First Zoeal Stage of *Petrolisthes japonicus* (De Haan,1849) and its Taxonomic Significance (Decapoda, Porcellanidae)

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갯가게붙이 *Petrolisthes japonicus*의 第1期 Zoea幼生과 그 분류학적 의미(十脚類, 게붙이科)

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Summary

The first zoeal character of *Petrolisthes japonicus* (De Haan, 1849), *Porcellanidae*, is described and illustrated, and is compared with *P. armatus*, *P. tonsorius*, *P. novaezelandiae*, *P. elongatus* and *P. plathymerus*, known species of *Petrolisthes*. Consequently, present species is more closely related to *P. armatus* than other species of *Petrolisthes*. And the first zoeae of *P. japonicus* can be easily differentiated from other species of *Petrolisthes* by a combination of 4, 2, 3 setae formula on endopodite of the maxilla, 10+5 plumose setae formula on scaphognathite of the maxilla, 3, 3, 3, 6, 9+1 setae formula on 5-segmented endopodite of the first maxilliped and length of the posterior carapace spine.

Introduction

Petrolisthes japonicus is a species of genus *Petrolisthes*, a shallow-water porcellanid crab, which is distributed in high tidal zones along the Straits of Korea, Yellow sea, Cheju Island, Malacca, Borneo, Hong Kong and Japan (Kim, H. S., 1973). The larval stages of the genus *Petrolisthes* are known from the different region (Gore (1970, 1972a, b), Greenwood(1965), Pellegrini and Gamba(1985)). The first zoeal stage of *Petrolisthes japonicus* has not been described. The main purpose of the present study is to provide a detailed description and illustrations of the first zoeal stage of *Petrolisthes japonicus* and to discuss the

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morphological characteristics in relation to the *Petrolisthes* zoeae (*P. armatus*, *P. tonsorius*, *P. novaezelaniae*, *P. elongatus*, *P. platymerus*).

We can identify and classify the larvae with their characters such like size of the first zoeal stage (carapace length, rostral spine length, posterior spine length), rostrum and posterior spine ornamentation, antennular setation, anternnal structure and setation, setal formula on the first and second maxillipeds, setal formula on the maxillule and maxilla, abdominal segment armature and distribution pattern of chromatophores.

Materials and Methods

Ovigerous female of *Petrolisthes japonicus* were collected beneath stones at the high tide level from the City of Cheju, Cheju Island, 29 July 1985. The female were shipped by bus to the laboratory, where they were isolated in 30cm diameter glass bowls filled with nonflowing seawater. Rearing temperatures varied from 25°–28°C.

Hatching occurred cn 8 August 1985. Larvae of *Petrolisthes japonicus* hatch as pre-zoeae, remaining as such for appoximately one hour. Ater the eggs hatched, larvae were preserved in 10% formalin solution. A spent female and first zoeae are deposited in the laboratory.

Drowings of whole specimens of the first zoeae, as well as dissected appendages, were made using a compound microscope with camera lucida attachment. The measurements given are the mean of ten specimens examined. Measurements were made with a micrometer. In larvae, length of the rostrum was measured from its tip to the base of the orbit; length of the posterior carapace refers to the distance between the base of the orbit and the point of origin of the posterior spines.

Chromatopore pattern was checked from living zoea state.

Results

The major characteristics observed in the first zoea are as follows:

Carapace length: 1.42mm.

Carapace(fig. 1A). –Typically porcellanid, smooth and without spines. Rostral spine about 4X carapace length, armed dorso-ventrally with many pointed spinules and laterally with scattered spinules. Posterior carapace spines about 2.4X carapace length, armed dorso-ventrally with small spinules and laterally with irregularly placed spinules. Posterior lateral edge of carapace with two pairs of small spinules.

Antennule (fig. 1C).–A simple structure, three aesthetascs and three setae, as illustrated.

Antenna (fig. 1D).–Exopodite little more than 3/4 length of endopodite and with two subterminal setae on its inner border. Endopodite with one terminal setae.

Mandible(fig. 1B).–Asymmetrical, without palps and with numerous acute teeth.

Maxillule(fig. 1E).–Endopodite unsegmented, with three terminal setae and one smaller subterminal spinule; outer margin has fine hairs. Basal endite with 7 spines and 5 setae; coxal endite with 5 spines and 5 setae.

Maxilla(fig. 1F).–Endopodite with nine setae: four terminal, two subterminal, three lateral. Basal endite proximal and distal lobes with 10 and 11 setae respectively. Coxal endite proximal lobe has 10 setae and the distal lobe has 8 setae. The scaphognathite has 10 plumose setae around margin plus five apical setae; fine hairs are visible on the rest of the margin.

Maxilliped 1(fig. 1G).–Coxopodite naked. Basipodite ventral setae progressing distally, 2, 2, 3, 3,. Setae on five segmented endopodite ventrally

3, 3, 3, 6, 9, with one long plumose seta dorsally on last segment. Small hairs dorsally on segment 1–3. Exopodite two-segmented, 4 natatory setae.

Maxilliped 2(fig. 1H).–Coxopodite naked. Basipodite ventral setae 1, 2(rarely 1, 3). Setae on four-segmented endopodite progressing distally, 2, 2, 1+2, 5 with one long plumose seta dorsally on last segment. Fine hairs dorsally on segments 2 and 3. Exopodite two-segmented, 4 natatory setae.

Maxilliped 3 and pereiopods (fig. 1A).–Small, rudiment.

Abdomen (fig. 1I).–Five somites, somites three, four and five each with distinct lateral spine, larger toward telson.

Telson (fig. 1I).–Seven pairs of processes (setae fomula 7+7). First pair consisting of short strong spines; the second pair of fine plumose setae, and the five remaining pairs of plumose setae with distinct hooklike spines distally. Small anal spines present.

Colouration. –Transparent. Eyes pale metallic green; dark brown or black eyespots. Chromatophores on carapace at the level of the pereiopods, at the base of the mandibles, on maxillulary region, in each abdominal segment along the intestine and on gastric region, all red.

Discussion

A comparison of the first zoeal characters in six species of *Petrolisthes* is presented in Table 1. The following characters have been adopted for the identification of zoeae: 1), carapace length 2), rostral spine length 3), posterior carapace length 4), rostrum ornamentation 5), posterior carapace spine ornamentation 6), antennule 7), antenna 8), maxillule 9), maxilla 10), first maxilliped 11), second maxilliped 12), lateral spine of abdomen.

While the larvae of *Petrolisthes japonicus* are very close in many respects to larvae of genus *Petrolisthes* they nonetheless differ from each other in several important features.

The first zoea of *Petrolisthes japonicus* has a rostral spine, two posterior carapace spines, three aesthetascs and three setae on the antennule, two subterminal setae and one terminal seta each on exopodite and endopodite of antenna, 3, 1 setae formula on the endopodite of maxillule, 2, 2, 1+2, 5+1 setae formula on endopodite of the second maxilliped, which are same to those characteristics of *Petrolisthes* zoeae.

However, the first zoea of this species has a long rostral spine and two long posterior carapace spines, many spinules on the rostral and posterior carapace spines, 4, 2, 3 setae formula on the endopodite of the maxilla, 10+5 plumose setae formula on the scaphognathite of the maxilla, 3, 3, 3, 6, 9+1 setae formula on 5–segmented endopodite of the first maxilliped and red chromatophore. These seems to be the most useful for distinguishing from other *Petrolisthes* zoeae.

In addition, zoeae of the first stage of *Petrolisthes japonicus*, *P. armatus* and *P. tonsorius* have a A–type rostrum ornamentation, A–type posterior carapace ornamentation and a long rostral spine, which are different from *P. novaezelandiae*, *P. elongatus* and *P. platymerus* zoeae.

References

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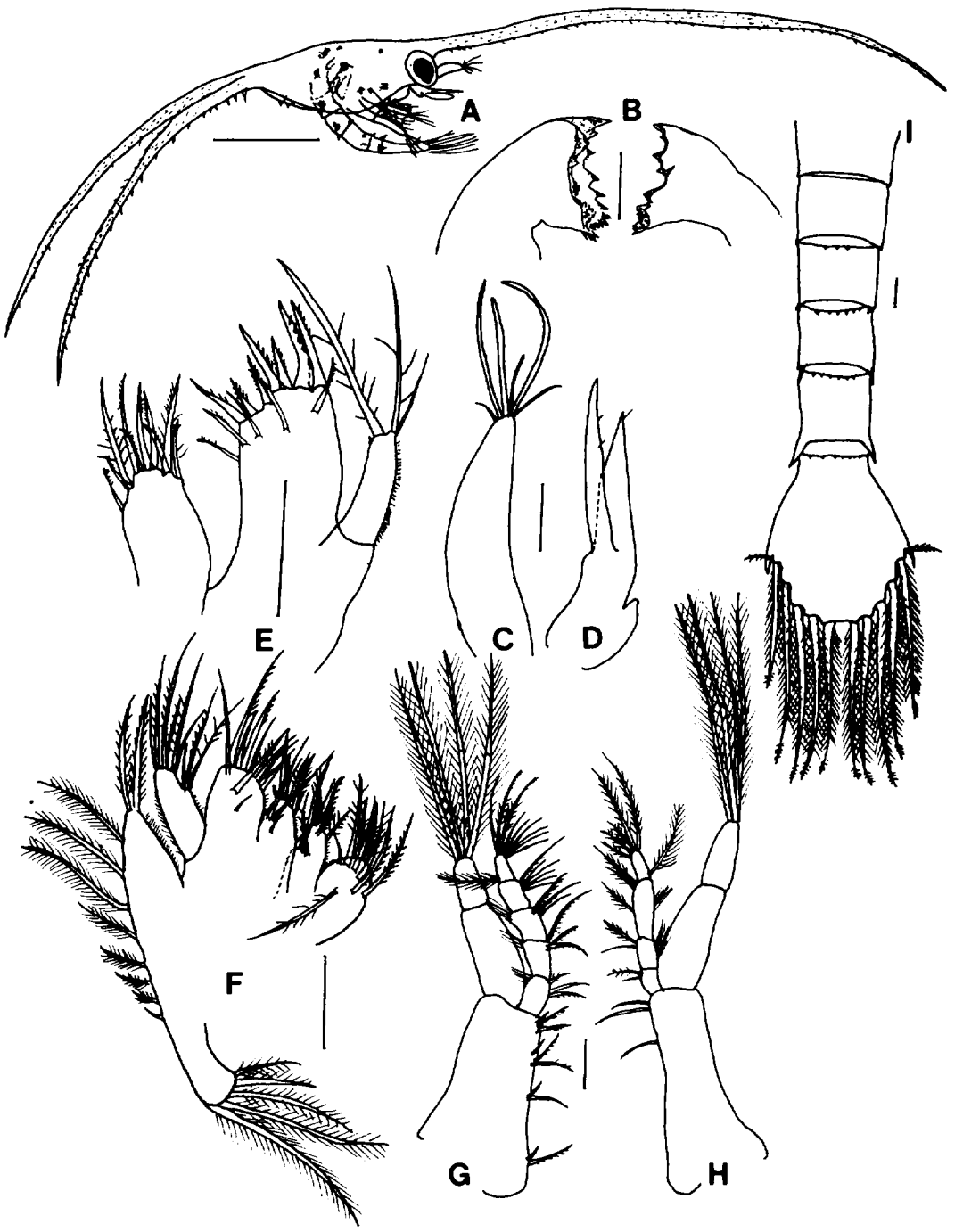

Fig.1. ***Petrolisthes japonicus*** **(De Haan, 1849), first zoeal appendages.**
A, lateral view; B, mandibles; C, antennule; D, antenna; E, maxillule; F, maxilla; G, first maxilliped; H, second maxilliped; I, abdomen. Scale line A=1mm. Scale lines B–I=0.1mm.

Table 1. Comparision of the first zoeal characters in six species of *Petrolisthes*.

Species	References	C.L.	R.	P.	R.O.	P.O.	An_1	An_2 Endo./ Exo.	Maxillule Endo.	Maxilla Endo./ Scapho.	Maxilliped 1 Basi./Endo./ Segment	Maxilliped 2 Basi./Endo./ Segment	Abdomen Lateral Spine
P. japonicus	Present study	1.42	4×	2.4×	A	A	3.3	1,2	3+1	4,2,3 10+5	2,2,3,3 3,3,3,6,9+I 5	1,2 2,2,1+2,5+I 4	*3,4,5
P. armatus	Gore, 1970 Atlantic Specimen	1.6	4×	1×	A	A	3.3	1,2	3+1	5,3 5+1	1,2,2,3 3,3,2+4,9+I 4	1,1 2,2,1+2,5+I 4	*4,5
P. armatus	Gore, 1972 Pacific Specimen	1.16	3×	0.7×	A	A	3.2	1,2	3+1	3,2,3 5+1	1,1,2,3 3,3,2+3,7-8 4	1,1 2,2,1+2,5+I 4	*4,5
P. tonsorius	Pellegrini & Gamba, 1985	1.36	2.72×	2.2×	A	A	3.3	1,1	4+1	3,3,3 6+1	2,2,3,3 3,3,2+3,7+I 4	1,2 2,2,1+3,5+I 4	*1,2,3,4,5
P. novaezelandiae	Greenwood, 1965	1.4	3.6×	1.3×	A	C	3.2	1,2+1	4+1	4,1,3 5+1	2,1,4 3,3,3,5,7 5	0 2,3,3,6 4	?
P. elongatus	Greenwood, 1965	1.4 1.55	4.6× 4.8×	2.5× 2.6×	B	B	3.3	1+3	4+1	5,3 8+5	1,2,3 2,4,3,6+I,7 5	1,1 3,2,2+3+I,6 4	*4,5
P. platymerus	Gore, 1972	1.12	1.8×	0.6×	B	D	3.3	1+2	4+1	5+3 6+1	2,2,3,3 3,3,1+3,7+I 4	1,2 2,2,1+2,5+I 4	*1,2,3,4,5

Abbreviation. C. L., Carapace length (mm); R, rostral spine; P, posterial spine; R.O., rostrum ornamentation; P. O., posterial spine ornamentation; An_1, antennule; An_2, antenna; Endo., Endopodite; Exo., Exopodite; Scaph., scaphognathite; Basi., basipodite; 4X, to 4X carapace length; A, clothed fine spines; B, series vent spines; C, 2–3 vent spines; D, unarmed; *, somites; ?, information not available; +Roman numerals indicate dorsal setae.

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國 文 抄 錄

게붙이科(Porcellanidae)의 1屬인 갯가게붙이屬(*Petrolisthes*)에 속하는 갯가게붙이(*Petrolisthes japonicus*)의 第1期 幼生의 형태적특징을 기술, 도시하고, 갯가게붙이屬내의 여러 種 즉 *P. armatus*, *P. tonsorius*, *P. novaezelandiae*, *P. elongatus*, *P. platymerus*와 第1期 幼生의 형태적 특징을 비교 연구했다.

그 결과 본종이 갯가게붙이屬내의이미 기재된 여러 種중에서 *P. armatus*와 훨씬 더 밀접히 관련됨을 보여주고 본 종의 유생은 第2小顎의 內肢의 刺毛式 4+2+3, 第2小顎의 顎舟葉上의 羽狀刺毛式 10+5, 第1顎脚의 內肢가 5節로 구성되며, 그 內肢의 刺毛式 3, 3, 3, 6, 9+1, 後棘의 길이들의 특징으로 갯가게붙이屬내의 다른 種들과 쉽게 식별될 수 있다.