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EFFECT OF ADDITION SPIRULINA FLOUR ON FEED FOR THE COLOR INTENSITY OF SWORDTAIL FISH (*XIPHOPHORUS HELLERI*)

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Swordtail fish, β-carotene, Spirulina Flour, Color Intensity, Growth Closed system transportation, clove oil concentration, induction and conscious recovery time, survival rate.

ABSTRACT

Swordtail fish (Xiphophorus helleri) is an ornamental fish that has attractive color characteristics. β-carotene is a dye or pigment that can give red and yellow colors which dominate pigmentation in ornamental fish. One source of β-carotene is found in spirulina flour. The purpose of this research was to analyze and determine the concentration of the addition of spirulina flour which is appropriate for artificial feed on the change in the intensity of the color of Swordtail fish. This research was conducted from February 2019 to June 2019. The research method used a Completely Randomized Design (CRD), with four treatments and three replications (addition of spirulina flour as much as 0%, 1%, 3%, and 5% in artificial feed) and tested using the Kruskal-Wallis Test. This research uses kohaku Swordtail fish measuring 3-4 cm in size maintained in 8-liter capacity maintenance media. Parameters in the study included color intensity, absolute growth, survival rate and water quality (temperature, dissolved oxygen and pH). The results showed the addition of 3% spirulina flour had the best effect with a score of increasing color intensity in the tail section of 6,52 and in the head section 10,67. addition of 3% spirulina flour is the best treatment for increasing weight (0.18 gr) and length (0.43 cm). 100% Survival Rate for all treatments and replications. During the research the temperature was 25.50-27.50 oC, DO 4.60-7.20 ppm and pH 7.23-8.13.

INTRODUCTION

Ornamental fish has its uniqueness when compared with consumption fish. The price of consumption fish is determined by the body weight and taste of the meat, while ornamental fish is determined by appearance. Ornamental fish are enjoyed by consumers through vision by displaying it in ponds or aquariums so that ornamental fish will look attractive and beautiful to look at (Gunawan 2005).

The 2014-2017 period of ornamental fish trade experienced a significant increase. In the 2014-2017 period, the volume of ornamental fish traded between provinces in Indonesia experienced an average growth of 27.51% per year. The highest growth occurred in marine ornamental fish commodities, where the average reached 69.64% per year. While the trade-in freshwater ornamental fish has reached 29.06% per year. The total volume of ornamental fish traded between provinces in Indonesia in 2017 reached 23.32 million, consisting of 20.61 million freshwater ornamental fish and 2.61 million marine ornamental fish (KKP 2018).

One type of ornamental fish is swordtail fish (Xiphophorus helleri). This fish has an interesting color characteristic, the color of the swordtail fish is very influential on its economic value. Beautiful colors in ornamental fish are caused by chromatophores (pigment cells) located in the epidermal layer, which can adjust to the environment and sexual activity (Lesmana 2001).The aquaculture sector plays an important role in supporting economic growth, increasing the income and welfare of the community and opening employment opportunities. Aquaculture has increased since 2009, with growth of 43.76%. According to the Directorate General of Aquaculture (2016), since 2013 West Java is the largest producer of tilapia from several provinces that produce tilapia, amounting to 205,951 tons. The level of fish consumption in West Java is 20-31.4 kg/capita (Central Bureau of Statistics 2017).

Spirulina platensis is a blue-green alga that is rich in protein, vitamins, minerals, and other nutrients. S. platensis contains phycocyanin, chlorophyll-a, and carotene. Carotene is composed of xanthophyll (37%), beta carotene (28%) and zeaxanthin (17%) (Tongsiri et al. 2010). One of the benefits is as food additives for fish to improve color quality, because it has a high content of beta carotene (Susanna et al. 2007).

Carotene is a dye or pigment that can give red and yellow colors which dominate pigmentation in ornamental fish. The main function of the pigment in fish naturally is to give changes to the color of the fish so that the fish will be more attractive. Carotene can be obtained from plants because plants can produce and store carotene (Lesmana 2004).

MATERIAL AND METHODS

This research will be carried out in the Wet and Hatchery Laboratories of Building 4, Faculty of Fisheries and Marine Sciences, Padjadjaran University. Observations were carried out for 28 days. The tools used in the research are 8-liter ice cream containers, container boxes, blowers, plastic hoses, trays, drafts, thermometers, pH meters, DO meters, millimeter blocks, digital scales, glass bottles, spoons, Toca Color Finders (TCF), plastics ziplock, stationery, and camera. The material used in the research was Kohaku swordtail fish, spirulina flour, progol, PF-500 feed.

The method used in this research is the experimental method, using an experimental design that is a Completely Randomized Design (CRD) model consisting of 4 treatments with 3 repetitions in each treatment. 4 treatments were the addition of 0% spirulina flour (control), 1%, 3%, 5%.

Research procedures include container preparation, water preparation, feed preparation, test fish preparation, and research implementation. Observation parameters observed in the research were color observation, absolute growth, survival rate and water quality (temperature, pH, and dissolved oxygen).

Color Observation

The color of the body of the fish that was observed was in the head and tail because the test fish used was the Kohaku swordtail fish (Xiphophorus helleri). Color observation data on swordtail fish were analyzed using the Kruskal-Wallis test. The statistical formula used in the Kruskal-Wallis test is as follows:

$$H = \frac{12}{N(N+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(N+1)$$

Description:
H: Kruskal-Wallis test statistics
N: Number of samples
ni: Number of samples in group i
Ri: Total rank in group i

Absolute Growth

Absolute weight growth is the difference between the wet weight at the end of the maintenance period and the wet weight at the beginning of the maintenance period (Effendi 2004). Following is the absolute weight growth formula:

$$W_m = W_t - W_0$$

Description:
W_m : The growth of absolute weight of fish (g)
W_t : Weight of fish at-t (g)

W_0 : Weight of fish at-0 (g)

Absolute length growth is the difference in the total body length of the fish at the end of the study with the total length of the fish body at the beginning of the study. Absolute length calculations can be calculated by equations (Effendi 2004):

$$P_m = P_t - P_0$$

Description:

P_m : The growth of absolute lenght of fish (cm)
P_t : Lenght of fish at-t (cm)
P_0 : Length of fish at-0 (cm)

Survival Rate

Survival Rate (SR) is the ratio of the number of live fish at the end of maintenance to the total number of fish stocked at the beginning of maintenance (Effendi 2004):

$$SR\ (\%) = \frac{Nt}{No} \times 100\%$$

Description:

SR = Survival of fish during the experiment.
N_t = Number of fish at the end of the experiment.
N_0 = Number of fish at the beginning of the experiment

Data Analysis

The color enhancement data obtained (the results of the difference in the measurement of the initial color to the final color on the Toca Color Finder color measuring device) were analyzed descriptively and the color brightness values were analyzed using Kruskal Wallis analysis, if there were significant differences, the Z test was carried out at the 95% confidence level. Weight gain was analyzed using Analysis of Variance (ANOVA) F test to find out the effect of treatment on parameters, if there were significant differences then it was continued with Duncan test at 95% confidence level (Gasperz 1995).

RESULTS AND DISCUSSION

Tail Color and Head Color

Based on the results of research conducted over 28 days, it was shown that the addition of spirulina flour increased the color score on the swordtail fish (Figure 1).

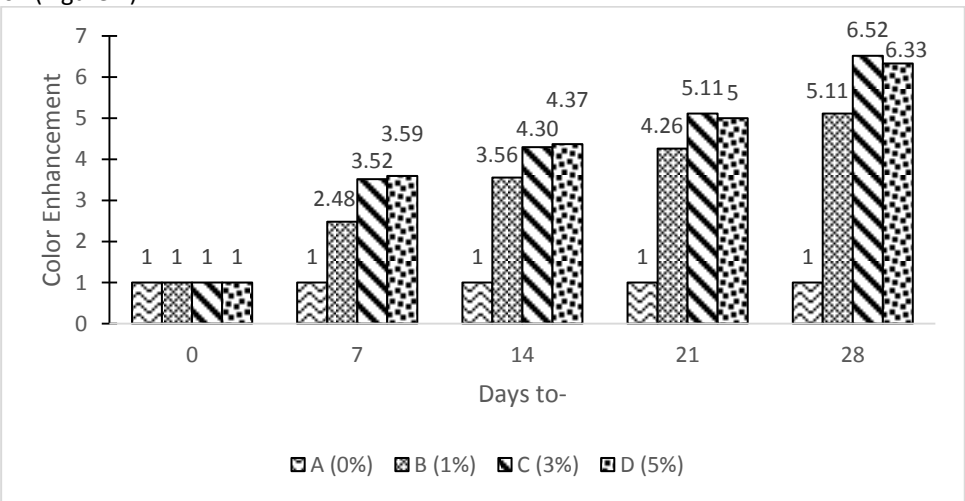


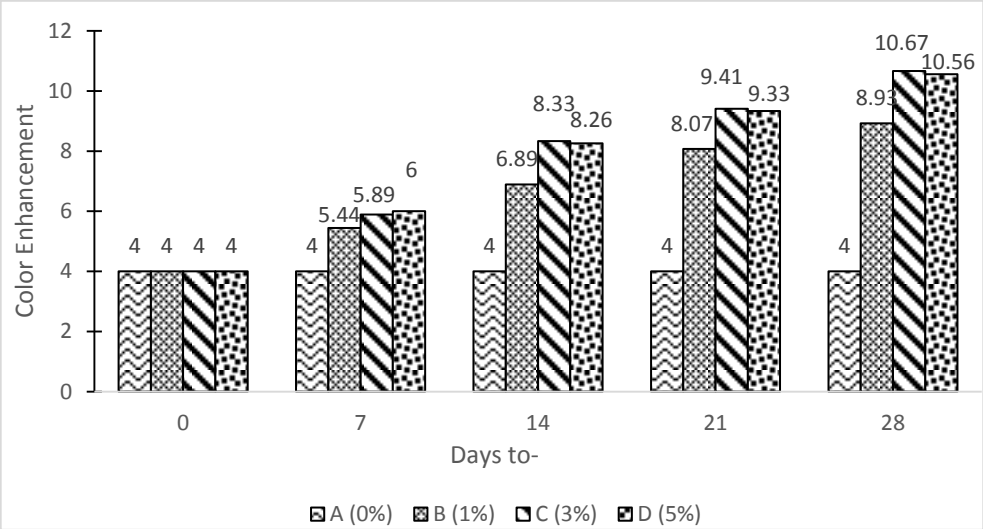
Figure 1. Increased Average Color Score on the Tail

The results of the study (Figure 1) showed that treatment C (3% spirulina flour concentration) gave a higher color change effect than other treatments (A, B and D). The average final score of the highest increase in color intensity on the 28th day was treatment C (3% spirulina flour concentration) with a value of 6.52; treatment D (5% spirulina flour concentration) with a value of 6.33; treatment B (1% spirulina flour concentration) with a value of 5.11 and treatment A (without the addition of spirulina flour) of 1. A treatment without the addition of spirulina flour did not increase. This is because the food used does not contain beta-carotene so that the fish's body cannot synthesize carotenoids without any additions from the outside Color observations on the 7th day to 28th day continued to increase in treatments B, C and D. The occurrence of swordtail fish discoloration due to the addition of spirulina flour to

feed - because spirulina flour contains carotenoids which can increase the color of fish. According to Sasson (1991), freshwater ornamental fish fed with spirulina flour can make the color more shiny or brilliant. According to Lesmana (2001), the main function of carotene is a pigment that can provide color so that fish are more attractive. Color in fish is caused by the presence of pigment or chromatophore cells found in the dermis on scales. Observations on the 7th day to the 28th day continued to increase the intensity of tail color in treatments B, C and D. Following the observations of Liao et al. (1993), that by mixing spirulina flour into shrimp food for 14-28 days there will be an increase in carotenoids in the breath.

Treatment C (3% spirulina flour concentration) is sufficient for the needs of swordtail fish for carotenoids in spirulina flour. Following the results of Barus et al (2015), the addition of 3% spirulina flour resulted in an increase in higher color intensity in goldfish compared to the addition of 5% and 1% spirulina flour. According to Kurniawaty (2012), fish need a longer time to break the carotene material into color pigments if the amount of pigment contained in the feed is increasing.

The results of a 28-day study showed that the addition of spirulina flour increased the color score on the swordtail's head (Figure 2).



Figur 2. Increased Average Color Score on the Head

The results of the study (Figure 2) showed that treatment C (3% spirulina flour concentration) had a more effective effect than treatment A (0% spirulina flour concentration), B (1% spirulina flour concentration) and D (concentration of spirulina flour 5). %) o swordtail fish. The average final score of the highest increase in color intensity on the 28th day was treatment C (3% spirulina flour concentration) with a value of 10.67; treatment D (5% spirulina flour concentration) with a value of 10.56; treatment B (1% spirulina flour concentration) with a value of 8.93 and treatment A (without the addition of spirulina flour) of 4.

According to Satyani and Sugito (1997), changes in the color of fish depend on the amount of composition of the color material in the feed. A dose of the right source of color pigment is needed, not excessive and also not lacking to obtain the best color appearance in fish. Giving color ingredients with the right dose will clarify the color pattern of the fish's body. According to Storebakken and No (1992) carotenoids that have been synthesized into pigments will be placed on the xanthofor (yellow) and eritophore (red or orange).

Absolute Growth

Observation of the growth of absolute weights and lengths is the supporting parameter observed to determine the effect of spirulina flour added to commercial feed on the growth of swordtail fish. According to Handajani and Widodo (2010), growth is a volume and weight increase at a certain time. Fish growth is closely related to the availability of protein in feed. The average growth of absolute weight and length of swordtail fish in research can be seen in Table 1.

Table 1. Average Change Value Absolute Weight and Absolute Length

Treatment	Weight (gr)	Lenght (cm)
A (0%)	0.08	0.16
B (Concentration 1%)	0.18	0.28
C (Concentration 3%)	0.18	0.43
D (Concentration 5%)	0.16	0.42

The average value of the biggest weight change occurred in treatment B (1%) and C (3%) 0.18 grams, the average value of the smallest change in treatment A (0%) 0.08 grams. The highest average value of change in length occurs in treatment C (3%) 0.43 cm, the average value of the lowest length change occurs at treatment A (0%) 0.16 cm. The addition of higher carotenoid concentrations affects increasing growth in weight and length. This shows that the growth of swordtail fish is not hampered by the addition of spirulina flour.

Swordtail fish with the addition of spirulina flour has a greater weight and length growth than without the addition of spirulina flour. The same thing was obtained by Sulawesty (1997), that is, feed added with carotenoids produced higher growth than feeds which were not added by carotenoids. According to Prayogo, et al. (2012), changes in the growth of these two parameters are directly proportional, the more body length increases the more body fish weight increases.

Survival Rate

SR research results from swordtail fish showed that the addition of spirulina flour to commercial feed had no significant effect on the SR level of swordtail fish.

Table 2. Survival Rate

Treatment	Survival Rate (SR)
A (0%)	100%
B (Concentration 1%)	100%
C (Concentration 3%)	100%
D (Concentration 5%)	100%

All treatments have an SR value of 100% referring to Table 6. This is because the carotene content in spirulina flour, as well as a source of color pigments, also does not endanger the health of fish. According to Satyani and Sugito (1997), besides functioning as a color pigment, carotene plays a role in protecting fish against light and can help in the metabolism of oxygen cycles. Carotene substances also naturally function as the basic ingredients of vitamin A, support thermoregulation or the process of regulating body temperature, help the formation of egg yolk in the reproductive process, and affect the health of fish (Bachtiar 2002).

Water Quality Parameters

Observation of water quality is one of the parameters that must be observed because water quality is one of the factors that influence cultivation. The water quality parameters observed in the research are temperature, pH, and DO. Observation of water quality in research is conducted every 7 days. The results of observations of water quality parameters are presented in Table 3.

Table 3. Water Quality Observation Results

Parameters	Rsults	Reference (Lesmana 2015)
Temperature (^{o}C)	25.50 – 27.50	22-26
DO (ppm)	4.60 – 7.20	> 4
pH	7.23 – 8.13	7.00-7.50

The results presented in Table 3 show the temperatures during the study ranged from 25.50 to 27.50 C, pH ranging between 7.23-8.13 and DO ranged from 4.60 to 7.20. According to Lesmana (2015), swordtail fish can grow optimally in water conditions that have temperatures ranging from 22-26˚C, a pH range of 7.0-7.5 and have DO content of> 4ppm. Fish are ectothermic animals which means they do not produce body heat, so their body temperature depends or adjusts the temperature of their surroundings (Hoole et al. 2001). As aquatic animals, fish have several physiological mechanisms that are not possessed by land animals. Habitat differences

cause the development of fish organs adapted to environmental conditions (Yushinta 2004). Observations of temperature, pH and DO during the research were not significantly different in each treatment, because temperature observations were carried out at the same time and the research site was in a closed place so that the changing outdoor conditions did not affect the research container.

Conclusion

Based on the results of research on the Effect of Spirulina Flour Addition on Feed on the Color Intensity of Swordtail Fish (Xiphophorus helleri), it can be concluded that the addition of 3% spirulina flour to the feed influenced the increase in swordtail fish color intensity and was the best treatment with average value the final colors are 6.52 (tail) and 10.67 (head).

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