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Larval Development of *Menaethiops bicornis* Alcock, 1895, Reared Under Laboratory Conditions (Crustacea: Decapoda: Majidae)

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Abstract: Larval development of *Menaethiops bicornis* Alcock, 1895 was carried out under laboratory conditions during 1996 from an ovigerous female to the second zoeal stage at room temperature, 27- 29 °C, with a salinity of seawater at 35-37 ‰ and pH 7.9. The larvae are illustrated, described and also compared with the laboratory reared larvae of *M. nodulosus* described by Ghory and Siddiqui (2002) from Pakistan.

Key Words: Decapoda, Majidae, Larval development of *Menaethiops bicornis*, Pakistan.

Introduction

The genus *Menaethiops* is represented by 12 species in the Indo-Pacific region reported by Tirmizi and Kazmi (1988). Later, 2 new records were added to the Indo-Pacific fauna, *Menaethiops gadaniensis* and *M. nodulosus* (Nobili, 1905), both described by Kazmi and Tirmizi (1999).

M. bicornis Alcock, 1895 commonly occurs on rocky shores, and is found entangled with seaweeds. The present paper is based on the larval development of *M. bicornis* Alcock, 1895, reared under laboratory conditions. Detailed descriptions with illustrations are presented and morphological characters are also given in the Table to show the development between consecutive stages. A comparison between the 2 zoeal stages of *M. nodulosus* and *M. bicornis* (present study) is provided. The aim of this study is to provide information about the larval development of *M. bicornis* for further studies.

Materials and Methods

An ovigerous female of *M. bicornis* was collected from Buleji (Long. 66 °49 'E, Lat. 24 °56 'N) on November 26, 1996. The specimen was brought to the laboratory and kept in a glass beaker with unfiltered seawaters of 35-37‰ salinity and pH 7.9, at room temperature (27-29 °C). Eggs hatched on December 14, 1996. The newly hatched larvae were segregated and equally distributed in 7 beakers filled with filtered seawater. *Artemia nauplii*

were provided as food. Subsequently, beakers were emptied and filled with freshly filtered seawater with the same salinity and pH levels. Exuviae and dead larvae were preserved in 5% formalin. Temporary slides were also made using glycerin plus 5% formalin (3:1). The specimens were dissected with a tungsten needle using a binocular microscope (Ogawa Seiki) with 4 x 10 magnification. The illustrations were made with the help of a Olympus BH2 microscope (magnifications 1.25 x 4, 10, 20 and 40) with Nomarski interference contrast and a camera lucida attachment. Measurements of each stage were made with the aid of a micrometer. The total length (TL) was determined by adding the carapace length (CL), measured from the tip of the rostral spine to the posterior midpoint of the carapace, and abdominal length was measured from the centre of the second abdominal somite to the midposterior margin of the telson. Measurements are in millimetres.

The spent female and remaining larvae were preserved and are stored in the Marine Reference Collection and Resource Centre (MRCC) (Cat. No. BRAC. 705).

Results

Zoea I (Figures 1a - I).

Size- CL = 0.55-0.62 mm, TL = 1.20-1.48 mm (5 specimens examined). Duration - 4 days.

Table. Morphological characters of *Menaethiops bicornis* Alcock, 1895 zoea I and II.

Characters	Zoea I	Zoea II
	CL = 0.55-0.62 mm TL = 1.20-1.48 mm Duration - 4 days	CL = 0.71-1.01 mm TL = 1.79-1.95 mm Duration - 3 days (died)
Carapace:	posterolateral margin bears 5 + 5 setules	posterolateral margin bears 10 + 10 setules
Rostrum:	very small	further developed
Eyes:	sessile	stalked
Antennule:		
aesthetascs	4	6
setae	1	absent
Antenna:		
protopod	1/5 distal end spinulate	no change
exopod	3 cuspidate setae	"
endopod	reaching up to 1/4 of exopod	reaching nearly 1/2 of exopod
Mandible:		
palp	absent	present
Maxillule:		
setae:		
coxal endite	8	6
basial endite	6	10
endopod	5	no change
Maxilla:		
setae:		
coxal endite	7	6
basial endite	9	10
endopod	5	no change
scaphognathite	10	17
Maxilliped I:		
setae:		
coxa	absent	no change
basis	9	"
endopod	13(3,2,1,2,1 + 4)	"
exopod	4	6
Maxilliped II:		
setae:		
coxa	absent	no change
basis	3	"
endopod	3 (0,1,2 + 2)	"
exopod	4	6
Pereiopods I-V:	rudimentary	buds more developed
Pleopods:	absent	rudimentary
Telson:		
furca:		
lateral spine	1 pair	no change
posterior processes	3 + 3	"

Carapace (Figures 1a, b) - Dorsal spine curved backwards; rostral spine small; posterolateral margin bears 5 + 5 setules. Eyes sessile.

Antennule (Figure 1c) - Uniramous with 4 terminal aesthetascs and 1 seta.

Antenna (Figure 1d) - Protopod developed, distally 1/5 spinous process with spinulate; exopod with 3 terminal cuspidate setae; endopod rudimentary, reaching up to 1/4 of spinous process proximally.

Mandible (Figure 1e) - Incisor and molar processes well developed, palp absent.

Maxillule (Figure 1f) - Coxal endite with 8 setae; basial endite with 3 cuspidate and 3 plumodenticulate setae; endopod 2-segmented, with 1 and 4 setae from proximal to distal segments, respectively.

Maxilla (Figure 1g) - Coxal and basial endite bilobed with 3 + 4 and 5 + 4 setae from proximal to distal lobes, respectively; endopod with 5 setae; scaphognathite with



Figure 1. *Menaethiops bicornis* Alcock, 1895. Zoea I: a, lateral view; b, dorsofrontal view; c, antennule; d, antenna; e, mandible; f, maxillule; g, maxilla; h-j, maxillipeds I-III; k, pereopods I-V; l, abdomen with telson, dorsal view.

10 marginal plumose setae, and terminates posteriorly in a plumose process.

Maxilliped I (Figure 1h) - Coxa without setae; basis with 9 setae on median margin; endopod 5-segmented with 3,2,1,2,1 + 4 setae from proximal to distal segments, respectively; exopod with 4 terminal natatory plumose setae.

Maxilliped II (Figure 1i) - Coxa without setae; basis with 3 setae on median margin; endopod 3-segmented with 0,1,2 + 2 setae from proximal to distal segments, respectively; exopod with 4 terminal natatory plumose setae.

Maxilliped III (Figure 1j) - Biramous, rudimentary.

Pereiopods I-V (Figure 1k) - Rudimentary.

Abdomen (Figure 1l) - Five somites, each somite with a pair of fine setae on its middorsal surface; somite 2 with a pair of forwardly directed curved dorsolateral processes; somites 3-5 with developed posterolateral processes.

Telson (Figure 1l) - Bifurcated; more than half of the furca covered with fine spinules and 1 pair of lateral spines; inner posterior margin with 3 pairs of spinulate setae.

Zoea II (Figures 2a- l).

Size - CL = 0.71-1.01 mm, TL = 1.79-1.95 mm (5 specimens examined). Duration - Died within 3 days.

Carapace (Figures 2a, b) - Slight increase in size from previous stage, rostral spine more developed, posterior margin bears 10 + 10 setae. Eyes stalked.

Antennule (Figure 2c) - Biramous, outer ramus with 6 aesthetascs, inner ramus rudimentary.

Antenna (Figure 2d) - Unchanged, except for endopod increase in size.

Mandible (Figure 2e) - Mandibular palp rudimentary.

Maxillule (Figure 2f) - Coxal endite with 6 setae; basal endite with 6 cuspidate and 3 + 1 plumodenticulate setae; endopod unchanged.

Maxilla (Figure 2g) - Coxal and basal endite bilobed with 3 + 3 and 5 + 5 setae from proximal to distal lobes, respectively; endopod unchanged; scaphognathite with 17 marginal plumose setae.

Maxilliped I (Figure 2h) - Coxa, basis and endopod unchanged; exopod with 6 terminal natatory plumose setae.

Maxilliped II (Figure 2i) - Coxa, basis and endopod unchanged; exopod with 6 terminal natatory plumose setae.

Maxilliped III (Figure 2j) - Biramous, rudimentary, little developed.

Pereiopods I-V (Figure 2k) - Buds further developed.

Abdomen (Figure 2l) - Six somites; pleopod buds present.

Telson (Figure 2l) - Unchanged.

Concluding Remarks

The genus *Menaethiops* is represented by 3 species, *M. bicornis*, *M. nodulosus* and *M. gadaniensis*, in Pakistani waters (Kazmi, 2003). *M. nodulosus* was reared and described by Ghory and Siddiqui (2002), through all the larval stages, 1 prezoal, 2 zoeal and 1 megalopal stages and *M. bicornis* was reared through 2 zoeal stages: according to Rice (1980), "all majid crabs are distinguishable from the other higher brachyurans in having only 2 zoeal stages". This is also observed in Pakistani majid crabs. The zoeae of *M. bicornis* can be differentiated from those of *M. nodulosus* through setal counts. The zoeal morphology of *M. bicornis* is very close to that of *M. nodulosus*, although some setal differences are noted, such as the maxillule of zoea I of *M. bicornis* has 8 setae on the coxal endite, the basis has 3 + 3 setae and the endopod has 1,4 setae, where as in *M. nodulosus* the coxal endite has 7 setae, the basis has 3 + 4 setae and the endopod has 1,1 + 4 setae. In the case of the maxilla of *M. bicornis*, the coxal endite has 3 + 4 setae, the basis has 5 + 4 setae and the scaphognathite 10 setae, but in the case of *M. nodulosus* the coxal endite has 4 + 4 setae, the basis 5 + 5 and the scaphognathite 9 setae. The differences in zoea II stages in both species are as follows: the antennular seta is absent in *M. bicornis* but is present in *M. nodulosus*. The maxillule of *M. bicornis* has 6 setae on the coxal endite and 6 + 3 + 1 setae on the basis and the endopod has 1,4 setae, where as in *M. nodulosus* the coxal endite has 8 + 2 setae, the basis has 5 + 5 + 1 setae and the endopod has 1,1 + 4 setae. In the case of the maxilla of *M. bicornis* the coxal endite has 3 + 3 setae and the scaphognathite has 17 setae, and in *M. nodulosus* the coxal endite has 4 + 4 setae and the scaphognathite has 17-19 setae. The basis of the first maxilliped of *M.*



Figure 2. *Menaethiops bicornis* Alcock, 1895. Zoea II: a, lateral view; b, dorsofrontal view; c, antennule; d, antenna; e, mandible; f, maxillule; g, maxilla; h-j, maxillipeds I-III; k, pereopods I-V; l, abdomen with telson, dorsal view.

bicornis has 9 (2,2,2,3) setae and the endopod has 13 (3,2,1,2,1 + 4) setae, and the basis of *M. nodulosus* has 8 (2,2,2,2) setae and the endopod has 12 (3,2,1,2,4) setae.

The present study is based on 2 zoeal stages; it is hoped that the megalopal study will be completed in the near future, along with the remaining species, *M. gadaniensis*. This study will be useful in confirming the

taxonomic status of the species and the larvae present in the natural environment as zooplankton.

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