***Pleonobopyrus kumanonadensis* gen. et sp. nov. (Crustacea, Isopoda):
A new bopyrid infesting the crangonid shrimp, *Prionocrangon dofleini* (Crustacea, Decapoda, Caridea)**

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Abstract.— *Pleonobopyrus kumanonadensis* gen. et sp. nov., a parasite of the crangonid shrimp, *Prionocrangon dofleini* Balss, 1913, is described on the basis of a female specimen collected from Mie Prefecture, off Owase, Pacific coast of central Japan. The specimen was attached to the ventral surface of the abdomen of the host shrimp. The species of the bopyrid subfamily Hemiarthrinae Markham, 1972, are known to occur on the abdomens of caridean shrimps, but morphological characteristics of the new species did not match those of Hemiarthrinae nor any other subfamilies. The attachment posture is backwards in contrast to that found in species of Hemiarthrinae. This new genus and species is the first abdominal bopyrid found on species of *Prionocrangon*.

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Key words: bathyal zone, Bopyridae, Crangonidae, Epicaridea, Kumano-nada Sea, shrimp parasite.

■ Introduction

The family Bopyridae Rafinesque, 1815 (Isopoda: Cymothoidea: Epicaridea) contains obligate parasitic species that infest decapod crustaceans and includes over 600 described species worldwide (Boyko *et al.*, 2008 onwards). Currently, Bopyridae is divided into nine subfamilies (Boyko *et al.*, 2013). Of these, species from three subfamilies (Athelginae Codreanu & Codreanu, 1956, Hemiarthrinae Markham, 1972, and Phyllodurinae Markham, 1977), and one genus (*Rhopalione* Pérez, 1920 in Keponinae Boyko, Moss, Williams & Shields, 2013) are found on the abdomens of anomuran crabs, caridean shrimps, gebiidean shrimps, and brachyuran crabs, respectively.

In the present study, an ovigerous female bopyrid was found on the ventral surface of the abdomen of one of two specimens of *Priono-*

crangon dofleini Balss, 1913 (Decapoda: Caridea), a crangonid shrimp, collected by “the survey of the Kumano-nada bathyal marine fauna” (Moritaki, 2020). Detailed morphological examination of the bopyrid specimen has revealed that it does not belong to Hemiarthrinae, the adults of which occur on the abdomens of caridean shrimps. Here, we describe the single mature female specimen as a new species and propose a new genus for it as well.

■ Materials and Methods

The crangonid shrimp attached to by a bopyrid was collected from the bathyal zone in the Kumano-nada Sea, Pacific coast of central Japan, by the fishing trawler *Jinsho-maru* during the series of surveys carried out by the Toba Aquarium in 2017. They were transported to the Toba Aquarium and fixed in 70% etha-

nol. Size measurements includes total body length for bopyrid (TL, measured from the tip of the head to the posterior end of the final pleomere along the dorsal mid-line), and postorbital carapace length for host shrimp (CL, measured from the posterior margin of the orbit to the midpoint of the posterodorsal margin of the carapace). Other measurements and terminology follow Markham (1985) for the bopyrid and Hayashi (2007) for the host shrimp. Morphological characters of the bopyrid and host shrimp specimens were observed under a binocular dissecting microscope (Olympus X-II). Measurements and drawings were made with the aid of a compound microscope (Olympus BHB-Tr) equipped with a drawing tube. The type material of the new bopyrid, along with the host shrimp, are deposited in the Seto Marine Biological Laboratory, Kyoto University (SMBL).

■ Taxonomic Account

Family Bopyridae Rafinesque, 1815

Genus *Pleonobopyrus* gen. nov.

[New Japanese name: Ebi-no-yutanpo zoku]

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Diagnosis

Female: Body symmetrically rectangular, all body regions and all segments distinct; head fusiform, eyes absent; barbula with 2 pairs of lateral projections; maxilliped without trace of articulated palp; coxal plates on each side small; pereopods 2 to 7 elongate; brood pouch formed by 5 pairs of oostegites, completely closed, expanded ventrally; pleon of 6 pleomeres, first 5 bearing uniramous elongate lateral plates, pleomere 6 with tiny triangular pleotelson and uniramous uropods of similar shape as lateral plates; 4 pairs of non-peduncular uniramous pleopods. Male unknown.

Type Species

Pleonobopyrus kumanonadensis sp. nov., by

original designation.

Etymology

The generic name refers to pleon (= abdomen) of the host shrimp, the attachment site of the new bopyrid, to which is added to the familiar stem *-bopyrus*.

Remarks

The subfamily to which this new genus belongs has not been confirmed. The symmetrical body and the brood pouch formed by oostegites from both sides of the body show that the new genus is not a member of Hemiarthrinae. The following features of the new genus key out for the subfamily Argeiinae (Boyko *et al.*, 2013): fusiform head separated from pereomere 1; small coxal plates; brood pouch formed by five pairs of oostegites; simple lateral plates; non-pedunculate uniramous pleopods. However, other morphological characters of the new genus differ from the diagnostic characters of Argeiinae provided by Markham (1977) (the features for the diagnosis of Argeiinae are in parentheses): body symmetrically rectangular (*vs.* rounded, from triangular to nearly circular; distortion up to only 20°); maxillipeds without trace of palp (*vs.* articulated palp present or at least tuft of setae indicating palp); pereopods 2–7 elongate (*vs.* generally reduced); brood pouch completely closed (*vs.* usually wide open); and pleopods of four pairs (*vs.* usually five pairs).

Eragia Markham, 1994, an argeine genus, was proposed for the species, *Eragia profunda* Markham, 1994, that infests the crangonid shrimp, *Prionocrangon paucispina* J. N. Kim & Chan, 2005 (as *Prionocrangon* sp. in Markham, 1994). In their description of *P. paucispina*, Kim & Chan (2005) mentioned that the shrimp examined was “with bopyrid parasite probably *Eragia profunda* attached on abdomen.” Subsequently, Williams & Boyko (2010) examined the pair of *E. profunda* contained same specimen as reported by Kim & Chan (2005) from the branchial chamber of *P.*

paucispina, thus, Kim & Chan (2005) were in error. Therefore, the present finding represents the first bopyrid attached to abdomen of crangonid shrimps of the genus *Prionocrangon*.

The morphological characters of the new genus indicate that it is most probably a member of the subfamily Pseudioninae. However, the uniramous pleopods and caridean host for the new genus and species are unusual among species in Pseudioninae. Some putative primitive characters of Pseudioninae occur in males (An *et al.*, 2015); therefore, the relationship between *Pleonobopyrus* gen. nov. and Pseudioninae is speculative, because no male of the new genus is known.

***Pleonobopyrus kumanonadensis* sp. nov.**

(Fig. 1)

[New Japanese name: Ebi-no-yutanpo]

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Material examined

Holotype: ovigerous female (TL 5.65 mm). SMBL-V0594, removed from ventral surface of the abdomen of a crangonid shrimp, *Prionocrangon dofleini* Balss, 1913, female (CL 8.53 mm). Off Owase (34°01'10"N 136°23'10"E), Mie Prefecture, Pacific coast of central Japan, 280 m depth, 18 June, 2017, coll. Takeya Moritaki.

Description of holotype female

Body (Fig. 1A–C) symmetrical, rectangular in general outline; maximal body width 0.54 times as long as body length, body width slightly reduced posteriorly; dorsum weakly vaulted.

Head (Fig. 1D) fusiform, 1.47 times wider than long; distinctly from pereomere 1; frontal lamina absent. Eyes absent.

Antennule (Fig. 1E) of 5 articles; articles 2–4 and 5 with marginal and terminal setae.

Antenna (Fig. 1F) of 7 articles; article 3 longest, articles 5–7 short; articles 2–6 with a robust seta and distal setae, article 7 with terminal setae.

Maxillipeds (Fig. 1G, H) triangular, nearly straight medially, without trace of palp, bearing short spur; anterior articles approximately 1.8 times as long as posterior articles. Left anterior article with large lateral projection.

Barbula (Fig. 1I) with 1 right and 2 left short stout lateral projections (right anterior projection irregularly missing).

Pereon (Fig. 1A) with pereomere 1 shortest, approximately 0.1 times as long as pereomere 5; pereomere 5 longest. Pereomeres 1–4 with dorsolateral bosses, those of 3 and 4 largest. Inflated completely closed brood pouch (Fig. 1B) formed by 5 pairs of oostegites on both sides, greatly expanded ventrally, slightly asymmetrical expanded on right side at posterior margin. Oostegite 1 (Fig. 1J) prominently produced into rounded posterolateral point, internal ridge smooth.

Pereopod 1 (Fig. 1K) with all articles distinct; basis rectangular, ischium rectangular and longer than basis, merus trapezoidal and shorter than ischium, carpus triangular with a few distal setae, propodus ovate, dactylus stout. Basis, ischium, and merus of pereopods 2–7 (Fig. 1L–N) markedly elongated; merus with a few distal setae.

Pleon (Fig. 1A, O) with six pleomeres distinct dorsally, without ventral tubercles, terminal pleomere with tiny triangular tubercle (pleotelson?).

Five pairs of uniramous, simple, elongated lateral plates and four pairs of uniramous lobe-shaped pleopods present (Fig. 1A, O). Uropods semi-equal in length and shape to lateral plates present on pleomere 6.

Ecological notes

The host crangonid shrimp, *Prionocrangon dofleini*, is known to occur from the Pacific coast of central Japan to Taiwan at depths of 200 to 600 m (Kubo, 1965; Kim & Chan, 2005). It is, however, uncommon in Kumanonada Sea. Thus, this finding is the first capture of this shrimp from “the survey of the Kumanonada bathyal marine fauna” (Moritaki, 2020)

Fig. 1. *Pleonobopyrus kumanonadensis* gen. et sp. nov., holotype, ovigerous female (TL 5.65 mm), SMBL-V0594, removed from ventral surface of abdomen of crangonid shrimp, *Prionocrangon dofleini* Balss, 1913 (CL 8.53 mm). A, dorsal view; B, ventral view. C, right lateral view; D, head, dorsal view; E, left antennule, ventral view; F, left antenna, ventral view; G, right maxilliped, ventral view; H, left maxilliped, ventral view; I, barbula, ventral view; J, left oostegite 1, ventral view; K, right pereopod 1, lateral view; L, right pereopod 2, lateral view; M, same, terminal carpus, propodus, and dactylus, medial view; N, right pereopod 5, lateral view; O, pleon, ventral view. Abbreviations: lp 1-5, lateral plates 1-5; p 6-7, pereopods 6-7; pl 1-4, pleopods 1-4; o 2-5, oostegites 2-5; oc, oral cone; u, uropod.

during 2013 to 2020. A few specimens were caught from layers at 280 and 290 m depths, and two specimens were brought back to the

Toba Aquarium for species identification.

When the female of the new bopyrid is attached on the ventral surface of the shrimp's

Fig. 2. A, *Prionocrangon dofleini* Balss, 1913, female (CL 8.53 mm), off Owase, Mie Prefecture, Japan, 280 m deep, with holotype of *Pleonobopyrus kumanonadensis* gen. et sp. nov., attached on ventral surface of the abdomen; B, close up of the bopyrid attachment.

abdomen (Fig. 2A), the ventral surface of the brood pouch is oriented to the ventral surface of the second and third abdominal somites of the host, and faces backward relative to the host (Fig. 2B). This posture is backwards in contrast to that of all bopyrid species in the subfamily Hemiarthrinae found attached to the abdomen of shrimps. It is likely that pereopods 2 to 7 are hooked to the medial sides of the second and third lateral plates of the host abdomen; these pereopods do not reach beyond the

ventral surface of the abdomen of the shrimp.

Etymology

The specific name refers to the type locality, Kumano-nada Sea, Pacific coast of central Japan.

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