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First zoeal stage of Pachygrapsus crassipes Randall*

by

Carlos R. Villalobos**

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Pachygrapsus crassipes is a common crab inhabiting the rocky areas of the northern Pacific coast of the United States. It was described first by RANDALL (11) in 1839, but a better morphological description was given later by RATHBUN (12).

Members of this widely distributed genus are usually found running around on rocky shores or in tidepools. GROSS (6) has pointed out that *P. crassipes* is a crab of semiterrestrial habits, most often found in exposed rocky shore situations, and occasionally in muddy burrows in protected bays.

P. crassipes may be considered a long-spawning species and although most adult females become ovigerous between April and September, there is some evidence that berried females occur in all months (RICKETTS & CALVIN, 14; HIATT, 8). Females carry their eggs on the underside of the recurved abdomen, attached to the fine endopoditic setae of the four pairs of pleopods located on the second to fifth abdominal metameres.

Information concerning the larval stages of Brachyura and their development is still very limited. The earliest works in the 19th century are mainly descriptions of the different stages in the life cycle.

However, these stages were not recognized as larvae of known animals and were usually assigned to new genera. Thus, the first decapod larva, a *Cancer germanus* megalops, described by Linnaeus in 1767 was given the name of *Megalopa armata* by LEACH (10). BOSC (3) assigned an assemblage of similar larval forms characteristic of decapods to the genus *Zoea* (COFFIN, 4).

Studies on the life cycle of members of the family Grapsidae are even more limited. The majority of important studies belongs to the 20th century,

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** Present address: Departamento de Biología, Universidad de Costa Rica.

particularly those by AIKAWA (1, 2), RATHBUN (13) and COSTLOW, BOOKHOUT and MONROE (5) on *Sesarma cinereum*. Also important are the works by HYMAN (9), HART (7) and HIATT (8).

MATERIAL AND METHODS

Gravid *Pachygrapsus crassipes* females were collected in a rocky area at the University of Southern California Marine Laboratory, Santa Catalina Island, Los Angeles County, California, as well as at Scotchman Cove, Orange County, approximately 10 miles south of Newport Beach.

The females were placed in individual 11½" x 7" x 5" plastic containers placed in an Ambi-lo variable temperature cabinet at 18.5 C., ambient temperature at both collecting sites. Two titan aquarium air pumps were placed in the cabinet in order to provide a supply of air to each container. Sea water was brought periodically from Scotchman Cove and filtered in the laboratory by means of a Millipore Filter using HA 0.45 μ filters. Salinity was adjusted to 30 parts per thousand and the water was changed every three days to eliminate wastes and food particles. An algal mixture of *Ulva, Enteromorpha* and *Pelvetia* was used as a food source. The photoperiod in the cabinet was maintained at 14 hours daylight and 10 hours darkness by means of an automatic timer. The light source was a Sylvania cool, white fluorescent light (F 20T12-CW).

Each morning the plastic containers were checked to determine whether larvae had hatched. If free-swimming zoeae were present, the female was removed and preserved. The larvae were transferred to 9" x 5" x 2" enameled metal trays containing fresh-filtered sea water.

RESULTS

The zoea (Fig. 1) has a well developed carapace, which is produced into a rostral and a dorsal spine. Paired lateral spines are absent. The abdomen is composed of five segments plus the telson. The thoracic complex consists of a pair of large compound eyes, tubular antennules, antennae, bilobed mandibles, two pairs of lamellar maxillae and the first two pairs of maxillipeds. The other thoracic appendages are small knobs posterior to the maxillipeds and covered by the carapace. The dorsal and rostral spines of the first zoea are short and stout. Both pass outward perpendicularly to the long axis of the body.

The abdomen (Fig. 2) is composed of five segments. The first three are rectangular and the last two more or less bicornute. There is a large lateral knob on each side of the second abdominal segment. The third segment shows a smaller lateral knob. The telson is tipically bicornute (Fig. 3), with three internal setae on the median surface of each cornu. The lateral surface is smooth and does not show spines. The antennules (Fig. 4-A) have the usual brachyuran form. They are tubular and conical toward the base, with two long filaments, the aesthetes, and one short non-plumose seta. The antennae (Fig. 4-B) differ completely from those described for other members of the family, e.g., *Sesarma*

and *Hemigrapsus,* in having no distal spines. *P. crassipes* also differs from related species, e.g., *P. marmoratus,* in having no hairs and no exopodite. The antennae are in the form of strong spikes, equal in length to the rostral spine. The maxilulle (Fig. 4-C) has four terminal setae on the distal segment of the endopodite, plus one subterminal and another one on the basal segment. The endite of the basipodite and coxopodite has three plumose setae.

The endopodite of the maxilla (Fig. 4-D) is slightly bilobed and shows one terminal seta on the upper lobe and two on the lower, plus another subterminal one. Eight plumose setae project from the basal endite and seven from the coxal endite. The distal margin of the scaphognathite bears three soft "hairs" plus one on the apical tip.

The endopodite of the first maxilliped (Fig. 4-E) is five-segmented and has setation of 0, 2, 1, 2, 4 (counted from the base to the tip) and the exopodite bears four plumose swimming (large) setae. There are four bristles on the base of the first maxilliped. The three-segmented endopodite of the second maxilliped (Fig. 4-F) has setation of 0, 1, 4 and the exopodite has four plumose swimming setae. There are only two bristles on the base of the second maxilliped.

DISCUSSION

HYMAN (9) found the larvae of the family Grapsidae quite uniform in structure. However, AIKAWA (1), in some Japanese species, found a discrepancy between these and the earlier described types, both in the absence of lateral spines on the carapace and in the length of the antennae. The first laval stage of *P. crassipes* is a good example of this discrepancy. It can be easily distinguished from the first larval stage of *Hemigrapsus* by the absence of lateral spines on the carapace. *Sesarma* and *Planes,* two other members of the family, also lack the lateral spines, however, the first zoea of *P. crassipes* may be distinguished by a straight dorsal spine when compared with that of *Sesarma* which curves greatly posteriorly, and also by the absence of a well developed exopodite of the antennae.

In the first zoea of *Planes,* the distal portions of the antennae, and the lateral surface of each cornu of the telson are covered with minute hairs. In contrast, the surface of both the antennae and the telson of *P. crassipes* are smooth.

Structural differences were also found in related species. Thus, *P. crassipes* may be distinguished from *P. marmoratus* by the absence of hairs and exopodite on the antennae, as well as by some less conspicuous characters, such as the setation of the first and second maxillipeds.

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SUMMARY

Morphological studies on the first zoea of *Pachygrapsus crassipes* (Brachyura: Crustacea) have shown structural differences, primarily concerning the presence or absence of lateral spines on the carapace, the structure of the antennae, and the number and position of the setae, as compared with members of the same family and in particular with *P. marmoratus.*

RESUMEN

Estudios morfológicos en el primer estado larval del cangrejo *Pachygrapsus crassipes* demuestran la existencia de diferencias estructurales, especialmente en relación con la presencia o ausencia de espinas laterales en el caparazón, la estructura de las antenas, y el número y posición de las vellosidades más gruesas (cerdas). Estas diferencias se confirman al comparar a *P. crassipes* con otros miembros de la familia, especialmente con los géneros *Hemigrapsus, Sesarma, Planes* y *P. marmoratus.*

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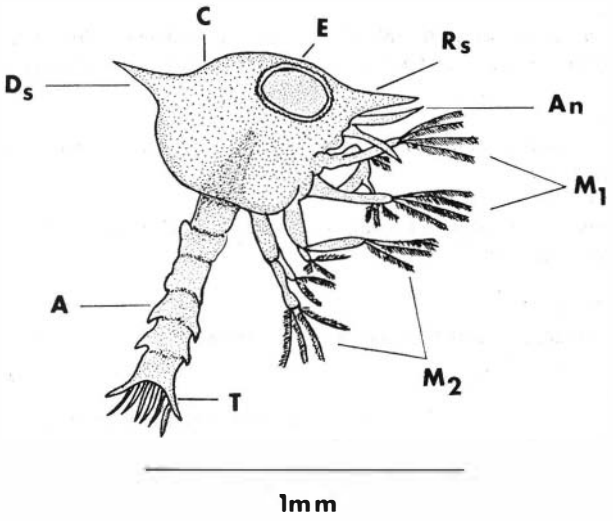
Fig. 1. Lateral view of the first zoea of *P. crassipes.*
C: carapace; E: eyes; Rs: rostral spine; Ds: dorsal spine; A: abdomen; T: telson; M_1: first pair of maxillipeds; M_2: second pair of maxillipeds; An: antennae.

Fig. 2. Ventral view of the abdomen of the first zoeal stage.
S_1: first abdominal somite; K: lateral knobs; T: telson.

Fig. 3. Ventral view of the telson.
Is: internal setae; C: cornu.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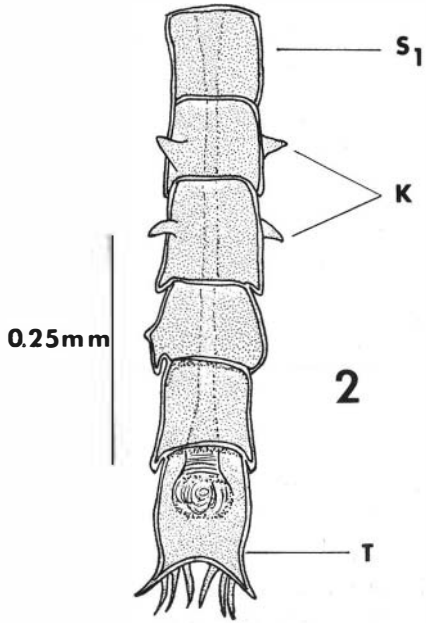
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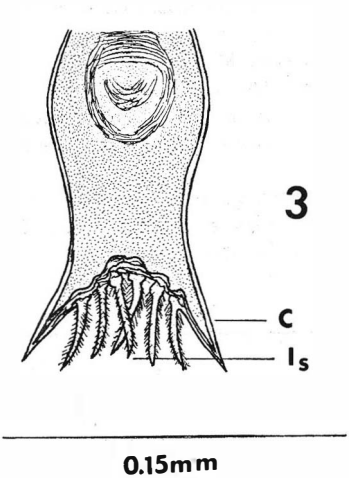
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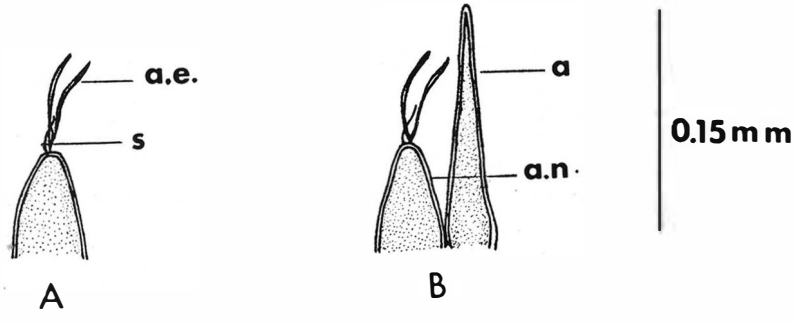
Fig. 4. Morphological characters of the first zoeal stage of *P. crassipes*.

A: Antennule: a.e. aesthetes; s. seta.
B: Antennule-antenna complex: a. antenna; a.n. antennule.
C: Maxilulle: e. endite; b.e.p. basal endite of protopodite; c.e.p. coxal endite of protopodite.
D: Maxilla: e. endopodite; b.e. basal endite; c. e. coxal endite; s.c. scaphognathite.
E: First maxilliped: b. bristles; e. endopodite; e.x. exopodite; s. setae; s.s. swimming setae.
F: Second maxilliped.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