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# ADDITION OF ECO-ENZYME IN DIFFERENT MAINTENANCE MEDIA ON POPULATION AND GROWTH OF MAGGOT (HERMATIA ILLUCENS)

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## ABSTRACT
Maggot is an organism that has a high protein content that can be used as natural food for carnivorous fish. Maggot growth media is available in abundance and contains organic matter nutrients. This study aims to determine the best growing media for BSF maggot larvae (Hermatia illucens) which are added to eco-enzymes for maggot population and growth. This research was conducted experimentally using a completely randomized design (CRD) consisting of 7 treatments and three replications. The media used were tofu dregs, sago dregs, coconut dregs and a mixture of these media, all media were added with 40 mL/Kg of eco-enzyme. Parameters observed were maggot population, relative length, relative weight and nutritional content in maggot. The results of the study showed that the best number of population in the combination of sago dregs and coconut dregs media was 1,1787.51 heads, relative length growth in coconut dregs growth media was 492.88%, relative weight growth in tofu dregs growth media was 672.22% and analysis of protein content of 18.79% in growth media a combination of sago pulp and coconut pulp with the addition of eco-enzymes produced the best population results with complete amino acid content.

## KEY WORDS
Maggot, natural food, media, eco-enzyme, population.

A maggot or black soldier fly larva (Hermetia illucens) is one of the potential alternative natural feed sources of high protein. Maggot has a soft texture and is able to secrete cellulase enzymes which function to break down feed that is difficult to digest in the fish's stomach so that its nutritional value can be better and can be directly utilized by fish (Santoso, 2019). Maggot can be used as an option for providing feed because it is easy to breed, and has high protein. The growth of maggot is largely determined by the growing media, moreover the Hermetia illucens flies like the distinctive aroma of the media for laying eggs (Rachmawati, 2010).

Growing media that can be used for maggot culture can use various maintenance media, different maggot growth media can cause the protein content in maggot to also differ according to the growth media. Growing media that can be used for maggot culture include 39.95% coconut cake and 25.05% laying hen feces (Katayane et al., 2014). Combination of oil palm and rice bran 50.03%, tofu dregs and chicken manure 34.34 (Raharjo et al., 2016), fish waste and bran 41.22 (Azir et al., 2017), bran and probiotics (44, 26 %) (Mokolensang et al., 2018). maggot will grow on eco-enzymes if the organic waste used is rotten and the container is not tightly closed. Maggot can convert waste such as livestock and agricultural waste (Wuljanah, 2021).

The ability of maggot larvae to live in organic media indicates that these larvae can use this media as feed. In the digestive tract, the larva secretes digestive enzymes to convert organic waste into protein and body fat. (Supriyatna et al., 2015). Maggot larvae have protease, amylase and lipase enzymes, protease functions to convert protein into amino acids, amylase converts starch into maltose, and lipase converts fat into fatty acids and

glycerol (Kim et al., 2011). Enzymes are biocatalysts that function as catalysts in biological processes (Lehninger, 1982). Enzymes function to break down complex chemicals into simpler ones. The addition of eco-enzymes to growth media can speed up the digestion process of organic waste for growth. In general, Indonesia has a lot of potential for tofu dregs, sago dregs and coconut dregs, but only a small portion is utilized. Until now, this amount of waste has not been properly utilized, only allowed to accumulate in landfills without further processing, causing environmental pollution. Therefore there is a need for an alternative utilization of tofu dregs, sago dregs and coconut dregs to reduce adverse effects on the environment. This research provides an alternative utilization of tofu dregs, sago dregs and coconut dregs which are added with eco-enzymes for the growth of BSF maggot with the aim of analyzing the best growing media for BSF maggot larvae which will then be given as fish feed.

## METHODS OF RESEARCH

The study was conducted at the Maggot Palace, Ulin Village, Simpur District, Hulu Sungai Selatan Regency from February to March 2023. 0.5 gram maggot eggs were placed in a rectangular basin and then given growth media according to the treatment, 40 mL/kg of eco-enzyme was added to the every 1000 grams of growth media according to treatment. Every day in the morning and evening, 200 grams of media were added according to the treatment. Checking maggot eggs is carried out after 6 days of treatment (maggot begins to be seen and observed), and measurements are taken every 3 days until the 15th day of the rearing period.

The design used in this study was a completely randomized design (CRD) with 7 treatments, namely:

- P1 = 1000 grams of Tofu dregs and 40 mL of Eco-enzyme;
- P2 = 1000 grams of Sago Dregs and 40 mL of Eco-enzyme;
- P3 = 1000 grams of Coconut Dregs and 40 mL of Eco-enzyme;
- P4 = Tofu Dregs 500 grams, Sago Dregs 500 grams and 40 mL Eco-enzyme;
- P5 = Tofu Dregs 500 grams, Coconut Dregs 500 grams and 40 mL Eco-enzyme;
- P6 = 500 grams of Sago Dregs, 500 grams of Coconut Dregs and 40 mL of Eco-enzyme;
- P7 = Tofu Dregs 334 grams, Coconut Dregs 333 grams, Sago Dregs 333 grams and 40 mL Eco-enzyme.

Each treatment was repeated 3 times to obtain 21 experimental units. Observations were made on the maggot population, relative weight growth rate, relative length growth rate and maggot nutritional content. The nutritional content of maggot was observed for the treatment that produced the largest number of maggot populations. Observation of nutritional content was carried out by taking samples of BSF maggot eggs in the best treatment with the results of the highest number of maggot populations, then the samples were sent to PT. Saraswanti Indo Genetech for proximate and amino acid analysis6.

## RESULTS OF STUDY

The results of observing the number of maggot populations after 15 days of rearing on different growth media with the addition of 40 mL/Kg of eco-enzyme are presented in Figure 1.

The relative length growth rate of maggot with different growth media with the addition of 40 mL/Kg of eco-enzyme is presented in Figure 2.

The growth rate of maggot relative weight with different growth media with the addition of 40 mL/kg of feed eco-enzyme is presented in Figure 3.

The results of the analysis of proximate and maggot amino acids from the research growth media presented in Table 1.

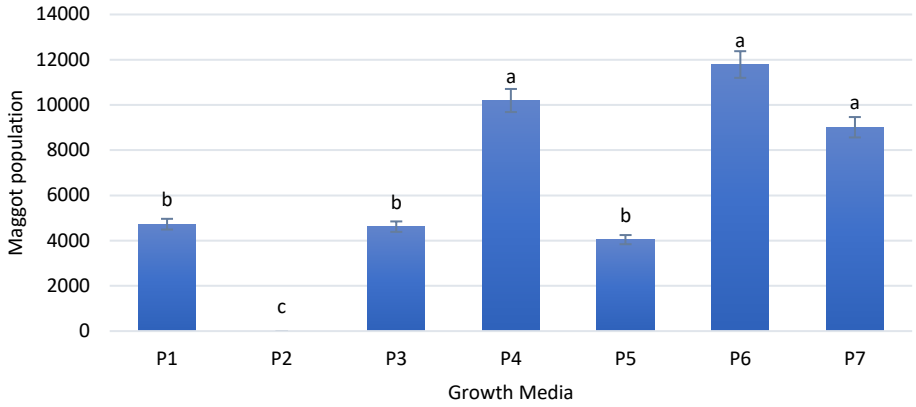


Figure 1 – Maggot population after 15 days of maintenance

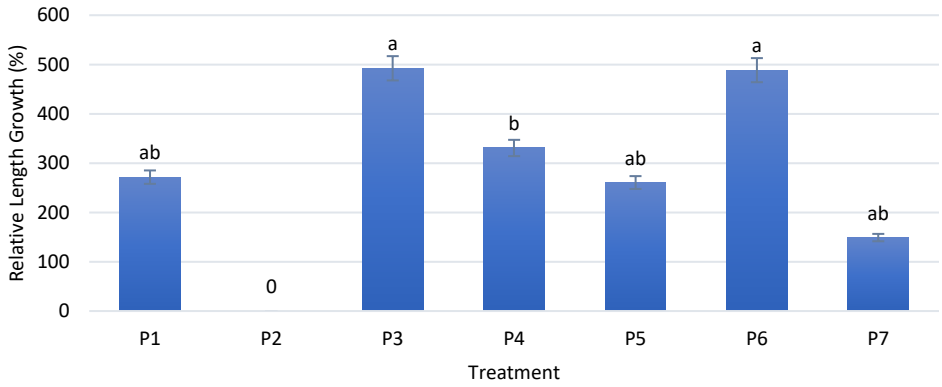


Figure 2 – Relative length growth of maggot after 15 days of maintenance

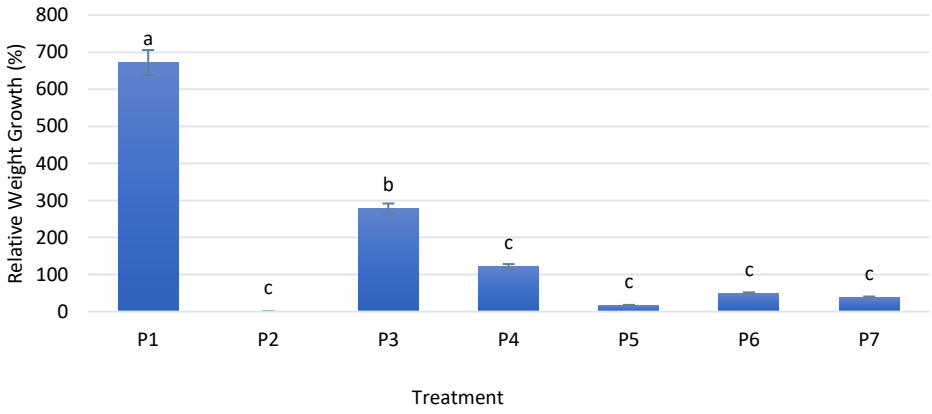


Figure 3 – Growth of maggot relative weight after 15 days of maintenance

Table 1 – Maggot proximate analysis for each treatment

| Treatment | Analysis Parameters | | | | |
|---|---|---|---|---|---|
| | Water content (%) | Ash Content (%) | Protein Content (%) | Fat level (%) | Crude Fiber Content (%) |
| P1 | 50,64 | 2,65 | 19,62 | 21,36 | 5,73 |
| P2 | 0 | 0 | 0 | 0 | 0 |
| P3 | 49,73 | 2,69 | 20,91 | 21,21 | 5,45 |
| P4 | 52,57 | 2,70 | 18,41 | 21,23 | 5,09 |
| P5 | 51,05 | 2,75 | 20,31 | 21,00 | 4,89 |
| P6 | 52,25 | 2,77 | 18,79 | 21,21 | 4,98 |
| P7 | 51,28 | 2,78 | 19,33 | 21,41 | 5,2 |

*Source: Primary Data, 2023.*

Table 2 – Analysis of Maggot Amino Acids from the combined treatment of sago dregs and coconut dregs (%)

| No. | Amino Acids | Result | No. | Amino Acids | Result |
|---|---|---|---|---|---|
| 1 | L-Serine | 5,59 | 9 | L-Lysine | 6,14 |
| 2 | L-Glutamate Acid | 12,79 | 10 | L-Aspartic Acid | 7,10 |
| 3 | L-Phenylalanine | 5,71 | 11 | L-Leucine | 8,70 |
| 4 | L-Isoleucine | 5,52 | 12 | L-Tyrosine | 6,43 |
| 5 | L-Valin | 7,17 | 13 | L-Proline | 6,20 |
| 6 | L-Alanine | 9,14 | 14 | L-Threonine | 5,61 |
| 7 | L-Arginine | 6,56 | 15 | L-Histidine | 3,41 |
| 8 | Glycine | 8,57 | | | |

*Source: Primary Data, 2023.*

## DISCUSSION OF RESULTS

The results of observations made for 15 days average the number of maggot populations in treatment P1 (tofu dregs + 40 mL eco-enzyme) with a population of 4,728 individuals, treatment P3 (sago dregs + 40 mL eco-enzyme) with a population of 4,619 tails, P4 treatment (tofu dregs and sago pulp + 40 mL eco-enzyme) with a population of 10,196 individuals, P5 treatment (tofu dregs and coconut dregs + 40 mL eco-enzyme) with a population of 4,045 individuals, P6 treatment (dregs sago and coconut dregs + 40 mL eco-enzyme) with a total population of 11,787 individuals, P7 treatment (tofu dregs, sago dregs and coconut dregs + eco-enzyme) with a total population of 9,014 individuals. The highest maggot population results were in the P6 treatment, 11,787 individuals and the lowest in the P5 treatment, 4,045 individuals. Duncan's test results with sig. 0.05 stated that the sago pulp and coconut pulp media with the addition of eco-enzyme had a very significant effect on the number of maggot populations, this indicated that the growth media using sago pulp and coconut pulp with the addition of eco-enzyme 40 mL/Kg (P6) was a treatment best.

The growth media used sago pulp and coconut pulp by adding 40 mL of eco-enzyme to become the media with the highest number of maggot populations after 15 days of maintenance. Adequate nutrition in growth media can increase the maggot population. The nutritional content contained in tofu pulp is 26.82% protein, and 13.72% crude fat (Aldi et al., 2018). Furthermore, Maulana et al., (2021) stated that the nutritional content of coconut pulp contains a water content of 80.01 %, 5.71% crude protein and 36.6% crude fat. Meanwhile, tofu dregs contain 78.33% water, 24.11% crude protein and 29.75% crude fat.

Proteins that have a complex and simplified structure are broken down into 2 groups, namely essential amino acids and nonessential amino acids. The factors that determine the nutritional value of a protein are its digestibility and essential amino acid content (Winarno, 2000). Buwono, 2000 explained that essential amino acids are amino acids that cannot be produced in the body so they must be added or taken from outside the body in the form of food and drink, while nonessential amino acids are amino acids that can be produced in the body so they are not need food from outside the body.

The amino acids in this study consisted of 9 essential amino acids and 6 non-essential amino acids. The essential amino acids found in maggot include: histidine, valine, phenylalanine, isoleucine, leucine, lysine, threonine, proline and arginine while the non-essential amino acids found in maggot include: aspartic acid, glutamic acid, serine, glycine, alanine and tyrosine (Winarno, 2000). One of the essential amino acids is lysine where the lysine content of maggot in this study was 6.14. According to Giri et al. (2009), a lysine content of 2.84% is equivalent to 6.37% of feed protein.

The use of a single maintenance medium, namely tofu dregs, bran, coconut dregs and palm oil cake resulted in a lower maggot population density compared to treatment with a combination of tofu dregs, bran, coconut dregs and palm oil cake media which was the best treatment in increasing density. maggot population with an average of 4.60 individuals/cm3 (Hartami et al., 2015). Thus the combination rearing medium gives better results than using a single rearing medium.

The sago pulp media used for maggot growth has a high water content, this can be seen when the sago pulp media is used while it is still wet. Maggot growth is influenced by the environmental conditions of the media and the organic matter content used. The media that is suitable for growing maggot is material that contains organic matter. According to DuPonte and Larish, (2003) the high organic matter in the media will increase the number of bacteria and the number of organic particles decomposed by bacteria so that it can increase the amount of food in the media and affect the increase in the number of maggot individuals. In addition, the sago pulp media generally emits an unpleasant odor, based on observations during the research, when sago pulp is used for maggot maintenance media, the odor is absent, meaning that maggot can eliminate the unpleasant odor from sago pulp, which means maggot maintenance using the pulp. sago can improve environmental quality.

The results of observations made for 15 days mean maggot length in treatment P1 (tofu dregs + 40 mL eco-enzyme) with an average length of 271.64%, in treatment P3 (sago pulp + 40 mL eco-enzyme) with an average length of 492. 38%, P4 treatment (tofu dregs and sago pulp + 40 mL eco-enzyme) with an average length of 330.73%, P5 treatment (tofu dregs and coconut dregs + 40 mL eco-enzyme) with an average length of 260.62%, treatment P6 (sago dregs and coconut dregs + 40 mL eco-enzyme) with an average length of 488.57%, treatment P7 (tofu dregs, sago dregs and coconut dregs + eco-enzyme) with an average length of 149.2%. The highest maggot length results were in the P3 treatment 492.38% and the lowest in the P7 treatment 149.2%. The results of Duncan's test analysis with sig. 0.05 showed that the administration of coconut dregs with the addition of eco-enzymes had a very significant effect on the growth in the relative length of the P3 and P6 treatments.

The highest maggot (Hermetia illucens) length growth was 0.83 cm with a media combination of 30% household waste, 30% coconut pulp and 40% tofu waste (Hulu F et al, 2022). The results of the study (Cicilia et al, 2018) showed that the total length of maggot at harvest used 100% + EM4 tofu dregs with an average length of 22.7 mm. Maggot growth is influenced by media conditions, where it grows, the nutrients contained in a medium (Mingawati, Infa, et al., 2019). In accordance with (Susanto, 2002) the growth of organisms is strongly influenced by environmental conditions and the availability of food.

Hasil pengamatan yang dilakukan selama 15 hari rata-rata panjang maggot pada Maggot Relative Weight Growth

The results of observations made for 15 days mean maggot length in treatment P1 (tofu dregs + 40 mL eco-enzyme) with an average weight of 672.22%, treatment P3 (sago pulp + 40 mL eco-enzyme) with an average weight of 277, 77%, treatment P4 (tofu dregs and sago pulp + 40 mL eco-enzyme) with an average weight of 122.21%, treatment P5 (tofu dregs and coconut dregs + 40 mL eco-enzyme) with an average weight of 17.29%, treatment P6 (sago dregs and coconut dregs + 40 mL eco-enzyme) with an average weight of 49.44%, treatment P7 (tofu dregs, sago dregs and coconut dregs + eco-enzyme) with an average weight of 38.88%. The highest maggot weight growth results were in the P1 treatment 672.22% and the lowest in the P5 treatment 17.29%. The results of Duncan's test analysis with sig. 0.05 indicates that the provision of tofu dregs with the addition of eco-enzyme has a very significant effect on the growth of the relative weight of the P1 treatment.

The results of Azir et al, 2017's study used a combination of fish waste media and coconut dregs to produce 1,149.88 grams, (Cicilia et al, 2018) maggot growth with 50% tofu pulp media, 25% rice bran, 25% chicken manure and the addition of EM4 with an average of 0.30 grams, this is because the composition of the media is able to meet the nutritional needs for maggot growth and the high organic matter content in tofu pulp, so that it can affect the increase in total maggot production.

Adequate media nutrient content can cause a rapid increase in maggot production, but conversely, if the nutrient content is insufficient, growth will decrease rapidly.

Maggot with growing media using coconut dregs added with eco-enzyme (P3) obtained the highest proximate protein content of 20.91% and the lowest protein content in the combination of tofu and sago dregs added with eco-enzyme (P4) of 18.41 %.

Research using 100% tofu waste culture media contained 16.38% protein. 100% bran culture media contains 37.97% protein and 39.78% coconut cake (Indariyanti, 2018). The research results of Azir et al., 2017 stated that maggot with culture media of 100% fish waste contained 25.22% protein, culture media of 50% fish waste and 50% vegetable waste contained 30.85% protein, culture media 50% waste fish and 50% waste bran contains 41.22% protein and culture media 50% fish waste and 50% coconut dregs contains 34.90% protein,

The lower protein content compared to previous studies is suspected because the growing media used has a high water content exceeding 50%. According to Hairunnisa et al., (2017) the low protein content is affected by the water content, the lower the water content, the higher the protein content. This proves that the amount of water content is inversely proportional to the amount of protein content.

## CONCLUSION

The growth medium for BSF maggot larvae (Hermatia illuncens) with the addition of 40 mL/kg eco-enzyme with the highest population was a combination of growth media (P6) sago pulp and coconut pulp (11,787, 57 individuals), relative long growth (P3) coconut pulp ( 492.38 %), relative weight growth (P1) of tofu dregs (672.22 %) and protein content (P3) of coconut dregs (20.91 %).

## REFERENCES

1. Aldi, Muhammad, Farida Fathul, and Syahrio Tantalo. 2018. "The Effect of Various Growing Media on Water Content, Protein and Maggot Fat Produced as Feed." Journal of Research and Innovation of Animals (Journal of Research and Innovation of Animals) 2.2 (2018): 14-20.
2. Azir, Harris and Haris, 2017. Production and Nutritional Content of Maggot (Chrysomya Megacephala) Using Different Culture Media Compositions. Journal of Fisheries Sciences and Aquaculture Volume 12, Number 1, June 2017. Palembang.
3. Buwono, I. D. 2000. The need for essential amino acids in fish rations. Kansius. Yogyakarta.
4. Cicilia, AP. and Susila, N. 2018. "Potential of Tofu Dregs on Maggot (Hermetia illucens) Production as a Source of Fish Feed Protein". Anterior Journal, 18(1): 40–47.
5. DuPonte, M.W. and Larish, L.B. 2003. Tropical agriculture and human resources (CTAHR).
6. Giri, NA., A.S. Sentika, K. Suwirya, and M. Marzuqi., 2009. Optimal Lysine Amino Acid Content In Feed For The Growth Of Sunu Grouper, Plectropomus Leopardus Seeds. J. Ris. Aquaculture Vol. 4 No. 3, December 2009: 357-366.
7. Hartami, P. 2015. Maggot Population Density Levels in Different Media. Staff of the Aquaculture Study Program, Faculty of Agriculture, Malikussaleh University. The worst fisheries periodical 43 (2).
8. Hairunnisa, Suherman & Supriadi, 2017. Analysis of Macronutrients from Flour Combination of Cocoa (Theobroma cacao L.) and Cassava (Manihot utilissima) as Biscuit Basic Ingredients. Journal of Chemistry Academics.;6 (4):200-207.
9. Hulu Fidarnius, Dwi Tika Afriani2, Uswatul Hasan, 2022. The Effect of Different Media Using Household Waste, Coconut Dregs and Tofu Dregs on the Growth of Maggot (Hermetia Illucens). J. Aquac. Indonesia. Vol 2, No 1, November 2022: 47-59.
10. Indariyanti, 2018. Evaluation of Biomass and Nutritional Content of Magot (Hermetia illucens) in Different Cultivation Media. Proceedings of the National Seminar on Agricultural Technology Development, Lampung State Polytechnic 08 October 2018 ISBN 978-602-5730-68-9 page 137-141 http://jurnal.polinela.ac.id/index.php/Prosiding.
11. Katayane AF, Wolayan FR, Imbar MR. 2014. Production and protein content of maggot (Hermetia illucens) using different growing media. J Zootech. 34:27-36.

12. Kim, W., Bae, S., Park, K., Lee, S., Choi, W., Han, S., Koh, Y., 2011. Biochemical Characterization Of Digestive Enzymes In The Black Soldier Fly, Hermetia illucens (Diptera: Stratiomyidae). Journal Of Asia Pacific Entomology. Vols 14.
13. Lehninger, A.L., 1982. Fundamentals of Biochemistry Volume 1. Erlangga, Jakarta.
14. Maulana, Maulana, Nurmeiliasari Nurmeiliasari, and Yosi Fenita. 2021. "The Effect of Different Growing Media on Water, Protein and Fat Content of Maggot Black Soldier Fly (Hermetia illucens)." Tropical Livestock Bulletin 2.2 (2021): 149-157.
15. Mokolensang, J. F., M. G. Hariawan, and L. Manu. 2018. Maggot (Hermetia illunces) as an alternative feed in fish farming. e-Journal of Aquaculture. 6(3): 14-18.
16. Minggawati, Infa, et al. "Utilization of Apu-Apu (Pistia stratiotes) Plants for Growing Maggot (Hermetia illucens) As Fish Feed." Ziraa'ah Agricultural Scientific Magazine 44.1 (2019): 77-82.
17. Rachmawati, Buchori D, Hidayat P, Hem S, Fahmi MR. 2010. Development and Nutrition Content of Hermetia illuncens (Linnaeus) Larvae (Diptare: Startiomyidae) in Oil Palm Cake. J Entomol Indonesia 7:28-41.
18. Raharjo, E. I., Rachimi., A. Muhamad. 2016. The Effect of Combination of Oil Palm Dregs and Rice Bran Media on Maggot (Hermetia illucens) Production. Ruaya Journal. Vol. 4 (2): 41- 46.
19. Raharjo, E.I., Rachimi., M. Arief. 2016. Use of Tofu Dregs and Chicken Manure to Increase Maggot (Hermetia illucens) Production. Ruaya Journal. Vol 4 (1): 33-38.
20. Santoso, 2019. The Effect of Artificial Feeding and Hermetia Illucens Maggot on the Growth of Leptobarbus Hoevenii Jelawat Fish (Bleeker, 1851). Faculty of Agriculture, University of Lampung.
21. Silmina, Edriani, Putri, 2010. The effectiveness of various cultivation media on the growth of Hermetia illucens maggot. Bogor Agricultural Institute.
22. Susanto. 2002. Fertilizer and Fertilization. Publisher Rineka Cipta. Jakarta.
23. Supriyatna, A. & Putra, R.E. 2017. Estimation of Growth of Black Fly Larvae Soldier (Hermetia illucens) and the Use of Rice Straw Feed Fermented with P. chrysosporium Mushroom. Biodjati Journal. 2(2): 159-166.
24. Winarno, F. G. 2000. Food Chemistry and Nutrition. PT Gramedia Pustaka Utama. Jakarta.
25. Wuljanah, 2021. Making an Eco Enzyme Solution from Organic Waste Grapefruit, Yellow Pumpkin, Kale, Chicory and Papaya from the Gedebage Main Market, Bandung City. Faculty of Pharmacy, Bhakti Kencana University.