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LARVAL DEVELOPMENT OF THE CLAM *MERETRIX MERETRIX (LINNAEUS)*

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ABSTRACT

The clam *Meretrix meretrix* was induced to spawn in the laboratory by rapid salinity changes and addition of sperm suspension. The clam eggs were fertilized and larvae were reared in laboratory upto metamorphosis. The descriptions of the larvae and spat are presented in the paper.

Key words: Larvae, *Meretrix meretrix*, Salinity.

The edible clam *Meretrix meretrix* is distributed on both east and west coasts of India. The species is found at the mouth of estuaries and coastal regions (Nayar and Mahadevan, 1974). The meat of this clam is tasty before the bivalve spawns and the fisher folk exploit the clams. Jeyabal (1984) studied the biology of this species, but information on its larval development and the duration of the larval life is lacking. Therefore studies were undertaken to describe the larval stages of this clam and to standardise methods for the rearing of the larvae for spat production for aquaculture purposes. Further such description of the larvae with respect to morphological and size changes in the free swimming larvae would permit identification of these larvae in plankton collections and also facilitate prediction of spat settlement.

The clams were collected from the natural beds found at the mouth of the Vellar estuary and thoroughly cleaned with filtered seawater before placing in plastic troughs. The clams were fed with unialgal cultures of *Skeletonema costatum*, *Thalassiosira* sp. and *Amphiprora* sp. Gonadial smears were taken to ascertain its condition before the clams were induced to spawn. Batches of 15 clams were taken at a time and induced by changing the salinity rapidly from 33 to 25‰ and sperm suspension added (Stephen and Shetty, 1981). The bivalves were taken out after spawning and the supernatent water was discarded and fresh filtered seawater poured. The eggs were screened using a fine mesh bolting silk and placed in fingerbowls and plastic troughs. The sperm suspension was added to the containers and the early development observed. The veliger larvae (i.e. straight-hinge stage) developed 16 hours after fertilization. The larvae were screened by bolting silk of fine mesh and then kept in finger bowls and plastic trough for further development. After changing the water, axenic culture of

Chlorella sp. (50-100 cells μl) was added daily to the rearing containers. The mortality was high at this stage and only 25-35% of the straight-hinge larvae survived. The larvae (20-25 numbers) were measured using an ocular micrometer after they were narcotized with magnesium sulphate. The terminology used is the one followed by Chanley and Chanley (1980).

Egg

The diameter of the unfertilized egg was 60 to 70 μm. The ovarian eggs were spoon shaped and they develop in a gelatinuous matter.

Early development

The polar body extruded within 15-20 minutes after fertilization followed by the first cleavage of the cell into two unequal halves in 1 hour. During the second division the four blastomeres were formed in 10 minutes after the first cleavage and in third division, 8 celled stage results in 10 minutes of the second division. Further divisions result in the multicellular stage and then to form morula stage. The embryo later reaches the blastula and starts rotating by means of cilia developed on its surface. The free swimming trochophore develops in 6 hours after fertilization with a pre-oral circlet of cilia and attains the early straight-hinge stage (16 hrs after fertilization) completely enclosed by the embryonic shell.

Larval development

Straight-hinge stage

The early straight-hinge larvae (Fig 1A) are about 80 μm long and retain their 'D' shape until they grow upto 90-100 μm. During straight-hinge stage the height increased from 60 to about 80 μm, the height being 20 μm less than the length. The hinge line measured 60 μm. The anterior end (length) and the posterior shoulder lengths are equal (40 μm). The larvae swim actively and aggregate near the water surface.

Umbo stage

On the 5th day the umbo begins to obscure the hinge line when the larvae attain 110 μm in length (Fig. 1B). The shape of the umbo, broadly rounded upto the size (length) of 130 μm of the larva changed to a knob like structure (knobby umbo) at 140 μm length and was clearly visible at the length of 150 μm on the 9th day (Fig. 1C). The slope of the anterior shoulder was steep while that of the posterior gradual. The anterior end was more pointed than the posterior and the ventral margin rounded. The colour was not distinctive. The shell showed a few concentric straiations indicating the formation of the growth lines.

Pediveliger stage

The rudimentary foot developed on the 10th day when the larva became the pediveliger and was 160 μm in length and 140 μm in height (Fig. 1D). During this stage the velum was functional and the larva alternatively swam by means of the velum and crawls over the bottom of the fingerbowls using its foot. When the larvae approach metamorphosis stage at the length of 180 μm the velar movements disappear and crawling with the foot persists.

Spat

On the 12th day the larva metamorphoses into plantigrade which begins to lead a benthic life when 190 μm in length. The larva metamorproses into spat (Fig. 1E) without provision of any substratum. During metamorphosis, the velum degenerates and the gills develop into distinct structures. Feeding currents can be observed within a day or so after the commencement of metamorprosis. The foot becomes fully functional as an organ of locomotion. The larval life

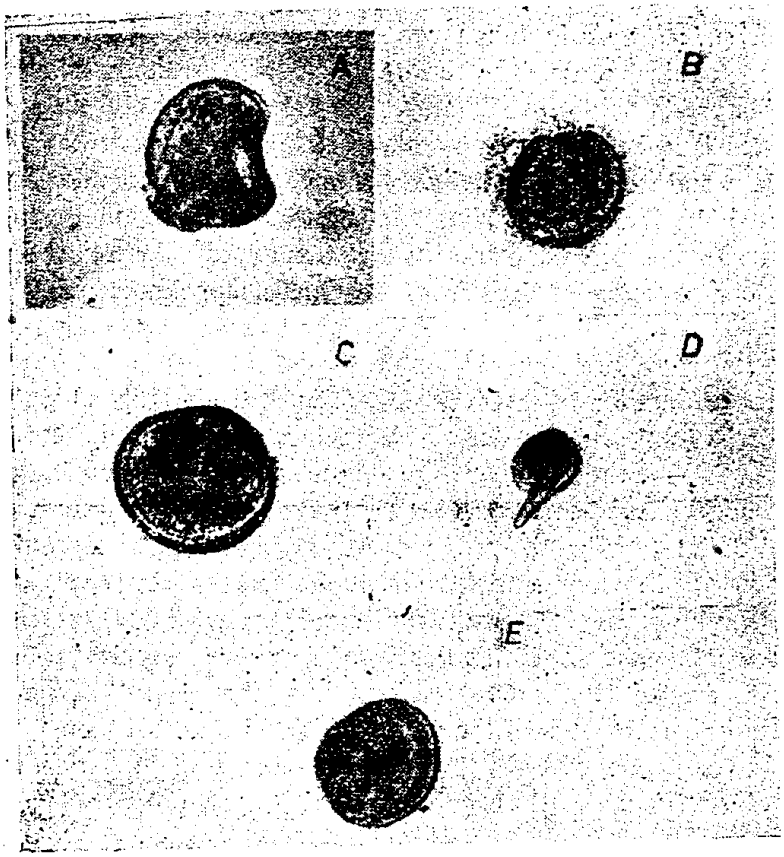

Fig. 1. Larval development of *Meretrix meretrix*.
A — Straight-hinge stage (x 400) B — Umbo larva (x 120) C — umbo larva (x 270) D — Pediveliger larva (x 60) E — Spat (x 120)

history is completed in 12 days from the time of appearance of the straight-hinge stage.

The availability of a large quantity of seed of commercially important edible bivalves is an essential prerequiste for culturing on a commercial scale. Spat production under controlled conditions by inducing the adults to spawn and then rearing the larvae from fertilized egg to the setting stage, forms an important aspect of mass culture operations. The larval development and optimum conditions required for the larval rearing of commercially important bivalves of temperate species have been reported (Loosanoff and Davis, 1963; Walne, 1974; Dupuy. Windsor and Sutton, 1977; Aquacop, 1977). In India similar studies on *Crassostrea madrasensis* (Rao, 1983; Nayar, Rajapandian, Gandhi and Gopinathan, 1984). *Perna viridis* (Rao, Krishnakumari and Qasim, 1976). *Pinctada fucata* (Algarswami, Dharmaraj, Velayudhan, Chellam, Victor and Gandhi, 1983) have been carried out, but information on larval development of the species under study is lacking. Yoshida (1941) studied the early development of *Meretrix meretrix lusoria* in Japan waters. The duration of larval life varies in different geographical areas. The results of the present study show that the straight-hinge larvae developed 16 hours after fertilization of the egg. But Yoshida reported it to be 24 hours. Yoshida (1941) was able to rear the larvae only for 20 days and not any further due to mass mortality of the larvae. Further he collected the larvae from plankton and reared them till they metamorphosed to spat. In the present work it has been found that larval life of *M. meretrix* is completed in 12 days from the time of appearance of the straight-hinge stage.

The shorter duration of larval life of M. meretrix in tropical waters recorded in the present study may be due to the favourable conditions during experimentation. Similar observations have been reported by SriKrishnadhas (1977) in the larval development of polychaetes from Porto Novo waters. Loosanoff, Miller and Smith (1951) observed that 12°C increase in temperature shortened the duration of development of *Mercenaria mercenaria* larvae A mixture of 2-3 diatom species seem to sustain faster larval growth in *M. mercenaria* and *Mytilus edulis* than do the similar volumes of a single species (Davis and Guillard, 1958; Bayne, 1965). Observations on the larval description of *M. meretrix* are in agreement with the works of Yoshida (1941) on *M. meretrix lusoria* from Japan waters with the exceptional absence of long flagellum and faint yellow colour (in the pediveliger stage).

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