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A new record of *Parametaphoxus asiaensis* (Hirayama, 1992) (Crustacea: Amphipoda: Phoxocephalidae) from Korea

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During a survey of sand-burrowing amphipods, a phoxocephalid species, *Parametaphoxus asiaensis* (Hirayama, 1992), was found on the tidal flat of Yellow Sea and Jeju Island, Korea. The genus *Parametaphoxus* is reported for the first time in the Korean fauna. In this paper, we describe and illustrate the species, *P. asiaensis* of the family Phoxocephalidae in detail.

Keywords: Amphipoda, Korea, *Parametaphoxus asiaensis*, Phoxocephalidae

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Introduction

The family Phoxocephalidae, one of the burrowing amphipod groups, is composed of 78 genera in 11 subfamilies (Horton *et al*., 2015). The members of phoxocephalid amphipods are known to live mainly on coastal shelf sediments of the world. They exhibit fossorial adaptations morphologically. Their appendages are armed with strong spines and dense setae (Barnard and Drummond, 1978; Barnard and Karaman, 1991; Shin *et al*., 2015).

The genus *Parametaphoxus* Gurjanova, 1977 was established based on the type species, *P. fultoni* (Scott, 1890). Currently, the genus *Parametaphoxus* is characterized by the enlarged and dissimilar gnathopods 1 and 2: a parachelate palm and a free carpus in gnathopod 1, whereas a transverse (vertical) palm and a cryptic carpus in gnathopod 2 (Gurjanova, 1977; Barnard and Drummond, 1978; Barnard and Karaman, 1991; Jarrett and Bousfield, 1994). To date, four species are known in the genus *Parametaphoxus*: *P. asiaensis* Hirayama, 1992; *P. fultoni* (Scott, 1890); *P. quaylei* Jarrett and Bousfield, 1994; and *P. tulearensis* (Barnard and Drummond, 1978). Of these four species, *P. fultoni* distributes in the eastern Atlantic and Mediterranean, *P. quaylei* and *P. tulearensis* have been recorded from the eastern Pacific and Madagascar, respectively (Barnard and Drummond, 1978; Barnard and Karaman, 1991; Jarrett and Bousfield, 1994).

During a scientific survey of sand-burrowing amphipods, we found a phoxocephalid species of the genus *Parametaphoxus*, *P. asiaensis*, for the first time in Korea.

Materials and Methods

Materials were collected using a grab from the tidal flat of the Yellow Sea and Jeju Island, Korea between 2004 and 2007. The specimens were fixed in 10% formalin and preserved in 80% ethanol. Dissection and mounting were conducted according to the methodology of Barnard and Karaman (1991). Illustrations were made by using a drawing tube or camera lucida. Body length was measured from the tip of rostrum to the posterior end of urosomite 3. All specimens examined herein were deposited at Marine Arthropod Depository Bank of Korea (MADBK), National Marine Biodiversity Institute of Korea (MABIK), and National Institute of Biological Resources (NIBR).

Taxonomic Account

Order Amphipoda Latreille, 1816
Family Phoxocephalidae Sars, 1891
Genus *Parametaphoxus* Gurjanova, 1977

***Parametaphoxus asiaensis* (Hirayama, 1992) (Figs. 1-3)**

Metaphoxus fultoni: Hirayama, 1987, 58, figs. 260-263.

Metaphoxus fultoni asiaensis Hirayama, 1992, 127, figs. 10-14; Lowry, 2000, 323; Ren, 2012, 378, fig. 164.

Parametaphoxus asiaensis Jarrett and Bousfield, 1994, 122.

Material examined. 1♀, Jongdal-ri, Gujwa-eup, Jeju-si, Jeju Island, Korea, 1 Aug 2004; 1♀, Biyang-ri, Hanlim-eup, Jeju-si, Jeju Island, Korea, 14 Sep 2007; 1♀ (NIBRIV0000681436), Dangjin, Chungcheongnam-do, Korea, 16 Oct 2007.

Description. Female: Body (Fig. 1A) small, 3.24 mm long, smooth.

Head (Fig. 1B) about 15 percent of total body length, rostrum curved slightly downwards, un-constricted, extending beyond peduncular article 2 of antenna 1. Eyes rounded.

Antenna 1 (Fig. 1C) peduncular article 1 stout, about 1.7 times as long as article 2; flagellum 4-articulate, about 1.1 times as long as peduncular article 1; accessory flagellum 3-articulate. Antenna 2 (Fig. 1D) peduncular article 4 longer than broad, posterior margin short; peduncular article 5 shorter than article 4; flagellum 3-articulate.

Left mandible (Fig. 1F), incisor with 4 humps; lacinia mobilis with 6 teeth; raker low with 3 finely pectinate spines; molar process small and non-triturative. Right mandible (Fig. 1G), incisor with 3 teeth; lacinia mobilis flabellate, denticulate; raker low with 2 spines. Mandibular palp (Fig. 1H) 3-articulate; palp article 2 slightly longer than article 3, with 1 mediodistal seta; palp article 3 with 8 apical setae.

Upper lip (Fig. 1E) broad, rounded apically. Lower lip (Fig. 1I) mandibular process weak, apically rounded.

Maxilla 1 (Fig. 1J) inner plate broad, ovate, without seta; outer plate with 1 trifid, 2 bifid, and 4 serrate spines; palp uniarticulate, bearing 3 apical setae. Maxilla 2 (Fig. 1K) inner plate much shorter than outer, with facial oblique row of 3 setae; outer plate with 3 apical setae.

Maxilliped (Fig. 1L) inner plate with 2 apical setae; outer plate having 2 short teeth and 2 mid-length setae on apical margin, with 1 marginal seta. Maxillipedal palp (Fig. 1M) articles 2-3 with short and long setae; nail of article 4 long, stout.

Gnathopod 1 (Fig. 2A) coxa subrectangular, with 5 unequal simple setae on posterior half of ventral margin; basis longest, posterior margin with 2 long setae, anterodistal margin with 1 short seta; ischium short with 1 posterodistal seta; merus about 0.6 times carpus, meeting middle expansion of carpus, with 1 short posterodistal seta; carpus growing at proximal part of merus, with 1 setae; propodus subrectangular, bearing1 spine and 1 tooth posterodistally; palm parachelate weakly, with setae; dactylus falcate, reaching inner side of posterodistal tooth.

Gnathopod 2 (Fig. 2B) subchelate; coxa subrectangular, with 3 unequal simple setae on posterior half of ventral margin; basis posterior margin with 3 long setae; ischium short, with 1 short posterodistal seta; merus as long as carpus, posterodistal lobe acute with 1 seta; carpus with 1 midposterior seta; propodus longer than broad, palm transverse, defined by strong corner tooth with 1 spine.

Pereopod 3 (Fig. 2C) coxa subrectangular, ventral margin with 5 posterior submarginal setae; basis 2.2 times propodus; merus 1.8 times propodus; carpus bearing 2 unequal spines on posterior margin; propodus narrow, with 1 pair of locking spines. Pereopod 4 (Fig. 2D) coxa posterior margin deeply excavated; carpus bearing 2 unequal spines on posterior margin; propodus narrow, with 1 pair of locking spines; dactylus slender.

Pereopod 5 (Fig. 2E) relatively short, coxa bilobed, posterior lobe expanded; basis longer than broad, anterior margin with several setae, bearing developed posterodistal lobe; carpus about 2 times as long as ischium; propodus and carpus subequal in length; dactylus slender, exceeding half of propodus.

Pereopod 6 (Fig. 2F) coxa bilobed, anterior lobe shallow; basis anterior margin strongly convex, with numerous bunches of long simple and plumose setae, posterodistal lobe well developed, over reaching distal end of ischium; merus slightly longer than carpus; carpus and propodus subequal in length; propodus slender; dactylus about half length of propodus.

Pereopod 7 (Fig. 2G) shorter than pereopod 6. Coxa weakly bilobed; basis prominently expanded backward, extending beyond end of carpus, slightly rounded ventrally, with 1 anterodistal spine, posterior margin finely crenulate; merus longer than carpus; carpus slightly shorter than propodus; propodus shorter than merus; dactylus 0.7 times propodus.

Epimeral plates 1-3 (Fig. 3A) rounded posterodistally; epimeral plate 2 bearing 1 facial plumose seta.

Uropod 1 (Fig. 3B) peduncle longer than rami, with 2 dorsolateral and 2 dorsomedial spines; rami subequal in length; outer ramus having 1 dorsolateral spine; inner ramus smooth, unarmed.

Uropod 2 (Fig. 3C) peduncle subequal to rami, with 2 dorsolateral and 1 dorsomedial spines; outer ramus slightly longer than inner ramus, bearing 1 dorsolateral spine; inner ramus smooth, unarmed.

Uropod 3 (Fig. 3D) peduncle about 0.6 times outer ramus, longer than inner ramus, with 2 laterodistal and 1 mediodistal spines; outer ramus biarticulate, proximal article about 1.5 times inner ramus, with 3 spines on distal corner, and distal article bearing 3 apical setae; inner ramus 0.7 times as long as first article of outer ramus,

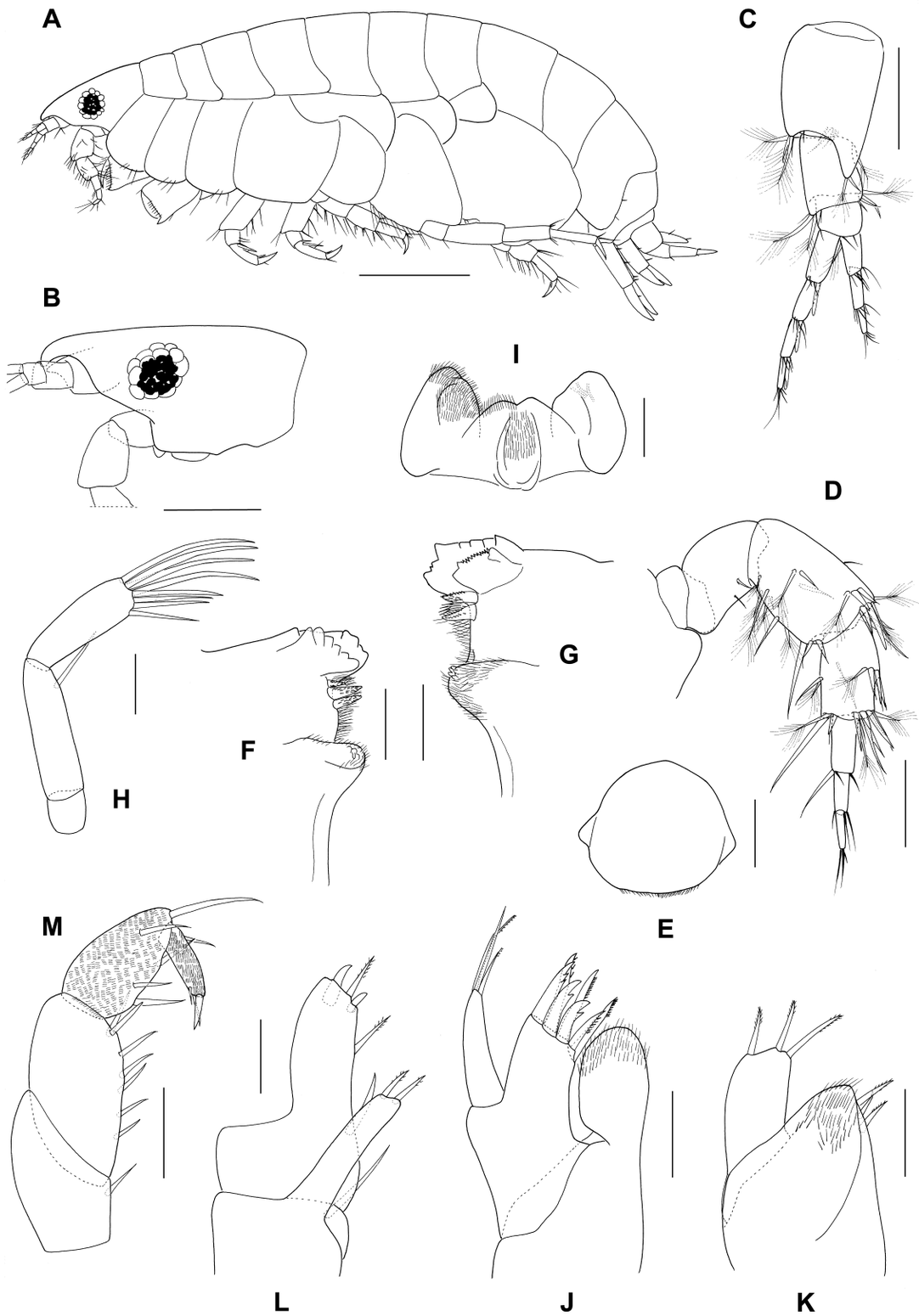

Fig. 1. *Parametaphoxus asiaensis* (Hirayama, 1992), female. A, body; B, head; C, antenna 1; D, antenna 2; E, upper lip; F, left mandible; G, right mandible; H, mandibular palp; I, lower lip; J, maxilla 1; K, maxilla 2; L, maxilliped; M, maxillipedal palp. Scales: A, 0.5 mm; B, 0.2 mm; C, D, 0.1 mm; E, H, I, M, 0.05 mm; F, G, J-L, 0.03 mm.

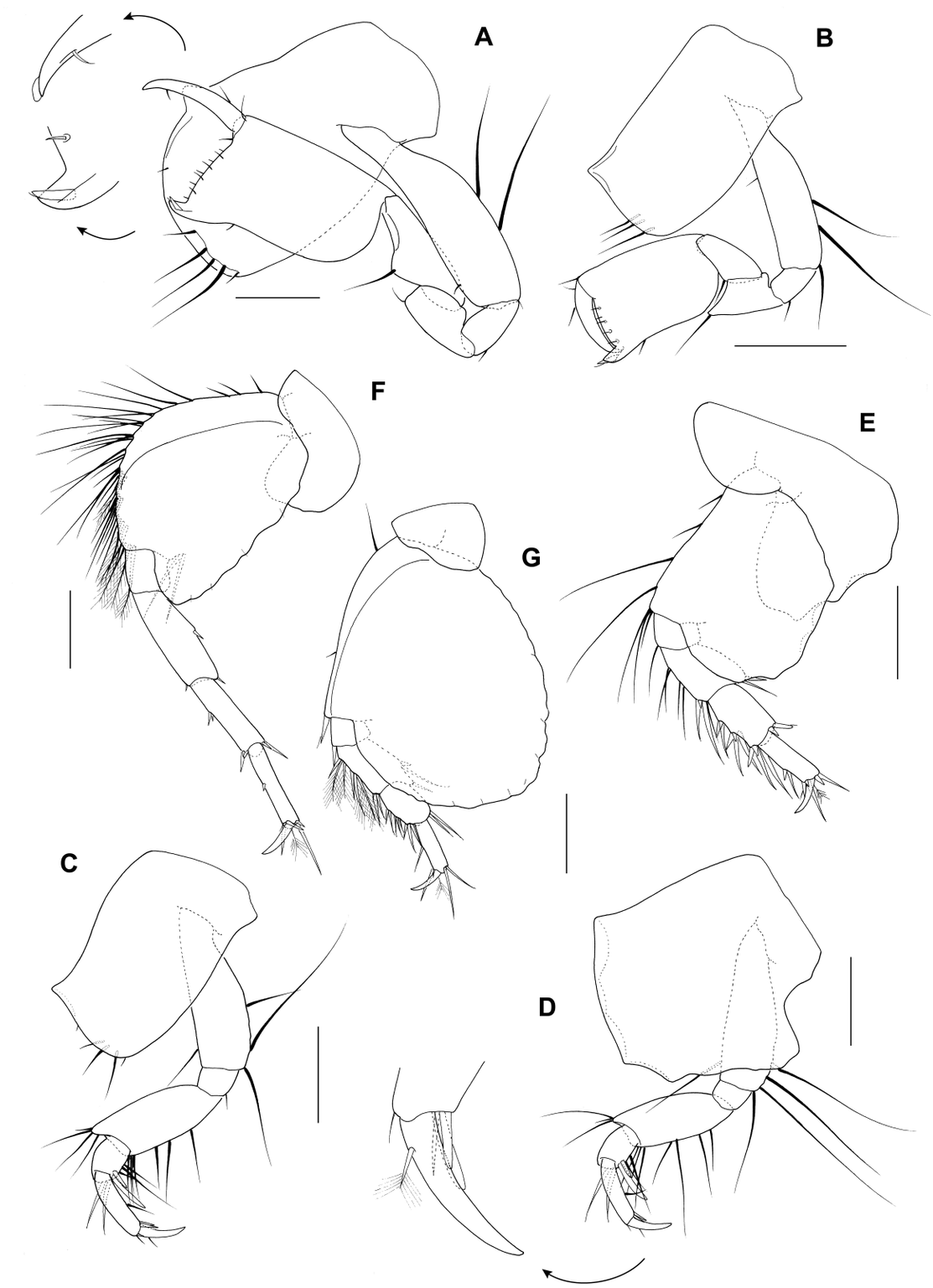

Fig. 2. *Parametaphoxus asiaensis* (Hirayama, 1992), female. A, gnathopod 1; B, gnathopod 2; C, pereopod 3; D, pereopod 4; E, pereopod 5; F, pereopod 6; G, pereopod 7. Scales: B-G, 0.2 mm; A, 0.1 mm.

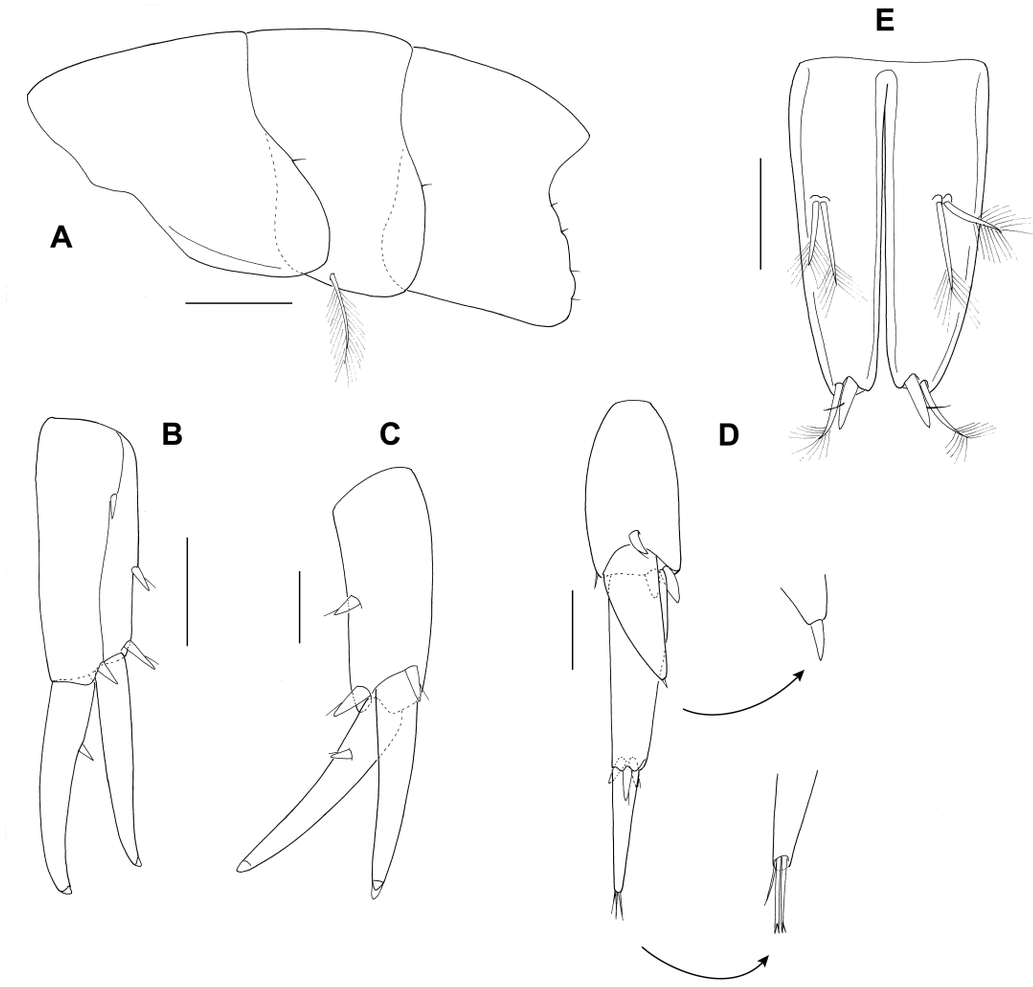

Fig. 3. *Parametaphoxus asiaensis* (Hirayama, 1992), female. A, pleonites 1-3; B, uropod 1; C, uropod 2; D, uropod 3; E, telson. Scales: A, 0.2 mm; B, 0.1 mm; C-E, 0.05 mm.

with 1 apical seta.

Telson (Fig. 3E) deeply cleft, each lobe rather slender, bearing 1 spine and 1 plumose seta, apically, and 1 pair of plumose setae, middorally.

Male: No males were identified in the current study.

Distribution. Korea (current study), Hong Kong, China, and Japan.

Remarks. In 1992, Hirayama described a new subspecies *Metaphoxus fultoni asiaensis*, in Hong Kong which was discriminated from *M. fultoni fultoni* (Scott, 1890) and *M. fultoni tulearensis* (Barnard and Drummond, 1978). According to Hirayama's discussion, *M. fultoni asiaensis* has a pair of locking spines on the propodi of pereopods 3-4, same as that of *M. fultoni tulearensis*. In gnathopod 1 of *M. fultoni asiaensis*, however, the palm is almost transverse and the propodus is less prolonged than those of two subspecies, *M. fultoni fultoni* and *M. fultoni tulearensis* (Hirayama, 1992). Thereafter, Jarrett and Bousfield (1994) transferred *M. fultoni asiaensis* to the genus *Parametaphoxus*, and elevated the subspecies into species status. In this study, we followed the classification scheme of Jarrett and Bousfield (1994).

Parametaphoxus asiaensis is similar to *P. quaylei* Jarrett and Bousfield, 1994. However, it differs from latter species. In *P. quaylei*, the third article of mandibular palp has more distal setae than that of *P. asiaensis*. In *P. quaylei*, the proximal article of uropod 3 outer ramus has a marginal spine, whereas no spine is evident in *P. asiaensis*. In addition, the telson of *P. quaylei* bears two long apical spines, whereas there is a single short spine in *P. asiaensis*.

The characteristics of our specimens coincided with those shown in Hirayama's original description. However, two minor differences were observed between our

materials and the illustration of Hirayama's female. In our specimen, the outer ramus of uropod 2 bears a marginal spine, and the epimeral plate 2 bears a single plumose seta on the ventral surface. However, there was no evident seta and spine in those of the Hirayama's illustration. These variations might be a result of the developmental stages of the individuals examined, because the body length of our material was 3.24 mm, and that of Hirayama's illustration was 2.3 mm.

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