

The first zoeal stage of *Parthenope macrochelos* (Herbst, 1790) hatched in the laboratory (Crustacea: Brachyura: Parthenopidae)*

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SUMMARY: The first zoeal stage of the parthenopid crab *Parthenope macrochelos* is described and illustrated from laboratory-hatched material obtained from an ovigerous crab captured in the western Mediterranean. The first larva of *P. macrochelos* possesses all the characters as diagnostic of the Parthenopidae and some additional features, including a seta on the basal segment of the endopod of the maxillule and a well developed lateral spine on the telson forks. The present stage is compared with those previously described from other species of the genus *Parthenope*.

Key words: Crustacea, Brachyura, Parthenopidae, *Parthenope macrochelos*, first stage zoea, western Mediterranean.

INTRODUCTION

Parthenope macrochelos (Herbst, 1790) is a crab species whose distribution area encompasses the whole Mediterranean (García-Raso, 1984, 1996; Noël, 1992; Števcic and Galil, 1994) and is phylogenetically very close to *Parthenope notialis* Manning and Holthuis, 1981 from tropical West Africa (Manning and Holthuis, 1981). The species is rare throughout most of its distribution range and is known to inhabit sandy-muddy bottoms at depths between 18 and 370 m (Zariquiey-Álvarez, 1968; Abelló *et al.* 1988; Noël, 1992). Little is known about the biology and ecology of the species. Only scattered data are available, especially on morphometrics (Cau *et al.* 1981) and occurrence of ovigerous females (Zariquiey-Álvarez, 1968; García-Raso, 1984).

Data on larval morphology or ecology of the family is also very scarce. For instance, Bourdillon-Casanova (1960) and Heegaard (1963) described the reared first and second zoeal stages of *Parthenope massena*, while the first zoeae of *Parthenope valida* De Haan and *Parthenope angulifrons* Latreille were described respectively by Aikawa (1937) and Heegaard (1963). Thiriot (1973) described five zoeal stages and a megalopa collected from the plankton which were attributed to *P. massena*, and a first zoeal stage of *Heterocrypta maltzami* from laboratory-reared material obtained from an ovigerous female. Rice and Williamson (1977) and Paula (1987) described a number of plankton zoeae attributed to *P. massena* and other unidentified parthenopid species. There is only one published account of the complete development of a parthenopid crab based on reared material: *Parthenope serrata* by Yang (1971).

*Received October 23, 1998. Accepted January 29, 1999.

The present paper describes the morphology of the first zoeal stage of *Parthenope macrochelos* and compares its larval features with those known for other species of the genus and the family.

MATERIAL AND METHODS

An ovigerous female *Parthenope macrochelos*, 49 mm carapace width, with eggs in an advanced stage of development, was collected by trawling on muddy bottoms off Alacant (38° 14.9 N, 0° 18.0 E, western Mediterranean) from a depth of 450-453 m on 18th May 1998. Sampling was performed with-

in the frame of the EU demersal fisheries research program "MEDITS" on board B/O "Cornide de Saavedra".

The crab was placed in an aquarium (60 x 35 x 30 cm) on board the ship containing well-aerated sea water at a salinity of approximately 37.5 ‰ and kept at 17 ± 1°C. The crab was transported to the laboratory and kept at 15 ± 1°C. Hatching took place on 25th May 1998. The first zoeae were placed in both mass culture and compartmented boxes and freshly hatched *Artemia* nauplii were provided. Specimens were preserved in 70° ethanol. A high mortality followed and no larvae reached the second zoeal stage.

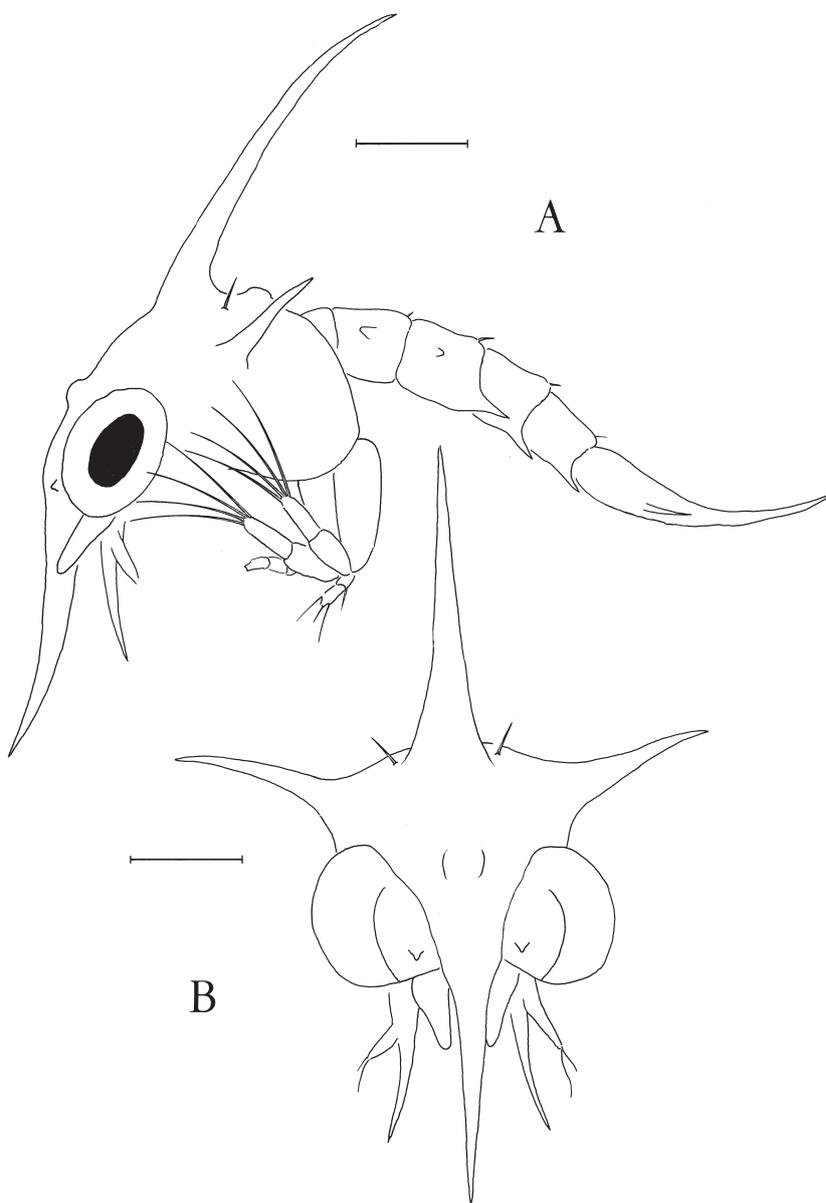


FIG. 1. – *Parthenope macrochelos*, first zoea. (A) Lateral view; (B) frontal view. Scale bars = 0.2 mm.

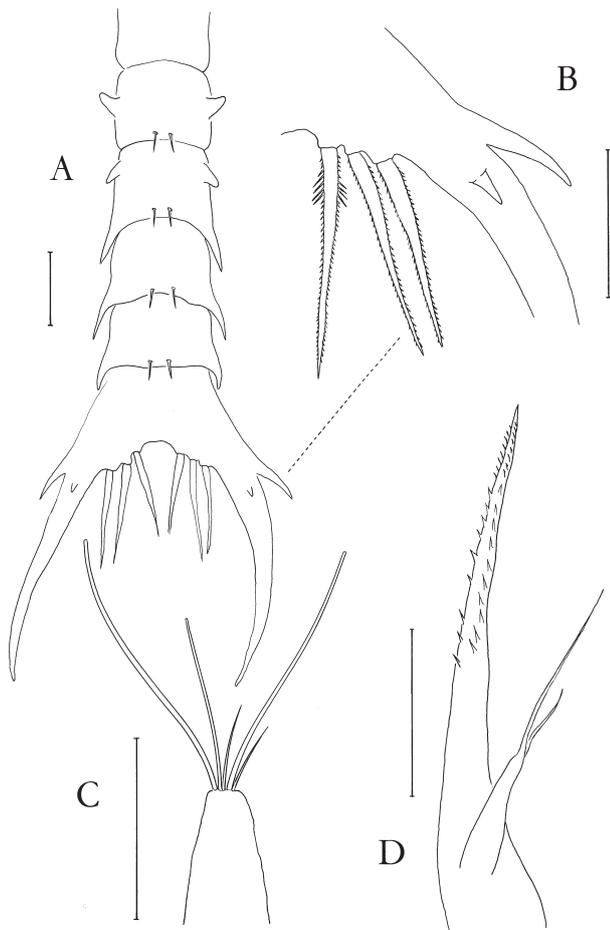


FIG. 2. – *Parthenope macrochelos*, first zoea. (A) Abdomen, dorsal view; (B) half of telson, enlarged; (C) antennule; (D) antenna. Scale bars= 0.1 mm.

An Olympus phase contrast microscope was used in the dissection and observation of the setal formula of the appendages. Measurements were taken with a Wild binocular microscope equipped with an ocular micrometer, and are based on measurements of five individuals. All drawings were made with the aid of a *camera lucida*. The following measurements were taken: distance from base to tip of dorsal spine (DS); distance between tips of dorsal and rostral spines (TT); carapace length, from between eyes to the postero-lateral margin of the carapace (CL); total width, distance between the tips of lateral spines (TW); length of the dorsal spine of the telson furca (TDS); length of the lateral spine of the telson furca (TLS); length of the furca measured from line across base of dorsal spine to furcal tip (TF). Larval description followed the basic malacostracan body pattern (Clark *et al.*, 1998).

The adult female crab of the present study is deposited in the Biological Reference Collections of

the Institut de Ciències del Mar (CSIC) in Barcelona (Registration Number: ICMD 406/1998).

RESULTS

Size. DS= 0.56-0.61mm; CL= 0.49-0.52 mm; TT= 1.40-1.45 mm; TW= 0.9 mm.

Carapace (Figs 1A, 1B). Dorsal, rostral and lateral spines well developed; dorsal spine slightly curved posteriorly; rostral spine slightly curved upwards; without subsidiary spinules on the carapace spines. Frontomedian and posterodorsal tubercles present and well-developed. One pair of posterodorsal setae; without setae on ventral margin. Eyes sessile with small papillae.

Antennule (Fig. 2C). Uniramous; endopod absent; exopod unsegmented with 3 terminal aesthetascs and two minute setae.

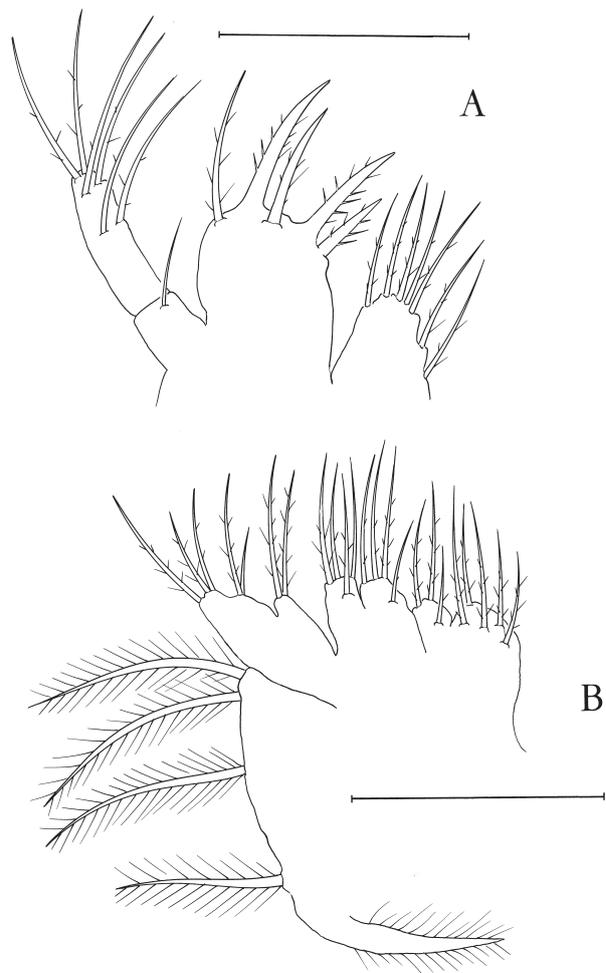


FIG. 3. – *Parthenope macrochelos*, first zoea. (A) Maxillule; (B) maxilla. Scale bars= 0.1 mm.

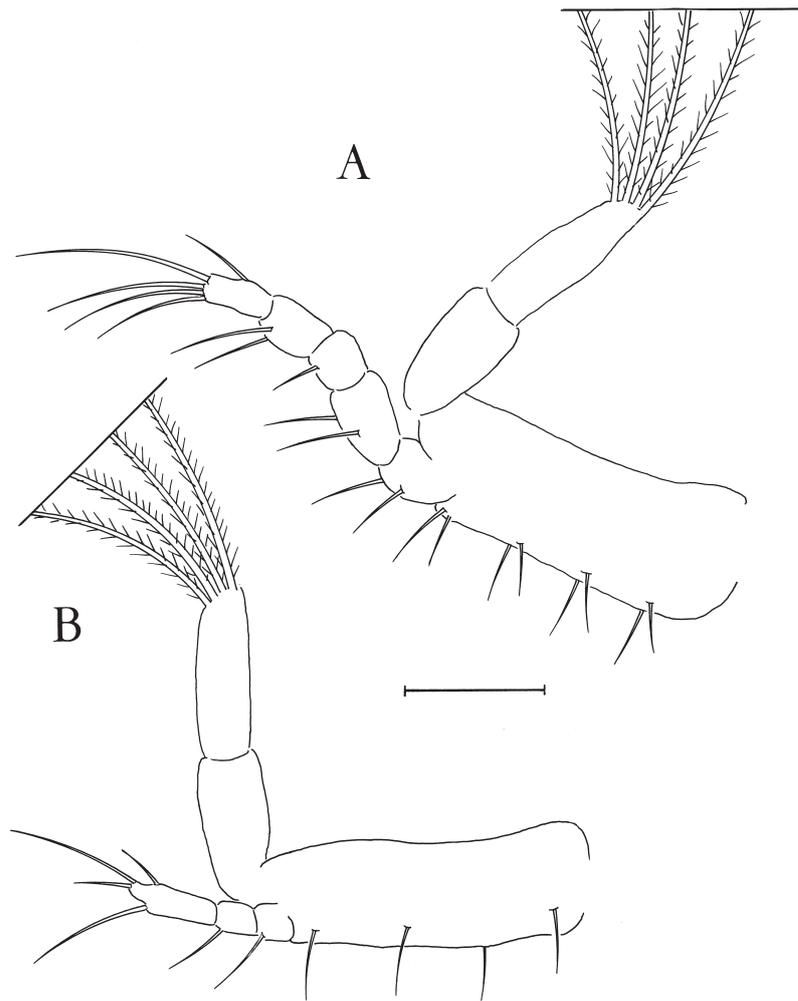


FIG. 4. – *Parthenope macrochelos*, first zoea. (A) First maxilliped; (B) second maxilliped. Scale bars= 0.1 mm.

Antenna (Fig. 2D). Endopod absent; exopod less than half the length of the spinous process, with one long and one short setae; protopodal process distally spinulate.

Mandible. Incisor and molar processes well developed; mandibular palp absent.

Maxillule (Fig. 3A). Coxal endite with 7 setae; basal endite with 5 setae; endopod 2-segmented with 1 seta on the basal and 6 (2 subterminal + 4 terminal) setae on the distal segment.

Maxilla (Fig. 3B). Coxal endite bilobed with 5+3 setae; basal endite bilobed with 4+4 setae; endopod bilobed with 2 + 5 (2 subterminal + 3 terminal) setae; exopod (scaphognathite) margin with 4 setae and a distal stout process.

First maxilliped (Fig. 4A). Basis with 8 setae arranged 2,2,2,2; endopod 5-segmented with 2,2,1,2,5 (1 subterminal + 4 terminal) setae, respectively; exopod incompletely 2-segmented,

distal segment with 4 long terminal plumose natatory setae.

Second maxilliped (Fig. 4B). Basis with 4 setae; endopod 3-segmented with 1,1,4 (2 subterminal + 2 terminal) setae, respectively; exopod incipiently 2-segmented, distal segment with 4 long terminal plumose natatory setae.

Abdomen (Figs. 1A, 2A). Five somites; somites 2 and 3 with 1 pair of lateral processes, those on the third somite smaller; postero-lateral processes on somites 3-5; somites 2-5 with 1 pair of postero-dorsal setae; pleopods absent.

Telson (Figs. 2A, 2B). Telson lunate; telson forks smooth, with one lateral and one dorsal spines (TLS/TDS ratio 2.6-3.1); TF/TD ratio 11.1-11.2; inner margin with 3 pairs of plumodenticulate setae, separated by a shallow median notch; setules of the base of the inner pair longer than the rest.

TABLE 1. – Morphological differences in the first zoea of five species of the genus *Parthenope*. S= setae; A= aesthetascs.

Feature Reference	<i>P. macrochelos</i> Present work	<i>P. serrata</i> Yang (1971)	<i>P. valida</i> Aikawa (1937)	<i>P. massena</i> Thiriot (1973)	<i>P. massena</i> Heegaard (1963)	<i>P. angulifrons</i> Heegaard (1963)
CL (mm)	0.50	0.37	0.49	0.40	0.40	0.40
Antennule (A+S)	3+2	2+1	?	2+1	2	2
Maxillule:						
Endopod (S)	6+1	6+1	6+1	6+0	6+0	6+0
Coxa (S)	7	6	5	6	7	8?
Telson fork:						
Dorsal spine	1	1	1	1	1	1
Lateral spine	well developed	0	0	0	thin	thin

DISCUSSION

Several authors remark the resemblance between the zoeae of parthenopid crabs and those of some cyclometopous families and the important differences with the zoeae of the Majidae (Yang, 1971; Rice, 1980; Ingle, 1992).

The first zoea of *Parthenope macrochelos* possesses all the characters listed by Yang (1971) as diagnostic of the Parthenopidae. However, several additional features can help to clearly differentiate the first larval stage of *P. macrochelos* from the zoeae of other described Parthenopidae species (Table 1). As a first important characteristic, the first zoea of *P. macrochelos* has a well developed lateral spine on each telson fork. Other described parthenopid larvae have telson forks armed with a single small dorsal spine (which is also present in *P. macrochelos*) and, sometimes, with a very fine lateral spine (Aikawa, 1937; Heegaard, 1963; Yang, 1971; Thiriot, 1973), with the exception of two larval forms described by Rice and Williamson (1977) from plankton samples. One of these larval forms (coded as ASM 18) has a well developed lateral spine in addition to the dorsal in its first and second stage, like in *P. macrochelos*, and a very small second lateral spine only in the first stage, while the larval form coded AMS 19, which was identified as a third zoeal stage, bears one long and one short lateral fork spines.

Paula (1987) described from the plankton a parthenopid from southwestern Portugal (coded S15), which was very similar to the specimens captured by Rice and Williamson (1977) and considered that they belonged to the same species. The larval form coded S14 differs slightly from the accounts of *P. massena* and distinctly from *P. macrochelos*. They could perhaps therefore belong to *Parthenope miersi* (Paula, 1987).

Another interesting feature of the first zoea of *P. macrochelos* is the presence of a seta on the

basal segment of the endopod of the maxillule, which is absent in other described Mediterranean species (Table 1). This feature has only been observed on the first zoea of *Parthenope valida* of the Japan seas (Aikawa, 1937), *Parthenope serrata* of the western Atlantic (Yang, 1971) and in the larval forms ASM 16 and ASM19 of Rice and Williamson (1977).

In addition to the above mentioned differential characteristics, the zoea I of *P. macrochelos* has seven setae on the coxal endite of the maxillule, whereas all the other described species of the genus *Parthenope* have six setae on the coxal endite of the maxillule (Table 1). However, Heegaard (1963) drew seven setae in *P. massena* and eight in *P. angulifrons*, but in the complete description provided by Thiriot (1973), only six setae were recognised in *P. massena*.

The first zoea of *Parthenope macrochelos* can be distinguished from the first zoea of *Heterocrypta maltzami* (the only Mediterranean species of the family which does not belong in the genus *Parthenope*) (Thiriot, 1973) by the presence of a well developed lateral spine on each telson fork (absent in *H. maltzami*), the presence of a seta on the basal segment of the endopod of the maxillule (absent in *H. maltzami*), the setation of the endopod of the maxilla (2+5 on *P. macrochelos*, and 2+4 on *H. maltzami*) and the setation of the endopod of the first maxilliped (2,2,1,2,5 on *P. macrochelos* and 2,2,0,2,5 on *H. maltzami*).

ACKNOWLEDGEMENTS

We wish to thank all participants in the cruise MEDITS_ES-98 on board B/O “Cornide de Saavedra” for their support. This research was performed within the frame of the EU research program “MEDITS” (DG XIV: MED/93/018).

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Scient. ed.: E. Macpherson