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Productivity of Cultivating Silk Worms (*Tubifex* sp.) in a Tray System Using Different Doses in The Maintenance Media at Bpbat Mandiangin

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Abstract The success of this aquaculture effort is determined through a handful of activity segments which are the key to the success of an effort to cultivate fish. One natural food that has high nutritional content is silk worms. Silk worms (*Tubifex* sp.) are a natural food that is widely used as fish food. The aim is to determine productivity, biomass and increase in worm population. The methods used in this activity are primary data collection, secondary data collection and documentation. The treatments given were treatments A and B, namely in the treatment of probiotics and 10% molasses with a media height of 5 cm and in treatment B probiotics and 20% molasses with a media height of 4 cm. The stages of implementing the activities included preparing containers, preparing culture media, spreading silk worms (*Tubifex* sp.), maintenance and harvesting of silk worms. The test parameters observed included absolute biomass, population increase and productivity. The results of the research showed that silk worm productivity, absolute biomass and silk worm population increase with the tray system with different doses in the highest media was in treatment A with a productivity value of 3.8 kg/m^2, total biomass 164 grams and population increase of 138 720 ind/m^2.

Keywords Silk worms; Natural feed; Productivity

1 Introduction

The success of this aquaculture effort is determined through a handful of activity segments which are the key to the success of an effort to cultivate fish. This includes providing natural feed so that the fish seeds that are raised produce healthy food fish. Silk worms (*Tubifex* sp.) are a natural food that has a high nutritional content and contains relatively high levels of nutrients for the development of fish larvae. According to Hadiroseyani et al. (2007), the supply of tubifex in the environment will not be available in every season, because the silkworms in nature are carried away by the strong current due to the influence of high rainfall intensity. Thus, silkworm cultivation efforts are needed with the aim of being able to meet the needs of natural feed for freshwater fish seeds. silk worms are a type of natural food that fish like because they have good nutrition for the development of fish larvae. The nutritional content of silk worms is 51.9% protein, 20.3% carbohydrates, 22.3% fat and 5.3% ash (Darillia et al., 2022)

Natural feeding of silkworms for fish larvae has so far used silkworms from nature such as rivers, ditches and canals, therefore to help the existence of silkworms must be done by cultivating them. The lack of availability of silkworms such as those obtained from ditches and water channels will often bring parasites and diseases that can cause mass death in fish larvae if eaten by the larvae. Meanwhile, if silkworms are kept alone in a controlled maintenance place, then silkworms are free from disease and parasites because the substrate and food obtained can be managed by the larvae (Khotimah et al., 2023).

One of the problems in aquaculture activities is the high mortality rate of fish larvae caused by the capacity of natural feed that is still less than optimal. To overcome this, a type of natural feed is needed that can meet the needs of fish. In accordance with the existing problems, this study was conducted with the aim of determining the productivity, absolute biomass and population growth of silkworms (*Tubifex* sp.) maintained with different media doses and determining the dosage of probiotics and molasses that are good for silkworm maintenance media (*Tubifex* sp.) in order to meet the need for natural feed containing high protein for fish larvae at BPBAT Mandiangin.

2 Result and Analysis

Based on the results of research on cultivating silk worms (*Tubifex* sp.) for 31 days using different doses in maintenance media at BPBAT Mandiangin. Productivity data, absolute biomass growth and population increase were obtained.

2.1 Productivity

Based on productivity in rearing silk worms for 31 days (Figure 1), it shows that in treatment A the highest productivity value was 3.8 kg/m^2 and followed by treatment B the productivity value was 3.4 kg/m^2. The high value of silkworm productivity in treatment A is due to the dose of probiotics and molasses utilized by silkworms to meet their growth and reproduction needs so that they are more effective in increasing silkworm productivity, in addition to the difference in mud height in the silkworm maintenance media where in treatment A the mud height is 5 cm and in treatment B 4 cm resulting in the distribution of nutrients in the media with a height of 5 cm not being too excessive so as not to cause overfeeding of silkworms. According to Febrianti (2004) in Hidayat et al. (2016) states that providing different doses in the maintenance media will directly affect the organic matter content in the media. The balance of molasses and probiotic doses can increase the availability of organic matter dissolved in the mud accordingly and the composition between probiotics and balanced molasses is what can increase the productivity value for silk worms. The decrease in biomass and productivity of silk worms is caused by the inability of silk worms to absorb the nutrients needed by silk worms to grow and develop too much in the mud so that it cannot be tolerated by silk worms `which ultimately causes death between individuals. In addition to being influenced by the addition of probiotics and molasses, the difference in value is also caused by the difference in mud height in the silkworm maintenance media in treatment A, the mud height is 5 cm and in treatment B 4 cm, it is suspected that this causes the productivity value in treatment B to be low where the low media height with a greater amount of probiotics and molasses can cause nutrients in the maintenance media to be too abundant. The difference in productivity values was caused by the use of molasses and probiotics in treatment A which could be optimized more effectively by the silk worms compared to treatment B with mud media with the addition of 20 mL of molasses and probiotics resulting in the silk worms experiencing an overfeeding condition where the silk worms could not consume nutrients properly. efficient thus affecting the reproduction of silk worms (*Tubifex* sp.).

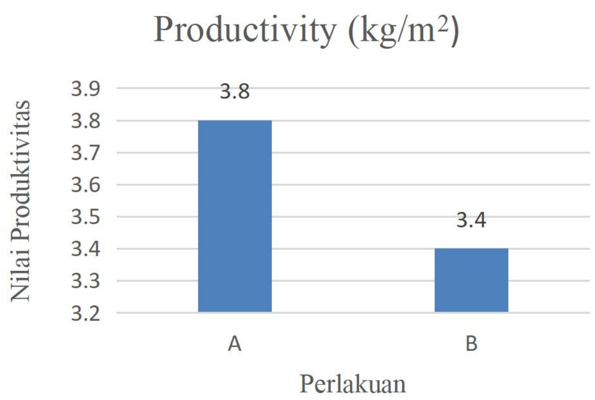

Figure 1 Productivity of silk worms (*Tubifex* sp.) in different probiotic and molasses treatments over 31 days

2.2 Absolute biomass growth

Based on silk worm rearing activities, it can be seen that the highest biomass obtained in treatment A was 164 grams and in treatment B the biomass was obtained at 130 grams (Figure 2). Treatments A and B experienced different amounts of biomass, because the absolute biomass was low in treatment B due to the presence of organisms such as snails, mosquito larvae and maggots which were competitors for silk worms to obtain food in the form of tofu dregs and in treatment A there were no organisms due to the section of tray A it is placed on the top level, while in treatment B it is placed on the bottom level. According to Astuti et al. (2017) cultivating silk worms in the open can give rise to other biota, namely keong and culex which can cause low biomass growth and crop failure.

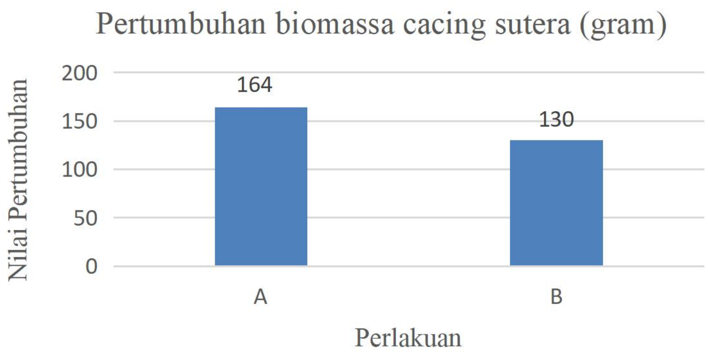

Figure 2 Population growth of silk worms (*Tubifex* sp.) in response to different probiotic and molasses treatments

2.3 Silk worm population

Based on the results of silk worm maintenance activities (Figure 3), harvesting the silk worm population for 31 days of maintenance obtained the highest population growth in treatment A of 138 720 ind/m^2 and treatment B of 122 400 ind/m^2. In treatments A and B, there were different population numbers in each treatment. This is due to food competition which results in the death of worms due to lack of food sources.

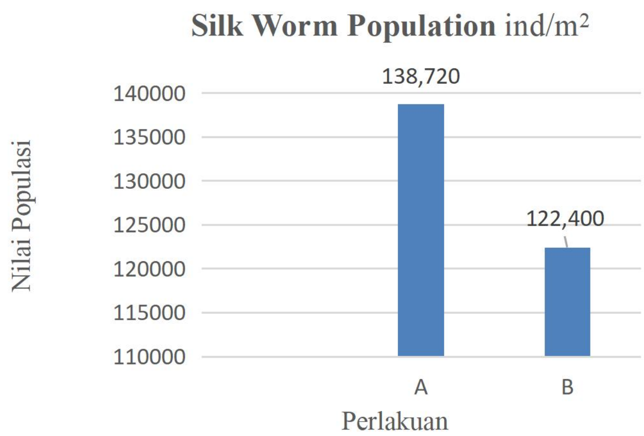

Figure 3 Population graph of silk worms

2.4 Water quality measurement

From the measurement of the water quality results in the A treatment (Figure 4), it can be seen that in this case the temperature is in the range of 25.9~27.4, which is still in good condition to support the growth and development of silk worm cultivation

3 Discussion

The increase in silkworm biomass is also influenced by the use of probiotics and feeding tofu dregs that have been fermented with probiotics. According to Novita et al. (2018), the increase in silk worm biomass was due to the use of probiotics, and by providing tofu dregs as complementary feed. Apart from providing food during the maintenance period for silk worms, you must also pay attention to the water flow so that the water continues to flow and there must be enough oxygen so that the silk worms do not die. According to Ngatung et al. (2017), apart from probiotics and tofu dregs, water circulation also influences the increase in biomass in cultivating silk worms. Water circulation also has a significant effect on the maintenance of silk worms.

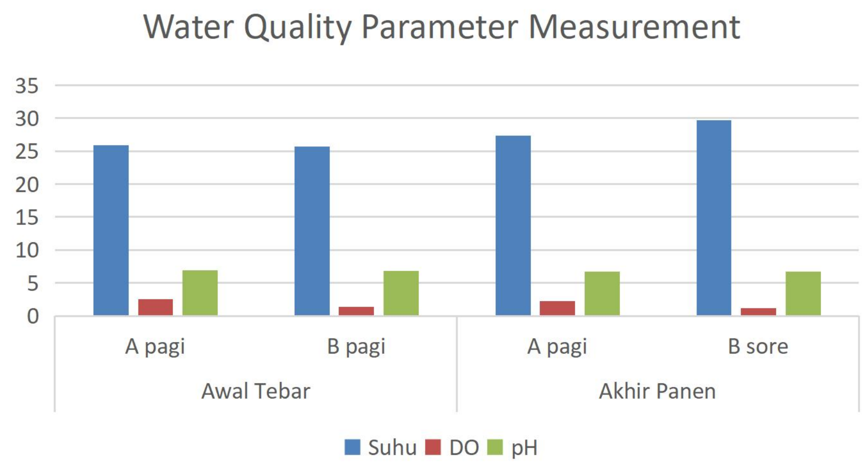

Figure 4 Water quality data used for recirculation of silkworm maintenance media

Febrianti (2004) in Hidayat et al. (2016) stated that giving different doses to the maintenance media will directly affect the organic matter content in the media. In addition to being influenced by the addition of probiotics and molasses, the difference in value is also caused by the difference in mud height in the silk worm maintenance media in treatment A, the mud height is 5 cm and in treatment B 4 cm, due to the low productivity value in treatment B, namely Silk worms do not get enough nutrients to grow and develop, as well as the availability of organic matter in the media that is inadequate until harvest time. This is in accordance with the research of Bintaryanto and Taufikurohman (2013) which states that the decrease in biomass and productivity of silk worms is caused by a lack of nutrients needed by silk worms to grow and develop, resulting in intense food competition, which ultimately causes death between individuals.

According to Mi'raizki et al. (2015) explained that tubifex cultivation in open areas causes Chironomous and other competitors that also eat bacteria, microalgae and detritus, this can affect biomass growth and crop failure. In addition, according to Safrudin et al. (2005) in Mi'raizki et al. (2015) the decrease in the number of silkworms in treatment B is suspected due to the failure of young worms to maintain survival.

Silk Worm Population is the total number of individual silk worms living in a certain area. Silk worms are a species of freshwater worms that are often used as fish feed (Febrita et al., 2015). Increasing the maintenance media with balanced doses can increase the availability of organic materials dissolved in mud for silkworms and can increase productivity values. According to Suryadin et al. (2017) silkworm productivity will increase along with the increase in media thickness until reaching a certain point will increase silkworm productivity, because the composition between mud, probiotics and molasses is balanced. According to research by Putra et al. (2022), variations in the population produced by silkworms in each container are caused by differences in the biological abilities of silkworms that were introduced at the beginning of the study, namely the number of eggs, hatching rate, and individual growth rate. According to Kusumorini (2017), adult individuals began to experience death and young individuals were not yet able to reproduce further, decreasing the number of silkworm individuals.

Research by Mewekani and Tampobulon (2019), shows that silk worms develop well at temperatures of 26.5 °C~29 °C. In treatment B, the temperature was still in optimal conditions, namely 25.7 °C (start of stocking) and the temperature at the time of harvest which was carried out in the afternoon was 29.7 °C. The high fluctuation of water temperature in the afternoon is due to the hot weather during the day. The physiological system of silk worms can be influenced by changes in water temperature. According to Shafrudin et al. (2005)

when water temperature increases, metabolism and oxygen demand also increases, and the toxicity of pollutants also increases, because the life phase of silk worms is around 25 °C~30 °C. According to Syam (2012), a good acidity level for silkworms is between pH 6~7.6. Bacteria that break down organic materials into simpler compounds, which can then be used as food for silkworms. The acidity level value in treatment A and treatment B when silk worms were spread ranged between 6.8 - 6.9 and at harvest time the pH was 6.7. Silk worms have the ability to reproduce at a pH between 6~8 (Syafriadiman and Masril, 2013)

Silkworms have been widely cultivated with various media, including the use of chicken manure and tofu dregs (Sari et al., 2021). According to Suharyadi (2012), silkworm cultivation media can also use tofu dregs because they contain nutrients suitable for the needs of silkworm life. The provision of tofu dregs for silkworm feed aims to meet the needs of silkworms. According to Jewel et al. (2016) silkworms obtain protein from their food, and tofu dregs have a protein content of 21.91% and carbohydrates of 69.41% where the carbohydrate content is used as an energy source for the growth of silkworms.

4 Materials and Methods

Preparation of tools and materials, preparation of media, making silk worm food, distribution of silk worms, and maintenance of silk worms.

Prepare a place for rearing silk worms (*Tubifex* sp.), namely using a 30×25×15 tray with a rectangular shape, with a mud height of 5 cm for treatment A and 4 cm for treatment B. Take 5 kg of mud from the pond using a hoe. The mud taken as a maintenance medium is first crushed using a sieve. The mashed mud media is added with a dose of probiotics (Smart bio fish fisheries). Feed for silk worms is 10 kg of tofu dregs which have been purchased directly at the tofu manufacturing factory. then the tofu dregs are put into an iron vat and fermented using 500 mL probiotics. Then mix evenly, after mixing evenly, cover with plastic packing and cover again with an iron lid so that air doesn't enter, then leave for 24 hours. Give 164 grams of fermented tofu dregs per tray in the morning or afternoon. Before feeding the silk worms so that the water circulation is turned off so that the food is not carried away by the water flow, the tofu dregs are spread directly on the surface of the media and left without recirculation for 10~15 minutes. The next thing to do when harvesting is to prepare 3 trays and fill each tray with clean water, then scoop out the part of the mud containing the silk worms using a filter and 1 bucket is used to place the filtered mud. Next, the silk worms have been harvested and cleaned from mud by taking it using a filter, then rinsing it with water that has been placed in a tray gradually so that the remaining dirt and mud is clean. Next, the clean silk worms are separated into a separate tray filled with water, then the worms are taken and counted. Before counting the worms, they are weighed first to find out the population obtained at harvest. According to Syarifuddin et al. (2022), cultivating silkworms using an apartment system is done by using flowing water recirculation with the aim of supplying DO in the media water.

5 Conclusion

Based on the results of the study of Silkworm Cultivation Productivity (*Tubifex* sp.) in the Tray System with Different Doses in Maintenance Media at BPBAT Mandiangin, it was concluded that the addition of 10 mL of probiotics and molasses to the mud media (Treatment A). provides the highest productivity value, absolute biomass growth and silkworm population when compared to treatment B (probiotics and molasses 20 mL) this is because the use of molasses and probiotics in treatment A can be utilized more effectively by silkworms compared to treatment B which causes silkworms to experience overfeeding conditions so that silkworms cannot consume nutrients efficiently and have an impact on the reproduction of silkworms (*Tubifex* sp.).

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