

Larval Development of *Neocaridina denticulata sinensis* (Decapoda: Caridea: Atyidae) Reared in the Laboratory

Hoi Jeong Yang* and Hyun Sook Ko¹

(Nakdong River Research Institute, Silla University, Busan 617-736, Korea;

¹Department of Life Sciences, Silla University, Busan 617-736, Korea)

ABSTRACT

The first larval stage of *Neocaridina denticulata sinensis* (Kemp, 1918) is described and illustrated in detail. The first larvae of *N. d. sinensis* are compared with those of four other known congeners of *Neocaridina* from Asia.

Key words: First larval stage, *Neocaridina denticulata sinensis*

INTRODUCTION

Neocaridina denticulata sinensis (Kemp, 1918) was previously assigned to the genus *Caridina* (Kim, 1977; The Korean Society of Systematic Zoology, 1997). However, since Kubo (1938) erected a new genus *Neocaridina* on the basis of the morphological differences in male, the endopod of the first pleopod and the appendix masculina of the second pleopod, this species was placed in the new genus *Neocaridina* (Hayashi, 1990; Holthuis, 1993). Kubo's arrangement is followed here.

Larval description of *Neocaridina* is known for four species from Asia: *N. brevisrostris* (Stimpson, 1860) (cf. Shokita, 1973; Shy *et al.*, 1987) from Japan and Taiwan; *N. denticulata* (De Haan, 1844) (cf. Mizue and Iwamoto, 1961) from Japan; *N. ishigakiensis* (Fujino and Shokita, 1975) (cf. Shokita, 1976) from Japan; and *N. serrata* (Stimpson, 1860) (cf. Dudgeon, 1987) from Hong Kong. Larvae of the subspecies of *N. d. sinensis* were also described by Zhang and Sun

* To whom correspondence should be addressed

Tel: 82-51-309-5192, Fax: 82-51-309-5083, E-mail: alpheidae@hotmail.com

(1979) from China. However, it is impossible to obtain available information for morphological comparison from the previous description on the first larval stage of *N. d. sinensis* because Zhang and Sun (1979) provided morphological characteristics of the habitus in lateral view, the first and second maxillipeds, and the telson only.

This study is to describe and illustrate in detail the first larval stage of *N. d. sinensis* and to compare the first larval morphological characteristics of *N. d. sinensis* with those of four other known congeners of *Neocaridina* from Asia.

MATERIAL AND METHODS

On 23 May, 2000, an ovigerous female of *Neocaridina denticulata sinensis* was collected from Woopo marsh in Changnyeong, Korea. Newly hatched larvae were reared in using method described by Yang (2003) in a growth chamber at 25°C. The first larvae were fed daily with powdered 'Tetramin'. Some specimens were preserved in 7% neutral formalin for later examination. Drawings were made with the help of a camera lucida. Total length (TL) was determined from the rostral tip to the posteromedian margin of the telson, excluding posterior setae. Carapace length (CL) was determined from the postorbital margin to the posteromedian margin of the carapace. The setal armature of appendages is described from proximal to distal segments. The chromatophore pattern was determined by observation of living larvae.

RESULTS

The first larval and one decapodid stages were obtained. Decapodid stage of *Neocaridina denticulata sinensis* was first attained in two days after hatching. The first larvae of *N. d. sinensis* used up yolk exclusively and did not feed. The first stage is described only.

First stage (Figs. 1, 2)

TL. 123.0 mm; CL. 32.5 mm.

Carapace (Fig. 1A). Rostrum acute, pointed, reaching end of first segment of peduncle of antennule, with 8 dorsomedian teeth; pterygostomian and antennal spines present; eyes stalked.

Antennule (Fig. 1B). Stylocerite pointed distally, with 5 plumose setae; peduncle 3-segmented, with 8, 9, 6 plumose setae, respectively; inner flagellum longer than outer flagellum, 8-segmented; outer flagellum 5-segmented; third segment with 2 aesthetes.

Antenna (Fig. 1C). Flagellum elongated; scaphocerite with distolateral spine and 20 marginal plumose setae.

Mandible (Fig. 1D). Palp absent; molar and incisor processes developed; 4 spines present between molar and incisor processes.

Maxillule (Fig. 1E). Coxal endite with 3 denticles; basal endite with 10 denticles; endopod palplike.

Maxilla (Fig. 1F). Coxal endite with 22 short plumose setae; basal endite bilobed, with 13+7

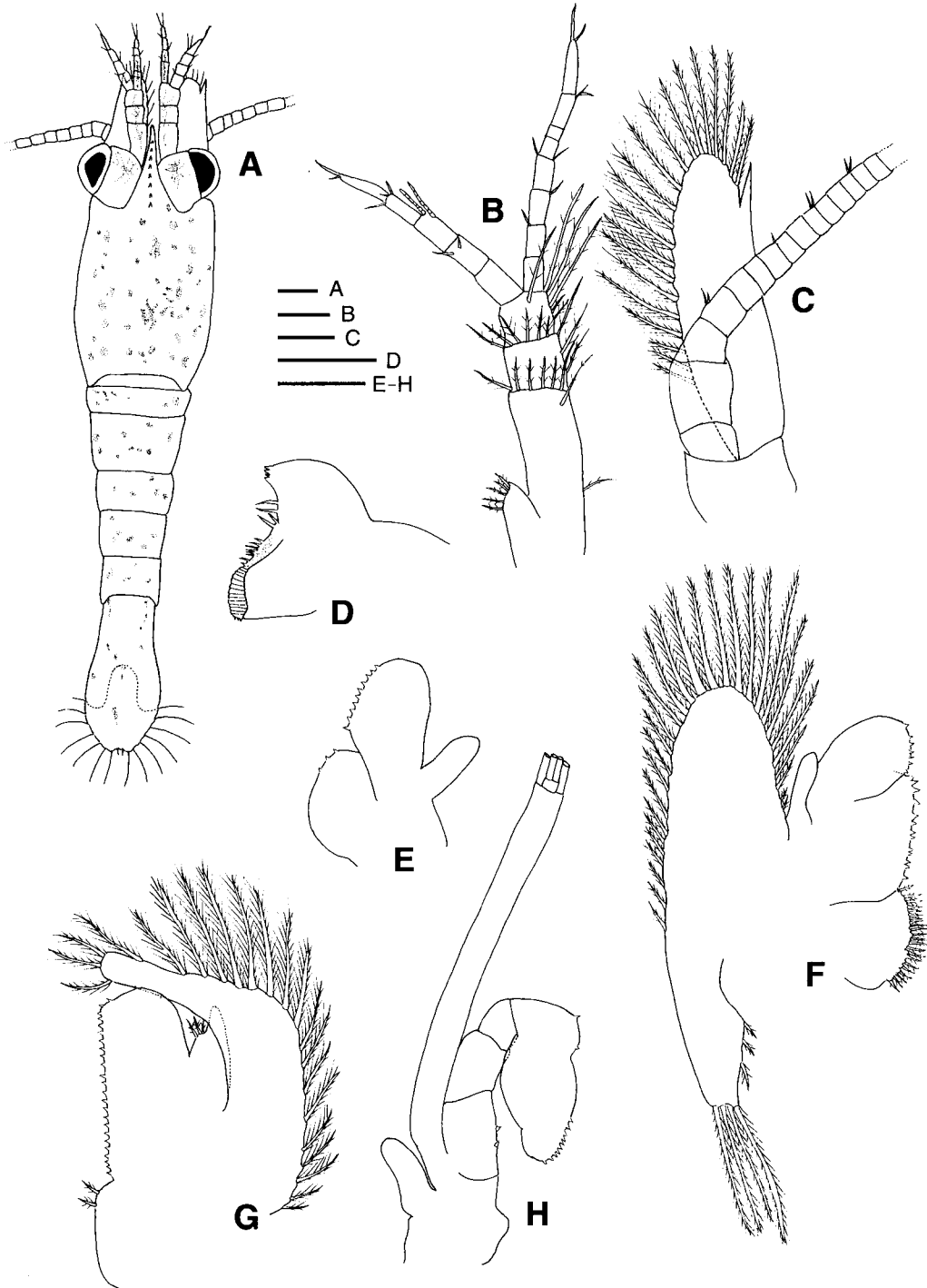


Fig. 1. First larval stage of *Neocaridina denticulata sinensis* (Kemp, 1918). A, habitus, dorsal view; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilla; G, first maxilliped; H, second maxilliped. Scales = 0.1 mm.

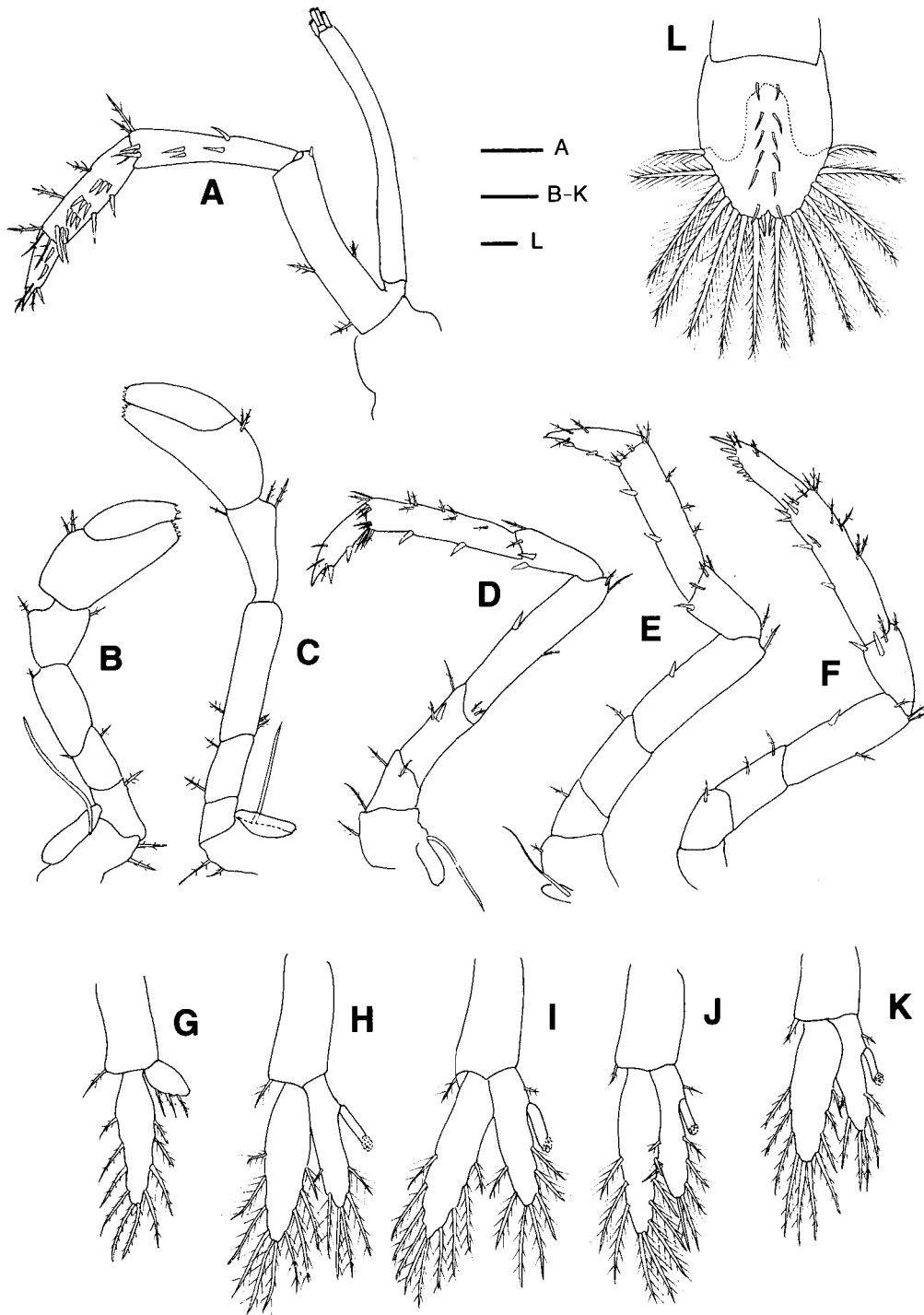


Fig. 2. First larval stage of *Neocaridina denticulata sinensis* (Kemp, 1918). A, third maxilliped; B, pereiopod 1; C, pereiopod 2; D, pereiopod 3; E, pereiopod 4; F, pereiopod 5; G, pleopod 1; H, pleopod 2; I, pleopod 3; J, pleopod 4; K, pleopod 5; L, telson and uropods. Scales = 0.1 mm.

denticles; endopod palplike; scaphognathite with 4 long and 3 short plumose setae on proximally directed lobe and 29 plumose setae on lateral and distal margins.

First maxilliped (Fig. 1G). Coxa with 2 short plumose setae; basis with 24 denticles; endopod with 3 plumose setae; exopod leaflike, with 21 marginal plumose setae.

Second maxilliped (Fig. 1H). Epipod present; endopod 4-segmented: first segment with 2 denticles; second and third segments unarmed; fourth segment with 12 denticles; exopod with 4 terminal natatory setae, symmetrically disposed in 2 pairs.

Third maxilliped (Fig. 2A). Endopod 4-segmented; exopod with 4 terminal natatory setae, symmetrically disposed in 2 pairs.

Pereiopods (Fig. 2B-F). Pereiopods 1-4 with epipods. Pereiopods 1-2 chelate. Pereiopods 3-4 biunguiculate. Pereiopod 5 with dactylus armed with 6 spines on inferior margin.

Pleopods (Fig. 2G-K). Pleopods 1-5 with setose endopods and exopods. Pleopod 1 without appendix interna. Pleopods 2-5 with appendices internae.

Abdomen (Fig. 1A). 5 somites present, sixth somite not differentiated from telson.

Telson and uropods (Fig. 2L). Telson spatulate, with 6 pairs of dorsomedian simple setae; posterior margin with 8+8 setae; outermost pair plumose only on innerside. Uropods visible.

Brown chromatophores interspersed with red chromatophore present on whole carapace, rostrum, eyestalks, peduncle and flagella of antennule, scaphocerite of antenna, basis of first maxilliped, coxa and merus of endopod of third maxilliped, coxae of pereiopods 1-5, whole abdominal somites 1-5, and telson.

DISCUSSION

The first larvae of four species of *Neocaridina* have been described from Asia: *N. brevirostris*, *N. denticulata*, *N. ishigakiensis*, and *N. serrata*. Dudgeon (1987) described that the first larvae of *N. serrata* had the carapace without the pterygostomian and antennal spines, the eyes sessile, the peduncle of the antennule unsegmented, the flagellum of the antenna not elongated, the pereiopods 1-2 and the pleopods 1-5 bud-like, and the telson with deep posteromedian concavity bearing 7+7 posterior setae. However, the first larvae of *N. d. sinensis* have the carapace with the pterygostomian and antennal spines, the eyes stalked, the peduncle of the antenna 3-segmented bearing the stylocerite, the flagellum of the antenna elongated, the pereiopods 1-2 chelate, the pleopods 1-5 with setose endopods and exopods, and the telson with shallow posteromedian concavity bearing 8+8 posterior setae. These morphological characteristics in the first larvae of *N. d. sinensis* can be also seen in those of *N. brevirostris*, *N. denticulata*, and *N. ishigakiensis*. In the first larvae of the latter three congeners, the endopod of the third maxilliped is 3-segmented, the dactylus of the pereiopod 5 has five spines on inferior margin, and the telson is devoid of dorsomedian setae. The first larvae of *N. d. sinensis* are distinguished from those of *N. brevirostris*, *N. denticulata*, and *N. ishigakiensis* by having the endopod of the third maxilliped 4-segmented, the dactylus of the pereiopod 5 with six spines on inferior margin, and the telson with six pairs of dorsomedian setae.

It is uncertain that the first larvae of *N. denticulata* have the rostrum with dorsomedian teeth

since Mizue and Iwamoto (1961) gave no description. Shokita (1973, 1976) described that both species of *N. brevirostris* and *N. ishigakiensis* has the rostrum without dorsomedian teeth. However, the first larvae of *N. d. sinensis* have the rostrum with eight dorsomedian teeth. Therefore, the number of dorsomedian teeth on the rostrum can be an important distinguishing character of the first larvae of *N. d. sinensis* from those of *N. brevirostris* and *N. ishigakiensis*.

ACKNOWLEDGEMENTS

This work was supported by a grant from Muryanghyang Research Society in 2001. The first author (HJY) is grateful to Prof. K.-I. Hayashi of the National Fisheries University, Shimonoseki, Japan, for providing valuable literature.

REFERENCES

- Dudgeon, D., 1987. The larval development of *Neocaridina serrata* (Stimpson) (Crustacea: Decapoda: Caridea: Atyidae) from Hong Kong. Arch. Hydrobiol., **110**(3): 339-355.
- Hayashi, K.-I., 1990. Prawns, shrimps and lobsters from Japan (51). Family Atyidae-genus *Neocaridina* and key to genera. Aquabiology 66, **12**(1): 36-39 (in Japanese).
- Holthuis, L. B., 1993. The recent genera of the caridean and stenopodidean shrimps (Crustacea, Decapoda) with an appendix on the order Amphionidacea. Nationaal Natuurhistorisch Museum, Leiden, The Netherlands, 328 pp.
- Kim, H. S., 1977. Illustrated Encyclopedia of Fauna and Flora of Korea, Vol. 19. Macrura. The Ministry of Education, Republic of Korea, 414 pp (in Korean).
- Kubo, I., 1938. On the Japanese atyid shrimps. Journ. Imp. Fish. Inst., **33**(1): 67-100.
- Mizue, K. and Y. Iwamoto, 1961. On the development and growth of *Neocaridina denticulata* De Haan. Bull. Fac. Fish., Nagasaki Univ., **10**: 15-24.
- Shokita, S., 1973. Abbreviated larval development of fresh-water atyid shrimp, *Caridina brevirostris* Stimpson from Iriomote Islands of the Ryukus (Decapoda: Atyidae). Bull. Sci. Engin. Div., Univ. Ryukyus (Methem. Nat. Sci.), **16**: 222-231.
- Shokita, S., 1976. Early life history of the land-locked atyid shrimp, *Caridina denticulata ishigakiensis* Fujino et Shokita, from the Ryukyu Islands. Res. Crust., **7**: 1-10.
- Shy, J.-Y., W.-H. Liou and H.-S. Yu, 1987. Morphological observation on the development of larval *Neocaridina brevirostris* (Stimpson, 1860) (Crustacea: Decapoda: Atyidae) reared in the laboratory. Journ. Fish. Soc. Taiwan, **14**(1): 15-24 (in Chinese).
- The Korean Society of Systematic Zoology, 1997. Lists of animals in Korea (excluding insects). Academy Publishing Co., Seoul, Republic of Korea, 489 pp (in Korean).
- Yang, H. J., 2003. Early zoeas of *Athanas japonicus* Kubo, 1936 (Decapoda: Caridea: Alpheidae) reared in the laboratory. Crustaceana (in press).
- Zhang, J. and X. Sun, 1979. Studies on the larval development of six freshwater prawn species in the middle and lower Chang Jiang (Yangtze) Valley. Acta Zool. Sinica, **25**(2): 143-153 (in Chinese).

RECEIVED: 5 February 2003

ACCEPTED: 20 March 2003

중국새뱅이 (십각목: 생이하목: 새뱅이과)의 유생발생

양 회 정* · 고 현 숙¹

(신라대학교 낙동강 연구원; ¹신라대학교 생명과학과)

요 약

중국새뱅이의 제1유생기를 상세히 기재하고 도시하였다. 중국새뱅이의 제1유생의 형태적인 특징을 아시아 지역에서 보고된 동 속의 다른 4종의 제1유생과 비교하였다.