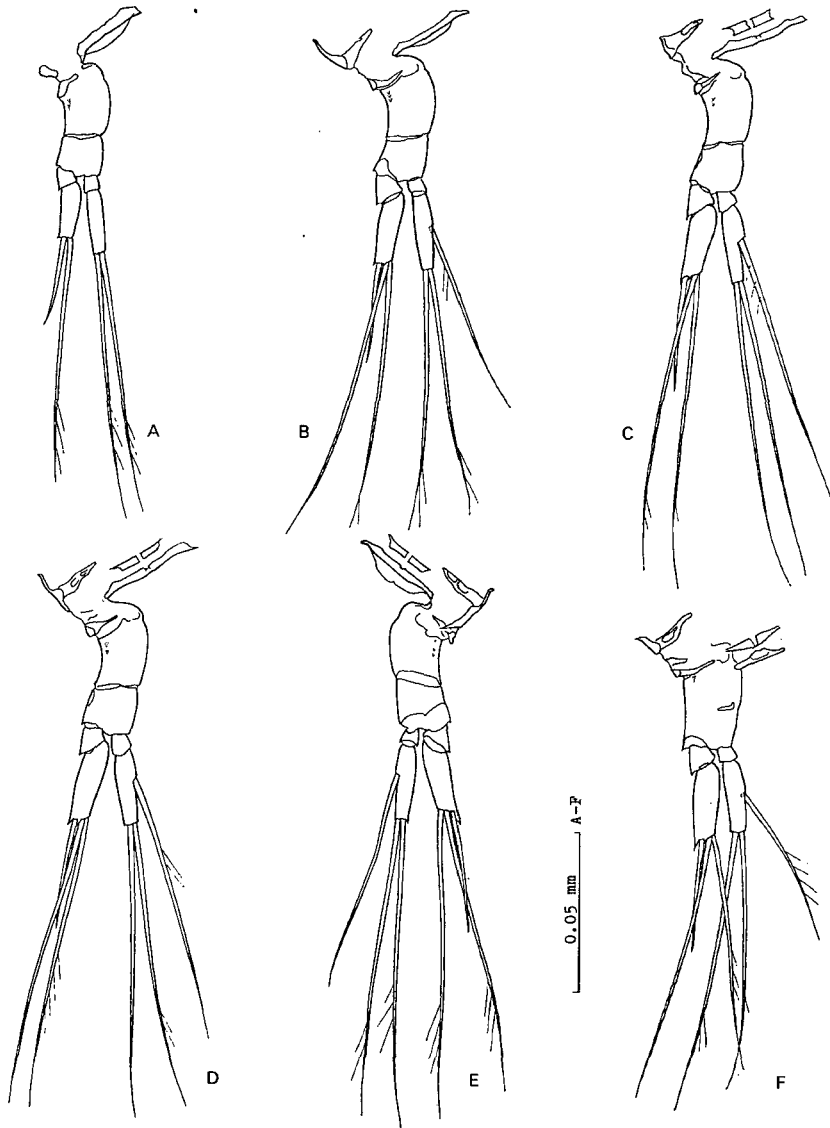


Fig. 3. *Cypris y*. A. Leg 1; B. Leg 2; C. Leg 3; D. Leg 4; E. Leg 5; F. Leg 6.

Discussion

The present specimen is easily discernible from any of the previously known *cypris y* because of unique characteristics: viz., the cephalothorax frontally forming a prominent protrusion, the transverse chitinous stripes on the dorsal surface of the fourth abdominal somite clearly arched, the first antenna not armed with any claw.

The present specimen seemed to have the fifth abdominal somite which was inserted into the fourth abdominal somite. Since the possession of the fifth abdominal

somite had not been detected for the cypris y specimen previously described by Itô and Ohtsuka (1984), I carefully re-examined the abdomen of the specimen. However, any additional somite could not be found inside its fourth abdominal somite.

Bresciani (1965) described that the abdomen of his cypris y consisted of five segments. The "abdomen" in his sense does not include the "furca" which is the fourth abdominal somite in my sense: therefore, the fifth segment stated by him is not identical to the fifth abdominal somite described by me. On the other hand, Schram (1970) who also excluded the furca from the abdomen described that the abdomen of his specimens had three segments. I suppose Bresciani likely misconceived transverse ridges on the dorsal surface of the first three abdominal somites as further "segments" (see Grygier, 1983). Although the specimens reported from the Atlantic Ocean by Bresciani (1965) and Schram (1970) do not seem to have the somite inserted into the "furca", careful re-examination on these specimens will be desirable to ascertain it.

Although the present specimen has a pigmental mass in the particular portion of cephalothorax where an nauplius eye with paired ocelli was present in the specimen described by Itô and Ohtsuka (1984, Fig. 2), the pigmental mass is not accompanied with paired ocelli. It is uncertain whether this pigmental mass is a nauplius eye.

The possession of the aggregation of large spherical cells and small pigmental droplets through the body is another question. The aggregation may be a gonad or a mass of undifferentiated cells such as it has been recognized in rhyzocephalan cypris (Delage, 1884), though these possibilities must be ascertained by further studies. Depending on the result, we may have to reconsider the view that cypris y is a larva (see Bresciani, 1965, p. 257; also Grygier, 1983, p. 87).

Bending Behavior

A special posture exhibited by a cypris y specimen of the formerly described type (Itô and Ohtsuka, 1984) was discovered. The specimen was found in a formalin-preserved plankton sample which was collected in Tanabe Bay (26-X-1983, Ohtsuka leg.) off the Seto Marine Biological Laboratory.

As shown in Fig. 4, this specimen deeply bends its trunk at about the fourth thoracic somite, and inserts its abdomen between free ventral, inward deflected, rims of the carapace (Fig. 4-A). All legs are placed almost horizontally toward anterior between the cephalothorax and the abdomen which is now turned toward a reversed direction and is fitted into a space beneath the carapace. Hence, all appendages of cephalothorax and thorax are nearly concealed, and an open space beneath the carapace is filled. I would like to call this interesting posture the 'bending behavior'.

The bending behavior seems to have such a protective effect that is supposed for cirriped cypris larvae by Boxshall (1983), and it brings the cypris y close to the



Fig. 4. Cypris y of the formerly described type showing the bending behavior. A. Ventral view; B. Ventrolateral view. Scale bar 50 micra.

cypris larva of cirripedians, rhizocephalans, and ascothoracids in the appearance (see Fig. 4-B). In the cypris larva of the latter, reduction of trunk (viz., fusion of thoracic somites and shortening of abdomen) proceeded through their evolution, and it enabled the cypris larvae, especially of thoracicans, to well conceal their trunk within a bivalved carapace, which is no doubt a homologue of the carapace of cypris y. In contrast to such cirriped cypris, the cypris y has free thoracic somites and well-developed abdomen; therefore, the cypris y is more primitive than cirriped cypris in these character-states (see Grygier, 1983, for comparison between the ur-maxillopodan and its descendants including cypris y). The fact that the cypris y has a certain ability to conceal its trunk within the carapace by the bending behavior enables me to image a precursory state of a cirriped ancestor which chose an evolutionary course toward the reduction of trunk as well as the development of the bivalved carapace of the opening-closing type in order to more easily and effectively contain their trunk within the protective carapace (see Boxshall, 1983, p. 130, for evolutionary meanings of bivalved carapace).

REFERENCES

- Boxshall, G.A. 1983. A comparative functional analysis of the major maxillopodan groups. *In*: F.R. Schram, ed., *Crustacean phylogeny*, pp. 121-143. A.A. Balkema Publishers, Rotterdam.
- Bresciani, J. 1965. Nauplius "y" Hansen. Its distribution and relationship with a new cypris larva. *Vidensk. Medd. fra Dansk Naturh. Foren.*, 128: 245-258, pl. XL.
- Grygier, M.J. 1983. Ascothoracida and the unity of Maxillopoda. *In*: F.R. Schram, ed., *Crustacean phylogeny*, pp. 73-104. A.A. Balkema Publishers, Rotterdam.
- Itô, T., and S. Ohtsuka 1984. Cypris y from the North Pacific (Crustacea: Maxillopoda). *Publ. Seto Mar. Biol. Lab.*, 29: 179-186.
- Delage, Y. 1884. Evolution de la Sacculine. *Arch. Zool. exp. gen.*, 2(2): 417-736, 9 pls.
- Schram, T.A. 1970. Marine biological investigations in the Bahamas. 14. Cypris y, a later developmental stages of nauplius y Hansen. *Sarsia* 44: 9-24.
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