

ON THE SPAWNING AND EARLY DEVELOPMENT OF THE MARINE PRAWN, *PARAPENAEOPSIS STYLIFERA* (H. MILNE EDWARDS) IN THE LABORATORY.

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ABSTRACT

Marine penaeid prawns of the species, *Parapenaeopsis stylifera* (H. Milne Edwards) kept in tanks in the laboratory have successfully spawned. The larvae were reared upto Mysis I stage. The eggs have taken an average of 7 hrs for hatching. The larvae passed through five naupliar stages and reached Protozoa stage in 38-40 hrs. Passing through two more protozoal substages they metamorphosed into Mysis I stage within 8 days 18 hrs to 9 days 17 hrs. Brief descriptions of various larval stages are given.

INTRODUCTION

There have been several reports, in recent years, on the successful spawning of prawns and rearing of the larvae under controlled conditions. Important contributions in the field are by Cook (1969), Hudinaga (1942), Fuginaga (1969), Liao (1969) and Liao and Huang (1972). The only record of laboratory spawning of penaeid prawns of India, is by Rao and Kathirvel (1973) who reported the spawning in brackishwater medium of *Metapenaeus dobsoni* collected from Cochin backwaters. Rao (1974) described certain larval developments of *Penaeus indicus*, *Metapenaeus dobsoni*, *M. monoceros*, *M. affinis* and *Parapenaeopsis stylifera*, after rearing the larvae obtained from plankton collections. The present communication deals with the results of the laboratory spawning of the marine prawn, *Parapenaeopsis stylifera* (H. Milne Edwards) and the rearing of its early larvae.

MATERIAL AND METHODS

Mature female specimens of *Parapenaeopsis stylifera* were collected from the fishing grounds off Cochin and brought alive in large polythene containers to the shore laboratory. They were kept in glass and fibre-glass aquaria, and large polythene troughs containing fresh seawater from the area of fishing. Sodium salt of EDTA was added to the medium at the rate of 1g per 100 litres. During the studies following spawning, round-the-clock observations were made on fertilized eggs and larvae undergoing development, based on samples drawn at every 2 hours interval. Samples were fixed in neutralized

5% formalin. Water from the bottom of the container in which the larvae were kept was siphoned out every day, along with the metabolic wastes, and the level made up with the fresh seawater. From Protozoa I stage onwards, they were fed with pure and mixed cultures of unicellular algae viz., *Synechocystes marina*, *Tetraselmis gracilis* and *Chlorella* sp., in sufficient quantities. Fresh brine shrimp (*Artemia*) larvae were offered as food at Mysis I stage.

SPAWNING

Experiment I

Four mature females (total lengths, 73, 74, 85 and 89 mm) obtained by trawling on 5-5-1973 were kept in a large fibre-glass tank containing 50 litres of fresh seawater. A single mature specimen (78 mm) collected from the same source was kept in a polythene trough containing 30 litres of fresh seawater. Both these were left undisturbed in a corner of the laboratory, away from light, and no food was offered. The salinity of the water was 35.06‰, while the surface temperature in open sea and the laboratory were 31.2°C and 30.0°C respectively. The single specimen in the trough spawned completely by 00.15 hrs on the next day, while the prawns in the other container spawned only partially. The number of the eggs spawned by the single specimen was estimated to be about 10,000 while the eggs found in the fibre-glass tank were very few.

Experiment II

Three mature specimens from the same locality were kept in fibre-glass tank and two plastic troughs on 28-5-1973. The specimens in the fibre-glass container spawned by 23.00 hrs on the same day and those in the other troughs started spawning at 02.00 hrs on the following day. The temperature of the seawater was 31.8°C and that in the laboratory was 30.4°C. Salinity was 35.24‰.

HATCHING

About 80% of the spawned eggs hatched out into nauplii at 07.15 hrs on 6-5-1973. The viable eggs hatched 7 hrs after spawning in both the experiments. During hatching, the fully developed nauplii were clearly visible moving inside the vitelline membrane. They made quick jerking movements when the egg membrane ruptured and the larvae were released. They were positively phototactic and swam about very actively.

The sequence in the larval development and duration of each of the larval stages are furnished in Table 1.

LARVAL DEVELOPMENT

The viable eggs were spherical and they settled down at the bottom of the container (Fig. 1, a). These eggs measured 0.32-0.37 mm in diameter,

TABLE 1. *Results of laboratory spawning and rearing of Parapenaeopsis styliifera*

Larval stage	1st experiment			2nd experiment			
	Date	Time	Duration after spawning (hrs)	Date	Time	Duration after spawning (hrs)	Average duration after spawning (hrs)
Spawning	5-5-1973	00.15 hrs	0	28-5-1973	23.20 hrs	0	0
Nauplius I	6-5-1973	07.15 hrs	7	29-5-1973	06.20 hrs	7	7
Nauplius II	6-5-1973	10.00 hrs	10	29-5-1973	09.30 hrs	10	10
Nauplius III	6-5-1973	13.00 hrs	13	29-5-1973	12.00 hrs	12	12
Nauplius IV	6-5-1973	16.00 hrs	16	29-5-1973	15.00 hrs	15	15
Nauplius V	6-5-1973	18.00 hrs	18	29-5-1973	18.20 hrs	19	18
Protozoa I	7-5-1973	20.00 hrs	44	30-5-1973	22.00 hrs	47	45
Protozoa II	10-5-1973	04.00 hrs	98	1-6-1973	08.00 hrs	81	89
Protozoa III	15-5-1973	11.00 hrs	225	6-6-1973	10.00 hrs	203	214
Mysis I	17-5-1973	14.00 hrs	277	8-6-1973	16.00 hrs	257	267

with an average of 0.33 mm. The nauplius larva (length, 0.19-0.22 mm) has a pair of uniramous antennules, a pair of biramous antennae and a pair of biramous mandibles (Fig. 1, b). Median eye was present. The rounded posterior end bore a pair of setae. Nauplius II stage (length, 0.24-0.26 mm) was reached in 10 hrs after spawning. In this stage the posterior portion became more elongated and its margin developed a median notch, there being two more pairs of small setae. In 13 hrs after spawning, they moulted to Nauplius III stage which measured 0.26-0.27 mm in length. The body elongated further and the appendages developed faint segmentation. One more pair of setae was added to the furcae. The larvae became more slender in the sub-stage (Nauplius IV: length, 0.27-0.28 mm) attained in 16 hrs after spawning. The furcal setae increased to six and rudiments of Maxilla I, Maxilla II and Maxillipeds appeared posterior to the mandibles. In Nauplius V stage (length, 0.27-0.29 mm) which was attained in 18 hrs after spawning, the caudal lobes were well developed with seven setae on each. Mandibles developed prominent swellings at the bases while maxillae and maxillipeds bore minute setae at the tips of rami. Nauplii IV and V were observed together in 22 hrs after spawning, but in 24 hrs there were only Nauplii V.

The Nauplii V metamorphosed to Protozoa I on the subsequent day, 44 hrs after spawning (length, 0.53-0.63 mm). The body of the larva was clearly divided into an anterior cephalic region covered by carapace, middle thoracic region and a posterior abdomen. Anterior border of the carapace became semicircular, with a median notch. The paired compound eyes made

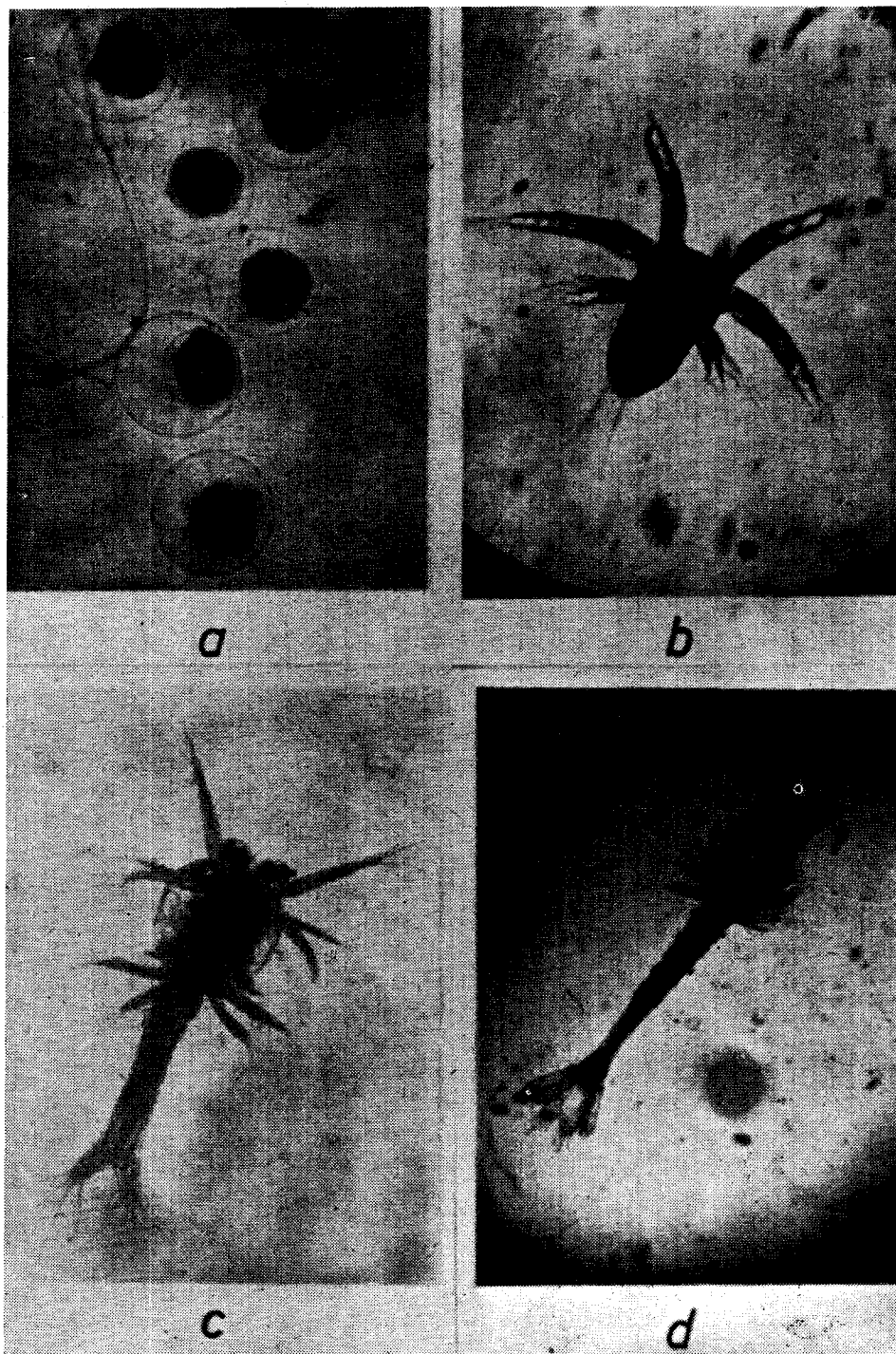


FIG. 1. Eggs and larvae of *Parapenaeopsis stylifera*

a. Eggs. b. Nauplius I. c. Protozoeca II. d. Mysis I.

their appearances on either side of the persistent median eye. First and second maxilliped were well developed. Third maxilliped was biramous and unsegmented. Traces of segmentation on thoracic region were present at this stage. In about 52 hrs the metamorphosis into Protozoa I was completed. The larvae became Protozoa II by 98 hrs (04.00 hrs on 10-5-1973). They were 0.85-0.87 mm in length. The rostrum made its appearance for the first time at this stage. Compound eyes became free from the carapace. Buds of thoracic appendages posterior to third maxilliped appeared. All thoracic segments and the sixth abdominal segment were demarcated, the sixth abdominal segment being much elongated. Telson was with seven setae. The Protozoa III stage was reached 225 hrs (14.00 hrs on 15-5-1973). This substage was characterised by the development of spines on abdominal segments and the appearance of uropods. Carapace extended further backwards over the thorax. Compound eyes had conspicuous stalks. Third maxilliped was with unsegmented rami, and setae increased in size. The exopods of the biramous uropods became longer with five setae and endopods with only two small setae. In 277 hrs one of the Protozoa III metamorphosed to Mysis I (Fig. 1, d) which measured 1.0 mm in length. This larva assumed shrimp-like form with well developed carapace and thoracic legs. Antennal and pterygostomian spines made their appearances for the first time. Pleopods became more differentiated.

In the second experiment also, the development of the nauplius proceeded as in the first, accomplishing all the developmental process in almost the same period (Table 1). First Protozoa emerged in 47 hrs after spawning and they were kept in glass and polythene troughs, in batches, as before. These larvae metamorphosed into Protozoa II in 81 hrs. By about 84 hrs several Protozoa I had changed to Protozoa II and in 91 hrs all were in this stage. Several specimens died during this stage. In 203 hrs one of the Protozoa II larvae transformed into Protozoa III stage. There was no further change till 257 hrs when one of the Protozoa III moulted to Mysis I stage. This lived upto 273 hrs and died before moulting further.

In the Protozoa stage the larvae were actively swimming and feeding. They were fed with pure and mixed cultures of unicellular algae viz., *Synechocystes marina*, *Tetraselmis gracilis* and *Chlorella* sp., in sufficient quantities. This is perhaps, the critical period in the larval history of the prawn as it is at this stage that the larva becomes fully dependent on external source of food. Adequate supply of appropriate food at this stage is an essential prerequisite for successful rearing of the larval forms. Although these larvae were regularly fed with different algal cultures in the present studies, there was heavy mortality and this is probably due to the unsuitability of the food offered.

DISCUSSION

The eggs of *Parapenaeopsis stylifera* hatched out during the present experiments in 7 hrs, a duration which is almost half of what is reported in case

of *Penaeus japonicus* from Japanese waters, which was 13-14 hrs (Hudinaga, 1942) and *P. monodon*, *P. semisulcatus* and *Metapenaeus monoceros* from Taiwan, which was between 12-13 hrs (Liao *et al*, 1969a and 1969b). Subsequently, more rearing experiments have been conducted on the larval stages of *P. styliфера* (in March 1975) which confirmed the previous results, indicating that *P. styliфера* actually takes much less time for hatching than the allied forms.

The developmental sequence and the structure of the various larval stages observed in the present investigations agree well with those described by Rao (1974) from plankton collections except that the third maxillipeds in the protozoal substages are in the form of biramous, unsegmented rudiments, and the larvae were slightly smaller in size than those obtained by him from the plankton. It would appear that the larvae obtained from natural environment are relatively healthier and larger when compared with those reared under laboratory conditions.

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