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Redescription of *Alpheus bisincisus* De Haan (Decapoda: Alpheidae) from Korea

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The snapping shrimp *Alpheus bisincisus* is redescribed on the basis of nine specimens collected in southern Korea. This species is readily distinguished from the other reported species of the Edwardsii group of *Alpheus* from Korea (*A. heeia*, *A. hoplocheles*, *A. japonicus*, *A. lobidens*, *A. malabaricus*, *A. pacificus*, *A. richardsoni*, and *A. sudara*) by having the rostrum and rostral triangle on the carapace flattened dorsally and sharply demarked, and by the presence of overhanging orbitorostral grooves.

Key words: *Alpheus bisincisus*, Alpheidae, Korean fauna, Redescription

Introduction

Since Miers (1879) reported the snapping shrimp *Alpheus bisincisus* De Haan, 1849 in Korean waters, there have been many reports of *A. bisincisus* in Korea (Kim and Park, 1972; Kim, 1976, 1977; Kim et al., 1981; Kim and Choe, 1982; Kwon, 1983; Kim and Chang, 1987, 1990; Kim and Song, 1987; Kim and Kim, 1988; Min and Kim, 1991; Kim and Kim, 1997; Cha et al., 2001; Park and Choi, 2001; Je et al., 2002; Seo et al., 2004). Of these taxonomic records, Kim and Park (1972), Kim (1976, 1977), and Cha et al. (2001) were based on erroneous species identifications. Other reports (Kim et al., 1981; Kim and Choe, 1982; Kwon, 1983; Kim and Chang, 1987, 1990; Kim and Song, 1987; Kim and Kim, 1988; Min and Kim, 1991; Kim and Kim, 1997; Park and Choi, 2001; Seo et al., 2004) require confirmation of the species identification. Recently, Je et al. (2002) provided a color photograph of a true *A. bisincisus* showing the whole animal in dorsal view, based on a single specimen from Seoguipo, Jejudo, Korea. However, no description or illustrations were given in their work.

A faunistic and ecological survey of Korean Alpheidae in southern Korea (Jejudo Island and Geomundo Island) was made, and *A. bisincisus* is redescribed with illustrative figures.

The specimens examined in this study were deposited in the Invertebrate Resources Bank of Korea (IRBK), Seoul National University, Korea and the Laboratory of Zoology, Silla University (SUZ), Korea. Carapace length (cl) was measured from the tip of the rostrum to the posteromedian margin of the carapace.

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Systematic account

Alpheus bisincisus De Haan, 1849
Korean name: Hombal-ddackchongsaewoo
(Fig. 1)

Restricted synonymy

Alpheus bis-incisus De Haan, 1849: 179 (as *A. avarus*. in text), (1844) pl. 45, fig. 3 (as *A. bis-incisus* on plate).

Alpheus bisincisus (or *Alpheus bis-incisus*): Stimpson, 1860: 30; Miers, 1879: 22, 53; Coutière, 1905: 910; Pearson, 1911: 182; Tiwari, 1963: 304, fig. 23; Banner and Banner, 1966: 78 (in key), 125, fig. 46; Banner and Banner, 1982: 33 (in key), 263, fig. 81; Jeng and Chang, 1985: 244 (in key), 249, fig. 29; Hayashi, 1986: 107, fig. 64; 1998: 290 (in key), 290, figs. 352, 353a, e, 354a, 355a; Debelius, 2001: 146, unnumbered fig.; Je et al., 2002: 224, unnumbered fig.

Alpheus bis-incisus var. *malensis*: Coutière, 1905: 910, pl. 86, fig. 48; Pearson, 1905: 86.

Alpheus bis-incisus var. *stylirostris*: Coutière, 1905: 911, pl. 86, fig. 49; Pearson, 1905: 86.

Alpheus bis-incisus var. *variabilis*: De Man, 1909: 109; 1911: 406, pl. 22, fig. 95a-e.

Alpheus bisincisus: Kim et al., 1981: 284 (list); Kim and Choe, 1982: 320 (list); Kwon, 1983: 98 (list); Kim and Chang, 1987: 47 (list); 1990: 41 (list); Kim and Song, 1987: 43 (list); Kim and Kim, 1988: 169 (list); Min and Kim, 1991: 18 (list); Kim and Kim, 1997: 213 (list); Park and Choi, 2001: 128, unnumbered fig.; Seo et al., 2004: 97 (list).

Not *Alpheus bisincisus*: Kim and Park, 1972: 198 (list) (= *Alpheus richardsoni* and *Alpheus lobidens*); Kim, 1976: 142 (list) (= *Alpheus richardsoni* and *Alpheus hoplocheles*); Kim, 1977: 247, pl. 24, fig. 100 (= *Alpheus richardsoni* and *Alpheus hoplocheles*); Cha et al., 2001: 84, two unnumbered figs. (= *Alpheus hoplocheles*).

Material examined

Deoknam (Geomundo Island), 21 June 2002, coll. H.S. Rho-1 ♂ (cl 14.0 mm), 1 ovig. ♀ (cl. 13.0 mm), SCUBA, IRBKARAR003497; Chaguido Island (Jejudo Island), 08 June 2001, coll. S.H. Kim-1 ♂ (cl 15.0 mm), SCUBA, IRBKAR003498; Deoknam (Geomundo Island), 23 June 2002, coll. H.S. Rho-1 ovig. ♀ (cl 18.5 mm), SCUBA, IRBKAR003500; Ducknam (Geomundo Island), 23 June 2002, coll. H.S. Rho-1 ♂ (cl 16.5 mm), SCUBA, IRBKAR-003501; Daesambudo Island, 26 June 2002, coll. H.S. Rho-1 ♂ (cl 16.0 mm), SCUBA, IRBKAR003502; northern Sekkiseom off Munseum (Jejudo Island), 19 April 2002, coll. H.S. Rho-1 ♂ (cl 19.0 mm), SCUBA at 45 m in depth, IRBKAR003499; Seungsanpo (Jejudo Island), 20 June 1993, coll. C.H. Kim-1 ♂ (cl 15.0 mm), intertidal zone, SUZ Cr.10119; Munseum (Jejudo Island), 14 July 1999, coll. H.S. Ko-1 ♀ (cl 18.5 mm), SCUBA at 25 m in depth, SUZ Cr.10120.

Description

Species of Edwardsii group. Rostrum (Fig. 1A, B) acute, triangular, not reaching end of first segment of antennular peduncle, about 2.0 times as long as broad at base, flattened dorsally with margins overhanging deep orbitorostral groove. Orbital hoods (Fig. 1A) rounded and unarmed; orbitorostral grooves deep. Pterygostomian angle (Fig. 1B) rounded. Second segment of antennular peduncle (Fig. 1A) about 2.2 times as long as broad and about 1.4 times longer than visible part of first segment of antennular peduncle; stylocerite distally pointed, reaching end of first segment of antennular peduncle. Scaphocerite (Fig. 1A) with lateral margin concave; distolateral tooth strong, overreaching end of third segment of antennular peduncle. Carpocerite (Fig. 1B) longer than distolateral tooth of scaphocerite.

Third maxilliped (Fig. 1E) with ultimate segment about 2.5 times as long as penultimate segment.

Major chela (Fig. 1F, G) about 2.5 times as long as broad; palm about 1.3 times broader than fingers; superior saddle well defined; proximal shoulder subacute, overhanging transverse groove; distal shoulder gradually rounded; lateral palmar depression shallow, quadrangular, extending to *linea impressa*; mesial palmar depression triangular; inferior shoulder blunt; inferior notch well marked; merus about 2.4 times as long as broad, with strong tooth distally on inferointernal margin.

Minor chela (Fig. 1H-K) sexually dimorphic, with that of male balaeniceps. Male chela about 3.6 times as long as broad; fingers about 0.9 times as long as palm; superior margin of palm bearing shallow transverse groove proximal to dactylus; fringes of setae on dactylus meeting on superior surface at distal third; merus 2.0 times as long as broad, with acute and distal tooth on outer margin. Female chela not balaeniceps, 4.0 times as long as broad; fingers slightly longer than palm; merus about 3.1 times as long as broad, with distal tooth on outer margin.

Second pereopod (Fig. 1L) with first carpal segment about 1.9 times as long as second segment; second segment 2.0 times as long as third segment; third segment equal to fourth segment in length; fourth segment about 0.7 times as long as fifth segment: fifth segment 0.4 times as long as first segment.

Third pereopod (Fig. 1M) with movable spine on ischium; merus 6.1 times as long as broad; carpus about 0.4 times as long as merus; propodus about 1.9 times as long as carpus, with 8 spines on inner margin; dactylus simple, acute, about 0.3 times as long as propodus.

Abdomen (Fig. 1C) with pleura rounded.

Telson (Fig. ID) about 1.8 times as long as broad at posterior margin, with 2 pairs of dorsolateral spines; posterior margin slightly arcuate, with pair of spines at each lateral end.

Remarks

In their list of Korean prawns and shrimps, Kim and Park (1972) listed *Alpheus bisincisus* based on seven males, two females, and five juveniles collected from various localities in southern and western Korea, of which four males were deposited in IRBK, Seoul National University, Korea: a single male (IRBKAR003043) from Duckjuckdo Island off Incheon on 12 June 1968 and three males (IRBKAR-003759) from Maryangpo off Biin on 24 July 1971. As a result of our reexamination, we have shown that

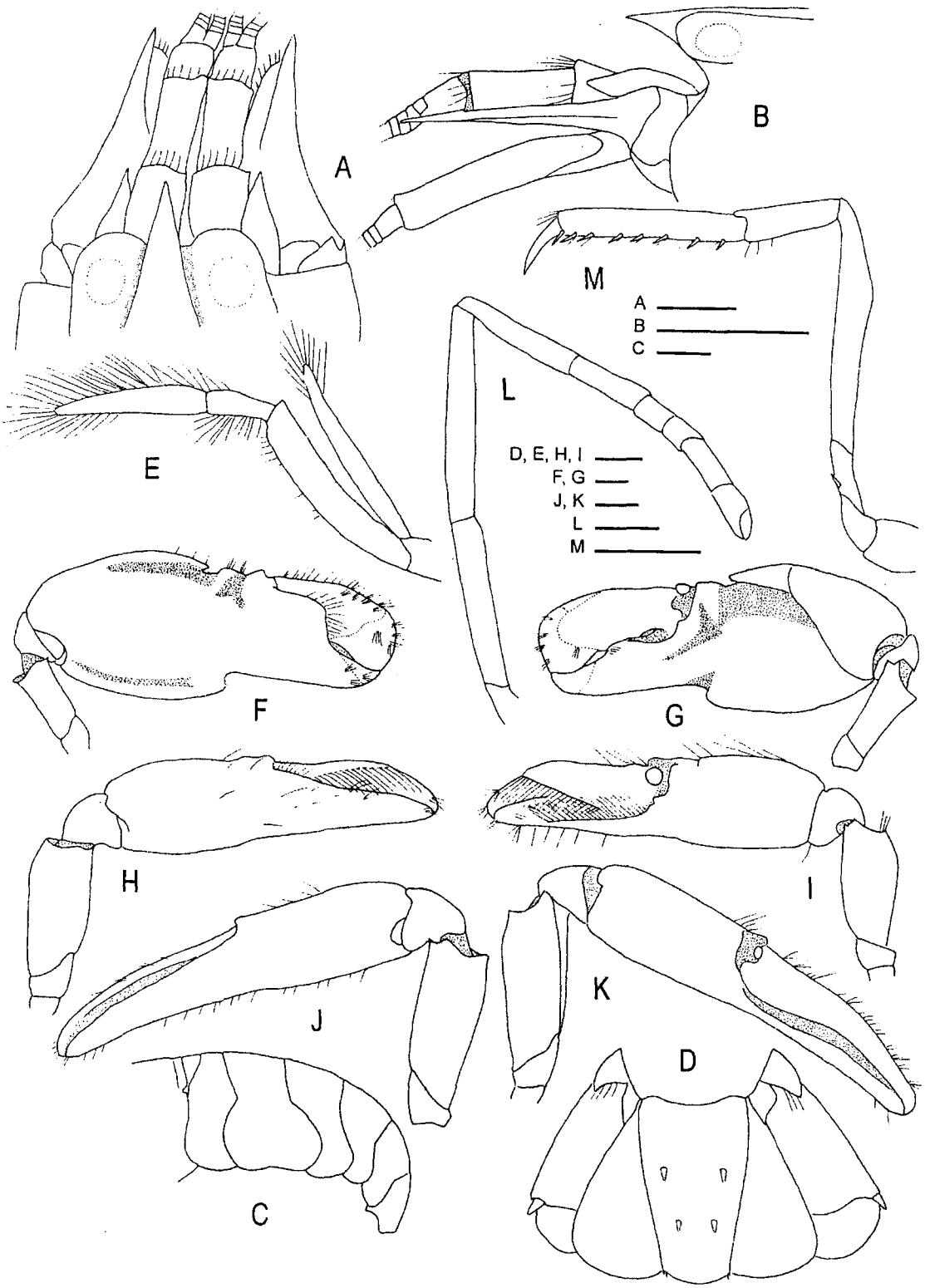

Fig. 1. *Alpheus bisincisus* De Haan, 1849. A, anterior carapace and cephalic appendages, dorsal; B, same, lateral; C, abdomen, lateral; D, tail fan, dorsal; E, third maxilliped, lateral; F, major chela, mesial; G, same, lateral; H, J, minor chela, mesial; I, K, same, lateral; L, second pereopod, lateral; M, third pereopod, lateral. A-G, J-M, female (cl 18.5 mm, catalog number SUZ Cr.10120); H, I, male (cl 15.0 mm, catalog number SUZ Cr.10119). Scales = 2 mm (A, B, D-K), 5 mm (C).

the specimens under catalog no. IRBKAR003043 and IRBKAR003759 are not *A. bisincisus* but *A. richardsoni* and *A. lobidens*, respectively.

Kim's (1977: p. 247, figs. 100, 101) description and illustrations of *A. bisincisus* are problematic, although his illustrations are detailed. The description and figures of *A. bisincisus* given by Kim (1977) were made from one male collected from Ganghwado Island, western Korea, in 1972. Body dimensions including measurements of the carapace, the rostrum, the telson, the scaphocerite, the third maxilliped, the first to third pereopods, and the fifth pereopod taken from one male and one female of *A. bisincisus* were also given in his description, both of which were collected from Seodo, near Ganghwado Island in 1973. Moreover, Kim (1977: p. 249, fig. 100D, E, G) described the orbitorostral groove on the carapace as being shallow and slightly concave, the proximal shoulder of the major chela as being rounded, and the ischium of the third pereopod being without a movable spine, a condition that never occurs in *A. bisincisus*. He also described that the dactylus of the third pereopod was simple. We have reexamined the specimens (IRBKAR003338 and IRBKAR003758) that he identified as *A. bisincisus* from Ganghwado Island and Seodo, and found that they are *A. richardsoni* and *A. hoplocheles*, respectively. His description and dimensions for *A. bisincisus*, therefore, were based on these two species. In the specimens from Ganghwado Island (IRBKAR-003338), we also found the dactylus of the third pereopod to be spatulate and the ischium of the third pereopod with a movable spine, indicating that he inadequately examined the third pereopod. In Kim's (1976) checklist of prawns and shrimps of Korea, his listing of *A. bisincisus* could also be *A. richardsoni* and *A. hoplocheles* because this identification was based on the same specimens as those of Kim (1977).

As mentioned by Yang and Ko (2005), *A. bisincisus* sensu is actually *A. hoplocheles* (Cha et al., 2001).

Many authors subsequently listed *Alpheus bisincisus* providing insufficient morphological information (Kim et al., 1981; Kim and Choe, 1982; Kwon, 1983; Kim and Chang, 1987, 1990; Kim and Song, 1987; Kim and Kim, 1988; Choe and Kim, 1989; Min and Kim, 1991; Kim and Kim, 1997; Park and Choi, 2001; Seo et al., 2004). At this time, it is impossible to identify the species reported by these authors without reexamination of their specimens. Therefore, their reports remain unverified.

Eight other species belonging to the Edwardsii group of the genus *Alpheus* have been reported in Korea: *A. heeia*, *A. hoplocheles*, *A. japonicus*, *A. lobidens*, *A. malabaricus*, *A. pacificus*, *A. richardsoni* (as *A. euphrosyne richardsoni*), and *A. sudara* (Kim, 1977; Miya, 1995; Park and Han, 2000; Yang and Anker, 2003; Yang and Ko, 2005). *Alpheus bisincisus* is readily distinguished from all of these species by having the rostrum and rostral triangle on the carapace flattened dorsally and sharply demarked, and by the overhanging orbitorostral grooves.

Color

Entirely red-orange, with a pair of small black spots on the first, third, and fourth abdominal terga (Hayashi, 1986).

Biology

Mainly free-living; often found under stones or sponges in the tidal zone (Debelius, 2001).

Development

Larval development of *Alpheus bisincisus* remains unknown (Yang and Kim, 2006).

Distribution

Southern Korea (Jejudo Island and Geomundo Island), Japan, South China Sea, Taiwan, Singapore, the Philippines, Indonesia, Australia, New Caledonia, Vietnam, Ceylon, Madagascar, Seychelles, Maldive and Laccadive Archipelagoes, Sri Lanka, Red Sea, Persian Gulf, and East and South Africa.

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