



Freshwater pearl culture: Scope and importance in North West States of India

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Pearl is known as “Queen of Gems” and considered as symbol of beauty, love, purity and good wealth. Pearls were considered as an exclusive privilege of royalty and throughout history held presence within wealthy and powerful people. According to our Indian system of gemology, of nine maharatnas (Heera, Mukta, Manikya, Pravala/Munga, Gomeda, Indra-neela, Vaidurya, Pushyraga and Panna) the pearl (Mukta) is only next to diamond (Heera).

A natural pearl is formed when a foreign particle, such as a piece of sand or parasite, makes its way into particular species of mollusc and cannot be expelled. As a defense mechanism, the animal secretes a substance, known as nacre, to coat the foreign body. Layer upon layer of this coating is deposited on the irritant, resulting in a shimmering and iridescent creation of a gem. Cultured pearls are produced both in marine and freshwater environments. The cultured pearl undergo the same process of formation as that of natural pearl. The only difference is that an irritant of foreign particle, otherwise called as ‘nucleus’, of desired shape and size is surgically implanted into the body of bivalve mollusc where it cannot be expelled. The animal does the rest, creating the precious biological gem, the pearl. A pearl is more or less similar to the inner shining layer called ‘mother of pearl layer’ or nacre of shells. The composition of a pearl is about 82-86 per cent aragonite crystals of calcium carbonate; 10 to 14 per cent organic matrix, a scleroprotein termed as conchiolin; and 2 to 4 per cent water. A pearl has 3.5 to 4.5 hardness on Moh’s scale with a specific gravity of 2.7. Pearl culture is a billion dollar business and one of the world’s largest aquaculture activities in terms of value.

Indian freshwater pearl mussels : The Indian freshwater mussel fauna comprises of two major genera, which are abundantly found in most of the freshwater bodies. The genus *Lamellidens* is represented by nine species and two sub-species, while the genus *Parreysia* is represented by 35 species and six sub-species. Of the 52 Indian species, only three common species are being employed in pearl culture operations, though a majority of

other regional species also possesses pearl nacre, indicating future prospects.

Freshwater pearl mussel species available in the region : Three species of freshwater mussels *i.e.* *Lamellidens marginalis*, *L. corrianus* and *Parreysia corrugata* are available in the Harike wetland and the surrounding areas (canals) in Ferozpur district of Punjab (Fig. 1) and Bhakhra and Nangal areas of Himachal Pradesh. These species can be employed for pearl production in North West states of India as they are abundantly available in the regional natural water bodies. Different size and age groups of the said mussel species had been found during survey collection from different



Fig. 1 and 2 : Collection of different species of freshwater pearl mussels from natural waters

Table 1 : Proposed activity table for freshwater pearl culture in the region

Sr. No.	Activity	Duration (months)	Remarks
1.	Procurement of instruments, nucleus, plastic wares etc.	April-May	Surgical instruments for the implantation of mussels, plastic wares should be procured and nucleus can be prepared from dead mussel shells
2.	Selection of site for pearl culture and pond preparation	May-June	Factors are presence of mussel stock, good sources of water, protection from flood, free from pollution and salinity
3.	Collection of live mussels	June-July	Found in shallow areas of ponds, rivers, lakes, irrigation canals and dams
4.	Pre-operative conditioning and implantation of nuclei	July-August	Batch wise pre-operative conditioning for two days and surgical implantations of nuclei, depending on the pearl type targeted
5.	Post-operative care and culture	August-July	Implanted mussels are tagged and placed in nylon bags, suspended in earthen pond for rearing, suitable water quality and natural food provided during rearing
6.	Harvesting*	July	Mantle cavity implanted design/image pearls can be harvested depending on the quality and size

* The pearls can be harvested after one to three years of culture depending on the quality of pearls desired and the size of the nuclei inserted. The longer the culture period, the better the quality of pearls.

water bodies (Harike, Nangal, Govind Sagar etc.) in the region.

Feeding : The freshwater mussels feed on a variety of food items like detritus, diatoms, algal filaments, desmids, spores and small amount of animal remains like crustacean appendages.

Regional achievement : Under UGC financed project, pearl culture activity was started for the first time in Punjab at College of Fisheries, Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana. Different species of freshwater pearl mussels were collected from natural sources (Fig. 1 and 2) and screenings of suitable species were done. Design/image and round nucleus were successfully produced (Fig. 3) from dead mussels shell, as base material for implantation in mussels for pearl production. Prepared nuclei were implanted (Fig. 4) by three methods (gonadal, mantle cavity



Fig. 4 : Implantation of nucleus in mussels



Fig. 3 : Design/image and round nuclei

and tissue), Out of these three methods, mantle cavity implantation method was found to be better in terms of higher survival and growth. Further, rearing of implanted mussel in nylon bags (hanged from bamboo frame (Fig. 6) was found to be comparatively better than rearing in perforated plastic crate for higher survival and growth of implanted pearl mussel under local climatic conditions. True pearls were successfully produced (Fig. 7) in implanted mussels reared along with carps in polyculture system. The maximum and minimum thickness of nacreous layer was 0.35 and 0.20 mm respectively in mantle cavity implantation method. Preliminary trials on breeding of *L. marginalis* and *Parreysia corrugata* under captivity had also been successful for the first time in Punjab. So, there is great potential in relevance to utilization of one of the abundantly available freshwater pearl mussel, for pearl



Fig. 5 : Post-operative care of mussels



Fig. 7 : Designer and round pearls inside the mussels produced at GADVASU, Ludhiana, Punjab



Fig. 6 : Nylon bags rearing method in pond

culture in the region.

As a filter-feeder or suspension feeder, pearl mussels feed mainly on plankton through the filtration of gills. The pearl mussels have shifted their niches from the benthos in natural waters to the water column in cultured ponds, where they have hung in the upper layer of the water column in net bags, thus plankton becomes even more important food source for them. So practically, it becomes

essential to frequently fertilize the ponds with organic/inorganic fertilizer for sustainable plankton growth to support optimum mussel growth. However, the disadvantages of this technology are: 1) pond water is often heavily loaded with high concentration of nutrients (e.g., N and P) and high Chemical Oxygen Demand (COD) that resulted from frequent fertilization, which are potential pollution sources to the surrounding environment; 2) high loading of nutrients often leads to the frequent occurrence of algal blooms (especially cyanobacterial blooms), which further causes a high pH and a violent fluctuation of Dissolved Oxygen (DO) in mussel ponds; 3) the phytoplankton assemblage is often dominated by mussel inedible cyanobacteria (such as microcystis etc.) due to the enrichment of nutrients, and 4) poor water quality and unpalatable algae impact the growth of mussels, which further impact the quality of pearls, etc. Therefore, with good management practices survival of implanted mussels can be increased. Pearl culture can be integrated with carp polyculture system as the implanted mussels are kept in nylon bags suspended in an earthen pond from a bamboo frame. There is a vast scope of pearl culture in North West states of India and the farmers/small entrepreneurs can harness its commercial potentials.

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