



Effect of Biopesticide Gamak Leaf Extract on Jabon Caterpillar Pest Mortality (*Arthroschista hilaralis*) in White Jabon Plants (*Anthocephalus cadamba* Miq)

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Abstract

White Jabon (*Anthocephalus cadamba* Miq). is one of the tree species that has high prospects for industrial plantations and reforestation (greening) in Indonesia because it has very fast growth, very good adaptability. Disorders of plant disturbance organisms most commonly found in Jabon, Jabon caterpillar (*Arthroschista hilaralis*) become a major problem that can reduce the quality and quantity of wood. Pest control with chemicals does not provide maximum results so it is necessary to test with biopesticides. The study to examine the effect of gamal leaf extract as a natural insecticide was carried out using a completely randomized design with four treatments, namely the concentration of gamal leaf extract 0% (P0), 50% (P1), 75% (P2), 100% (P3). The results showed that gamal leaf extract as a vegetable insecticide had a positive effect on the mortality of *A. hilaralis* larvae in Jabon plants. The higher the concentration of gamal leaf extract, the higher the mortality rate in *A. hilaralis* larvae. This can be seen in the most effective concentration is the concentration of 100% with a mortality rate of 95%. The highest total mortality of *A. hilaralis* larvae occurred at a concentration of 100% ie 2.1 head / day. The higher the concentration of gamal leaf extract, the higher the speed of death of the larvae

Keywords: *Arthroschista hilaralis*, Gamal Leaf Extract, biopesticide , white Jabon

A. Introduction

The need for wood has become one of the important issues that has become a serious conversation in the past few years. Wood is needed for various industrial needs and building materials on the one hand, but on the other hand forest sustainability is no less important to reduce the impact of global warming as the times progress. Timber demand in Indonesia is estimated at 58 million m³ and most still rely on logging from natural forests and not from cultivation or plantations (Warisno & Dahana, K., 2011).

Jabon putih (*Anthocephalus cadamba* Miq). is one of the tree species that has a high prospect for industrial plantations and reforestation (greening) in Indonesia, due to its very fast growth, its ability to adapt to various growing conditions, its relatively easy silvicultural treatment, and relatively free from pests and diseases serious. This type is also expected to become increasingly important for the timber industry in the future, especially when woodworking raw materials from natural forests are expected to decrease (Agri, F., 2011).

White Jabon (*Anthocephalus cadamba*) is a fast-growing industrial tree species from the Rubiaceae family and has many uses. Jabon has a shorter cycle, so it is profitable in terms of high production in a short time. Jabon is also classified as a light-demanding type and is fast growing at a young age. Jabon trees can grow to 45 m tall with 30 m branch-free height, and can reach a diameter of 160 cm. Jabon tree has a straight and cylindrical stem. Jabon planting is easy to do, easy to get seeds in large quantities and there are no obstacles in the procurement of seeds on a large scale (Martawijaya, A., Kertajusana, I., Mandang, Y.I, Prawira, S.A & Kadir, K., 1989). Other advantages of Jabon plants compared to other hard plants include fast growing with a growth of 10 cm / year stem diameter, harvesting of Jabon wood is relatively short 5-6 years (Halawane, J.E., Hanif N.H., & Khino, J., 2011).

However, in the maintenance of Jabon trees, especially white Jabon there are several obstacles such as the presence of pest attacks. Pest disorders (*Plant Pest Organisms*) can reduce the quality and quantity of wood in the Jabon forest stand. According to Salmawati 2018, one of the most common pests in the Jabon Putih plant is Jabon caterpillar (*Arthroschista hilaralis*). At present, in terms of pest control in cultivated plants, it still relies on chemicals as the main ingredient in controlling pests, but does not provide maximum results (Pribadi, A., 2010).

Biopesticides are a new breakthrough that can be used as an alternative to pest control that is safe, effective and easily obtained. Biopesticides are ingredients of pesticides whose basic ingredients are obtained from plants or plants. The advantages of plant-based insecticides, among others, are rapidly degraded so that they do not leave a residue for a long time, how they work quickly, the toxicity of mammals is low, and the toxicity to plants is also low (less phytotoxic) (Wyriadiputra, S., 2006).

One plant that can be used as a plant insecticide is gamal leaves (*Gliricidia sepium*), because the leaves and skin of the gamal stem have long been known as rodenticides in the American central and gamal extracts are also antifungal (Elevitch & Francis, 2006). The results of the Nismah study. E.L. Widiastuti and Sumiyani, E. (2009) showed that ethanol extract and fresh gamal leaf water can cause 100% death in demental booster pest (*Quadrastichus erythrinae*) after 72 hours of treatment on a laboratory scale. Gamal leaves contain many toxic compounds such as dikumarol, cyanide acid (HCN), flavonoids, tannins and nitrates (NO₃). The results of the study by Nukmal, N., Utami, N., & Suprpto (2010) also prove that the polar (water and ethanol) extract of gamal leaves can cause 100% death in the dementia booster pest (*Quadrastichus erythrinae*) after 72 hours of treatment on a laboratory scale. Gamal leaf extract from macerated results with the lowest concentration of 2.19% can kill 50% of pepper-sucking pests (*Dasyneus Piperis*) after the bioassay test treatment on a laboratory scale.

B. Methodology

This research used a completely randomized design (CRD) with four treatments and four replications, so that there were 16 treatment combinations. Each treatment was given 10 instar IV A. hilaralis larvae, so that the larvae used amounted to 160 tails. The four treatments tested are as follows:

- P0 = Concentration of gamal leaf extract 0%
- P1 = 50% gamal leaf extract concentration
- P2 = Concentration of gamal leaf extract 75%
- P3 = 100% gamal leaf extract concentration

1. Preparation and Maintenance of *A. hilaralis*

Test insects were obtained by collecting *A. hilaralis* larvae from the planted white Jabon which was attacked. The collected larvae are then put into a plastic jar that has been covered with organdy cloth. The larvae are nourished by being fed fresh white Jabon leaves and replaced every day. The life cycle of the larvae will become pupa, then become imago. The male and female moths are then transferred into a special maintenance jar of imago and fed with a 10% honey solution which is applied to cotton and hung in an imago cage.

After a few days, female moths lay their eggs on the jabon leaves that are on the maintenance jar. The eggs are then collected and then maintained until they enter the phase of the instar V larvae which will be used in the study.

2. Making Gamal Leaf Extract (*Gliricida sepium*)

Gamal leaves used in making this extract are selected from fresh leaves. Gamal leaves are cleaned and dried for 2-3 days, then blended until they form fine powder. The powder is then soaked in water for 24 hours. The solution is then filtered using gauze to get a stock solution. The stock solution was then diluted to obtain a pure gamal leaf extract concentration (100%). Gamal leaf extract is then diluted with water to obtain the desired concentration of 0%, 50%, 75% and 100%. Making the solution concentration of each treatment is using the formula:

$$V_1.C_1 = V_2.C_2$$

3. Application of Vegetable Insecticide Gamal Leaf Extract (*Gliricidia sepium*)

The tool used is a plastic container that has been given an organdy cloth cover. The containers were then filled with fresh white jabon leaves and each of them was given IV instar *A. hilaralis* larvae of 10 tails, so that the total larvae used in this study were 160 tails. The application of biopesticides from gamal leaf extract was carried out in the afternoon by spraying white jabon leaves and *A. hilaralis* larvae using a hand sprayer with concentrations of each treatment 0%, 50%, 75% and 100%. After that, the plastic container was tightly closed and left for further observation of mortality of *A. hilaralis* larvae.

Data that has been collected is tabulated in table form, making it easier for the data analysis process. The data is then analyzed using Analysis of Variance or ANAVA and if there are significant differences, it will be further tested by Tukey's honestly significance difference (HSD).

C. Result and Discussion

1. Effect of Gamal Leaf Extract on Mortality of *A. hilaralis* Larvae

The results of observations on the administration of gamal leaf extract (*Gliricidia sepium*) on mortality of Jabon caterpillar (*Arthroschista hilaralis*) with different concentrations for 4 days showed different effects on each treatment. The highest mortality was found in the treatment of 100% extract concentration with an average mortality of 95%, and the lowest was at the smallest concentration ie control with an average mortality of 5% (Table 1, Figure 1).

Table 1. Average Mortality of Jabon Caterpillar (*Arthroschista hilaralis*) After Treatment of Vegetable Insecticide Gamal Leaf Extract

No.	Concentration Treatment (%)	Mortality Average (%)	Notation
1	0 %	5 %	a
2	50 %	45 %	b
3	75 %	72,5 %	c
4	100 %	95 %	d

LSD 5 % = 12,38

Description: Numbers followed by the same letters are not significantly different from the level of the LSD test 0.05

The average mortality of *A. hilaralis* larvae with the treatment of gamal leaf extract concentration showed a significant difference. The concentration of 0% is significantly different with concentrations of 50%, 75% and 100%. This shows that the higher concentration of gamal leaf extract will cause more flavonoid content, so the higher the killing power of *A. hilaralis* larvae, according to Mulyana (2002), the higher the concentration, the more active substances entering or being exposed to insects. Flavonoid compounds are one of the secondary metabolites in gamal leaves which are toxic. These compounds are known to act as insecticides and provide various effects on organisms.

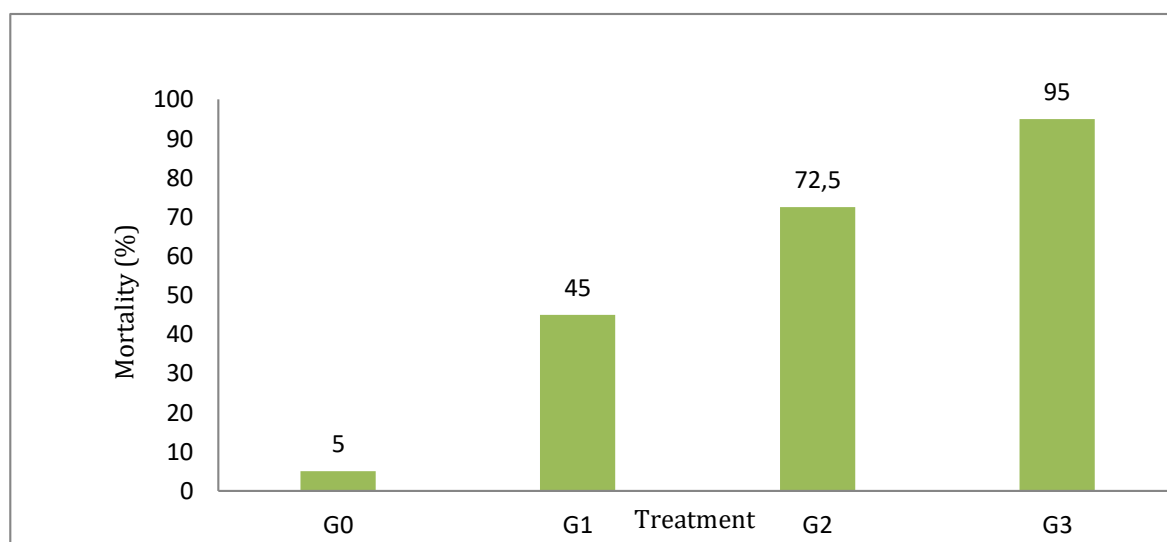


Figure 1. Average Mortality of Jabon (*A. hilaralis*) Caterpillar After Treatment of Vegetable Insecticide Gamal Leaf Extract.

Flavonoid compounds have a way of working that is by entering into the body of the caterpillar through the respiratory system which will then reduce nerve function and damage to the respiratory system and cause the caterpillar to be unable to breathe and eventually die. Flavonoids can also inhibit the ability to eat insects (antifeedant). When these compounds enter the insect's body, the digestive tract will be disrupted and inhibit the taste receptors in the insect's mouth area. This results in insects failing to get a sense stimulus so they are unable to recognize the food and eventually die of starvation.

Control treatment showed 5% hilaral mortality and 50% concentration of gamal leaf extract caused 45% mortality, 75% concentration caused 72.5% mortality and 100% concentration caused 95% mortality of hilaral A. This shows that the higher the concentration of gamal leaf extract, the higher the mortality of *A. hilaralis*.

A. hilaralis which died due to the treatment of biopesticides of gamal leaf extract has poisoned the stomach because it sucks up liquid that has been sprayed onto the leaves of Jabon as a test medium which is food from the caterpillar. This is in accordance with Sinaga, R (2009) which states that flavonoid compounds are stomach poisoning which works when the compound enters the insect's body and disrupts its digestive organs.

2. Speed Percentage of Death of *A. hilaralis* Larvae

The speed of death indicates the number of dead caterpillars in a certain time unit. Data collection is carried out 1 day after application up to 4 days. The highest mortality rate of *A. hilaralis* larvae was found in the treatment with 100% gamal leaf extract concentration of 2.1 head / day while the lowest was found in the control, 0.2 tail / day (Table 2, Figure 2).

Table 2. Average Speed of Death of *A. hilaralis* Larvae after Treatment of Gamal Leaf Extract

No	Concentration Treatment (%)	Speed of Death /day	Notation
1	0 %	0,2	a
2	50 %	1,35	b
3	75 %	2,075	c
4	100 %	2,1	c

Description: Numbers followed by the same letters are not significantly different from the level of the LSD test 0.05

The treatment of plant insecticidal concentrations of gamal leaf extract gave a significant effect on the speed of death of *A. hilaralis* caterpillar. The treatment with a concentration of 0% was significantly different with concentrations of 50%, 75%, and 100%. The 100% concentration treatment showed the highest mortality rate of 2.1 birds / day, but it was not significantly different from the concentration of 75% which showed a mortality rate of 2, 075 head / day. While at a concentration of 50% it only shows a death speed of 1.35 head / day. This shows that the higher the concentration of gamal leaf extract, the higher the speed of death of *A. hilaralis* as Prijono (2007) said that the more concentrated concentrations of biopesticides

given, the greater the effect on the speed of death of target organisms due to the accumulation of toxins caused by the insecticide. This is presumably because the higher the concentration, the higher the content of flavonoids that are toxic to insects.

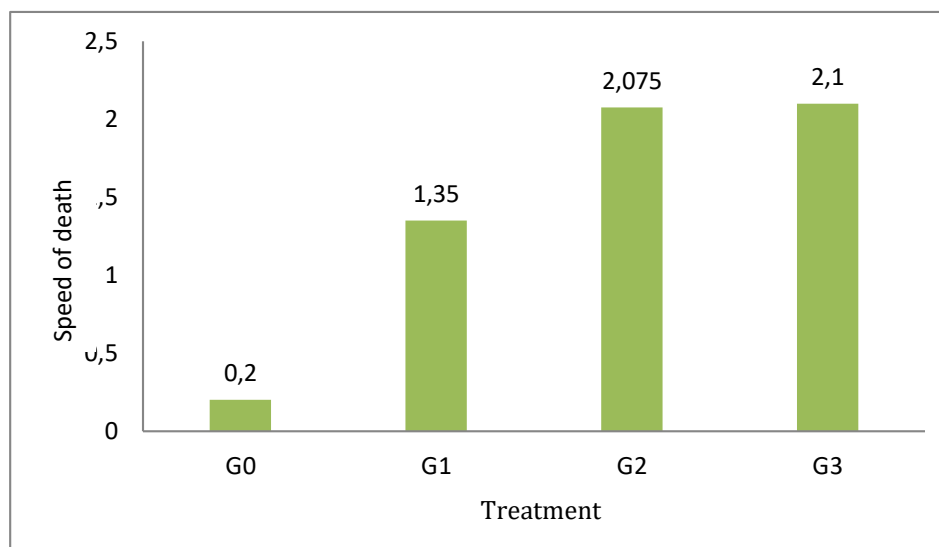


Figure 2. Average Speed of Death of *A. hilaralis* Larvae after Treatment of Gamal Leaf Extract.

The speed of death in the control, slower than all treatments, was 0.2 tail / day. This is due to the control treatment that there is no insecticide that can poison the insects, so that the mortality should not occur. However, in this study, the results of observations on the last day showed a mortality in the control even though only 2 larvae were caused by a failure to adapt to the local environment, not because of the active insecticide.

D. Conclusion

Gamal leaf extract as a plant insecticide has a positive effect on the mortality of *A. hilaralis* larvae in Jabon plants. The higher the concentration of gamal leaf extract, the higher the mortality rate in *A. hilaralis* larvae. This can be seen in the most effective concentration is the concentration of 100% with a mortality rate of 95%. The highest total mortality of *A. hilaralis* larvae occurred at a concentration of 100% ie 2.1 head / day. The higher the concentration of gamal leaf extract, the higher the speed of death of the larvae.

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