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Small-Scale Guppy Breeding¹

by Diana Walstad
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Guppy breeding appears to be a daunting business—a fish room full of tanks, automatic water changers, etc. It doesn't have to be that way. Here, I describe a low-key approach.

From the beginning, I decided to limit myself to 8 tanks and less than 100 gal of water. I could expand in the summer with 4 outdoor tubs, but that was the limit.

Modern Guppies

There was a time when the guppy (*Poecilia reticulata*) was the gateway fish for beginners and children. In the 1950s, guppies were beloved for their hardiness and pretty colors. No large tanks, special conditions, and massive water changes... Unlike other aquarium fish, guppies can produce offspring with a riotous—and often unexpected—variety of colors and patterns [Fig 1]. Breeding guppies was fun.

However in the past few decades, the common guppy has lost its reputation as an easy-keeper [1]. Many hobbyists—and not just beginners—have difficulty keeping purchased guppies alive more than a couple months. Disease is not fun. Premature deaths are often attributed to poor care, but genetic weaknesses in the fish itself could also be involved.

Guppies have been captive-bred now for hundreds of generations. Breeders try to maintain the uniformity of their strains.

Competitive shows have standards for a particular strain's color, fin shape, etc. Commercial farmers, mostly from Southeast Asia, fulfill retail store requirements for so many Half-black Blues, Sunset guppies, etc. They selectively breed to conform to the strain's designated label.

Persistent inbreeding is essential to maintain uniformity and to counteract the guppy's natural tendency to revert back to its wild coloration. Fancy guppies are now highly inbred compared to native guppies [2]. Inbreeding inevitably results in some loss of fitness and disease resistance [3, 4, 5].

Aside from a few small heirloom and niche guppy breeders, fish fitness is not a big part of most breeding programs. After all, there are no show awards or economic incentives for longevity and disease resistance. Thus, we have a fragility problem with many modern guppies.

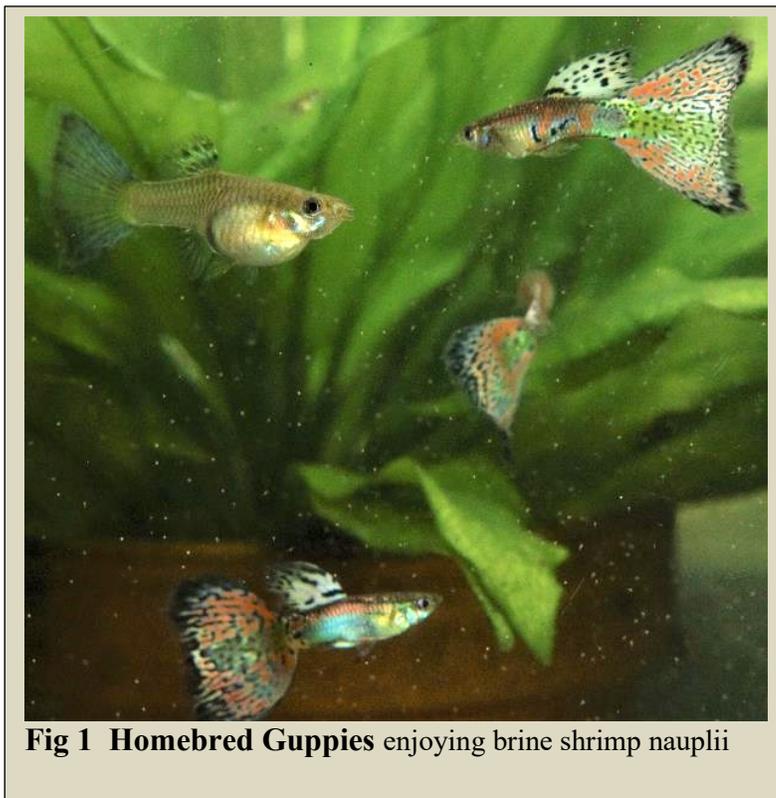


Fig 1 Homebred Guppies enjoying brine shrimp nauplii

¹ *Acknowledgement:* Alan S. Bias, a long-time successful guppy breeder and authority on their genetics, provided valuable editorial assistance for this article.

Purchasing Guppies

Guppies can be purchased from pet stores, on-line, or at aquarium club auctions.² That said, buying guppies is not like buying a book or a pair of shoes. Risks abound. Guppies may carry pathogens, become diseased, or have genetic problems. Finding guppies that are satisfying pets and/or worth breeding is not that easy.

Store guppies, mostly males imported from Southeast Asia, are usually where most beginners start. The guppies are inexpensive, readily available, and often quite colorful. And unlike ordering guppies on-line, you actually see ahead of time what you get. Generally, these commercial guppies are raised under healthy conditions [1], but the lengthy shipping process stresses them greatly, making them vulnerable to pathogens. For beginners, though, pet and aquarium stores are reasonable starting places.

Unfortunately, *female* guppies in pet stores are usually unavailable and of poor quality. To get high-quality females, I have had to go directly to the breeder.

Guppies purchased on-line (AquaBid.com, ebay.com) vary hugely in quality, and the web pictures are often deceiving. I use price to begin sorting out the “wheat from the chaff.” You will not get quality in a \$6 bag of guppies. Breeding quality guppies is hard work, and the responsible breeder deserves a higher price.

Aquarium club auctions and trade shows are good places to find guppies. You can actually see the guppies beforehand and possibly talk to the breeder.

For hobbyists fed up with the modern guppy’s fragility, options to consider are obtaining feral, feeder or swordtail guppies [Figs 2, 3, 4]. Generally, these variations of *Poecilia reticulata* are more disease resistant than their fancier brethren. Males crossed with fancy, inbred females often produce decent quality progeny with increased disease resistance.

Tank Setup with Plants

Assuredly, live plants are not necessary for breeding guppies. Most breeders rely on water changes, aerators and filters to purify the tank water. Tanks maintained according to established norms work just fine. But I happen to like plants.

I use fast-growing plants in all my setups to purify the water. Thus, I can feed the fish well without using filters and doing massive water changes.



Fig 2 Feral Guppies [6] from a West Virginia hot-springs are descendants of wild-type and domestic guppy strains. They have largely reverted back to their wild origins with clear fins and brilliant iridescent body patches.



Fig 3 Feeder Guppy

One notable breeder used this colorful male—rescued from a store’s feeder tank—to increase disease resistance. [8]



Fig 4 Swordtail Male Guppy [7] that I used to increase the longevity in a fancy delta-tail strain.

² I relate several specific experiences in purchasing guppies in a subsequent article ‘Breeding Guppies: Genetic Pitfalls and Successes’. (Article is available on my website.)

Breeding guppies, frankly, requires considerable culling and fish catching, tasks that would be well-nigh impossible in the typical planted tank. All plants in my guppy tanks, therefore, are portable. Plants are either floaters or grown in pots that I can easily pull out of the tank before catching the fish (**Fig 5**). I do not use a typical 2" deep gravel substrate. Plants won't grow in it, plus it will collect debris, become anaerobic, and release toxins.

I use gentle air bubbling to circulate water in the tanks. Bubbles are released from a glass tube connected with regular airline tubing to a small air pump. Large air-bubbles come out of the glass tubes at about ~30 bubbles per minute. Excessive bubbling (e.g., fizz from an air-stone) is not necessary and will stunt plant growth, because it degasses out CO₂.

For potting plants, I only use a clay garden soil. (Potting and organic soils can become severely anaerobic when confined in a pot.) I cover the soil with a little aquarium gravel.

For plant beginners, I suggest starting with summer tubs [**Fig 6**]. They are easy to work with, requiring neither artificial lighting or heaters. I do not use any aeration or water circulation in the tubs.

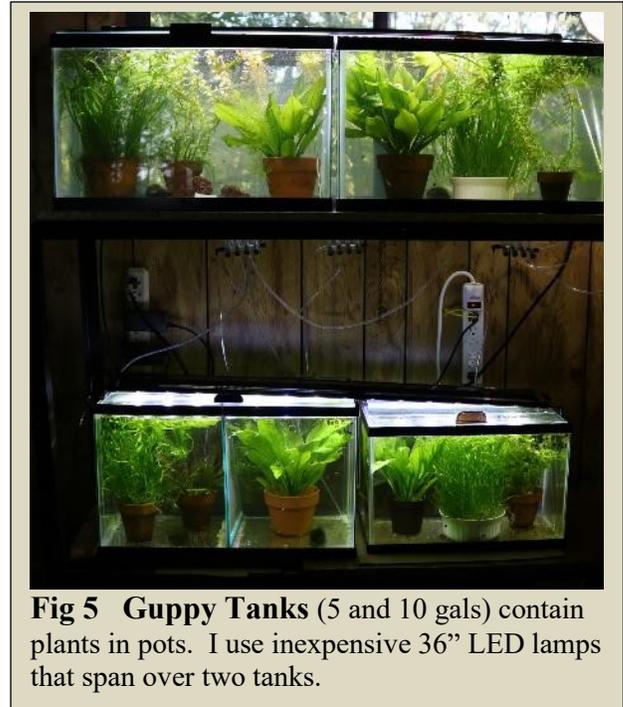


Fig 5 Guppy Tanks (5 and 10 gals) contain plants in pots. I use inexpensive 36" LED lamps that span over two tanks.

Maintenance and Stocking Densities

General tank maintenance for me includes siphoning mulm from the bottom, culling excess guppies, trimming and repotting plants, removing mat algae, changing water, etc. About 20-50% of the water gets changed every 2-6 weeks.

I keep my tanks lightly stocked. My comfort zone for a 10 gal is 40-80 babies, 20-25 juveniles (1" and 2-3 mos. old), and 3-5 adults (1.5- 2" and 6-12 mos. old).

Generally, I keep a female's entire batch of 30-80 fry and later cull it down to 20-25. I keep each batch separate so that I can follow the genetics and identify superior individuals.

I carefully monitor fish health by observing behavior. If the guppies start acting strangely and not eating, I take corrective action immediately.

My male guppies begin showing color around 4-5 weeks. While females do not reach their full adult size until 5-6 months, they start having babies at 10 weeks. Guppies raised in Southeast Asia are exported for sale at 75-120 days (~10-17 weeks) [1]. I use these grow-out times to roughly monitor the growth rate of new strains and the efficacy of my fish-rearing system.



Fig 6 Summer Tubs

Each tub holds about 12 gal and receives shaded sunlight. Water temperatures range from about 60°F to 78°F from May until September. Tubs are inexpensive storage containers from hardware stores. I cover them at night to keep heat in and raccoons/frogs out. The guppies will take care of any mosquito larva.

Euthanasia

To breed guppies, the sad fact is that one must routinely remove and euthanize fish. Large, well-fed females produce ~50-80 babies every ~4 weeks. One cannot realistically raise or sell all these fry. Nor should one keep sickly and deformed guppies in a breeding colony. Rigorous culling is essential for maintaining quality.

Disposing of unwanted guppies should be painless for the fish AND the hobbyist. I would argue against putting unwanted fish in the freezer or down the toilet to a lingering death. I use clove oil, which is inexpensive and widely available. I collect all unwanted guppies and put them into a dark container with about 2 cups of water. Then, I sprinkle the surface with 2 drops of 100% clove oil and cover the container. The clove oil puts guppies gently into a permanent sleep in about 5-10 minutes. Afterwards, I scatter the container's contents in the garden as fertilizer.

Foods

Guppies are omnivores, so I include vegetable pellets in their diet. Pellets are generally better than flake food [9]. Vitamins degrade, so I store bulk stocks of food in the freezer and portion out enough for 2-4 weeks of feeding. Treats include freeze-dried bloodworms, hard-boiled egg yolk, and a homemade food paste. I try to adhere to a daily feeding schedule starting with flake food at 8 AM. Fish get fed 2-3 times a day. The more food juveniles get, the faster they will grow. And females that produce 25-80 babies every 4 weeks need lots of food.

One can raise and breed guppies without hatching brine shrimp eggs, but I like to feed baby guppies live baby brine shrimp (nauplii) for the first two weeks. Guppy fry will hunt down nauplii until their bellies are properly swollen.³

Stress Reduction

Guppies are social fish. Juveniles, in particular, like to be in groups. In pairing up breeders, I often keep two females with a male even if I only need one female. Some males can be overly zealous and pick on one particular female. In turn, some older females will bully a younger female. If I see continuous bullying in the tank, I separate the bully from the victim. Bullying stresses the victim, and stress can cause poor growth, disease, and death.

When newly purchased fish are not eating, I sometimes add one of my homebred guppies to make them less fearful. Feeding them live baby brine shrimp also helps; it often stops their fretting.

I am careful when netting older guppies. Males with big delta tails can get bent backs by rough handling. I use soft mesh nets as opposed to rougher nets that might scrape their skins. Sometimes I gently coax a net-trapped individual into my cupped hand. Tank transfers do not need to be traumatic.

Fortunately, modern guppies are thoroughly domesticated and accustomed to being handled. I move mine around directly and frequently from one tank to the other. Generally, they settle down by the next feeding time.

Diseases

In 2017, I started buying guppies from breeders and pet shops. I knew that disease would be a major hurdle. Most of the new fish were healthy, but it only takes a couple afflicted individuals to wreak

³'Hatching and Growing Brine Shrimp', an article available on my website, describes several ways to provide guppies with this nutritious, delectable food.

havoc. Unsurprisingly, it was not long before some fish became diseased. The parasites *Camallanus* worms and skin flukes caused the most problems.⁴

After eradicating these parasites, I realized that one does not have to become a disease expert to keep guppies healthy. Many major guppy pathogens are external, opportunistic parasites (flukes, *Costia*, *Ich*, *Tetrahymena*) that can be killed by ordinary table salt. In contrast, guppies that slowly develop shrunken bellies probably have “Fish TB,” the most common bacterial disease. Since it is incurable and somewhat contagious, the afflicted individual should be removed and destroyed.⁵

Most diseases are caused by organisms that are part of the fish’s natural environment. Ordinarily, opportunistic pathogens are not a problem, because the fish’s immune system keeps them under control, thereby preventing disease. However, many of the fancier guppy strains have lost genes for disease resistance [5]. (The fish might do very well for the original breeder but fall apart when moved into a new environment.)

Diseased individuals should be removed from the tank as soon as possible. A diseased fish is a reservoir of activated, pumped-up pathogens. Allowing a sick fish to die in the tank is a very bad idea. As it decomposes, it releases astronomical numbers of the pathogen into the tank. Small numbers of potential pathogens like *Ich* or mycobacteria may be harmless; large numbers can cause disease. Numbers count!

One particular guppy strain (Metalheads) that I worked with developed notably more disease than my other strains [Fig 7]. When the tank had a fluke outbreak, the Metalheads were the first ones to get sick. Other strains did not get sick or fared much better with disease treatment. Eventually, I got rid of the Metalheads.

Whenever possible, I let tanks rest a few days without fish. [Many parasite larva (e.g., *Ich*, skin flukes, etc) will die if they are unable to latch onto a fish within a few days of hatching from their cysts.]

Incoming guppies are very vulnerable the first 2-3 weeks. They are not only stressed but exposed to novel microorganisms in a new environment. A UV sterilizing filter used during this critical adjustment period can be very helpful. It kills microorganisms in the water, lessening the *number* of potential pathogens. It gives the fish a precious 2 weeks to produce protective antibodies.

Salt is an under-rated, all-purpose treatment that has rescued sick guppies for me time and time again. At the first sign of problems (clamped fins, not eating, etc), I’ll put the guppies into a small hospital tank with 0.9% saltwater for 3-4 days. [I acclimate them beforehand with half the concentration (0.45%) for 1 hour.] The osmotic pressure change will not harm the guppies, but it quickly kills bacteria, flukes and other external parasites. If the guppies are not too far gone, many will improve dramatically within a couple days.

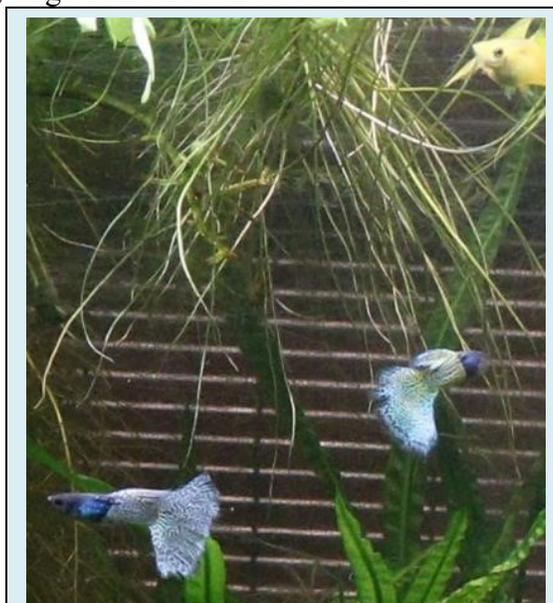


Fig 7 Metalhead Males were beautiful but too fragile for my tanks.

⁴ Eventually, I eradicated these pests as described in two separate articles on my website. (I used fishfood laced with fenbendazole for the *Camallanus* worms. For the flukes, I used either salt, praziquantel or levamisole.)

⁵ My website article ‘Mycobacteriosis in Aquarium Fish’ describes how I stopped a Fish TB outbreak by using UV sterilizing filters.

I don't mind coddling fish that have been weakened by shipping, bullying, accidents, etc. However, there came a time when I was unwilling to rescue every single sick guppy, especially those that I had raised myself and that were well-established. I decided that heroic measures were counter-productive. Diseased individuals threaten their tankmates, and if used for breeding, perpetuate genetic fragility.

Now, I have fish that are healthy and relatively trouble-free. Disease is a rarity. I can concentrate on the fun stuff—breeding and genetics. I can trade, sell and share my guppies without qualms.

Keeping Records

I keep a journal of every pairing, birth date, death, etc. I also write down the reason for and results of each pairing. Every month I inventory each tank. With these records, I can follow the genetics more easily.

Pictorial records are useful. Many strains require 5-6 months to develop fully. I use pictures of young fish [Fig 8] to gauge the quality of their progeny. That is, do the juveniles look as good as their parents did at the same age?



Fig 8 Ten-week-old Guppy Pair

Months after taking this picture, I used it to gauge the quality of their progeny.

Reproductive Factors

Virgin females are fertile and—upon encountering their first male—generally mate within an hour. Afterwards, the female guppy stores the sperm and can produce batches for 8 months without any additional mating [3]. About 1-5 days after parturition (giving birth), the female guppy fertilizes eggs internally for the next batch with stored sperm and/or any new sperm from males encountered after her first mating.

A non-virgin female may produce mixed batches—fry sired by multiple males. A paternity analysis of 101 batches from ten wild guppy populations reported an average of 3.5 sires (range 1-9) [10]. This polyandry trait is believed to contribute to genetic heterozygosity and the guppy's success as a species.

The non-virgin female is only receptive to males during her estrus period (~1-6 days after parturition). Peak time is 1-3 days. Thus, when I start a new pairing, I try to add the new male 1-3 days after the female's parturition. This is the time when she will be most likely to accept the male.⁶

Generally, fresh sperm takes precedence over older sperm. Females mated 1 and 4 days after parturition showed 83% and 60% precedence for the fresher sperm, respectively [11]. One guppy breeder [3] reported 100% precedence for fresh sperm. When gold-bodied virgin females were first housed with gold males and then housed (at parturition) only with gray-bodied males, the first batch consisted of all gold fry; the second, all gray fry. (Gray is the guppy's natural body color and is genetically dominant over gold.)

After pairing a female with a new male, I discard the female's next batch sired by previous matings. I keep only her later batches. This “wait a month” policy has worked well for many pairings; fry results clearly indicate that the most recent male sired 100% of progeny. However, it does not *always* work. One authority [12] waits at least 6 weeks, until females have gone through at least two estrus periods. No doubt, some males are more sexually potent, more enthusiastic courtiers than others. And females have their own mating preferences, which can affect paternity.

⁶ Females can also be inseminated by non-consensual sex (“gonopodial thrusts”). However cooperative mating is the norm and is more likely to produce progeny than forced copulations [12].

Once I have identified a superior female, I try to get as many batches from her as possible. [Older females produce bigger batches and have more genes for fitness and disease resistance than those that die young.] Using my “wait a month” policy, I can see what she will produce mated to new males.

The cumbersome delta tails of older males (> 1 year) reportedly interferes with impregnating females [3]. Rather than put high-quality, proven males “out to pasture,” I trim their tails and use them for breeding [Fig 9]. To trim their tails, I hold the male down—using a wet fish net—on a wet cutting board and then quickly slice off about 1/4 ” (~0.5 cm) of his tail with a fresh razor blade. No blood. Any distress is over in seconds. Eventually the tail will grow back out.

Many breeders sex their guppies when they are 2-3 weeks old and raise males and females in separate tanks. However, I find this early sexing procedure tedious. Plus, it requires devoting two tanks to raise one batch.

Instead, I sex and cull juvenile guppies beginning when they are about 6-8 weeks. Rigorous culling prevents tank over-crowding and faster growth. It increases the probability that the young female’s first few batches will be sired by higher quality siblings.

I keep one 20 gal tank just for males (Fig 10). It contains old breeder males, potential breeder males, and young select males that I might sell.

Discussion

Hobbyists can keep male guppies in a tank and enjoy their beauty just like any other tropical fish. Breeding guppies is far more work. Many hobbyists understandably object to the requisite culling. But removing inferior individuals is essential for breeding quality guppies. It is also good policy; overstocked tanks are not healthy tanks.

Seasoned breeders, not just beginning hobbyists, encounter problems keeping their fish healthy. Breeding guppies became doable for me only after I dealt with the fragility of modern guppies. First, I quarantined and treated newly purchased guppies for any disease. Second, I methodically eliminated sickly strains and weak individuals from my breeding stock. Third, I outcrossed my fancy strains to hardier swordtail guppies to bolster fitness and longevity. Finally, since genetic abnormalities and disease susceptibility sometimes reveal themselves only with time, I started using only older guppies for breeding.



Fig 9 Trimmed Tail

Before using this older male (9 mos.) for breeding, I trimmed his large delta tail.



Fig 10 Holding Tank for Males Only

I keep about 20-30 males in this 20 gal single-sex tank.

The current emphasis on strain uniformity goes against the genetic make-up of guppies. (The guppy's trait of "color polymorphism" is unique among fish species.) And because maintaining strain standards requires persistent inbreeding and extreme selection for non-fitness factors, it can easily lead to weak guppies with a poor genetic makeup.

Allowing guppies to express some color and phenotypic variation is healthier for the fish and more interesting for the breeder. Anticipation abounds in waiting for the first juvenile male to "turn" and show his colors—often an overnight transformation. Because of color polymorphism, his colors and patterns may be entirely different from his parents.

I was captivated by guppies as a child. Despite long sojourns with other fish types (Rainbowfish, cichlids, etc), I reverted back to the "lowly" guppy. Someday, I hope that this marvelous little fish will regain the popularity it deserves.

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