Butll. Inst. Cat. Hist. Nat., 67: 39-44. 1999 ISSN: 1133-6889

GEA, FLORA ET FAUNA

Morphology of the first zoea of the Shamefaced Crab *Calappa granulata* (Brachyura, Calappidae) obtained in the laboratory

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Rebut: 27.02.98
Acceptat: 02.06.99

Abstract

The first zoeal stage of the calappid crab *Calappa granulata* is described and illustrated from laboratory-reared material obtained from an ovigerous female captured in the western Mediterranean. The morphology of this larval stage is clearly different from previous descriptions from plankton-collected specimens attributed to this species. The present stage is compared with those previously described from other species of the genus *Calappa.*

KEYWORDS: Crustacea, Brachyura, Calappidae, *Calappa granulata,* larval development, zoea.

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Resum

Morfologia del primer estadi larvari del cranc *Calappa granulata* (Brachyura, Calappidae) obtingut al laboratori

En aquest treball es descriu el primer estadi larvari del pessic, el cranc *Calappa granulata.* Les larves es varen obtenir a partir d'una femella ovígera capturada a la Mediterrània occidental. La morfologia de la primera zoea és clarament diferent a la d'anteriors descripcions realitzades amb exemplars obtinguts al plàncton, i que varen ser atribuïts a *C. granulata.* La primera zoea d'aquesta espècie es compara amb la d'altres espècies descrites del gènere *Calappa.*

MOTS CLAU: Crustacea, Brachyura, Calappidae, *Calappa granulata,* desenvolupament larvari, zoea.

Resumen

Morfología del la primera zoea del cangrejo *Calappa granulata* (Brachyura, Calappidae) obtenida en el laboratorio

En el presente trabajo se describe el primer estadio larvario del cangrejo *Calappa granulata.* Las larvas

se obtuvieron a partir de una hembra ovígera capturada en el Mediterráneo occidental. La morfología de la primera zoea es claramente diferente a la de anteriores descripciones realizadas a partir de ejemplares obtenidos en el plancton, y que fueron atribuidos a *C. granulata.* La primera zoea de esta especie es comparada con la de otras especies descritas del género *Calappa.*

PALABRAS CLAVE: Crustacea, Brachyura, Calappidae, *Calappa granulata,* desarrollo larvario, zoea.

Introduction

Knowledge of the larval stages of calappid crabs is limited and fragmentary (Rice, 1980; Stevcic, 1983). There are only a few papers concerning the larval development of calappid crabs and most of them deal only with the zoeal or prezoeal stages (Lebour, 1944, 1959; Raja Bai, 1959; Motoh, 1977; Seridji, 1993; González-Gordillo, 1994; Taishaku & Konishi, 1995). Most of the authors who have tried to rear larvae of crabs of this family have found serious difficulties in rearing them, probably related to feeding (Taishaku & Konishi, 1995).

Calappa granulata (Linnaeus, 1758) is a sublittoral species known from the Mediterranean Sea and eastern Atlantic waters from Portugal to Mauritania, including the Azores, Madeira, and the Cape Verde Islands (Zariquiey-Álvarez, 1968; Manning & Holthuis 1981). It lives on sandy mud and muddy detritus at depths of between 13 and 400-700 m (Manning & Holthuis, 1981; Abelló *et al.,* 1988; García-Raso, 1984).

The prezoeal stage of *Calappa granulata* was obtained in the laboratory and described by González-Gordillo (1994). Seridgi (1993) described and illustrated a first stage zoea from Mediterranean plankton samples collected off the Algerian coast that was attributed to the family Calappidae and, with some doubts, to the species *C. granulata.* Guerao *et al.* (submitted) described the megalopa and first juvenile stage of *C. granulata* obtained from a megalopa collected in a plankton sample and subsequently reared in the laboratory.

The present paper aims to describe the morphology of the first zoeal stage of *Calappa granulata* and to compare its larval features with those known for other species of the genus.

Material and methods

An ovigerous female *Calappa granulata*, of 65.9 mm carapace width, with eggs in an early stage of development, was collected by trawling on muddy bottoms off Cartagena (37°30.65 N. 1°09.49 W. western Mediterranean) from a depth of 184-187 m on 19th May 1997. Sampling was performed within the framework of the EU demersal fisheries research program «MEDITS» on board the B/O «Cornide de Saavedra».

The crab was placed in an aquarium (60 × 35 × 30 cm) on board the ship containing well-aerated sea water at a salinity of approx. 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 23rd June 1997. Freshly hatched *Artemia nauplii* were provided. First zoeae were preserved in 7 % buffered formalin. A high mortality followed and no larvae reached the second zoeal stage.

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 a micrometer eyepiece, 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

TABLE 1. Morphological differences between the first stage zoeae of *Calappa granulata, C. japonica, C. gallus, C. lophos,* and *C. philargius.* Abbreviations: S= setae, A= aesthetascs, ND= no data.

Diferències morfològiques en el primer estadi larvari de *Calappa granulata, C. japonica, C. gallus, C. lophos,* i *C. philargius.*

Species Reference	*C. japonica* Taishaku & Konishi (1995)	*C. gallus* Taishaku & Konishi (1995)	*C. lophos* Terada (1987) Raja Bai (1959)*	*C. philargius* Terada (1987) Motoh (1977)*	*C. granulata* Present paper	*C. granulata?* Seridji (1993)
Morphometrics:						
DS (mm)	?	?	0.466*	?	0.70-0.77	0.45
TL (mm)	1.48-1.78	1.28-1.46	0.95 1.066*	0.93 1.20-1.30*	1.70-1.78	2.20
LS (mm)	1.02-1.18	0.84-0.98	?	0.72-0.75*	1.03-1.10	?
Antennule (A+S)	4	4	3	3? 2+1*	4	?
Maxillule:						
endopod (S)	0, 6	0, 6	0, 6	0, 6 1, 4*	0, 6	1, 6
basis (S)	5	5	5	5 6*	5	5
Maxilla:						
coxa (S)	5+3	5+3	5+3	5+3 5+2*	5+3	5+4
scaphognathite (S)	4	4	4	4	4	?
Maxilliped 1:						
endopod (S)	2, 1, 0, 2, 5	2, 1, 0, 2, 5	2, 1, 0, 2, 5	2, 1, 0, 2, 5	2, 1, 0, 2, 5	3, 2, 1, 2, 5
basis (S)	2, 2, 2, 2	2, 2, 2, 2	2, 2, 2, 2	2, 2, 2, 2	2, 2, 2, 2	1, 1, 2, 3
Maxilliped 2:						
endopod (S)	1, 1, 3	1, 1, 3	1, 1, 3	1, 1, 3	1, 1, 3	1, 1, 5

tips of dorsal and rostral spines (TT); carapace length, from between the eyes to the postero-lateral margin of the carapace (CL); total width, the distance between the tips of the lateral spines (TW).

The adult female crab of the present study was deposited in the Biological Reference Collections of the Institut de Ciències del Mar (CSIC) in Barcelona (Registration Number: ICMD 086/1998).

Results

Size. (DS) 0.70-0.77 mm; (CL) 0.55 mm; (TL) 1.70-1.78 mm; (TLW) 1.03-1.10 mm.

Carapace (Fig. 1 A,B,C,D). Dorsal, rostral and lateral spines well developed; dorsal spine slightly curved; rostral spine slightly curved with 4-6 spinules on its surface (Fig. ID); lateral spines slightly curved with 4-6 spinules (Fig. 1C). One minute seta between the bases of the dorsal and lateral spines.

Antennule (Fig. 1G). Uniramous; endopod absent; exopod unsegmented with 3 terminal aesthetascs and 1 seta.

Antenna (Fig. 1H). Exopod (less than half the length of the spinous process) with one long and one short setae; spinous process with small spinules on the surface of the distal half.

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

Maxillule (Fig. 2A). Coxal endite with 7 setae; basal endite with 5 setae; endopod 2-segmented, the distal segment with 4 terminal and 2 sub-terminal setae.

Maxilla (Fig. 2B). Coxal endite bilobed with 5 + 3 setae; basal endite bilobed with 4 + 4 setae; endopod bilobed with 2 + 5 terminal setae; exopod (scaphognathite) margin with 4 setae and 1 distal stout process.

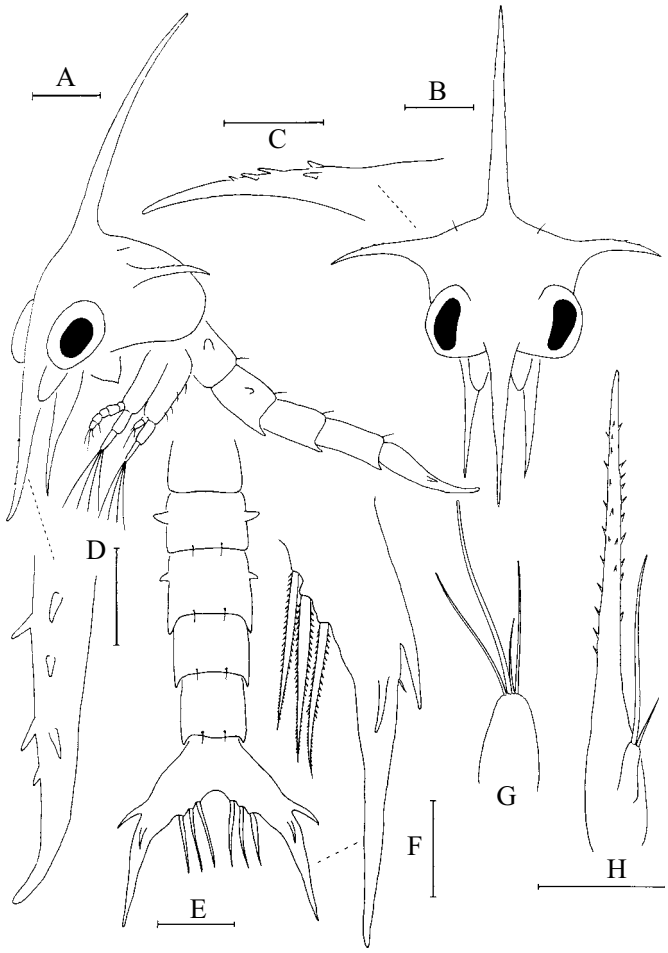

FIGURE 1. *Calappa granulata,* first zoea. (A) lateral view; (B) frontal view; (C) dorsal spine; (D) rostral spine; (E) abdomen, dorsal view; (F) half of telson, enlarged; (G) antennule; (H) antenna. Scale for A, B and E = 0.2 mm; scale for C, D and F-H = 0.1 mm.

Calappa granulata, primera zoea. (A) visió lateral; (B) visió frontal; (C) espina dorsal; (D) espina rostral; (E) abdomen, visió dorsal; (F) ampliació del telson; (G) antènula; (H) antena. Escala de A, B i E = 0,2 mm; escala de C, D i F-H = 0,1 mm.

First maxilliped (Fig. 2C). Basis with 8 (2,2,2,2) setae; endopod 5-segmented with 2,1,0,2,4 + 1 setae, respectively; exopod incompletely 2-segmented, the distal segment with 4 long terminal plumose natatory setae.

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

Abdomen (Fig. 1A, E). 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.

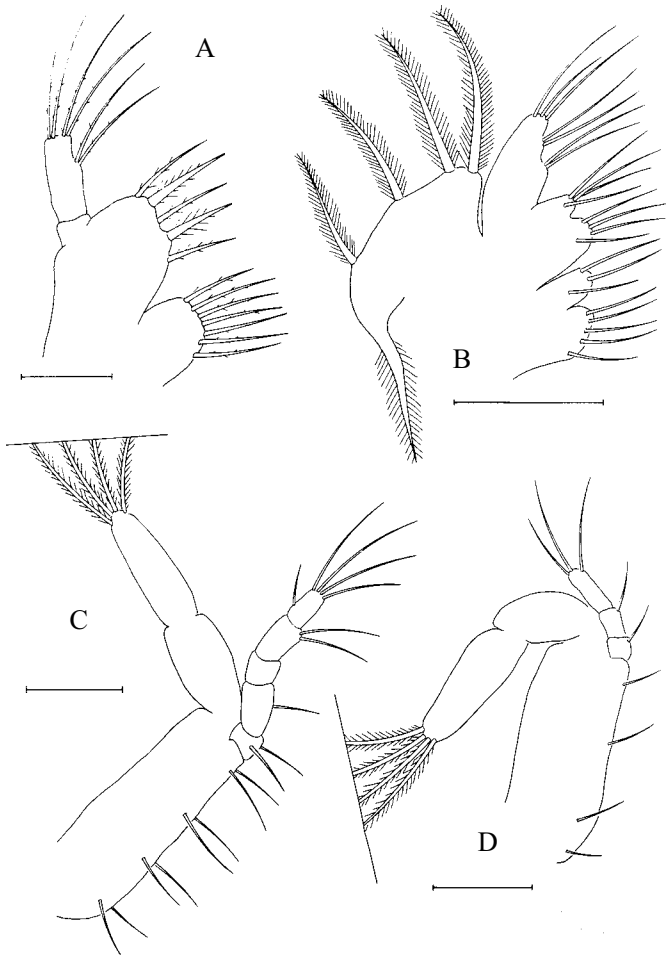

FIGURE 2. *Calappa granulata,* first zoea. (A) Maxillule; (B) maxilla; (C) 1st maxilliped; (D) 2nd maxilliped. Scale for A = 0.05 mm; scale for B-D = 0.1 mm.

Calappa granulata, primera zoea. (A) Maxil·lula; (B) maxil·la; (C) lr maxil·liped; (D) 2n maxil·liped. Escala d'A = 0,05 mm; escala de B-D = 0,1 mm.

Telson (Fig. 1E, F). Each telson fork with a well developed dorsal and lateral spine, and a very minute and vestigial lateral spine observed in most of, but not all, the zoeae studied; inner margin with 3 pairs of plumodenticulate setae; posterior margin with 3 pairs of plumodenticulate setae with the setules smaller on the distal part.

Discussion

The morphology of the first zoea of *Calappa granulata* is very similar to that of other species of the genus that have been described (see Table 1), but differs considerably from the larva described by Seridji (1993). Thus, the zoea I described in the present pa-

per does not bear denticles or spicules on the dorsal spine or on the carapace. Also, the second lateral spine of the telson is vestigial and very minute in *C. granulata.* The present zoeae are also smaller (TL: 1.70-1.78 mm vs. 2.20 mm). Other important differences involve the setation of the appendages (Table 1), such as the basal segment of the endopod of the maxillule, which lacks the seta figured by Seridji, which is also lacking in all the rest of the first zoeae of the genus *Calappa* described to date. The larva described by Seridji also differs considerably in the setation of the maxillipeds and of the coxa of the maxilla (Table 1). All these differences lead us to conclude that Seridji's larva most probably does not belong to the genus *Calappa*.

Acknowledgements

We wish to thank all the participants in the cruise MEDITS_ES-97 on board the B/O «Cornide de Saavedra», and especially Drs. L. Gil de Sola and D. Lloris, for their support. This piece of research was carried out within the framework of the EU research program «MEDITS» (DG XIV: MED/93/018).

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