Utilization of Maggot Black Soldier Fly (BSF) Cultivation for Fish Feed

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ABSTRACT

The use of black soldier fly or maggot black soldier fly (BSF) as a degrading agent for organic waste has begun to be developed to reduce the volume of organic waste. BSF maggot used to degrade organic waste also has a valuable protein source for animal feed to the alternative to conventional feed. Therefore, this study aims to produce a BSF maggot product that can be used as fish feed and analyze its feasibility based on SNI 01-4266-2006 concerning Artificial Feed for Carp (Cyprinus carpio L.) on an intensive aquaculture scale. The results showed that BSF maggot is an alternative feed used as fish because it is rich in water, protein, fat, ash, and fiber content.

Keywords: Maggot Black Soldier Fly (BSF), Fish Feed, Organic Waste

I. INTRODUCTION

Garbage is the most common problem in developing countries such as Indonesia. The production of waste, especially organic waste, continues to increase with people's consumption patterns. It is exacerbated by the fact that Indonesia is the fourth country with the largest population globally (Sari et al., 2018).

People use many alternatives to treat organic waste, such as using incineration and composting techniques. In the incineration technique, waste is burned into gas, but this technique will produce residues and harmful gases. In contrast, the composting process converts organic waste into a stable product, where any residue produced can be used in a new product.

In recent years, the cultivation of Maggot Black Soldier Fly (BSF) has become an alternative for processing organic waste because it has no adverse side effects on the environment. This method is not like the gasification process, which still produces emissions, although the emissions produced are less than the direct combustion model (Falatehan & Sari, 2020). It also does not require a large land area to reduce greenhouse gas emissions, such as biogas installations (Sari et al., 2019). In addition, this method can minimize environmental health problems and public health problems caused for areas that do not have facilities and means of transporting waste to the trash (Sari et al., 2018).

BSF larvae can be an alternative to conventional feed. Feed formulations have been widely used, but the price is relatively high. BSF larvae can be fed with various foods such as kitchen waste, fruits, vegetables, liver, fish waste, urban waste, human waste, and animal waste (Yuwono & Mentari, 2018). Maggot BSF can decompose organic waste containing 60% to 90% water content. In addition, maggot black soldier fly food is high in protein and carbohydrates, suitable for larvae for nutritional needs. Several

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factors influence the nutrient requirements of adult flies, one of which is the fat content stored at the time of pupa. So that when fat stores run out, it will cause flies to die (Makkar et al., 2014).

The availability of quality animal feed is one of the critical success factors in the livestock industry and is the most significant component in business activities (Beski et al., 2015). Protein components have an essential role in an animal feed formula because they are involved in vital metabolisms such as enzymes, hormones, antibodies, etc. BSF larvae can consume a wide variety of foods. The versatility of the diet of BSF larvae makes it an ideal insect for protein production.

Artificial feed results from several raw materials and additives with specific nutritional values can support growth and reproduction. This feed is made through a molding process in the form of granules or pellets that can be adjusted to the size of the carp's mouth; the physical properties of this feed float or sink. The method of making feed pellets is that freshly harvested larvae are mixed with other ingredients such as soybeans, sorghum, corn, and others (Yuwono & Mentari, 2018). This mixture is made to meet the nutritional needs of the animals to be fed.

II. METHODOLOGY

This study used secondary data obtained from the literature of SNI 01-4266-2006 regarding Artificial Feed for Carp (Cyprinus carpio L.) in Intensive Cultivation. In this study, researchers made fish feed from BSF maggots by directly giving BSF maggots mixed with anything as fish feed. Furthermore, after the finished product, the researchers conducted laboratory tests and analysis by comparing SNI 01-4266-2006 with laboratory tests.

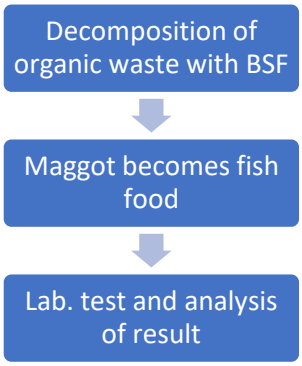

Figure 1. Research Flow of Fish Feed Making

The quality of BSF maggot as fish feed will pass several tests, namely water, protein, fat, and crude fiber content tests. The requirements for the quality of carp feed in intensive aquaculture follow the standard of SNI 01-4266-2006 concerning Artificial Feed for Carp (Cyprinus carpio L.) in Intensive Cultivation. This study will be used as a requirement for broodstock because the fish to be fed using BSF maggots are already brooders. The quality standards used are as follows:

Table 1. Fish Feed Quality Standard

No.	Test Type	Unit	Requirement		
			Seed	Enlargement	Parent
1.	Water content	%	Max 12	Max 12	Max 12
2.	Ash Level	%	Max 13	Max 13	Max 13
3.	Protein Level	%	Min 30	Min 30	Min 30
4.	Fat level	%	Min 5	Min 5	Min 5
5.	Crude Fiber Content	%	Max 6	Max 6	Max 6
6.	Non-Protein Nitrogen	%	Max 20	Max 20	Max 20
8.	Floating Rate	%	Min 80	Min 80	Min 80
9.	Stability in Water	hour	Min 1	Min 1	Min 1
10.	Content of Microbes/ Toxins				
	- Alphatoxin	ppb	< 50	< 50	< 50
	- - Salmonella	Col/ gr	-neg	-neg	-neg
11	Forbidden Antibiotic Content				
	Nitrofuran Ronidazole Dapsone Chloramphenicol Colicin Chlorpromazine Trichlorphone Dimethyldazole Metronidazole Aristolochia spp	µgr/ kg	0	0	0

Source: SNI 01-4266-2006

III. RESULTS AND DISCUSSIONS

Organic waste processing with the help of BSF maggots has a positive impact on the environment and has an economic impact. The accumulated waste can produce methane and cause greenhouse gases (Falatehan & Sari, 2020). In addition to reducing the accumulation of greenhouse gases in the atmosphere that can increase the global average temperature (Sari et al., 2019), BSF maggots can be used and sold as fish feed products.

According to Indarmawan (2014), there is a high content of animal protein in BSF maggots or fly larvae, which is around 30-25%. Therefore, BSF maggot has excellent potential as additional feed for fish rearing. In addition, the presence of anti-fungal and anti-microbial content in maggot, if consumed by fish, the fish will be resistant to diseases caused by bacteria and fungi. Meanwhile, according to Bosch et al. (2014), the protein content in BFS larvae is around 40-50%, and the fat content is approximately 29-32%.

Table 2. Fish Feed Test Results

Parameter	Result	Standard Quality (SNI 01-4266-2006)				Note
		Unit	Quality Standard			
			Seed	Enlargement	Parent	
Water	6,09	%	Max 12	Max 12	Max 12	according to quality standards
Protein	43,91	%	Min 30	Min 25	Min 30	according to quality standards
Fat	33,57	%	Min 5	Min 5	Min 5	according to quality standards
Coarse Fiber	11,97	%	Max 6	Max 8	Max 8	exceed quality standard
Ash	11,35	%	Max 13	Max 13	Max 13	according to quality standards

Source: Laboratorium Test Result

The provision of BSF maggot as fish food was carried out when the maggot had entered the pre-pupa phase. According to Popa, R., and Green, T. (2012) in (Pratiwi 2020), the best stage in using maggot as fish feed is in the pre-pupa phase due to the high protein content of fat, calcium, phosphorus, and calories.

Table 2 shows the results of laboratory tests for water, protein, fat, and ash content values under the quality standard used, namely SNI 01-4266-2006. The value of crude fiber even exceeds the specified quality standard. According to Wantika (2020), the acceleration of food travel in the digestive tract is due to the high fiber content. However, it can cause a decrease in the absorption of nutrients in food in the gastrointestinal tract. Then, when comparing the existing theory and the results of laboratory tests, such as protein and fat levels, the test results follow the theory used.

Figure 2. BSF Maggot Harvesting

Figure 3. *Dried BSF Maggot as Fish Feed*

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IV. CONCLUSION

The conclusion drawn from the study is that the results of laboratory tests on the use of BSF larvae as fish feed showed that the water content, protein, fat, and ash content values were following the quality standard values used. The crude fiber content is relatively high so that the value of the natural fiber content exceeds the quality standard. According to researchers, BSF maggot is an alternative feed used for fish because it is rich in water, protein, fat, ash, and fiber content.

V. ACKNOWLEDGEMENT

This research has been funded by the Ministry of Education, Culture, Research and Technology, Indonesia (PTUPT Scheme), with contract number 309/E4.1/AK.04.PT/2021; 3511/LL3/KR/2021; 126/SPK/LPP-UB/VII/2021 and Universitas Bakrie, with contract number 141/SPK/LPP-UB/VII/2021.

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