TIK-242 Growth of Patin Fish (Pangasius hypophthalmus) Using Kasgot (Black Soldier Fly Larvae) Media as the Basic Ingredient for Fertilization

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Research Paper

Growth of Patin Fish (*Pangasius hypophthalmus*) Using Kasgot (*Black Soldier Fly Larvae*) Media as the Basic Ingredient for Fertilization

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ABSTRACT

Patin fish larvae have very small mouths, requiring natural feed at the early stages of larval rearing. This necessitates alternative rearing technologies without compromising the quality and quantity of the fry. The aim of this study is to determine if Black Soldier Fly Larvae can be used as a base material for pond preparation in Patin fish rearing. The materials used include 76 grams of Black Soldier Fly Larvae, placed in a bag according to the Indonesian national standard for fertilization in Patin fish rearing (200-500 grams/m2). The bag was then placed in a 38 cm diameter basin, which had been cleaned and filled with 20 cm of river water. During the 10-day rearing period, water quality (pH, temperature, and DO) was monitored, water changes were performed, and PF 0 feed was provided. After 10 days, the fry was harvested to measure their growth in length, weight, and survival rate. Black Soldier Fly Larvae or used maggot rearing media can be utilized as a fertilization medium in Patin fish fry rearing, as the growth parameters of the fry meet the Indonesian National Standards.

Keywords: *Black Soldier Fly Larvae, Growth, Patin fish*

INTRODUCTION

Black Soldier Fly (BSF) maggots can be used as animal feed, helping to reduce feed costs. According to Anggitasari, Sjofjan, and Djunaidi (2016), the raw materials for feed production are still heavily dependent on imports, which drives up feed prices. Therefore, alternative feeds, such as BSF larvae (Hermetia illucens L.), are needed to ensure feed availability. In addition to reducing feed costs, maggots can enhance the protein content and stabilize the productivity of livestock. BSF maggots can be fed to livestock either directly or mixed with bran to make pellets.

In maggot cultivation, not only the maggots themselves are useful, but their metabolic byproducts can be used as organic fertilizer, commonly referred to as "black soldier fly larvae" or "maggot residue." This 100% organic fertilizer, derived from the bioconversion of organic waste by BSF larvae, can improve the growth and health of ornamental plants, vegetables, and fruits. According to Agustin et al. (2023), BSF larvae from organic waste, harvested at two weeks of age, meet the standards set by the Ministry of Agriculture Regulation (Permentan) 2019 for organic fertilizers, with criteria including pH 4-9, organic carbon greater than 15%, C/N ratio less than 25, total NPK nutrients over 2%, and available Fe below 500 mg/kg.

Bioconversion is a method of fermenting organic waste using living organisms. BSF larvae can decompose organic waste commonly produced by humans, such as rice, vegetables, fruits, and meat, making their use beneficial for reducing environmental pollution. The growth of maggots is greatly influenced by their growing medium. For instance, the H. illucens fly prefers a distinct medium aroma, but not all media are suitable for oviposition (Tomberlin et al., 2009). Maggot farmers have begun using BSF larvae as organic fertilizer. According to Sri Widyastuti and Sardin (2021), the BSF larvae (Hermetia illucens, Diptera: Stratiomyidae) are highly suitable for insect-based organic waste management technology. This technology is a form of waste management through the 3R concept (Reduce, Reuse, Recycle) to decrease organic waste at its source. BSF larvae can decompose organic waste in 10-11 days, resulting in compost and larval biomass or prepupae that can serve as nutritious animal feed.

This is consistent with the findings of Popa Radu and Terrence R. Green (2012), who stated that Black Soldier Fly (BSF) larvae fed on organic waste wastewater thrived. BSF larvae can eliminate volatile organic acids (VOA) and organic nitrogen, demonstrated by the removal of ninhydrin-positive metabolites in the treated organic waste wastewater, along with a significant increase in NH4, a reduction in COD values, and the neutralization of acidic pH in the organic waste wastewater.

The annual consumption of Patin fish fish is increasing, necessitating the production of Patin fish fry to meet the demand. Innovations and technologies are required to improve the quantity and quality of Patin fish fry production. Setiawati Mia et al. (2013) stated that the addition of vitamin C to Artemia as feed for Patin fish larvae can positively impact their growth and survival. However, the rising cost of Artemia burdens farmers, creating a need for alternative feeds that are efficient, affordable, and readily available.

According to research by Ariyanto Didik et al. (2012), Siamese Patin fish larvae and fry can utilize natural feed available in rearing ponds, including both phytoplankton and zooplankton. This was evident from the types of natural feed found in the digestive tracts of fish at 5-, 10-, and 15-days post-hatching. At 5 days post-hatching, Nauplius was the dominant natural feed found in the digestive tracts, while at 15 days post-hatching, Daphnia was dominant. This indicates a change in the type of feed consumed, likely related to the mouth size of the Siamese Patin fish larvae/fry at different ages. Purnomo Kunto and Andri Warsa (2011) noted that Siamese Patin fish are omnivorous, consuming everything. While they are plankton feeders like tilapia at the fry stage, their diet becomes more similar to that of Patin fish as they mature.

Using BSF larvae or maggot fertilizer can be an alternative for fertilizing Patin fish fry rearing ponds. BSF larvae production requires organic waste, which is readily available in daily life. Mabruroh et al. (2022) confirmed that maggot cultivation can decompose waste, addressing a significant community issue.

The purpose of this research is to determine whether BSF larvae fertilizer can be used as a base material for pond preparation in Patin fish rearing. This could resolve the issues of organic waste management in the community and the problem of natural feed for Patin fish rearing.

MATERIALS & METHODS

The materials used included 76 grams of Black Soldier Fly Larvae, which were placed in a bag or applied at a dosage of 200 grams/m², following the Indonesian National Standard for fertilization in Patin fish fish farming of 200-500 grams/m². The larvae were then placed into a 38 cm diameter basin. The preparation of the basin involved thorough cleaning. Once prepared, the basin was filled with river water to a height of 20 cm. After 4 days, the Black Soldier Fly Larvae fertilizer was removed from the basin and left for 6 days. Then, 35 ten-day-old Patin fish fry were introduced into the basin.

During the rearing period, water quality parameters such as pH, temperature, and dissolved oxygen (DO) were monitored. These measurements aimed to assess the water quality in the media, as water quality is a crucial factor in the successful rearing of Patin fish fry. The experiment was conducted with three replicates over 10 days. Throughout the rearing period, water changes and feeding of the Patin fish fry with PF 0 feed were carried out. After 10 days, the fry were harvested, and their growth in terms of length, weight, and survival rate was measured. The survival rate analysis was calculated using the formula:

$$KH = \frac{NT}{NO} \times 100\%$$

Where NT represents the number of fish at the end compared to the initial stocking (in individuals), and the result is multiplied by 100%. The higher the survival rate value, the better the treatment.

For absolute length analysis, it compares the average length at the end of the fish rearing period to the average length of fish on the first day of stocking. As shown in the figure below:

Absolute length = Lt – Lo (cm)

The higher the absolute length value obtained, the better the growth of the patin fish larvae compared to smaller values.

Meanwhile, calculating the absolute weight of the fish is done by comparing the average weight at the end of the rearing period to the average weight of the fish on the first day of stocking, multiplied as shown in the figure below:

$$W = Wt - Wo \text{ (g)}$$

Absolute weight calculation is performed to determine the total weight gain during rearing. The higher the value, the better the treatment.

RESULT

The harvested Black Soldier Fly Larvae were immersed in a basin at a rate of 200 grams per square meter, or alternatively, each basin received 76 grams of Black Soldier Fly Larvae contained in a sack, submerged in the basin with a water depth of 20 cm. The experiment was conducted with 3 replicates. After 4 days, the Black Soldier Fly Larvae fertilizer was removed from the basin and left for 6 days. Subsequently, 35 ten-day-old Patin fish fingerlings were stocked into each basin. This approach is based on research by Ariyanto et al. (2012), which indicates that the highest survival rate during the Patin fish fingerling rearing phase occurs at the 10-day-old stage.

Observations on the growth parameters of Patin fish showed the following results: The survival rate of Patin fish in the 3 replicates was 82.86%. In the first replicate, the survival rate of Patin fish fingerlings was 65.71%, equivalent to 23 individuals out of 35 stocked initially. In the second replicate, the survival rate was 91.43%, with 32 individuals surviving out of 35 stocked at the beginning of rearing. Similarly, in the third replicate, the survival rate was 91.43%, with 32 individuals surviving out of the initial 35 stocked, consistent with the results of the second replicate. A graphical representation of the survival rate of Patin fish fingerlings over a 10-day rearing period across 3 replicates is depicted below:

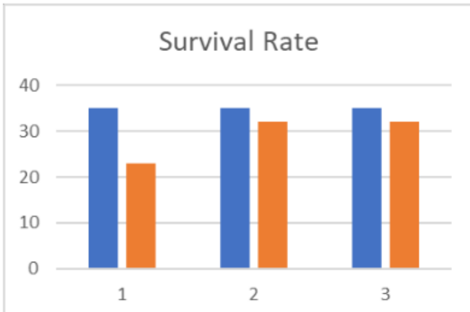


Figure 1. Survival Rate

From the experiment results, it can be observed that the survival rate of Patin fish reared with Black Soldier Fly Larvae fertilization was 82.86%. This result complies with the Indonesian National Standard for the production of Siamese Patin fish (Patin fish hypthalmus) seed class number 01-6483.4-2000.

The growth observation on the weight of Patin fish fingerlings reared for 10 days yielded the following results: In the first replicate, the weight of Patin fish fingerlings was 0.046 grams per fish. These 10-day-old fingerlings were sampled, with 10 samples taken, weighed, and then averaged. After 10 days of rearing, the average weight of the Patin fish fingerlings was 0.137 grams per fish. In other words, the growth in the first replicate was 0.091 grams per fish.

In the second replicate, the initial weight of the Patin fish fingerlings was 0.046 grams per fish. After 10 days of rearing, the average weight was 0.125 grams per fish, indicating a growth of 0.079 grams per fish in the second replicate.

Similarly, in the third replicate, the initial weight of the Patin fish fingerlings was 0.046 grams per fish. After 10 days of rearing, the average weight was 0.128 grams per fish, signifying a growth of 0.082 grams per fish in the third replicate.

A graphical representation of the weight growth of Patin fish fingerlings over a 10-day rearing period across 3 replicates is depicted below:

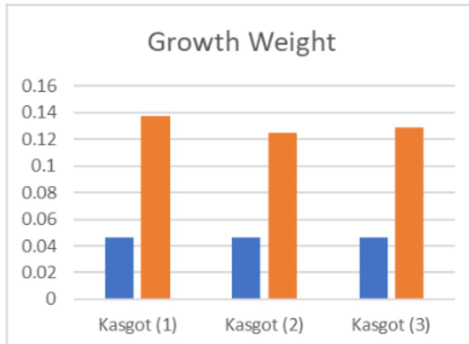


Figure 2. Growth Weight

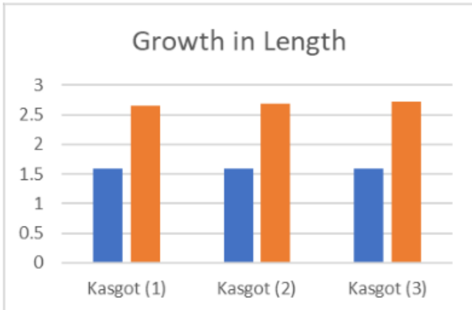
Here is the English translation of the growth observation on the length of Patin fish fingerlings reared for 10 days:

Observation results for the length growth of Patin fish fingerlings reared for 10 days are as follows: In the first replicate, the length of the Patin fish fingerlings was 1.59 cm per fish. These 10-day-old fingerlings were sampled, with 10 samples taken for measurement, and the average length was calculated from these samples. After 10 days of rearing, the Patin fish fingerlings were harvested, and 10 samples were taken for measurement, resulting in an average final length of 2.65 cm per fish. Therefore, the growth in the first replicate was 1.06 cm per fish.

In the second replicate, the initial length of the Patin fish fingerlings was 1.59 cm per fish. After 10 days of rearing, the average length was measured at 2.69 cm per fish, indicating a growth of 1.1 cm per fish in the second replicate.

Similarly, in the third replicate, the initial length of the Patin fish fingerlings was 1.59 cm per fish. After 10 days of rearing, the average length was measured at 2.72 cm per fish, signifying a growth of 1.13 cm per fish in the third replicate.

A graphical representation of the length growth of Patin fish fingerlings over a 10-day rearing period across 3 replicates is depicted below:



Gambar 3. Growth in Length

From the experiment results, it can be observed that the increase in length during the rearing of Patin fish with Black Soldier Fly Larvae fertilization is 1.096 cm per fish. This finding aligns with the Indonesian National Standard for the production of Siamese Patin fish (Patin fish hypthalmus) seedlings, which states that growth during the second nursery phase ranges from 0.64 to 3.18 cm per fish over a rearing period of 21 to 30 days.

According to Tahapari Evi et al. (2008), the first two weeks of Patin fish rearing are influenced by the availability of natural feed in the rearing pond. However, after this period, the types and quantity of natural feed available in the pond are insufficient to sustain the life (growth) of the fish, necessitating the provision of artificial feed to support their survival and expected growth. This is supported by Effendie (1997) as cited in Tahapari Evi et al. (2008), who states that the energy obtained from consumed feed is first used to maintain the body, movement, and repair damaged cells, with the remainder used for growth.

Water quality during the rearing process was assessed based on parameters such as Dissolved Oxygen (DO), Temperature, and pH. DO observations during the fertilization process ranged from 2.1 to 5.6 mg/L, while during Patin fish rearing, DO observations ranged from 0.4 to 2.9 mg/L. This does not meet the Indonesian National Standard, which specifies that DO levels during the second nursery phase should exceed 5 mg/L. Factors influencing DO levels during rearing include the use of basins for Patin fish rearing without aeration. However, the Patin fish fry were still able to survive due to the low stocking density of 35 fish per 12 liters, whereas the Indonesian National Standard specifies a maximum of 20 fish per liter for Patin fish rearing.

Temperature readings during the 10-day fertilization and 10-day rearing period ranged from 26.9 to 28.1°C, which aligns with the Indonesian National Standard for Patin fish rearing of 25-30°C. pH readings during the study ranged from 6.5 to 7.2, which also meets the Indonesian National Standard specifying the optimal pH range for Patin fish rearing as 6.5-8.0.

Besides directly affecting fish density, stocking density indirectly influences aquatic environmental conditions. Higher stocking densities require more feed, resulting in increased waste materials due to metabolism. One consequence of this is a decrease in dissolved oxygen (O2) levels in the water.

CONCLUSION

Black Soldier Fly Larvae or spent maggot cultivation media can be used as a fertilization medium in the nursery of Patin fish due to the growth parameters of Patin fish fry aligning with the Indonesian National Standard.

Declaration by Authors
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