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LARVAL DEVELOPMENT OF *CRANGON URITAI* (DECAPODA: CRANGONIDAE) REARED IN THE LABORATORY

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ABSTRACT

The complete larval development of *Crangon uritai* Hayashi and Kim is described from laboratory-reared material. This species has five zoeal stages and one postlarva. Detailed morphological descriptions and illustrations of each stage are provided. The larvae of *C. uritai* present two remarkable differences compared with those of other congeneric species, *C. affinis* and *C. hakodatei*: the number of zoeal stages, and in possessing one submarginal seta of antennal scale in zoeal stages. One outstanding simple seta on the rostrum is the only remarkable difference in the postlarval stage.

The sand shrimp *Crangon uritai* Hayashi and Kim, 1999, is common in shallow coastal areas on bottom of soft sandy or sandy-mud substrate in East Asian waters (Hayashi and Kim, 1999).

In Korea and neighboring waters, *Crangon* is represented by seven species (Hayashi and Kim, 1999): *Crangon affinis* De Haan, *Crangon amurensis* Brashnikov, *Crangon cassiope* De Man, *Crangon dalli* Rathbun, *Crangon hakodatei* Rathbun, *Crangon propinquus* Stimpson, and *Crangon uritai* Hayashi and Kim. Of these, the larval development based on parentage material has been previously described in four species: *C. affinis* (by Tanaka, 1942; Yokoya, 1957; Kurata, 1964; Yamauchi, 1965; Hong, 1991; Jang, 1999); *C. amurensis* (by Konishi and Kim, 2000); *C. dalli* (by Makarov, 1967); and *C. hakodatei* (by Jang, 1999; Li and Hong, 2003).

Tanaka (1942) described the first zoea of *C. affinis* reared in the laboratory. Yokoya (1957) described only the first zoea of *C. affinis* based on material of known parentage. Kurata (1964) briefly described the first zoea of *C. affinis* hatched in the laboratory from ovigerous females and the remaining five zoeal stages and one postlarval stage from plankton samples collected near Hokkaido waters, and also described six unidentified crangonid larvae collected by plankton samples. Yamauchi (1965) roughly described the complete larval development of *C. affinis*, as *Crago affinis*, reared in the laboratory. Hong (1991) completely described six zoeal and one postlarval stages of *C. affinis* reared in the laboratory. Jang (1999) also described the complete larval development of *C. affinis*, composed of six zoeal and one postlarval stage from material of known parentage. Makarov (1967) presented only figures of the first zoeal stage of *Crangon dalli* from known parentage and of the remaining four zoeal stages and one postlarval stage based on plankton samples. Konishi and Kim (2000) described and illustrated only the first zoea of *Crangon amurensis* based on laboratory-hatched material. Jang (1999) and Li and Hong (2003) described and illustrated in detail the complete six zoeal stages and one postlarval stage of *Crangon hakodatei* reared in the laboratory. However, the larval development of *Crangon uritai* has never been described. Therefore the purpose of this present paper is to make a detailed, illustrated description of the complete larval development of *C. uritai* based on laboratory-reared larvae, and to compare it with other previously known larvae of the genus *Crangon*, particularly with its confounded species, *C. affinis* and *C. hakodatei*.

MATERIALS AND METHODS

An ovigerous female of *Crangon uritai* was collected by a shrimp beam trawl on sandy and muddy bottom at depth of 3–6 m on January 30, 2001 in Dadaepo (35°02′N; 128°57′E), Busan, Korea. The ovigerous shrimp was kept in filtered and aerated seawater aquarium at constant temperature and salinity conditions until hatching.

Of all hatched larvae, 50 larvae were reared individually in 100 mL glass bottles while remaining larvae were kept in 1000 mL beakers for mass-culture (18 ± 1°C; 33.2 ± 0.5‰; D:L = 12:12). The larvae were fed daily with newly hatched *Artemia* nauplii. Molting and mortality were checked daily, exuviae were removed immediately after molt to prevent consumption, and the larvae were transferred to the freshly prepared glass bottles.

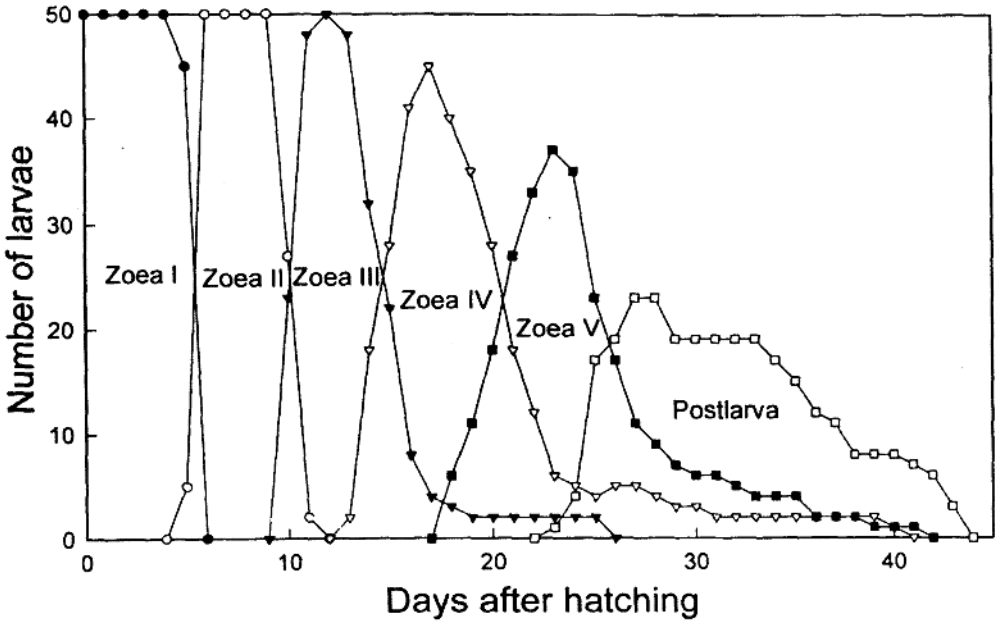

Fig. 1. *Crangon uritai* Hayashi and Kim, 1999. Survival and duration in stage of larvae reared under laboratory conditions of 18 ± 1°C and 33.2 ± 0.5‰.

Ten specimens at all stages and exuviae were fixed in 3% buffered Formalin solution for 48 h and preserved in 70% ethanol for measurements and morphological observation. Drawings and measurements were conducted with drawing tube attached to a microscope (Olympus BX50). Measurements of larvae were made to the nearest 0.01 mm with an ocular micrometer as follows: carapace length (CL), from the anterior tip of the rostrum to the posterior-median carapace margin; total length (TL), from the anterior tip of the rostrum to the posterior-median margin of the telson, excluding telson processes. The spent females and the remaining larval stages were deposited in the Laboratory of Invertebrate, Pukyong National University, Korea.

RESULTS

Crangon uritai passed through five zoeal stages before the postlarval stage. Of the 50 larvae reared individually, 23 larvae molted to the postlarval stage. The first postlarva appeared 23 days after hatching, whereas the last appeared 38 days after hatching (Fig. 1).

Description

Crangon uritai Hayashi and Kim, 1999
Figs. 2–8

First Zoea

Duration.—5–6 days.

Size.—CL = 0.81 mm (0.76–0.85 mm; SD = 0.03; n = 10); TL = 2.13 mm (2.07–2.16 mm; SD = 0.03; n = 10).

Color.—Dark brown chromatophores on: dorsal base of antennule; dorsomedian eyes; dorsomedian part and posterolateral part of carapace; dorsomedian part of abdominal somites 1 and 3; dorsoanterior part of abdominal somite 2; posterolateral part of somites 4 and 5; anterolateral, dorsomedian, posterolateral part of telson.

Carapace (Fig. 2A, B).—Rostrum well developed, straight and tapering distally without teeth; anteroventral margin with 3 denticles (excluding pterygostomian spine).

Eyes (Fig. 2A, B).—Sessile.

Antennule (Fig. 2C).—Uniramous; peduncle unsegmented, with long plumose seta; single flagellum with 3 aesthetascs and 1 seta.

Antenna (Fig 2D).—Biramous; propodite with 1 short spine; endopod (flagellum), a tapering process with row of fine spinules on distal half; exopod (antennal scale, scaphocerite) broad and flat, with 10 marginal setae (2 simple, 8 plumose) and 1 short submarginal seta.

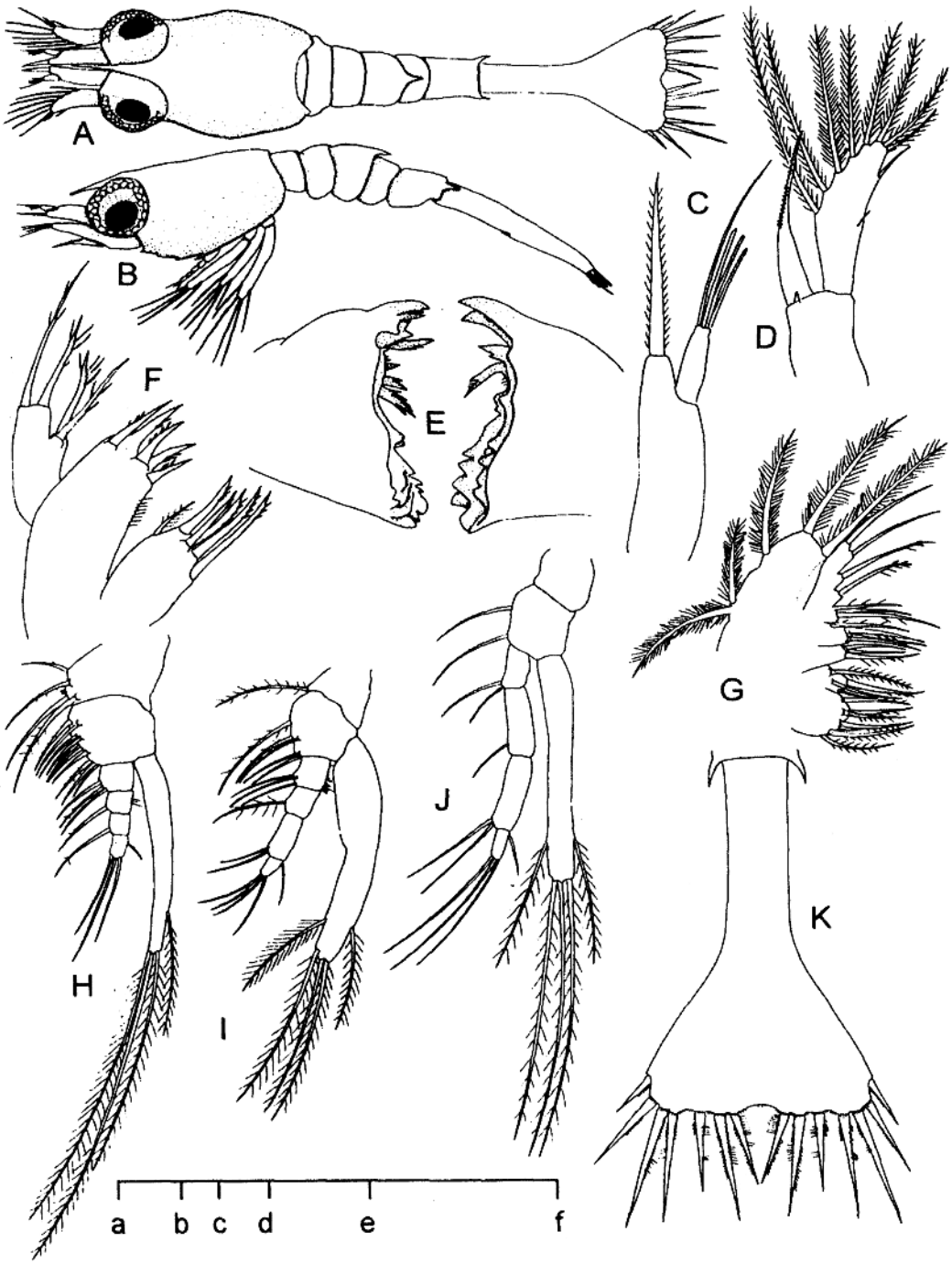

Fig. 2. *Crangon uritai* Hayashi and Kim, 1999. First zoea. A, Dorsal view (Scale ab); B, lateral view (ab); C, antennule (ae); D, antenna (ad); E, mandible (af); F, maxillule (af); G, maxilla (ae); H, first maxilliped (ad); I, second maxiliped (ad); J, third maxilliped (ad); K, telson (ac). Scale = 0.3 mm.

Fig. 3. *Crangon uritai* Hayashi and Kim, 1999. Second zoea. A, dorsal view (scale ab); B, lateral view (ab); C, antennule (ad); D, antenna (ad); E, mandible (af); F, maxillule (af); G, maxilla (ae); H, first maxilliped (ad); I, second maxilliped (ad); J, third maxilliped (af); K, telson (ac). Scale = 0.3 mm.

Mandible (Fig. 2E).—Asymmetrical; with well-developed incisor and molar processes, molar processes with strong teeth; left with lacinia mobilis.

Maxillule (Fig. 2F).—Coxal endite with 5 serrate marginal setae and 1 pappose submarginal setae; basial endite with 5 cuspidate marginal setae and submarginal

Fig. 4. *Crangon uritai* Hayashi and Kim, 1999. Third zoea. A, dorsal view (scale ab); B, lateral view (ab); C, antennule (ad); D, antenna (ac); E, mandible (ae); F, maxillule (af); G, maxilla (ae); H, first maxilliped (ae); I, second maxilliped (ae); J, third maxilliped (ae); K, pereiopod 1 (ae); L, pereiopods 2–5 (ac); M, uropods and telson (ac). Scale = 0.3 mm.

microtrichias; endopod bilobed, with 2+2 setae.

Maxilla (Fig. 2G).—Coxal endite weakly bilobed, with 7+4 spinulous setae; basial endite bilobed, with 3+4 spinulous setae; endopod unsegmented but 4-lobed, with 3+1+1+2 spinulous setae; scaphoganathite (exopod) flattened, with 5 long plumose setae.

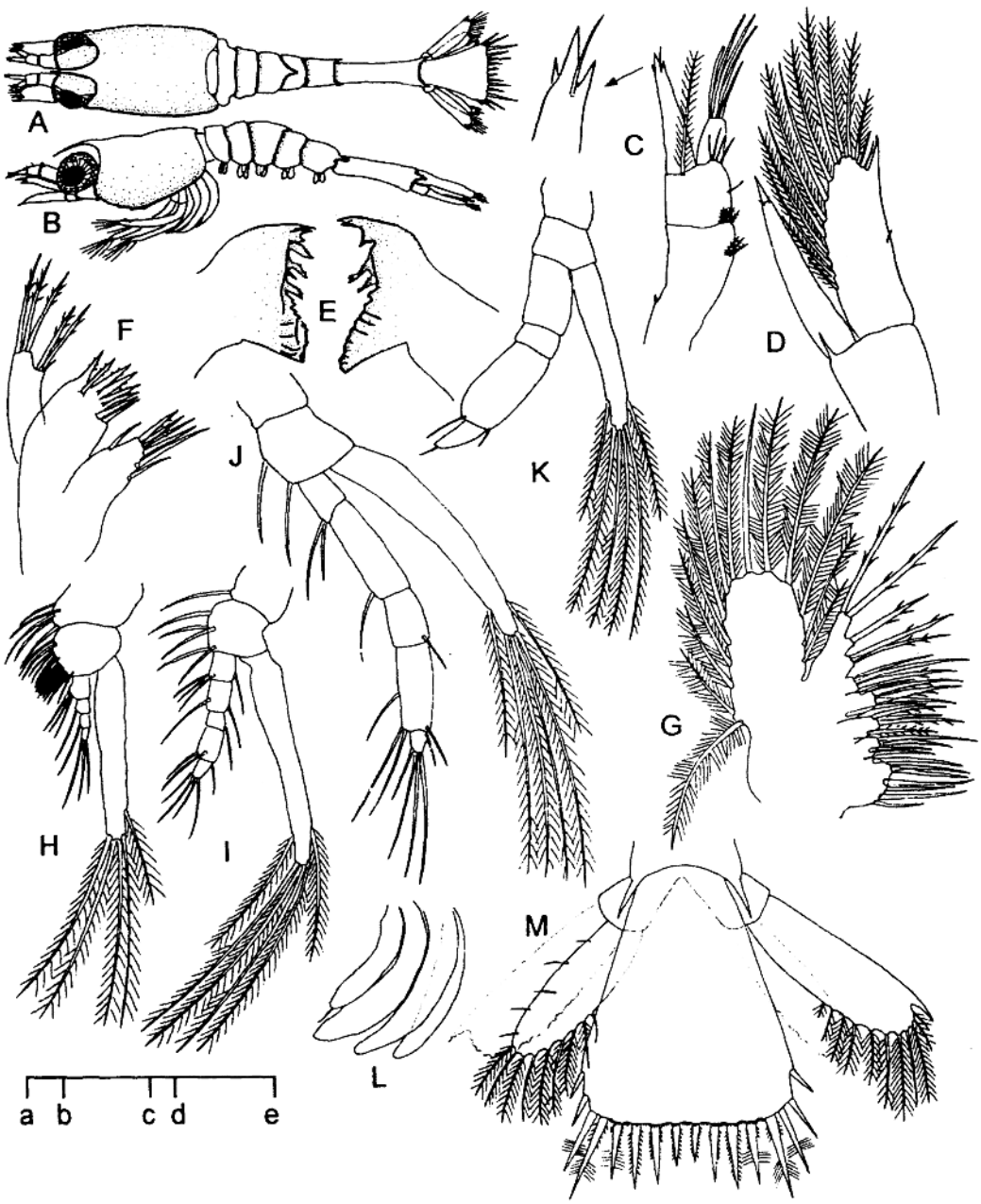

Fig. 5. *Crangon uritai* Hayashi and Kim, 1999. Fourth zoea. A, dorsal view (scale ab); B, lateral view (ab); C, antennule (ad); D, antenna (ac); E, mandible (ae); F, maxillule (ae); G, maxilla (ae); H, first maxilliped (ac); I, second maxilliped (ac); J, third maxilliped (ac); K, pereiopod 1 (ac); L, pereiopods 2–5 (ac); M, uropods and telson (ac). Scale = 0.3 mm.

First Maxilliped (Fig. 2H).—Coxal endite with 4 setae and microtrichias; basial endite with 10 setae; endopod 4-segmented, with 3, 1, 1, 3+1 setae and additional microtrichias on dorsal margin of segment 2; exopod unsegmented, with 4 (1 subterminal, 3 terminal) plumose natatory setae.

Second Maxilliped (Fig. 2I).—Coxal endite with 1 seta; basial endite with 5 setae; endopod

Fig. 6. *Crangon uritai* Hayashi and Kim, 1999. Fifth zoea. A, dorsal view (scale ab); B, lateral view (ab); C, antennule (ac); D, antenna (ac); E, mandible (ae); F, maxillule (ac); G, maxilla (ae); H, first maxilliped (ad); I, second maxilliped (ac); J, third maxilliped (ac); K, pereiopod 1 (ac); L, pereiopods 2–5 (ac); M, uropods and telson (ac). Scale = 0.3 mm.

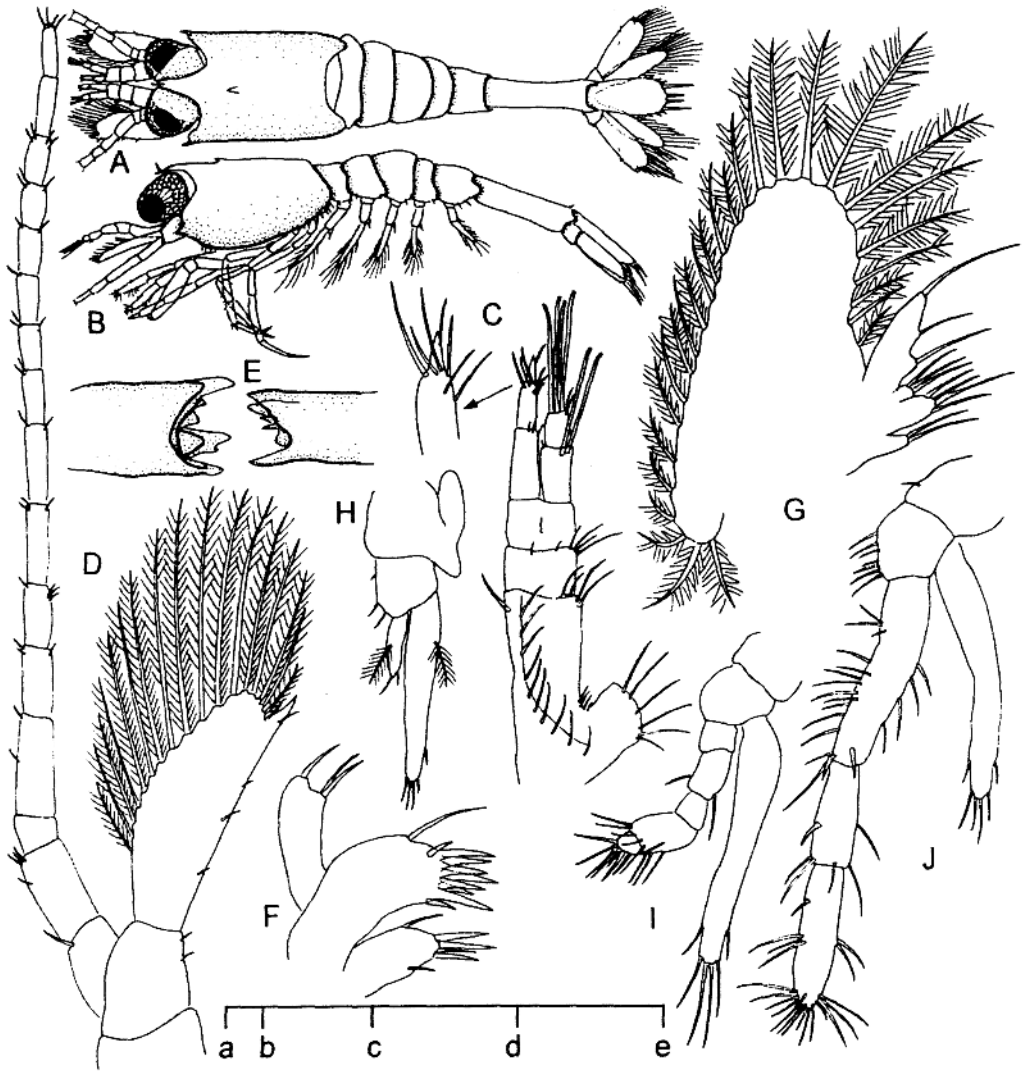

Fig. 7. *Crangon uritai* Hayashi and Kim, 1999. Postlarva. A, dorsal view (scale ab); B, lateral view (ab); C, antennule (ac); D, antenna (ac); E, mandible (ae); F, maxillule (ad); G, maxilla (ad); H, first maxilliped (ac); I, second maxilliped (ac); J, third maxilliped (ac). Scale = 0.3 mm.

4-segmented, with 3, 1, 2, 4+1 setae and additional microtrichias on segment 1; exopod unsegmented, with 5 (2 subterminal, 3 terminal) plumose natatory setae.

Third Maxilliped (Fig. 2J).—Coxal endite without setae; basial endite with 2 setae; endopod 4-segmented, with 2, 1, 2, 3+1 setae; exopod with 5 (2 subterminal, 3 terminal) plumose natatory setae.

Abdomen (Fig. 2A, B).—Five somites and telson; somite 3 with 1 posterodorsal spine; somite 5 with 1 pair of posterolateral spines.

Telson (Fig. 2K).—Triangular, with shallow median notch; posterior margin with 7+7 pairs of plumodenticulate spines of which third longest; and with minute setae between 7 inner pairs of spines and on median notch.

Second Zoea

Duration.—3–5 days.

Size.—CL = 0.85 mm (0.78–0.89 mm; SD = 0.03; $n = 5$); TL = 2.22 mm (2.12–2.29 mm; SD = 0.07; $n = 5$).

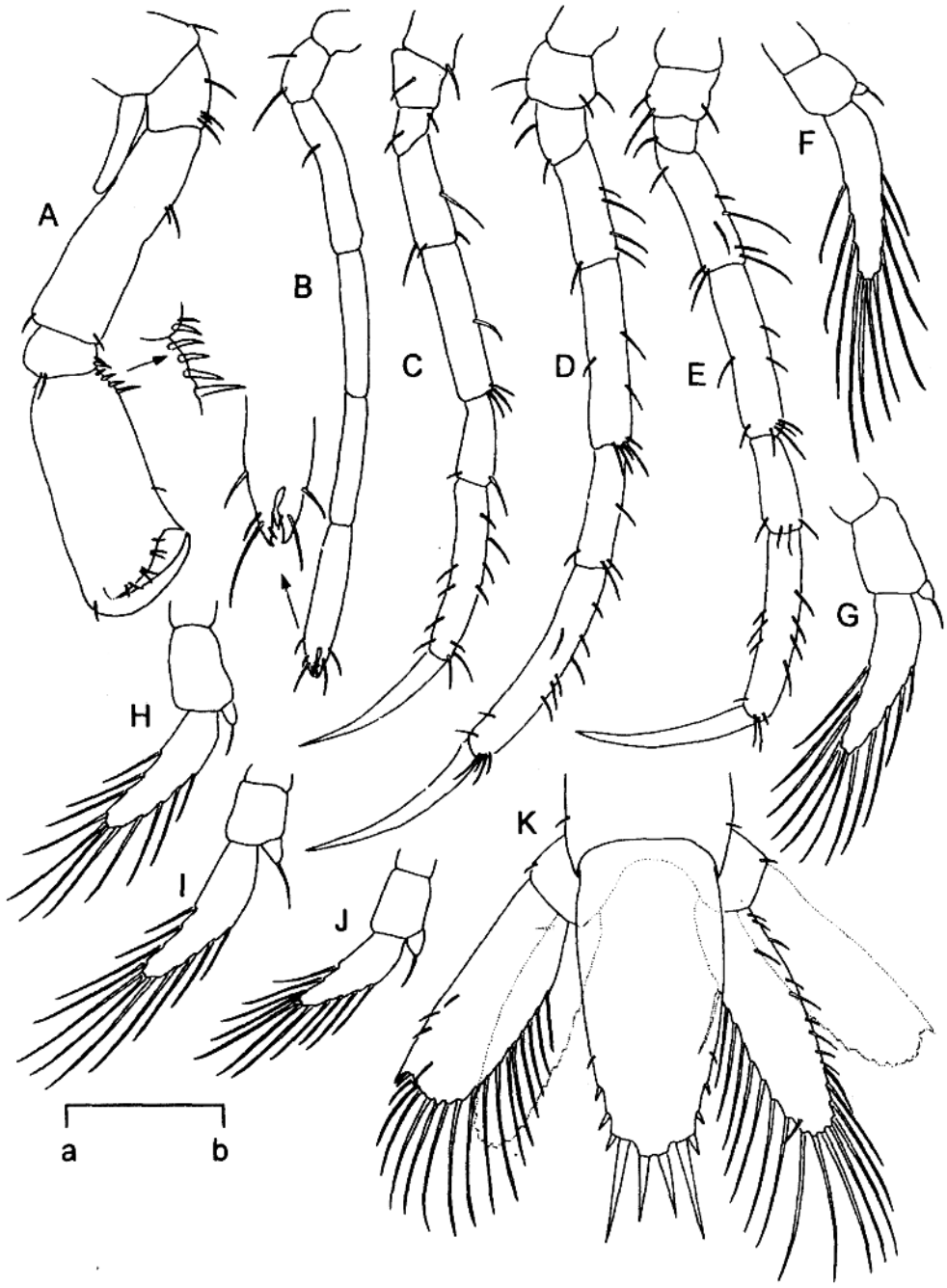

Fig. 8. *Crangon uritai* Hayashi and Kim, 1999. Postlarva. A–E, pereiopods 1–5 (scale ab); F–J, pleopods 1–5 (ab); K, uropods and telson (ab). Scale = 0.3 mm.

Carapace (Fig. 3A, B).—Larger; otherwise unchanged.

Eyes (Fig. 3A, B).—Stalked.

Antennule (Fig. 3C).—Biramous; peduncle unsegmented, with 2 subterminal and 4 terminal setae; tip of inner flagellum spiniform with seta; outer flagellum, half length of the inner flagellum, with 4 aesthetascs and 1 plumose terminal seta, 1 short subterminal seta.

Antenna (Fig. 3D).—Outermost marginal setae shortened; otherwise unchanged.

Mandible (Fig. 3E).—Larger but unchanged.

Maxillule (Fig. 3F).—Coxal endite with 5 serrate marginal setae and 2 pappose submarginal setae; basial endite with 7 cuspidate marginal setae; endopod bilobed, with 2+3 setae.

Maxilla (Fig. 3G).—Setation of coxal endite unchanged; basial endite still 2-lobed, with 8+3 spinulous setae; endopod 4-lobed, now with 3+2+1+2 spinulous setae; scaphognathite with 7 long plumose setae.

First Maxilliped (Fig. 3H).—Basial endite with 12 setae; exopod with 5 (1 subterminal, 4 terminal) plumose natatory setae; otherwise unchanged.

Second Maxilliped (Fig. 3I).—Endopd 5-segmented, with 3+1 (3 pappose, 1 plumose), 1, 0, 2, 4+1 setae; exopod with 6 (2 subterminal, 4 terminal) plumose natatory setae; otherwise unchanged.

Third Maxilliped (Fig. 3J).—Endopod now 5-segmented, with 2, 1, 0, 2, 3+1 setae; exopod with 6 (2 subterminal, 4 terminal) plumose natatory setae; otherwise unchanged.

Pereiopods (Fig. 3K).—Small uniramous buds present.

Abdomen (Fig. 3A, B).—Unchanged.

Telson (Fig. 3L).—Posterior margin now with 8+8 plumodenticulate spines, inner pair shortest.

Third Zoea

Duration.—3–5 days.

Size.—CL = 0.92 mm (0.84–0.97 mm; SD = 0.04; $n = 7$); TL = 2.53 mm (2.31–2.69 mm; SD = 0.12; $n = 7$).

Carapace (Fig. 4A, B).—Rostrum slightly concave.

Antennule (Fig. 4C).—Peduncle 2-segmented, proximal segment with 2 subterminal and 1 terminal setae, distal segment with 1 long plumose and 4 simple short setae; inner flagellum unchanged; outer flagellum, one-third length of inner flagellum, unchanged.

Antenna (Fig. 4D).—Biramous; endopod, multidenticulated at one-fourth distal part; exopod with 1 large apical spine and 13 inner and terminal plumose setae.

Mandible (Fig. 4E).—Larger but unchanged.

Maxillule (Fig. 4F).—Basial endite with 8 cuspidate setae; endopod bilobed, with 3 (2 long, 1 short) +3 setae; otherwise unchanged.

Maxilla (Fig. 4G).—Scaphognathite now with 10 long plumose setae; otherwise unchanged.

First Maxilliped (Fig. 4H).—Coxal endite with 5 setae; basial endite with 14 setae; otherwise unchanged.

Second Maxilliped (Fig. 4I).—Endopod still 5-segmented, with 3+1, 1+1, 0+1, 2, 4+1 setae; otherwise unchanged.

Third Maxilliped (Fig. 4J).—Endopod still 5-segmented, with 2, 1, 0+1, 2, 4+1 setae; otherwise unchanged.

Pereiopod 1 (Fig. 4K).—Biramous; coxal and basial endites without setae; endopod unsegmented, with 1 terminal seta; exopod with 6 (2 subterminal, 4 terminal) plumose natatory setae.

Pereiopods 2–5 (Fig. 4L).—Still uniramous but enlarged.

Abdomen (Fig. 4A, B).—Somite 6 separated from telson, with 1 pair of strong lateral spines.

Uropods (Fig. 4M).—Biramous, exopod longer than endopod; endopod with 2 plumose setae; exopod with 7 plumose setae.

Telson (Fig. 4M).—Length reduced by formation of abdominal somite 6; posterior median notch has disappeared; 8+8 pairs of spines unchanged.

Fourth Zoea

Duration.—3–6 days.

Size.—CL = 1.05 mm (0.92–1.20 mm; SD = 0.11; $n = 6$); TL = 2.94 mm (2.59–3.43 mm; SD = 0.38; $n = 6$).

Carapace (Fig. 5A, B).—Rostrum more concave.

Antennule (Fig. 5C).—Peduncle 2-segmented, proximal segment with 3 subterminal, 5 terminal short setae, distal segment with 1 long plumose and 5 simple setae; tip of inner flagellum still spiniform, 1 spine added; outer flagellum unchanged.

Antenna (Fig. 5D).—Endopod (not multiarticulated) with 2 setae on almost subdistal part; exopod unchanged.

Mandible (Fig. 5E).—Unchanged.

Maxillule (Fig. 5F).—Enlarged; otherwise unchanged.

Maxilla (Fig. 5G).—Basial endite 2-lobed, with 4+5 spinulous setae; scaphognathite now with 14 long plumose setae; otherwise unchanged.

First Maxilliped (Fig. 5H).—Basial endite now with 15 setae. Setation of coxal endite; otherwise unchanged.

Second Maxilliped (Fig. 5I).—Unchanged.

Third Maxilliped (Fig. 5J).—Endopod still 5-segmented, with 2, 1, 0+1, 3+1, 4+1 setae; otherwise unchanged.

Pereiopod 1 (Fig. 5K).—Endopod now 4-segmented, with 0, 0, 1+1, 1 setae; otherwise unchanged.

Pereiopods 2–5 (Fig. 5L).—Pereiopod 2 with 1 terminal seta; otherwise unchanged.

Abdomen (Fig. 5A, B).—Unchanged.

Pleopods (Fig. 5B).—Simple uniramous buds present.

Uropods (Fig. 5M).—Biramous; endopod now with 9 plumose marginal setae and 5 simple submarginal setae; exopod with 1 distolateral spine and 11 plumose setae.

Telson (Fig. 5M).—Posterior width only slightly greater than anterior width; the rest unchanged.

Fifth Zoea

Duration.—4–6 days.

Size.—CL = 1.16 mm (1.13–1.20 mm; SD = 0.17; $n = 7$); TL = 3.35 mm (3.15–3.68 mm; SD = 0.17; $n = 7$).

Carapace (Fig. 6A, B).—Unchanged.

Antennule (Fig. 6C).—Distal segment of peduncle with rudimentary basial lobe (stylocerite); otherwise unchanged.

Antenna (Fig. 6D).—Endopod (longer than exopod) 2-segmented, distal segment still with 2 setae on almost distal part; exopod with 1 apical spine and 15 inner and terminal plumose setae.

Mandible (Fig. 6E).—Unchanged.

Maxillule (Fig. 6F).—Coxal endite with 5 serrate marginal setae and 3 pappose submarginal setae; basial endite with 9 cuspidate setae; endopod unchanged from stage IV.

Maxilla (Fig. 6G).—Basial endite 2-lobed, with 3+4 spinulous setae; platelike scaphognathite with 20 long plumose setae; otherwise unchanged.

First Maxilliped (Fig. 6H).—Unchanged.

Second Maxilliped (Fig. 6I).—Unchanged.

Third Maxilliped (Fig. 6J).—Larger but unchanged.

Pereiopod 1 (Fig. 6K).—Distal 2 segments of endopod forming rudimentary chela and weakly divided with 1+2 and 1 setae; exopod with 6 (2 subterminal, 4 terminal) plumose natatory setae.

Pereiopods 2–5 (Fig. 6L–O).—Pereiopods 2 and 3, 7-segmented, distal segments each with 1 simple seta, respectively; pereiopods 4 and 5, 6-segmented and without setae.

Abdomen (Fig. 6A, B).—Unchanged.

Pleopods (Fig. 6B).—Enlarged but unchanged.

Uropods (Fig. 6P).—Endopod with 12–13 plumose setae; exopod now with 1 distolateral spine and 13–14 plumose setae.

Telson (Fig. 6P).—Further narrowing distally; posterior margin straight or slightly convex.

Postlarva

Duration.—5–7 days.

Size.—CL = 1.08 mm (1.03–1.15 mm; SD = 0.06; $n = 6$); TL = 3.38 mm (3.15–3.63 mm; SD = 0.21; $n = 6$).

Carapace (Fig. 7A, B).—Rostrum short, with simple seta on rounded apex; 3 anteroventral denticles missing, but pterygostomian spine more developed; 3 and 7 simple setae on anterolateral and posterolateral margin of carapace; 1 dorsomedial spine present.

Antennule (Fig. 7C).—Peduncle 3-segmented, proximal segment with well-developed basial lobe bearing 6 setae and with 19 medial simple setae; inner flagellum 2-segmented, proximal and distal segment with 3 and 7 setae, respectively; outer flagellum 2-segmented, proximal segment with 2 aesthetascs, distal segment with 4 aesthetascs and 2 short setae.

Antenna (Fig. 7D).—Propodite with 2 short setae; endopod markedly elongated, 16-segmented, each segment with 1–4 short setae; exopod with 18 inner and terminal plumose setae, additional 4 short outer submarginal setae.

Mandible (Fig. 7E).—Cutting edge simplified, not clearly divided into incisor and molar processes.

Maxillule (Fig. 7F).—Slightly simplified; coxal endite with 4 serrate marginal setae and 2 simple submarginal setae; basial endopod with 9 cuspidate marginal setae and 1 simple submarginal seta; endopod still bilobed, but with 2+1 simple setae.

Maxilla (Fig. 7G).—Setation of coxal endite, basial endite and endopod reduced and simplified; coxal endite with 2 setae; basial endite 2-lobed, with 4+3 setae; endopod weakly 3-lobed, bearing 1+1+1 setae; scaphognathite more flattened, with 27–30 long plumose setae.

First Maxilliped (Fig. 7H).—Coxal endite with epipod; basial endite with 2–3 short setae; endopod unsegmented, with 1 long subterminal and 2 short simple terminal setae; exopod with 2 (1 long plumose, 1 short simple) subterminal and 4 short terminal setae.

Second Maxilliped (Fig. 7I).—Coxal and basial endites without setae; endopod still 5-segmented, with 0, 1+1, 0, 6+3, 7 setae; setation of exopod unchanged but shortened.

Third Maxilliped (Fig. 7J).—Coxal endite with 1 seta; basial endite with 7 setae; endopod now 3-segmented, all segments with numerous setae; exopod with 6 (2 subterminal, 4 terminal) short setae.

Pereiopod 1 (Fig. 8A).—Biramous and stouter than second; basial endite with 1 seta; endopod 5-segmented, with several setae, propodus and dactylus subchelate, propodus and carpus with 4 and 2 tooth-like spines; exopod reduced as small bud.

Pereiopod 2 (Fig. 8B).—Uniramous, 6-segmented, slender, chelate.

Pereiopods 3–5 (Fig. 8C–E).—Typical walking leg, each 6-segmented, with numerous setae, each dactylus unguiculate.

Abdomen (Fig. 7A, B).—Somite 3 with 1 rudimentary posterodorsal spine; pleuron of somites 1–5 with 1–3 setae; somite 6 with 1 posterodorsal seta.

Pleopods 1–5 (Figs. 7B, 8F–J).—Biramous; endopod, small bud, with 1 simple setae; exopod well developed, with 11 plumose natatory setae; pleopod 5 usually smaller than pleopods 1–4.

Uropods (Fig. 8K).—Endopod with 16 plumose setae; exopod with 1 distolateral spine and 17–18 plumose setae.

Telson (Fig. 8K).—Posterior margin extremely narrowing; each margin bearing 3 short marginal spines, additional pair of simple submarginal setae, and 2 long posterior marginal spines; minute spines between posterior spines have disappeared.

Discussion

Since Tanaka (1942) described the first zoea of *Crangon affinis* hatched in the laboratory, several authors have described the larvae of *C. affinis*. Yokoya (1957) described only the first zoea of *C. affinis* based on material of known parentage. Kurata (1964) also briefly described the first zoea of "*C. affinis*" based on laboratory-reared material. Yamauchi (1965) roughly described the complet larval development of *C. affinis*, as *Crago affinis*, reared in the laboratory. Hong (1991) completely described the zoeal and postlarval stages reared in the laboratory. Jang (1999) also described complete larval development of *C. affinis* from material of known parentage. However, the larval descriptions of

Crangon affinis by Tanaka (1942), Yokoya (1957), Kurata (1964), Yamauchi (1965), Hong (1991), and Jang (1999) all differ from each other, and, consequently, Konishi and Kim (2000) have questioned the accuracy of the adult identifications.

These different larval descriptions of *C. affinis* are compared with that of *Crangon uritai* (Table 1). Tanaka's (1942) first zoea of *C. affinis* is relatively larger than that of *C. uritai*, and different in the number of aesthetascs and the setal formula of endopods of maxillule, maxilla, and maxillipeds. Yokoya's (1957) first zoea of *C. affinis* is remarkably different from that of *C. uritai* in the segmented antennal scale and the setal formula of endopod of maxillule. In the carapace length, and the number of anteroventral denticles of carapace and aethetascs of antennule, Kurata's (1964) first zoea seems to be similar to that of *C. uritai*. On this point, Konishi and Kim (2000) even suggested that "Kurata's first zoea of *C. affinis* may be assigned to *C. uritai*. However, it is difficult to assign Kurata's *C. affinis* to *C. uritai* because of his brief description. Yamauchi's (1965) first zoea of *C. affinis* shows differences from that of *C. uritai* in the carapace length, the number of anteroventral denticles of the carapace and the antennule aethetascs, and the setal formula of endopod of the maxillule. Hong's (1991) first zoea of *C. affinis* is also different from that of *C. uritai* in: the relatively small carapace length, the carapace with three anteroventral denticles, the antennal scale with 10 setae, and the maxillule with 3, 3 endopod setae. Hong's parental females were collected from Nakdong River Estuary, Korea, where three species of *Crangon* (*C. affinis*, *C. hakodatei*, and *C. uritai*) have been reported (Hayashi and Kim, 1999; personal observation). The larval characters of Hong's *C. affinis* are also different from that of *C. hakodatei* described by Li and Hong (2003) in having three anteroventral denticles of the carapace in the first zoea, 3, 3 endopod setae of maxillule in the early stages, and the relatively small carapace length. Therefore, Hong's (1991) larvae may be referred to *C. affinis* and are compared with that of *C. uritai* below. With similarity in general features, Jang's (1999) first zoea of *C. affinis* is considerably smaller than that of *C. uritai*, and is different in the setal formula of endopod of maxillule. Larval characters of her *C. affinis* is rather similar to that of *C. hakodatei* in having 2, 3 endopod setae of maxillule and 3, 2, 1, 2 endopod setae of maxilla in the early stages. All of the above described larvae of *C. affinis* are different from that of *C. uritai*.

Kurata (1964) also described several unidentified crangonid larvae of species A–F collected from Hokkaido waters. Having one posterior spine on abdominal somite 5, the spiniform rostrum without teeth, the anteroventral denticles on the carapace, and the similar general apperance, the larvae of species B–F fall within the range of genus *Crangon* documented by several authors (Lebour, 1931; Gurney, 1942; Williamson, 1960; Kurata, 1964; Haynes, 1985; Konishi and Kim, 2000). However, none of these species B–F belongs to *C. uritai* because of the following characters: abdominal somite 3 without dorsal spine (species B, C); pleopods present in first stage (species D, E); carapace with one anteroventral denticle and antennule with 2-segmented peduncle (species F).

Larval and postlarval stages of *C. uritai* are also compared with those of *C. affinis*, *C. amurensis*, *Crangon dalli*, and *C. hakodatei* (Table 2). The first zoea of *C. uritai* can be separated from that of *C. amurensis* by the absence of pereiopods, and by the relatively long carapace length. Although the larval description of *C. dalli* was too brief to be compared in detail, the larvae of *C. uritai* can be easily distinguished from that of *C. dalli* by the stage of first appearance of pereiopods and pleopods, and by the possession of one dorsal spine on abdominal somite 3. However, these different characters are invalid to separate the larvae of *C. uritai* from those of *C. affinis* and *C. hakodatei*.

The larvae of three confounded *Crangon* species, *C. affinis*, *C. hakodatei*, and *C. uritai*, show many similarities in general appearance. However, noticeable differences are found in the number of zoeal stages, the presence or absence of one outer submarginal seta on antennal scale in zoeal stages, and one outstanding simple seta on the rostrum in the first postlarval stage. *Crangon uritai* has five zoeal stages, whereas *C. affinis* and *C. hakodatei* have six zoeal stages. It is often reported that the larvae of genus *Crangon* have five or six zoeal stages (Makarov, 1967; Gurney, 1982; Hong, 1991). The larvae of *C. uritai* have one outer submarginal seta on the antennal scale through the zoeal stages, whereas those of *C. affinis* and *C. hakodatei* have no such seta. This seta is not common in the larvae of genus *Crangon* (Tanaka, 1942; Yokoya, 1957; Kurata, 1964; Yamauchi, 1965; Makarov, 1967; Hong, 1991; Jang, 1999; Konishi and Kim,