



Freshwater Mussel Culture In India: A Status Review

Adarsh Singh and Reeta Singh Rawat

P. G. Department of Zoology, B.S.N.V. PG. College, Lucknow

University of Lucknow, India

Abstract

Freshwater mussels are an essential component of the aquatic ecosystem and play a crucial role in biogeochemical cycle. Freshwater mussels are ecological as well as economically important, and they are potent candidates for aquaculture. Now a days aquaculture of freshwater mussels increases rapidly in India and also in all over world because of their pearl producing ability, high nutritive values and their ecological contribution towards aquatic ecosystem. This article provides detailed available information on freshwater mussel aquaculture in India with special reference to *Lamellidens marginalis*.

Key words- Fresh water mussel, Aquatic ecosystem, Aquaculture, Pearl, *Lamellidens marginalis*

Introduction-

Fresh water mussels are molluscs, which have two hinged shells with special features of filter feeding (Rawat and Singh, 2023). The Unionoida are freshwater bivalves that possess a parasitic larval phase in their life cycle in all types of inland waters throughout the world. They are found Culture of Freshwater mussels in a freshwater environment is developing in India. Mussel culture technology, which probably originated in China, is on the threshold of becoming a major aquaculture industry in Japan and China. Realizing global trade potential of cultured freshwater pearls, other countries Bangladesh, Korea, Philippines, Thailand, and Vietnam have initiated both research and industrial-scale projects in recent years (Fassler1994). It is in this context that fresh water pearl culture assumes significance in the aquaculture sector. The species of pearl mussels under the genera *Lamellidens* and *Parreysia* are widely distributed in Southeast Asia. Common freshwater mussel *L. marginalis*, *L. corrianus*, and *P. corrugata* have been identified as important species for pearl culture operations in India (Janakiram 1989). They are widely distributed in the northeast, western, central, and southern states of India (Thomas 1974). Species of *Lamellidens* are described as inhabitants in stagnant to slow flowing habitats such as ponds and reservoirs up to a depth of 0.5-1.0 m, while *P. corrugata* is recorded in lotic habitats (Janakiram and Radhakrishna

1984). Studies on distribution of pearl mussels *L. marginalis* and *L. corrianus* in the state of Orissa have indicated that mussels prefer alluvial soil areas and particularly ponds having soft sediment. Mussels also were recorded in greater abundance in water with green algal bloom (*Chlorococcum* sp. and *Scenedesmus* sp.). Environmental variables such as red loam soil areas, hard substratum of the bodies of water, presence of macrophytes *Eichhornia* sp. and algal blooms like *Euglena* sp. and *Microcystis* sp. appear to restrict the distribution of pearl mussels. *Lamellidens marginalis* (Lamarck), an important pink pearl producing freshwater mussel is increasing demand in pearl producing countries (Ram 1989). It is also playing an important role in ecosystem services (Ngor et al., 2018; Vaughn, 2018). Though freshwater mussels are not commercially very important as a source of food, these mussels support small-scale fisheries in some parts of India and are potential candidate species for freshwater pearl production (Ramakrishna and Dey, 2007; Thippeswamy et al., 2014). It is also used as a bio-indicator for monitoring the health of aquatic ecosystems because they are extremely sensitive to a wide range of environmental factors including the levels of dissolved oxygen in water (Wayker et al., 2012; Ray et al., 2013; Mundhe et al., 2015; Ramesha and Sophia, 2015). India has more than 50 species of mussels distributed in various freshwater bodies and among them, the genus *Lamellidens* is represented by nine species and two sub-species (Rao, 1989). *Lamellidens marginalis* (Lamarck, 1819), the most commonly available freshwater mussel, is widely distributed in ponds and derelict water bodies in Bihar and substantially contributing as a source of protein and income for local people. Thus, changes in the abundance and biomass of this species can directly or indirectly influence the ecosystem functioning and the livelihood of local people. Fresh water mussels are filter-feeders that have a unique life history, requiring that their larvae (glochidia) needs a fish host to complete their life cycle. Embryos mature into glochidia in the gills of the female mussel. Once mature, the female then releases the glochidia into the water, where they must attach and encyst on the gills, fins, or epidermis of a suitable host fish for metamorphosis to the juvenile stage. Once this transformation is complete, juveniles excyst and drop off the fish host to begin their lives on the bottom of a river or lake. Freshwater mussels (Bivalvia, Unionida; hereafter, mussels) are important ecosystem engineers in many of the world's rivers, canals, lakes, and ponds, yet globally they represent one of the most imperiled taxonomic groups (Böhm et al., 2021). Mussels can dominate the benthic biomass of rivers (Newton et al., 2011) and their filtration of water, coupled with the creation of bio deposits, plays a key role in transferring suspended material from the water column to the benthos, thus influencing water clarity, primary and secondary production, biogeochemical cycles, and sedimentation rates (Vaughn, 2018). Their shells provide substrate for epiphytes and refuge for macrozoobenthic taxa (Ilarri et al., 2018).

Global Status of Freshwater mussel Culture-

Freshwater mussel farming is the world's fastest growing aquaculture sector, with an annual growth rate of about 10%. It is now practiced in many parts of the globe for the production of freshwater pearl mussels and freshwater pearl oysters. Tradition of Aquaculture is about 4000 years old. Mussel culture technique, which most likely originated in China, is on the verge of becoming a significant aquaculture sector in Japan and China, with annual revenue of \$2 (US) billion. Other nations, such as Bangladesh, Korea, the Philippines,

Thailand, and Vietnam, have recently begun both research and industrial-scale programs in response to the worldwide commerce potential of farmed freshwater pearls (Fassler 1994). Fresh water Pearl mussels of the genera *Lamellidens* and *Parreysia* are found across Southeast Asia (Patil et., al. 1976). This sector has expanded as more people become aware of the potential for pearl production in freshwater mussels, particularly in the Republic of China. According to Ward (1985), the United States of America is joining the field of Fresh water mussel culture. Bangladesh began a program of mussel pearl culture with large riverine resources (Ahmed, 1982). Barman et al., (2018) reported availability of *L. marginalis* *L. corrianus*, *L. jenkinsianus* and *L. phenchooganjensis* in natural waters of Bangladesh and their potential for pearl culture.

Indian Status of Fresh water mussel culture

Mussel culture is fast becoming popular in the Malabar area since 1997 following the success achieved by CMFRI in rearing green mussel by rack culture in the backwaters and popularizing through involvement of progressive farmers who took up its culture in the backwaters and found it as profitable venture. Total mussel production in India is about 20,000 tonnes in 2009-10. (CMFRI, 2009-10). 1997. Two species of mussels, green mussel *Perna viridis* and brown mussel *P. indicaare* available in Indian coast and are exploited on commercial basis for edible purpose. Kerala is considered as the 'mussel fishery zone of India since extensive natural mussel leads are available in the Malabar. In early 70's the Central Marine Fisheries Research Institute, Kochi developed simple, eco-friendly farming techniques through experiments and demonstration trials in different parts of the country through group farming activities in Kerala (CMFRI, 2008).

Some Important genera of Freshwater mussels in India-

There are two genera of Fresh water mussels can be used for aquaculture, *Lamellidens* and *Parreysia*, for the production of pearls and food The one used for pearl culture should be *Lamellidens marginalis*, for two reasons. First, due to its size (the mature ones range from 7 to 10 cm, measured from anterior to posterior end) as compared to *Parreysia*, it is suitable to operate on. Second, they are common in most inland bodies of water (Mahnoor Patel et al. 2019). Both species *Lamellidens* and *Parreysia* are widely distributed in Southeast Asia. Other freshwater mussel *Lamellidens corrianus*, and *Parreysia corrugata* have been identified as important species for pearl culture operations in India by Janakiram in 1989. *Lemellidens marginalis* (Lamarck) was also recorded in River Gomti and other water reservoirs in and around Lucknow (U.P) India with one more variety of fresh water mussel, *Parreysia favidens* (Benson) by Shukla et., al 2018. *Lamellidens marginalis* is found throughout the year in river Gomti,Lucknow (U.P) and help in producing pearl through their culture (Rawat and Singh et.,al 2023).



Fig 1- *Lamellidens marginalis* in Laboratory Fig 2- *Lamellidens marginalis* in water of Gomti River,Lucknow

Fresh water mussel culture methods-

Fresh water mussels are potent candidate for aquaculture because they are high in nutrition and easily cultivable. They are important components of food webs, and they link and influence multiple trophic levels. Mussels filter food from both the water column and sediment with ciliated gills. Differences in cilia structure and arrangement might allow mussel species to partition food resources. Mussels are omnivores that feed across trophic levels on bacteria, algae, detritus, zooplankton, and perhaps, dissolved organic matter (Parmalee *et. al* 1974.). Mussels are cultured in ways that imitate the natural circumstances they might experience in streams, rivers, or lakes. The larval form glochidia act as parasite and attache to gills of fishes for the nutrition. and The survival of juveniles is frequently irregular and uncertain. because of the presence of various limiting constraints, such as Infestation of host fish caused by larvae released by a pregnant female process, as well as natural pathogenic contamination agents in the water (Bauer, G., 1988, Keller & Zam, 1991; Yeager & Saylor, 1995). The two main phases of freshwater mussel culture include the metamorphosis of glochidia and the rearing of newly metamorphosed individuals to their adult form. Freshwater mussel Farming is done in lakes, ponds, and rivers that have clean water that is relatively free of pollutants. The most commonly grown Fresh water mussel in India are *Lamellidens* sp. And *Payressia* sp. The process of growing freshwater mussels begins with collecting adult mussels from their natural habitats. Then Adult mussels are then brought to a hatchery where they are kept in recirculating systems that control the water quality and food availability. After about six weeks, larvae begin to form and attach themselves to ropes or nets submerged in tanks of water. After about two months, larvae will grow large enough to attach themselves to a hard surface such as rocks or concrete blocks before being released into clean bodies of water where they will mature.

Importance of Fresh water mussel culture-

Fresh water mussel culture is a low investment activity with very good returns. If promoted properly, mussel farming can be used as a tool empowerment of farmers in India and can stimulate a healthy socio economic development. Fresh water mussels are essential for aquatic ecosystem, because of their filter feeding behaviour. *Lamellidens marginalis* (Lamarck), an important pink pearl producing freshwater mussel is increasing demand in pearl producing countries (Ram 1989). Freshwater pearl culture is an emerging enterprise across the Asia now days, which is directly linked with the type of shell and secretion of nacre (Mishra et al., 2009). Freshwater pearl culture is a developing technology in India, which is possible by culture of Fresh water mussel. They are widely used in pearl industry, button industry, medicines, as food etc. since long (Mishra, 2005; Safaktullah and Krishnamoorti, 2014; Dhaneswari and Sanjeevi, 2016). Wide range of distribution, sedentary mode of life and filter-feeding behavior of Fresh water mussels qualify them as candidate species for assessment of toxicity of pollutants and related bio-monitoring of the health of water bodies. As sedentary suspension feeders, they remove a variety of materials from the water column, including sediment, organic matter, bacteria, and phytoplankton. Siphoned material is either transferred to the mouth for digestion or sloughs off the gills and exits via the ventral margin of the shell (pseudo faeces). Digested material is either used as fuel for various life processes or excreted as faeces. The amount and rate of particulate matter removed from the water column and subsequent deposition of waste is largely dependent on temperature, particle concentration, flow regime, mussel size, and species. While the siphoning activities of mussels are often overlooked, they provide an integral resource link between pelagic and benthic habitats. Freshwater mussels are commonly labeled as “good” indicators of biological integrity and water quality by scientists.

Conclusion- The current study provides information about the diversity of Fresh water mussels and their role in aquatic ecosystem as well as their economical value. They are renowned as ‘Ecosystem Engineers’ for their valuable ecosystem services. These include filter-feeding on organic matter, phytoplankton, zooplankton, bacteria, and algae etc., suspended in the water and excrete fine particulate matter, thereby improving the water quality. Fresh water mussels are economically, nutritionally and medicinally important mollusc. These are considered as an indigenous source of dietary protein of human, fish and poultry. Different body parts of Fresh water mussels are consumed as medicinal and therapeutic purposes for the cure of rheumatism, asthma, anaemia, tuberculosis, paralysis, muscle dystrophy, menstrual disorder etc. Freshwater bivalves or mussels play an important ecological role in lotic and lentic ecosystems and their distribution in stream bears manifold implications for aquatic ecosystem. The shell of mussels are utilized to manufacture jewelries and production of commercial lime in small scale industries. Freshwater mussels play a number of important roles in aquatic ecosystems. But Habitat of this freshwater bivalve is under ecological threat due to different anthropogenic activities like habitat destruction and pesticide contamination. It has been concluded that the over exploitation, water pollution causing major threats not only to Mollusca fauna but to entire flora and fauna. With these findings, concrete and conservative

measures should be immediately applied, not only for the health of aquatic ecosystem but for the well-being of the human population. Fresh water mussel culture helps in conservation of these important molluscs. In India Culture of Fresh water mussel is profit making industry. It could be used for economic development of Country as well as sustainable use of Rivers.

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