LARVAL DEVELOPMENT IN CHICOREUS RAMOSUS

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INTRODUCTION

Larval developmental studies are useful for a better understanding of behaviour, movement, mortality, causes of mortality, desired habitat, food preference and growth. In addition, larval developmental studies of a particular species will help in developing a successful hatchery technology to produce juveniles. Mass culture of particular larval stocks is needed for commercial production of seafood and also for reseeding to preserve the natural stocks. The molluscs have attracted attention since prehistor ic times due to their importance as food, tools and ornaments and have served as objects of scientific studies for centuries. Cultivation of marine molluscs have centered largely on a few species. More than 75% of the papers devoted to molluscs deal with the commercially important bivalves. With over 36,000 species, the largest molluscs class, the gastropods, have received less attention from the culturists than bivalves (Kinne, 1977). Several successful culture procedures of gastropods have been outlined by Pilkinson and Fretter (1970). As far as India is concerned, the larval developmental studies have mainly focused on commercial bivalves like edible oyster (Samuel, 1980 and Kalyanasundaram, 1987), pearl oyster (Alagar swami et al., 1980) and clams (Kalyanasundaram, 1987). Regarding studies on gastropod larval development, particularly on muricids, only few works have been carried out (Natarajan, 1958; Kasinathan et al., 1975 and Tagore, 1989).

The overexploitation of the majority of gastropod species for operculum, ornamental purpose, food, and for making lime in recent years, may result in the depletion of the natural stocks. Since these gastropods play an appreciable role in the shell economy, hatchery technolo-
Nitzschia sp. and Rhizosolenia sp. during early hours of the day at regular intervals of 24 hrs. Streptomycin was used at a concentration of 0.75 mg l⁻¹ as an antimicrobial agent in the filtered sea water. After 25 days of development, the addition of streptomycin was discontinued.

RESULTS

The veliger larvae came out from the capsule through the escaping aperture and immediately started swimming towards the water surface. Only few larvae were found on the bottom of the container. The larvae had a transparent, pale yellow shell with one complete whorl. Minute purple colour dots were found on the surface of the shell. The larvae possessed a bilobed velum with heavily ciliated margins. The size of newly hatched larvae ranged from 565 to 620 μm.

No remarkable change was observed till the 8th day of the development except the increment in size of the shell and the velar lobes. The food grooves, tentacles and eyes were visible when the velar lobes were extended. On the 10th day of development the apex of the shell had developed and the velum had developed four lobes. The size of larvae with a four lobed velum was about 990 μm. In the whorl region three transverse lines were visible. Other clearly observed organs were tentacles with eye and well developed foot with operculum.

On the 22nd day of development, a curved spine like structure had developed in the aperture facing the columellar region. The aperture was clearly wider. The 22nd day larvae were about 1212 μm. On the larvae, at the aperture region near the suture line, the first spine protrusion was visible. Most of the larvae were found adhering to the bottom of the bowl. The second turn of the spire had developed during the 28 days of growth. The shell of the larvae became thick. The digestive diverticula and the heart beat were still visible. The larvae spent most of the time on the bottom of the culture bowl. However, they started swimming when illuminated.

On the 29th day of development one growth line had appeared in the whorl region. It was more or less situated at the centre part of the shell, i.e. it extended from the labial teeth to the opposite end of the body whorl. Two varices like structures were visible in the siphonal canal region. At the tip of the siphonal canal the siphon was found extending and the outer margin of the siphon was bordered with minute ciliary structures. The length of the siphonal canal was about 264 μm. After the 30th day onwards the velar lobes were markedly reduced.

Metamorphosis

During the 45th day onwards the larvae lost their velar lobes and became benthic. Heavy mortality was observed when the larvae were about to undergo metamorphosis.

DISCUSSION

The larvae of C. ramosus emerged from the "escape aperture" as planktonic veligers, resembling typical veliger larvae of other prosobranch molluscs. The larvae feed on plankton, and hence belong to the planktrophic type similar to the species Thais rustica (D’Asaro, 1970) and Nucella emarginata (LeBœuf, 1971). The veliger might be a teleplanktonic veliger because it shows a planktonic existence of so long a duration (44 days). This mode of planktonic life enhances the opportunities for dispersal, colonization of new habitats and genetic exchange (Scheltema, 1971; Strathmann, 1974). Roller and Stickle (1988) observed teleplanktonic veligers in a muricid gastropod Thais haemostoma canaliculata in laboratory culture. In the muricid family however, the development pattern of larvae is quite different from species to species. For instance, in Mures florifer and M. pomum (D’Asaro, 1970); Nucella lapillus (Lebour, 1937) and Urosalpinx cinerea (Hancock, 1935) the larvae hatched out as juveniles (direct devel-
opment). Webber (1977) suggested that the occurrence of direct development is related to
temperature, and he also observed that high level
percentage of direct development is restricted
towards the arctic environment. Regarding the
hatching mechanism it is known that larvae of
Thais hippocastanea physically rasp or cut their
way through the capsule wall with radula
(Thorson, 1935, 1940). Hancock (1959)
reported that in Urosalpinx cinerea an enzyme softened
the 'plug' of the capsule which pops free when the juveniles
are ready to escape. As the C. ramosus larvae are plankto-
phic, cutting the capsule aperture may not be possible
and probably the hatching mechanism by chemical
means or by increase in osmotic pressure (Tat-
tersall, 1920).

Bussarawit and Ruangchua (1991) observed that the veligers of C. ramosus have a
two lobed velum which gradually degenerates,
when the larvae become benthic after about 10
days of development. In our observation the larvae had distinct bilobed velum immediately
after hatching and then it divided into four lobes.
Ten days after hatching the larvae were found actively swimming in contrast to the findings in
Thailand.

In the present study, the juvenile stages
were observed after the 45th day onwards. No
special substratum was provided for settlement
and metamorphosis. Even then, most of the
larvae completed metamorphosis.

According to our observation, C. ramosus takes about 45 days, to develop into juve-
niles. This can be compared to Thais haemosto-
ma canaliculata (Roller and Stickle, 1988) which
needed a planktonic period of 50-53 days in the
laboratory. Roller and Stickle (1988) suspected
that the delay in metamorphosis may be due to
insufficient nutrients from the algal cell provid-
ed. We suspect that the delay in C. ramosus
may be caused by the food factor, or the lack of
specific substratum for their successful meta-
morphosis. Hahn (1989) reported that the rate
of veliger development depends on the handling
technique, water temperature, larval density and
most importantly quantity, quality and type of
food.

Though limited information is available
for metamorphosis and settling of gastropod
larvae, no information is available for Murex
species. However, it is known that micro organ-
isms (Sheltema, 1961), or chemicals (Hadfield,
1984) can be required to induce settlement and
metamorphosis in molluscan larvae.

CONCLUSION

One purpose of this investigation is to
determine whether C. ramosus can be produced
in commercial quantities, and to evolve a suit-
able culture technique. This study indicates that
the culture of larvae is possible. Methods and
techniques obviously require considerable modi-
fications to have a satisfactory result. Hence,
the following aspects will be given more empha-
sis in future studies.
1. Suitable nutrients (planktonic diet) for veliger
larvae.
2. Knowledge on the substrate selection is
imperative.

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