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# SPERM STORAGE AND SPERM RESERVE USAGE IN FEMALE GUPPY(*Poecilia reticulata*)

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**ABSTRACT**

In this research, it was examined that how long and how many sperm could be used by female guppies from bundles of spermatozoa at the absence of males. Two treatments were conducted with five replicates in ten aquariums. In the first group male fish were held with females until first birth of female fish, and then they were taken away and never put together till the end of the experiment (9 months). On the other hand, in the second experiment group all female and male fish were kept together over the experiment. At the end of the trial, it was determined that female fish in the first group could use the sperm that they stored in their bodies nine times with nearly 28-day intervals.

**Key words**: Guppy, *Poecilia reticulata*, sperm storage, usage period, usage number

# DİŞİ LEPİSTES BALIKLARINDA (*Poecilia reticulata*) SPERM DEPOLAMA VE DEPOLANAN YEDEK SPERMLERİN KULLANIMI

**ÖZET**

Bu araştırmada, dişi lepistes balıklarının aldığı spermleri, ortamda erkek balık olmaksızın ne kadar sürede ve sayıda kullanabildiği incelenmiştir. Araştırma, 2 grup ve 5 tekerrürden oluşan toplam 10 adet akvaryumda yürütülmüştür. 1. grupta erkek ve dişi ilk yavru alınana kadar bir arada tutulmuş, 2. grupta ise 1. gruptaki üreme sona erene kadar erkek-dişi devamlı bir arada tutulmuştur. Dokuz aylık deneme sonunda 1. gruptaki dişi balıklardan 2. gruptaki dişi balıklarla aynı sayıda ve sürede (9 ay süresince 28 günde bir) yavru alınmıştır. Sonuç olarak, bu çalışmada dişi lepisteslerin ortamda erkek balık olmaksızın, depoladığı spermleri maksimum 9 defa kullanımının mümkün olduğu saptanmıştır.

**Anahtar kelimeler:** Lepistes, *Poecilia reticulata*, sperm depolama, kullanım süresi, kullanım sayısı

## INTRODUCTION

As other animals, fish must reproduce to maintain their lives and growth. Fish need to reproduce continuously and productively throughout their lives so that they can continue their lineage by adding new individuals to the population. For a successful reproduction, the environment where fish lay eggs must have certain features. For example, various physical and chemical parameters of water should be convenient and the environment should be rich in nutrients. Adaptation and reproduction features of fish depend on breeding season, migration location and degree of protection feature (Çelikkale 1991). It is possible to classify aquarium fish as fresh water and sea water fish. In Turkey, fresh water fish species are more preferred in aquarium fish sector due to their low costs and easy maintenance. Of fresh waterfish, those with remarkable colors and easy produce without

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too much care are very popular. Guppy, platy, swordtail and angel fish have these basic specialties. Guppies are the most preferred species. These fish are in Poecilidae family, which is also known as "Cyprinodontidae". They, especially males, attract attention with colorful bodies. The most suitable aquarium size for guppies is between 50 and 80 L. Optimum water temperature is around 24-26ºC. Males are typically 2.5-3 cm long and they are distinguished from females by their reproductive organs called gonopodium (Figure 1). Females are nearly 5 cm long and have more rounded and bigger bodies compared to males (Laudien et al. 1980, Newton 1982, Altınköprü 1990, Paul 1995, Şahin 1999).

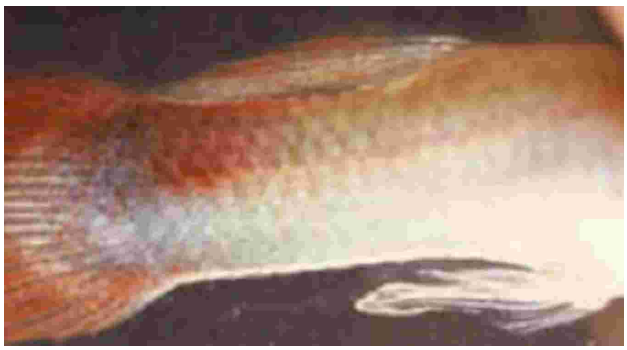

**Figure 1.** The gonopodium in male guppy (original)

Reproduction of fish is classified in three groups: ovoviviparous, ovipar and viviparous. Ovoviviparous means that eggs are fertilized by male fish when they are in females abdominal cavity, and their development happens in the oviduct. The juvenile should absorb the vitellus sac and be ready to swim before leaving the female's body. Juveniles that reach this stage in female's body start to swim after a few trials (Pandian and Sheela 1995). In ovoviviparous reproduction, internal fertilization is realized by an organ which transfers sperm to females. This organ is the gonopodium, which is formed with a change of the anal fin. The gonopodium is formed with elongation of 3rd,4th and 5th radius of the anal fins and it works as the copulation organ of males. The change of the anal fin is completed at fish maturation, meaning that young fish do not have a gonopodium. The gonopodium is systematically very important. It has an ability of move owing to a muscular system. Before they mate, male and female court together. After mating, sperm are transferred to females as spermatozeugmata (bundles of spermatozoa). Eggs are fertilized and hatched in female's abdominal cavity and baby fish are egressed one by one. Sperm are transported to female's genital pore and then pushed to the oviduct by the gonopodium. By the time sperm in the sperm bundles reach the oviduct, the bundle breaks and some of free sperm fertilize eggs. For this reason, once mated, females get a few sperm bundles sequentially. Females give birth about twenty-eight days later and continue to breed in monthly intervals. Female can use these sperm up to 3-4 times (Dugatkin and Godin 1992, Pandian and Sheela 1995, Şahin 1999, Alpbaz 2000, Demir 2006). Female guppie scan give 2-20 litter at a time and this number can reach up to 100-200 juveniles in next births. However, size of offspring reduce with an increase in number (Houde 1997, Nakajima and Taniguchi 2002). It is reported that guppies'sex can be identified with naked eye at sixty days after birth and males' anal fin starts to change from 60th day onwards with appearance of shape of the gonopodium and body color. It is also noted that growth rate of males either stops or slows down from 90th day onwards. In this research, it was examined that how long and how many sperm could be used by female guppies from bundles of spermatozoa at the absence of males.

## MATERIALS AND METHODS

The experiment was conducted between March and November 2008 in the Aquarium Unit of Fisheries Faculty of Sinop University, Turkey. In the trial, ten female and ten male guppies were used. All fish used were mature enough to reproduce and generated from German variety (Figure 2).

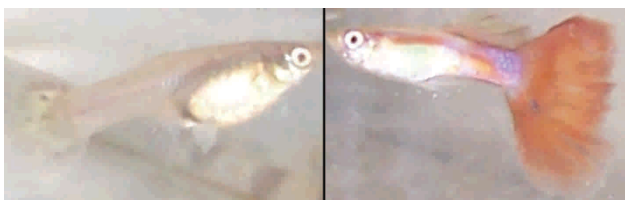

**Figure 2.** Female and male guppy used in the experiment (original)

Fish were fed with flaked feed twice a day at a rate of 15% of body weight (48% protein, 8% fat, 2% cellulose). Live feed (*Daphnia* spp. or *Artemia salina*) was also offered once a week in order to make them stronger (Harpaz et al. 2005). Experimental aquariums

were siphoned once a week. The tanks were 10 L and they were placed in a fiberglass tank with dimensions of 120*120*50 cm. Each tank was stocked with 10 fish. A thermostat heater was used to stabilize water temperature and mixed with an aid of air supply. Water parameters are given in Table 1.

**Table 1.** Water parameters in the experiment

| | |
|---|---|
| Water temperature | 25-26ºC |
| Salinity | 0‰ |
| pH | 7.64 |
| Total ammonia | 0.0 mg/L |
| Dissolved oxygen | 8 ppm |

The trial consisted of two treatment groups with five replications. Fish-all reached sexual maturity (6 months old) were put in each aquarium as one male and one female. Male fish in the first group were held in the aquarium until first birth of female fish and then they were removed and never put together till the end of the experiment. On the other hand, all female and male fish in the second group (control group) were kept together till the end of the experiment. The trial period was terminated when reproduction of female fish in the first group naturally ended, which lasted about 10 months.

## RESULTS

At the end of the trial, it was determined that female fish in the first group used sperm that they stored in their bodies nine times with nearly 28-day periods. The bundles of sperm stored in the female fish bodies are presented in Figure 3.

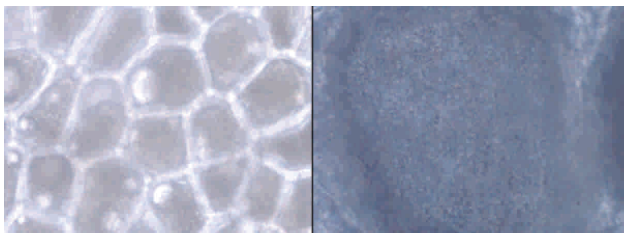

**Figure 3.** Sperm bundles and sperm cells observed in the study (original)

In the first group, guppies from one aquarium produced juvenile six times where as three aquariums produced nine times (Figure 4).

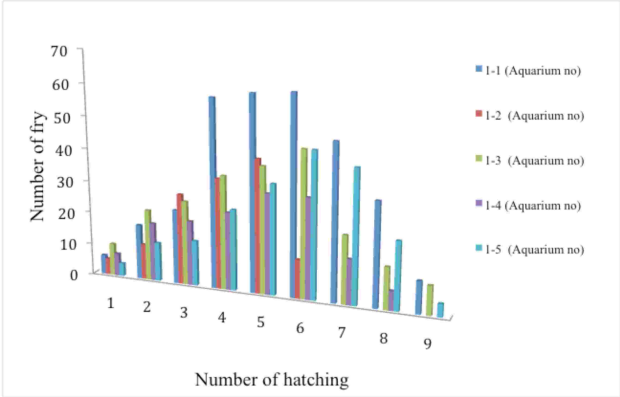


**Figure 4.** The number of fry produced by guppies in each aquarium of the fisrt treatment group over the experiment

## DISCUSSION

This study aimed to determine the use of sperm stored by guppy, one of the most wanted species in ornamental fish aquaculture. From beginning to end of the experiment, fish in the first group were able to produce litter six to nine times without a need of male fish. Reproduction period of guppies is known to be directly related to water temperature and this period is reported as 28 days in the literature. Besides it is reported that female guppies store sperm in their bodies for a long time and can continue to give birth 5-8 times using reserved sperm every 4-6 weeks after male fish transfer the bundles of sperm to female fish (Pilastro and Bisazza 1999, Clyde et al. 2001). While results of the present study are parallel with those in the literature in terms of number of breeding, incubation period is longer than the literature (39 days in the first group-42 days in the second). Under proper conditions guppies can give 10-15 drops at the first birth. With a good care, the number of juveniles can be increased but offspring yield decreases with time. There is an inverse relationship between the number of juveniles and their sizes (Houde 1997, Alpbaz 2000). In the present study, the number of juvenile at the first birth of two groups were low but this number ascended at next births as seen in Figure 4. As a conclusion, female guppies bred up to 9 times without a male by using reserved sperm. Taking these findings into account, future studies should focus on structure of the sperm bundles and ways how female fish use the bundles.

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