
The Effectiveness of Using Honey in Feed for Fish Sex Change Green Swordtail (*Xiphophorus helleri*, Heckel 1848)

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Abstract

*This study aims to determine the effect of forest bee honey on changes in male sex of green swordtail (*Xiphophorus helleri*). The benefits of this study were to determine the appropriate dose of honey for changes in male sex and how the survival rate of green swordtail larvae was. This study was conducted using a completely randomized design (CRD) with five treatments and three replications, namely Treatment A: Control (Ordinary Feed), Treatment B: Dosage of 3 ml of honey mixed into 100 g of feed, Treatment C: Dosage of 4 ml of honey which is mixed into 100 g of feed, Treatment D: Dosage of 5 ml of honey mixed into 100 g of feed, Treatment E: Dose of 6 ml of honey mixed into 100 g of feed. The results showed that mixing honey into feed gave a significantly different effect on the percentage of male sex ratio where $F_{count} > F_{table}$ ($5.15 > 3.48$). Where the best dose is found in treatment E: 6 ml of honey mixed into 100 g of feed with a percentage of 66.05%. While the lowest percentage value is in treatment A (Control) with a total percentage of 40.79%. For the survival rate, mixing honey into the feed had no effect between all treatments. The percentage of survival rates is still in the range above 50%. The range of water quality values is the temperature ranges from 26.55-27.52 °C, pH ranges from 7.02-7.06 and dissolved oxygen ranges from 5.13-5.31 ppm.*

Keywords: Sword plate, honey, sex ratio, and survival

1. Introduction

The existence of natural resources in Indonesia (both biological and non-biological), has been widely used for many purposes, especially to meet the economic needs of the community. One of the most encouraged resources for now is the fisheries sector [1]. Even in certain areas the community is very dependent on this sector. One of the fishery activities that have potential today is ornamental fish cultivation.

Ornamental fish is one of the fishery commodities which has become a potential trade commodity at home and abroad. One of the ornamental fish that has a very high economic value today is the sword plate. The advantage of this sword plate ornamental fish is its very beautiful body color. Moreover, the sword plate which has a male sex [2], because the male has a brighter color brightness than the female. The swordtail belongs to the Poeciliidae family which is spread in the waters around Belize, Honduras, Mexico to Guatemala [3].

Green Swordtail is one type of ornamental fish that is much in demand for hobbies and ornamental fish cultivators. This freshwater ornamental fish is not native to Indonesia [4] but comes from Central America [5]. In addition, the green swordtail has an attractive color and unique shape because the male fish has a long dorsal fin resembling a sword [6]; [7]; [8]; [9], this fish is easy to get to maintain and raise because it is very adaptable and has good tolerance in various environmental conditions. This fish is also very social and not aggressive so it can coexist with others

The beauty found in male fish makes the price high, so it is necessary to manipulate reproduction so that when the eggs hatch, males are more dominant than females. This fish species is characterized by sexual dimorphism, in the form of modification of the anal fin into a gonopodium and a tail fin that elongates like a sword in male fish [10]. Research on swordtail fish is mostly carried out on a laboratory scale such as observing spawning behavior, male engineering [11], and feeding testing [12].

For now, various kinds of reproductive manipulation have been carried out to produce male fish, including the use of hormones. Among the hormones commonly used is the hormone methyltestosterone [13]. The use of the hormone 17-methyltestosterone has been shown to improve the growth quality of red claw crayfish (*Cherax quadricarinatus*) seeds [14]. [15] also reported that tilapia produced a male sex ratio of 94.7% with treatment using the hormone 17 α -methyltestosterone through feed at a dose of 60 mg/kg for 10 days. However, the more difficult and limited the availability of the hormone, especially so far it has been obtained by importing from abroad such as America and Germany, then other materials are needed which are easier to obtain and possible to use more efficiently.

One alternative that can be done to produce quality green swordtail seeds with male monosex naturally is the supplementation of honey in broodstock feed. Honey contains minerals that can affect the success of Y spermatozoa in the fertilization process, so it is expected that the higher the percentage of Y spermatozoa that fertilize the egg, the higher the male larva or seed produced by the parent. Therefore, the author is interested in conducting research with the title "Effectiveness of Forest Bee Honey to Increase Sex Reversal Male Ratio in Sword Plati Fish (*Xiphophorus helleri*).

2. Materials andMethods

2.1 Time and place

This research was conducted in August – September 2022. The study was conducted at an ornamental fish farming business, Geulanggang Teungoh village, Bireuen Regency, Aceh Province

2.2 Experimental design

The research method used was experimental with a non-factorial completely randomized design (CRD) 5 treatments with 3 replications. The treatment used in this study was a modified study [16] with the best dose of 7 ml of honey supplement added to Betta Fish (*Betta Sp*) rations.. And the results of preliminary tests conducted on green swordtail (*Xiphophorus helleri*). The treatments are:

Treatment A = Control (Ordinary Feed)

Treatment B = Dosage of 3 ml of honey mixed into 100 g of feed

Treatment C = Dosage of 4 ml of honey mixed into 100 g of feed

Treatment D = Dosage of 5 ml of honey mixed into 100 gr of feed

Treatment E = Dosage of 6 ml of honey mixed into 100 g of feed

2.3 Work procedures

a. Container Preparation

The container used in this study was an aquarium measuring 30 x 30 x 60 cm. First, the aquarium is washed with detergent to be free from parasites or microorganisms that can cause disease. After washing, the aquarium was left for 24 hours for the drying process. Then the aquarium is filled with water with a volume of 15 L.

b. Giving Honey Supplements in Feed

Pelleted artificial feed of 100 g each was added with bee honey supplements with different doses of honey (0, 3, 4, 5, 6 ml/100 g of feed). Previously, the honey solution was mixed with an adhesive or binder in the form of CMC, then only after that it was mixed with the

pellet feed that had been prepared, so it was hoped that the honey would not easily dissolve in the media water until everything was absorbed by the mother of the green swordtail (*Xiphophorus helleri*).

c. Parent Maintenance and Spawning

Parent platy swords with a total of 45 females were found in the vicinity of Lhokseumawe City. The broodstock were then acclimatized for 2 days in the laboratory. After that spawned in the aquarium tank. During spawning, the broodstock were fed pellets. After spawning is complete, the male parent is transferred to another tank while the female parent remains in the treatment tank to be given feed that has been mixed with forest bee honey according to the treatment dose (0, 3, 4, 5, 6 ml/gr of feed). with a frequency of three times a day. Feeding was given until the swordfish mother gave birth to her young. To support the success of the spawning process, a substrate that serves as a shelter is needed. The substrate used can be algae and water hyacinth.

d. Larvae Care

Seed care includes feeding and changing media water. Platy sword fry are not fed until they are 4 days old. Because it still has food supplies in its body in the form of egg yolks. After 4 days the new seeds were fed chicken egg yolks. With a frequency of 3 times a day After 15 days of age, the feed given is tubifex worms, Moina and Daphnia. Change the water at least every 2 days. The harvesting process can be carried out after the green swordtail seeds have shown both male and female sex.

2.4 Observation Parameter

The test parameters measured in this study include:

a. Male and Female Sex Ratio

Male sex reversal is the main parameter to be an indicator of the success of sex reversal. Calculations were made at the end of the study using the formula:

$$\text{Male sex ratio (\%)} = \text{Total Males} / \text{Final Total} \times 100\% \quad (1)$$

b. Larval Survival Rate (SR)

To get the percentage of survival rate of green swordtail larvae for 2 months of research, the following formula can be used:

$$\text{SR} = \text{Nt} / \text{No} \times 100\% \quad (2)$$

Information:

SR: Survival rate (%)

Nt: Number of larvae at the end of rearing (tails)

No: Number of larvae at the beginning of rearing (tail)

c. Water quality

Water quality parameters to be measured in this study include pH, DO and temperature. Measurements were taken every day during the study.

2.5 Data analysis

The research data were analyzed using a non-factorial completely randomized design with 5 treatments and 3 replications and the data collected from the research results was made using the Microsoft Excel application.

$$Y_{ij} = + i + ij \quad (3)$$

Information:

Y_{ij} = Observation value at the i -th dose treatment and j . repetition

\bar{y} = General average

i = Effect of using the i -th dose

$i = 1,2,3$ (treatment)

$j = 1,2,3$ (repeat)

ij = Experimental error (error) at the i -th dose in the j

3. Results and Discussion

3.1 Results Male Sex Change

The results of research that has been carried out for 90 days with feeding mixed with honey give good results. Where the visual appearance of gender is when the fish is 80 days old. For more details can be seen in the Figure 1.

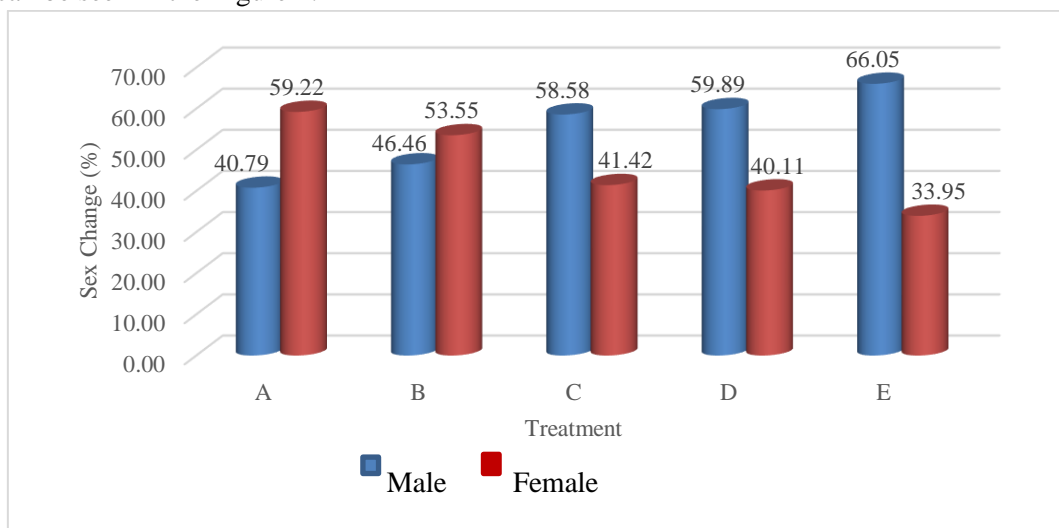


Figure 1. Change In Sex Ratio

Based on Figure 1, it can be seen that the percentage of male sex changes in each treatment is very different. The percentage of male sex changes that appeared the most was found in treatment E with a dose of 6 ml of honey mixed into 100 g of feed. The average percentage of male sex change values in treatment E was 66.05%. The high rate of change in sex ratio in treatment E was due to the very good effect caused by giving honey at a dose of 6 ml/gr. This explains that the higher the dose of honey given to the feed, the more the sex changes to males. This is similar to the study [where treatment with the use of high doses of honey was able to increase sex changes in the sex of guppy. [17]. The same thing was also found in betta fish research [mustaqim]

Honey contains chrysin compounds with flavonoids (72.7%), aromatic acids (16.5%) and esters (10.8%) which function as natural aromatase inhibitors that function to inhibit the action of aromatase in estrogen synthesis [18]. Honey is a safe and economical alternative, honey contains chrysin which can act as an aromatase inhibitor [19]. The high percentage of changes in treatment E was caused by the effect of chrysin which inhibited aromatase activity to the transcription of the aromatase gene. This inhibition causes the content of the hormone testosterone to be higher than the content of the hormone estradiol [20]. The decrease in the concentration of estrogen by aromatase inhibitors results in the production of a large amount of testosterone hormone, which directs the sex of the fish to become male [21].

3.2 Survival

Based on the results of research that has been carried out for 90 days, the survival rate of green swordtail (*Xiphophorus helleri*) larvae has no effect between treatments. In each treatment, visual observations were made by calculating the number of live larvae at the end of the study. For more details on the survival rate of platy fish larvae (*Xiphophorus helleri*) the sword can be seen in Figure 2 below.

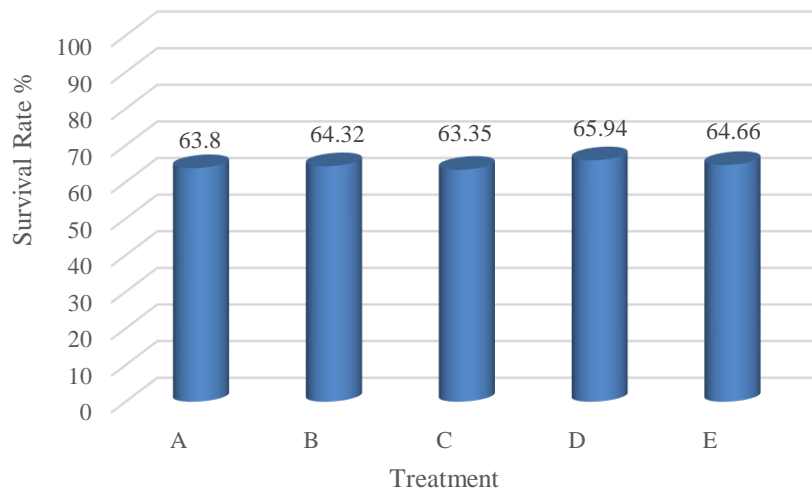


Figure 2. Survival

Based on Figure 2 it can be seen that the survival rate of green swordtail fry (*Xiphophorus helleri*) the highest was found in treatment D by mixing 5 ml of honey into 100 g of feed, then followed by treatment A (control) without mixing honey. Furthermore, treatment B was mixing 3 ml of honey into 100 g of feed and then followed by treatment E by mixing 6 ml of honey into 100 g of feed, finally in treatment C by mixing 4 ml of honey into the feed.

Green swordtail Seed Survival Rate Percentage (*Xiphophorus helleri*) in all treatments was classified as high because it was above 50%. The average survival rate in treatment A is 63.80%, then in treatment B is 64.32%, then in treatment C it is 63.35% then in treatment D is 65.94% and in treatment E the survival rate is sword plate fish is 64.66%.

The high survival rate in treatment D which reached 65.94% was thought to be because the food intake given was consumed by the fish. So, the death rate is low. Meanwhile, in treatments E and C, several fish larvae died due to technical errors, so it was estimated that the dissolved oxygen entering the water was reduced. Several factors that must be considered are the way of feeding in accordance with the mouth opening of the fish larvae, the availability of feed in the rearing media, regular siphoning to keep the water clean from the rest of the feed or fish feces [22]. [23], also stated that the better the maintenance technique, the better the survival. The same thing was also said by [24] that feed is one of the factors that affect the survival of fish.

3.3 Water Quality

Water is a very influential medium for life and growth for biota or organisms that live and develop in it. In this study, the value of water quality in larval rearing media was very good and suitable. For details, see Table 1 below.

Table 1.
Water Quality Parameters

Treatment	Observation parameters		
	Temperature (°C)	pH	DO (mg/L)
A	26.55 - 27.31	7.02-7.06	5.16 - 5.27
B	26.58-27.39	7.03 -7.05	5.17 - 5.26
C	26.58-27.39	7.06 -7.03	5.13 - 5.22
D	26.63-27.37	7.02 - 7.06	5.15 - 5.19
E	27.28-27.52	7.04 - 7.03	5.23 - 5.31

Water has an important meaning for the growth of organisms that live in the waters because it affects the growth of organisms. Water quality that is suitable and suitable will make the biota that live in it good and healthy too. From the results of research on research media, it was found that the value of water quality in both spawning and larval rearing media was feasible and good. Where the temperature in all treatments, both in the spawning media and larval rearing is in the range of 26-29 °C. [1] said that a good temperature for fish rearing media ranged from 26-29 °C. This is according to opinion [25] the ideal temperature in the maintenance of swordtail fish is 25-28 °C, temperatures below or above this number are very dangerous.

The pH value in the research that was carried out for 94 days ranged from 6.2 - 7.4 which was considered good for the life of sword platy fish. This value is in accordance with the quality standard in fish life as expressed by [26] that a good pH for keeping fish ranges from 6-8. In addition to measuring the temperature value and measuring the pH value of the water, at the time of the study, dissolved oxygen measurements were also carried out. The dissolved oxygen value obtained in this study was 4.9 – 5.9 ppm. The dissolved oxygen value is still good and suitable for the life of sword platy fish. This is also as stated by [27] in general fish can live in high dissolved oxygen ranges but for optimal growth fish require dissolved oxygen levels > 4 ppm. Meanwhile, the optimal dissolved oxygen required for the growth of swordfish is 3.3-5.0 ppm [28].

4. Conclusion

The conclusions that the author can give from the results of this study are as follows, namely mixing forest bee honey into the mother's feed has an effect on changes in the male sex of green swordtail (*Xiphophorus hellerii*), where with the treatment 6 ml of honey mixed into 100 g of feed was able to provide a percentage of the number of males of 66.05%. On average, the survival rate of fish is around 50%, and the water quality during maintenance is quite good.

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