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# LARVAL DEVELOPMENT OF THE INDIAN SPIDER CRAB *ELAMENOPSIS DEMELOI* (KEMP) (BRACHYURA, HYMENOSOMATIDAE) IN THE LABORATORY

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## ABSTRACT

Complete larval development of the spider crab *Elamenopsis demeloi* (Kemp) was studied from larvae hatched and reared from an ovigerous crab in the laboratory. At 26-28°C temperature and 17-20 ppt salinity, three zoeal stages were observed, followed by a first stage crab. A megalopa stage was not present. Morphological features of these larvae are compared with the other species of the family and the important characters that differ from those of other zoeae are: Zoeae with very long mid-dorsal and rostral spines and coxal endite of 2nd maxilla with 2 setas.

Key-words: Larval development, spider crab larvae, *Elamenopsis demeloi* (Kemp), Brachyura.

## INTRODUCTION

Aikawa (1929) was the first to work on the larvae of Hymenosomatidae, the well known small spider crabs from Indo-Pacific region. Aikawa obtained first stage zoeae from ovigerous females respectively of *Halicarcinus messor, Trigonoplax unquiformis* and *Halicarcinus septentrionalis.* Subsequently, zoeae of the other hymenosomatids have been figured or described by various workers, viz. *Elamena mathaei* by Gurney (1938) and Al-Kholy (1959); *Hymenosoma orbiculare* by Broakhuysen (1955); *E. sindensis* by Prasad & Tampi (1957); *Halicarcinus cooki* by Melrose (1975); *H. planatus* by Boschi, Scelzo and Goldstain (1969); *E. cristatipes* by Hashmi (1970); *Amarinus (Halicarcinus) paralacustris* and *Amarinus laevis (Halicarcinus australis)* by Lucas (1971); *H. orientalis* and *H. messor* by Muraoka (1977) and *Trigonoplax unguiformis* by Fukuda (1981). Wear and Fielder (1985) have described the zoea stages I, II and III of New Zealand species reared from laboratory hatched eggs of *Neohymenicus pubescens, Elamena longirostris, E. momona* and *E. producta.* In the same publication, these authors have described the first stage zoeae of *Halicarcinus cooki, H. innominatus, H. whitei, H. varius, H. planatus* and *Hymenosoma depressum* from laboratory hatched eggs and in some cases the subsequent stages were described from the zoeae collected in plankton or reared from the planktonic larvae. Lucas (1980), Rice (1980) and Wear and Fielder (1985) in their studies have reviewed the larval works of Hymenosomatidae and described the diagnostic characters of the larvae.

In the present study, *Elamenopsis demeloi* (Kemp), one of the species of the spider crabs of the family Hymenosomatidae from India, was reared in the laboratory and is described.

## MATERIAL AND METHODS

Larvae were obtained from an ovigerous crab, *Elamenopsis demeloi* (Kemp), collected from the Kali estuary, Karwar, along the west coast of India (Lat. 14°18'N and Long. 74°97'E). This species was observed to be available abundantly near the Kali river mouth where a variable salinity is encountered. After the collection the crab was maintained in water of 17 ppt salinity until the larvae hatched. During the experiment salinity fluctuated between 17 and 20 ppt and temperature between 26 and 28°C. Other ovigerous females collected subsequently also released healthy larvae leading to successful rearings. The method of rearing the larvae is the same as described by Kakati (1977).

## RESULTS AND DISCUSSION

The larvae passed through three zoeal stages. A prezoeal stage was not observed and none of the third stage zoeae passed through megalopa stage, instead, they moulted directly into first stage crabs. The zoeae were voracious feeders on *Artemia* nauplii and were always active, covering the entire space of rearing medium. The zoeae reached first stage crab within a minimum period of nine days. Survival rate from first zoeae to first stage crabs was fifty percent.

*First zoea* (Fig.1)

Rastral spine length (RSL) = 2.01 mm.
Dorsal spine length (DSL) = 1.35 mm.
Cérapace length (CL) = 0.63 mm., and
Duration of the stage (DS) = 3 days.

*Carapace* with very long rostral and dorsal spines, dorsal spine being shorter than rostral, tips of both these spines directed in opposite directions, minute spinules present on the surface of rostral spine, eyes sessile, telson quadrangular (Fig.1a & i). *Antennule* (Fig.1b): Uniramous with 1 small seta and 2 unequal long aesthetascs. *Antenna* (Fig.1c): Pointed, with a terminal spine, spine smooth and almost as long as lobe. *Mandible* (Fig.1d): With well developed molar and incisor processes but without palp. *Maxillule* (Fig.1e): Coxal endite with 5 and basal with 4 setae, palp 2-segmented, and long distal segment with 4 setae in two sets of 2 each and the short proximal with 1 seta. *Maxilla* (Fig.1f): Coxal endite with 2 setae and slightly bilobed basal with 8, palp bilobed, with 2 setae on proximal lobe and 2+1 on distal, scaphognathite with 3 marginal plumose setae distally and a broad pointed posterior end with fine hairs. *First maxilliped* (Fig.1g): Basipod with 10 setae, endopod 5-segmented, long, with 3, 2, 1, 2 and 5 setae distalwards, unsegmented exopod with 4 natatory setae. *Second maxilliped* (Fig.1h): Basipod

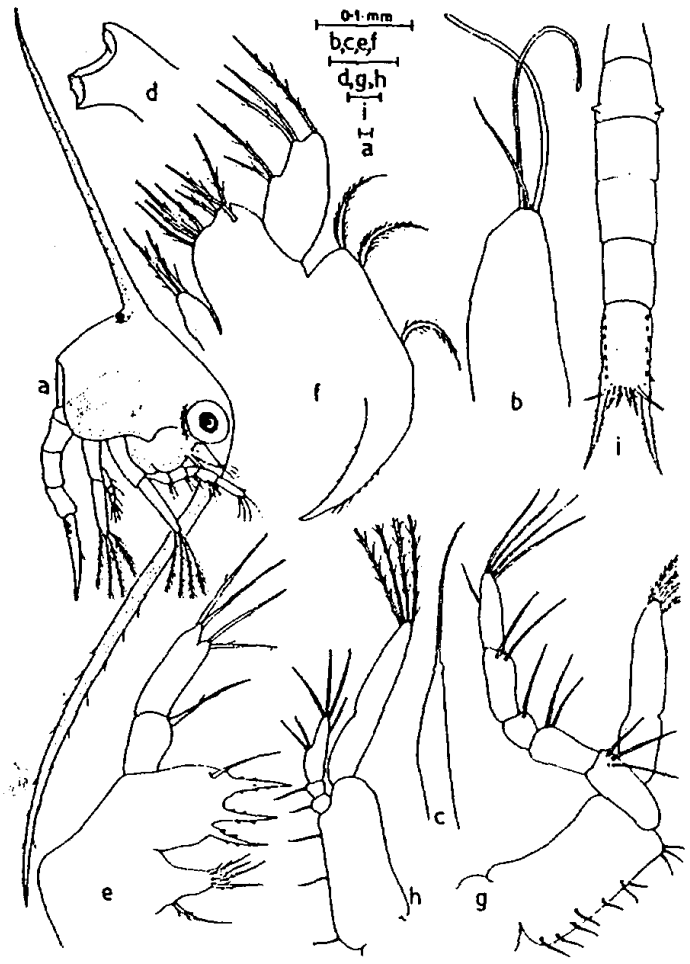


Fig.1. First zoea. (a) Lateral view of zoea; (b) antennule; (c) antenna; (d) mandible; (e) maxillule; (f) maxilla; (g) fist maxilliped; (h) second maxilliped; (i) abdomen.

with 3 setae, 3-segmented endopod with 1, 1 and 2+4 setae distalwards, exopod as in first maxilliped. Abdomen (Fig.1i): Five-segmented, segments without dorsal setae, second segment with posteriorly situated lateral protuberances. *Telson* (Fig.1i): Quadrangular, with slightly curved long cornua, a small spine near the base of each cornua, telson process formula 3+3, the outer process smooth while the inner ones plumose.

*Chromatophores:* Brownish-red chromatophores as illustrated; along the dorsal and rostral spines, on telson, mandibles, labrum, basis of first and second maxillipeds, first abdominal segment, below the eyestalks on the carapace (Fig.1a).

*Second zoea* (Fig.2).

RSL = 3.82 mm, DSL = 2.90 mm, CL = 1.4 mm and DS. = 3-4 days.

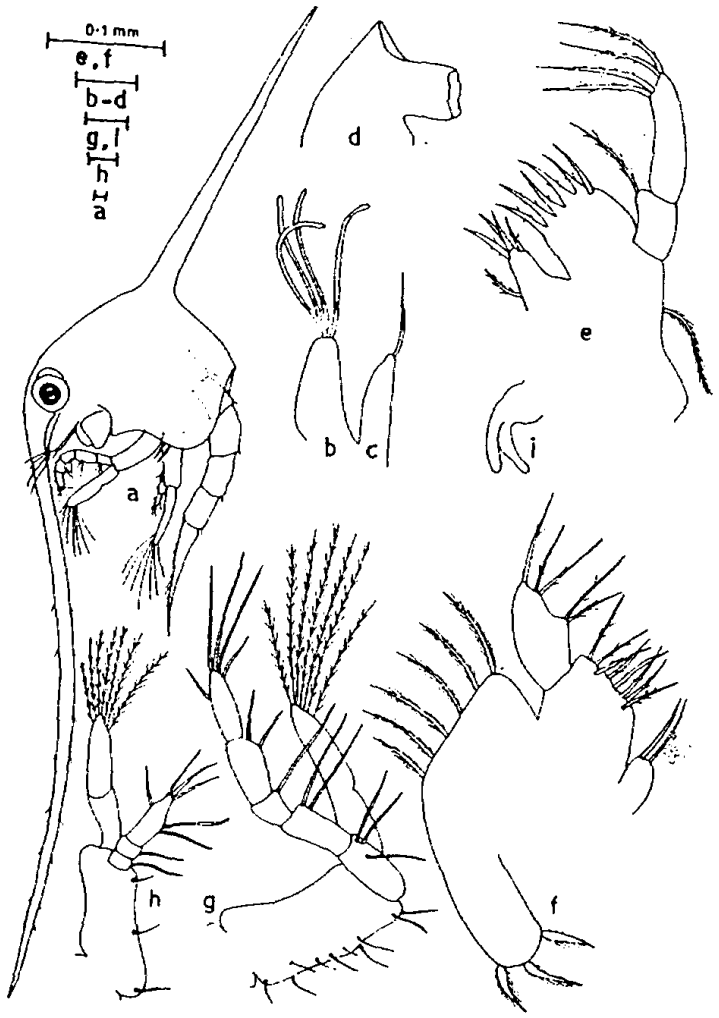


Fig.2. Second zoea. (e) Lateral view of zoea; (b) antennule; (c) antenna; (d) mandible; (e) maxillule; (f) maxilla; (g) first maxilliped; (h) second maxilliped; (i) third maxilliped bud.

Ventral margin of carapace with 2 setae and eyes stalked (Fig.2a). *Antennule* (Fig.2b): Aesthetascs increased in number from 2 to 4 but was devoid of seta. *Antenna* (Fig.2c): Terminal spinous portion eccentrically placed. *Mandible* (Fig.2d): Increased in size and with strong molar surface. *Maxillule* (Fig.2e): Coxal endite with 5 setae and basal with 6, a plumose seta added distally on outer margin. *Maxilla* (Fig.2f): Except for increase in number of marginal plumose setae of scaphognanthite to 9 (6+3), no other change. *First and second maxillipeds* (Figs.2g and h): Natatory setae increased to 7, no other change. *Other appendages: Third maxilliped* (Fig.2i) biramous. First pereiopod chelate, others as uniramous buds. Abdomen and telson increased in size and length.

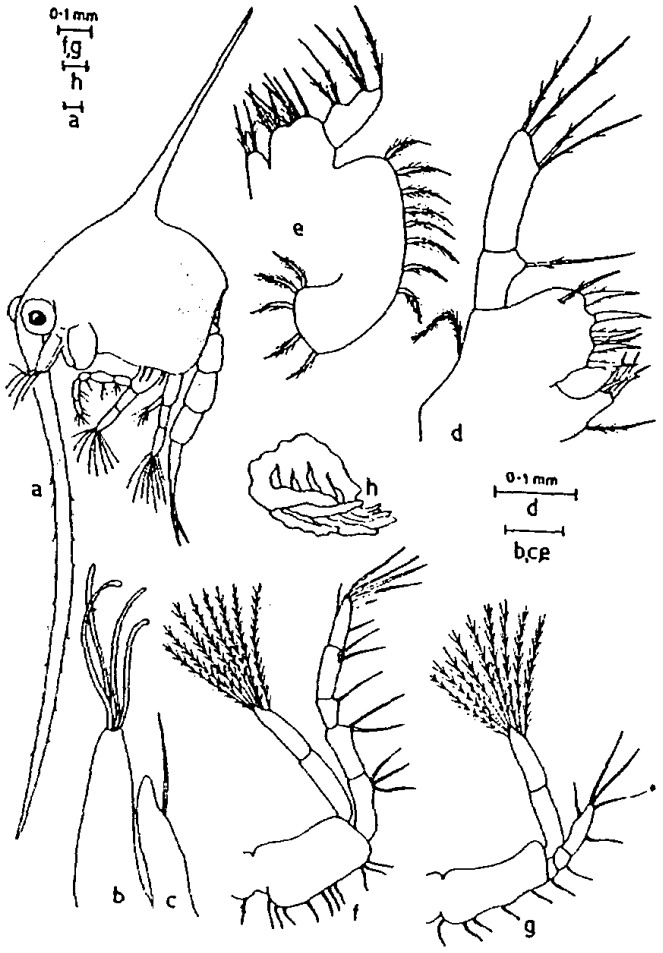


Fig.3. Third zoea. (a) Lateral view of zoea; (b) antennule; (c) antenna; (d) maxillule; (e) maxilla; (f) first maxilliped; (g) second maxilliped; (h) pereiopod buds.

*Third zoea* (Fig.3).

RSL = 3.30 mm, DSL = 1.40 mm; CL = 1.50 mm and DS = 3-4 days.

Ventral margin of carapace with 3 setae (Fig.3a). *Antennule* (Fig.3b): Base swollen, with 4 aesthetascs. *Antenna* (Fig.3c): Terminal spinous portion now shifted subterminally. *Maxillule* (Fig.3d): Coxal endite with 5 setae and basal with 7, no other structural change. *Maxilla* (Fig.3e): Except for increase in number of marginal plumose setae of scaphognathite to 13 (8+5), no other change. *First and Second maxillipeds* (Figs. f & g): Exopod 2-segmented with 8 and 9 natatory setae respectively on first and second maxillipeds. *Other appendages* (Fig.3h): Third maxilliped and pereiopods 1-5 fairly well developed and elongated.

The third stage zoea moulted directly to first stage crab.

Zoeae of only a single species *Elamenopsis lineata* A. Milne Edwards described by Lucas (1980) have elongated dorsal and rostral spines like the ones in the present species. *Amarinus laevis* (*H. australis*) (Lucas, 1971) and *H. orbiculare* (Broekhuysen, 1955) have moderately large carapacial spines, but are clearly smaller than in *E. demeloi*. The lengthy rostral and dorsal carapacial spines of the present species are reminiscent of the carapacial spines of porcellanid larvae. The present larvae stand apart from the larvae of other species of Hymenosomatidae in general and differ from the above mentioned latter species in particular in the sense that the rostral spine in the present larvae has minute spinules throughout the entire length.

The carapace spines appear to be an environmental adaptation, since these spines help the larva in floatation and orientation in the turbulent estuarine waters. In the rearing bowls, these larvae always swam with their long carapacial spines oriented horizontally to the substratum. The carapacial spines in the present species increased in length in the second stage zoeae, but decreased in third stage. These, like many other hymenosomatid larvae, neither curl up into balls nor remain near the substratum. The first stage crabs are thigmotactic in behaviour and cling to each other thereby forming a ball.

Most of the hymenosomatid zoeae have lateral protuberances on second abdominal segment. A pair of protuberances was found in the posterior half of the dorso-lateral portion of the second abdominal segment in *E. demeloi*, *H. orientalis* and *H. messor*. However, the third abdominal segment is devoid of any such protuberances. The first abdominal segment of *H. messor* has a mid-dorsal plumose seta which is lacking in *E. demeloi* as well as in other species of the family. The abdomen in most of the zoeae has a lobe-like projection on the ventral surface of fifth segment. But this projection was not observed in *E. demeloi*. Pleopods or pleopod buds are absent in all the three zoeal stages, thus conforming to the pattern of life history of the family as a whole. The absence of pleopods in any species of the family can be readily attributed to the absence of megalopa stage where the function of pleopods is for locomotion.

In both *H. messor* and *E. demeloi* the first stage zoeae possess three setae on scaphognathite and the setation of endopod of first maxilliped is 3, 2, 1, 2 and 5 for both the species. The major difference from other hymenosomatid zoeae is exhibited in number of setae on coxal endite of maxilla: *E. demeloi* and *E. lineata* have 2 setae instead of a single seta hitherto described for the other zoeae of the family. Moreover, number of coxal setae of maxillule in *E. demeloi* is 5 (4+1) as against 4 (3+1) of the other species.

Most species of Brachyura possess successively 4, 6, 8, 10, ... natatory setae of exopods of maxillipeds from first stage onwards by an addition of 2 setae in each subsequent stage. This pattern is not followed in the zoeae of Hymenosomatidae, in which it is generally represented by 4, 7 and

8/9 natatory setae in first, second and third stage zoeae respectively. The exopod of first maxilliped is not a 2-segmented appendage in the first two zoeal stages, but in third stage it is clearly 2-segmented. The exopod of second maxilliped is unsegmented in first stage zoea but 2-segmented in later zoeal stages in *E. demeloi*. Thus, the segmentation pattern of maxillipeds differs among the species described. As already suggested by Lucas (1971), the presence of primary chromatophores in both the maxillipeds is not a good diagnostic feature of the family since other brachyuran families also do possess these (Aikawa, 1937).

A small spine is present near the base of each telson cornua on lateral margin in *E. demeloi*. Similar spines have been observed in *H. rostratus* and *A. paralacustris* but were absent in *H. orientalis* and *H. messor*.

Lucas (1980) has described the larval characters of the family Hymenosomatidae based on Wear (1967) and Lucas (1971) as"telson elongate trapezoidal, wider anteriorly; telson-fork short and straight, with three pairs of close-set spines; 2nd maxillae with single coxal and basal endites, coxal endite vestigial, with a single seta or, less commonly, with two setae; antennae simple, varying from inconspicuous blunt lobes to conspicuous pointed lobes, pointed form with a fine basal hair or terminal spine which tends to be eccentric; abdomen of 5 segments with no traces of pleopods; with three zoeal stages and without pre-zoeal and megalopa stages.

The distinctive telson and telson fork of hymenosomatid larvae are the most useful characters for identifying these larvae in plankton samples.

There is much variation in the development of carapace spines within this family. Lucas (1980) states that as a rule the hymenosomatid species occurring in brackish water have greater development of the larval carapacial spines than do the marine species. This statement holds good in case of *E. demeloi* which is also an estuarine species.

Based on the larval characters of *E. lineata* described by Lucas (1980) and *E. demeloi* described in the present study, the two important zoeal characters of the genus found are: 1. Zoeae with very long mid-dorsal and rostral spines, two and three times the carapace length, respectively, 2. Presence of two setae (not one) on the coxal endite of the 2nd maxilla.

The absence of a megalopa stage in the present larval development and in those of the other species hitherto described points to the fact that three zoeal stages may be taken into consideration as a general diagnostic feature of the family.

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