

LARVAL REARING OF BIVALVE MOLLUSCS

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Probably no more than two species of commercially important marine bivalves in the Philippines have ever been cultured thru their entire life cycle. The life cycles of the window-pane shell, Placuna placenta, the pearl shell, Pinctada maxima, the sun and moon scallop, Amusium pleuronectes, the oyster, Crassostrea iredalei and scores of other bivalves are entirely unknown. However, many investigators in the United States, Europe, Great Britain, Australia and New Zealand have made significant contributions to the field of larval rearing of bivalves and many of their techniques are adaptable to our tropical species. The larval stages of the green mussel, Perna viridis (Mytilus smaragdinus) for example, have been successfully reared (Young, 1979) thru the juvenile stages using such adapted techniques. This paper is a synopsis of such techniques for rearing the larvae of bivalve molluscs.

To avoid excessive citations (owing to the wealth of literature on almost every aspect of larval rearing), literature references will be kept to a minimum. Instead, a list of references is appended for the benefit of those who wish to delve deeper into the topic.

Broodstock

Only adults with mature gametes are collected as breeding stock. To determine general gonadal condition of a specific population it is sufficient to examine a few sample specimens. Mature eggs become well rounded in seawater, while spermatozoa swim actively upon introduction of seawater.

Adults with mature gametes may be kept in ripe condition for short periods of 1-2 weeks without food in 20-22°C aerated seawater, or for longer periods (1-2 months) if well fed. By maintaining 30-40 mature adults in a cold water (20-22°C) broodstock tank, a supply of viable gametes for experimental work can be assured year-round.

Induced Spawning

Most bivalves release their gametes into the water where fertilization and larval development occur. Spawning may be induced in a male or female by introducing gametes of the opposite sex. At times, it may be necessary to rapidly increase and/or decrease the water temperature before adding the sperm or egg suspension. The oyster, Crassostrea iredalei has been found to respond to either stimuli. The green mussel P. viridis does not respond to temperature fluctuations unless "conditioned" in cold water for a few days. They are stimulated to spawn by sudden cessation of water flow and/or by its resumption. The scallop Amusium is easily induced to spawn by raising the temperature of the water by 7-10°C.

If natural spawning occurs, care must be taken to discard excess sperms as these soon rot and foul the water. Fertilized eggs may be cultured at densities recommended below.

Rearing of Larvae

Seawater

Seawater to be used for rearing bivalve larvae must be free of pollution by metals, detergents or pesticides -- all of which are directly toxic to larvae. Indirect toxicity can occur thru chelation of essential trace elements, inactivation of cilia, or inactivation of digestive enzymes. Freshly sand-filtered seawater has been used satisfactorily for larvae of mussels and oysters. If available, finer filters which can remove all particles bigger than 10 μm will give even better results. As an alternative to the use of costly and possibly even growth-inhibiting additives for reduction of contaminants in seawater, strict attention should be paid to good housekeeping, frequent washing of larvae and avoidance of static water conditions.

Culture Vessels

Because of the corrosive nature of seawater and the great sensitivity of the larvae to traces of dissolved substances, culture vessels used for rearing bivalve larvae should be preferably those made of either glass, plastic or fiberglass and should be essentially cylindrical in shape, with the depth greater than the diameter.

Food for Larvae

The best food for very young larvae is naked flagellates -- mobile, unicellular organisms of microscopic size (nannoplakton) without any cell wall but containing chlorophyll. In this regard, Isochrysis galbana and Monochrysis sp. have been found to be excellent food for mussel and oyster larvae. Later larval stages will feed on unicellular green algae which have a cell wall, and even on diatoms.

Larval Density/Food Concentration

Recommended concentration for optimum larval growth:

<u>Larval length</u>	<u>Number/ml</u>	<u>Algal cells/ml</u>
50 - 100 μm	15 - 30	30,000
100 - 200 μm	8 - 10	50,000
200 - 300 μm	5 - 8	80,000
300 μm +	1 - 3	100,000

Water Management

Water should be changed at least every third day. To change water, the culture may be siphoned and the larvae collected in a sieve. With precise selective screening, the larvae can be separated from debris and only clean and healthy larvae should be returned to the culture vessels. Gentle aeration should be provided at all times. Bivalve larvae grow well at temperature between 28-30°C and salinities between 25-31 ppt.

Larval Development

Fertilized eggs normally develop into the first larval stage, the trocophore, 10-12 hours after fertilization. After another 12 hours they become well-formed straight-hinge veligers with a bivalve shell and a swimming organ called the velum. As growth proceeds, the umbo starts to form and gradually becomes distinct and/or prominent in most species. Mature larvae develop an eyespot on each side of the bivalve shell and soon are equipped with a functional foot for crawling and subsequent attachment to suitable substrates. Attached larvae (spats) soon metamorphose into the adult form.

Monitoring of Settling

When plenty of mature larvae are observed in the cultures, artificial substrates such as empty bivalve shells, tiles, or bamboo pieces should be suspended in the water to provide settlement substrates for the settling larvae. Spats may be fed algal cells up to 250,000 cells/ml and can utilize a wide variety of algal species. Spats may be transferred to the field at the size of 10-20 mm.

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