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STUDY THE BREEDING BIOLOGY OF ORNAMENTAL FISH

POECILIA RETICULATA (GUPPY)

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ABSTRACT

The breeding biology guppy fish, *Poecilia reticulata* was studied during December 2014 to March 2015 in laboratory, Government College for Women (A) Kumbakonam, Bharathidasan University. Guppy bred all over year, when in compared to December to January with a pick period in March. They were viviparous and multiple breeders (i.e) give birth to fry several times in the breeding season. The gestation period ranged from 20 to 35 days. In the present study, successive stages of fry development of *Poecilia reticulata* were observed. The number of fry per brood ranged from 10 to 70. New born fries were observed with transparent or blackish color having slender body with jaws developed on month and were fully capable of swimming, eating and avoiding danger. In general guppy grew rapidly, attained sexual maturity 7-9 weeks and reached full size in 4 months.

KEY WORDS

Guppy fish, *Poecilia reticulata*, breeding biology.

INTRODUCTION:

The annual value of the world's wholesale trade in ornamental fish (including commodities) was estimated 1 billion dollars in 2001 (Olivier, 2001). The Free- On-Board export value of freshwater and saltwater fish was estimated 264 million US dollars in 2005, an increase of 50% with respect to 2001 (FAO, 2007). Ornamental fish farming is a relatively new branch of the agricultural industry. Popular aquarium fish, *Poecilia reticulata* commonly known as 'guppy' was introduced in various countries for mosquito control and often loosely

called 'mosquito fish'. It has been found to establish itself in both fresh and polluted waters (Ahmed *et al.* 1985). It introduced in India as early as 1910 to control mosquito (Kaira *et al.* 1967). Guppies are small poeciliid fishes of northeastern South America (Endler, J. A., 1987). This species is widely studied as a model species ecology and evolutionary biology, and has had a long and popular history as an ornamental fish. A wide variety of strains differing in color and fin shape have been developed by aquarists (Axelrod *et al.* 1985; Sakurai *et al.* 1993; Wischnath 1993). Males are brightly colored and vary greatly in their colour patterns within and populations, where as females do not have conspicuous colour patterns. Their biology, ecology, behaviour and genetics have been reviewed previously (Endler 1978, 1983). Briefly, guppies live in tropical forests, in clear streams with clean gravel or sand bottoms, and occasional patches of leaf litter. The larvivorous fish, *Poecilia reticulata* is an effective biological control agent of mosquitoes in different habitats in Iran. This specie regulates the populations of different species of pest and vector mosquitoes. *P. reticulata* can consume a good number of mosquito larvae, with the consumption rate varying with the body size (Manna *et al.*, 2008). Hora & Mukherjee classified the gender *Poecilia* in surface feeder which is less efficient owing to their mode of life (Chakraborty *et al.*, 2008).

Animals often find themselves in a dilemma: By increasing the energy devoted to reproductive processes, they decrease the resources available for growth and maintenance, which can in turn constrain their future reproductive attempts (Hirshfield and Tinkle 1975). From the physiological costs of gamete production to the effort allocated into parental care, females are traditionally considered the sex that pays higher energetic costs to reproduce (Andersson 1994). However, recently, more emphasis has been placed on recognising the energetic constraints suffered by males in order to reproduce (Bonduriansky 2001). Females with enlarged bellies, presence of gravid spots, eggs, or embryos seen with the naked eye were classified as gravid according to Winemiller (1989). We adapted the methods of Shahjahan *et al.* (2013) to determine under the binocular stereomicroscope the developmental stages of reproductive females. Males increase their reproductive success when they have access to a large number of females (Bateman 1948) The guppy was one of the first vertebrates in which sex-linked inheritance of color loci was demonstrated (Winge, 1927). More recently, the guppy has become a model organism for studying behavioral traits such as courtship and mate choice (Evans *et al.*, 2003; Magurran and Henderson, 2003), as well as for understanding ecogeographic adaptation (Endler, 1991, 1995; Reznick, 1997). The nature of the guppy mating system makes guppies especially amenable to studies of sexual selection and mate choice, and previous work on guppy sexual behavior has already provided much

needed information on how sexual selection may operate in natural populations (Houde, 1997). This larvivorous fish are quite tolerant of a variety of water conditions thus can be used as predators of mosquito larvae and they can be moved to water areas where they are needed (Travis 1957). Larvivorous fish have been used in mosquito control on and off for many years in different parts of the world (Ahmed *et al.* 1985). An understanding of the breeding biology of *P. reticulata* is a basic requirement for the successful proliferation of the fish, hence successful mosquito control. It is a viviparous fish and is capable of increasing its population in shallow or polluted water (Menon and Rajagopalan 1977). In Bangladesh no published information on the breeding of *P. reticulata* is available. Researches have been carried out on the bio-control of mosquito larvae by guppies (Ahmed *et al.* 1985, Khanum *et al.* 2002). Therefore, the present investigation was carried out on the breeding biology of *P. reticulata* in a controlled aquarium condition.

MATERIAL AND METHODS

Procurement and rearing of experimental fishes

A common fresh water aquarium fish, guppies are known for their extraordinary colors and patterns sure pleasing to have in any aquarium. *Poecilia reticulata* was collected from the Star Aquarium Centre in Kumbakonam. The collected fishes without least disturbance were transported in polythene bags filled half with water. About ten fishes were put in a bag and water was well aerated tap water using pressurized air from a cylinder. This mode of transit proved successful, since there was no mortality in all consignments throughout the course of this study. The fish were acclimated to laboratory conditions 30 days. Ground water used for maintaining the fish in the fish tank had a PH 7.2 ± 0.1 , dissolved oxygen 8.0 ± 0.3 mg/l and bicarbonates 95.0 ± 5.0 mg/l. The fish tanks kept free were fungal infection by washing with potassium permanganate solution. The fish were disinfected with 0.1% potassium permanganate solution and were maintained for 4 weeks in well aerated tap water. The test fishes were critically screened for the signs of disease, stress, physical damage and mortality. The injured, severely diseased abnormal and dead individuals were discarded. Males should be selected with the fins and body with the desired color, shape, and size. Females are selected for good body shape, desired tail color, and good tail shape. Both sexes should have thick peduncles to hold the large tails well. In this experiment the breeding set up is 2 males to 3 females to reduce stress on specific females from the male.

Males were clearly distinguished by having modified and taking the form of gonopodium and in females, body color was less bright and had swollen abdomen. Each of the aquatic contained 5 liters of water. Water was changed manually every day in the afternoon when the temperature of the aquarium water was close to that of the tap water. The guppy prefers hard water and can with salinity up to one ppt. An active fish, guppies use an enormous amount of energy and need to be fed at least 3 times a day, with a variety of foods including dry, fresh, frozen or live foods. Guppies are top feeders and will readily take most prepared foods. However, they should be given a diet with high vegetable content and a dry food such as TETRA's Spirulina Tropical Flakes should be used occasionally. The broods were provided with paper food and commercial pellet feed as their food and given twice a day in the morning and afternoon. The fishes were observed young one that from moment of birth the newly born baby fish (fry) were observed in ten occasions viz (1 hour 1,5,10,15,20&50 days) of age till up to 7 weeks. The month wise reproduction of *Poecilia reticulata* was also observed in 3 months (December, January, February, and March).

RESULT AND DISCUSSION

The month wise reproduction of *Poecilia reticulata* was observed throughout the year in December, January, February, and March (Fig.1). Guppy began fry birth in December and ended in March with a peak in March. Hidebrand (1921) reported that the breeding season of guppy in the Southeastern U. S. begins in May and ends in September and October. Davis (1978) reported that in South-central Texas, the breeding season of *Gambusia affinis*, a closely related fish of guppy ranges from March to October with a peak in April. In the present study, it was observed that the gestation period of guppy was 25-35 days with an average of 28 days. Guppy was reported to bring out broods at approximately four-week intervals (Ahmed *et al.* 1985). Krumholz (1948) reported that the average gestation period of *G. affinis*, a closely related fish of guppy (*P. reticulata*), was 23-24 days. In guppy, fertilization is internal and takes place through mating of couples showing specific mating behavior. Male transfer's sperms into female body by a modified anal fin called gonopodium. Male perform an S-shaped posture known as 'sigmoid display' and orientates himself in front of the females at the beginning of courtship. Collier (1936) and Paden (1975), observed courtship behaviour in mosquito fish, that was similar to the present study. Houde and Endler (1995) observed that females exhibit sexual preferences for males with larger color spots,

which is displayed during elaborate “sigmoid” courtship displays. Larger females produce large number of offspring than smaller fish. Shikano and Fujio (1997) reported that the female guppy gave birth 2 to 100 fry, but the typical range is between 5 and 30. Nutritional balance, water condition or differences in rearing procedure might be the cause of the variation. The neonate fry was knocked by the mother with her head to learn swimming and they floated and moved around the aquarium. The fries took birth with jaws developed on mouth. So, they could easily take food immediately after birth. It was observed that from the moment of birth, each fry was fully capable of swimming, eating and avoiding danger. Shikano and Fujio (1997) also made similar observation. It was observed that females typically mate with more than one male. Evans and Magurran (2000) noted the similar facts in guppies during their sexually receptive phase. Females have the ability to store sperm, so that they can give birth many times, after mating with a male only once. Three to five times hatching was observed after a single mating in several couples during this study. Constantz (1989) also observed that female guppies store sperm for several months. It was observed that *P. reticulata* hatch its first brood at the age of 3-4 months. Menon and Rajagopalan (1977) also reported that this fish can reproduce at the age of 90 days. After giving birth, the female became ready for conception again within only a few hours.

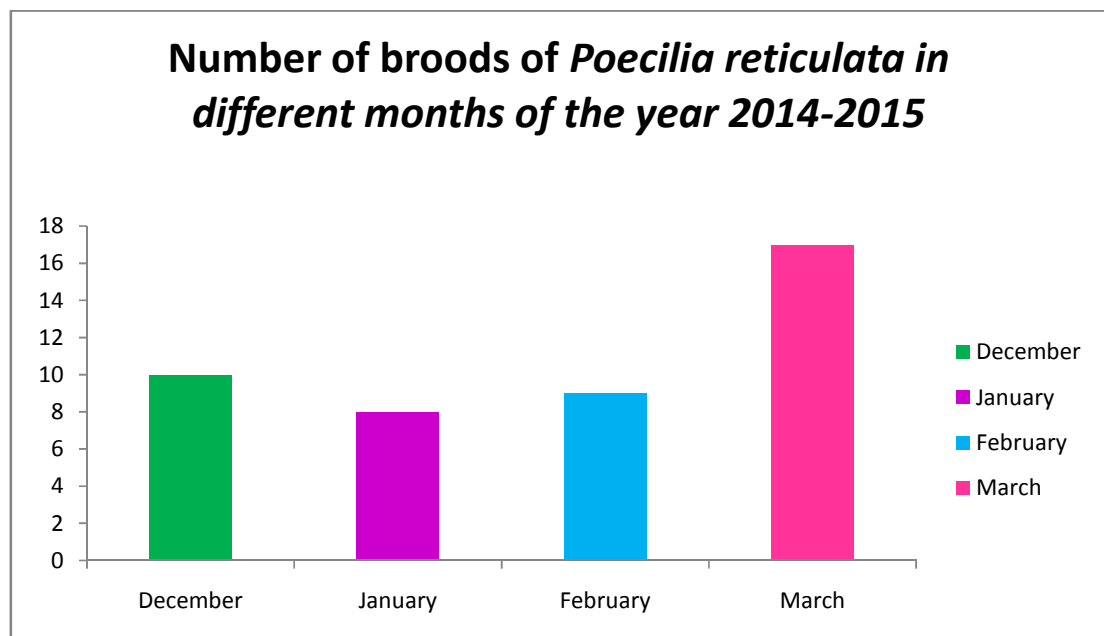


Fig. 1. Number of broods of *Poecilia reticulata* in different months of the year 2014-2015.

Development after birth:

Newly hatched fries were blackish or transparent and slender with chromatophore on head measuring from 6.5 to 7.5 mm in length. They settled down at the bottom of the aquarium and searched food in the stones within 1-2 hours. Characteristics of the different stages of fry development are briefly pointed below-

Fry, just after birth:

Transparent, some are blackish or grayish in color. Body slender, about 0.8-1cm long. Pectoral fins were larger than caudal.

One day old fry:

Fins clearly observed, pelvic fin is smaller than pectoral. Caudal fin with dark spot. Length of the body was 6.6-7.5mm.

5-day old fry:

Caudal fin somewhat flat clearly appeared as a tail. A longitudinal thread like structure, the alimentary canal was observed in the transparent body. Body length was 6.8-8.0mm.

10-day old fry:

Caudal and pectoral fin was clearly appeared in body. Body length was 7.2-8.5mm.

15-day old fry:

A primary concept might be achieved of sex differences. Female abdomen was somewhat wider than male. Body measured 7.8-9.0mm in length. Anal fins of both sexes were similar.

20-day old fry:

The anal fin of male becomes elongated and tube shaped while in the female it becomes small and rounded. Fin rays observed in male but not in female. Body measured 8.0-9.0mm in length.

25-day old fry:

Anal fin of both sex shapes was clearly. Body length was 8.0-9.5mm.

30-day old fry:

Caudal fin of the male becomes colored, especially appeared as brownish. Female caudal fin was blackish in color. Size of female became larger compared to that of the male. The range of the body length was 8.2-9.5mm.

35-day old fry:

Male and female were clearly distinguished according to their size, tail and anal fin. The abdomen of female became larger and flatter compared to that of the male. Body measured 8.2-10mm in length.

40-day old fry:

Black tail clearly appeared in female. Body length was 9.2-10.5mm.

45-day old fry:

Fish was clearly appeared in tail and fin. Body length was 9.2-11mm.

50-day old fry:

Male initiate their sexual traits and moved behind female. In some cases, a dark spot surrounding the anus and urinogenital area known as 'gravid spot' present in females while that was absent in males. Approximate body length was 10.8-12mm.

The full size of male ranged 3-5 cm and female ranged 4-7 cm and reached full size at about 4-6 months.



Plate 1. Successive stages of fry development of *Poecilia reticulata*.

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