AGRI MAGAZINE
(International E-Magazine for Agricultural Articles)
Volume: 03, Issue: 11 (November, 2026)
Available online at http://www.agrimagazine.in
©Agri Magazine, ISSN: 3048-8656

Ornamental Fish Culture for a Sustainable Livelihood Opportunity

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The ornamental fish industry is a rapidly growing sector with significant economic, ecological, and employment potential. India, with its rich biodiversity, harbors over 150 native ornamental fish species while also accommodating more than 280 exotic species. The successful captive breeding of over 100 species has contributed to the expansion of the trade, making it a vital contributor to the global market. This sector not only supports livelihoods, particularly in rural and coastal regions, but also fosters advancements in aquaculture technologies, sustainable breeding practices, and conservation efforts. However, challenges such as water quality management, disease control, and the ecological impact of invasive species pose concerns.

Introduction:

Ornamental fish keeping, introduced in 1805, is among the earliest and most cherished hobbies worldwide, second only to photography, while also supporting rural and coastal economies through exports. The global demand for ornamental fish is rising, with prices significantly higher than those of fish for consumption. Over the past 40 years, advancements in breeding technology have enhanced overall production of oviparous (egg-laying) and viviparous (live-bearing) fish. Intensified breeding operations now require a steady provision of a nutritious diets and economical feed, contributing to the steady growth of the ornamental fish industry. India holds a vital position in the ornamental fish sector, providing substantial employment opportunities and contributing significantly to the economy.

Keywords: Ornamental fishes, Breeding, feeding





Types of Ornamental Livebearers

Livebearers are ornamental fish species that give birth to live young rather than laying eggs. These fish are highly popular in the aquarium trade due to their vibrant colours, adaptability, and ease of breeding. The most commonly kept livebearers include guppies, mollies, swordtails, and platies, each of which has distinct characteristics that make them suitable for different aquarium environments.

Guppies



Guppies, also known as million fish (*Poecilia reticulata*), originate from Central America and have a lifespan of approximately two years. They are small fish with a variety of caudal fin shapes and colors, an upturned mouth, and large eyes. Male guppies are more colorful than females and possess a gonopodium for reproduction. They thrive in temperatures ranging from 22-24°C and a pH of 7.0-8.0. Guppies consume various types of food, including live feed such as bloodworms and daphnia. Since they are cannibalistic towards their fry, breeding traps are often used to protect the young. Guppies reproduce frequently, with a single female giving birth to up to 250 fry every 4-6 weeks. Common guppy varieties include black guppy, double sword guppy, red snakeskin guppy, and tuxedo guppy.

Swordtail





Swordtails (Xiphophorus helleri), another widely kept livebearer, are recognized for the elongated lower lobe of the male's caudal fin, resembling a sword. These fish originate from Central America and can live up to five years. Males are smaller than females, reaching about 10 cm in length, while females grow up to 12 cm. They thrive in temperatures of 22-25°C and a pH of 7.0-7.5. Swordtails are omnivorous and accept a variety of foods, including bloodworms and tubifex worms. They breed easily, with females giving birth to 50-60 fry every 4-6 weeks. Notable varieties of swordtails include marigold wag swordtail, pineapple swordtail, and hi-fin lyretail swordtail

Platies





Platies (Xiphophorus maculatus), another livebearer species, are known for their deep-bodied shape and peaceful nature. They exhibit an impressive range of colors due to selective breeding. Males are smaller, measuring around 3.5 cm, while females can grow up to 6 cm. Platies prefer water temperatures of 22-27°C and a pH of 7.0-7.5. They are omnivorous, feeding on both live and artificial food. A single female can produce 30-100 fry within 20-25 days of mating. The species' vibrant color variations make them highly desirable in-home aquariums.

Mollies



Mollies (Poecilia sphenops) are another significant group of livebearers, requiring slightly brackish water for optimal health. They can live for 3-5 years and thrive at temperatures between 20-25°C with a pH of 7.0-7.5. Male mollies are distinguished by their elongated dorsal fins and gonopodium, whereas females have a fan-shaped caudal fin. Mollies exhibit diverse colors, including black, white, and marbled patterns. A female molly can give birth to 30-100 fry after a gestation period of 20-25 days. Common types include sailfin molly (Poecilia latipinna), short-fin molly (Poecilia mexicana), and marble molly.

Culture and Breeding of Livebearers

Livebearers are widely cultured due to their ability to give birth to free-swimming juveniles, eliminating the need for egg incubation. Their breeding process is relatively simple, with females capable of storing sperm and producing multiple broods from a single mating event.

The ideal breeding conditions include a temperature range of 22-28°C, a pH of 7.0-8.0, and well-aerated water. A sex ratio of 1 male to 3-5 females is recommended to optimize reproduction and minimize stress on females. Selective breeding programs have been implemented to enhance desirable traits such as color intensity, fin shape, and disease resistance. Moreover, breeding traps and separate nursery tanks are used to protect fry from predation by adult fish. Advancements in recirculatory aquaculture systems (RAS) and raceway ponds have improved the mass production of livebearers, ensuring a steady supply to the ornamental fish market.

Importance of Nutrition in Broodstock

Broodstock nutrition plays a crucial role in fish growth, reproductive performance, egg quality, and larval survival. A balanced diet, particularly with adequate protein, lipids, and essential fatty acids, is essential for proper gonadal development, oocyte maturation, and spawning success. Fish meal is a valuable protein source, typically containing 60–72% protein, and is commonly included in broodstock diets. In ornamental livebearers, dietary protein levels of about 25–40% have been reported to support better growth and reproductive performance. Adequate nutrition promotes vitellogenesis, increases ovary weight and gonadosomatic index (GSI), and improves fry production and survival. Therefore, proper broodstock nutrition is essential for successful reproduction and healthy offspring production in ornamental fish culture.

Food and Feeding

Food, particularly the initial diet of larvae, is crucial for ensuring high survival rates. Small-scale farmers often cannot afford commercial pellet feed or brine shrimp larvae. Instead, they successfully utilize low-cost alternative live feeds. Common options include green water, water fleas, Tubifex (sludge worms), mosquito larvae, and chopped earthworms. Additionally, various homemade feeds such as whole-wheat bread, vegetable peelings, and rice are used. However, most farms primarily rely on Daphnia, tubificid worms, and mosquito larvae. Farmers collect Daphnia from nearby ponds by sieving them through fine mesh screens early in the morning, while Tubifex worms and mosquito larvae are typically gathered from sewage water channels. In fact, some individuals make a living by collecting and selling these live feeds to farmers.

Broodstock Management

Effective broodstock management is crucial for ensuring the production of high-quality fertilized eggs in aquaculture. This process requires a deep understanding of gonad maturation, spawning induction, and fertilization techniques. Ornamental fishes exhibit diverse and complex reproductive strategies, making it challenging to accommodate their breeding needs for sustainable production. Reproduction in broodstock fish follows three key stages: gonad and gamete development, final oocyte maturation, and gamete release. However, this process is highly complex and influenced by various environmental factors, including behavioral, physical, and chemical conditions . Proper conditioning of broodstock is essential to maximize gamete output and quality, yet this remains a major challenge in both foodfish and marine ornamental fish aquaculture. Critical factors such as careful broodstock selection, appropriate husbandry, optimized tank design, and spawning induction techniques play a vital role in ensuring reproductive success.

Aquarium Keeping and Intensive Rearing of Livebearers

Aquarium keeping is a popular recreational activity, and livebearers such as guppies, mollies, platies, and swordtails are widely maintained because of their attractive appearance and ease of care. Rectangular glass tanks equipped with lighting, filters, heaters, and air pumps are commonly used. Aquascaping with gravel, rocks, biological filters, and aquatic plants such as Vallisneria and Java fern improves both the appearance and functionality of the aquarium. For commercial production, intensive rearing systems such as LDPE-lined ponds, raceway ponds, and recirculatory aquaculture systems (RAS) are increasingly used. LDPE-lined ponds

reduce water loss, raceways provide continuous water movement, and RAS enables efficient water purification and high stocking densities. These systems help reduce water consumption and disease risks while improving fish growth, survival, and production efficiency.

Water Quality Management in Ornamental Fish Farming

Water quality is essential for the growth, reproduction, health, and survival of ornamental fish. Important parameters such as temperature, pH, hardness, dissolved oxygen, carbon dioxide, ammonia, nitrite, nitrate, and chlorine should be regularly monitored. Tropical ornamental fish generally thrive at 21–30°C, while livebearers show good growth at 22–25°C and better breeding performance around 27°C. Livebearers generally prefer a pH of 6.5–8.5, with guppies tolerating relatively soft water and mollies and platies preferring harder water (100–300 ppm). Dissolved oxygen should preferably be maintained above 3.5 mg/L through adequate aeration and water circulation. Carbon dioxide levels should be controlled to prevent stress and oxygen depletion. Toxic substances such as chlorine, ammonia, and nitrite must be carefully controlled. Chlorine concentrations as low as 0.1 ppm can damage fish gills and impair respiration; therefore, water should be properly dechlorinated before use. Ammonia should be maintained below 0.02 mg/L, nitrite below 0.2 mg/L, and nitrate preferably below 50 mg/L. Biological filtration, regular water exchange, proper stocking density, and aquatic plants help maintain these parameters. Regular removal of organic wastes, adequate aeration, filtration, and partial water exchange are essential for maintaining a healthy aquatic environment. Effective water quality management reduces stress and disease occurrence and promotes successful and sustainable ornamental fish farming.

Disease and Health Management in Ornamental Livebearers

Disease outbreaks in ornamental livebearers occur through interactions between host, pathogen, and environmental conditions. Diseases are broadly classified into non-infectious and infectious diseases.

- **Non-infectious diseases:** Caused by poor water quality, stress, temperature fluctuations, oxygen imbalance, ammonia/nitrite toxicity, chlorine, heavy metals, and poor nutrition. Proper aeration, filtration, regular water exchange, stable temperature (20–28°C), balanced feeding, and waste management help prevent these problems.
- **Infectious diseases:** Caused by parasites, bacteria, fungi, and viruses. Common problems include Ich, velvet disease, fish lice, gill parasites, fin rot, dropsy, and fungal infections. Treatment depends on the cause and may include appropriate antiparasitic, antibacterial, antifungal, or supportive treatments.

Prevention: Maintain good water quality, avoid overcrowding, provide balanced nutrition, quarantine new fish, maintain clean tanks, and monitor fish regularly for early signs of disease.

Conclusion

Ornamental fish culture continues to be a cornerstone of the aquarium fish industry due to their ease of breeding, aesthetic appeal, and adaptability. Advancements in aquaculture technology, selective breeding, and sustainable trade practices have significantly improved their production and marketability. Future research should focus on genetic improvement, disease resistance, and eco-friendly rearing techniques to enhance the sustainability of ornamental fish culture. With appropriate investment and policy support, countries like India can capitalize on their rich aquatic biodiversity to strengthen their position in the global ornamental fish trade. Expanding education and training programs for aquaculture professionals and hobbyists will further drive innovation and sustainability in the ornamental fish sector.

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