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Description of the Megalopal Stage of *Orithyia sinica* (Decapoda: Brachyura: Orithyiidae) reared in the Laboratory

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범게, *Orithyia sinica* (Decapoda: Brachyura: Orithyiidae)의 메갈로파 유생기의 형태학적 연구

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Abstract

실험실에서 사육된 범게(*Orithyia sinica*) 의 메갈로파 유생을 형태적으로 기술하고, 근연과에 속한 메갈로파 유생들과 형태적인 특징들을 비교 하였다. 범게(*O. sinica*) 의 메갈로파기는 근연과에 속한 메갈로파들과 다음과 같은 면에서 비교 구분되었다: 갑각은 그 폭이 길이보다 약간 길며 옆으로 2개의 가시가 있고, 다섯 번째 보각의 발가락마디 끝에 긴 강모가 없으며, 꼬리는 매끈하고 그 끝이 약간 오목하였다.

Key words : *Orithyia sinica*, megalopa, decapoda, Brachyura, Orithyiidae

Ⅰ. Introduction

Orithyia sinica (Linnaeus, 1771) is a rare species, which occurs along the continental waters of East Asia from Hong Kong up to South Korea, but is absent from the adjacent islands, such as Taiwan, Ryukyus and Japan (Kim, 1973; Sakai, 1976; Miyake, 1983; Ng et al., 2001).

Orithyiidae is a singularly unusual taxon, containing just one genus and one species (Števčić, 2005; Ng et al., 2008). The genus *Orithyia* has traditionally been belonging to the Calappidae (Rathbun, 1937; Sakai, 1976), which was recently reviewed based upon a phylogenetic analysis of adult crabs (Bellwood, 1996). Zoeal morphology of *O. sinica* has been described by Hong (1976), however, the megalopa of the species is unknown. Therefore, the megalopal stage of *O. sinica* is described based on the specimens reared in the laboratory, and compared with other megalopae of related groups.

Ⅱ. Materials and methods

Thirty five egg bearing female crabs were

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captured from the Dongho beach in Gochang-Gun, Jellabuk-Do from the 20th of September to the 2nd of October in 2012. They were kept in 50-100 l tanks at 20-22℃ and 30-32 psu. Approximately, 30,000 larvae were produced per a mother crab. Hatched zoeae were fed with a diatom, *Chaetoceros calcitrans* of 10^4 cells/ml and *Artemia* nauplii of 1 individual per ml every day. When zoeae metamorphosed to megalopal stage, chopped shrimp and clam meats were provided. It took 14 days from zoea to megalopal stage. We here described only megalopal stage because Hong (1976) described zoeal stages previously.

We followed the terminology of Clark et al. (1998). Carapace length (CL) was measured from the rostrum to the posterior margin of the carapace, and carapace width (CW) was measured as the maximum width of the carapace.

Ⅲ. Results

Description

Size: CL=3.57–3.98 mm (3.85±0.17); CW=3.82–4.23 mm (4.01±0.17)

Carapace ([Fig. 1A, B]): Slightly broader than long; rostrum deflected ventrally with a medial notch; 2 pairs of lateral (small hepatic and large branchial) spines present.

Antennule ([Fig. 1C]): Peduncle 3-segmented, each with 7, 2, 1 simple setae, respectively. Endopod 2-segmented with 2 subterminal and 3 terminal simple setae on distal segment. Exopod 3-segmented with 0, 5, 5 aesthetascs.

Antenna ([Fig. 1D]): Peduncle 3-segmented, each with 0, 0, 1 simple seta, respectively. First segment retaining modified protopod. Flagellum 5-segmented with 0, 0, 4, 1, 3 simple setae.

Mandible ([Fig. 1E]): Palp 2-segmented with 0, 9-10 setae, 8-9 plumose setae and 1 simple seta. Scoop-shaped, smooth incisor process with thin cutting edge, molar process very reduced.

Maxillule ([Fig. 1F]): Coxal endite with 10 setae; basial endite with 9 denticulate, 11 plumose setae and 1 seta on its inner lateral margin; endopod 3-segmented, each with 1, 2, 2 setae, respectively.

Maxilla ([Fig. 1G]): Coxal endite bilobed with 0 and 1 simple seta; basial endite bilobed with 10 and 9 simple setae; endopod unsegmented with 2 setae in its outer lateral margin; scaphognathite with 88 plumose setae.

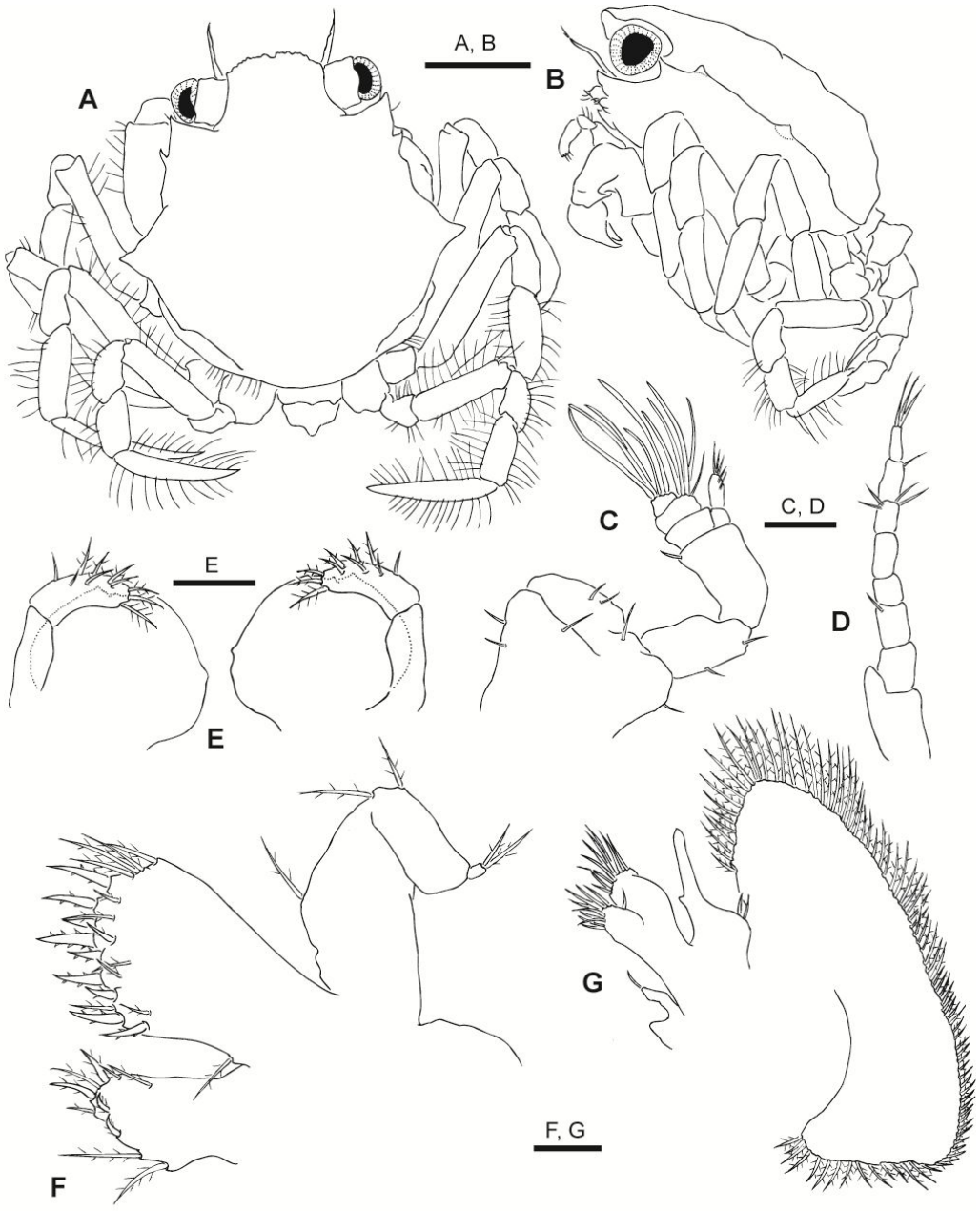
First maxilliped ([Fig. 2A]): Epipod subtriangular with 2 medial plumose setae and 2 subterminal and 2 terminal setae; coxal endite with 11 plumose setae; basial endite with 27 plumose setae; endopod unsegmented ending in a square shape, with 5 setae; exopod 2-segmented, proximal segment with 2 plumose setae; distal segment with 5 terminal plumose setae.

Second maxilliped ([Fig. 2B]): Epipod with 16 setae; coxa and basis not differentiated, with 3 plumose setae; endopod 4-segmented, each with 5, 1, 7, 8 plumose setae, respectively; exopod 2-segmented with 1 distal plumose seta on

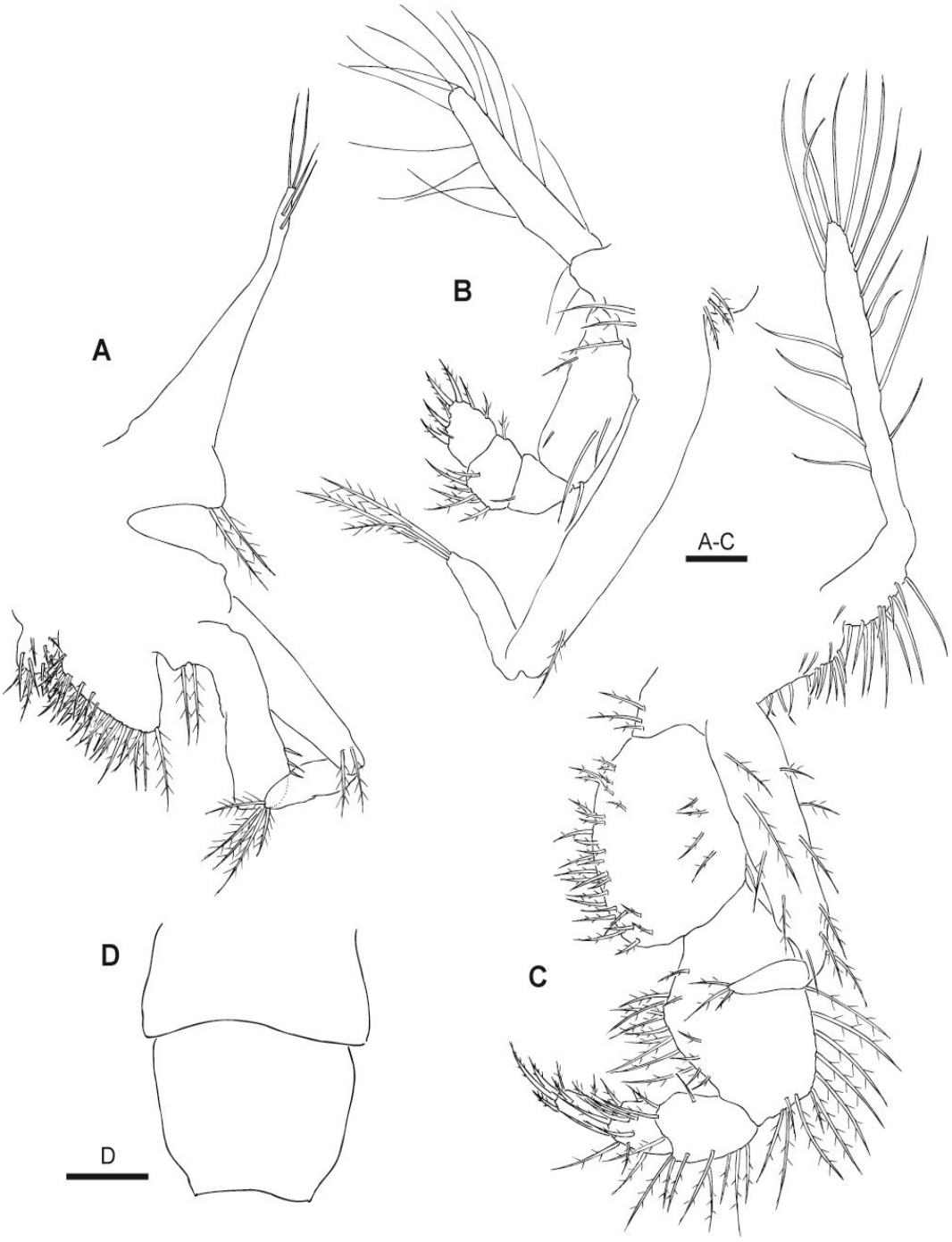
proximal segment; distal segment bearing 3 long terminal plumose setae.

Third maxilliped ([Fig. 2C)): Epipod elongated with 28 medial and 16 terminal setae; coxa and basis not differentiated, with 29 setae; endopod 4-segmented, fused ischium-merus with 26 plumose setae; carpus with 12 plumose setae; propodus with 11 plumose setae; dactylus with 5 plumose setae.

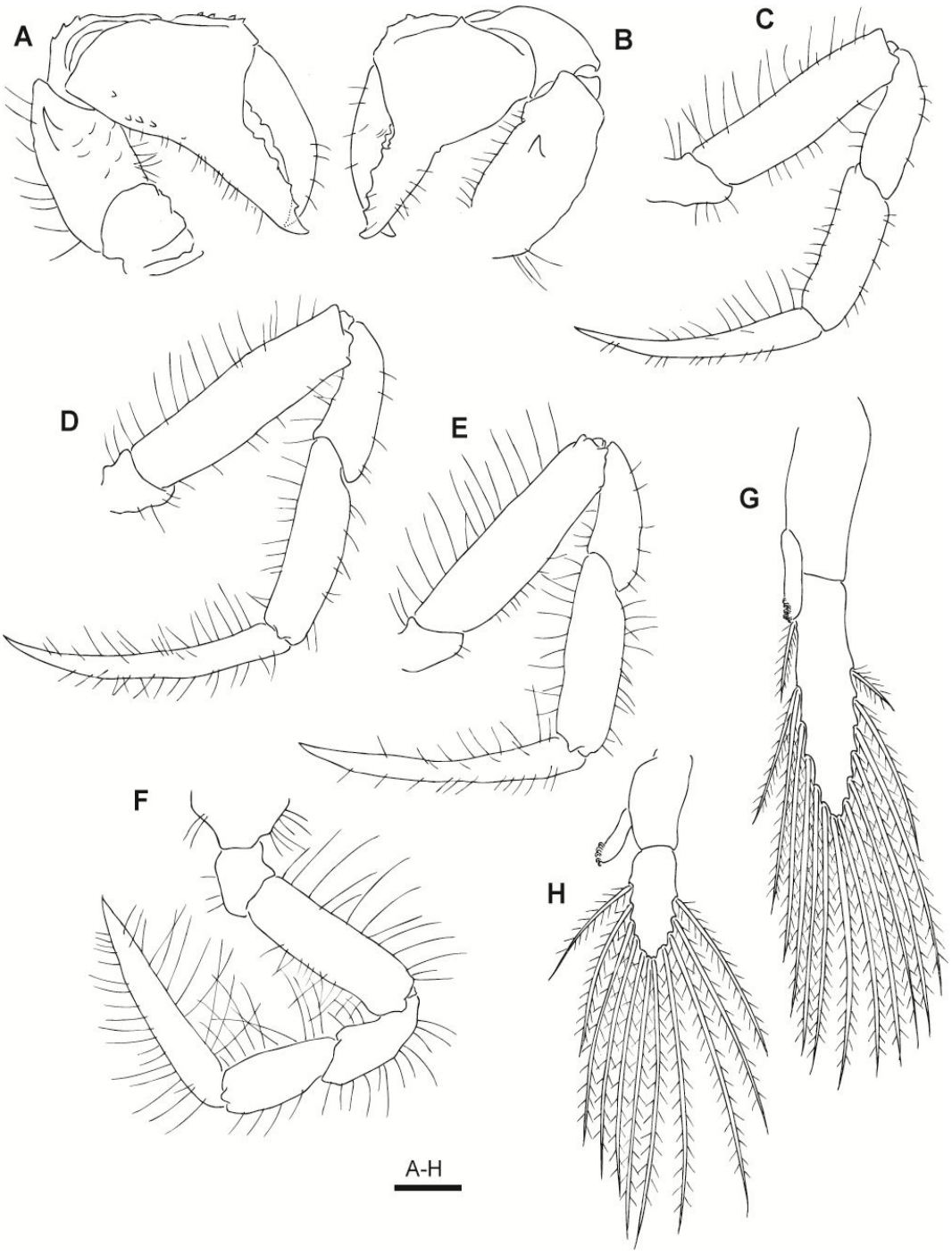
Chelipeds ([Fig. 3A, B]): Large, dorsoventrally compressed; dactyl directed ventrally; merus with 1 strong spine.



[Fig. 1] *Orithyia sinica* (Linnaeus, 1771). Megalopa. (A) Dorsal view; (B) Lateral view; (C) Antennule; (D) Antenna; (E) Mandible; (F) Maxillule; (G) Maxilla. Scale bars: A, B = 0.75 mm, C-G = 0.12 mm.



[Fig. 2] *Orithyia sinica* (Linnaeus, 1771). Megalopa. (A) First maxilliped; (B) Second maxilliped; (C) Third maxilliped; (D) Telson. Scale bars: A-D = 0.12 mm.



[Fig. 3] *Orithyia sinica* (Linnaeus, 1771). Megalopa. (A) Right cheliped; (B) Left cheliped; (C) Second pereiopod; (D) Third pereiopod; (E) Fourth pereiopod; (F) Fifth pereiopod; (G) First pleopod; (H) Fourth pleopod. Scale bars: A-F = 0.3 mm, G, H = 0.12 mm.

Pereiopods (Fig. 3C-F): All segments well differentiated and with setae as figured; dactylus of fifth pereiopod without long terminal setae.

Pleopods (Fig. 3G, H); Biramous; present on 2-5 abdominal segments; endopods of second to fourth pleopods unsegmented, each with 8, 8, 6, 5 subterminal coupling hooks on internal margin; exopods of second to fifth pleopods 2-segmented, each with 15, 15, 13, 11 long marginal natatory setae, respectively; uropods absent.

Telson (Fig. 2D): Subquadrate, slightly broader than long; terminal margin slightly concave.

Ⅳ. Discussion

Orithyia sinica is a distinctive species with stripes on the legs, prominent eyespots on the carapace and the females' abdomen having a relatively narrow and short, leaving the vulvae exposed (Guinot, 1979). The zoeal morphology of *O. sinica* described by Hong (1976) as well as adult morphology is clear that larvae of *O. sinica* are very different from those of the other crabs, especially in the shape of rostrum and telson. Rice (1980) considered the larvae of Orithyiidae to be distinct from those of other calappid crabs and most closely related to the Dorippidae having the long rostral and dorsal spines which is fairly long and curved posteriorly at the proximal portion. In spite of the similarities of zoeal morphology in the Orithyiidae and Dorippidae, the megalopa of *O. sinica* is distinguished from that of other related species (e.g., Calappidae, Matutidae, Hepatidae and Dorippidae by Lebour, 1944; Roff et al., 1984; Quintana, 1987; Guerao et al., 1998; Chen et al., 2000; Negreiros-Fransozo et al., 2008) albeit with morphology of rostrum. The rostrum is not produced into a spine and flat, rather medially notched or depressed ventrally. Except the morphology of rostrum, it is markedly different in the following characters. The carapace is slightly broader than long. Other related species are usually longer than wide carapace. In the fifth pereiopod, it is naked without setae in the inner margin of the dactylus. But, other related megalopae except for the *Calappa flammea* have several serrated setae. Noteworthy differences of the megalopa of *O. sinica* are also found in the telson, which is slightly concave in the terminal margin and naked, while that of other related species has slightly convex or rounded terminal margin and with setae on dorsal surface or posterior margin (Lebour, 1944; Roff et al., 1984; Quintana, 1987; Guerao et al., 1998; Negreiros-Fransozo et al., 2008).

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