



Handling Fruit and Vegetable Waste By Breeding BSF Larvae at the Penebel Village Waste Management Center, Tabanan

Ni Ketut Mardewi¹, Luh Suryati², and Luh Kartini³

¹Animal Husbandry Study Program, Faculty of Agriculture, Warmadewa University. Indonesia

²Food Science and Technology Study Program, Faculty of Agriculture, Warmadewa University. Indonesia

³Agrotechnology Study Program, Faculty of Agriculture, Warmadewa University. Indonesia

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CORRESPONDING AUTHOR

*E-mail: mardewiketut8@gmail.com

ABSTRACT

The KSM Penebel Berlian Waste Management Center is a non-governmental group to manage waste from households and from the traditional market of Penebel Village, which is in the form of organic waste and inorganic waste. In a day about 10 cubic feet of waste enter the KSM Penebel Berlian, 60% of which is organic waste. So far, organic waste is processed into compost, but it takes a long time while the waste is sent every day so that there is more and more organic waste and has not had time to be processed. It was also tried to process organic waste into eco-enzymes but failed because the community did not understand how it was made and the process of hardening the eco-enzyme until it matured took a minimum of three months. The group wants to cultivate maggots intensively in KSM because the raw materials for maggot feed are adequate, can handle the problem of organic waste faster, is odorless, and involve group members. Maggot cultivation results will be used as poultry feed and fish feed, aquaculture waste will be used as organic fertilizer. Maggots are very positive to be developed into an alternative solution to the problem of organic waste without causing odors. Maggot larva of the BSF Fly (Black Shoulder Fly) which has the Latin name *Hermetia illucens* or black soldier fly is a large black fly and is not pathogenic. This cycle takes 40 to 45 days only. Community service activities have been running smoothly. Members of KSM Penebel Berlian have been able to independently produce BSF maggots from vegetable and fruit waste. Thus, the problem of organic waste in Penebel Village is also resolved, does not cause odors, waste does not accumulate, is handled in a shorter time with the concept of zero waste, and produces a product, namely BSF maggots that can be used as fish and poultry feed

1. INTRODUCTION

1.1. Research Background

The KSM Waste Processing Center "**Penebel Berlian**" is a non-governmental group established on August 16, 2019, to manage village waste both from households and from the traditional market of Penebel Village into useful, *zero waste*, and environmentally friendly products. Following the mandate of Bali Governor Regulation Number 47 of 2019 concerning Source-Based Waste Management [1], the establishment of the KSM Penebel Berlian Waste Processing Center, waste from Penebel Village can be handled properly so that it will not contaminate neighboring villages and can produce a product, namely maggots and organic fertilizers. *Berlian* (diamond) are the slogan of the group and stand for a Clean, Beautiful, and Comfortable Environment.

The KSM Penebel Berlian waste processing center stands on an area of approximately 12 acres and its construction is funded by the State Electricity Company (PLN Care) *Corporate Social Responsibility* program assistance fund. It has an office to carry out administration, on the side of the office is a flower garden and ornamental plant land and at the back of the office, there is a waste processing area consisting of a kiln, a waste sorting place, and a waste processing plant equipped with an organic waste chopping machine. In a day about 10 cubic feet of waste enter the KSM Penebel Berlian waste processing center in the form of organic waste and inorganic waste, 60% of which is organic waste in the form of vegetable waste, fruit, restaurant waste, kitchen waste, and ceremonial organic waste. So far, organic waste is processed into compost which is used as fertilizer in flower garden plants and ornamental plants. However, the composting process takes quite a long time to become compost [2] while the waste is sent every day so organic waste is increasing and has not had time to be processed. It was also tried to process organic waste into *eco-*

enzymes but failed because the community did not understand how it was made and the process of hardening the *eco-enzyme* until it matured took a minimum of three months [3].

Small-scale (home-based) BSF maggot cultivation has been tried by the Village Head, but due to his busy schedule and having to collect organic waste for BSF maggot feed, the experiment stopped. The group wants to cultivate maggots on a larger and more intensive scale at the KSM Penebel Berlian waste processing center because the raw materials for maggot feed (market waste) are quite a lot and must be processed immediately so as not to accumulate and cause odors, the results of cultivation in the form of maggots both fresh and dried can be used as a protein source feed for poultry and fish [4], wanting to involve group members in cultivation, maggot waste can be used as organic fertilizer, as well as to decompose the problem of organic waste more quickly.

Maggots are very positive to be developed into an alternative solution to the problem of organic waste without causing odors. Magot BSF is a larva of the BSF Fly (Black Soldier Fly) or black soldier fly, which is a large black fly and is not pathogenic [5]. Larvae are the first of the four life cycles of BSF flies. The life cycle of BSF flies starts from eggs, larvae, pre-pupae, pupae, and adult flies. This cycle takes 40 to 45 days only.

Hermetia illucens is the Latin name of the BSF fly, belonging to the insect type, this fly comes from America and spreads to other subtropics to the tropics including Indonesia and the tropical climate conditions of Indonesia are ideal for the cultivation of BSF flies [6]. This fly is not a pest fly when viewed in terms of human health, it has many advantages, namely environmental improvements, BSF larvae can consume large amounts of organic feed and in a short time where around 15 thousand BSF fly larvae or BSF maggots can consume organic waste of approximately 2 kg within 24 hours to be able to reduce the amount of organic waste which has been a problem in the community [7].

Another benefit of BSF larvae is for poultry and fish fodder is full of nutrients, containing considerable protein around 30 - 45%, 29-32% fat, which is useful for livestock growth, does not smell fishy, is easy to take and store, easily digested by livestock, cheap and easy to cultivate [4].

Penebel village is located in Penebel District, Tabanan Regency. The population of Penebel village as of 2016 was 4,475 people consisting of 2,232 males and 2,243 females with a sex ratio of 99.51%. Most of the people's livelihoods are farmers and ranchers. In Penebel Village, there is a lot of potential for the development of fish farming because water is very abundant, and also a livestock business. Penebel village is also one of the tourist destinations [4]. Penebel Village is located in the middle of Jatiluwih Tourist Attractions, Angsri Hot Springs, Air Panas Penatahan, and Coughau Temple. As one of the tourist destinations, the waste problem will become a barrier and detrimental factor if not managed and handled properly. With the devotion of the community funded by the Research Institute of Warmadewa University, KSM Penebel Berlian hope to have knowledge and skills in dealing with waste problems, especially organic waste by cultivating BSF maggots. The counseling and Training "Cultivation of BSF Maggots with Fruit and Vegetable Waste Media can handle waste problems well and environmentally friendly, as well as producing BSF maggots and organic fertilizers as products that have the opportunity to be marketed. Below are shown pictures and conditions of the KSM Penebel Diamond Waste Treatment Center documented during the first survey (Figure 1).



Figure 1. Situation and Condition of the KSM Penebel Berlian Waste Processing Center at the First Time of Site Survey

2. MATERIALS AND METHOD

The method applied includes coaching, training, mentoring, and structured consultation on various things that are obstacles to providing added value for partners. Methods are one of the tools to achieve goals. Various methods that can be applied in the implementation of community service include interviews, lectures, discussions, demonstrations, and models. Such methods can be implemented separately or implemented in combination according to the capabilities and characteristics of the material being studied. The implementation of PKM (community service) activities is carried out in several stages, namely: (1) Site survey for the implementation of extension activities, cage model placement plans, and cultivation processes (Figure 1); (2) Interviews and questions and answers about the problems faced by partners, as well as planning activities that show steps to solve the problems faced; (3) Partners were given material that had been prepared by the team in the form of leaflets on the cultivation and benefits of maggots, counseling was given on the model and shape of BSF fly cages, nesting sites, egg transfers, maggot feed from fruit and vegetable waste, maggot maintenance, pre-pupae, and pupae.

Problems in the field of cultivation are overcome by providing counseling, handing over equipment assistance to partners to support "Community Empowerment with BSF Maggot Cultivation from Fruit and Vegetable Waste in KSM Penebel Berlian", making cage models, and preparing supporting equipment for cultivation, as well as implementing BSF maggot cultivation training.

Partner participation in the implementation of PKM activities is needed for the smooth process of this activity. Partners are expected to abide by all agreements that have been made. Partners are expected to be disciplined and earnestly follow and carry out all series of activities until all activity plans end. After the PKM activity ends, the partner can continue cultivation activities properly and the business initiated can develop. Mentoring, evaluation, and cooperation will continue even though the PKM program has ended.

3. RESULT AND DISCUSSION

3.1. Implementation of Activities

The implementation of this activity has an impact on increasing the knowledge and skills of group members in handling and utilizing fruit and vegetable waste. Of the 10 group members who were present at the time of the activity, as many as 8 people (80%) had understood and were skilled in maggot cultivation, before the service activity was held, only 2 people (20%) understood but were not very skilled (Figure 2). In the KSM Penebel Berlian, the group can independently use fruit and vegetable waste from market waste as maggot feed so that the waste problem, namely the accumulation of organic waste and causing odors, can be resolved. The waste problem is solved with the concept of *zero waste*. With the use of organic waste as maggot feed, it can be a source of income for groups where groups can sell maggots produced as animal feed (fish and poultry) (Figure 3).

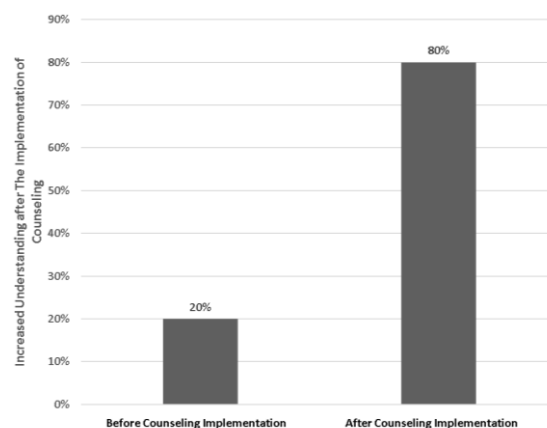


Figure 2. Increased Understanding after The Implementation of Counseling



Figure 3 . Documentation of BSF Maggot Cultivation Activities and Practices at KSM Penebel Berlian

3.2. Achieved output

The outputs achieved in this community service activity are: {a} The PKM team has donated equipment for maggot cultivation and assisted in the manufacture of BSF fly cages so that a good model of BSF fly breeding cages has been produced; (b) Partners have known, understood, and mastered the knowledge and skills of BSF maggot cultivation where partners have succeeded in producing maggots; (c) Partners have been able to handle waste without causing odors and according to the concept of *zero waste* by cultivating BSF maggots.

3.3. Partner Contribution to the implementation of PKM

The Community Partnership Program activities regarding the Cultivation of BSF Maggots from Fruit and Vegetable Waste at the KSM Penebel Berlian of Tabanan, Penebel Village have been running smoothly. The activity in the form of counseling or theoretical studies to provide an understanding of the BSF Maggot Cultivation material from Fruit and Vegetable Waste

which was attended by 10 people from *KSM Penebel Berlian* members, 4 people from Village Apparatus, and 4 community leaders. The activity continued with the direct practice of maggot cultivation. Partners are always accompanied during the cultivation process until the partner succeeds in producing maggots which are then used as animal feed. All partners (100%) participants actively participated in the activity and partners expected continuous assistance in the cultivation of BSF maggots and subsequently in post-harvest.

3.4. Factors that inhibit and support

In the implementation of PKM activities, what is an inhibiting factor is the difficulty of finding a schedule for the implementation of activities in community busyness because many of its activities are usually carried out in villages, so the implementation of the schedule of community service activities is difficult to agree. Supporting Factors are members of KSM Penebel Berlian who are very enthusiastic, active, and enthusiastic to know the technique of cultivating BSF maggots from fruit and vegetable waste until the whole activity ends. The location prepared for the implementation of PKM activities is very supportive and representative.

3.5. Solutions and Follow-ups

The obstacles faced in the implementation of PKM can be overcome by communicating with the group leader and village officials, so counseling and practice can take place smoothly. Furthermore, the PKM team will continue to assist in the cultivation of BSF maggots from vegetable and fruit waste as well as the post-harvest process. The next plan is that the implementation team plans to accompany the group for BSF maggot processing such as processing maggots into dry maggots, maggot flour, processing maggots into pellets as animal feed, packaging, and labeling.

3.6. Strategic Steps for Further Realization

Strategic steps to realize the next plan are to provide counseling and direct practice on appropriate technology for drying and processing BSF maggots into maggot flour and pellets as animal feed.

4. CONCLUSION

Community service activities have been running smoothly. Members of KSM Berlian Penebel have been able to independently produce BSF maggots from vegetable and fruit waste. Thus, the problem of organic waste in Penebel Village is also resolved, does not cause odors, waste does not accumulate, is handled in a shorter time with the concept of *zero waste*, and produces a product, namely BSF maggots that can be used as fish and poultry feed.

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