

REPRODUCTION OF THREE COLOUR VARIETIES OF ANGELFISH (*Pterophyllum scalare*)

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ABSTRACT

A study into the reproductive performance of three color varieties of angelfish, *Pterophyllum scalare* (Black, Black & White, and Marble) was conducted in a farmer's hatchery at Depok, West Java. Five pairs of broodstocks of each variety were reared in five aquaria for two months. Fecundity, hatching rate, spawning frequency and fry production were monitored. The Black variety had the highest breeding production, shown by greatest fecundity (1059.72 eggs), hatching rate (92,173%), egg diameter (1.186 mm) and seed production (505,59 fries); compared to the Black & White (783,83 eggs, 91,020%, 1.157 mm and 407,70 fries) and the Marble (555,62 eggs, 81,22%, 1.130 mm and 280,85 fries). The Marble variety had the lowest spawning frequency. There was no significant difference between the Black and Black & White varieties.

KEYWORDS: reproduction performance, color varieties, angelfish.

INTRODUCTION

The angelfish (*Pterophyllum scalare*), belonging to the family Cichlidae, is one of the best known and most popular ornamental fish. This "Queen of the aquarium" is native to the Amazon River (Sakurai *et al.*, 1990) and its original color is silver with three black vertical bars passing along the body.

In the past few decades, the angelfish has been used intensively in breeding experiments by aquarists and today their varieties are far from the original form, which is now becoming very rare. Many color varieties have been developed, such as the Black angelfish which is a melanistic mutant with a totally black body (Sterba, 1983). Axelrod (1980) suggested that this variety occurred as a result of selective inbreeding. Black & White variety has been developed by European aquarists which has normal coloration in front of the body, while the anterior is black (Axelrod & Vordenwinkler, 1965). The marble variety is a result of cross breeding between the original silver color and black mutant (Sterba, 1983); its color is silvery white with many black spots. There are many other color varieties, such as the gold angel and zebra, but none is as popular as the above mentioned varieties. The Black & White is most popular and has a great market demand, although its availability is limited.

Although there are many color varieties present, the environment requirements for their optimal growth are similar. Freshwater with 26°

29°C temperature and pH 6.5-7.5 is the optimum condition for angelfish rearing (Axelrod *et al.*, 1995). They can be reared in tank or aquarium as long as in sheltered or shading place. Feeding angelfish is not a problem. Larvae can be fed with *Artemia nauplii* or tiny *Moina* or *Daphnia*. The adult can eat tubifex worm, bloodworm or mosquito larvae.

Normally, the first maturation (first spawning) of angelfish is 6-7 months old, about 5-6 cm length and can produce 300-500 eggs (Techner, 1996). Spawning takes place almost the whole year especially in rainy season during which the environment or water quality, primarily the temperature, is suitable.

This study observed the reproductive capacity of three popular color varieties of the angelfish (Black, Black & White, and Marble), to supply information needed by the hobbyists and farmers working on the breeding of this fish.

MATERIAL AND METHODS

Three color varieties of the angelfish, (Black, Black & White and Marble, standard length: 6-6.5 cm), were reared in pairs in aquaria containing 50 L water, one pair per aquarium. A piece of PVC pipe (10 cm) was provided as spawning substrate, which was placed vertically in the middle of the wall of the aquarium.

The fertilized eggs which were laid in PVC pipes were then transferred into plastic jars to hatch. Fish larvae were transferred to another

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aquarium (60x30x30 cm³) and reared for 20-22 days.

Fecundity was counted as the number of eggs laid by each broodstock. The frequency of spawning was observed by time of ovulation from each broodstock during two months rearing period (September to November 1997). Average egg size was obtained by measuring 25 eggs per sample every spawning period up to the third spawning. The hatching rate of egg or larval production per broodstock was counted immediately after the larvae began swimming (6-7 days after egg were laid). It was calculated as follows:

$$\text{Hatching rate (\%)} = \frac{\text{Number of hatching eggs}}{\text{Number egg laid}} \times 100\%$$

The fry or seed production was counted 19-22 days since egg laid after all fins of the young fish completely developed. Data were analyzed statis-

tically with "nested anova with unequal samples" by Sokal & Rohlf (1981).

RESULTS AND DISCUSSION

The number of eggs laid by each broodstock at each spawning during the two months rearing period showed that there was a significant difference in the fecundity among the three varieties. The Black variety had the highest fecundity, followed by the Black & White and the Marble. This Marble also had very low egg production, whenever according to Techner (1996) the healthy angelfish broodstocks of 8-9 months old and 6-7 cm normally produced 600-1,000 eggs at each ovulation.

Fecundity also differed at each spawning time (Table 1). The number of eggs laid was greater with increased spawning frequency, especially in the case of the Black variety.

Table 1. Average number of egg laid by each ovulation of three varieties of the angelfish in two months breeding period.

Time of spawning	Black	Black & White	Marble
1 st	964*	763	602
2 st	1,006*	741	507
3 rd	1,101*	825	534
4 th	1,079*	782	592
5 th	1,283*	856	
6 th		759	

* = significantly different (P=0.05)

Table 2. Average frequency of spawning, hatching rate, egg size and fry production of three colors varieties of angelfish (data were collected from two months rearing period).

	Black	Black & White	Marble
# of ovulation	4.4	4.6	2.6*
Eggs ovulation	1,060*	784*	556*
Total fecundity per fish	4,663*	3,606*	1,807*
Hatching succes (%)	92	91	81
Egg size (mm)	1.18*	1.15	1.13
Fry production	506*	408*	281*
Total fry production	11,120*	9,377*	3,651
Survival rate (%)	48*	52	51

* = significantly different (P=0.05)

During two months breeding period, frequency of egg laid by Black and Black & White did not fluctuate much (4-5 times and 4-6 times) (Table 2). However, the spawning frequency of the Marble variety was found to be 2-4 times lower. Besides lower in frequency of spawning, the Marble variety also seemed to be more vulnerable to poor environmental condition. This was indicated by the number of dead broodstocks in aquarium no.2 after the second spawning and in aquarium no.5 which died on the twelve days after plotting before spawning. The temperature and the pH during observation period were 26°-28°C and 6.5-7.0, which were the optimum condition of water quality for angelfish breeding.

There were no differences of the hatching rate between the Black and the Black & White varieties, but for Marble variety. Marble's hatching rate was lower than those of the two other varieties. However, from the spawning frequency observation, these three varieties showed no difference in hatching rate in every spawning time.

The eggs size of the Black variety was larger than the others. There was, however, no difference among the spawning time. There was a correlation between age and size of broodstock. The larger and the older the broodstocks generally have the larger egg, greater fecundity, higher hatching rate and survival rate until they reach a maximum rates (Bromage & Robert, 1995).

Corresponding to its fecundity, the Black variety also showed the highest fry production, while the Marble had the lowest. However, the fry production in each spawning time in all of the three varieties did not vary significantly.

From the parameters observed (fecundity, hatching rate and fry production), the Black angelfish had the highest reproductive capacity while the Marble had the lowest. Even though the Black showed an increase in fecundity together with increasing of spawning time, its hatching rate and seed production did not increase, meaning that the larval survival was lower in the Black variety than the Marble.

The number of eggs laid were higher in the Black variety and greater with increasing spawning frequency which resulted in greater number of larval production (higher hatching rate was also an important factor). Since they reared fry in the same size of aquarium, the rearing density of the larvae became higher causing high mortality. It might be the reason why the seed produced in every spawning time (first until sixth) did not differ. It seemed that the maximum

capacity of rearing aquarium was not more than 700 larvae. Meanwhile it was indicated that the Black variety had a larger egg size compared to the other varieties. According to Tamaru *et al.* (1988) and Bromage & Robert (1995) larger egg not only producing higher hatching rate but also has higher survival rate and stronger larvae because of the greater yolk sac.

Nevertheless, during the two months rearing period, the Black variety had still the highest fry production compared to the other varieties. The Black variety seemed to have superior characteristics showing higher reproductive capacity (fecundity, hatching rate, egg size and seed production) (Satyani, 1996). On the contrary, the Marble variety had the inferior characteristics showed by low reproduction capacity; it was probably an inbreeding product. This was indicated by apparent symptoms of inbreeding depression like the susceptibility to disease and the low of fecundity, hatching rate and small egg size (Phang, 1993; Satyani, 1996).

From the economic point of view, farmers apparently will gain more benefit to produce the Black because of its productivity and the homogenous color of the offspring (all black). Supposing that the Black larval density in the rearing aquarium was reduced, the seed production might be increased. Less productivity and the beautiful appearance of the transparent from of the Black & White make it becoming less in number but more in commercial value. This is the prime reason why some farmers at present keep rearing the Black & White variety because of its higher market demand and higher market prize (Lingga & Susanto, 1989).

CONCLUSION

Black color variety as melanistic mutant of the angelfish has a higher reproductive capacity (fecundity, hatching rate and seed production) than the Black & White variety. While those of Marble variety has the lowest reproductive capacity, although Black color variety is easier to rear. This variety is not a popular as Black & White variety which has nice looking color and high market demand; and those Black & White variety commands higher prices in the market than the Black variety.

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