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RECENT ADVANCES IN THE HATCHERY PRODUCTION OF SEED OF SOME COMMERCIAL BIVALVES IN INDIA

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ABSTRACT

The Central Marine Fisheries Research Institute has established a shellfish hatchery laboratory at its Tuticorin Research Centre with the objective of developing appropriate technology for the production of seed of commercial bivalves. A viable technology was developed for the mass production of the seed of *pinctada fucata*, *P. margaretifera*, *Crassostrea madrasensis*, *Perna indica*, *p. viridis*, *Anadara granosa* and *Meretrix meretrix*. In this article are described the hatchery facility and the technology, comprising brood stock conditioning, induced spawning, larval rearing and seed production. In the light of these developments the future outlook is appraised.

INTRODUCTION

The bivalves are efficient converters of primary production into protein food suitable for human consumption and in aquaculture they give high production rate. As a result of the high priority given by the Central Marine Fisheries Research Institute in its research programmes, viable technologies have been developed in the seventies in the mariculture of pearl oysters and pearl production, edible oysters, mussels and clams. Soon it became evident that it is unsafe to depend on nature for seed requirements in order to undertake any developmental programme, even on a modest scale, to augument the production of bivalves by the adoption of the technologies. The success in the earlier attempts was limited to studying the larval development upto the setting stage (Rao, 1976) mainly because providing good quality water and the desired algal food at different growth stages proved to be a constraint.

The CMFRI has established a Shellfish Hatchery Laboratory with all basic facilities at the Tuticorin Research Centre and a breakthrough was achieved here in the induced spawning, larval rearing and spat production, first in the Indian pearl oyster, *Pincteda fucata* in 1981 (Alagarswami *et al*,1983), followed in the edible oyster, *Crassostrea madrasensis* in 1982 (Nayar *et al*,1984),in the black lip pearl oyster *p. margaretifera* in 1986 (CMFRI,1986), in the great clam *Meretrix meretrix* in 1987 and in the blood clam *Anadara granosa* in 1988 (unpublished). Success was also achieved in the spat production of the brown mussel *Perna indica* (Appukuttan *et al*,1984) and in the green mussel *p. viridis* (Sreenivasan *et al*, 1988) at the Vizhinjam and Madras Research Centres respectively of the Institute. In this communication are dealt briefly the hatchery facility at Tuticorin, the technology developed for bivalve seed production and the perspectives.

HATCHERY FACILITY AT TUTICORIN

The hatchery building faces the Tuticorin Bay and has two identical hatcheries, each of 24 m x 10 m with elevated fibre glass roofing and suitable drainage facility in the concrete floor. Separate air-conditioned rooms are provided for conditioning the brood stock and rearing the microalgal food. The sea water, from beyond the low water mark, is drawn into a well by gravity, pumped into a 4-chambered sedimentation tank and passed through a biological filter of coarse river sand, pebbles and charcoal. The filtered sea water is stored in 1,00,000 *l* sump, divided into 2 compartments to facilitate easy cleaning and maintenance. The water from the sump is lifted to a 25,000 *l* capacity overhead tank and is drawn to the hatchery and conditioning room. It is again filtered through sterilised cotton before passing into the rearing tanks. For experimental studies, the water is further passed through U.V. chambers but for routine mass culture it is dispensed with P.V.C. pipes and fittings are used and air compressor provides aeration. The algal culture facility can supply 400 1 of axenic culture per day with a cell concentration of 0.5 to 1.0 million/ml. In this hatchery, the annual mean variation of the water temperature is 25.4°C to 32.6°C, salinity from 31.7% to 37.48%, dissolved oxygen from 3.18 ml/l to 5.04 ml/l and pH from 7.7 to 8.4. The hydrographic conditions are generally stable and permit year round operation of the hatchery.

HATCHERY TECHNOLOGY

The techniques developed (Alagarswami *et al*,1987 and Nayar

et al, 1987) are essentially the same for all the bivalves experimented. Mechanical, chemical and thermal stimuli induced spawning in ripe specimens but the latter method is used as a routene. A batch of about 25 adult animals are conditioned in 100 l fibre glass tanks at about 5°C below the ambient temperature and are fed intensively with mixed phytoplankton. They are periodically examined for gonad condition and when ripe are transferred to 75 l perspex tanks. Spawning is induced by raising the water temperature 2°-5°C above the ambient. Spawning takes place in about an hour and the spawners are removed. The fertilised eggs settle at the bottom and the supernatant water is siphoned out, adding isothermal water repeatedly. After 4 h, the free swimming morula larvae are siphoned into 1 l fibre glass tanks. The veliger larvae develop in about 20 h and take food. The flagellate *Isochrysis galbana* is given as food during its exponential phase at 3000 to 4000 cells per larva per day. The feed is increased gradually to reach about 12,000 cells at pediveliger stage, which is reached in about 2 weeks. Of the 18 species of flagellates isolated and tested *Pavlova lutheri*, *Chromulina* sp and *Dicrateria* sp also give satisfactory results. The spat settles in 15-20 days and suitable spat collectors are provided where required. In some larval rearing experiments over 90% survival was achieved till spat settlement. The spat is fed with mixed phytoplankton containing *Chaetoceros*, *Skeletonema*, *Thalassiosira*, *Nitzschia* etc., reared in enriched water. After about 2 months the spat are ready for transfer to the field. Food is given daily after water change.

In algal cultures, for the isolation of the desired species, the serial dilution technique is followed and Walne's medium is used for the maintenance of both stock and mass culture.

PERSPECTIVES

The hatchery technology developed is simple and low cost for adoption. Its viability has been proved by the repeated success achieved during the past 7 years. Supply of good quality water and the right type of food are the critical factors behind this success story. It is also geared for the mass production of seed as is evident by the production of 1.3 million pearl oyster seed in one experiment (Alagarswami *et al*, 1987). At the rate of 4 batches per year an estimated 10 million seed can be produced in the two hatcheries at Tuticorin. The hatchery technology should help to solve the resource constraint as no commercial venture can come up based on widely fluctuating natural resources. It may be mentioned that the CMFRI has taken up a

sea ranching programme and since 1985, a total of over 9 lakh hatchery produced pearl oyster spat were released in the pearl banks of the Gulf of Mannar to replenish the natural population.

A tentative estimate of the cost of production of spat made in 1982 was approximately 22 ps (Anonymous ,1982). Since then considerable improvements have been effected in maximising the survival rate of the larvae and spat in the hatchery. There is need to start a pilot scale hatchery and work out the economics of seed production.

The development of the hatchery technology has opened the doors to undertake studies on aspects such as brood stock management, larval ecology, nutritional requirements at different growth stages, identification of diseases and their control and genetics to improve the quality of the stocks. Though a beginning was made in some of these areas much remains to be done.

Apart from the bivalves mentioned earlier, recently diverse organisms such as the gastropod *Trochus radiatus* and the holothurian *Holothuria scabra* have been successfully induced to spawn and their seed produced at the Tuticorin Shellfish Hatchery by suitable modification of the techniques. This achievement makes the concept of a versatile hatchery a reality with far reaching significance in that it enables a switchover from one species to another, depending on the demand.

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