THE POST-LARVAL DEVELOPMENT OF THE SHORE CRAB *OCYPODA PLATYTARSIS*
M. EDWARDS AND *OCYPODA CORDIMANA* DESMAREST

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Received July 14, 1953
*(Communicated by Professor R. V. Seshaiya, F.A.sc.)*

PREVIOUS WORK

In the family Ocypodidae the megalopæ have been described only in the two genera *Uca* and *Ocypoda*. Say (1817) described a new genus and species *Monolepis inermis* which he referred to Macrura though he was aware of its Brachyuran features. Dana (1852) described and figured

**TEXT-FIG. 1.** Ventral view of the cephalothorax of the megalopa of *Ocypoda platytarsis.*
a second species *Monolepis orientalis* from Philippines. Smith (1880) definitely established the identity of the forms described by Say and Dana as the megalopa of *Ocypoda quadrata* after an examination of the young crab within the partially cast skin of one of the megalopæ collected by him at New England and Long Island which buried itself in sand and tried to moult. In 1915 Kemp studied the habits of the megalopæ of *Ocypoda macrocera* in the sandy beach of Ennur near Madras. Rathbun (1924) got a megalopa from Galapagos and identified it as belonging probably to *O. gaudichaudi*. This megalopa was later identified by Crane (1940) as belonging to the genus *Plagusia*. Lebour (1932) referred two megalopæ collected at Philippines provisionally to the family Ocypodidae. Crane (1940) considers one of these as an *Ocypoda*, and the second with seven hairs on the last pleopod and with no hairs between the third and the fourth pair of legs as not an *Ocypoda*. Crane (1940) has also described the zoeæ and megalopæ of *Ocypoda gaudichaudi* Milne Edwards and the megalopa of *O. occidentalis* Stimpson which are different from the megalopa of the common *O. albicans* (Bose) as shown by the number of setæ on the last pleopod.

I. **MEGALOPA AND FIRST CRAB STAGE OF OCYPODA PLATYTARSIS**

(Figs. 1–17)

*Megalopa*

Twelve megalopæ of *Ocypoda platytarsis* were collected on Waltair beach on 12–12–1951 while they were in the act of burrowing into sand during high tide (Fig. 1).

Four of these were placed in separate finger bowls with sand and sea water, and fed on crab muscles, shrimps and mantle pieces of bivalves. Three lived for about 3 to 4 days while the fourth moulted into the first crab stage on 18–12–1951. The megalopa skin broke open at the posterior end of the cephalothorax and the first crab stage emerged. On 29–12–1951 it was killed and preserved.

Subsequently during the period, April to July 1952, fourteen megalopæ were collected. Though attempts were made to rear them, none moulted and all died within a week.

On 12–2–1953 five megalopæ were collected from burrows of about six inches depth and 3/16 inch diameter, about 25 feet away from the sea in the coastal battery region of Vizagapatam. Later many more were collected in burrows in the same region.
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**Colouration.**—Carapace is yellowish-grey or light bluish-grey. The frontal and gastric regions are white or light blue or it may have the same colouration as the rest of the carapace. The lateral and posterior regions of the carapace are either yellow or pale grey. Chelipeds and ambulatory legs are ash or light brown with tiny black chromatophores.

The megalopæ have been observed to undergo changes in colour when kept in the laboratory. These colour changes take place in about 2 to 3 days.

The carapace of the cast skin of the megalopa is 7 mm. in length and 6 mm. in width at the broadest part. The front end of the carapace forms a three-horned rostrum of which the central one is the largest (Fig. 2). The rostrum is deflexed to the antero-ventral side and is therefore not visible dorsally.

The carapace is without pores. In the suborbital region the carapace shows on either side a club-shaped prominence followed by a constriction. The postero-lateral regions of the carapace show on either side an indentation for the reception of the last pair of legs. The lateral margins of the carapace are deep and vertical and serve for the reception of the first, second and third pair of ambulatory legs. Hooks are absent on the ischium of the legs. There is a tuft of hairs between the bases of second and third pair of ambulatory legs—a characteristic feature of the *Ocypoda*. The dactyli of last pair of legs have three long feelers.

**Appendages.**—Eye is well developed, stalked and projecting but without horns.

*First Antenna.*—The first antenna consists of a large basal segment containing the statocyst, and a five-jointed process having two long setæ at the distal end (Fig. 3). The flagellum is given off from the first segment and terminates in two setæ. All the segments are fringed on the inner side with a number of long setæ. The fourth segment has one seta on the outer side.

*Second Antenna* (Fig. 4).—Consists of three basal segments and a flagellum of seven segments. One or two sensory hairs are present on all segments except the proximal basal segment.

*Mandible* is well developed with a cutting process and a palp.

*First Maxilla* (Fig. 5).—It consists of a coxopodite, a basipodite and an endopodite.

*Second Maxilla* (Fig. 6).—Consists of a protopodite, an endopodite and an exopodite. The protopodite is composed of a short coxopodite and
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Figs. 1-9.  Fig. 1. Megalopa of Ocypoda platytarsis, × 10. Fig. 2. Rostrum of O. platytarsis—front view, × 10. Fig. 3. Palp of first antenna of the megalopa of O. platytarsis, × 100. Fig. 4. Second antenna of the megalopa of O. platytarsis, × 15. Fig. 5. First maxilla of the megalopa of O. platytarsis, × 40. Fig. 6. Second maxilla of the megalopa of O. platytarsis, × 40. Fig. 7. First maxillipede of the megalopa of O. platytarsis, × 15. Fig. 8. Second maxillipede of the megalopa of O. platytarsis, × 40. Fig. 9. Third maxillipede of the megalopa of O. platytarsis × 15.

(N.B.—Figures have been reduced to \(1\frac{1}{2}\) the magnification given along with the explanation of figures.)

a distal basipodite; the latter is partially divided into two lobes, fringed with setae. The endopodite is on the outer side of basipodite. The scaphognathite is broad and is fringed with setae at the anterior and posterior margin.

First Maxillipede (Fig. 7).—The protopodite consists of the usual two parts, a coxopodite and a basipodite. The coxopodite and basipodite are clothed with a number of setae. The endopodite and exopodite are armed with setae at the distal ends. The epipodite is well developed.

Second Maxillipede (Fig. 8).—The protopodite is very much reduced. The endopodite is comparatively larger than that of the first maxillipede. It arises from the basipodite and is divided into five parts. The proximal most segment is the basischiopodite. The other segments are meropodite, carpopodite, propodite and dactylopodite. The exopodite and the epipodite are in the same position as in the first maxillipede but the epipodite is much shorter than that of the first maxillipede.

Third Maxillipede.—It is built on the same plan as the second maxillipede (Fig. 9).

The mandible, maxillae and maxillipedes are exactly like those of an adult.

There are a pair of large chelae (Fig. 10) almost of equal size and four pairs of ambulatory legs. The dactylus of the last leg has three long feelers (Fig. 11).

The abdomen consists of seven segments including the telson which is rounded (Fig. 12). Five pairs of pleopods are present. In the last pair, the exopodite has 32 setae (Fig. 13).

The Gill Formula.—Six gills plus three epipodites. The gill of the cheliped is a great gill. The gills are of the same number as in the adult.

First Crab Stage of O. platytarsis (Fig. 14)

On 18–12–1951 the megalopa moulted and the first crab emerged. It was quite large and of carapace length 6·3 mm. and breadth 6·8 mm. (measurements taken on 20–12–1951 when it was killed and preserved). Twelve hours after moulting it was able to lead a normal Ocypoda life. It dug a number of burrows and remained mostly inside one of the burrows.
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Figs. 10-17. Fig. 10. Major cheliped of the megalopa of *O. platytarsis*, × 15. Fig. 11. Last ambulatory leg of the megalopa of *O. platytarsis*, × 15. Fig. 12. Abdomen of the megalopa of *O. platytarsis*, × 15. Fig. 13. Last pleopod of the megalopa of *O. platytarsis*, × 50. Fig. 14. First crab stage of *O. platytarsis* (from the cast skin), × 4. Fig. 15. Eye of first crab stage, × 15. Fig. 16. Major cheliped of first crab stage of *O. platytarsis* showing the stridulating ridge consisting of fine tubercles on the palm, ×30. Fig. 17. Second ambulatory leg of the first crab stage of *O. platytarsis* showing tuft of hair at the base, × 15.

(N.B.—Figures have been reduced to 11/36 the magnification given along with the explanation of figures.)

It lived on organic matter from the sand and threw the unwanted sand in the form of pellets. Once when a Mysid was given, it ate the animal most ravishly.

Eyes are jet black, long and stalked but without horns (Fig. 15). The carapace has a mottled grey colour. Chelae and legs are light brown with dark brown stripes. The carapace has a bulged appearance unlike the flat carapace of the adult. The presence of a stridulating ridge consisting of small tubercles on the inner surface of the major chela is a clear indication of the specific identity of the form (Fig. 16).

A first crab stage was obtained on 20-5-1952 and was reared in the laboratory. This moulted to the second crab stage on 28-5-1952. The crab died on 16-6-1952. At this stage the carapace is not bulging and is more like the condition seen in the adult. The horns of the eyes, however, are not yet developed.

II. **Megalopa and Crab Stage of Ocypoda cordimana**

*(Figs. 18-30)*

*Megalopa*

A large number of megalopæ (Fig. 18) of *Ocypoda cordimana* were collected during high tide on the Waltair beach on 30-8-1951. Of these only one lived for about a month and then died without casting off its skin. During April and May 1952 a few more megalopæ were collected. On 21-5-1952 two of these moulted to first crab stage and the others died. On 12-2-1953 a megalopa was collected in a burrow of about six inches depth and 2/16 inch in diameter about 25 feet from sea at low tide.

The megalopa skin is of length 5·7 mm. and breadth 4·8 mm.

*Colouration.*—The megalopæ exhibit two types of colour schemes alternating with one another during this period of their existence. (1) In the centre of the carapace there is a leaf-like patch of brick red splashed with brown and the rest of the carapace is yellowish. The abdomen is of the same colour as the leaf-like patch of carapace. The pereiopods and the ventral side of the cephalothorax are almost colourless with a slight tinge of brown. In the second scheme of colouration the central part of carapace may be oval in
shape and navy blue in colour and the rest of carapace light blue. The pereiopods are of dark brown shade and the ventral surface of the megalopa is colourless. The two colour patterns have been observed to alternate in the same form at intervals of about 48 hours or they may be constant. The colour changes go on for some time till just prior to ecdysis the leaf-shaped patch of the carapace becomes brilliant orange and the rest of the carapace has a cream colour.

The megalopæ which were reared in finger bowls spent most of the time swimming and all of a sudden they went to the bottom and burrowed into the sand with a characteristic cork-screw-like movement. When a megalopa swimming about actively is taken in the hand, the animal folded its legs tightly close to its body and remained motionless for some time. Later it tried to run, tucking its abdomen underneath the sternum.

The megalopæ thrived well in the laboratory on pieces of the mole crab, crab muscles and mantle pieces of bivalves. As to their food in nature, examination of the stomach-contents of freshly collected specimens showed occasional presence of such bits of partly digested muscle.

The megalopæ of *O. cordimana* resemble that of *O. platytarsis* except in the shape of the telson and the number of setæ in the last pleopod.

*First Crab Stage* (Fig. 26)

The megalopa cast off its skin on 21–5–1952 and the first crab stage of *O. cordimana* emerged. It has a maximum length of 5 mm. and a maximum breadth of 5 mm. The carapace is grey with patches of black. The eyes are jet black and the rest of the body is grey. After five days a few pink chromatophores appeared on the carapace and appendages. It was very active and took in quantities of sand apparently for the organic matter contained in it and discarded the sand in the form of pellets by the side of the burrow.
KEY TO THE MEGALOPÆ AND FIRST CRAB STAGE OF
  *O. platytarsis* AND *O. cordimana*

**Megalopæ**

The megalopæ are quite large in size with thick cuticle. Special grooves are present at the sides of the body for folding their appendages tightly close to their bodies. Between the second and third ambulatory legs there is a tuft of hair. The last joint of last leg is provided with three long feelers.

Carapace length ranges from 6·8 to 7·0 mm. and breadth from 6·1 to 6·3 mm. Just before moulting to first crab stage the carapace is greyish. Telson rounded and exopodite of the last pleopod with 32 setæ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ...
moult into the first crab stage. As additional evidences for this view she states 'the outstanding characteristics of the megalops of Ocypoda are its obesity, the thickness of its cuticle and its provision for folding the appendages tightly against the body'. She correlates the structure of the Ocypoda megalopæ with their habits. Her observation is well exemplified by the megalopæ of Ocypoda platytarsis and Ocypoda cordimana. In addition to having all the peculiar structures mentioned by Crane, I observed that the number and structure of gills are similar to those of the adult and it is needless to say that these peculiar structures help the megalopa to tide over the adverse circumstances when it lands from waves on shore. The megalopæ were caught by the author while they were in the act of burrowing or just burrowing into moist loose sand during high tide. In the laboratory the megalopæ were observed to disappear into the sand by burrowing in a cork-screw-like movement. One of the megalopæ lived in the laboratory for a month and died without moulting. During high tide, I observed some first crab stages of these two species running towards land. On 12–2–1953 and subsequently megalopæ were collected in burrows of six inches depth and 3/16 inches diameter about 25 feet or more from the sea during low tide. This removes all doubt regarding their life on land. The megalopæ burrow in sand, lead a semi-terrestrial existence for some days before moulting to first crab stage.

Crane collected megalopæ of O. occidentalis further away from the habitat of O. gaudichaudi; these show difference in the number of setæ of the last pleopod and patterns of the sternal sculptrue. Her identification is also based on how near the megalopæ were collected with reference to the habitat of the adult species. Such identification cannot be final for it is quite possible that the megalopæ of a particular species can be carried by the action of currents and waves to places nearer to the habitat of some other species. I find that the megalopæ of O. platytarsis and O. cordimana are very similar to one another in many respects except for size, colouration, number of setæ on the last pleopod and the shape of the telson. It was possible to identify the species correctly only after getting the first crab stages.

The megalopæ of the Indian forms differ only slightly from those of the American forms; the setæ of the last pleopod of O. platytarsis and O. cordimana are 32 and 30 (Fig. 25) respectively whereas in O. occidentalis, O. albicans and O. gaudichaudi the number of setæ are 22, 23 and 26 respectively. The telson of the American forms are round as in O. platytarsis, while the telson of O. cordimana is triangular with a blunt apex (Fig. 24).
The first crab stage of *O. platytarsis* differs from the adult stage in the following respects:

1. The carapace is strikingly bulging, so different from that of the adult.

2. The eyes though stalked are without horns.

3. In the manner of taking food, it differs from the adult but is similar to *O. macrocera*. It obtains its nutrition by feeding on detritus found in sand; a small quantity of sand is taken into the south and after taking in the fine particles of food contained therein, the sand is thrown out close to the burrow in the form of pellets of uniform size and shape.

The first crab stage of *O. cordimana* differs from the adult stage in the following respects:

1. The carapace is quite bulging though to the same extent not as in the first crab stage of *O. platytarsis*.

2. In the manner of taking food it behaves similar to *O. macrocera*.

**SUMMARY**

1. The megalopæ of *O. platytarsis* and *O. cordimana* were for the first time successfully reared in the laboratory to the first crab stage.

2. The megalopæ of the two species differ in size, colour, shape of telson and number of setæ on the last pleopod.

3. The megalopæ of both species burrow in the sand of the intertidal zone before metamorphosing into the first crab stage.

4. A key for the identification of the megalopæ and the first crab stages of the two species is given.

**ACKNOWLEDGMENT**

My thanks are due to Dr. P. N. Ganapati, M.A., D.Sc., Head of the Department of Zoology, for his valuable help and encouragement during the course of this work and also for kindly going through the manuscript and offering valuable suggestions. My thanks are also due to the Government of India for the award of a Research Fellowship during the tenure of which the work was undertaken and completed and to the Andhra University for affording me all facilities for the work.
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