Micro-nurseries for bivalve seed production

M. K. Anil*, P. Gomathi, B. Raju, P. M Krishna priya, O. Salini, Ambarish P. Gop and S. Surya
Vizhinjam Research Centre of ICAR-Central Marine Fisheries Research Institute, Vizhinjam P.O,
Thiruvananthapuram - 695 521, Kerala

*E-mail: mkanil65@gmail.com

Abstract

Along the southwest coast of India, mussel farming is practiced by thousands of farmers in the estuarine areas using rack and rope method or on-bottom method, during the post monsoon months. Production of farmed mussel after the peaking in 2009 (18400 t) has stagnated around 9000-10000 t per year. Large scale collection of seed from the natural mussel beds following increased adoption of green mussel farming has led to conflicts between wild mussel pickers and farmers in the past. Moreover, mussel and oyster farmers face an unpredictable wild seed supply and lack of dependable supply of quality seed from hatcheries. Vizhinjam Research Centre of ICAR-CMFRI has developed micro-nursery systems with down-welling and up-welling subsystems for the settlement and metamorphosis of floating larvae to spat and for further nursery rearing of green mussel spat to seed size suitable for farming. This will make large scale bivalve seed production of mussels, edible oyster, pearl oyster and clam possible in the hatchery which can cater to the requirements of thousands of bivalve farmers in coastal areas of India.

Keywords: *Mussel seed, micro-nursery, bivalve farming*

Bivalve larvae settled in the hatchery as spat have to be reared for a short period in the nursery until they reach a size which can tolerate field culture conditions. Land based and field based systems are used for nursery rearing of bivalve seed. Common land based systems used are down wellers, upwellers and race ways. On-bottom, off-bottom containers, floating up-wellers and floating rafts are the common field based systems for nursery rearing.

Micro-nursery (upwelling and down welling), one of the land based culture systems used for bivalve seed production needs continuous circulation of seawater, regular cleaning and monitoring of seeds. Even though the fabrication of these systems are costly, survival and growth rates of spat are better. Therefore these systems are successfully used in USA (especially in the Gulf of Mexico, Georgia, North and South Carolina) for nursery rearing of hard clam species, *Mercinaria mercinaria* and single oyster (cultchless oyster seed) of *Crassostrea virginica*. This system is also used in countries like Canada, France and Australia for bivalve seed rearing.

In the case of commercially important bivalves such as green mussel *Perna viridis*, brown mussel *Perna indica*, edible oyster *Crassostrea madrasensis*, pearl oyster *Pinctada fucata* and short neck clam *Paphia malabarica* fertilization is external and the fertilized egg takes 18 hrs to develop in to D shaped larvae. In 17-21 days the larvae attains eyespot larval stage after passing through morula, D veliger and umbo stages. Then it passes through the pediveliger and palntigrade stage and reaches the spat stage. The typical bivalve larval life stages as recorded for the commercially important green mussel is given (Fig. 1).

Micro-nursery system: This consists of one down-welling and one upwelling sub systems and each with separate reservoir tanks and pumps for providing water circulation (Fig 2). In the down-welling system eyed stage larvae of mussel, oyster or clam can be stocked at high density for settlement and further growth. When the settled spat reaches 4 mm size it can be transferred to upwelling system for further rearing.

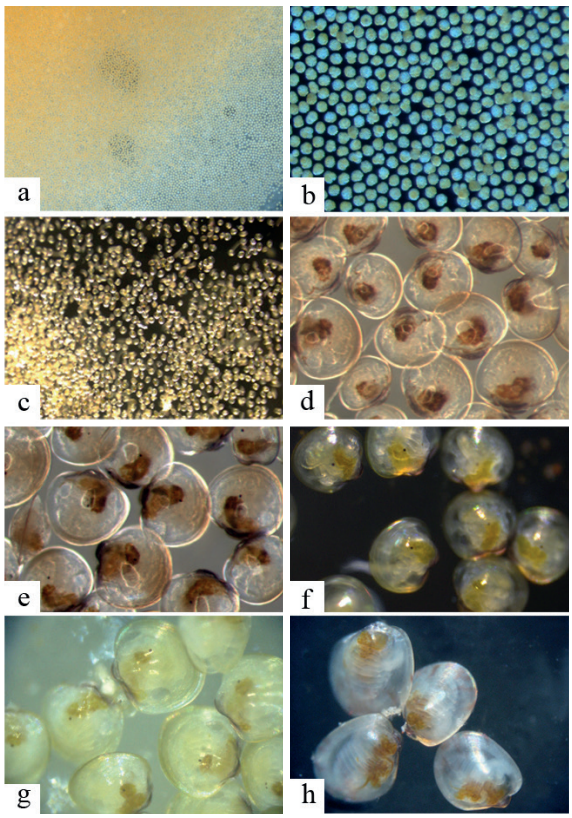

Fig. 1. (a-h) Larval stages of green mussel *Perna viridis* (a) Fertilized eggs (b) Morula stage (c) D-veliger stage (d) Umbo stage (e) Eye-spotstage larvae (f) Pediveliger stage (g) Plantigrade stage (h) Spat

Fig.2 Micronursery

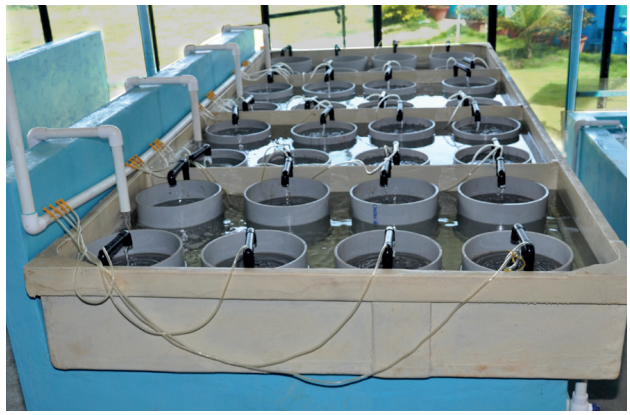

Fig. 3. Down-welling compartments and wells

Down welling system: This unit has 2000 litre capacity divided into 4 compartments of equal size (Fig.3). Down-wellers are the containers or vessels designed to rear the eyespot larvae until they metamorphose to spat. Each compartment has eight PVC wells each of 30 cm diameter and 25 cm height. Wells are provided with air lift mechanism for pumping water to the well from the compartment system. There are downwellers with 150 μ, 250μ, and 750μ mesh which can be used in succession as the growth of the bivalve larvae proceeds. Spat is allowed grow in the down welling containers or wells till they reach 4 mm size that can be transferred to 2 mm upwellers.

Through all the 32 wells water passes from surface to down the system through the mesh (down-welling). Eyed stage bivalve larvae can be transferred directly to down-welling wells with 150 micron mesh. A 30 cm diameter down-weller can accommodate up to 0.3 million eyed larvae. Eyed stage will settle in the wells and can be grown till 2 mm (15-20 days) size by changing to 250 μ and 500 μ wells. On the 20th day the spat are transferred to 750 μ mesh and grown there till they reach 4 mm (15-20 days).

Up-welling system: It has two race way compartments with a total 1500 litre volume capacity (Fig.4). Each compartment has 8 wells provided with the bottom mesh of 2 mm size. Here spat can be grown from 4 mm to seed size of 20 mm in 60 days. Water flows from these compartments up through the mesh (upwelling) of the wells upwards to the middle drainage section through a half inch pipe and from where water is drained to the reservoir. Stocking rate in the upwelling wells is from 50000-100000 depending on size and species.

Seawater with required feed is circulated through the systems from the reservoir by two dedicated pumps of 0.2 hp. Required quantity of the feed proportional to the stocking density and size of the spat is directly poured in to the respective reservoirs of upwelling and down welling systems. In the micron nursery usually the feed given is ratio of 2:1:1 *Chaetoceros calcitrans*: *Isochrysis galbana:Nanochloropsis salina.*

About 0.1 million spat can be nursery reared to seed size (8-12 mm) in a micron meshed nursery within 45

Fig. 4. Up-welling system

days and 17-20 mm on 60 days. On the other hand, spat reared in hatchery shows only limited growth and low stocking density. Seed grown in the micro-nursery nursery can be used for seeding ropes or used for on-bottom farm nurseries for further growth.

Every alternate day the wells are cleaned by spraying seawater through a nozzle connected to 0.5 hp pump and water is fully drained from the compartment and reservoirs and refilled with fresh seawater so that all the accumulated waste materials are removed.

There is a high demand for bivalve seed especially mussel and oyster seed as the quantity of seed available from the wild are erratic. Also, most of the time when it reaches the farmer it is of lowered quality. Bivalve seed of required quality and quantity can be made available using the present technology.