International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

Vol. 35 No. 1 October 2022, pp. 292-297

# *Growth Rate Of Sangkuriang Catfish* (*Clarias Gariepinus* Var. Sangkuriang) *Substituted With Black Soldier Fly* (*Hermetia Illucens* Linnaeus, 1958) *Larva In Artificial Feed*

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**Abstract – The need for Sangkuriang catfish in each region has increased. One of the obstacles faced by fishery commodities is the high price of feed, reaching 50–70% of the production cost. The high price of fish meal and dependence on imported fish meal in feed formulations are big obstacles, so it is necessary to develop alternative feeds to replace fish meal protein, namely BSF larvae. This study aimed to analyze the growth rate of sangkuriang catfish substituted with BSF larvae in artificial feed. The method used was Completely Randomized Design (CRD), consisting of 5 treatments and 5 replications. Substitution of 30-40% BSF larvae in artificial feed formulations increased the daily weight growth rate of fish by 1.44–1.60% during 40 days of rearing. However, the growth rate of fish length is 0.69-0.70 mm. The addition of the amount of feed consumed has a linear relationship pattern to the weight of the fish and a quadratic relationship to the length of the fish**

**Keywords – growth, feed, black soldier fly**

## I. INTRODUCTION

Sangkuriang catfish (Clarias gariepinus) is one of the fish that is widely consumed by the public because it has a fairly economical price, is easy to find in the market, is rich in nutrients, and is low in fat. The nutritional content of catfish per 100 grams is 17.7% protein, 4.8% fat, 1.2% minerals, 0.3% carbohydrates, and 76% water (Astawan, 2008). Gunawan (2009a) stated that the demand for catfish never subsided; in fact, it tends to increase every year. So far, current production has not been able to meet market demand.

The most important problem in aquaculture activities is feed. Feed is one of the components that supports aquaculture business activities' growth and survival of the fish that are cultivated. Afrianto and Liviawaty (2005) estimate that aquaculture costs 60-70% of the cost of feed production. So far, people still use commercial pellets to support the growth of cultured fish, so the price of feed is higher than the selling price of fish. The feed given determines the quality of fish meat (Poernomo et al., 2015; Setiawati et al., 2015). Considering the increasing price of fish meals and some imports, it is necessary to use artificial feed to help reduce production costs. One alternative protein source as a substitute for fish meal is using Black Soldier Fly larvae.

Black Soldier Fly larvae have received special attention because of their rich source of nutrients. Henry et al. (2015) state that amino acids, fats, vitamins, and minerals contained in larvae are comparable to conventional proteins. On the other hand, BSF larvae can utilize organic waste into high-quality protein. Larvae contain 60 % protein and 10–30% fat and have a balanced fatty acid profile depending on the growth medium of the larvae (Diener et al., 2009; NRC, 2011).

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Fish cultivators have been using commercial feed so that the cost of feed is greater than the production price. The source of animal protein commonly used is fish meal. The high price of fish meal requires an alternative source of animal protein, namely larvae, because it is known as a high protein source. Therefore, it is necessary to research the growth rate of sangkuriang catfish fed artificial feed with black soldier fly larvae flour substitution.

## II. RESEARCH METHODS

This research was conducted from June to October 2022. Larval rearing was carried out at the Minagot house in West Sumatra, Kuranji District, Padang. Fish rearing is carried out at the Bungus Fish Seed Center (BBI), Bungus Timur Village, Bungus Teluk Kabung District, Padang. This research method uses an experimental design with a completely randomized design consisting of 5 treatments and 5 replications. The treatment in this study was a larvae substitution in artificial feed formulations (0%, 10%, 20%, 30%, and 40%).

In the process of flouring larvae, larvae that have been kept in the market and restaurant waste media for 15 days are ready to be harvested to be used as larvae flour. First, separate the larvae from the rest of the feed medium and wash them thoroughly with running water. The clean larvae are doused with hot water until they die. To produce larvae flour, the dead larvae are dried in the sun to dry and blended until smooth to produce flour.

The maintenance of sangkuriang catfish is carried out at the Bungus Fish Seed Center (BBI), Bungus District, Teluk Kabung, Padang. The fish seeds used are 8–12 cm in size. Fish rearing was carried out for 40 days by sampling four times every 10 days. The frequency of feeding the fish is as much as 5% of the body weight every morning at 08.00 WIB and in the afternoon at 17.00 WIB.

**Data analysis**

1. The rate of daily weight gain

The daily weight growth rate uses the Effendie formula (2002), which is as follows:

$$LPBH = \frac{Ln\ Wt - Ln\ W0}{t} x\ 100\%$$

Description:

LPBH = Daily weight growth rate (%/day).
Wt = Average fish weight at the end of the experiment (g)
W0 = Average fish weight at the start of the study (g)
t = Time required for maintenance (days)

2. The rate of daily length growth

The daily length growth rate of fish can be calculated using the Effendie formula (2002), namely:

$$LPPH = \frac{Ln\ Wt - Ln\ W0}{t} x\ 100\%$$

Description:

LPPH = Daily lenght growth rate (%/day).
Wt = Average fish lenght at the end of the experiment (g)
W0 = Average fish lenght at the start of the study (g)
t = Time required for maintenance (days)

Data on daily weight growth rate and daily length growth rate were analyzed using a one-way ANOVA test, and if significant differences were found between treatments, Duncan's test was continued.

## III. RESULTS AND DISCUSSION

1. The rate of daily weight gain

The daily weight growth rate during the study was found to be highest in treatment D (1.60±0.14%/day), followed by treatment E (1.44±0.13%/day), treatment A (1.04±0,10%/day), treatment B (1.02±0.17%/day) and treatment C (0.95±0.09%/day). The results of the statistical test of the daily weight growth rate can be seen in Figure 1.

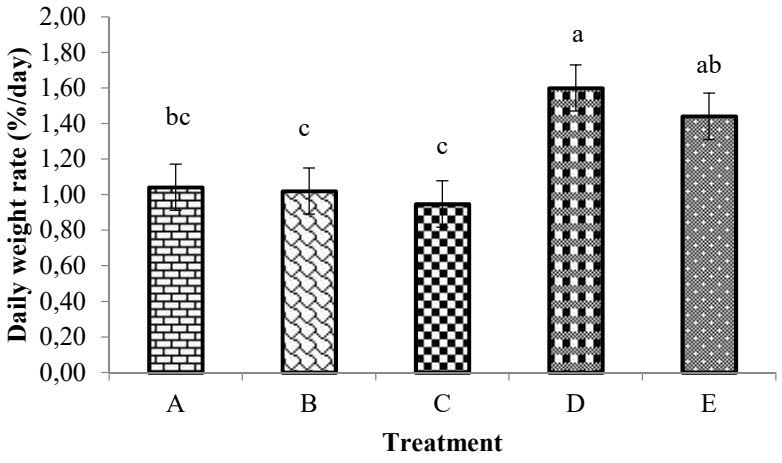


Figure 1. Daily weight rate of sangkuriang catfish during maintenance

Different superscript letters showed significant differences ($p<0.05$) between treatments

Based on Figure 1, it was found that the daily weight rate based on the results of statistical analysis of the addition of BSF larvae to artificial feed with different percentages had a significant effect ($p<0.05$) on the daily weight rate. Duncan's further test results in treatment D were not significantly different from treatment E. However, treatment D was significantly different from treatment A, treatment B, and treatment C. The highest daily weight rate was found in treatment D (30% BSF larvae) at 1.60%/day and the lowest was found in treatment C (20% BSF larvae) at 0.95%/day. The high rate of daily weight of treatment D (30% BSF larvae) is thought to be protein and energy in the artificial feed that is in accordance with the needs of sangkuriang catfish so that the feed can be utilized efficiently. Halver (1972) stated that fish needed protein for the first time for growth. This is in accordance with the statement of Effendie (1997), which states that growth occurs when excess metabolic energy is used for body maintenance and activity. Fish can grow well if their nutritional needs are fulfilled, especially protein needs.

2. Relationship between feed amount and weight growth rate of sangkuriang catfish The relationship between the amount of feed consumed and the weight of fish has a linear relationship pattern with the regression equation $y = -0.001x + 0.766$ ($R2 = 0.373$; $p<0.05$) as shown in Figure 2.

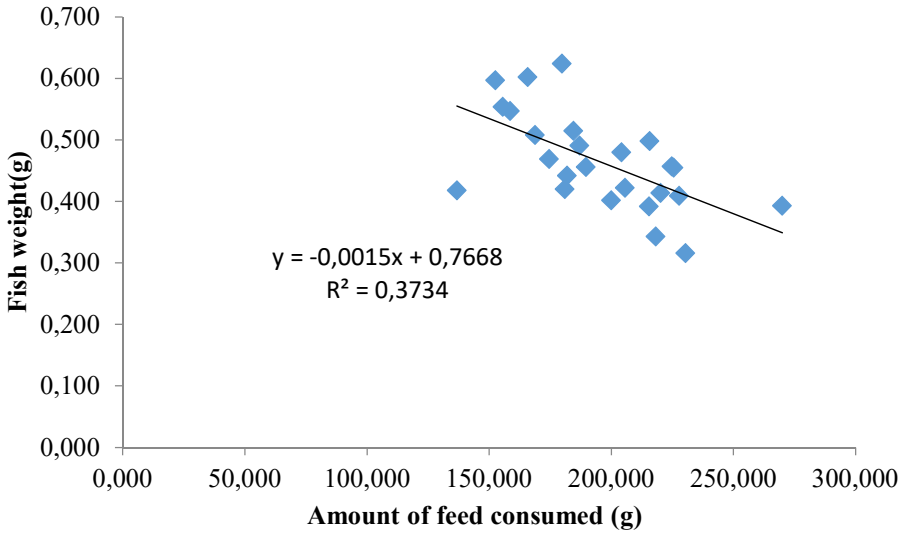


Figure 2. The relationship between fish weight and the amount of feed consumed

The relationship between the amount of feed consumed and the weight of the fish in Figure 2 can be seen to have a negative linear relationship pattern. This means that each addition of 1 gram of fish feed consumption will reduce fish weight by 0.001 grams, where the amount of feed consumption has an effect on fish weight, which is 37.3%.

3. The rate of daily length growth The highest daily growth rate of fish was found in treatment B (0.70±0.17%/day), followed by treatment D (0.69±0.15%/day), treatment C (0.50±0, 09%/day), treatment E (0.46±0.03%/day) and treatment A (0.41±0.04%/day) as shown in Figure 3.

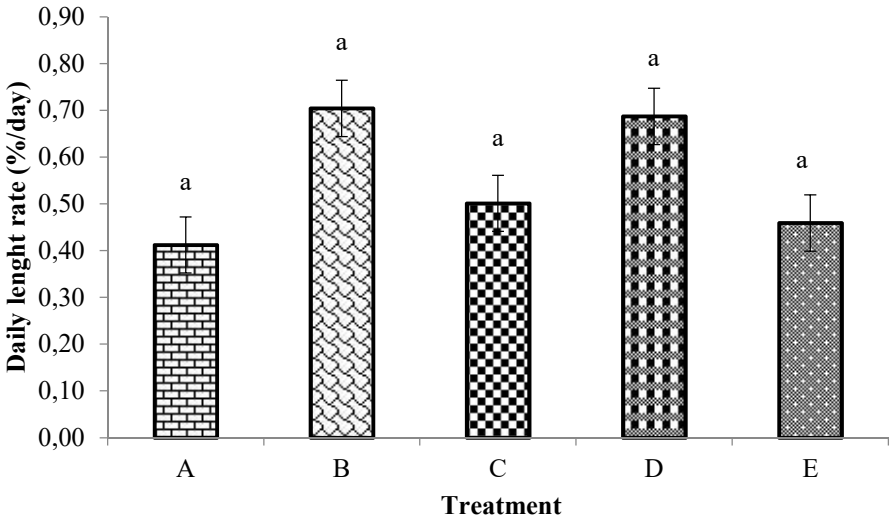


Figure 3. Daily lenght rate of sangkuriang catfish during maintenance

Different superscript letters showed significant differences ($p<0.05$) between treatments

Figure 3, based on the results of statistical analysis, showed that the addition of BSF larvae had no significant effect ($p>0.05$) on the daily length rate of sangkuriang catfish. The highest daily length rate was found in treatment B at 0.70 mm, and the lowest was found in treatment at 0.41 mm. Setiawan et al. (2022) found that feeding a combination of larvae with commercial feed on pearl catfish did not have a significant effect ($p>0.05$) on the length of pearl catfish.

4. The effect of feed amount on the length growth rate of sangkuriang catfish The relationship between the amount of feed consumed and the length of the fish has a quadratic relationship pattern with the regression equation y = 4.705E-5x2–0.012x + 1.143 (R2 = 0.609; p<0.05) as shown in Figure 4.

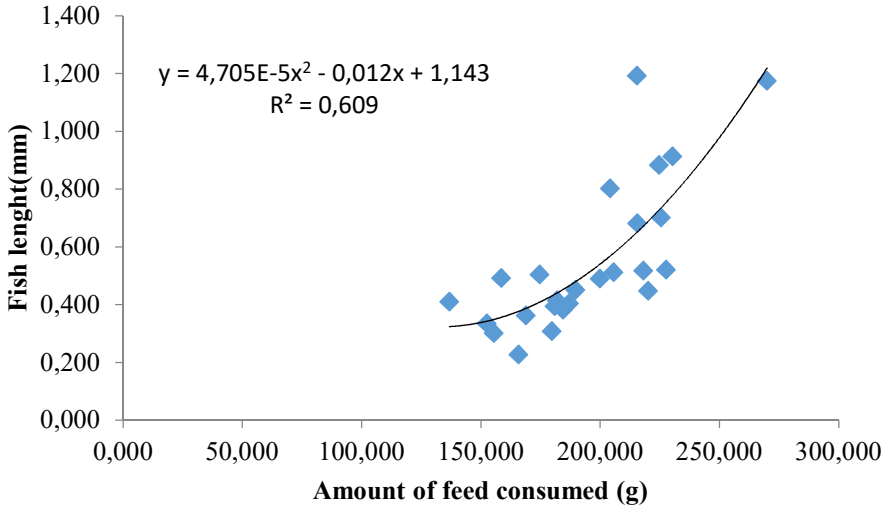


Figure 4. The relationship between fish lenght and the amount of feed consumed

The relationship between the amount of feed consumed and the length of the fish in Figure 4 can be seen to have a positive square relationship pattern. This means that for each addition of 1 gram of feed, the consumption of fish feed will increase the length of the fish by 4.705E-5 mm, where the amount of feed consumption has an effect on the weight of the fish, which is 60.9%.

## IV. CONCLUSION

The addition of 30% and 40% BSF larvae in artificial feed formulations had a significant effect (p<0.05) on the daily weight growth rate. The amount of artificial feed consumption has a linear relationship pattern to the weight of sangkuriang catfish. The addition of BSF larvae to artificial feed formulations had no significant effect (p>0.05) on the daily length growth rate. The amount of artificial feed consumption has a quadratic relationship pattern with the length of sangkuriang catfish.

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