NOTES ON THE EGGS AND EARLY LARVAL STAGES OF *HIPPOLYSMATA ENSIROSTRIS* KEMP*

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ABSTRACT

Hippolysmata ensirostris which contributes to a minor extent to the crustacean fisheries of India is an ovoviviparous form. Berried females with eggs carried by the first four abdominal appendages are encountered in the shore-seine returns at Cannanore during the south-west monsoon months. The present paper gives an account of three different stages of the egg and three early larval stages reared in the laboratory.

The eggs are spherical with opaque yellow yolk and measure 0·406–0·449 mm. in the first stage. In the second stage they become transparent, more so in the periphery. Gastrulation, embryogenesis and most of the organogenesis are completed in the third stage (0·577–0·642 mm. long).

The newly hatched larva is a protozoea with a prominent rostral spine, well-developed carapace and sessile eyes. In the second larval stage which is designated as the first zoea the eyes have become stalked. The third larval stage which is the second zoea is marked by the formation of the uropods.

INTRODUCTION

OF the six species and varieties of the genus *Hippolysmata* Stimpson (family Hippolytidae, Macrura, Decapoda) known from India (Kemp, 1914), only *H. ensirostris* Kemp contributes, although to a minor extent, to the crustacean fisheries of our waters. The commercial importance of *H. ensirostris* was first reported by Shaikhmahmud and Tembe (1960) although Rai (1933), Chopra (1943) and Panikkar and Menon (1955) have dealt with various aspects of the prawn fisheries of the country.

H. ensirostris is not of common occurrence except around the waters off Bombay from April to September. At Sassoon Docks, an important prawn fishing centre in Bombay, Shaikhmahmud and Tembe (1960) have observed *H. punctata* and *H. dentata* along with *H. ensirostris*. Brief notes on the sex-ratio of *H. ensirostris* are given by these authors. Ramamurthy (1963), reporting on the prawn fishery of Kutch, mentions *Hippolysmata* sp. as occurring at Modhwa from September to January. From the scientific reports of the Central Marine Fisheries Research Institute, Mandapam Camp, South India, for the period 1960–1964, it can be seen that *H. ensirostris* accounts for a good proportion of the prawn fishery at Sassoon Docks. It occurs in good quantities along with other small-sized prawns like *Palaemon tenuipes, Parapenaeopsis stylifera, P. sculptilis, Metapenaeus affinis, Acetes indicus, Solenocera indicus*, etc. During certain months the species is reported to have formed as much as 18% of the prawn catches in this centre.

South of Bombay region, no information is available of the abundance of *H. ensirostris*. At Cannanore (north part of Kerala State), a few specimens can be observed occasionally in the boat-seine catches along with the common penaeid prawns, *Parapenaeopsis stylifera, Metapenaeus affinis,*

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M. dobsoni, etc. During the south-west monsoon (May–September) this species occurs in small numbers in the shore-seine units operated in the shallow inshore areas at a distance of about ¼ kilometer from the shore at a depth of 1–1½ fathoms. Most of the specimens observed during this period are egg-bearing females.

Apart from a post-larval stage described by Kemp (1916) from the Orissa coast nothing is known of the developmental history of *H. ensirostris*. The present paper reporting the early developmental stages of the species may therefore be of interest.

Material and Methods

For studying the structure of the egg, a few of them were removed from the general egg mass and observed under the microscope. In order to determine whether eggs of the different regions of the egg-mass were in different stages of development, eggs from a number of regions both from the periphery and the interior were examined. No significant difference in the embryonic development of the eggs from a single specimen was noticed. In the case of an allied species, *H. vittata*, Kuriyan (1951) has noted that more than one stage of development was present in individual specimens. In the present case three representative stages in the development of the egg have been collected from three specimens.

For rearing the berried females a large beaker with sea-water was brought to the fish-landing centre, and as the shore-seine units were being hauled up, the live berried female was picked up and transferred to the beaker.

In the laboratory, the berried female was fed with the flesh of the penaeid prawn, *Parapenaeopsis stylifera*, ground to a thin paste. The specimens took to this diet readily. Water in the aquarium was changed twice a day. The temperature of the sea-water varied between 24–28° C.

The larvae hatched from a berried female measuring 73 mm. long (measuring from the apex of the rostrum to the end of the telson), collected at 09·00 hours on 10–6–1964 are described in the present paper. Till the evening (17·30 hours) of the following day, 11–6–1964, the eggs were not ready for hatching. On the morning at 07·00 hours of 12–6–1964 all the eggs were found hatched out. Obviously the process of hatching took place during the preceding night. After the eggs hatched out the mother appeared pale and inactive.

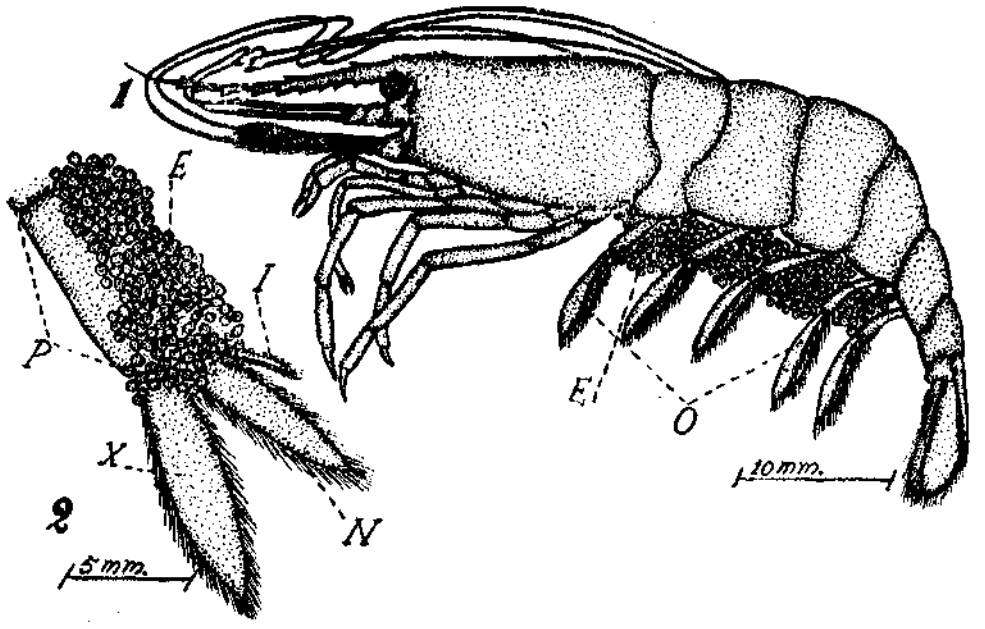
A few larvae were examined at each stage to observe the changes in the colour, pigmentation, etc. After this they were preserved for subsequent detailed studies. A close observation was also made of the locomotion as well as other habits of the larvae. They were fed with the well-ground thin paste of the flesh of *P. stylifera* and like the mother, the larvae also took to this diet readily. Sometimes a tiny food particle was found "attacked" by 3–5 larvae at the bottom of the aquarium. Everyday the larvae suffered large-scale mortality, chiefly owing to the attack of ciliates. Only a few larvae could be reared up to the second-zoea stage.

All the figures except 1 and 2 were drawn with the aid of a camera lucida on the material in formalin. In naming the various stages, the nomenclature used by Menon (1951) for the penaeid prawn, *Metapenaeus dobsoni* has been adapted.

Berried Female

Berried females of *H. ensirostris* (Fig. 1) lived in the aquarium for about five days. They were bright orange-red in colour and active and occasionally swam with the ventral side up. Generally they could be seen resting at the bottom of the aquarium. When disturbed they became restless,

If a support, such as a glass rod, was provided the specimens often climbed on to it with the aid of their pereiopods, ventral side upwards.



FIGS. 1 and 2. Fig. 1. A berried female specimen of *Hippolysmata ensirostris* measuring 72 mm. total length. Fig. 2. The third pleopod of a specimen of 70 mm. total length. E., Developing eggs; I, Epipodite; N, Endopodite; O, Ovigerous pleopods; P, Protopodite; X, Exopodite.

The egg-mass is attached to the median as well as to the posterio-median aspects of the protopodite (Fig. 2) of the first four pleopods. The eggs are clustered together by delicate, transparent membraneous processes (Fig. 3); and in the living condition were aerated by the vigorous movements of the pleopods.

EGG

Three typical stages in the development of the eggs of *H. ensirostris* have been collected and studied.

Stage I (Fig. 3)

Collected from a specimen measuring 70 mm. total length.

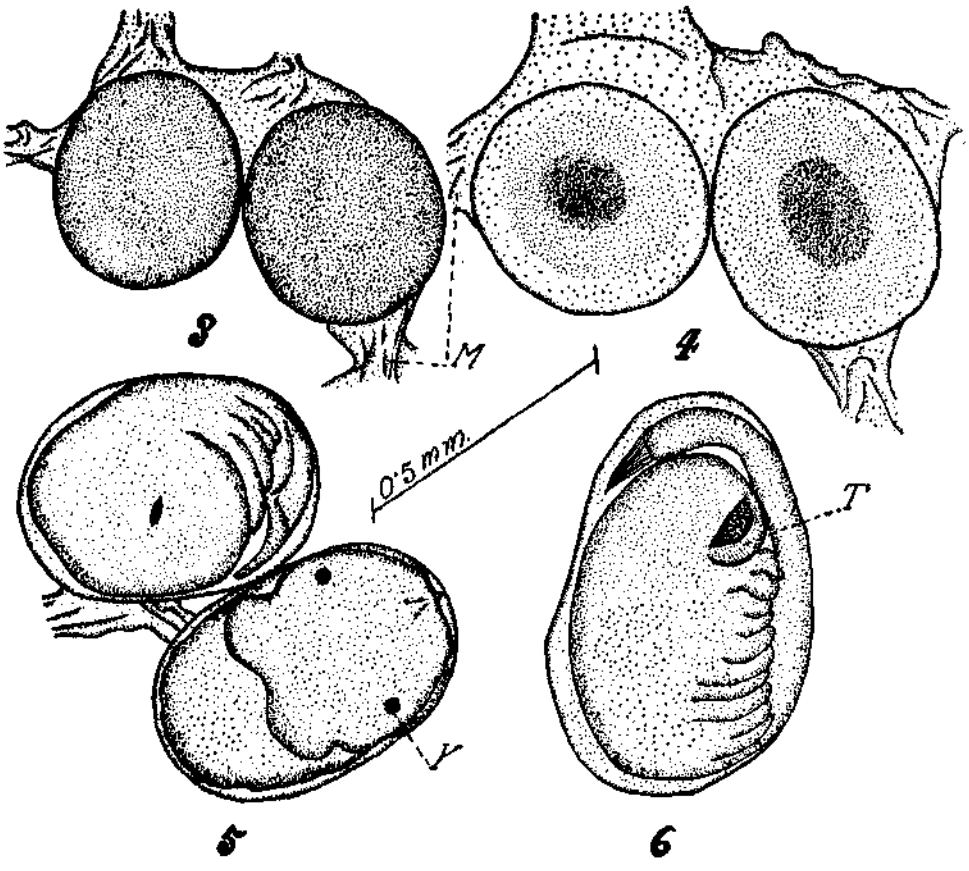
The eggs are roughly spherical with an average diameter of 0·427 mm. and ranging from 0·406–0·449 mm. They are opaque and the yolk fills the whole interior of the ovular cell and has a light yellow colour. Obviously, this stage is an early condition of the developing egg.

Stage II (Fig. 4)

Collected from a specimen 72 mm. in total length.

The eggs at this stage can be distinguished from the previous by the fact that they have become transparent in the region of the periphery. The yolk has assumed a granular structure and is chiefly

confined to the central region, thus assuming a centro-lecithal character, common to curstacea. The average diameter has also increased a little to 0·440 mm.



FIGS. 3–6. Developing egg stages of *H. ensirostris*. Fig. 3. Stage I. Fig. 4. Stage II. Fig. 5. Stage III A. Fig. 6. Stage III B. *M*, membraneous processes clustering the eggs with one another and with the pleopods. *T*, ommatidia of the eyes; *Y*, eye spot.

Stage III (Figs. 5 and 6)

The eggs have become elongated and pyriform. They measure an average diameter of 0·69 mm. and a range of 0·577–0·642 mm. along the longer axis. Most of the organogenesis has been completed at this stage. The eyes are indicated as black pigment spots, and about 4–6 appendages are recognisable.

The development of *H. ensirostris* unlike that of many panaeid prawns is devoid of a free-swimming nauplius stage. It is evident that the nauplius stage is suppressed and underwent in the embryonic period itself, as in stage III of the egg the embryo is apparently a protozoea. A free-swimming nauplius stage is also absent in an allied hippolytid prawn, *Saron marmoratus* (*see* Sankolli and Kewalramani, 1962).

Two different phases in the embryonic protozoea stage have been collected.

Stage III A (Fig. 5)

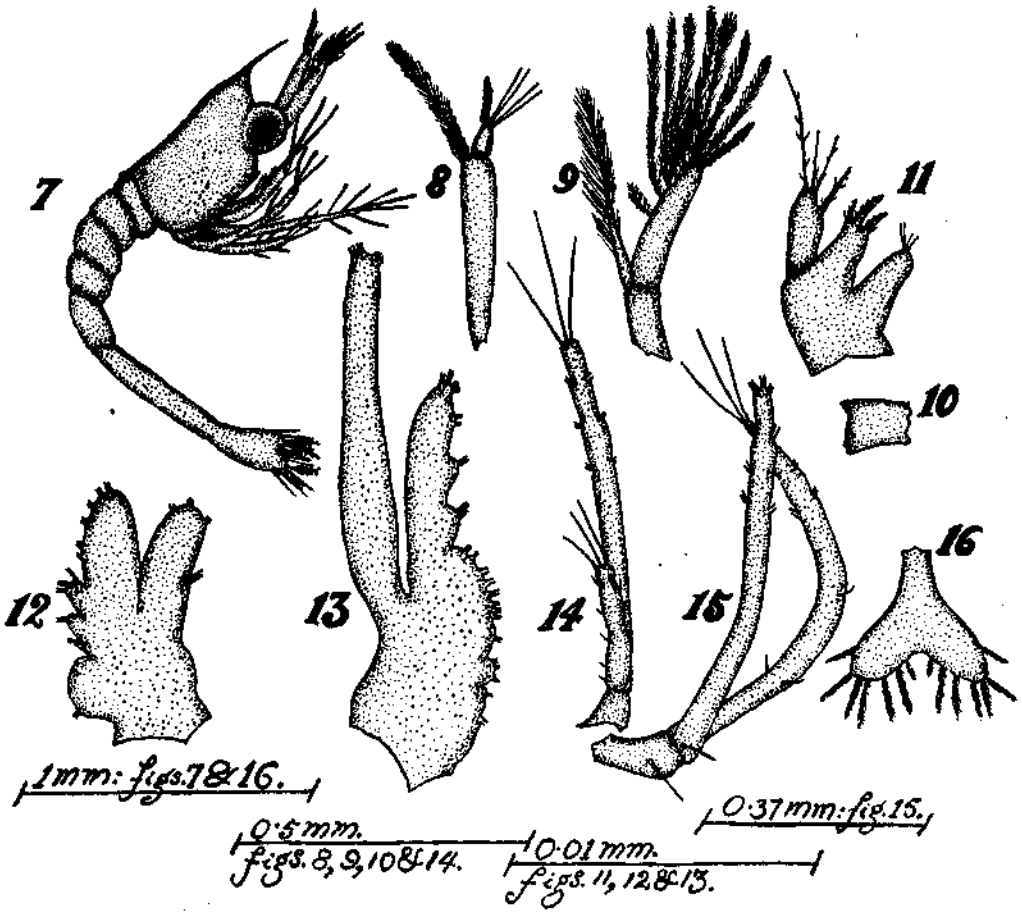
Collected from a specimen measuring 73 mm. total length.

Organogenesis is completed in the cephalothoracic region but the abdomen is not fully organised at this stage. In the eyes the region of the cornea is recognisable but the ommatidia are not yet developed.

Stage III B (Fig. 6)

Collected from a specimen measuring 72 mm. total length.

In this stage the abdomen is fully formed with well-developed telson; and the ommatidia of the eyes have developed.



FIGS. 7–16. Stage I larva (protozoea) of *H. ensirostris*. Fig. 7. Right side view of the entire larva. Fig. 8. First antenna. Fig. 9. Second antenna. Fig. 10. Mandible. Fig. 11. First maxilla. Fig. 12. Second maxilla. Fig. 13. First maxilliped. Fig. 14. Second maxilliped. Fig. 15. Third maxilliped. Fig. 16 Telson.

EARLY LARVAL STAGES

The larvae were reared successfully for six days from 12-6-1964 to 18-6-1964 and three typical stages in the early life-history were obtained.

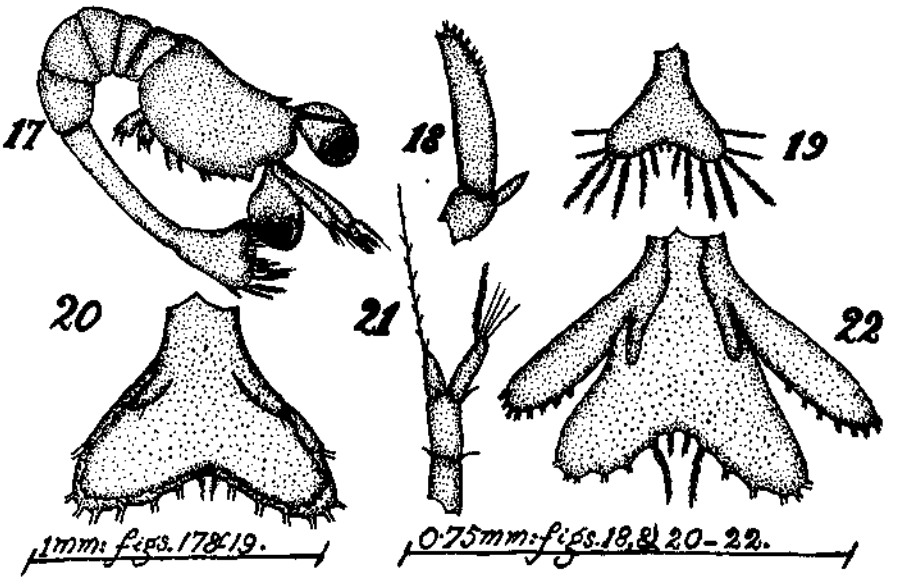
Stage I (Fig. 7)

As has already been mentioned, the process of hatching had taken place during the night of 11–6–1964, and this is the earliest stage observed at 07·00 hours on 12–6–1964. All the larvae were orange-red in colour in the thoracic region. At times the larvae became colourless and transparent. Such larvae when disturbed regained the orange-red colour after a few minutes. Colour changes in larval crustacea are of widespread occurrence and have been noted recently in the larvae of *Saron marmoratus* by Sankolli and Kewalramani (1962). The larvae of *H. ensirostris* were devoid of pigmentation.

The larvae were observed swimming by the active movements of the appendages. Sometimes they were moving with the head directed downwards, and when disturbed they moved with the head directed up. Very often the larvae could be seen browsing at the bottom of the aquarium. They are *positively phototropic* and gathered towards the side where the illumination due to sun-rays was maximum.

The larva at this stage is a protozoea. It has a total length of 2·15 mm., with a 0·22 mm. long rostrum. The cephalothoracic region is fairly stout but the abdomen is slender and long. The carapace has three minute marginal teeth along its antero-lateral aspects. The ventral margin of the carapace is smooth. The rostrum is long, slightly turned upwards and does not reach the distal end of the first and second antennae.* The eyes are sessile and large with well-developed ommatidia. The telson is broad with spines.

The first antenna (Fig. 8) is segmented distally. Its exopodite has four aesthetes and one medium-sized feathered seta on the inner side. The endopodite is represented by a single feathered seta.



FIGS. 17–22. Fig. 17. First zoea larva of *H. ensirostris*. Fig. 18. Second antenna. Fig. 19. Telson of the same. Fig. 20. Telson at 09·00 hours on 17–6–1964. Fig. 21. First antenna. Fig. 22. The uropods of the second zoea stage.

* The terms first antenna and second antenna are used in place of antennule and antenna respectively. Similarly first maxilla is used in place of maxillule.

The scale of the second antenna (Fig. 9) is feebly segmented distally and carries nine feathered setae. Its endopodite is represented by a single feathered seta which is long and has a stout basal region.

The mandible (Fig. 10) is represented only by the mastigatory portion. The molar process has several minute teeth.

The first maxilla (Fig. 11) has two endites, a proximal one with four setae and a distal one with three prominent serrated spines. The endopodite is unsegmented and carries four long setae. Two setose endites are present in the second maxilla (Fig. 12). Its *scaphognathite* also carries setae.

The first maxilliped (Fig. 13) is unsegmented and has two setose endites. Of the second and third maxillipeds the former (Fig. 14) has a three-segmented and the latter (Fig. 15) has a four-segmented endopodite. Both carry three terminal setae each. Segmentation of the exopodites is feeble.

The abdominal appendages are not indicated even as rudiments. There are six abdominal segments of which the last one is long, slender and is fused with the telson. The telson (Fig. 16) is broader than long and has a rather forked structure due to the presence of a shallow central notch in the hinder region. There are seven feathered spiny processes on each lobe of the telson; the first and the last spines being the shortest while the others are more or less of equal length.

The protozoea larvae remained in the same condition till 17·30 hours on 14–6–1964. The succeeding morning the larvae were observed to have passed on to the next stage.

Stage II (Fig. 17)

Reared larva at 09·00 hours on 15–6–1964.

It took nearly three days for protozoea to moult over to this stage which is designated as the first zoea. The presence of well-developed movable stalked eyes free from the carapace and formation of an additional spine on either side of the central notch in the telson are characteristic of this stage.

The larva has not increased in length. Behind the base of the rostrum a minute spiny process has developed on the carapace. The first antenna has become feebly segmented proximally. The second antennal peduncle has become well marked and carries a scale-like process ventrally (Fig. 18). The mandible, maxillae and maxillipeds do not show any appreciable change except that the segmentation of the exopodite of the third maxilliped has become marked. Abdominal appendages are not yet indicated. The telson (Fig. 19) has developed an eighth spine on either side of the notch. The larvae were devoid of pigmentation.

The first zoea larva did not show any appreciable change on 16–6–1964. On 17–6–1964 at 09·00 hours, the development of the uropods as lateral buds in the proximal region of the telson (Fig. 20) was observed. On 18–6–1964 at 09·00 hours the larva was in the first zoea stage only; but at 13·00 hours of the same day it was observed to have passed on to the next stage.

Stage III

Reared larva at 13·00 hours on 18–6–1964.

This is the second zoea larva and is characterised by the formation of the uropods. The segmentation in the proximal region of the first antenna is completed (Fig. 21); the mandible does not bear palp. The chief change noted is the formation of the uropods (Fig. 22). They are uniramous and bear eight setae. The biramous nature of the future uropods is however noticed in this stage by the presence of the rudiments of the inner rami. The telson has become narrower and its forked structure is marked in this stage. The number of spines of the telson has reverted to 7 + 7.

COMPARISON OF THE EARLY LARVAE WITH THOSE OF ALLIED PRAWNS

Kuriyan (1951) has described the first stage larva of an allied species, *H. vittata*. From the description given by Kuriyan (*l.c.*) the first stage larva described by him is obviously a protozoea. The protozoea of *H. ensirostris* differs from that of *H. vittata* in the longer size; the rostrum not reaching beyond the peduncle of the first antenna the six-segmented abdomen in contrast to the five-segmented condition in *H. vittata*; the absence of paired spines at the posterior margin of the fifth abdominal segment; the feebly-forked telson in contrast to the "triangular" condition in *H. vittata*; the presence of marginal teeth of the carapace in contrast to their absence in *H. vitatta* and in details of the structure of the appendages.

The early larval stages of *H. ensirostris* can be distinguished from those of an allied hippolytid prawn, *Saron marmoratus* described by Sankolli and Kewalramani (1962) in the absence of pigmentation; the smaller size; the simpler structure of the carapace; the shape of the telson; the structure of the appendages, etc.

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