

Re-description of the first zoea of deep-sea spider crab *Platymaia alcocki* (Brachyura: Majoidea: Inachidae) from laboratory-hatched materials

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Abstract

The inachid genus *Platymaia* includes 4 species in Japanese coasts, but their larval development has been poorly known because of their deep-sea habitat. In the genus, the first zoeal stage was described in *P. alcocki* in Japan, however, some morphological characters, from the recent viewpoint, are insufficiently described. We re-describe the first zoea of *P. alcocki* in detail from laboratory-hatched materials, and compared with previous description of *P. wyvillethomsoni*. The zoeas of *Platymaia* species are very similar to each other, it can be distinguished by lengths of the rostral and dorsal carapace spines. Additionally, among the first zoeas of 6 inachid genera, *Platymaia* is closely related to the genus *Cyrtomaia* especially in the endopodal setations of the maxillule and the second maxilliped.

Key words: Crustacea; Inachidae; larva; morphology; re-description

Introduction

In Japan, the majoid family Inachidae consists of 38 species ranging 13 genera, based on JAMSTEC's online database BISMAL (www.godac.jamstec.go.jp/bismal). To date, larval morphology has been described in 24 % of the Inachidae (Konishi 2017). Early life history of this family is insufficiently documented yet, because not a few inachid genera, such as *Platymaia*, have deep-sea habitat. The genus *Platymaia* consists of ten species and four species have been recorded from Japan: *P. bartschi* Rathbun, *P. fimbriata* Rathbun, *P. wyvillethomsoni* Miers, and *P. alcocki* Rathbun. Among these, larval descriptions have been given in two species, *P. alcocki* and *P. wyvillethomsoni* (see Terada 1985; Oh and Ko 2011). In Terada (1985)'s paper, however, some

morphological characters are insufficiently described yet from the recent viewpoint. Recently, we had a chance to catch ovigerous *P. alcocki*, and obtained zoeas under laboratory conditions. In this paper we re-describe the zoeal morphology of the species, *P. alcocki*, and compare previous larval descriptions within the genus, and inachid genera.

Materials and Methods

Ovigerous females were collected from the waters off Makurazaki (130°19'E, 31°08'N-130°21'E, 31°08'N), southern Japan, at about 300 m depth, on 4 December 1997. First zoeas hatched on 26 January 1998, and a part of them were fixed with 5 % formalin and preserved in 70 % ethanol. The larval specimens were dissected under an Olympus SZX10 with fine insect pins. Drawings

and measurements were made with a drawing tube attached to an Olympus BX51 microscope. The terminology for setae generally follows that of Ingle (1992). All setal arrangements are described from proximal to distal. Roman numerals for setation denote the dorso-lateral seta. Carapace length (CL) was measured from the anterior tip of the eye to the posterior tip of the carapace for 13 specimens. Length between the tip of rostral spine and the tip of dorsal spine (RDL) was also measured for 6 specimens with no deformed spines. These values are shown as mean \pm SD. The specimens used in this study were deposited in the Hokkaido University Museum under the accession No. ICHUM-5960.

Description

Size: CL = 1.34 ± 0.05 mm (n = 13), RDL = 5.51 ± 0.26 mm (n = 6).

Carapace (Fig. 1A, 1A'): Dorsal and rostral spines well developed, straight. No lateral spines. One pair of anterodorsal and posterodorsal short setae present. Anterior ventral margin just upon maxilla shirred outwards. A large anterior plumose seta ('majid seta', arrow in Fig. 1A'), plus 4 posterior plumose setae on ventral margin. Eyes sessile.

Antennule (Fig. 2A): Unsegmented, conical with 3 terminal aesthetascs and 2 short simple setae.

Antenna (Figs. 1A, 2B): Biramous, about half length of rostral spine. Protopod spinulate

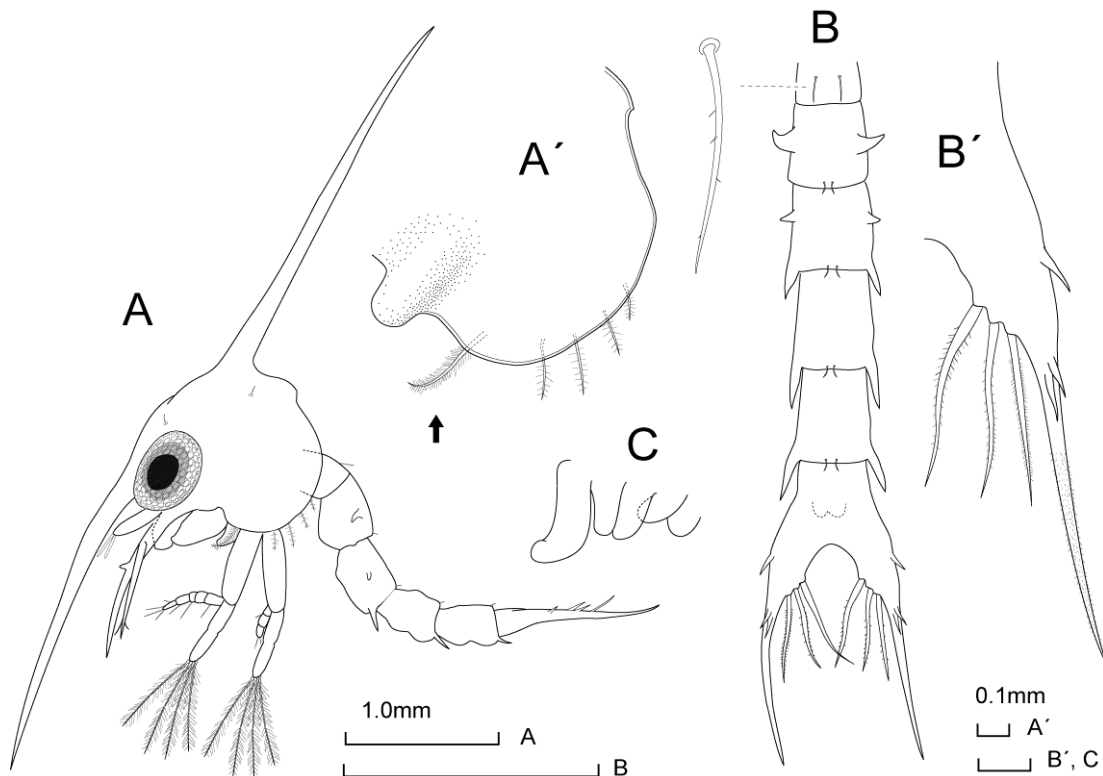


Fig. 1. First zoea of *Platymaia alcocki* Rathbun. A: Whole body in lateral view, A': enlarged ventral margin of carapace, arrow indicates anterior 'majid seta', B: abdomen and telson in dorsal view, B': left telsonal fork, C: rudiments of maxilliped 3 and pereopods. Scale bars = 1.0 mm for A, B, and 0.1 mm for A', B', C.

distally. Endopod as a small rudimentary bud.
 Exopod with 2 subterminal spines of unequal length.
 Maxillule (Fig. 2D): Coxal and basal endites with 6/7 (“/” means or) and 6 spinous setae, respectively. Endopod 2-segmented, with 1 terminal seta on proximal, 2 subterminal and 4 terminal setae on distal segment.
 Maxilla (Fig. 2E): Coxal and basal endites slightly bilobed, with 4/5+4 and 5+4 setae, respectively. Endopod unsegmented, with 2+2 setae terminally. Scaphognathite with 7 or 8 marginal plumose setae and a long distal process.
 Maxilliped 1 (Fig. 2F): Basis with 2+2+2+3 inner

setae. Endopod 5-segmented, with 3,2,1,2,4+I. Exopod with 4 natatory setae. Maxilliped 2 (Fig. 2G): Basis with 1+1+1 setae. Endopod 3-segmented with 0,1,4 setae. Exopod with 4 natatory setae. Maxilliped 3 and pereiopods (Fig. 1C): Rudimentary buds.
 Abdomen and telson (Fig. 1B, 1B’): Five somites and a forked telson. Somite 1 with a pair of long dorsomedial setae. Somite 2 with dorsolateral processes forming a semi-collared ridge, 2 short lateral processes on somite 3. Telson with 3 posterior marginal plumose setae, fork with 2 dorsal spines and 1 lateral spine.
 Antennule (Fig. 2A): Unsegmented, conical with 3

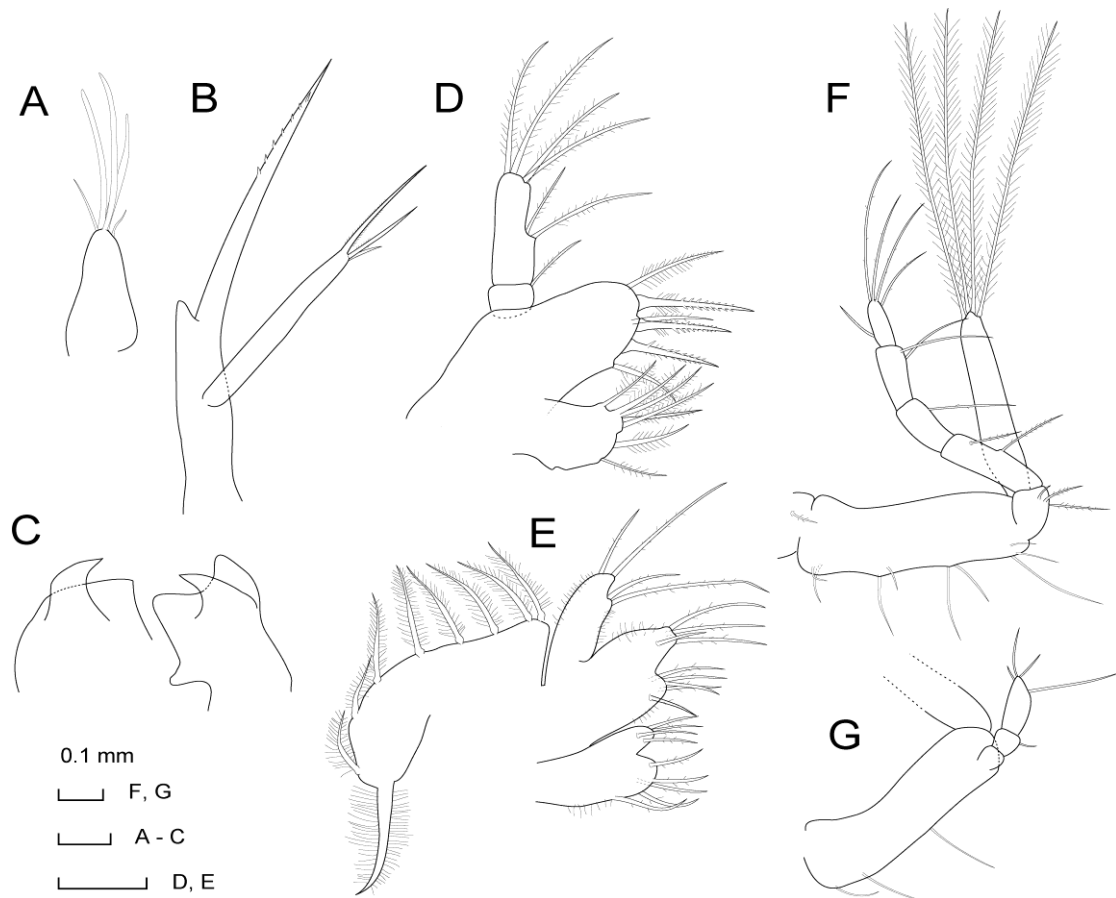


Fig. 2. First zoea of *Platymaia alcocki* Rathbun. A: antennule, B: antenna, C: mandibles, D: maxillule, E: maxilla, F: maxilliped 1, G: maxilliped 2. Scale bars = 0.1 mm.

terminal aesthetascs and 2 short simple setae.

Antenna (Fig. 2B): Biramous, about half length of rostral spine. Protopod spinulate distally. Endopod as a small rudimentary bud. Exopod with 2 subterminal spines of unequal length.

Mandible (Fig. 2C): Incisor and molar processes, without palp.

Maxillule (Fig. 2D): Coxal and basal endite with 6/7 (“/” means or) and 7 spinous setae, respectively. Endopod 2-segmented, with 1 terminal seta on the proximal and 2 subterminal and 4 terminal setae on the distal segment.

Maxilla (Fig. 2E): Coxal and basal endite slightly bilobed, with 4/5+4 and 5+4 setae, respectively. Endopod unsegmented, 2+2 setae terminally. Scaphognathite with 7 or 8 marginal plumose setae and an apical process.

Mandible (Fig. 2C): Incisor and molar processes, without palp.

Maxilliped 1 (Fig. 2F): Basis with 2+2+2+3 inner setae. Endopod 5-segmented with 3,2,1,2,4+1. Exopod with 4 natatory setae.

Maxilliped 2 (Fig. 2G): Basis with 1+1+1 setae. Endopod 3-segmented with 0,1,4 setae. Exopod with 4 natatory setae.

Maxilliped 3 and pereopods (Fig. 1C): Rudimentary buds.

Discussion

In the first zoeal characteristics of *Platymaia alcocki*, the present study generally agrees with that described by Terada (1985); however, some differences are found (Table 1). The endopodal setations of the maxillule and the maxilla, which

are important characters at family or generic levels, are 1,5 and 4 in his description, while, these are 1,6 and 5 in the present work. Such differences seem to be as a result of his overlooking mouthpart setae because our setations coincide well with those of *P. wyvillethomsoni*. In addition, the differences of CL and RDL could be considered as individual variation in female batches.

The first zoeas of two *Platymaia* species are very similar to each other; however, the present species can be distinguished from *P. wyvillethomsoni* in lengths of the rostral and dorsal carapace spines. The former is 1.7 and 2.2 times of CL, while the latter has 1.3 CL and 1.5 times.

Kurata (1969) commented that the majoid zoeas showed diverse feature. Later, Oh and Ko (2011) reported that the inachid genus *Platymaia* agrees with the inachid genera *Pleistacantha* and *Macropodia* based on zoeal morphology - rostral carapace spine, antennal exopod, endopod of maxillule, basis of second maxilliped, lateral processes of abdomen, and outer spines of telson fork. After comparing Japanese inachid zoeas of eight known species, *Achaeus japonicus*, *A. tuberculatus*, *Camposcia retusa*, *Cyrtomaia owstoni*, *Macrocheira kaempferi*, *Paratymolus pubsecens*, *Platymaia wyvillethomsoni* and *P. alcocki*, we find that the genus *Platymaia* is somewhat different from the genera *Achaeus*, *Camposcia*, *Inachus*, and *Macrocheir*. It is closely related to the genus *Cyrtomaia* described by Iwata et al. (1991) especially in the characteristics of the endopodal setations of the maxillule (1, 6) and the second maxilliped (0, 1, 4).

Table 1. Comparison of main larval characters in the 1st zoeas of two *Platymaia* species.

Reference	<i>P. alcocki</i>		<i>P. wyvillethomsoni</i>
	Terada (1985)	this study	Oh and Ko (2011)
CL (mm)	1.13	1.34	1.46
RDL (mm)	4.41	5.46	5.62
Carapace			
Rostral spine	(no data)	1.7 CL	1.3 CL
Lateral spine	absent	absent	absent
Dorsal spine	(no data)	2.2 CL	1.5 CL
Anterior 'majid' seta	(no data)	present	present
Antennule			
Aesthetascs	2	3	3
Setae	3	2	2
Antenna			
Endopod	r	r	R
Maxillule			
Coxal endite	7	7	7
Basal endite	7	6	7
Endopod	1,5	1,6	1,6
Maxilla			
Coxal endite	5+4	4/5+4	5+4
Basal endite	5+4/5	5+4	5+4
Endopod	4(2+2)	5(3+2)	5(3+2)
Scaphognathite	8+ap	7/8+ap	9+ap
Maxilliped 1			
Basis	2+2+2+3	2+2+2+3	2+2+2+3
Endopod	3,2,1,2,4+I	3,2,1,2,4+I	3,2,1,2,4+I
Maxilliped 2			
Basis	1+1+1	1+1+1	1+1+1
Endopod	0,1,4	0,1,4	0,1,4
Abdominal somites			
Dorsomedial setae	(no data)	somite 1	somite 1
Posterolateral spines	somites 3-5	somites 3-5	somites 3-5
Dorsolateral processes	somites 2-3	somites 2-3	somites 2-3
Telson			
Lateral spine	3*	1	1
Dorsal spine	0*	2	2

/: or, *: from the figure, ap: apical process, CL: carapace length, I: dorsal seta, r: rudiment, RDL: distance between tip of rostral and dorsal spine.

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ヒラアシクモガニの第1ゾエアについて

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クモガニ上科の中で原始的な位置づけのクモガニ科のなかで、ヒラアシクモガニ属 (*Platymaia*) は 10 種が知られ、この内 4 種がわが国に分布しているが、いずれも深海種であるため初期発育史に関する知見に乏しい。これまでに本属ではヒラアシクモガニ (*Platymaia alcocki*) の第 1 ゾエアが、また韓国産のヒラアシクモガニモドキ (*P. wyvillethomsoni*) の第 2 ゾエアまでが記載されている。今回、ヒラアシクモガニの抱卵雌からふ化ゾエアを得て、これまでに知られている本属の幼生形態と比較した。これらの種において主要な幼生形質ではほぼ一致したが、頭胸甲長や第 1 小顎の剛毛配列などで異なる部分もみられた。特に重要形質の 1 つである第 1 小顎内肢の毛式は寺田 (1985) では「1,5」であるが、今回の結果では「1,6」で、ヒラアシクモガニモドキと同じであった。また、本属の小顎・顎脚の内肢毛式、第 2 触角や尾節の形状は、これまでに知られる中ではオーストンガニ属 (*Cyrtomaia*) に近いが、その他の属とは異なっている。クモガニ科内においては属によるゾエア形質の変異が大きく、今後より多くの種での記載が望まれる。

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