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Vermicompost Biochemical Content of Different Types of Worms and Waste Feed Material

*Dewi Hastuti
Agroecotechnology Department, Agriculture Faculty, University of Sultan Ageng Tirtayasa
Indonesia Center of Execelenc for Food Security (I-CEFORY), UNTIRTA
(Local Food Innovation)
Serang, Indonesia
*Email: dewihastuti@untirta.ac.id

Sri Ritawati
Agroecotechnology Department, Agriculture Faculty, University of Sultan Ageng Tirtayasa
Serang, Indonesia
Email: s.ritawati@yahoo.com

Eltis Panca Ningsih
Agroecotechnology Department, Agriculture Faculty, University of Sultan Ageng Tirtayasa
Serang, Indonesia
Email:eltispn14@gmail.com

Rida Oktorida Kastini
Biology Department
Teacher Training and Education Faculty,
University of Sultan Ageng Tirtayasa
Serang, Indonesian
Email: rida.khastini@untirta.ac.id

Abstract*-- Plant resistance can be induced with various secondary metabolites from vermicompost. Vermicompost has been known to have many advantages including containing a variety of secondary metabolites produced by earthworms. Polyphenols are a group of secondary metabolites needed by plants to form resistance against brown plant hopper attacks. Vermicompost is also rich in the enzyme chitinase. This enzyme is very useful to induce plant resistance to pests and diseases because it can decompose chitin on the body of insects and cell wall pathogens. Vermicompost combined with household kitchen waste such as eggshells, shrimp shells and banana peels are expected to increase the metabolite content. This study aims to determine the content of the enzyme chitinase and polyphenols in vermicompost from household kitchen waste. This research was conducted at the Laboratory of Basic Sciences and Plant Protection of Faperta Untirta from May 2019 to September 2019. The research used 2 factors. The first factor is the type of worm: 1) Lumbricus rubellus 2) Eisenia fetida, 3) Eudrilus eugeniae. The second factor is various media additives: 1) eggshells 2) rice straw, 3) banana peels. The basic ingredients of vermicompost consist of soil and buffalo dung in a ratio of 1: 1. There were 9 treatment combinations that were repeated 5 times, so that there were 45 experimental units. Data obtained by observing biochemical parameters 1) macro nutrient levels 2) polyphenols 3) silicates 4) pH 5) aflatoxin. There are various obstacles in the implementation of this study including the acclimatization of worms that experienced many failures. The results showed that there were differences in biochemical content in vermicompost with a combination of treatments between types of worms and household waste materials. Based on the results of the analysis, the resulting C/N ratio of 20.07 (N 1.15%, C-organic 23.09%, P_2O_5 total 0.47%) silica 10% in the C1L2 worm type treatment, was higher compared to other treatment types. While the results of qualitative analysis showed that there were polyphenol compounds in all treatments observed.

Keywords: vermicompost, biochemical content, waste

I. INTRODUCTION

Vermicompost has been known to have many advantages including containing a variety of secondary metabolites and micro macro nutrients produced by earthworms. One of them is polyphenol [9]. Polyphenols are a group of secondary metabolites needed by plants to form resistance against brown plant hopper attacks. Vermicompost according to [11], is also rich in the chitinase enzyme. This enzyme is very useful to induce plant resistance to pests and diseases because it can decompose chitin on the body of insects and cell wall pathogens. Vermicompost can increase the number of soil microorganisms, including Bachillus thuringiensis [5]. The Bt toxin it produces is insecticidal to pests. The results of the study of [3] showed that the effect of vermicompost in combination with biological fertilizers followed by a reduction in the dose of inorganic fertilizers had a significant effect on leaf productivity and the incidence of pests and mulberry plant diseases. populations of insect pests such as white flies and thrips were found to be significantly reduced below the economic threshold level. Vermicomposts can also suppress arthropod pests such as caterpillars: including white cabbage caterpillars, tomato horn worms, and cucumber beetles, and suck arthropods: such as scale insects, flour aphids, aphids and spider mites [8]. Application of vermicompost to the soil makes plants less attractive to pests and can suppress their reproduction.

Vermicompost combined with agricultural waste such as eggshells, straw and banana peels are expected to increase the metabolite content. The density of the

population brings its own problems in terms of household waste. The problem of household waste can be overcome by processing it back into useful material. Agricultural waste and kitchen waste can be made into vermicompost been done. Therefore it is necessary to conduct research that aims to determine the effect of the combination of worm types with feed source waste on vermicompost quality.

II. RESEARCH METHODS

This research will be conducted at the Laboratory of Basic Sciences and Plant Protection of Faperta Untirta from January 2019 to September 2020. The research used a Randomized Block Design with 2 factors. The first factor is the type of worm: 1) *Lumbricus rubellus* 2) *Eisenia fetida*, 3) *Perionyx excavates*. The second factor is various media additives: 1) banana stems 2) rice straw, 3) banana peels. The basic ingredients of vermicompost consist of chopped straw, cabbage vegetables and buffalo dung in a ratio of 1: 1: 1 (BPPT Mataram, 2001). There were 9 treatment combinations that were repeated 5 times, so that there were 45 experimental units. Data were obtained by observing biochemical parameters in the media. Observation parameters are 1) total N was analyzed by the Kjeldahl method 2) P and K total by the HNO_3 and $HClO_4$ extraction method 3) pH by the Electrometry method 4) C-Organic by the Walkley and Black method 5) Determination of polyphenol content by the Fransolin Folin-ciocalteu method (1966) continued with a spectrophotometer at 740 nm, 6) Silicate levels were determined by the 750 therm C subsequent thermolysis method with HCL pretreatment. While the aflatoxin levels were analyzed by the SDS-PAGE electrophoresis method.

III. RESULT AND DISCUSSION

The results of the analysis of the chemical components of Pa Vermicompost in this study have been analyzed both the content of macro, micro nutrients and the content of secondary metabolites, especially the total phenol content (Table 1.). In general, all treatments of different types of worms as well as from different types of kitchen waste have nutrient content which is not much different from compost standards according to SNI 19-7030-2004 (Table 2).

Table 1. Vermicompost quality of different types of wormsand kitchen waste (%)

Treatment	C/N	Total N	P_2O_5	K_2O	SiO_2	Total Fenol	pH	Aflat oxin*
C1L1	19.97	1.01	1.48	2.5	9.29	2,13	4,6	-
C1L2	22.64	1.15	0.47	2.18	10.20	2,47	6.7	-
C1L3	22.1	2.23	0.364	2.75	5.09	0,03	6,9	-
C2L1	21.05	1.2	2,00	0.37	7.98	3,01	5.04	-
C2L2	20.09	1.09	0.38	2.11	13.97	3,05	7.12	-
C2L3	19.67	1.12	0.21	2.8	4.88	2,66	7,3	-
C3L1	19.58	2.40	0.42	1.39	7.73	2,45	5,00	-
C3L2	20.04	2.13	0.48	0.48	10.3	1,78	5.98	-
C3L3	17.09	1.82	0.33	2.7	5.14	0,70	6,55	-

Source: Soil And Agroclimate Laboratory of Untirta,
* Saraswanti Indo Gnetech Laboratory

after being degraded by earthworms (*Lumbricus* sp.). Research on the mechanism of absorption of chitinase metabolites, polyphenols and Bt toxins in rice plants and their effects on brown plant hopper populations has never

Table 2. Compost characteristic due to standar SNI 19-7030-2004

Contend	Minimal	Maximal	Unit of measurement
C/N	10	20	%
Total N	0,40	-	%
P2O5	0,10	-	%
K20	0,20	-	%
pH	6,80	7,49	-

A. Macro nutrient content

Data from Table 1. Shows that the vermicompost under study is quite varied in both its C / N ratio, total N, P2O5 and K2O content. However, the one that has the highest C / N ratio is C1L2 treatment which is derived from the *Lumbricus rubellus* worm and rice straw waste by 22.64%. Whereas the treatment with the lowest C / N ratio was C3L3 which was 17.09%. This treatment uses the Perionyx excavates worm or african blue worm worm with a food source that is given a banana peel. In the total N content, C3L1 treatment had the highest yield of 2.4%. The lowest N content is in vermicompost produced from Lumbricus rubellus worm excretion with banana stem feed. For the element potassium (K_2O), the best treatment was obtained from vermicompost of C1L3 (2.75%) and the lowest C2L1 (0.37%). C2L3 treatment is a combination of types of worms Eisenia fetida with banana peel feed. Nevertheless these results are still within SNI standard limits because they are above 0.20%. The highest pospat (P_2O_5) nutrient content in vermicompost under study was highest at 2% in the C2L1 treatment and as low as 0.21% in C2L3.

The high C/N ratio of vermicompost resulting from the combination of the Lumbricus rubellus worm with rice straw shows that the treatment of this type of worm decomposes the fastest organic matter so that it can be completely degraded. The results of [2] study concluded that the *Lumbricus rubellus* worm species can increase the P and K content and decrease the C/N ratio content than the initial substrate. Whereas the Eisenia fetida worm species can only reduce the C/ N ratio and increase K alone.

B. Silikat (SiO_2) Compound

Silicate levels in vermicompost that were analyzed ranged from 4.88% to 10.20%. Vermicompost that contains the highest silicate is C1L2 treatment, which is a combination of *Lumbricus rubellus* worms with rice straw chopped feed. The lowest silicate content results in the treatment of C2L3 with Eisenia fetida worms allegedly strongly influenced by the type of food that is chopped banana peels. There is a tendency in which all types of

worm treatment always have the highest silica content when fed with rice straw. (picture 1). This is consistent with several studies that show that rice straw is one of the organic materials rich in silicates up to 29.1% of the total dry weight [1].

Silicates contained in vermicompost are very useful in the defense mechanism of cultivated plants against pests and diseases. If the silica content in vermicompost can be absorbed by plant matter, this compound will be synthesized to be part of the cell wall and plant tissue so that the cell and tissue will be stronger or harder. Harder plant tissue will be difficult to damage by pests, especially the type of mouth sucker sucker. Research by [5] shows data about the raw silica content in selected rice accessions differed significantly between accessions and susceptible checks of TN-1 varieties. The amount of silica was found to be higher in BG 367-2 (14.99) (Table.4), ACK 09030 (14.95) and Thogai Samba (14.52) compared to the TN-1 vulnerable check (9.00). Varieties that are sufficiently resistant to brown plant hopper have more raw silica content when compared to susceptible checks in TN-1.

C. Total phenol dan aflatoxin Compound

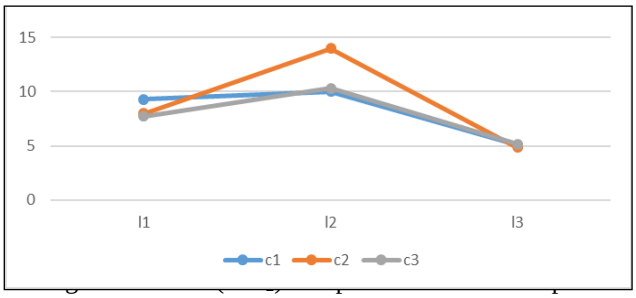
The total phenol content in vermicompost, such as silica, can also affect plant resistance to pests and diseases. Phenolic compounds can usually be in the form of flavonoids, simple monocyclic phenols, phenyl propanoids, polyphenols (lignin, melanin, tannin), and phenolic quinones. This compound contained in vermicompost is likely the result of degradation of the feed by enzymes in the worm's body. The highest total phenol content in this study was found in C2L2 treatment or a combination of Eisenia fetida with chopped rice straw (3.05%). While the lowest total phenol was shown by the treatment of C1L3 or Lumbricus rubellus worms with banana peels by 0.03%. However, all treatments with various combinations of worm types and sources of feed waste showed poditive containing phenols, although the levels were only low. [7] research states that the application of 15 mL vermiwash, 1 g phosphate, and 20 g vermicompost per plant increases the total phenol content in Piper auritum.

The phenol compounds found in vermicompost are expected to be able to be absorbed into the root organs of plants. If this happens then this compound will accumulate in plant cells and is useful in the face of pests and diseases. Biosynthesis and the role of phenolics in plants that protect them against herbivores [4]. The aflatoxin content in all treatments showed negative. This means vermicompost is safe to use because aflatoxin produced by fungi can inhibit plant growth.

D. pH

The vermicompost studied has varied degrees of acidity. The character of compost based on SNI standard 19-7030-2004 requires that ideal compost is the pH of between 6.80-7.49 (table 2.). However, from all treatments given there were some whose pH was less than 6, namely C1L1 (4.60), C2L1 (5.04), C3L1 (5.00) and C3L2 (5.98). Meanwhile, there is no treatment that has

The silicate rate of the analyst in the analysts ranged from 4.88% up to 10.20%. Vermikompos containing the highest silicate is the C1L2 treatment, namely the combination of worm Lumbricus rubellus with rice straw feed. Results of the lowest silicate in the C2L3 treatment with the Eisenia Fetida worm allegedly strongly influenced by the type of food that is the banana peel. There is a tendency where in all types of worm treatment always has the highest levels of silica when fed in the form of rice straw. (Fig. 1). This is in accordance with some research that shows that Rice straw is one of the cored-rich organic ingredients up to 29.1% of the total weight of the dry [1].



alkaline phosphorus. The high number of vermicompost produced from low pH may be caused by the decomposition or fermentation process of organic matter which has not been maximized since the vermicompost is still fresh. In this study there was a tendency for worms fed eggshell to have a relatively low pH when compared with other types of feed. The level of acidity of vermicompost in addition to influencing the availability of nutrients to be absorbed by plants can also affect the life of microorganisms in it. The results of [10] showed that the vermicompost pH of the Perionyx excavatus worm was highly positively correlated with the pH of the initial feed substrate and also the duration of composting time. This study shows an exponential relationship between the pH of the substrate and the time for making vermicompost.

IV. Conclution

The conclution of this researsh there were differences in biochemical content in vermicompost with a combination of treatments between types of worms and household waste materials. Based on the results of the analysis, the resulting C / N ratio of 20.07 (N 1.15%, C-organic 23.09%, P_2O_5 total 0.47%) silica 10% in the C1L2 worm type treatment, was higher compared to other treatment types. While the results of qualitative analysis showed that there were polyphenol compounds in all treatments observed. Lumbricus rubellus eartworm that combine with rice straw seen to be the best treathment to produce hingh quality vermicompost rather than other earthworm type and waste feed material type. It is recommended to apply the vermicompost to plants to see their absorption and their effect on pests.

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