# Two bopyrid isopods infesting caridean shrimp *Hippolyte* sp. in the Seto Inland Sea, western Japan (Crustacea: Peracarida)

Michitaka SHIMOMURA<sup>1</sup>, Susumu OHTSUKA<sup>2</sup> & Tadashi SAKAKIHARA<sup>2</sup>

<sup>1</sup>Kitakyushu Museum of Natural History and Human History, 2-4-1 Higashida, Yahata higashi-ku, Kitakyushu, Fukuoka 805-0071, Japan E-mail: shimomura@kmnh.jp <sup>2</sup>Takehara Marine Science Station, Graduate School of Biosphere Science, Hiroshima University, 5-8-1 Minato-machi, Takehara, Hiroshima 725-0024, Japan

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**ABSTRACT** – Two bopyrid isopods, *Metaphrixus setouchiensis* sp. nov. and *Bopyrina ocellata* (CZERNIAVSKY, 1868) were obtained from a caridean shrimp *Hippolyte* sp. collected from the *Sargassum* bed in the Seto Inland Sea, western Japan. *Metaphrixus setouchiensis* is the first record of the genus from Japan. The new species differs from its congeners in having indistinct head, the articulated antenna 1, and presence of dorsolateral bosses on the pereon. *Bopyrina ocellata* is redescribed using newly collected specimens.

KEY WORDS: Bopyridae, Metaphrixus, Bopyrina, Hippolyte, the Seto Inland Sea, Japan

#### INTRODUCTION

The Bopyridae RAFINESQUE-SCHMALTZ, 1815 is the largest family in the epicaridean isopods: about 570 species in 150 genera are reported worldwide (KENSLEY *et al.*, 1996). All species in the family are holoparasites of decapod crustaceans. In Japan, 87 species belonging to 54 genera are known (SAITO *et al.*, 2000).

During our recent coastal survey in Kokuno-Shima Island, Takehara City, the Seto Inland Sea, western Japan, two bopyrid isopods including a new species were found in the branchial chamber and on the ventral surface of pleon of the carideran shrimp *Hippolyte* sp. Based on this material, we describe in this paper a new species, *Metaphrixus setouchiensis* as the first record of the genus from Japan and also redescribe *Bopyrina ocellata* (CZERNIAVSKY, 1868).

#### MATERIALS AND METHODS

Host caridean shrimp, *Hippolyte* sp., of the two bopyrids were obtained by a dip net on the *Sargassum* bed in Takehara City, Hiroshima Prefecture, located in the central part of the Seto Inland Sea, western Japan, during Nov. 12, 2004 to Feb. 24, 2005. The shrimps collected were fixed in 10% neutralized buffered formalin/sea-water and then preserved in 70% ethanol. The parasitic isopods were removed from the hosts under a stereomicroscope. Each individual was dissected and prepared for observation using a compound microscope equipped with DIC optics.

Terminology follows MARKHAM (1985). The type series is deposited in the Kitakyushu Museum of Natural History and Human History (KMNH IvR).

## TAXONOMY

## Metaphrixus setouchiensis sp. nov. (Figs. 1-2)

Material examined. 34°18′N, 132°59′E, Kokuno-Shima Island, Takehara City, Hiroshima Prefecture, the Seto Inland Sea, Japan, Feb. 24, 2005: holotype, ovig.  $\stackrel{\frown}{}$ , 1.64 mm (KMNH IvR 700,091); allotype,  $\sigma^3$ , 0.59 mm (KMNH IvR 700,092), obtained from the holotype; paratypes, 2 ovig.  $\stackrel{\frown}{}$ , 2.47 mm (KMNH IvR 700,093), data same as holotype, 1.51 mm (KMNH IvR 700,095), Dec. 21, 2004, 2  $\sigma^3 \sigma^3$ , 0.68 mm (KMNH IvR 700,094), obtained from the female (KMNH IvR 700,093), 0.54 mm (KMNH IvR 700,096), obtained from the female (KMNH IvR 700,095).

## Diagnosis.

Female: head and pereon (Fig. 1A) indistinctly separate, frontal margin of head concave; pereonites (Fig. 1A) of concave side each with dorsolateral bosses; antenna 1 (Fig. 1C, D) composed of 3 articles; antenna 2 (Fig. 1C, E)



Fig. 1. Metaphrixus setouchiensis sp. nov. A, D-G, holotype female (KMNH IvR 700,091), B, C, paratype female (KMNH IvR 700,093): A, habitus, dorsal; B, habitus, ventral; C, head, dorsal; D, left antenna 1, dorsal; E, left antenna 2, dorsal; F, right pereopod 1, medial; G, right pereopod 2, lateral. Scales = 100 μm. Appendages numbered; mp 3- mp 4, third and fourth plates of marsupium; lat 3 and lat 4, third and fourth lateral plates; pl-1-pl-4, first to fourth pleopods; ant-1 and ant-2, first and second antennae; o. c, oral cone.



Fig. 2. Metaphrixus setouchiensis sp. nov. A-E, holotype female (KMNH IvR 700,091), F, G, allotype male (KMNH IvR 700,092): A, right maxilliped, dorsal; B, left maxilliped, dorsal; C, right oostegite 1, ventral; D, left oostegite 1, dorsal; E, left side of pleon, ventral; F, habitus, dorsal; G, habitus, ventral. Scales = 100 µm. Appendages numbered; lat-1-lat-4, first to fourth lateral plates; pl-1-pl-4, first to fourth pleopods; pt, pleotelson.

composed of 5 articles; terminal pleomere (Fig. 1A) bulbous. Male: pereomere 7 (Fig. 2F, G) fused with pleon on ventral side.

Description of the holotypic female (KMNH IvR 700,091). Body (Fig. 1A) distortion 91°.

All percomeres (Fig. 1A) distinct on concave side and medially but not on convex side.

Pleomeres 1 and 2 (Fig. 1A) distinct; pereomeres 3 and 4 (Figs. 1A, 2E) indistinct, each with ventral tubercle. Lateral plates (Fig. 1A) lanceolate to oval; first two subequal in length, lateral plates 2 to 4 decreasing in length.

Antenna 1 (Fig. 1D): article 1 largest, with 3 simple setae and some scales dorsally; article 2 small, with 4 aesthetascs dorsally; article 3 smallest, with 2 aesthetascs terminally. Antenna 2 (Fig. 1E): article 1 largest; articles 3-6 each with some aesthetascs distally.

Pereopod 1 (Fig. 1F): basis robust, about twice as long as wide; about five-seventh as long as basis; merus with short teeth ventrally; carpus fused with propodus, with acute tooth ventrally; propodus ovate, with some short teeth ventrally; dactylus curved to inward. Pereopod 2 (Fig. 1G): merus fused with carpus and propodus. Pereopods 3-7 similar to pereopod 2.

Right maxilliped (Fig. 2A) semicircular, about 2.2 times as long as wide, with some fine setae proximally. Left maxilliped (Fig. 2B) with curved short projection proximolaterally.

Right oostegite 1 (Fig. 2C) rather rectangulate, with some fine setae proximolaterally. Left oostegite 1 (Fig. 2D) rather ovate, with proximal projected lobe bearing some fine setae.

Pleopods (Fig. 2E) lanceolate, curved to inward, covered with many scales.

Description of the allotypic male (KMNH IvR 700,092).

Body (Fig. 2F) about twice as long as maximal width. Head separated from pereon.

Pereon (Fig. 2F) slightly widest across third and fourth pereomeres, with some short fine setae laterally. Pereomeres 1-5 widest at posterior borders, lateral margin rounded inward anteriorly; pereomeres 6 and 7 widest at anterior borders.

Pleon (Fig. 2F) triangular, lateral and anterior margins of nearly same length. Lateral margins bearing scattered setae.

Antennae (Fig. 2G) tipped with sparse setae: antenna 1 of 3 articles; antenna 2 of 7 articles.

Pereopods (Fig. 2G) of nearly same size and structure.

Description of the paratypic female (KMNH IvR 700,093). Body (Fig. 1B) about 1.4 times as long as maximal width, having well-developed brood pouch ventrally.

Antennae 1 and 2 (Fig. 1C) well-developed, protruded from frontal margin of head.

**Remarks.** Metaphrixus is a small genus in the Bopyridae, now containing 3 species. These are the type species, *M.* carolii NIERSTRASZ & BRENDER à BRANDIS, 1931, a ventroabdominally attached parasite of *Hippolyte* spp. from Virgin Islands (type locality), Florida to the Caribbean Sea (BRUCE, 1965, 1972; ROUSE, 1970; STRÖMBERG, 1971; MARKHAM, 1972, 1985, 1988); *M. intutus* BRUCE, 1965, a dorsoabdominally attached parasite of species of Palaemonella and Percilemenes, in Zanzibar (type locality), Singapore and Australia (BRUCE, 1965, 1979, 1986); and *M. rastriferis* MARKHAM, 1990, a ventroabdominally attached parasite of Periclimenes in New Caledonia (MARKHAM, 1990).

The following characters displayed by the new species indicate that it belongs to *Metaphrixus*: greatly distorted body axis; nearly circular body outline; presence of pereopods 1-7 on the concave side and pereopods 1-2 on the convex side; presence of five pleomeres; prominent lateral plates; uniramous pleopods; conspicuously extended fifth pleomere; and absence of uropods.

The lanceolate lateral plates links the new species to *Metaphrixus carolii. Metaphrixus setouchiensis* is distinguished from *M. carolii* in female by the following characters (those of *M. carolii* in parentheses): head fused with pereomere 1 (distinct); articulated antenna 1 (unsegmented); and presence of dorsolateral bosses on the pereon (absence).

Etymology. Named for its type locality.

Bopyrina ocellata (CZERNIAVSKY, 1868) (Figs. 3-4)

Bopyrus ocellatus CZERNIAVSKY, 1868: 63, 118, pl. VI, figs. 1-3; CARUS, 1885: 452.

- Bopyrus virbii WALZ, 1881: 62-64, pl. I, figs. 1-7b.
- Bopyrina ocellata form pontica CZERNIAVSKY, 1881: 529.
- Bopyrina ocellata form mediterranea CZERNIAVSKY, 1881: 529.
- Bopyrina virbii GIARD & BONNIER, 1890: 383; BONNIER, 1900: 368, fig. 59a-c; TATTERSALL, 1905: 54.
- Bopyrina ocellata GIARD & BONNIER, 1890: 383; BONNIER, 1900: 369, fig. 60.
- Bopyrina giardi BONNIER, 1900: 365-368, pls. XXXVIII-XL;
  GERSAECKER, 1901: 235; CHOPRA, 1923: 532-534, fig. 31a-d; NIERSTRASZ & BRENDER à BRANDIS, 1926: 30-31, figs. 87-99; SHIINO, 1934: 270-272, fig. 6a-g; MOTAS & BALEANU, 1937: 164-172, pl. I, figs. 1-5; SHIINO, 1958: 62; BOURDON, 1968: 388-405, figs. 183-190.



Fig. 3. Bopyrina ocellata (CZERNIAVSKY, 1868). A-C, female (KMNH IvR 700,101): A, habitus, dorsal; B, habitus, ventral; C, pleon, ventral. Scale =100 µm. Appendages numbered; c, coxal plate; mxp, maxilliped; pl-1-pl-3, first to third pleopods.

Material examined.  $34^{\circ}18^{\circ}N$ ,  $132^{\circ}59^{\circ}E$ , Kokuno-Shima Island, Takehara City, Hiroshima Prefecture, the Seto Inland Sea, Japan, 2 ovig.  $22^{\circ}$ , 2.22 mm (KMNH IvR 700,099), Dec. 21, 2004, 2.18 mm (KMNH IvR 700,101), Feb. 24, 2005, 2  $\sigma^{1}\sigma^{2}$ , 0.76 mm (KMNH IvR 700,100), obtained from the female (KMNH IvR 700,099), 0.64 mm (KMNH IvR 700,102), obtained from the female (KMNH IvR 700,101).

Diagnosis.

Female (Figs. 3A-C): head and pereon indistinct; first pereomere bearing coxal plate on convex side; some pairs of pleopods present. Male (Fig. 4A, B): antenna 2 composed of single article; at least three pleomeres present



Fig. 4. Bopyrina ocellata (CZERNIAVSKY, 1868). A, B, male (KMNH IvR 700,102): A, habitus, dorsal; B, habitus, ventral. Scale =100 µm.

or indicated.

Description of the reference female (KMNH IvR 700,101).

Body (Fig. 3A) oval, about 1.7 times as long as maximal width, without abrupt disruption of margins: body distortion 48°.

Head (Fig. 3A): width exceeded anteriorly by large frontal lamina only indistinctly separated from rest of head; frontal lamina asymmetrically produced into rounded lateral points and slightly undulating anteriorly.

Percomeres 1-4 (Fig. 3A) fused in mid-dorsal region; other percomeres more or less distinct. Dorsolateral bosses absent.

Pleon (Fig. 3A) completely fused leaving 5 segmental relics on both sides; notches of segmental relics on convex side deeper than on concave side. Pleopods (Fig. 3C) as irregularly shaped uniramous flaps; three pairs present.

Antennae and uropods absent.

Description of the reference male (KMNH IvR 700,102).

Body (Fig. 4A) lanceolate, about 3.8 times as long as maximal width, rounded anteriorly, and tapered posteriorly.

Head (Fig. 4A) almost semicircular, completely fused with pereon posteriorly, but juncture indicated laterally. Eyes large, irregularly shaped, dark spots.

Pereon (Fig. 4A) with sides nearly parallel, all pereomeres well separated laterally.

Pleon (Fig. 4A) triangular, tapering to sharp point; first pleomere distinct dorsally but not ventrally; pleomeres 2-6

faintly undulate margins indicating remnants of five pleomeres laterally.

Antenna 1 (Fig. 4B) of 3 articles, tipped with sparse setae.

Pereopods (Fig. 4B) small, all about same size and proportions.

No pleopods or uropods, but two small tufts of very short setae on posterolateral borders.

**Remarks.** *Bopyrina* is a genus of branchial parasite isopods in the Bopyridae. It contains 5 species, all of which infest hippolytid shrimps (MARKHAM, 1985).

The present material was identified with *Bopyrina* ocellata (CZERNIAVSKY, 1868) by the presence of the following characters: head fused with pereon; developed coxal plate 1; presence of some pairs of the pleopods in female; and unsegmented antenna 2 in male.

Bopyrina ocellata is similar to the Atlantic and the Indian species B. abbreviata RICHARDSON. B. ocellata is distinguished from B. abbreviata by the indistinct head and the presence of a coxal plate only on pereonite 1 in mature female. SHIINO (1934) reported B. ocellata from Tanabe Bay in the central Japan as B. giardi BONNIER. He considered B. abbreviata a synonym of B. giardi. However, when BOURDON (1968) included B. giardi in the synonymy of B. ocellata, he did not regard B. abbreviata as a synonym.

Many species of the hippolytid shrimp are infested with B. ocellata: Hippolyte longirostris CZERNIAVSKY (CZERNIAVSKY, 1868; BOURDON, 1968); H. inermis LEACH (WALZ, 1881; BOUR-DON, 1968); H. varians LEACH (BONNIER, 1900; BOURDON, 1968); H. ventricosus H. MILNE EDWARDS (CHOPRA, 1923); H. sp. (SHIINO, 1934); H. leptocerus (HELLER) (TURQUIER, 1962); H. inermis armoricana SOLLAUD (BOURDON, 1968); Heptacarpus geniculatus (STIMPSON) (SHIINO, 1958).

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