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Utilization of Local Vegetable Materials To Control *Cylasformicarius*PestPlant Power Plants

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Abstract*: Sweet potato is one of the commodities currently being developed in South Central Timor District, but its productivity is much lower than the national productivity. The cause of Cylas formicarius pests. The use of chemical insecticides carried out by farmers today can lead to various negative effects that need to find another alternative to control pests or by searching for chemical pesticide substitution. One such substitution is to use vegetable pesticides derived from plants.*
Nature in South Central Timor District (TTS) provides many potential ingredients as vegetable pesticides. For example mimba (Azadirachta indica), babadotan (Ageratum conyzoides), soursop (Annona muricata), anona (Annona squamosa), kenikir (Tagetes erecta), papaya (Carica papaya), and betel forest (Piper caducibracteum). However, the effectiveness of these vegetable ingredients to control Cylas formicarius pests is unknown. This study aims to determine the effectiveness of plant pesticides against mortality of pests Cylas formicarius. The results of this study are expected to be a rationale for farmers in determining techniques of pest control Cylas formicarius environmentally friendly.
Based on the result of the research, it can be concluded that the effectiveness of vegetable pesticide against mortality of pest Cylas formicarius highest until the lowest respectively are: mimba leaf of 97.5%; soursop leaf of 92.5%; leaf anona 87.5%; betel leaves of 82.5%; leaf of babadotan equal to 67,5%; leaves of kenikir of 47.5%; and papaya leaf of 45%. It is recommended to use neem leaves, soursop leaf, anona leaf, betel leaf, and leaf of babadotan to control Cylas formicarius pest because it can cause mortality of larvae above 50% in laboratory conditions.
Keywords*: Entomopathogenic Fungi, Vegetable Insecticide, Local Isolate, Cylas formicarius, Sweet Potato.*

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I. Introduction

As an alternative food source of carbohydrate substitutes for rice, sweet potato can be developed to strengthen the food security of the community. The district of South Central Timor (TTS) is one of the areas that is currently promoting sweet potato planting. The productivity of sweet potatoes in TTS in 2014 amounted to 130.20 ku/ha, much lower than the national productivity of 151.97 ku / ha (BPS TTS, 2014). Factors affecting sweet potato yield include age and cultivar of plants, soil fertility, planting height, climate (planting season), and pest and disease diseases.

Some species of insects become pests in sweet potato, but the most damaging is *Cylas formicarius*, also called tuber borer or pest. These pests besides damaging the tubers in the crop, also attack the tubers that have been stored in the warehouse (Nonci, 2005; Powell, 2001). These pest attacks can cause yield loss between 10 - 80% (Capinera, 2012; Kalshoven, 1981). Generally, larvae, pupae, and imago live inside the tubers so damage to the inside of the bulbs is very harmful. Both larvae and imago, both cause damage (Powell, 2001). Damage can be seen on the surface of the bulbs, the presence of small holes and a distinctive foul odor. Tubers that have been attacked are no longer feasible to be consumed because if consumed it will be harmful to the health of the liver and lungs (Supriyatin *in* Romadhon, 2008). Pest wastes present in damaged parts of the tubers also cause bitterness (Zuraida *et al.*, 2005).

C. Formicarius control measures that are often carried out by farmers are by using chemical insecticides, whereas the use of chemical insecticides that are excessive or unwise will cause the pest to become resistant, the emergence of new pests and more importantly killing of natural enemies such as parasitoids and predators that are able to suppress pest populations. Given the negative impacts caused by pesticides, it is necessary to find other alternatives to control pests or by searching for chemical pesticide substitution. One such substitution is to use vegetable pesticides derived from plants.

There are currently more or less 2,400 plant species in the world containing pesticide materials and 100 other species have the potential to be developed as a vegetable pesticide (Grainge and Ahmed, 1988). As a country located in the tropics, Indonesia has abundant biological resources including plant species containing active ingredients of vegetable pesticides (Heyne, 1987).Nature in South Central Timor District (TTS) provides many potential ingredients as vegetable pesticides. For example mimba (*Azadirachta indica*), babadotan (*Ageratum conyzoides*), soursop (Annona muricata), anona (*Annona squamosa*), kenikir (*Tagetes erecta*), papaya (*Carica papaya*), and betel forest *(Piper caducibracteum*). However, the effectiveness of these vegetable ingredients to control Cylas formicarius pests is unknown.

Seeing the magnitude of potential biological resources of local plant species to be developed as a source of vegetable pesticides in the future that the results of this study are expected to serve as a basis for developing these local plant species into a herb of pesticides for plant control *Cylas formicarius* pest. This study aims to determine the effectiveness of plant pesticides against mortality of pests *Cylas formicarius*. The results of this study are expected to be a rationale for farmers in determining techniques of pest control *Cylas formicarius* environmentally friendly.

II. Method

Vegetable materials used are mimba leaves, babadotan leaves, soursop leaves, anona leaves, kenikir, papaya leaves, and betel leaf forests. The manufacture of flour from vegetable materials follows the procedure Brotodjojo (2002). Leaves are prepared not too young and not too old or leave to three of the shoots. The materials obtained from the area in TTS regency are dried for ± 5 days, then pounded with mortar until smooth. The material has been mashed then dioven at a temperature of 40 - 45 0C to get the weight kostan. After a constant weight, the material is smoothed again with a blender and sieved with a 200 mesh sieve. Furthermore, the material is extracted with aquadest solvent according to the required concentration of 10% and has been soaked for 24 hours. The concentration of 10% is obtained by inserting the fine material as much as 10 grams and then inserted into a 100 ml measuring glass and then added aquadest to the limit of tera.

Test the Effectiveness of Vegetable Materials

The test was performed by putting 10 larvae of three instar larvae formicarius larvae into a clear glass containing 10 ml of excretion of vegetable material according to the treatment. Sweet potato tuber pieces are included as larvae feed. This study used Completely Randomized Design (RAL), with eight treatments (7 types of vegetable material and 1 control) and four replications. Observation of larval mortality was performed 5 times with observation interval every 6 hours. Observations were made by recording the number of dead larvae in each treatment.

The percentage of larval mortality was calculated using the formula:

M = A / D x 100 %

Description:

M = Percentage of mortality

A = Number of dead insects infected

D = Number of insects tested

The percentage of mortality obtained was then corrected using the Abbott's (Finey, 1971) formula:

$$Pt = \frac{P_0 - P_c}{100 - P_c} \times 100\ \%$$

Where:

Pt = Percentage of death corrected

Po = Percentage of deaths observed

Pe = Percentage of control deaths

III. Result And Discussions

The mortality of *Cylas formicarius* larvae as a result of the administration of some vegetable materials in the sweet potato plant is shown in Table 1.

No.	Treatment	Accumulation of Percentage of Larva Mortality (%) in Hours After Application				
		6	12	18	24	30
1	Control	0	0	0	0	0
2	Papaya leaf	0	2,5	12,5	25	45
3	Betel leaf	0	12,5	32,5	55	82,5
4	Anona Leaf	2,5	12,5	32,5	55	87,5
5	Kenikir Leaf	0	2,5	12,5	27,5	47,5

6	Babadotan Leaf	0	7,5	22,5	42,5	67,5
7	Soursop leaf	2,5	17,5	37,5	62,5	92,5
8	Mimba Leaf	5	17,5	40	67,5	97,5

According to Table 1, the highest mortality of*C. formicarius* larvae on the first observation (6 hours after application) was found in the neem leaf treatment of 5% followed by soursop leaves and anona 2.5%. While in other treatments not found dead larvae. The second highest larvae C. formicarius larvae mortality (12 hours after application) was found in the treatment of soursop leaf of soursop and neem leaves 17.5%, followed by mortality in betel leaf and anona which was 12.5%, leaf of babadotan of 7.5 %, papaya leaves and papaya leaves 2.5% and 0% control. The third observation (18 hours after application), highest mortality of *C. formicarius* larvae was found in mimba leaf treatment (40%), followed by soursop leaf (37.5%), betel leaf and anona (32.5%), papaya (12.5%), control (0%). Twenty four (24) hours after application (fourth observation), larval mortality from highest to lowest was neem leaves (67,5%), soursop leaf (62.5%), betel leaf and anona leaf (55%), leaf of babadotan (42,5%), leaves of thinker (27,5%), papaya leaf (25%), and control (0%). The last observation (30 hours after application), the highest larval mortality in the mimba leaves treatment was 97.5%, followed by soursop leaves of 92.5%, 87.5% leaf anona, 83.5% betel leaf, bayadotan leaf 62 , 5%, leaves kenikir (47,5%), papaya leaves 45%, and control 0%.

Based on the observations made, larvae of C. insticarius instar III larvae after application showed anxiety behavior, stationary (immobile) until finally experiencing death. The highest larvae of C. formicarius mortality in each treatment (excluding control) was present at the last observation (30 hours after application). According to Kardinan (2005), mainly plant-based pesticides that work as stomach poison usually take time to be able to kill insects. Possibly because the extract of vegetable material takes sufficient time to reach the digestive tract of the insect. Substances contained in the plant material into the digestion through the food will be absorbed by the intestinal wall so that the active compounds of plant materials begin to work when it comes to the intestine. Therefore, it can be said that the observation time affects the mortality of *C. insticarius* larvae III larvae. The longer the observation time increases the mortality of *C. insticarius* instar III larvae.

Seven (7) types of vegetable materials used are stomach poison (Asikin *et al.*, 2002), because the toxic reactions of each of these vegetable materials can be seen after the larvae of the C. fomicarius pest eat the sweet potato tubers that have been treated with extract liquid from each of these vegetable materials. According to Asikin *et al.,* (2002), that plant material that can be used as a vegetable insecticide material is generally a stomach poison.

According to Kardinan (2005), soursop leaves and seeds act as insecticides, larvacids, reppelent, antifeedant, by working as a toxic poison and contact poison. Substances contained in the leaf A. muricata into the digestion through the food will be absorbed by the intestinal wall, so that the active compound of A. muricata leaf extract is tannins and acetogenin start to work when it comes to the intestine. Tannin inhibits enzyme activity in the gastrointestinal tract of insects while acetogenin compounds poison the gastrointestinal cells eventually testicular insects experience death. At high concentrations, acetogenin compounds have a feature as an antifeedant. In this case, the insects no longer eat the parts of the plants they like. While at low concentrations, the usual stomach toxins that cause insects pest death.

Claus (1961) *in* Padang (2001), added that *A. muricata* plants contain isoquanolin which belongs to the alkaloid group. Alkaloids are wet compounds present in certain plants in relatively small amounts and affect biological activity. Further Panda and Gurdev (1995), stated that isoquanolin alkaloid is a compound that causes insects do not eat, in this case is as antifeedant. Added by Dadang (1999), that antifeedant is a substance that substantially does not give rejection of eating activity but gives a sense of dislike to insects.

The main active compound of anona plant (*Anonna squamosa*) with pesticide effect is an annonain consisting of squamosin and asymicin which belongs to the acetylcinine compound and has a good enough contact effect on the insect. In addition it acts as a poison that can resist insects, inhibiting insects that want to put their eggs on the leaves of plants. This poison also plays a role in reducing the appetite of insects.

The mortality of *C. formicarius* larvae is caused by the toxins contained in the betel leaves of the forest, especially the essential oils, alkaloids, tannins, flavonoids, and terpenoids. Betel forest has a very sharp aroma, due to the presence of kavikol and betlephenol contained in essential oils (Moeljanto and Mulyono, 2003). Essential oils and flavonoids act as respiratory toxins. According to (Mulyantana, 2013) essential oils in betel leaf are toxic which works to inhibit the activity of insect respiration, causing death slowly. The action of essential oils is to enter the body of *C. formicarius* through the respiratory system and then cause wilting of the nerves as well as damage to the respiratory system and cause *C. formicarius* larvae can not respirate so that it eventually dies. Larvae exposed to vegetable pesticides betel leaf of the forest looks wilted, hini due to the active compound content of betel leaf forests. According to Yenie, *et al.,* (2013) the tannins contained in the betel leaves of the forest can shrink the tissue and close the protein structure of the skin and mucosa.Application of vegetable pesticides betel leaves causes sweet potato tubers are bitter, so it is not favored by C. formicarius larvae. As a result the *C. formicarius* larvae would not eat and eventually died of starvation. The bitter taste of betel leaves is due to terpenoid compounds. According to Afifah, *et al.* (2015), terpenoids have a bitter and antifeedant taste that can inhibit the activity of eating insects. Terpenoid is also an insect repellent (repellant) because there is a stinging smell that is not liked by insects so that insects do not want to eat. As a result, *C. formicarius* larvae experience death slowly due to hunger.

The active compound of betel leaf forests that enter the body of *C. formicarius* larvae causes death slowly. This is because in vegetable pesticides betel leaf forests contain alkaloid compounds. Alkaloids act as a stomach poison. According to Handayani, *et al.*, (2013) alkaloid contained in betel leaf is arecoline. Arecoline is nitrogenous in foods so it neutralizes stomach acid and works as an astringent that can harden the mucous membrane of the stomach.

Babadotan is a herbaceous plant that grows in the forest area to a height of 2100 meters above sea level. Babadotan leaves contain alkaloids and flafanoid compounds. According to Dinata (2007), flavonoids can be used as an active ingredient in the manufacture of vegetable insecticides. While the alkaloid according to Suryani (1991) *in* Sanyoto (2003), is a bitter and toxic compound can cause dizziness and will not eat the mustard leaves due to its bitter taste and eventually die. Furthermore, Samsudin (2008), stated that the active content of babadotan plant is saponin, flavanoid and polifenol able to prevent pest near the plant (repellent) and able to inhibit the growth of larvae into pupa. Vegetable pesticides can control the attacks of pests and diseases through a unique way of working, which can be through a combination of several ways or in tungal. The workings are very specific: damage to development, eggs, larvae and the pupa, food repellent, inhibits the reproduction of insect female insects, expels insects and inhibits insect skin replacement (Solikin, 2011).

To reduce the use of synthetic insecticides, then controlled by the use of vegetable insecticides. The use of natural insecticides derived from plant extracts proved to be safer because of their short residual life. After application, natural insecticides will break down into compounds that are not harmful to humans and the environment (Desi, 2007). According to Syahputra (2001), natural insecticides have certain advantages that are not possessed by synthetic insecticides. In nature, natural insecticides have an unstable nature that allows them to be degraded naturally. In addition to the negative impacts of synthetic pesticides such as resistance, resurgence and killing of non-targeted bodies, today the price of synthetic pesticides is relatively expensive and sometimes difficult to obtain. On the other hand, farmers' dependence on insecticide use is quite high. Alternatives that can be made between utilizing plants that have the property of insecticides, especially plants that are easily obtained and can be mixed farmers as insecticide preparations.

IV. Conclusions

Based on the result of research, it can be concluded that the effectiveness of vegetable pesticide against mortality of pest *Cylas formicarius* highest until the lowest respectively are: mimba leaves of 97.5%; soursop leaf of 92.5%; leaf anona 87.5%; betel leaves of 82.5%; leaf of babadotan equal to 67,5%; leaves of kenikir of 47.5%; and papaya leaf of 45%.Based on the results of the study it is suggested to use the leaves of mimba, soursop leaf, anona leaf, betel leaf, and leaf of babadotan to control *Cylas formicarius* pest because it can cause mortality of larvae above 50% in laboratory conditions.

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