UTILIZATION OF BLACK SOLDIER FLY'S MAGGOT IN ORGANIC WASTE CONVERTION IN CITEUREUP NORTH CIMAHI

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Abstract. **Background :** Organic waste is waste that comes from the residual living things that are easily biodegradable. Organic waste is the largest composition (60.6%) among other types of waste that are produced every day. Organic waste that is not managed properly can be a big problem, one of which is that it can cause disease and unpleasant odors which are the result of the decomposition of organic waste. Indeed, organic waste can still be utilized optimally so that the amount of organic waste can be minimized and become more valuable. The active role of higher education institutions is needed as a strategic institution that is capable of carrying out system support functions, especially in efforts to spread knowledge, environmental impacts and also in the development of studies on appropriate technology related to processing organic waste in the community.

Methods : Community empowerment activities. The area of RW 12 and RW 04 Citeureup Village, North Cimahi is one of the densely populated communities that actively produces organic waste from household activities and trades food which is carried out every day so that it is worthy of being targeted by partner communities in this activity. One effort that can be applied by the community in the area to process organic waste is bioconversion using black soldier fly larvae (maggot). The maggot has an ability to degrade organic waste so as to increase the economic potential of the organic waste. The knowledge and skills of partner communities regarding the use of maggot need to be improved. The method used is technology transfer through counseling, training and mentoring.

Results : The result of this activity is an increase in the knowledge and skills of partner communities regarding waste bioconversion using BSF larvae. In addition, other additional benefits in the cultivation of BSF larvae are that it can increase the production of organic vegetables obtained from using fertilizers from biodegradable waste maggot (*kasgot*) and the development of organic catfish production that is fed using maggot so that it has an impact on improving family nutrition.

Conclusion : the community's ability in cultivating maggot is expected to continue to be developed so that it can become one of the new jobs for the local community as a supplier of *maggot* whose benefits are very broad for the community.

Keywords: bioconversion; larvae; Maggot black soldier fly; waste; organic

Introduction

Cimahi city government has been able to reduce only 16% of waste production, but that is less than the provisions in accordance with Presidential Regulation (Perpres) Number 97 of 2017 concerning National Policies and Strategies for the Management of Household Waste and Similar Waste and Household Waste, namely 30% reduction. In this provision, it is stated that the percentage of waste that is disposed of to the TPA is a maximum of 70%, while 30% left must be reduced from the source and managed in the district/city area. According to Mochammad Ronny, Head of the Environmental Service (DLH) of Cimahi City, on Monday, February 24, 2020, currently in Cimahi City, the total waste disposal of 270,399 tons/day has been reduced by 16% from the supposed target of 30%. Ronny hopes that the reduced waste in Cimahi City without having to be disposed of in the TPA this year can increase by up to 20%. For this reason, his party continues to campaign for the Zero Waste program.

Based on data from the Cimahi City Environment Agency, the waste heap in 2019 reached 270,399 tons/day generated from various sources. The composition consists of 50.6% organic waste, 8.6% paper, 15.6% plastic, 3.1% metal, 5.3% cloth, 3.0% glass, 1.4% B3RT and other waste 0.5%. Organic waste is the largest portion of waste. So far, the generated waste that is handled is transported and disposed of to the Sarimukti Final Disposal Site (TPAS), West Bandung Regency, while the untreated waste will become a problem in the environment.

Problems that can arise from the presence of waste that is not managed properly in the residential environment can decrease the health status of the surrounding population. The degree of health is one of the important elements in efforts to increase the Human Development Index (HDI) of the Indonesian nation. Meanwhile, health status is not only determined by health services, but what is more dominant is environmental conditions and community behavior. Efforts to change people's behavior in order to support the improvement of health status are carried out through a clean and healthy behavior development program (HPHBS) (WHO, 2011).

PHBS cannot be separated from a healthy environment. A healthy environment can be created by properly processing waste, such as household waste before being disposed of in a landfill, it should be processed by sorting organic and non-organic waste. Organic waste can be minimized and beneficial by converting organic matter into other products that are useful and have added value by utilizing biological processes from microorganisms and enzymes, and also bioconversion by black soldier fly larvae (maggot). (Mentari, 2018).

The active role of higher education institutions is needed as a strategic institution that is capable of carrying out system support functions, especially in efforts to spread knowledge, environmental impacts and also in the development of studies on appropriate technology related to processing organic waste in the community through community empowerment activities (Departemen Kesehatan RI, 2008).

The target of community empowerment is carried out in the Cimahi Utara sub-district, one of the sub-districts in Cimahi City which has a dense population of 142,474 people from the total population in Cimahi City amounting to 442,549 people. The area of RW 12 & RW 04 Citeureup Village, North Cimahi District was used as a partner target considering that the area has a dense population and many street food vendors and restaurants so that it becomes an area with a lot of organic waste production (BSN, 2004).

The continuous production of organic waste in this partner area is a risk factor for environmental pollution which has an impact on the health of the residents around the waste disposal area. Control of these risk factors has not been optimal due to several things, including: lack of knowledge and skills of partners regarding waste management; lack of skills and confidence in carrying out counseling; and, the technical guidance obtained from the local community development officer is not optimal. With this condition, the community does not benefit from the presence of Binmas officers, especially in terms of waste processing. Various risk factors will not be monitored and in the end the residents become more at risk of experiencing various diseases (BPTP, 2016).

The solution that can be offered by the author in improving the condition of partners is to work with two partners, namely RW 12 as partner-1 and RW 04 as partner-2. During the implementation of the activity, all parties were asked to participate in jointly seeking the procurement of tools and materials for cultivating maggot. The community empowerment team also applies an extension model in solving problems in Partner-1 and Partner-2 by holding special training activities aimed at providing sufficient knowledge for cadres regarding the procurement of tools and materials for cultivating maggot and how to carry out tasks in each partner. In addition, the

community empowerment team assisted partner-1 and partner-2 in processing organic waste and cultivating BSF larvae.

This community empowerment activity has aims of producing human resources form partner communities in order to know and have skill about the use of BSF maggot in bioconversion of household organic waste; 2) increase the knowledge of partner communities about the use of BSF Maggot larvae in the bioconversion of household organic waste; 3) make the community skilled in the bioconversion technology of household organic waste using BSF larvae through training; 4) increase new knowledge and skills for the community regarding the use of BSF maggot as fish/livestock/poultry feed; 5) improve the knowledge and skills of partner communities in maintaining BSF maggot; 6) improve the knowledge and skills of partner communities in the use of *kasgot* as organic fertilizer; 7) optimizing cooperation between partners as an effort to help the government overcome the problem by organic -based organic waste.

Methods

This community empowerment activity was done by counseling, training and monitoring and evaluation methods. The preparation of this activity includes preparing pre-test and post-test questions in the Google form media to measure the initial and final knowledge of partner communities regarding BSF maggot and organic waste. Extension materials sourced from reliable literature with substances that are adjusted to the achievement targets and objectives of the extension are arranged to be delivered using interactive exposure and discussion methods through online media, namely the Zoom Meeting application. In addition to the two things above, the empowerment team also coordinates the implementation of various activities with Partners-1 and Partners-2 by preparing the procurement of equipment and materials needed by partners in cultivating Maggot BSF. Monitoring was carried out by showing the presence of maggot cage on both partners according to the BSF maggot cage standard. The evaluation of the extension was carried out by simulating the method of making and processing waste using maggot BSF by the two partners and measuring the increase in the knowledge of paticipants was measured by a set of post-test questions.

Results and Discussion

Community empowerment activities consist of conducting counseling, training, monitoring and evaluating of BSF larvae (maggot) breeding. Before giving training, all the participant from both partners were allowed a pre-test to measure their initial knowledge before giving a counseling and training.

Both of partners were invited to join an online meeting as the form of socialization and online demonstrations by using the Zoom Meeting application to minimize the spread of Covid-19 from community associations according to government advice at the time.

Figure 1. Counseling was done by the team of community empowerment about the BSF larvae (maggot) utilization and cultivation

After receiving learning materials from team by online meeting (picture 1), each partner who are represented by the Chair of RW 12 and Chair of RW 04 received handbooks (Picture 2) containing guidelines for the cultivation of BSF larvae eggs. In addition, the two partners also received 10 grams of BSF eggs and the equipment needed for the cultivation of the *maggot*. With sufficient preparation and guidance from the handbook, the two partners were asked to carry out independently the technically practice of cultivating BSF eggs under the guidance of the head of RW12 and RW 04. Virtual assistance will be held by the community empowerment team through Whatsapp chat and Video Calls.

Figure 2. Handbook of BSF larvae (*maggot*) and organic waste

As a form of monitoring and evaluation, the community empowerment team has given questionnaires twice to all partners involved in this activity with a total of 13 participants. The first questionnaire was in the form of pretest questions given before the counseling and training was carried out, and the average score was 57.4.

Furthermore, the second questionnaire was given as post-test questions given after the partners completed this activity training with an average score of 81.1. Based on the average value, there was an increase in knowledge about the cultivation and utilization of BSF Maggot larvae by 41%. The measurement of initial and final knowledge is carried out as a step for monitoring and evaluating partner knowledge which is presented in the following graph (Figure 3).

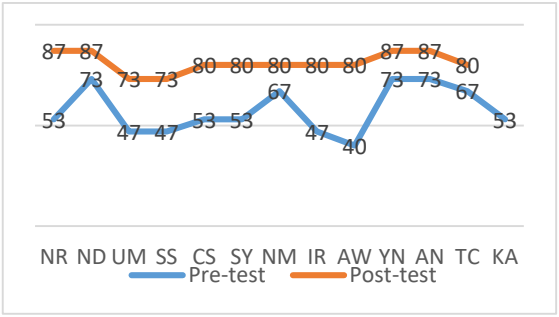

Figure 3. Participants' knowledge about BSF larvae (*maggot*) utilization and cultivation improved after given conseling and training

In addition to the knowledge aspect, the partner's skill aspect was also assessed by the community empowerment team. Before this service activity was carried out, the partner community admitted that they had never received training related to BSF *maggot* breeding. Based on the monitoring and evaluation of skills aspects, the Bandung Ministry of Health Poltekkes empowerment team has provided a very good assessment of the success of the partner community in making standard cages for independent breeding of BSF Maggots and the practice of breeding eggs into BSF Maggots carried out by partner communities produces more than 70% larvae out of 10 grams of previously given BSF eggs and still growing. Figure 4 shows the success of improving the skills of partner communities in making cages and hatching the BSF eggs become larvae.

Figure 4. Aspects of partner skills assessment: (a) the ability of partners to explain how to cultivate BSF maggot and its benefits; (b) manufacture of larval feed; (c) making standard cages for breeding eggs into BSF maggots; (d) periodic observation of maggot development; (e) highly active BSF maggots after hatching from their eggs.

From the two partners have succeeded in making media for incubating BSF eggs in spite of in different time of incubation, in approximately 1 week (7-8 days). Then, the larvae were grown until approximately 10-14 days became enlarge and turned to be black. The different time of incubation is possible because the method of making bran media for hatching larvae between partner-1 and partner-2 was different in humidity because of different portion of mixing water and bran. The other possible reason that caused this difference was partner-1 and partner-2 stored the BSF eggs on media using a sieve which made of different material of wire (Dorman et al, 2017).

Currently, the larvae have grown a lot, but a new problem that arises is the lack of organic waste as nutrition for the larvae. This is due to the difficulty in collecting organic waste because most of the community does not separate organic and non-organic waste so that all waste is put together for disposal. People on community feel difficult to collect more organic waste at every house because the accumulation of waste can cause bad smell, thus disrupting the mobility of the surrounding community so that a special area for collecting organic waste is needed which is far from residential areas. In addition, education regarding waste separation to all residents should be improved. In addition, the stimulation of residents to collect organic waste separately from other types of waste can be done by optimizing cooperation between partners as the efforts were wished to help the government in overcoming the organic waste problem.

Organic waste is nutrient that BSF larvae need to live. BSF is very active in feeding throughout the larval stage which is about 18 days before metamorphosing into pupae. The process of larvae eating organic waste is referred to as the biodegradation process of organic waste and produces decomposed waste from the degradation of Maggot which is often called cassava. The use of cassava can be a source of organic fertilizer, as well as larval cultivation for fish/livestock/poultry feed (Alfarez, 2012; Yuwono, 2018).

It is hoped that further guidance regarding the maggot cultivation can be carried out continuously by establishing collaboration with maggot producers so that it can motivate and mobilize the community to open up job opportunities for the

community and young people who do not have a steady income.

Conclusions

1. This community empowerment activity has produced 13 human resources form two partner communities who know and have skill about the use of BSF maggot in bioconversion of household organic waste.
2. The knowledge of partner communities about the cultivation and utilization of BSF maggot was increased in average of 41%.
3. The partner communities have skills in organic waste bioconversion technology using maggot.
4. The knowledge and skill of partner communities regarding the use of maggot as fish/ livestock/ poultry feed are increasing.
5. The knowledge and skills of partner communities in cultivating the BSF maggot are increasing.
6. The knowledge of partners about the use of *kasgot* as organic fertilizer are increasing.
7. Optimizing cooperation between these two partners can be done in utilizing the BSF maggot in organic waste convertion.
8. It is needed a receptacle that is able to coordinate the cultivation of maggot.
9. There is a need for socialization from maggot producers to the community.
10. Cooperation between the wider community is needed on maggot cultivation and marketing.

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