

Exploring the Fascinating World of Guppy Fish (*Poecilia reticulata*): Biology, Behavior and Beyond

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Abstract - Guppy fish are well known for their remarkable diversity, showing a broad variety of colour patterns, body forms, and reproductive techniques. Understanding the mechanisms underlying diversification and speciation is possible through research on the adaptive radiation of guppy fish. This review paper provides a comprehensive overview of various aspects related to guppy fish, including their taxonomy, anatomy, physiology, behavior, and habitat preferences. Additionally, it delves into the evolutionary ecology of guppy fish, exploring their remarkable adaptations, such as diverse coloration, sexual dimorphism, and reproductive strategies, and how these traits have evolved in response to ecological pressures. Guppy fish in captivity, including their husbandry needs, breeding methods, and the effects of captive breeding on their genetics and behaviour, are becoming more and more popular as aquarium fish.

Index Terms- Guppy, Behavior, Morphology, Ornamental.

I. INTRODUCTION

The guppy fish was named in honor of Robert John Lechmere Guppy (1836–1916), a British biologist who grew to popularity. Despite being introduced to multiple countries around the world, guppy origins are in north-eastern South America [1]. This fish was first imported to India in 1910 to help in mosquito control [2]. It has been discovered to grow in both clean and contaminated waters [3].

Guppy fish belongs to the Kingdom Animalia, Phylum Chordata, Class Actinopterygii, Order Cyprinodontiformes, Family Poeciliidae, and Genus *poecilia*. Ornamental fish production areas are spread over many countries. One of the decorative fish that is in high demand by the public is the guppy (*Poecilia reticulata*). Small freshwater ornamental fish named guppy which is well-liked since it is simple to care for and has many lovely colour patterns. Wilhelm CH Peters first observed the guppy in 1959 in the Venezuelan region. He named it *Poecilia reticulata*, but the more widely used name is guppy [4]. *Poecilia reticulata* co-exist with a number of predatory fish species and are present at low quantities. Killifish and guppies live in predator-free communities above barrier waterfalls (referred to as KG communities or killifish-guppy communities). Guppies are more common in these areas since there is less predation there [5].

II. MORPHOLOGY

The *Poeciliidae* are distinguished by giving birth to live young. One soft-rayed dorsal fin and the absence of a lateral line are additional family traits. The gonopodium, a structure that originated from the anal fin on male poeciliids, can be used for delivering sperm bundles to the female fish. *Poeciliidae* are less than 100 mm in length and are frequently substantially less in size than the male species. Guppy fish are renowned for their striking and diverse coloration patterns, which play a crucial role in courtship, mate selection, and predator-prey interactions. The coloration patterns can vary significantly between males, females, and juveniles. Here are some common coloration patterns observed in guppy fish like Male guppies exhibit vibrant and elaborate coloration, primarily to attract females. The coloration patterns often consist of a combination of colour. Female guppies generally have more subdued coloration compared to males. Their bodies often feature a drab, olive or grayish hue, providing camouflage and protection from predators. However, some females may exhibit slight variations in color, and their fins may display subtle patterns. Juvenile guppy fish typically exhibit coloration patterns similar to females, with a relatively plain and inconspicuous appearance. As they mature, the males develop their characteristic vibrant coloration [6], [7].

III. SEXUAL SELECTION

It is a form of natural selection that arises from competition for mates and the preferences of the opposite sex. In guppy fish, sexual selection primarily acts on males, as they engage in elaborate courtship displays and compete for female attention. Female guppies have been shown to exhibit preferences for certain male traits, such as brighter colors and larger fins. Through mate choice, females indirectly shape the genetic makeup of the population by selecting males with desirable traits as their mates.

Male guppies engage in aggressive interactions and compete for access to mates. Traits like body size, elaborate coloration, and fin size can influence their success in male-male competition. Males with superior traits have a higher likelihood of mating, passing on their genes to future generations. Male guppies may also provide direct benefits to females, such as resources or protection. Females that choose mates with better resources or protective abilities have higher chances of survival and reproductive success, leading to the transmission of beneficial genes [8].

IV. FORAGING BEHAVIORS AND STRATEGIES TO OBTAIN FOOD

They exhibit various foraging behaviors and strategies to obtain food resources in their natural habitats. Guppies often engage in surface feeding, where they actively swim near the water's surface and consume floating or surface-dwelling food items. This can include small insects, plant matter, and other organic material present on the water surface. Guppies also forage near the substrate or bottom of their environment. They search for food items such as algae, detritus, small invertebrates, and organic debris that accumulate on the bottom of rivers, streams, or ponds. Guppies are known to feed on various types of aquatic vegetation. They may browse on the leaves, stems, and roots of aquatic plants, consuming algae and other small organisms attached to the vegetation. Guppies possess a specialized feeding structure called a protrusible mouth. This allows them to engage in filtration feeding, where they filter tiny food particles from the water column. They can capture small organisms, such as zooplankton or microscopic algae, by filtering them through their gill rakers. Guppies are opportunistic feeders and can scavenge on decaying organic matter, including dead insects, plant material, or carcasses of other aquatic organisms [9].

V. GUPPIES AS LARVAL PREDATORS

Guppies are ferocious eaters that prefer to eat small invertebrates, such as mosquito larvae. They actively seek out and eat mosquito larvae because they have a special attraction for them. Guppies help lower mosquito populations in bodies of water like ponds, ditches, and containers where mosquitoes grow by eating mosquito larvae. They may not completely eradicate all mosquitoes or prevent the emergence of adult mosquitoes from other sources. Therefore, guppies are often used as part of integrated mosquito control strategies that may include other methods such as larvicide treatments, habitat modification, and mosquito surveillance [10].

VI. LIFE CYCLE

Guppies are live-bearing fish, so the lifecycle begins when the female gives birth to live, fully formed fry (baby guppies). The fry are typically born in a well-developed state, ready to swim and feed. After birth, the fry are independent and must fend for themselves. They are small and vulnerable, relying on their ability to find food and avoid predation. The fry feed on small food particles, including microorganisms and plankton. Guppy fry exhibit rapid growth during the early stages of their life. They undergo substantial size increase within a short period, primarily driven by a high metabolic rate and abundant food resources. As the fry grow, they enter the juvenile stage. During this stage, guppies continue to develop and mature. They become more robust and exhibit increasing resemblance to adult guppies in terms of body shape and coloration. Guppies reach sexual maturity at a relatively young age, typically between 2 to 3 months, although this can vary depending on environmental conditions and growth rates. Males typically mature earlier than females. Once sexually mature, guppies engage in reproductive activities. Mating occurs through internal fertilization, where males use their specialized organ called the gonopodium to transfer sperm to females. Females can store sperm and produce multiple broods from a single mating. Guppies exhibit limited parental care. After giving birth to live fry, females provide no further care for their young. The fry must rely on their own abilities to find food, evade predators, and survive [11]. Guppies are known for their ability to adapt and reproduce quickly, leading to high population turnover rates. Their reproductive strategy allows for rapid population growth, but it also makes them susceptible to predation and environmental fluctuations. The life history of guppy fish is characterized by early maturation, high fecundity, limited parental care, and short lifespan. These life history traits contribute to their success in colonizing and populating various aquatic habitats [12], [13].

VII. PARASITES RELATED TO GUPPIES

Nearly 80 different parasite species have been found in guppies, largely in captivity or in research settings. There are reports of over 30 different parasite species in wild guppies all across the world. The host size, snail species richness, and distance between populations are the three variables that are correlated with change in parasite species richness between individuals and communities. [14]. At one's level, parasite abundances were substantially associated with standard length of body, and parasite diverseness increased with it. Numerous freshwater fish species have been found to exhibit increased species richness with fish size, which is likely because larger (and older) hosts consume more food, have a wider diet, and have accumulated parasites over time. Additionally, it has been demonstrated that a larger surface area is positively connected with the quantity of fish pathogens. . [15], [16], [17].

VIII. PROBABILITY OF GUPPY PROPAGATION INTO NEARBY ECOSYSTEMS

Even though certain official guidelines expressly urge employing native fish populations wherever possible or indicate that fish escape can harm neighboring wildlife, they do not offer explicit recommendations for avoiding fish release and afterwards introduction into nearby ecosystems. If guppies were introduced to open bodies of water. Because these fish can be transported between bodies of water by flooding, people, or predators, there is a high potential of inadvertent guppy migration in such systems. However, as these placements are not being watched, we are currently unaware of the likelihood or size of an unintentional guppy getaway [18], [19], [20].

IX. GUPPIES SUPPORTING TO VARIOUS HYPOTHESIS

For crossover suppressing among sex-determining and other partly sex-linked genes, the guppy has frequently been cited as evidence in support of the SA polymorphism concept. Male colour polymorphism in this fish population is sexually hostile. Coloration patterns are advantageous to males during mating, although they are detrimental to both sexes in other situations because they raise predation rates. The advantages to unusual male morphologies while mating as well as attack likely help to sustain the polymorphisms, which are not entirely maintained by SA selection [21], [22], [23].

CONCLUSION

Guppies are well-liked freshwater aquarium fish that are prized for their vivid colors, flexibility, and simplicity of maintenance. The guppy, often referred to as the rainbow fish or million fish, is a tiny freshwater fish that is a member of the order Cyprinodontiformes and family Poeciliidae. *Poecilia reticulata* is the scientific name for the guppy, and it uses the Carl Linnaeus-invented binomial nomenclature system. *Poecilia*, the name of the genus, is derived from the Greek word "poikilos," which means "variegated" or "colorful," in reference to the guppy's eye-catching coloring. Latin's word for "net-like" in the species name, *reticulata*, refers to the fish's distinctive reticulated pattern. The science of identifying and categorizing living things according to their evolutionary connections. The taxonomic hierarchy includes the guppy. Phylogeny depicts the relationships and evolutionary history of species. The family Poeciliidae, which also includes species of live-bearing fish like mollies and swordtails, includes the guppy. The guppy has ancestry with several other fish species, notably killifish, within the order Cyprinodontiformes. Through genetic, morphological, and reproductive strategy comparisons, as well as genetic and morphological investigations, the evolutionary position of the guppy has been determined. Guppies live in a variety of aquatic environments, including ponds, wooded streams, and even still bodies of water. Guppies are tolerant of many water conditions and are versatile. To maintain the health and wellbeing of guppy fish, nevertheless, appropriate fishkeeping techniques are required, such as managing breeding and making sure the water is ideal. In order to biologically manage the population of mosquitoes in bodies of water like ponds or water tanks, guppies are frequently introduced. Guppies assist in lowering the quantity of adult mosquitoes that may potentially spread diseases to people and other animals by consuming mosquito larvae.

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DECLARATION:

We also declare that there is no conflict of interest among authors.

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