

Effect of Feeding Black Soldier Fly Larvae (*Hermetia illucens* Linnaeus, 1758) and Commercial Feed on the Growth Rate of Common Carp (*Cyprinus carpio* Linnaeus, 1758).

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ABSTRACT

Feed is an important element in supporting the growth and survival of fish. Availability and quality of feed is a factor that determines the success of cultivation. So far, some fish farmers still rely on feed directly from nature, such as small fish and leaves. The price of commercial feed is currently very expensive, so the costs incurred for feed are felt by fish farmers. To reduce feed prices, looking for alternative protein sources that are cheaper and easier to obtain is necessary. Therefore, it must provide other alternatives such as natural feed whose availability does not depend on the season, for example Maggot or black soldier fly larvae (*Hermetia illucens*) which are alternative feeds because they meet the requirements as a source of protein. The purpose of this study was to determine the comparative effect of feeding maggot (*Hermetia illucens*) and commercial feed on the growth rate of common carp (*Cyprinus carpio*) seeds, as well as to find out the best feeding on the growth rate and survival of common carp seeds. This study used a Complete Randomized Design (CRD) with 5 treatments and 4 replications. The frequency of feeding is 2 times a day at 08.00 and 16.00 morning and evening as much as 5% of fish biomass. Weight, length, survival rate and water quality measurements were carried out every 7 days. The results of the study showed that the highest growth in length and weight was found in the P3 treatment with a combination of 25% commercial feed and 75% maggot, namely 9.33 cm and 10.23 grams, and a survival value of 90% -100%.

Keywords: Feed, length, weight, maggot, common carp

INTRODUCTION

Feed is an important element in supporting the growth and survival of fish. Efforts to develop fisheries cultivation, especially for tilapia, common carp, and cat fish, are greatly influenced by the availability of sufficient feed in quantity and quality to support maximum production. The availability of quality and quantity of feed is a factor that determines the success of cultivation. So far, some fish farmers still rely on food taken directly from nature, such as small fish and leaves. Farmers' dependence on this food is inappropriate because its availability is determined by the season. The price of commercial feed is currently very expensive, so the costs incurred for feed are felt by fish farmers, to reduce the price of feed it is necessary to look for alternative protein sources that are cheaper and easier to obtain. (Setijaningsih *et al*, 2011).

Therefore, we must provide other alternatives such as natural food whose availability does not depend on the season, for example, maggots or larvae of black soldier flies (*Hermetia illucens*) which are alternative

foods because they meet the requirements as a protein source. (Mudeng, 2018).

Maggot was chosen as the raw material for making fish feed because it has a protein content of 44.26%, which is higher than commercial feed which only has 20-25% protein (Putri, 2019). Common carp (*Cyprinus carpio*) is a type of freshwater fish that has high economic value, because it is a type of freshwater fish that is very popular with Indonesian people. The demand for consumption fish continues to increase, marked by the continued increase in goldfish production every year (Ariyati et al, 2013). Providing artificial feed in intensive cultivation is an important supporting factor for increasing production. The existing natural food does not allow it to meet the fish's needs, so the fish's need for food for maintenance and growth can be met with artificial food that can meet the nutritional, digestive, and appetite requirements of the fish. (Nurhidayat, 2012).

The level of survival and growth of common carp fry depends on providing quality feed that is liked by the fish, which can increase the level of feed efficiency.

Cultivation techniques and efforts made by fish farmers to support good seed growth with a high survival rate, encouraging the growth of fish seeds by implementing controlled environmental conditions is one of the techniques that can be used in fish cultivation. The success of fish cultivation is supported by the environment and maintenance media as well as the availability of good feed. Providing natural food aims to increase the growth rate so that fish can achieve optimal survival and growth (Dodi, 2015).

One alternative feed as a source of animal protein is maggots which can be used as fish feed. The protein content of maggots is higher than the content of commercial feed, which is around 20 – 25% (Indramawan, 2014). Even though maggot cannot be used as the only feed ingredient, at least maggot can be applied with commercial feed so that production costs can automatically be reduced without reducing fish growth (Subamia et al, 2010).

RESEARCH METHODS

This research was carried out in February – April 2022. Common carp seeds were obtained from the place where fish seeds are sold on Jl. Damanhuri, Samarinda, East Kalimantan. Rearing of common carp seeds, stocking of common carp seeds, and data analysis were carried out on Jl. Sultan Alimuddin No.64, Samarinda, East Kalimantan. The tools used in this research were analytical scales, cameras, filters, fish scoops, aerators, aerator hoses, cover nets, thermometers, pH meters, DO meters, writing instruments, digital calipers, and 20 large 50-liter tubs. The materials used in this research were 200 carps, maggots aged 7-10 days, common carp aged \pm 45 days with a size of 5-7 cm, commercial feed type Hi Provit 783-2, and clean water.

The method used in this research is using a Completely Randomized Design (CRD) with 5 treatments and 4 replications. The treatments used in this research are as follows:

Treatment 1(P1): Combination of 75% commercial feed and 25% maggot

Treatment 2(P2): Combination of 50% commercial feed and 50% maggot

Treatment 3(P3): Combination of 25% commercial feed and 75% maggot

Treatment 4 (P4): 100% commercial feed (Control)

Treatment 5 (P5): Maggot 100%

Sampling was carried out 8 times with measurement intervals and data collection every 7 days. Feeding is given based on 5% of the fish's weight. The main parameters include the growth of Common carp (*Cyprinus carpio*), while the supporting parameters include several water quality parameters such as temperature, pH, and DO.

The parameters observed in this study were the length and weight of the fish. The observed parameter data will be analyzed using the following formula:

Daily Growth Rate or Specific Growth Rate (SGR)

The parameter measured is the average weight of the fish (grams), then the specific growth rate (SGR) is calculated using the equation according to Sawhney & Roopma (2010),



Information:

SGR = Daily growth rate (%)

W_t = average weight of fish at the end of rearing (tail)

W₀ = average weight of fish at the start of rearing (tail)

t = length of maintenance time (days)

Absolute Length Growth

The growth of catfish length during maintenance can be calculated using the formula of Nurmasiyah (2018) as follows:

L = L_t – L₀

Information:

L = absolute length growth (mm)

L_t = average length of fish at the end of maintenance (mm)

L₀ = average length of fish at the beginning of maintenance (mm)

Survival Rate

According to Wirabakti (2006), the survival of goldfish seeds is calculated using a formula. Calculations are calculated after the end of the research with the following formula:

$$SGR = \frac{[\ln W_t - \ln W_0]}{t} \times 100\%$$

Information :

SR = Survival Rate

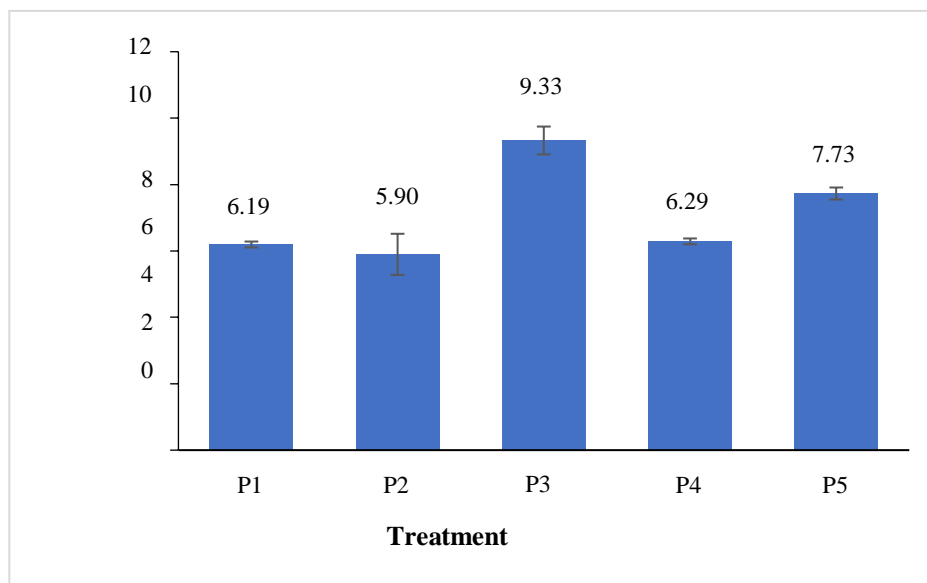
N_t = Number of fish that live during rearing, in time t

N_0 = Initial number of stock

RESULTS AND DISCUSSION

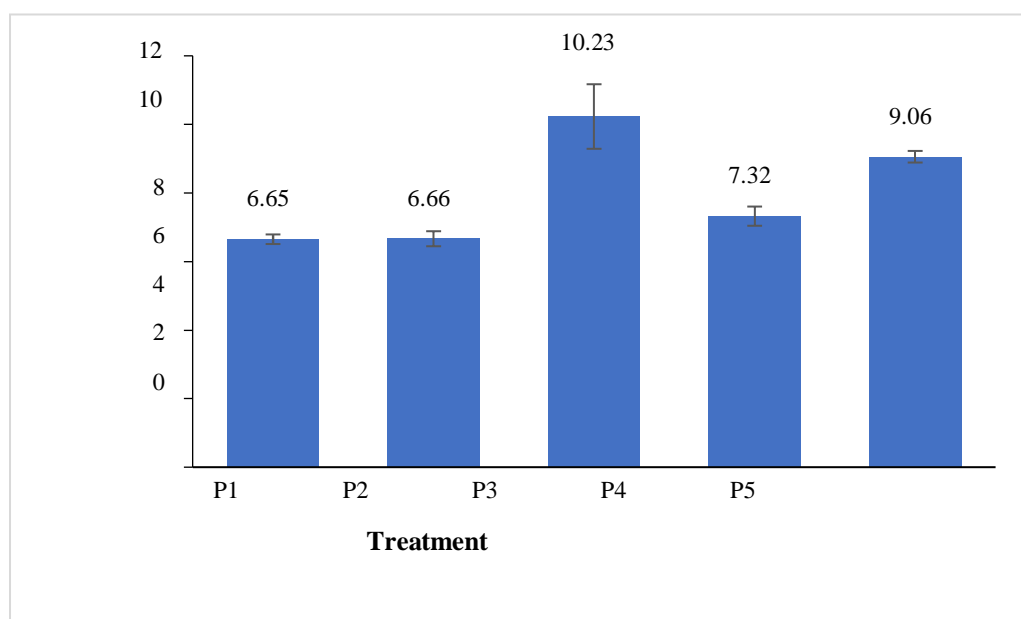
Results

Data analysis of the average length of common carp is shown in picture 1 below:



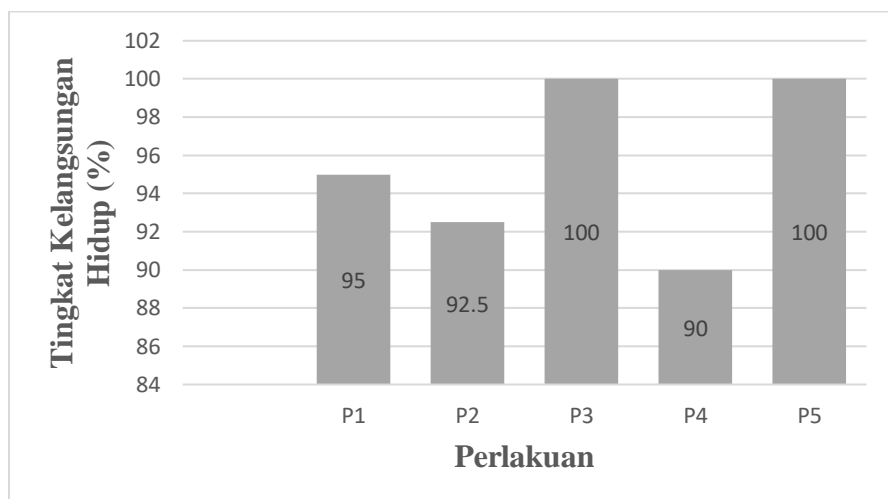
Picture 1. Average Value of Increase in Length of Common carp

Data analysis of the average value of common carp weight gain is shown in Picture 2 below:



Picture 2. Average value of common carp weight gain

Data on the survival rate of common carp during the research can be seen in Picture 3 below:



Picture 3. Average Common carp survival

Water quality data during the research is shown in Table 1 below:

Table 1. Average Value of Water Quality Parameters

Parameter	P1		P2		P3		P4		P5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Suhu	25	28,4	26,4	29,8	26,3	29,4	26	29,1	26,6	29,5
pH	6,6	7,3	6,8	7,8	6,8	7,6	6,7	7,6	6,9	8
DO	4,5	5	4,7	5,8	4,4	5,6	4	5,6	4,9	5,8

DISCUSSION

Based on the research results, there was an increase in the length of common carp in each treatment from day 0 to day 56 with an average value of 6.19-9.33 cm over the 56 observation periods. The average increase in length is obtained. This shows that the fish can respond well to feeding so that it can produce an increase in the length of the common carp. From the results of the research that has been carried out, there was an increase in the weight of goldfish in each treatment with an average value of 6.65 gr – 10.23 gr from day 0 to day 56 of the observation period. This shows that feeding can be responded to well by the fish so that it can produce growth for the common carp. Increasing optimum fish growth is influenced by the food source so it is necessary to provide additional high-quality feed to meet the fish’s nutritional needs (Musdalifah et al, 2019). Providing additional feed on fish weight had a positive effect, as evidenced by the increase in weight after giving maggots as feed. The survival rate of common carp is influenced by various factors including feed and water quality. Based on the results of observations, the survival rates of common carp were successively from highest to lowest, namely treatment P3 and P5 with a value of 100%, treatment P1 and P2 with a value of 95%, and treatment P4 with a value of 90%. The average survival rate in this study can be categorized as good because it is more than 80% for each treatment. Apart from that, the survival rate is related to the quality of water as a maintenance medium, because optimum water quality will also produce a good survival rate. This is supported by Gusman & Muhammad (2014), who stated that, according to their research, the survival rate for goldfish can be categorized as good if it reaches 83.33% - 96.67%. Good water quality can support the growth rate and survival rate of fish. Based on Table 4.4, it can be concluded that the average temperature in each treatment in the temperature range of 25°C to 29.5°C is a temperature range that falls into the good category and is suitable for fish rearing media.

CONCLUSION

Based on the 5 treatments that were given, the results showed that increasing the maggot concentration with commercial feed had a positive effect on the growth rate of common carp. This can be shown by the increase in weight and length of common carp. The combination of 25% commercial feed with 75% maggot and 100% maggot gave the best effect on the growth in weight and length of common carp (*Cyprinus carpio*) with average values of 10.23 ± 0.94 g and 9.33 ± 0.42 cm. Apart from that, these two treatments also had a positive influence on the survival of common carp with a percentage of 100%.

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