

Application of Termite Bait with Variation of Methylene Eugenol, Pineapple Peel Extract and Bintaro Liquid Smoke

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Abstract— One of the alternative methods of termite control that can be done is the feeding method. In this study, impregnated bait will be formulated with Pineapple peel extract and Bintaro liquid smoke which functions as a poison for termites. To attract termites to eat poisonous bait, 1% of an attractant compound in the form of methyl eugenol is given to the artificial bait. The concentrations of liquid smoke used were 2 and 4%. Pineapple peel extract is known to have antifeedant activity (reduces appetite) against pests that eat it. The active ingredients in this extract have the ability to damage the digestive mucosa of termites and kill the termite symbiont protozoa so that the ability of termites to digest can be decreased or lost. The concentrations of pineapple peel extract used in this study were 3 and 6%. Based on data obtained from data on time of death, percent mortality and percent palatability of termites to bait, it shows that the best treatment is treatment K7 which causes highest termite mortality for 12 days with palatability of bait is 7.55%.

Keywords— termite, bait, toxic, pineapple peel, bintaro.

I. INTRODUCTION

Coptotermes curvignathus are the main termite types of pests in rubber and oil palm plantations because they can damage the roots and stems of plants and cause the plants to die^[1]. Termites nest in moist soil and wood. West Kalimantan, which is a tropical area with 1.73 million hectares of peatlands and is the fourth largest peat area in Indonesia, has the potential for high intensity of termite attack on its crops^[2]. This is because the soil conditions are wet / moist and contain high organic matter. Termite pest control has been carried out using termiticides by spraying. This technique is less effective in controlling termites, because the level of contact with termites is low and the active ingredients are mostly wasted to non-targets and carried by water / air. In addition, there are negative impacts of the use of synthetic pesticides on the environment and the survival of the ecosystem around the application area.

One of the alternative methods of termite control that can be done is the feeding method. This method is more specific to termites than the spray method and has a higher impact on the termite mortality rate^[3]. The preferred feeding media for termites are materials with a high cellulose content^[4]. Wood with high cellulose and containing methyl eugenol compounds has the highest level of termite palatability. Methyl eugenol is a compound that can attract termites (attractants). This material is mixed with active ingredients that are toxic to termites. This feeding method utilizes the trophallaxis (mutual feeding) properties of termites in one colony^[5]. The worker caste termites whose job is to find food will like and eat the bait, then the toxic active ingredients that have been eaten are spread into the colony and kill the termites.

Based on the nature of these termites, it is expected that the poison bait used has slow action or direct non-lethal toxicity. Termites that carry bait containing poison will carry it into the nest, and the mechanism of trophallaxis and cannibalism between termites can take place. Therefore, a slow action poison was chosen. One of the natural ingredients that has the potential to be used as a slow action poison is the liquid smoke of Bintaro fruit and pineapple peel extract. The liquid smoke of Bintaro fruit contains cerebral compounds which are known to have activities that interfere with termites' nerves or do not directly kill^[6,7]. At its optimum concentration, 7.5% Bintaro liquid smoke can kill as much as 78.42% of termites^[6]. It is also known that pineapple peel extract has antifeedant activity (reduces appetite) against pests that eat it with an optimum concentration of 10%^[8]. In addition, the active ingredients contained in this extract have antimicrobial activity^[9], so that they have the ability to damage the digestive mucosa of termites and kill the termite symbiont protozoa so that the ability of

termites to digest can be decreased or lost. Termites that experience decreased feeding activity will experience hunger and die in their nests and become food for the colony.

II. MATERIALS AND METHODS

Termite harvesting was carried out at a rubber plantation in Sungai Ambawang Village, Kubu Raya Regency, West Kalimantan, Indonesia. The making of bait formulations and application tests was carried out at the Plantation Plant Science Laboratory of Agricultural Technology Department at the Pontianak State Polytechnic.

2.1 Equipment and Material

The equipment used in this study was a set of glass tools, distillator, pyrolysis apparatus, rotary evaporator and test container. The materials used were aquadest, bintaro fruit (*Cerbera manghas*), etanol 96%, methyl eugenol, pineapple peel, sand, and Whattman filter paper no 41.

2.2 Methods

The stages in this research were the pineapple peel extraction, production and purification of Bintaro liquid smoke, phytochemical screening, preparation of termites, bait formulations, application test on termites and analysis of palatability and mortality. The details of the research stages are as follows:

2.2.1 Pineapple Peel Extraction

Extraction of pineapple peel waste using the maceration method. About 10 Kg of pineapple peel is cut into small pieces, then dried for 8 days. The dry sample is then blended dry until smooth. Samples were weighed as much as 3,350 grams and soaked using 96% ethanol solvent with a ratio of 1: 5 (w/v) for 2 x 24 hours and washed 3 times. Filtering is carried out and the filtrate is taken and then evaporated at a temperature of 50°C so that the extract is separated from the solvent.

2.2.2 Production and Purification of Bintaro Liquid Smoke

Twenty Kg Bintaro fruit taken from the field. Then the fruit is washed using clean water and cut into 2 parts using a knife and then dried for 24 hours using a cabinet dryer at a temperature of 60°C until the Bintaro fruit is dry. Then the process of making liquid smoke from Bintaro fruit is carried out using pyrolysis equipment. The burning of Bintaro fruit is carried out in a simple pyrolyzer at 400°C for 8 hours. The liquid smoke obtained is Grade 3 liquid smoke^[6]. Furthermore, distillation is carried out at a temperature of 150°C to purify liquid smoke into Grade 2^[7].

2.2.3 Phytochemical Screening

Phytochemical screening was carried out to determine the content of active compounds in pineapple peel extract and liquid smoke of Bintaro fruit. The phytochemical screening included qualitative tests for alkaloids, flavonoids, tannins, saponins, steroids and terpenoids.

2.2.4 Termites Preparation

Termites are taken from rubber plantation on peatlands located in the Sungai Ambawang Village, Kubu Raya Regency, West Kalimantan, Indonesia. Termites are taken together with the nest and put in a container to be taken to the laboratory.

2.2.5 Bait Formulation

The main ingredient of this stage is filter paper dripped with pineapple peel extract (PPE) and bintaro liquid smoke (BLS) according to the specified treatment with and without methye eugenol (ME). K0= Control negative; K1= 1% ME; K2= 2% BLS+ 1% ME; K3= 4% BLS + 1% ME; K4= 2% BLS; K5= 4% BLS; K6= 3% PPE + 1% ME; K7= 6% PPE+ 1% ME; K8= 3% PPE; and K9= 6% PPE. Then the bait is drained and ready to be applied.

2.2.6 Bait Application Test on Termites

Each of the bait formulations was placed in a container measuring 30 x 10 x 10 cm. Into the container were 33 *C. curvignathus* termites, consisting of 30 worker termites and 3 soldier termites. All containers that have been filled with bait and termites are kept in the dark for two weeks. Each treatment received four replications. During testing the moisture of the sand at the bottom of the test media is maintained by adding water to the sand and the dead termites are immediately removed from the test media. After three weeks the test container was disassembled and the palatability of the bait

formulation and the mortality of *C. curvignathus* were calculated. Each bait formulation was dried on oven for 48 hours at a temperature of 60 ± 2 °C, then weighed.

2.2.7 Lethal Time and Palatability Analysis

Time of death of termite pests was observed at 30 minutes, and every 2 days after bait application for 2 weeks. The faster the time for the pest to die, the higher the rate of poison control in the bait against these pests.

Palatability is based on the weight loss of the bait, which is calculated by the following formula:

$$\text{Palatability (\%)} = \frac{(W1 + W2)}{W1} \times 100\%$$

W1 = bait weight (mg)

W2 = final bait weight (mg)

III. RESULTS AND DISCUSSION

3.1 Phytochemical Screening Analysis

The results of phytochemical screening on pineapple peel extract and Bintaro liquid smoke are shown in Table 1. The results obtained indicate a color change on the addition of reagents. A positive result indicates that the sample contains the phytochemical compounds.

TABLE 1

THE RESULT OF PHYTOCHEMICAL SCREENING OF PINEAPPLE PEEL EXTRACT AND BINTARO LIQUID SMOKE

Phytochemical	Pineapple Peel Extract	Bintaro Liquid Smoke
Alkaloid	+	++
Flavonoid	+	+
Tannin	++	+
Saponin	+	+
Steroid	+	+
Terpenoid	+	+

The table shows that both materials contain all the tested phytochemical compounds. Pineapple peel extract contains more tannin which was observed from a very concentrated color change. The presence of tannin compounds in a material is known to act as an antimicrobial because it is lipophilic^[9]. Tannins can inhibit damage to microbial cell walls, causing leakage and cell death. In termite bait, the presence of tannins in the bait formulation is expected to be toxic to the termite symbiont protozoa, thereby disrupting the termite's metabolism in digesting their food. In the liquid smoke of Bintaro fruit, it can be observed that it contains more alkaloid compounds. This is shown from the very concentrated color change in the test results. Alkaloid compounds are known to be neurotoxin, so that termite death due to these compounds can be observed from the symptoms of changes in termite movements^[7].

3.2 Lethal Time Analysis

Time of termite mortality can be observed in Figure 1. In all treatments, the number of termites that died increased with time. The 24 hours after application, there is no dead termites were seen. In general, death occurred on the second day. K7 was the treatment with the highest number of mortality and increased until the twelfth day. In some treatments, it appears that the pest mortality rate is quite slow (seen from the sloping graph) as in the K3 and K4 treatments, while in other treatments it shows that the pest mortality rate increases significantly from day to day.

Based on the data analysis, it shows that K3 and K4 treatments are significantly different from other treatments. The treatment with the highest percentage of mortality is K5 (4% Bintaro liquid smoke), was not significantly different from treatment K7 (6% pineapple extract + eugenol), but significantly different from other treatments. This shows that giving pineapple extract and liquid smoke at higher concentrations can kill pests more and more quickly.

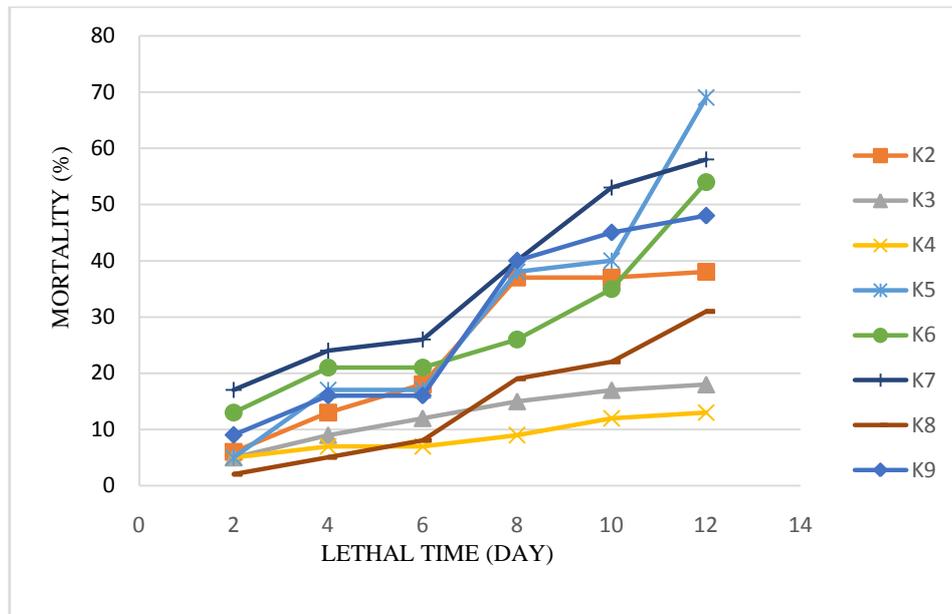


FIGURE 1: Time of Termite Mortality

3.3 Palatability Analysis

Based on the percentage palatability in Figure 2, it can be seen that the application of pineapple peel extract has a high percent palatability compared to giving Bintaro liquid smoke to the bait. This can be caused by the smell of the liquid smoke which termites do not like.

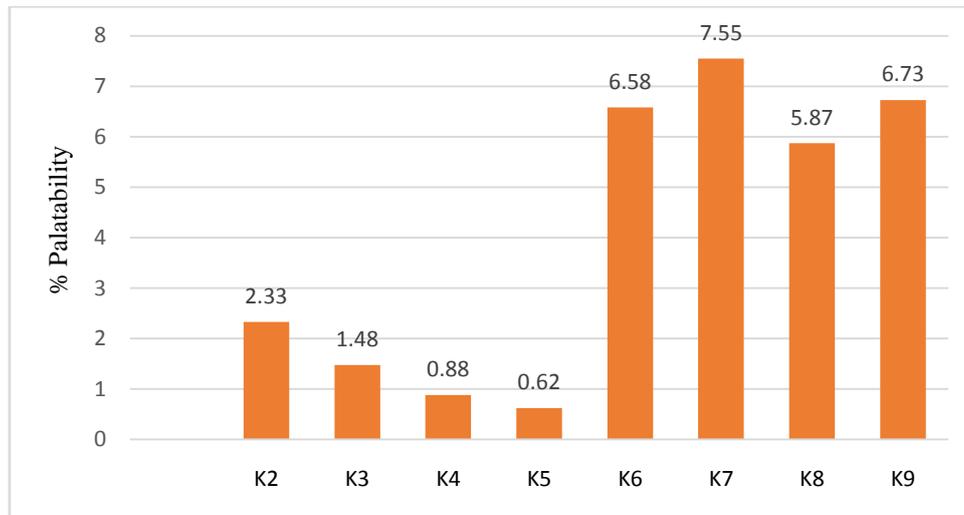


FIGURE 2: The Number of Termite Palatability for Bait Formulations

Pest mortality can be affected by high levels of termite feeding on the toxic bait given. The more bait is eaten, the higher the active compound in the formula is in the target pest's body, so that the poisoning reaction will be faster and the mortality will be higher. However, this was not the case in this study. It can be seen in Figure 2 that the K5 treatment is the treatment with the lowest percent palatability, meaning that the interest in eating termites to bait is very low. This can also be caused by the strong smell of liquid smoke. As much as 0.62% of the bait is eaten by termites, but the termite mortality rate in this treatment is the highest, followed by K7. The comparison between uneaten and eaten bait is shown in Figure 3. The author suspects that the pest's mortality in K5 treatment occurred due to pests of hunger due to no food consumed for days. Different things can be seen in the treatment of K6, K7, K8 and K9. It can be seen that the percent palatability of termites to bait is quite high, ranging from 5.87 to 7.55%. This is also directly proportional to the high rate of pest mortality, so it can be concluded that the death of pests in this treatment is due to the reaction of active compounds in the feed formulations given. In addition, it can be seen that in treatment K6 and K7 have a higher percent palatability than K8 and K9. This shows that the presence of eugenol in the bait increases the interest of termites to the artificial bait compared to bait without eugenol.

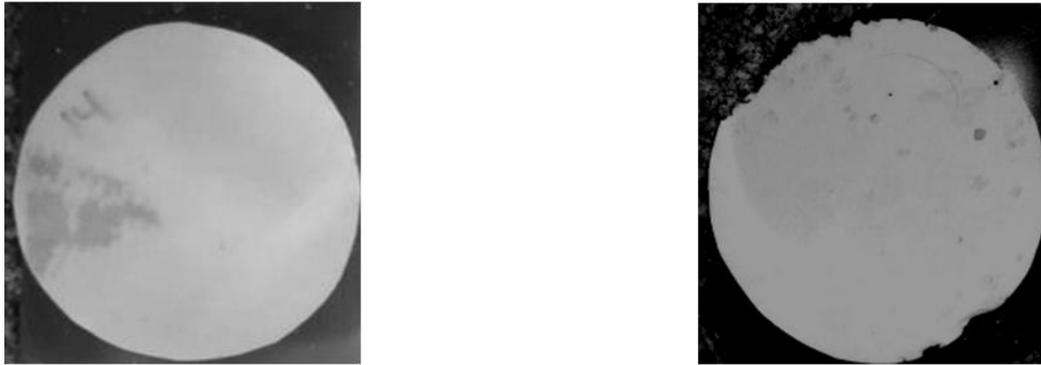


FIGURE 3: Uneaten Bait (Left) and Eaten Bait (Right)

IV. CONCLUSION

Treatment K7 (pineapple peel extract 6% + Eugenol 1%) is the best treatment, where termites have the highest feeding interest in this bait formulation and a highest mortality for 12 days of bait application. Pineapple peel extract formulations with and without the addition of eugenol given to high cellulose sources have the potential as a slow toxic attractant for termite control in rubber, oil palm and several other types of plants on peatlands. This is shown from the data on mortality and percent palatability after application.

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