

Selection of freshwater pearl mussel species for mantle transplantation in Bangladesh

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Abstract

Allograft mantle transplantations were studied in six species of freshwater mussels, *Lamellidens marginalis*, *L. corrianus*, *L. jenkinsianus*, *L. phenchooganjensis*, *Parreysia corrugata* and *P. favidens* by transplanting foreign mantle tissue into the mantle tissue of a host mussel. After three months of rearing, maximum survivability and pearl formation were observed in *L. marginalis* and *L. jenkinsianus* followed by *L. corrianus* and *L. phenchooganjensis*. Very poor results were observed in case of *Parreysia corrugata* and *P. favidens*. In addition to the natural pearl producing capacity of individual species, survivability and pearl production were related to the size of the mussel species. *L. marginalis* has been identified as the best species for mantle transplantation in Bangladesh.

Key words : Pearl, Mussel, Mantle transplantation

Introduction

Pearl culture is a type of aquaculture with high economic value. The prospect of pearl culture is bright and promising in Bangladesh due to the warm weather with twelve months growth period both for pearly mussel and pearl. Freshwater mussels, which are used for pearl culture, can be cultured in the fish pond and other suitable water bodies. Mussels filters the water as water cleaner, therefore, the pearl culture is environment-friendly. Pearl culture can be conducted in any kind of water bodies like ponds, lakes, rivers, reservoirs, etc. So, it is easy to extend in rural area with low input and high output. Pearl culture operation can be done by women. Therefore, it will provide more employment opportunities to the rural women who will play an important role in social and economic development of Bangladesh.

Although there is a great potential, pearl culture has not yet been flourished commercially in the country due to lack of technical know-how and financial constraints (Sarker 1994). A recent survey report also described the past history and present status of natural pearl culture and suggested the bright prospect of pearl culture in Bangladesh (Mazid 2001). Freshwater pearl culture started in China 2,000 years ago. Today, Chinese cultured pearls have demand throughout the world, 95% of freshwater pearl production

in the world market comes from China. Freshwater pearl culture is growing as a source of employment and income in many South-East Asian countries (Ram 1997).

Pearl production and quality mainly depends on the mussel species and operation techniques. The mantle tissue of different part has the different nacre secretion capability to produce the various qualities of pearl. Different place of tissue transplantation also affect the pearl quality. Pearl quality also depends on the age of mussels, juvenile secretes pearl layer and forms pearls much faster than adult. The environment such as water depth, water quality, natural food, etc. is also important to the pearl culture. Among all those factors related to pearl culture, mussel species is the key factor to the pearl culture. Because, nacre secretion of various mussel species may be different. In the present study, pearl formation through tissue transplantation in some mussel species have been investigated.

Materials and methods

Species selection

Six species of freshwater mussels have been selected. The species were, *Lamellidens marginalis*, *L. corrianus*, *L. jenkinsianus*, *L. phenchooganjensis*, *Parreysia corrugata* and *P. favidens*. Only strong and healthy mussels were selected for mantle tissue transplantation.

Methods for mantle tissue operation

Operation includes two steps, mantle tissue slice making and transplantation. For slice making, mussels of healthy and strong condition were selected. Mussel was opened and mantle tissue was then separated along pallial line from the mussel. Separated tissue strip was then transferred into a glass board and cut into small splices of 2 mm x 2 mm size.

For the mantle tissue transplantation, mussels of 1 year age, healthy and strong, with broad and distinct growth line and without disease or injury were selected. A piece of mantle tissue was taken with needle in one hand and a wound was created in the mantle tissue of mussels along the horizontal direction with a hook in another hand. At this point tissue slice was transplanted into the bottom of the wound. Similarly, the next one was transplanted following the direction from posterior side to center. In this process 8-10 slices were inserted in a single mussel.

Management practice

Operated mussels were transferred to a rearing pond of 65 decimal within 3-4 hours of operation. Water depth of the pond was 1.5-2.0 meters. In a net bag 3 mussels were stocked and hanged from a rope stretched across the pond in the surface of water. The hanging depth was 30-35 cm. Mussels are primarily plankton feeder, therefore yellow green water colour and about 30 cm transparency were maintained through proper fertilization to maintain the optimum plankton density in the pond.

Sampling

Mussels were checked for survival and health condition fortnightly. Water quality parameters were recorded fortnightly. After 3 months of rearing, mussels were counted for survival. Each mussel was opened and number of pearl in each mussel was counted.

Results and discussion

Table 1 showed the water quality parameters of rearing water. Temperature of water was suitable and in optimum range for pearl formation. Oxygen, pH and alkalinity also affect the pearl growth, which were in suitable range. Calcium is the most essential element to pearl culture, as calcium carbonate is the major component of both the mussel's shell and pearl. Mussel and pearl production depend on assimilation of calcium. It is recommended that calcium content of rearing water should be over 10 mg/l for better mussel growth and pearl production (Dan *et al.* 2001). In the present study, calcium in rearing water was more than 10 mg/l throughout the rearing period.

Table 1. Water quality parameters in the ponds during the rearing period

Parameters	Rearing period (weeks)						
	0	2	4	6	8	10	12
Temperature (°C)	28.5	28.0	29.2	30.0	31.1	29.8	31.5
Oxygen (mg/l)	5.2	5.4	5.8	6.0	5.5	5.4	5.8
pH	7.8	7.2	7.5	7.6	7.3	7.5	7.6
Alkalinity (mg/l)	170	170	180	165	185	190	175
Calcium (mg/l)	50	30	35	38	42	46	52

Survivability of mussels after tissue transplantation was the highest (100%) in *L. marginalis* (Table 2). Similar results also obtained in case of *L. Phenchooganjensis*, *L. jenkinsianus* and *L. corrianus*. Survivability was low in *Parreysia corrugata* and *P. favidens*. Low survivability in this two species was related to the smaller sizes of the mussels.

Table 2. Growth of pearl and survival of mantle tissue transplanted mussels after 3 months rearing in pond

Name of species	Average length (cm)	No. of mussel operated	survivability	% of pearl bearing mussels	maximum no. of pearl/ mussels	Average no. of pearl /mussels
<i>L. marginalis</i>	9.5	50	100	93	10	6.4
<i>L. phenchooganjensis</i>	10.5	50	87	75	8	5.0
<i>L. jenkinsianus</i>	9.4	50	97	89	8	6.0
<i>L. corrianus</i>	9.4	50	84	68	7	5.3
<i>P. corrugata</i>	6.1	50	56	45	5	2
<i>P. favidens</i>	5.1	50	59	53	6	3

Among the survived mussels, 93% of *L. marginalis* found pearl bearing, which was 89% in *L. jenkinsianus*. In case of *L. phenchooganjensis* and *L. corrianus* pearl bearing mussels were 75% and 68%, respectively. Only 45% and 53% of survived mussels was pearl bearing in case of *P. corrugata* and *P. favidens*, respectively.

In the present study, allotransplantation of mantle tissue has been followed. Pahna and Kasavititkul (1997) studied the mantle transplantation in freshwater pearl mussels in Thailand and observed that allotransplantation yielded the highest success rate of forming pearl sacs. Maximum numbers of pearl were produced in *L. marginalis* and *L. jenkinsianus*, highest average number of pearl also was belong to this two species. Begum *et al.* (1987) studied the pearl formation in *L. marginalis*. They used ceramic bead of 1-2 mm diameters and mantle pieces of 2 mm size. They observed that 15.1% of the transplanted mussels produced matured pearl. Mian *et al.* (2000) studied pearl production in freshwater mussel *L. marginalis*. They used nuclei pearl production process and selected sand, stone, fish eye ball and artificial pearl bead as nuclei. They recorded highest pearl production in stone and lowest in the sand. It is not clear from that study, whether a pieces of mantle was simultaneously inserted with nucleus, which is essential for pearl formation. From the results of the present study, it is clear that maximum pearl formation was found in *L. marginalis*. This is related to the size of this species, which is wider than other species. Long species *L. corrianus* and *L. phenchooganjensis* also showed encouraging results of pearl. formation. *P. corrugata* and *P. favidens* are not suitable for pearl culture operation due to its small size and high mortality after tissue transplantation. Among these species *L. marginalis* can be selected for freshwater pearl culture in Bangladesh. Because, this species is abundant in almost all freshwater bodies of Bangladesh (Sarker 1994). The present study was for a short period to investigate the pearl formation in different mussels species. Further, long-term study is necessary to compare the size and quality of pearl produced in different species.

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