TROPICAL PLANTATION JOURNAL

Tropical Plantation Journal. Vol. 1 (2022), No.2
Journal home page: https://jurnal.akpy-stiper.id
ISSN : 2828-1551 e-ISSN : 2828-1543
DOI : https://doi.org/10.56125/tpj.v1i2.9

Toxicity of Natural Insecticides on *Leptocorixa acuta*

Elisabeth Nanik Kristalisasi [1*], Badiatud Durroh [2], Endah Puspitojati [3], Bayu Adirianto [4], Agus Manto [5]

[1] Faculty of Agriculture Institut Pertanian Stiper Yogyakarta (Instiper), Yogyakarta, Indonesia
[2] Faculty of Agriculture, Bojonegoro University, East Java, Indonesia
[3] Polytechnic of Agricultural Development of Yogyakarta Magelang
[4] Polytechnic of Agricultural Development , Bogor, Indonesia
[4] Akademi Komunitas Perkebunan Yogyakarta, Indonesia

*Corresponding author: nanik.kristalisasi@gmail.com

Article History: Received: 07 Juni 2022, Final Revision: 29 Juni 2022, Accepted: 20 Juli 2022, Online Publication: 30 Juli 2022

ABSTRACT

The basic concept of organic farming prevents synthetic chemical compounds from using fertilizers, pesticides, and growth regulators. Natural insecticides are alternative pesticides in pest control on plants because they are available around us and have a good impact on the sustainability of the agricultural environment. This study aims to examine the level of toxicity of several alternative insecticides in controlling the walang sangit (*Leptocorixa acuta*). The research in the laboratory and greenhouse of Instiper Yogyakarta uses 3 natural ingredients, namely neem leaves, tobacco leaves, and *C. odorata* weed leaves at 2 stages of L. acuta on instra 3-4 and adults. Observations were made by looking at pest mortality, attack rate, and yield and analyzed using SPSS 16 software. The results showed that tobacco leaf extract was the most effective source of insecticide, with a mortality rate of up to 90% and damage rates below 9%.

Keywords: Leptocorixa acuta, mortality , pesticides, pest control,

INTRODUCTION

Organic farming is an agricultural production system to return of organic matter to the soil, both planting and livestock waste. The organic matter improves the fertility and soil structure and provides food to plants. The basic concept of organic farming is a way of producing crops by avoiding or, to the greatest extent preventing the of synthetic chemical compounds (fertilizers, pesticides, and ZPT) [1]. Organic farming is a model of sustainable agricultural management that can provide healthy haran and land conditions for crops and maintain a comprehensive ecosystem balance [2]. Organic farming positively impacts the preservation of the environment, resources and healthy living [3] [4]. One of the applications of

organic farming is using plants as natural insecticides.

Natural insecticides are alternative pesticides active ingredients derived from plants or organic treatments to used as pest control compounds in plants [5]. Some of the advantages of natural ingredients as natural insecticides are 1) cheap and easy to make themselves by farmers, 2) relatively safe for the environment, 3) not cause poisoning to plants, 4) difficult to produce immunity to pests, 5) are compatible with other control methods. , 6) produce healthy agricultural products because they are free of chemical pesticide residues. Meanwhile, the disadvantages of botanical pesticides are: 1) relatively slow action, 2) not kill the target body directly, 3) not resistant to sunlight, 4) not practical, 5) cannot be stored, 6) have to be sprayed repeatedly [6].

More than 1800 plants have the potential to can use as natural pesticides [5]. The plants considered a potential source of natural insecticides are Meliaceae, Annonaceae, Asteraceae, Piperaceae, and Rutaceae. However, this does not rule out the discovery of a new plant family to be used as a natural insecticide [7]. Neem (*Azadirach indica*) contains bioactive compounds with great potential ingredients for making natural pesticides. The toxic content found in neem plants is *azadirachtin, salannin, meliantriol, and nimbin*, mainly found in plants' seeds and leaves. The substance azadirachtin has a killing power against insect pests. Neem plants have the potential to be biological pesticides in integrated pest control (IPM) or biological control programs, to reduce or minimize the use of synthetic pesticides[8]. Neem leaf extract with a contrast of 25% is effective in controlling the pest *Sarchopaga Fly* [9]. Neem leaf extract contains toxic compounds that can prevent the hatching of *Aedes aegypti* eggs [9].

Tobacco is one type of natural pesticide-producing plant with the active ingredient nicotine. The active ingredients that play a role in controlling insect pests are nicotine compounds, and their derivatives include nicotine alkaloids, sulfate, and other compounds. This compound works as a contact poison, stomach poison, and fumigant. Nicotine compounds effectively control apids group insects and other soft-bodied insects [9]. Tobacco waste extract concentration of 10.0% in water effectively suppresses the population of Helopeltis sp. in cocoa flowers and does not negatively affect the growth of cocoa flowers. However, the treatment affects the population of predatory spider insects and Reduviidae [10].

Kerinyuh (Chromolaena odorata) is a type of weed that contains a type of alkaloid Pyrolizidine Alkaloids (PAs), which serve as an inhibitor of feeding and insecticide [11]. *C. odorata* leaf extract effectively inhibits the growth of *Phytophthora palmivora* in vitro on cocoa fruit [12]. The application of *C. odorata* leaf extract significantly affects the intensity of attacks on mustard plants [13]. *C. odorata* leaf extract can potentially regulate A. Craccivor aphids for 24 hours with morality of up to 55.00% [14].

Walang Sangit (*Leptocorixa acuta*) is a pest that attacks rice plants. The damage caused causes huge losses to the crop. Attack *L. acuta* can eliminate results up to 40% with an attack rate of up to 17.7% at the age of 56 -75 HST. *L. acuta* began to appear and attack on the grains of rice entering the milk cook. Infested rice will become empty (gabug) [15]. Adult nymphs and *L. acuta* suck grains that are in a milky state. The sucked

grain will become empty (gabug) or the development is not good [16]. The fungus Helminthosporium will usually attack rice is marked by grains of rice at first being white to brownish or blackish. The worst *L. acuta* attack occurs when the rains are evenly distributed in one year. Losses caused can reach 20 – 40% [17]. Based on the literature above, this study tested the toxicity of the content as an active ingredient in natural insecticides in *L. acuta*

MATERIALS AND METHODS

This research has been carried out in the greenhouse Laboratory of the Stiper Agricultural Institute Yogyakarta for 3 months in 2022. This study used a Completely Randomized Design with 2 factors. The first factor is the type of natural pesticide which consists of 3 levels, namely: control, neem leaves, tobacco leaves, *C. odorata* leaves The second factor is stadia *L. acuta* consists of 2 levels, namely: nymph *L. acuta* instar 3 - 4 and adults The test results will be analyzed with a fingerprint with a real level of 5% using SPPS 16. If there is a real influence, further testing will be carried out with duncan multiple range test at the real level of 5%.

Rice cultivation is carried out in the pot. Seed selection, seeding, sowing and maintenance using organic treatments. The medium is a mixture of paddy soil and compost.

Neem leaves, Tobacco leaves and *C. odorata* leaves each weighing 100 grams. The leaves are crushed then dissolved with 100 ml of water and soaked overnight. Filter the soaked solution with gauze, and the solution is ready to be sprayed

L. acuta is obtained by catching it directly from the rice fields. The collected *L. acuta* between the 3 – 4 instar and adult *L. acuta* . Adult and nymph stages with 3rd instar can be distinguished by their morphology including size, color and wing size. The adult *L. acuta* dominated by a greenish brown color with a fairly large size and has perfect wings and slower movements. *L. acuta* with 3-4 instars, light green underside, medium size and immature wings and aggressive movements.

Before the induction of *L. acuta* , rice plants are shaded / confined using fine nets. Induction is carried out on rice plants that will enter the generative phase, namely the formation of grains of rice (milk cooking). Each clump of rice plants (treatment) induced 5 *L. acuta* , stadia instar 3 - 4, and adults.

Applications Natural insecticide were applied 2 times. The first is before the *L. acuta* is inducted into the hood. The second application is 3 days after the first application. In this case, the *L. acuta* is still infested in the hood. The spraying dose was 6 ml for each treatment.

Observation To determine its effect on the level of pest attack and crop yields, the observation parameters that must be studied are:

Mortality (death rate) of *L. acuta* Observations were made every day after application and recorded dead bugs, marked by the fall of *L. acuta* to the bottom of the lid and alive, which was indicated by the presence in the rice clump.

Observation parameters include: the number of panicles, the number of grain in the panicle sample, and the total dry weight of the grain for each rice clump.

The degree of damage is the porsentase of grain infested by each panicle from the amount of grain per panicle. The grain attacked by *L. acuta* showed an open dash and the appearance of a blackish color on the puncture marks of the stilt. The observation of the level of damage is not only caused by *L. acuta* attacks but other factors, both lack of nutrient distribution and environmental factors. Characterized by *gabug* grains but not physically disabled. Calculation of the number of grains of hollow and pitted rice by random sampling of 3 panicles per clump.

data or pest mortality rate

$\frac{Xo - X1}{Xo}$ x 100 %

Xo : Pest population before application

X1 : Pest population after application

Damage rate

$\frac{Bo}{B1} x$ 100 %

Bo : Amount of empty grain

B1 : Total grain

RESULTS AND DISCUSSION

Mortality of *L. acuta*

Table 1. Mortality of *L. acuta*

Treatment	Mortality in Stadia *L. acuta* (%)		Average
	Instar 3- 4	Adults	
Control	46,67	60,00	53,33 c
Neem	60,00	80,00	70,00 b
C. Odorata	66, 67	93,33	80,00 ba
Tobacco	93,33	86,67	90,00 a
Average	66,67 p	80 q	(-)

Description : The average number followed by the same letter in the column or row shows no real difference based on Duncan's multiple spacing test at the real level of 5%.
(-) : no interaction

Based on the results of Duncan's analysis, there are noticeable differences in each of the perpetrators. Tobacco is not significant from *C. odorata* treatment but is significant from neem and control with the highest mortality reaching 90%. Analysis of mortality between stadia *L. acuta* shows a not significant. Mortality of instar 3 – 4 was 66.67% and adult instar was 80%.

The Level of Damage

The damage caused by *L. acuta* is characterized by empty rice grains and blackish grain color.

Table 2. The level of damage caused by *L. acuta*

Treatment	Damage Rate by *L. acuta* (%)		Average
	Instar 3- 4	Adults	
Control	14,80	15,57	15,18 a
Neem	12,94	14,70	13,82 a
C. odorata	9,13	9,37	9,25 b
Tobacco	9,80	8,83	9,32 b
Average	11,67 p	12,12 p	(-)

Description : The average number followed by the same letter in the column or row shows no real difference based on Duncan's multiple spacing test at the real level of 5%.
(-) : no interaction

The results of observations and analysis prove that the high level of damage caused by *L. acuta* that is without treatment (control) is 15.18% and is not significantly different from neem (13.82%). However, there was a significant between the treatment of *C. odorata* and tobacco with a lower level of damage reaching 9.25% and 9.32%, respectively. The level of damage based on the stadia of *L. acuta* does not show a significant.

Total Dry Weight of Grain

Weighing the total dry weight of grain aims to determine the productivity in one clump as well as a comparison of damaged rice grains.

Table 3. Total dry weight of grain

Treatment	Total dry weight of grain (grams)		Average
	Instar 3/4	Adults	
Control	29,42	28,78	27,99 a
Neem	30,51	25,47	29,10 a
C. odorata	28,63	31,04	29,83 a
Tobacco	32,21	28,02	30,11 a
Average	30,19 p	28,32 p	(-)

Description : The average number followed by the same letter in the column or row shows no real difference based on Duncan's multiple spacing test at the real level of 5%.
(-) : no interaction

The results of the total weight analysis showed no significant difference in each treatment. The highest weight was 30.11 g in the tobacco treatment. Instar stages 3-4 and adults showed no significant.

Based on the results of the study, effective natural insecticides to control the pest was tobacco and C. *odorata*. *L. acuta* mortality reached 90% (cigarette butts) and 80% *(C. odorata*). Nicotine compounds and alkaloids in tobacco and *C. odorata* have a toxic effect on stink bugs. It was proven that in the first application the mortality did not show significant mortality, but after the second application the mortality of *L. acuta* reached a maximum point of 60%. Natural insecticides do not have the ability to poison systemically. Natural insecticides are only attached to the husks of rice grains. Under certain conditions, the natural

insecticide solution will be easily degraded so it cannot poison *L. acuta* . The stylet is used to stab and suck the rice juice, it does not suck the toxic compounds because the toxic compounds from the insecticide cannot get into the rice grains..

Natural insecticides are attempting to hit the target directly. The compounds in the pesticide solution will adhere to the *L. acuta* and cause death slowly. Nicotine compounds and alkaloids are contact toxins. The compounds from tobacco extract and *C. odorata* will enter through the spiracal in the abdomen of the *L. acuta*. These compounds will be transported to the respiratory tract, namely trachea. At that time the poison then worked which caused death in the *L. acuta*. The mechanism of action of nicotine and alkaloid compounds is also able to disrupt the work of muscle nerves that cause seizures and death [18][19] . Azadirachtin compounds in neem leaves are not able to kill *L. acuta* directly. Azadirachtin attached to the body of *L. acuta* affects the eating power, leading to slow death [8]. Even so neem extract can still be used before panicles appear. Neem leaf extract will inhibit the process of pest reproduction and hatching of eggs [20].

The stadia in *L. acuta*, instar 3 -4 is proven to be more resistant to natural pesticides than adult *L. acuta*. The results of the analysis proved that the mortality of *L. acuta* instar 3 - 4 was lower, 66.33 %, while adults reached 80%. The resistance of *L. acuta* in young stadia will be stronger, this is because at instar 3-4 is able to increase metabolic processes in the body that encourage immune enzymes. When *L. acuta* reaches adulthood and has mated and laid eggs the survivability is weaker. This drawback strongly supports natural insecticides to work as toxins for *L. acuta*.

The greater the attack rate, the greater the level of damage caused. The damage at control treatment reached 15.18 %. The attack of *L. acuta* on the control treatment was quite large, it was seen that mortality only reached 53.33% during the week of observation. The ability of *L. acuta* to absorb food juice in milk cooking will increase along with the stadia. The degree of damage to adult is greater than that of instar 3-4, reaching 12.12%. Adult *L. acuta* will need more food sources, this is intended for the nutrition of the eggs that are containeda.

Damage to rice grains is not only caused by *L. acuta* attacks but also insufficient nutrient distribution or other pest attacks. During the observation and analysis of the degree of damage caused by other factors did not show a noticeable difference. Allegedly, each treatment on rice clumps has no difference in the pattern of cultivators so that the results produced are not different. This also has an effect on the total amount of total dry grain which shows no real difference. The influence of natural pesticides and stadia *L. acuta* did not interact. This means that the application of natural pesticides has no influence on the stadia, so it can be applied at any time, not looking at the development phase of *L. acuta* in rice plants.

CONCLUSION

The results of the analysis it can be concluded that the leaves of neem, tobacco and *C. odorata* is a plant as a natural insecticide that can be used to control *L. acuta* pests. Tobacco

is the most effective natural pesticide with a mortality rate of 90% in *L. acuta*. There is no interaction between natural pesticides and stadia so the application of natural pesticides is not determined on the development of stadia *L. acuta*

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