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Using a Pesticide Extracted from Leaves of Simaung (*Pangium edule* Reinw.) for Control of Soil Termite Pest (*Schedorhinotermes* sp.) as one of Solution Conservation

by
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Abstract

The use of plant extracts for pest control have been considered as an alternative to synthetic pesticides for effective pest control. The present studies examined the efficacy of simaung (*Pangium edule* Reinw) leaf extracts against *Schedorhinotermes* sp. in the Laboratory of the Forestry Faculty of Muhammadiyah University of West Sumatra. The experiment used a Completely Randomized Design with 2 factors, leaf condition, (young leaves or old leaves), and concentration (0 leaves/l (control), 15 g/l, 25 g/l, 35 g/l , and 45 g/l water) with 4 replication. Data were analyzed using ANOVA and DNMRT at P>0.05. *Lethal Concentration* and *Lethal Time* values were generated by probit analysis. The results showed that young leaves at concentration 45 gr/l water mortality value of 95 %, and it was not significantly different from the old leaf extract 45 gr/ l. The $_{50}$, $_{95}$ young leaves was 3.82 gr/l water while old leaves provided a value of 10.15 gr/l water. The fastest *Lethal time (* $_{50}$) 1.3 days was obtained at 35 g/l for young leaves and, 1.4 days old leaves at 45 g/l concentration. Based on these results, using a concentration of young leaf extract (15 gr/l of water) applied to soil will effectively kill 80% of the termites test.

Keywords: *leaf extract pesticide, simaung, Schedorhinotermes sp., (LC), (LT)*

Introduction

Pesticides are one of the means to control pest attack. Along with the rapidly expanding technological developments, the increasing and urgent need for life, the use of chemical pesticides is an alternative to the control of plant pest organisms (OPT). This, given the easy chemical pesticides, and many found and sold on the market and is instant, live applications without a long and complicated work process. Natawiria, (1973) in Sari (2012) states that the use of chemical pesticides in Indonesia has destroyed 55% of pests and 72% of biological control agents. Unwise use of chemical pesticides will pose a risk of poisoning that leads to death especially to wildlife, birds, bees, fertilizing insects, and affect forest biodiversity. On the other hand also cause an impact on the quality of water, soil and air.

One solution to the negative effects of chemical pesticide use is to substitute it with vegetable pesticides. Vegetable pesticides are pesticides whose basic ingredients come from plants. Made from environmentally friendly and biodegradable materials. Utilization of one forest plant, which is well known by the community in Batu Hampar, District Akabiluru in West Sumatera as simaung (*Pangium edule* Reinw). The leaves and seeds contain natural chemicals that can be used in the eradication of insect pests.

Termites are social insects that live in a community consisting of several castes. In forests, termite have an important role to decompose plant remnants, especially dead wood and litter. But under certain conditions termites also become pests, especially for Industrial Plantation Forest (HTI).

The use of vegetable pesticides on termite control is not new, Tarmadi *et al*. (2006) usied bintaro (*Carbera odollum* Gaertn) and amethyst (*Brugmansia candida* Press). Papaya leaf extract (*Carica*

papaya Linn.) the gastric poison method used against ground termites by Zulyusri *et al*., (2012), or the sour leaf extract (*Sambucus javanica* Reinws) by Zulyusri *et al*. (2013). But the leaf extract it self has not been tested in termite control, especially related to the condition/age of leaves. Therefore, this study aimed to determine the mortality and toxicity of simaung (*Pangium edule* Reinw) leaf extract as a pesticide against soil termite pest (*Schedorhinotermes* sp.).

Materials and Methods

This research was conducted in February until August 2017 located in Laboratory Faculty of Forestry University of Muhammadiyah West Sumatra.

The tool used in this research included a catter knife, blender, glass petridihess, measuring 20 ml and 100 ml, aluminum foil, Whatman filter paper, plastic beverage bottle (container of solution), 50 mesh filter, bucket or container, label paper, and stationary. The materials used included a simaung leaves taken from private gardens in the Nagari Batuhampar, District of Akabiluru, Lima Puluh Kota. Termites were collected from the remnants of wood material using a tissue, water, Whatman filter paper.

This research used a Completely Randomized Design (RAL) with 2 factors, namely: the conditions of young leaves and old leaves, and 4 concentrations plus a control as comparison with 4 replications. Each experimental unit consisted of 20 termites. The data obtained were analyzed by analysis of variance, and tested with Duncan's New Multiple Range Test (DNMRT) at the 5% level, and probit analysis was used to determine the value of toxicity. The observation parameters in this study were percentage mortality, leaf condition interaction and extract concentration, *lethal concentration (* $_{50}$, $_{95}$), *lethal time (* $_{50}$)

Results and Discussion

Mortalitas (%)

The results of observation of mortality of test termites after analyzed by using variance showed that the treatment of some concentration of Simaung leaf extract with different leaf conditions gave a significant effect on the value of termite mortality in each treatment. DNMRT further test results at 5% level can be seen in Table 1 below.

Table 1. Mortality Value (%) of Termite by Treatment

Leaves Conditions	Concentration				
	0 gr/l	15 gr/l	25 gr/l	35 gr/l	45 gr/l
Young leaves (A1)	27,50 d	83,75 abc	85,00 abc	93,75 ab	95,00 a
Old Leaves (A2)	28,75 d	68,75 c	70,00 bc	73,75 abc	90.00 abc

Based on Table 1, the lowest mortality was obtained in the treatment using old leaves at a concentration of 15 g/l water that is 68.75%, but not significantly different from the concentrations of 25 gr/l (70.00%), 35 g/l (73.75%), and 45 gr/l (90.00) of old leaf extract, while the young leaf extract at 15 g/l concentration had a mortality of 83.75%, that also was not significantly different from 25 g/l concentration (85.00%), or 35 g/l (93.75%).

The highest mortality was in the treatment using young leaves at a with concentration of 45gr/l water, 95.00%. However, it was not significantly different with the treatment of young leaves at the concentrations of 15 g/l, 25 g/l and 35 g/l and old leaves at 35 g/l water, 45 g/l water. The above data also show higher concentrations of simaung leaf extract increased mortality of termites. These data are reinforced by Dewi (2010) which states that higher concentrations of extract will have higher influence.

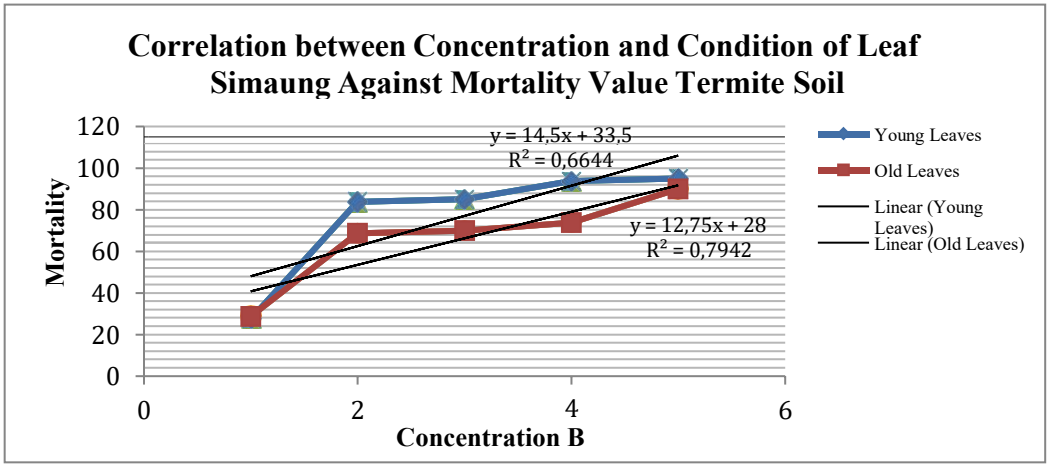

Figure 1. Correlation between concentration and condition of simaung leaves against termite mortality

Based on the regression R Square (R) or coefficient of determination for young leaf extracts 0.664, and old leaves 0.794, - indicates a good relationship between concentration and mortality. According Raharjo (2017), the value of the coefficient of determination (R Square) is only between 0-1. A small coefficient of determination (R Square), means the influence of independent variables on the dependent variable is weak. Conversely, if the R Square value is nearly 1, then the influence will be strong.

Leaf extract was effective at controlling *Schedorhinotermes* sp. pests. This is due to the concentration of simaung leaf extract 35 gr/l water that is capable of termite mortalities that ranged from 90.00% to 95.00%. This opinion is in accordance with the statement of Dadang and Prijono (2008) in Juliati *et al* (2016) which state that vegetable pesticide extracts are effective when mortality rates are greater than 80%.

Effect of Leaf Condition Interaction and Concentration on Soil Termite Mortality

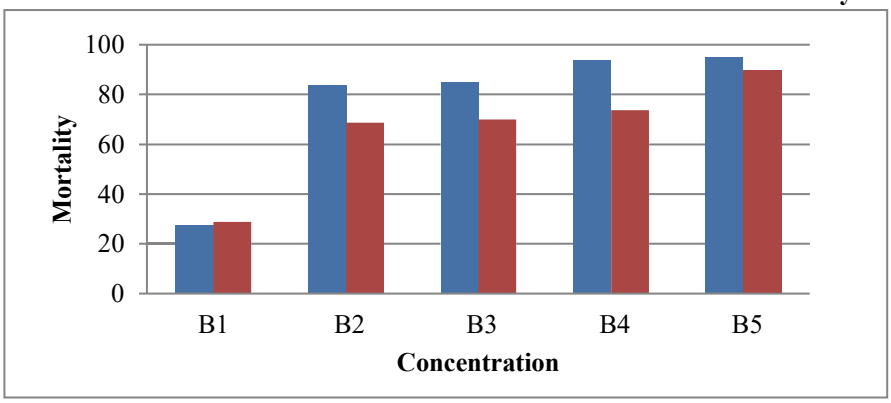

Figure 2. Influence of Leaf Condition and Concentration of Leaf Simaung on Soil Termite Mortality

Figure 2 shows that young simaung leaf and old leaf extract had different mortality values at the same concentration. Young leaf extracts tend to be superior to old leaf extracts. According Yuningsih *et al*. (2008) simaung leaf has the same cyanide content as young seeds which is about 500 ppm. The content of cyanide in the leaves of the simaung is influenced by soil conditions, season and seed structure. Cyanide is a deadly toxin if, not handled properly and wisely.

According Yuningsih *et al*. (2008) declared a python plant can be used as a vegetable pesticide, especially on the leaves. The anti-feedant properties contained in the leaf extract of this leaf, significantly affect termites, this is considering the condition of termite test food that the test paper alone without other options, the content of leaf extracts at various concentrations mixed on the test paper cause termites to be reluctant to eat it. This condition if left continuously lead to termite death. Extractions obtained with two different leaf conditions have different results, this is indicated by the difference in color and odor of the resulting extract solution. Young green leaf extract solution is soft but smelly, while dark green leaves are dark and smell less.

Figure 7. Result of Simaung Leaf Extract with Different Condition but Same Concentration

Differences in extracts produced between young leaves and old leaves can also be influenced by the age of the leaves. The older leaves tend to have a better nutrient content but are at a reduced phytotoxic compounds.

A. Lethal Concentration ($_{50}$, $_{95}$)

Lethal concentration is the value of a certain concentration and it's ability to kill test insects. In this study the calculated *Lethal concentration* (LC_{50}, LC_{95}) as shown in Table 3 below.

Table 3. *Lethal Concentrations ($_{50}$, $_{95}$)* for Young Simaung Extract Leaf Extract and Old Extract.

Leaf condition	$_{50}$,	$_{95}$
Young leaves	3.81 gr/l	49.07 gr/l
Old leaves	10.15 gr/l	165.58 gr/l

According to Table 3, young leaf extracts at concentrations of 3.81 g/l of water can cause 50% termite mortality. While the extract of old leaf leaves requires a concentration of 10.15 g/l of water. Meanwhile, to kill 95% of the test termites required young leaf extract of 49.07 gr/l water, and old leaf extract as much as 165.58 gr/l water. It takes a higher concentration of the old leaf extracts than young leaf extracts to cause death of termites. However, the mortality of each concentration indicates that the leaf extract is toxic certain concentrations.

According to Harbone (1987) in Heriyanto (2008) the toxic properties contained in simaung leaves are suspected bioactive compounds such as cyanide, cyanogen glycosides, alkaloids, flavanoids, and saponins. These compounds cause the presence of biological activity such as food-inhibition, antiparasite, and pesticide. The presence of toxic compounds in simaung leaf extract will provide a response by lowering the consumption rate or inhibiting termite feeding on the test paper and the effect their digestion and metabolism. This influence can be seen in the duration of the mortality period.

B. Lethal Time ( )

Provision of vegetable pesticides from simaung leaf significantly effected the mortality of termites. The *Lethal Time (50)* aims to determine the time required for each treatment to kill 50% of the termites.

Tabel 4. *Lethal Time Value(50)* Leaf Concentration of Simaung (gr/l) Each Treatment (Day)

Treatment	*Lethal time(50 ,)*	
A1 B2 (Young leaf extract 15 gr/l water)	1,7 days	40,8 hours
A1 B3 (Young leaf extract 25 gr/l water)	1,8 days	43,2 hours
A1 B4 (Young leaf extract 35 gr/l water)	1,3 days	31,2 hours
A1 B5 (Young leaf extract 45 gr/l water)	1,4 days	33,6 hours
A2 B2 (Old leaf extract 15 gr/l water)	2,3 days	55,2 hours
A2 B3 (Old leaf extract 25 gr/l water)	2,2 days	52,8 hours
A2 B4 (Old leaf extract 35 gr/l water)	1,9 days	45,6 hours
A2 B5 (Old leaf extract 45 gr/l water)	1,4 days	33,6 hours

Table 4 shows that the treatment of different concentrations of simaung extracts differed with the time required to kill 50% of the test termites. The higher concentration of simaung leaf extracts showed an increase in the speed of killing termite pests. The above data show that the application of several treatments with different concentrations resulted in a range of 50 values ranging from 1.3 days to 1.7 days for young leaf extracts and 1.4 days to 2.3 days for the old leaf extract.

Treatment using young leaf extract 15 gr/l water, provided 50 values of 1.7 days or 40.8 hours (40 hours 48 minutes) after application. Meanwhile, treatment with old simaung leaf extract, *was* 2.33 days or 55.2 hours (55 hours 12 minutes). This shows that low concentrations of young leaf extract can cause faster mortality. It is suspected that the content of young leaf extract is superior to the old leaves so it does not take long in terminating test termites. According to Sa'diyah *et al*., (2013) concentration is directly proportional to the development, the higher the concentration, the development of test insects is increasingly hampered.

This is not different at the concentration of 25 g/l water, young leaf extract with 50 termite of 1.8 days equivalent to 43.2 hours (43 hours 12 minutes) while the old leaf extract 2.2 day or 52.8 hours (52 hours 48 minutes) after application. The concentration of 35 gr/l of young leaf extract was 1.3 days or 31.2 hours (31 hours 12 minutes), 1.9 days old leaf extract or 45.6 hours (45 hours 36 minutes). The concentration of 45 gr / l young leaf extract was 1.4 days or 33.6 hours (33 hours 36 minutes), old leaf extract was 1.35 days or 33.6 hours (33 hours 36 minutes). Significant differences in each treatment are thought to be the result of more active compounds in the body of the termites tested and scattered in every part of the body will accelerate the time required for 50% mortality rate. The quick time to kill 50% of termites at a given concentration can be caused by higher concentrations. Because the higher concentration will cause more toxic compounds into the body of termites

The use of the old and young leaf extract are equally effective in controlling the termite pest at different levels of concentration. Young leaf extract is superior to the old leaf extract. Basically, the use of plant-based pesticides should not use conservative concentrations, this is because any concentration used in pest control will not last long in nature because of its biodegradability. In addition, the use of vegetable pesticides as an antifeedant that inhibits the rate of consumption, inhibits production activities, and breeding so as not to destroy pests. And the vegetable pesticide it self is part of conservation.

Given the effectiveness of leaf extracts in killing test termites, it is expected to become one of the vegetable pesticide materials that can reduce the use of chemical pesticides in termite control. Thus,

pest control in the forestry sector does not contribute to environmental pollution that leads to climate change and the destruction of existing food and ecosystem chains.

The recommended concentration in the use of vegetable pesticides from young simaung leaf extract is at 15 g/l water concentration and for the old leaf extract is 45 g/l water. Leaves used are expected to be one solution for people whose areas are affected by termite pests, where the residence area there is a simaung tree. So that people do not need to look for other alternatives, or other toxins. However, the use of vegetable pesticides is not recommended when plants have not been attacked by pests, this is to avoid the risk of pesticide ineffectiveness when used.

Conclusions

1. The use of vegetable pesticides from leaves of simaung (*Pangium edule* Reinw.) has the potential to control soil pest infestation (*Schedorhinotermes* sp.), because it has a marked effect on mortality of *Schedorhinotermes* sp. during the trial.
2. Extract simaung (*Pangium edule* Reinw) leaf has a different termite mortality value between the condition of young leaves and old leaves used on *Schedorhinotermes* sp., young leaves with concentration 45 gr/l water had the highest mortality 95.00% . This was not significantly different from the use of young leaf extract at 15 gr/l, 25 g/l, 35 g/l and 25 g/l, 35 g/l and 25 g/l concentrations of old leaf extract.
3. The existence of interaction between condition of leaf of simaung (*Pangium edule* Reinw) leaves and concentration, showed that young simaung (*Pangium edule* Reinw) leaf extract equal concentrations had superior mortality and toxicity compared to old simaung (*Pangium edule* Reinw) leaf extract
4. Toxicity value of leaf extract of simaung varies between young leaf extract with old leaf extract where young leaf extract at 3.81 g/l water concentration was able to kill 50% termites while the old leaf extract at 10.15 g/l concentration of new water killed 50% of the test termites. While the fastest time required to kill 50% of termites using the young leaf extract requires a concentration of 35 gr/l of water that was 1.3 days or 33 hours 12 minutes, while the old leaf extract at 45 g/l water concentration was 1.4 days or 33 hours 36 minutes.

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