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Effectiveness of Black Soldier Fly Larvae (Hermetia Illucens) as a Decomposer of Organic Waste in Food Court Sabilurrasyad Gorontalo State University

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ABSTRACT

Organic waste that is not managed quickly will create bad odors and cause disease. One way to reduce the weight of organic waste is to use black soldier fly larvae. The purpose of the study was to determine the effectiveness of black soldier fly larvae (Hermetia illucens) as a decomposer of organic waste at the Sabilurrasyad Food Court, Gorontalo State University. The type of research used is pre-experiment with a One-Shot Case Study design. The samples were vegetable organic waste, chicken waste and fish residue weighing 2500 grams each, as well as 250 grams of black soldier fly larval samples for each type of feed obtained using the purposive sampling technique. Data analysis used the Kruskal Wallis test with = 5% (0.05). The results showed that ∝the larval growth rate of vegetable type was 10.58 grams, chicken residue -4 grams, leftover fish -4.3 grams and substrate consumption ability of vegetable type 66.60%, chicken residue 9.48%, fish residue 16.64% with the same data analysis results, namely p-value = 0.368 > 0.05. In conclusion, there was no significant difference in larval growth rate and substrate consumption ability for the type of vegetable waste, chicken leftovers and fish leftovers. It is recommended to carry out variations and combinations of feed as well as temperature and humidity measurements for more optimal growth of black soldier fly larvae and more effectively decomposing organic waste.

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INTRODUCTION

Waste is an environmental problem that continues to be a concern of the world because the pollution caused has a global impact with a long duration (Kibria et al., 2023). The issue of global waste is the background of the increasing human population in the world. Various increasingly diverse community activities have led to an increase in the amount of waste (Maksum & Nurfadillah, 2024).

The high production of waste by the community is a difficult cause to solve because in Indonesia it is still a separate case of waste problems. Based on data from the National Waste Management Information System (SIPSN) of the Ministry of Environment and Forestry in 2023, waste production by 367 districts/cities throughout Indonesia was obtained at ± 38.3 million tons/year, 48% waste handling, 61.63% managed waste, 38.37% unmanaged waste, and the highest percentage of waste is known to be organic waste, namely food waste (41%). One type of waste that results in the generation of landfills (TPA) and its improper management is organic waste (Ministry of Environment and Forestry, 2023).

Organic waste, if not handled properly, can be a source of pollution that produces leachate liquid waste that can pollute groundwater, and produce methane gas, pollute the air that causes global warming and causes unpleasant odors. In Indonesia itself, there is a problem of waste management, so there is a need for cooperation between the community and the government to create a clean and comfortable environment (Auliani et al., 2021).

Based on data from the national waste management information system of the Ministry of Environment and Forestry in 2023, the waste produced in Gorontalo Province is 150 thousand tons with the highest composition of waste, namely organic food waste with a percentage of 29.04% (Ministry of Environment and Forestry, 2023). Food waste is the result of household waste such as kitchen waste and from food processing plants. Some examples of household waste are rice, vegetables, nuts, tubers, and fruits. If the waste is not processed properly, it will cause environmental pollution and health problems in the local community (Mabruroh et al., 2022).

Organic waste that is not managed quickly will create bad odors and cause disease. However, researchers have found a way to reduce the weight of organic waste by 85% by using black soldier fly larvae. This can accelerate the anaerobic decay of organic waste with the presence of black soldier fly larvae (Syofyan et al, 2022). The species of black soldier fly is different, because it is not like flies in general. Fly species that are in frequent contact with humans are one of the pests and can transmit various diseases (Maksum et al, 2024), but not for black army flies. This is because black soldier flies are not interested in perching on food because adult flies do not eat due to the absence of mouths and digestive organs (Amrul et al., 2022).

According to Mabruroh's research et al (2022), black soldier fly larvae can contribute 56% to the decomposition of organic waste. Black soldier fly larvae are able to degrade organic waste by up to 80% (Paradise) et al., 2021). The use of black soldier fly larvae as a natural decomposer can produce larvae as animal feed, liquids resulting from larval activity as liquid fertilizer, and dry organic waste as fertilizer. This makes the cultivation of black soldier fly larvae better than composting techniques because the process is faster and requires organic waste every day (Andriani & Pratama, 2024).

Based on research Khaer et al (2022), to minimize the amount of waste generation, utilizing black soldier fly larvae (Hermetia illucens) which has a relatively fast rate in decomposition waste into compost compared to ordinary composting methods and meets the requirements of compost quality. In addition, from the research Daughter et al (2023) that BSF larvae (Black Soldier Fly) can convert organic waste into objects that have economic value.

Based on the results of observations at the Sabilurrasyad Food Court at Gorontalo State University, the most organic waste produced is food waste, including chicken leftovers, fish leftovers, and vegetables. In addition, the waste produced from the Sabilurrasyad Food Court is simply thrown away without any prior processing or sorting. The existing waste is only disposed of in the surrounding garbage cans and even though 2 types of landfills have been provided, namely organic and inorganic, it is still found that these two types of waste are mixed in the same place.

Based on the background description, it is necessary to research on 'The Effectiveness of Black Army Fly Larvae (Hermetia illucens) as a Decomposer of Organic Waste at the Sabilurrasyad Food Court, Gorontalo State University'.

RESEARCH METHODS

Research Location and Time

The location of the research was located at the Sabilurrasyad Food Court, Gorontalo State University. As for the treatment location, it is at the Laboratory of the Department of Public Health, Gorontalo State University.

Research Design

The type of research used is pre-experiment with a One-Shot Case Study design.

Population and Sample

The population in this study is all organic waste in the Sabilurrasyad Food Court, Gorontalo State University as well as all black soldier fly larvae that are in the growth phase. The samples were vegetable organic waste, chicken waste and fish residue weighing 2500 grams each, as well as 250 grams of black soldier fly larval samples for each type of feed obtained using the purposive sampling technique.

RESULTS

Univariate Analysis Results

Table 1 Weight of black soldier fly larvae after decomposing organic waste

Types of Garbage	Initial Weight of Larvae (grams)	Final Weight of Larvae (grams)
Vegetables	250	377
Leftover Chicken	250	202
Fish Residue	250	198

Source : Primary Data, 2025

Based on table 1, the results were obtained after 12 days of decomposing organic waste such as vegetables, chicken leftovers, and fish residues, black soldier fly larvae from 250 grams increased in weight to 377 grams. In contrast to the rest of the chicken and fish from 250 grams, the remaining chicken becomes 202 grams and the rest of the fish becomes 198 grams.

After obtaining the results from table 1, the values of larval growth rate in the types of vegetable waste, chicken leftovers, and fish residues are as follows.

Table 2 Differences in Larval Growth Rate in Types of Vegetable Waste, Chicken Leftovers, and Fish Residues

Types of Garbage	*Larval Growth Rate*
Vegetables	10,58 grams
Leftover Chicken	-4 grams
Fish Residue	-4.3 grams

Source : Primary Data, 2025

Based on table 2, it was found that the larval growth rate in the type of vegetable waste was 10.58 grams. Meanwhile, in larval growth rates, the leftover chicken type is -4 grams and the rest of the fish is -4.3 grams.

Table 3. Weight of Organic Waste after Deciphering by Black Soldier Fly Larvae

Types of Garbage	Initial Weight of Organic Waste (grams)	inal Weight of Organic Waste (grams)
Vegetables	2500	835
Leftover Chicken	2500	2263
Fish Residue	2500	2084

Source : Primary Data, 2025

Based on table 3, after 12 days of vegetable organic waste, chicken residue and fish residue decomposed by black soldier fly larvae, it was obtained that the yield of vegetable organic waste was reduced from 2500 grams to 835 grams. Chicken and fish residue have also been reduced from 2500 grams of chicken residue to 2263 grams and 2500 grams of fish residue to 2084 grams.

After obtaining the results from table 3.3, the value of substrate consumption in the types of vegetable waste, chicken leftovers, and fish residues is as follows.

Table 4 Differences in Substrate Consumption Ability in Types of Vegetable Waste, Chicken Leftovers, and Fish Residues

Types of Garbage	*Substrate Consumption*
Vegetables	66,60%
Leftover Chicken	9,48%
Fish Residue	16,64%

Source : Primary Data, 2025

Based on table 4, it was found that the higher percentage of substrate consumption was in the type of vegetables with 66.60%, then in the type of fish residue 16.64% and the last in the type of chicken leftovers which was 9.48%.

Bivariate Analysis Results

Table 5 Results of Normality Test Analysis of Larval Growth Rate and Substrate Consumption Data

Parameters	*p-value*
Larval Growth Rate	0,034
Substrate Consumption	0,220

Source : Primary Data, 2025

Based on table 3.5 of the results of the data normality test using the Shapiro-Wilk test on larval growth rate, p-value = 0.034 < 0.05 was obtained, which means that the data was abnormally distributed, sed; The substrate consumption obtained p-value = 0.220 > 0.05 which means that the data is normally distributed.

Table 6 Results of Analysis of Larval Growth Rate and Substrate Consumption Data Homogeneity Test

Parameters	p-value
Larval Growth Rate	0,016
Substrate Consumption	0,019

Source : Primary Data, 2025

Based on table 6 on the results of the data homogeneity test using Levense's Test of Equality Error Variances test on larval growth rate , p-value = 0.016 < 0.05 was obtained which means that the data was not homogeneous, while the substrate consumption of distributed data was also inhomogeneous with the results obtained p-value = 0.019 < 0.05.

Differences in larval growth rate of black soldier flies to types of vegetable waste, chicken waste and fish residue

After the data normality and homogeneity test was carried out, normal and inhomogeneous data results were obtained, then a non-parametric Kruskal Wallis test was carried out.

Table 7 Results of the Kruskal Wallis Larval Growth Rate Test

Larval Growth Rate	***p-value***
Vegetables	0,368
Leftover Chicken	
Fish Residue	

Source : Primary Data, 2025

Based on table 7, the results of the Kruskal Wallis test on larval growth rate after black soldier fly larvae decompose organic waste in vegetable types, chicken leftovers, and fish residues are not significant. This was obtained from the results of the analysis, namely the larval growth rate with a p-value of 0.368 > 0.05 which means that there is no significant difference in vegetable waste, chicken leftovers and fish leftovers.

Differences in the substrate consumption ability of black army flies to types of vegetable waste, chicken leftovers and fish residues

After the data normality and homogeneity test was carried out, abnormal and inhomogeneous data results were obtained, then a non-parametric test was carried out.

Table 8 Kruskal Wallis Substrate Consumption Test Results

Substrate Consumption	***p-value***
Vegetables	0,368
Leftover Chicken	
Fish Residue	

Source : Primary Data, 2025

Based on table 8, the results of the Kruskal Wallis test to see if there is a significant difference in substrate consumption ability after organic waste on the type of vegetables, chicken leftovers, and fish residues described in black soldier fly larvae is the absence of significant differences. This was obtained from the results of the analysis, namely substrate consumption with a p-value of 0.368 > 0.05 which means that there is no significant difference in vegetable waste, chicken leftovers and fish leftovers.

DISCUSSION

Differences in Larval Growth Rate of Black Army Fly Larvae Against Types of Vegetable Waste, Chicken Leftovers, and Fish Residues

Based on table 7 of the three types of organic waste conducted by the study, a statistical test using the Kruskal Wallis test was obtained with a p-value of 0.368 > 0.05, which means that there is no significant difference in larval growth rate on the types of vegetable waste, chicken waste and fish waste. This happens because the results obtained in larval growth rate The type of chicken leftovers, namely -4 grams and the rest of the fish -4.3 grams, did not experience growth but a reduction because some of the larvae that were researched on the rest of the chickens and the rest of the fish died. Black soldier fly larvae will die if they are less able to adapt or experience stress after removal from the hatchery (Muhayyat et al., 2016). Larval mortality also occurred in the study Amri (2021) where in treatment A using vegetable waste experienced mortality of 6% and in treatment B using animal protein waste experienced mortality of 18%. Likewise in research Saragi (2015) That the deaths that occurred in his study reached 50% caused by the incompatibility of fish offal feed given to black soldier fly larvae.

Based on the results of the univariate analysis, obtained in table 4.2 from the three types of vegetable waste, chicken waste and fish waste, larval growth rate The type of vegetable experienced a growth of 10.58 grams. This is because the feed medium greatly affects the growth of black soldier fly larvae that contain nutrients and are needed by the larvae. The nutrients that larvae carry in their bodies affect how fast they grow, especially in terms of weight. If the nutrients in the food do not match the nutritional needs of the larvae, the larvae will grow slowly. (Minggawati et al., 2019). The development and growth of black soldier fly larvae can be seen through changes in the body size of the larvae. Changes in body size with two indicators, namely; increase in body length and weight. The more nutrients are fulfilled as the life needs of black soldier fly larvae, the more optimal their growth will be. Larvae that feed on quality substrate will accelerate their growth and development due to the presence of sufficient nutrients (Mangunwardoyo et al., 2011).

According to research Tschirner & Simon (2015) reveals that the nutrient component and the mixed ratio of the given substrate can affect the production characteristics of black soldier fly larvae. Substrates that have low nutrient components can produce low production of black soldier fly larvae due to limited nutritional components such as small individual weight, short larval size and low viability (Masir et al., 2020). In addition, from the research Umbrella (2015), the results of statistical tests were obtained that the type of food had a significant effect on the larvae body weight gain with a value of $p = 0.00$ (< 0.1).

Similar research is found in the results of the study Yuliana et al (2024) Where the results of the statistical test were obtained that there was no difference in the growth of black army fly larvae to the type of feed of vegetables, fruits, and leftover rice with $P = 0.610$ (> 0.05) because there was no large enough difference to be tested. Other research was also obtained in Lindawati's research et al (2023) where there was no significant difference in the weight of black soldier fly larvae as a decomposer of vegetables, fruits, and food waste with a value of p = 1,000 (> 0.05).

Larvae in the waste type of chicken and fish residue also die because at the place where the treatment is carried out, under the medium it feels hot to the touch. This is due to the activity of black soldier fly larvae in producing heat through their metabolism (Chia et al., 2018). According to Barrett et al (2023), the increase in substrate temperature is caused by the decomposition process carried out by the larvae actively, resulting in heat up to 42°C due to an increase in metabolic processes in the larvae's body, especially when the larvae become more numerous. On the other hand, the increase in temperature is caused by aerobic fermentation activity by decomposing microorganisms present in the substrate. In general, black soldier fly larvae can live and grow in substrates with varying moisture content, but in general, the maximum growth and survival of black soldier fly larvae can be increased in the range of substrate moisture content of 60-80%.

In research Aditama (2023) It shows that to produce the best amount of weight black army fly larvae are produced on 100% organic vegetable waste. The growth of black soldier fly larvae is influenced by the growing medium used as well as environmental factors.

Differences in the Substrate Consumption Ability of Black Army Flies Larvae Against Types of Vegetable Waste, Chicken Leftovers, and Fish Residues

Based on table 7 of the three types of organic waste conducted by the study, a statistical test using the Kruskal Wallis test was obtained with a p-value of $0.368 > 0.05$ which means that there is no significant difference in ability Substrate Consumption on the types of vegetable waste, chicken waste and fish waste. Based on table 4.4 capabilities Subtrate consumption by black soldier fly larvae a higher percentage was in vegetable type 66.60%, then fish residue 16.64% and finally in chicken residue 9.48%. Although the results of univariate analysis showed a difference in the ability to subtraté consumption, However, the statistical results showed no significant difference. This is because the substrate of chicken and fish remains has a lower moisture content than vegetables. So that it causes the larvae of black army flies to be uncomfortable and die. Black soldier fly larvae prefer organic waste that contains enough water and is slightly wet compared to having no water content which results in black soldier fly larvae having difficulty decomposing (Kofsoh, 2023).

In addition, the reduction of waste in chicken and fish residue does not indicate that there is a growth in the larval growth rate of chicken residues and fish residues, where the difference in the type of waste also does not affect the growth of larvae. As in the results of the research of Yuliana et al., (2024), namely a significance value of 0.081 (> 0.05) which shows that the difference in feed type does not affect the growth of black soldier fly larvae. This is because the weight of black soldier fly larvae in vegetable waste has changed, but in the treatment of fruit and rice waste, leftover masi looks the same because of the lack of moisture.

The results of the percentage of ability Substrate Consumption In vegetables it is higher because when it is treated by pounding vegetable waste contains higher water. So that the texture of vegetables is softer than that of leftover chicken and leftover fish which have a rough texture and are not moist. According to Liu et al (2023), the substrate used should be sufficiently moist with a water content of between 20-70% depending on the substrate used.

Based on the results of the study Andari & Nurdiana (2022), showing that the highest rate of decline in the degradation process was found in the type of vegetable waste media with the medium at the end of the process reaching < 100 grams. This indicates that the decline that occurred reached > 50%. The effectiveness of degradation in this vegetable medium is indicated by the suitability of nutrient components for the growth of black soldier fly larvae. The degradation process will make it easier for the larvae because the type of vegetable is easy to decay.

Things that affect the production process of black army fly larvae are the conditions of the media, environment, cultivation, and nutritional content of the larval growth media (Stuart & Scott, 2019). Although black soldier fly larvae are a type of animal that has a fairly high tolerance to their environment, the media used can be adjusted to their natural habitat so that the decomposer process can run optimally and the growth of black soldier fly larvae is also better.

CONCLUSION

In the results of the univariate analysis, the larval growth rate of vegetable waste was 10.58 grams, chicken residue -4 grams, and fish residue -4.3 grams with the result of a statistical test of p = 0.368 (> 0.05) which means that there was no significant difference in the larval growth rate of vegetable type, chicken residue and fish residue.

Of the three types of organic waste that were researched on the ability of subtrate consumption by black army fly larvae, a higher percentage was in vegetables 66.60%, then fish residues 16.64% and finally in chicken residues 9.48%. However, the results of the statistical test carried out obtained the result p = 0.368 (> 0.05) which means that there is no significant difference in the substrate consumption ability of vegetables, chicken leftovers and fish leftovers.

SUGGESTION

To the next researcher, to develop this research by adding variations or combining the types of feed that will be given. In addition, temperature and humidity measurements are also needed to control environmental conditions at the feed site so that the growth of black soldier fly larvae is optimal and can be more effective in decomposing organic waste.

To the University as well as the Food Court Sabilurrasyad of Gorontalo State University to be able to consider black soldier fly larvae as decomposers of organic waste at Gorontalo State University by providing further education to the cleaning service related to waste management or collaborating with outside parties if the management cannot be done on campus.

REFERENCES

Aditama, Y., Imanudin, O., & Widianingrum, D. (2023). Utilization of Organic Vegetable Waste and Laying Hen Fecal Waste as Media in Maggot Cultivation (Hermetia illucens). Tropical Livestock Science Journal, 2(1), 49–56.

Agustinus, F., & Minggawati, I. (2019). The Effect of the Utilization of Banana Stems (Musa paradisiaca) with Different Compositions to Grow Maggot (Hermetia illucens). Journal of Tropical Animal Sciences, 8(1), 9–12.

Amri, N. N. (2021). Effect of Feed Type on Larval Mortality of Black Soldier Fly (Hermetia illucens L.). (Thesis). Syarif Hidayatullah State Islamic University, Jakarta.

Amrul, N. F., Ahmad, I. K., Ezlin, N., Basri, A., Suja, F., Ain, N., Jalil, A., & Azman, N. A. (2022). A Review of Organic Waste Treatment Using Black Soldier Fly (Hermetia illucens). Sustainability, 1–15.

Andari, G., & Nurdiana, R. (2022). Effectiveness of Organic Waste Degradation Using Black Soldier Fly-Hermetia Larvae. Journal of Environmental Science, 16(1), 51–58.

Auliani, R., Elsaday, B., Apsari, D. A., & Nolia, H. (2021). Study on Bioconversion Management of Organic Waste through Black Soldier Fly Maggot Cultivation (Case Study: PKPS Medan). Serambi Engineering Journal, VI(4), 2423–2429.

Barrett, M., Chia, S. Y., Fischer, B., & Tomberlin, J. K. (2023). Welfare considerations for farming black soldier flies, Hermetia illucens (Diptera: Stratiomyidae): a model for the insects as food and feed industry. Journal of Insects as Food and Feed, 9(2), 119–148.

Chia, S. Y., Mbi, C., Id, T., Khamis, F. M., Mohamed, A., Salifu, D., Id, S. S., Fiaboe, K. K. M., Niassy, S., Loon, J. J. A. Van, Id, M. D., & Ekesi, S. (2018). Threshold temperatures and thermal requirements of black soldier fly Hermetia illucens : Implications for mass production. Journal PLoS ONE, 13(11), 1–26.

Firdausy, M. A., Mizwar, A., Firmansyah, M., & Fazriansyah, M. (2021). Utilization of Black Soldier Fly

Larvae (Hermetia illucens) as Organic Waste Reduction with Variations in Waste Type and Feeding Frequency Utilizationxof Black Soldier Fly Larvae (Hermetia illucens) As Organic Waste Reduction Withxvariations In Waste Type. Journal of Environmental Engineering, 7(2), 120–130.

Hakim, A. R., Prasetya, A., & Petrus, H. T. B. M. (2017). Bait Rate Study on the Bioconversion Process of Tuna Processing Waste Using Hermetia illucens Larvae. Journal of Postharvest and Biotechnology of Marine and Fisheries, 12(2), 179–192.

Jucker, C., Lupi, D., Moore, C. D., Leonardi, M. G., & Savoldelli, S. (2020). Recapture of nutrients from insect farm waste: Bioconversion with Hermetia illucens (L.) (Diptera: Stratiomyidae). Sustainability (Switzerland), 12(1), 1–14.

Ministry of Environment and Forestry. (2023). Data on Waste Processing and RTH. https://sipsn.menlhk.go.id/sipsn/public/data/timbulan

Khaer, A, Budirman, Andini, M. (2022). The Effectiveness of the Utilization of Black Army Fly Larvae (Hermetia llucens) in Processing Household Waste into Compost. Journal of Health Media, Makassar State Polytechnic, 57(1), 11–21.

Kibria, G., Imtiaz, N., Rafat, M., Huy, S., Nguyen, Q., & Mourshed, M. (2023). Plastic Waste : Challenges and Opportunities to Mitigate Pollution and Effective Management. In International Journal of Environmental Research, 17(1), 1-37.

Kofsoh, R. M. K. (2023). Effectiveness of organic waste management with black soldier fly larvae/Rakhel Maulidinatul Kofsoh. Journal of Sport Science and Health, 6(9), 955–967.

Lindawati, L., Gameli, C. R., Wijayantono, W., Marza, R. F., & Afridon, A. (2023). The Effectiveness of Black Soldier Fly Maggot as a Decomposer of Vegetable Waste, Fruit Waste, and Food Waste in 2023. Journal of Health Research and Development Media, 33(1), 33–42.

Liu, Z., Morel, P. C. H., & Minor, M. A. (2023). Substrate and moisture content effects on pupation of the black soldier fly (Diptera: Stratiomyidae). Journal of Insects as Food and Feed, 9(4), 415–426.

Mabruroh, M., Praswati, A. N., Sina, H. K., & Pangaribowo, D. M. (2022). Pengolahan Sampah Organik Melalui Budidaya Maggot Bsf Organic Waste Processing Through Bsf Maggot Cultivation. EMPATI Journal (Community Education, Service and Devotion), 3(1), 34–37.

Maksum, T. S., & Nurfadillah, A. R. (2024). Efforts to realize a Zero Waste Tourism Village through Household Waste Management Training in the Bajo Coastal Area. Journal of Pharmacy Community Service: Pharmacare Society, 3(2), 39–47.

Maksum, T. S., Tomia, A., Nurfadillah, A. R. (2024). Entomology and Disease Vector Control (First). Tahta Media Group.

Mangunwardoyo, W., Aulia, A., & Hem, S. (2011). The Use of Bioconverted Palm Core Meal as a Growth Substrate for Hermetia illucens L (Maggot) Larvae. Biota : Scientific Journal of Life Sciences, 16(2), 166–172.

Masir, U., Fausiah, A., & Sagita, S. (2020). Production of Black Soldier Fly Maggot (BSF) (Hermetia illucens) on Tofu Pulp and Chicken Feces Media. AGROVITAL: Journal of Agricultural Sciences, 5(2), 87–90.

Minggawati, I., Lukas, L., Youhandy, Y., Mantuh, Y., & Augusta, T. S. (2019). The use of apu-apu plants (Pistia stratiotes) to grow maggot (Hermetia illucens) as fish feed. Ziraa'Ah Scientific Magazine of Agriculture, 44(1), 77–82. https://doi.org/10.31602/zmip.v44i1.1665

Muhayyat, M. S., Yuliansyah, A. T., & Prasetya, A. (2016). Effect of Waste Type and Bait Ratio on Domestic Waste Bioconversion Using Black Soldier Fly Larvae (Hermetia illucens). Journal of Process Engineering, 10(1), 23–29.

Putri, R., Rianes, M., & Zulkarnaini, Z. (2023). Socialization of Household Organic Waste Processing Using BSF Maggots. Indonesian Journal of Community Service, 3(1), 89–94.

Saragi, E. S. (2015). Determination of optimal feeding rate of black soldier fly larvae (Hermetia illlucens) in reducing market organic waste. (Thesis). Sepuluh Nopember Institute of Technology.

Sipayung, P. Y. E. (2015). Utilization of the Black Soldier Fly (Hermetia illucens) larvae as a technology option for urban solid waste reduction. (Thesis). Sepuluh Nopember Institute of Technology.

Syofyan, P., Sundari, E., & Munzir, A. (2022). Organic waste treatment uses black soldier fly or maggot larvae. Journal of Research Implementation, 4(1), 44–54.

Tschirner, M., & Simon, A. (2015). Influence of different growing substrates and processing on the nutrient composition of black soldier fly larvae destined for animal feed. Journal of Insects as Food and Feed, 1(4), 249–259.

Yuliana, B. R., Hartini, H., & Putra, A. M. (2024). The Effect of Feeding Different Types of Feed on the Growth of Maggot Blck Soldier Ply (BSF) Larvae. Journal of Environmental Technology, 2(2), 1–10.