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Test of the extract effectiveness of red Betel Leaf (*Piper crocatum* Ruiz and PAV) as electricmate method (Plate) to *Aedes aegypti* Mosquito

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ABSTRACT

Red betel leaves (*Piper crocatum* Ruiz and Pav) which contain chemical compounds such as flavonoids, polyphenolic compound alkaloids, tannins, and essential oils, can be used as vegetable insecticides extracted by the electric mat (plate) method as an innovation of burning mosquito repellent. This study aimed to determine the effectiveness of red betel leaf extract (*Piper crocatum* Ruiz and Pav) as a botanical insecticide. Red betel leaf extract (*Piper crocatum* Ruiz & Pav) has a concentration of 1.25%, 2.5%, 5%, and 10%. It uses univariate and bivariate tests such as the probit test to determine LC50 and LC90, the One Way Anova test to know the concentration that has the potential for bioinsecticide. The results showed that from the univariate test, the average number of mosquitoes that died in the treatment group was 1.25% (26 heads), 2.5% (24 animals), 5% (15 animals), and 10% (20 animals). The data normality test results showed that the data were normally distributed (>0.05) from 4 concentrations. The One Way ANOVA test results showed no difference (sig 0.541) in the increase in mortality in *Aedes aegypti* mosquitoes in each concentration. Based on this study, the red betel leaf extract proved to be effective at a concentration of 1.25% with a value of 43.3% against *Aedes aegypti* mosquitoes and 24 hours of contact time with LC50 at a concentration of 9.901 ppm and LC90 19.524 ppm. In conclusion, red betel leaf as an environmentally friendly bioinsecticide can be used as an alternative to chemical insecticides.

Key words : *Aedes aegypti Mosquito, Red Betel Leaf Extract, Electric Mat*

Introduction

The *Aedes aegypti* mosquito is a group of the Diptera order, insects that have two wings. *Aedes aegypti* prefers to suck blood indoors rather than outdoors and prefers dark places. The *Aedes aegypti* mosquito carries a virus that causes various diseases such as yellow fever, Dengue Hemorrhagic Fever (DHF), and chikungunya caused by viruses that are taken by the *Aedes aegypti* mosquito (Sucipto, 2011).

In 2017, Dengue virus cases occurred in Indonesia with 68,407 cases with 493 deaths (incidence rate) 26.12 per 100,000 population with a significant decrease in 2016 as many as 204,171 cases. In 2017, the provinces with the highest cases occurred in three regions in Java, each West Java with 10,016 instances, East Java 7,838 cases, and Central Java 7,400 cases. Whereas in Riau Province, the 11th rank was dengue virus with 1928 points, and for the death rate, Riau Province was ranked 6th at the National level with 15 cases of death.

Seeing the dengue virus morbidity rate carried by the *Aedes aegypti* mosquito is hazardous, people have become very careful in preventing dengue vi-

rus disease. Many Indonesians misuse chemical insecticides and impact human health and resistance to mosquitoes exposed to insecticides. Insecticides are chemicals used to kill or control insect pests. Insecticides can be solids, solutions, and gases. Insecticides are used to control insects by disrupting or damaging the systems inside the insects (Sucipto, 2011).

The use of insecticides will also raise insect resistance problems, making handling difficult. Excessive use of insecticides is not recommended because they are not specific, so they will kill various other types of insects that are beneficial ecologically. The right and effective method for mosquito control can be done by controlling the environment, biological and chemical control (Kardinan, 2003). The use of chemical insecticides within a certain period of time will lead to resistance of the vector if the use is not right on target, not on the right dose, not on time, and has a negative impact on the environment and non-target organisms (Kemenkes, 2018).

Dewi *et al.* (2015) Mentioned in his research that apart from active chemicals, there are also certain additives such as dyes, preservatives, and fragrances. The composition and concentration of different ingredients for each mosquito repellent can be detrimental if its use is not controlled. The difference in each type of mosquito repellent on the packaging can cause interference with the organs of the body. The active ingredients of mosquito repellents will enter the body through respiration and skin, and then will circulate in the blood. The effect on the skin depends on the sensitivity of the skin. Because more mosquito repellents enter the body through inhalation, the active ingredients that enter through inhalation can cause lung disorders such as irritation; it will also cause the liver to be unable to perform detoxification completely.

Vegetable insecticides are natural insecticides obtained from nature. Several vegetable insecticides that are still used include pyrethrum, nicotine, rotenone, lionene, and azadirachtin. Vegetable pesticides contain not only one type of active ingredient (single active ingredient) but several types of active ingredients (multiple active ingredients). Several types of vegetable pesticides are quite effective against several types of pests. Such as pests in the field, households (mosquitoes and flies), or in the warehouse (Hadi, 2018).

Vegetable insecticides are natural ingredients from plants that have a group of secondary metabolites containing bioactive compounds. Bioactive compounds found in plants are used, such as synthetic insecticides.

The method of using insecticides is divided into seven groups, which are spray insecticides in the form of a gas (aerosol), second foggers/fumigation, the third electric insecticide using electricity, the fourth burning insecticide, the fifth insecticide lotion as a repellent, the six liquid insecticides, and the seven pieces of paper Matt (Hadi, 2018).

Electrical insecticides in the form of mat and liquid are usually used to kill mosquitoes using an electric current. The electric current can cause heat so that the insecticide contained in the mat or liquid will evaporate into a gas. The gas generated can kill insect pests such as mosquitoes. Commonly used materials are propoxur and pyrethroid plus synergistic ingredients (Michigan State University Extensio, 2006)

One of the developments of natural ingredients as botanical insecticides is the use of the Crocatum Ruiz & Pav piper plant, known as the red betel leaf plant. The red betel leaf plant (*Piper crocatum* Ruiz and Pav) is one of the potential medicinal plants which is known empirically to have the property to cure various types of diseases. Red betel is included in an important element that must be provided in every traditional ceremony. This plant is included in the Piperaceae family with the appearance of silvery red leaves and shiny when exposed to light. Red betel leaves contain various chemical compounds such as flavonoids, polyphenolic compound alkaloids, tannins, and essential oils that can be used as insecticides (Parfati, 2016).

Researchers will perform data analysis and observations with the SPSS computer program to determine the probit analysis LC50 (Lethal Concentration), and LC90 (Lethal Concentration) is a calculation to determine the activeness of an extract or compound. The meaning of LC50 and LC 90 is at what concentration the extract can kill 50% and 90% of the organisms to be tested. The extracts were tested experimentally at a certain dose or concentration that would kill the *Aedes aegypti* mosquito.

So the researchers were interested in conducting research with the theme of natural insecticides with the title "Test of Red Betel Leaf Extract Effectiveness (*Piper crocatum* Ruiz and Pav) as an Electric Mat (Plate) Method against *Aedes aegypti* Mosquitoes."

Methods

This research is an experimental study with the post-test-only controlled group design to determine the effectiveness of using red betel leaf extract using the electric matrix method against *Aedes aegypti* mosquitoes.

The research was carried out in two places: making red betel leaf extract at the STIFAR Chemical Laboratory (College of Pharmacy) while the experiment was carried out at the B2P2VRP Laboratory (Center for Research and Development of Vector and Disease Research) Salatiga, Central Java Province.

The research design used a completely randomized design with three treatments and four repetitions with the following information:

K- = Negative control, using distilled water (H^2O)

K+ = Positive control, using synthetic insecticides

B1 = Provision of red betel leaf extract with a concentration of 1.25%

B2 = Provision of red betel leaf extract with a concentration of 2.5%

B3 = Provision of red betel leaf extract with a concentration of 5%

B4 = Providing 10% concentration of red betel leaf extract

Preparation of *Aedes aegypti* Mosquito Research

The study used female *Aedes aegypti* mosquitoes obtained from the Laboratory Insectarium, Center for Research and Development of Vector and Disease Reservoir (B2P2VRP) Salatiga, which were taken randomly and then put in a paper cup. The paper cup is filled with 20 female *Aedes aegypty* mosquitoes. This research requires 36 paper cups and a total of 720 female *Aedes aegypty* mosquitoes.

Preparation of Research Materials

In this research, the ingredients for making red betel leaf extract, namely: red betel leaf (*Piper crocatum* Ruiz & Pav) 2 kg, 96% ethanol as a solvent solution in making red betel leaf extract, a knife for slicing red betel leaves (*Piper crocatum* Ruiz & pav), trays, to air red betel leaves (*Piper crocatum* Ruiz & Pav), research materials for insecticide tests for red betel leaves, *Aedes aegypti* mosquitoes, 50 ml distilled water as a mixture of extracts, 10% sugar water, as food for *Aedes aegypti* mosquitoes

Preparation of Research Tools

The tools for making red betel leaf extract (*Piper crocatum* ruiz & pav), namely: belender, analytical scale, filter cloth, measuring cup, extract making machine (rotary vocum evaporatum), watch, to calculate observation time, dark bottle, gauze, research tool *Aedes aegypti* mosquito, hygrometer, to measure air humidity in the room, paper cup, for holding (storing) for 24 hours, aspirator, to suck mosquitoes, rubber, to tie gauze to cover paper cups, cotton, to be moistened with 10% sugar water as mosquito food, glass chamber (70x70x70 cm), insecticide test area, electrical instrument (plate) as a place for extracts to be heated, digital scales, to weigh insecticide weight / dose, large volume pipette to adjust the concentration of red betel leaf extract, volume pipette small to adjust the weight dose to paper, tweezers to be used to insert the cloth / paper containing red betel leaf into the electric mosquito repellent mat, stopwatch, to count spare time, observation sheets, to record observations, writing tools and paper glue, draft glass chamber, for electric heating of mats containing red betel leaf extract, cloth / paper for absorption of red betel leaf extract, mini glasses, to accommodate and process extract, cctv, to record the behavior of the *Aedes aegypti* mosquito for 24 hours.

Preparation of Red Betel Leaf Extract

The extraction process of red betel leaves is carried out by maceration with 96% ethanol as a solvent. The process is as follows :

a. Red betel leaf (*Piper crocatum Ruiz & Pav*) 2 kg.
b. Red betel leaves (*piper crocatum Ruiz & Pav*) washed thoroughly with water to clean the dirt.
c. Red betel leaves (*Piper crocatum Ruiz & Pav*) were dried at room temperature for 1-7 days.
d. Then, the red betel leaves (*Piper crocatum Ruiz & Pav*) are blended until smooth.
e. The red betel leaf powder (*Piper crocatum Ruiz & Pav)* is put into a dark bottle and soaked until it is completely buried with 96% ethanol and filtered with filter paper. Soaking and filtering is done up to 2-3 times so that the chemical content of red betel leaf (*Piper crocatum Ruiz & Pav*) can be optimize.
f. The filter product is then evaporated with a rotary vacuum evaporator machine. The goal is to separate the red betel leaf extract (*Piper crocatum* Ruiz & Pav) from ethanol and obtain a pure quote.

g. The extract of red betel leaf (*Piper crocatum* Ruiz & Pav) was weighed according to the desired concentration dose.

Implementation of Making Solution Concentration

The research group consisted of a control group and a treatment group. The positive control group was given synthetic insecticide; the negative control group was assigned distilled water (H_2O). At the same time, the treatment group was given red betel leaf extract with a concentration of 1.25%, 2.5%, 5%, and 10%.

Preparation of Parent Solution

The main solution made was a concentration of 10% (gr / v) x 100%, namely, 10 g of red betel leaf extract (*Piper crocatum* Ruiz and Pav) plus 100 ml aqua dest. From the mother liquor, 4 ml was taken for the treatment group given 10% red betel leaf extract (*Piper crocatum* Ruiz and Pav). Furthermore, to get the extract concentration of 1.25%, 2.5%, and 5%, the following formula is used:

V1.N1=V2.N2

Information :
V1= Extract volume to be pipette (mother liquor to be taken)
N1= Extract concentration (mother liquor)
V2= The volume you want to create
N2= The concentration that you want to create

Testing Method

a. Prepare an electric mosquito repellent device containing red betel leaf content (*Piper crocatum* Ruiz and Pav), then measure/weigh according to the specified weight 700 mg.

Concentration

Heat the mosquito repellent plate mat in the draft glass chamber (1 hour) and then transfer it then heat it into the glass chamber testing for 3 minutes with the mosquito repellent condition still heated for 3 minutes, then turn off and enter the *Aedes aegypti* mosquito.

c. 20 *Aedes aegypti* mosquitoes were put into the Glass Chamber testing
d. Then observed for 20 minutes, the beginning of the 30th second, the minute 1.15 ", 2, 2. 30", 3, 3.30 ", 5, 7, 10, 15, 20 minutes recorded each period in the observation sheet.
e. Furthermore, all *Aedes aegypti* mosquitoes were moved using an aspirator into a paper cup that had been given a cotton swab soaked in 10% sugar water, then held for 24 hours on CCTV.

Result and Discussion

The results of the research that has been conducted on the "effectiveness test of red betel leaf extract (*Piper crocatum* Ruiz & Pav) as an electric method of the mat (plate) against the *Aedes aegypti* mosquito." This research was conducted at the Vector Laboratory of the Ministry of Health B2P2VRP Salatiga, Central Java Province, in February-June 2020.

This study used red betel leaf extract as a botanical insecticide for *Aedes aegypti* mosquitoes. There are four concentrations used during research: 1.25%, 2.5%, 5%, and 10%, where the method of using an electric mat at each concentration and treatment of mosquitoes in each test is 20 tails. The number of mosquitoes that died after treatment will be counted and then recorded on the observation sheet.

Based on Table 4 above, it is known that the frequency of the number of deaths of the Aedes aegypti mosquito from 20 tested in each glass test for 24 hours, which has the effectiveness of mosquito-killing power is at a concentration of 1.25% and 2.5% with the highest death rate of 11 *Aedes aegypti* mosquitoes. The first repetition and the lowest concentration of 5% with a mortality rate of 2 mosquitoes the second repetition.

Based on Figure 1 above, there are three repetitions. The *Aedes aegypti* mosquito mortality rate getting bigger at a concentration of 1.25%, with the death rate of 11 *Aedes aegypti* mosquitoes the first repetition. The smallest attention is 5%, with the death rate of 2 Aedes aegypti mosquitoes tested. The second.

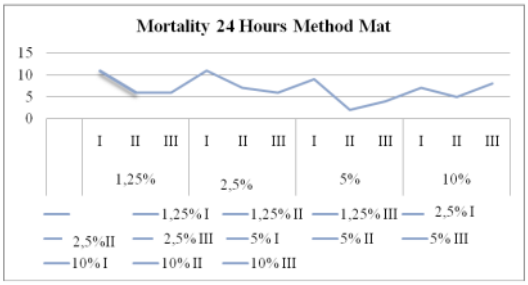

Chart 4.1. Mortality Rate in Each Concentration and Each Test on *Aedes aegypti* Mosquitoes Mat Electric Method (Plate)

Table 1. Frequency Distribution of Aedes aegypti Mosquito Death Numbers Using Red Betel Leaf Extract

No Mosquito	Amount Repetition		Concentration 1	2	3	Average
	2					
	3					
1	20	1.25%	11	8	7	8.6
2	20	2.5%	11	7	6	8
3	20	5%	9	2	4	5
4	20	10%	7	5	8	6.6

And it can be seen that the death rate of the *Aedes aegypti* mosquito in each repetition there is a death rate ranging from a concentration of 1.25% to 10%, that each concentration tested can result in death in the *Aedes aegypti* mosquito even though each tested has a different mortality rate.

Based on the Table 2, the probability solving value shows the estimated value of mortality in mosquitoes caused by red betel leaf extract with the electric mat method; it can be concluded that the LC50 value is obtained at a concentration of 9.901% (9.901 ppm) and for the LC90 value at a concentration of 19.524% (19.524 ppm).

Based on Table 3 above, the data normality test results are Shapiro-Wilk because the number of samples is <50. Shows the probability value of 4 concentrations and three repetitions of red betel leaf extract, the probability value is> 0.05, then the data is normally distributed (sig> 0.05).

Based on Table 4 above, the homogeneous variant test results to determine the mortality rate of the *Aedes aegypti* mosquito have the same data variant as a requirement in Anova testing. The homogeneous variant test used the Levene test and the probability value> 0.05 (sig, 238), so the data came from a population that had the same variance. And the One Way Anova test can be done because the conditions have been met.

Based on Table 5 above, the results of the One Way ANOVA test to determine the differences in the mortality of *Aedes aegypti* mosquitoes at various concentrations of red betel leaf extract using the electric method of the mat and based on the probability value> 0.05, the data is not significant (sig 0.541). Ha is rejected, and Ho is accepted. This study showed no significant difference in the increase in mortality in *Aedes aegypti* mosquitoes at any given extract concentration.

Table 2. Probit Test Results Confidence Limits

Probability		Estimate	95% Confidence Limits for kosentrasi kematian Lower Bound	Upper Bound
	0.01	2.886	2.047	3.637
	0.02	3.335	2.451	4.105
	0.03	3.655	2.747	4.434
	0.04	3.916	2.992	4.7
	0.05	4.142	3.208	4.927
	0.06	4.344	3.404	5.13
	0.07	4.53	3.585	5.315
	0.08	4.703	3.755	5.487
	0.09	4.866	3.917	5.648
	0.1	5.021	4.072	5.801
	0.15	5.717	4.778	6.481
	0.2	6.339	5.421	7.085
	0.25	6.926	6.036	7.654
	0.3	7.499	6.641	8.213
	0.35	8.072	7.246	8.777
	0.4	8.657	7.861	9.361
	0.45	9.263	8.49	9.981
PROBIT	0.5	9.901	9.139	10.653
	0.55	10.582	9.814	11.399
	0.6	11.323	10.522	12.243
	0.65	12.143	11.277	13.217
	0.7	13.072	12.099	14.366
	0.75	14.154	13.022	15.756
	0.8	15.464	14.103	17.5
	0.85	17.146	15.447	19.817
	0.9	19.524	17.287	23.217
	0.91	20.146	17.759	24.127
	0.92	20.844	18.286	25.159
	0.93	21.64	18.881	26.347
	0.94	22.565	19.567	27.742
	0.95	23.668	20.378	29.427
	0.96	25.033	21.371	31.541
	0.97	26.82	22.655	34.355
	0.98	29.394	24.477	38.495
	0.99	33.961	27.642	46.072

Results of Research Implementation

Based on the research results of the treatment of red betel leaf extract with each test 20 tails and a total of 240 *Aedes aegypti* mosquitoes with three repetitions carried out for 24 hours placed in a paper cup under

Table 3. Data Normality Test Results

No	Ekstract	Concentration	Shapiro wilk	
			df	sig
1	Red betel	1.25%	3	0.461
2		2.50%	3	0.363
3		5%	3	0.253
4		10%	3	0.637

Table 4. Homogeneous Variant Test Results

	Levene statistic	Sig.
Mortality	Red betel 1.728	0.238

Table 5. One Way ANOVA Test Results

	F	Sig.
Number of Deaths in Aedes aegypti Mosquitoes	0.774	0.541

CCTV surveillance and fed 10% sugar water in cotton, where Each concentration of 1.25%, 2.5%, 5%, and 10% has a different mortality rate for the tested *Aedes aegypti* mosquitoes, the tested *Aedes aegypti* mosquitoes are domestic mosquitoes, not the wild mosquitoes that are tested because the samples to be tested are samples. Who have never been exposed to vegetable or chemical insecticides because *Aedes aegypti* mosquitoes are not resistant to the red betel leaf extract tried.

Based on the results of 20 minutes of observations made on *Aedes aegypti* mosquitoes after being given red betel leaf extract with the electric mat (plate) method, the mosquitoes did not seem too active when given the section of red betel duan with the met electric process that had been burned and there was no mortality or death rate. knockdown during the 20-minute observation carried out in the glass chamber, after which the 24-hour word was carried out in a paper cup that was given 10% sugar water with CCTV monitoring, there were new signs of death according to the concentration being treated, until 24 hours of observation/observation which is done after 24 hours with CCTV and manual records (counted deaths) of the *Aedes aegypti* mosquito and recapitulated into data that results in mortality.

Total Mortality Rate

The highest mortality rate was at a concentration of 1.25% with an average value of 43.3%, a concentration of 2.5% with an average value of 40%, a concentration of 5% with an average value of 25%, and for a concentration of 10% with a value an average of 33.3% with a total number of mosquitoes from 3 repetitions of 60 individuals. It can be seen that the highest mortality rate is at a concentration of 1.25%. The lowest is at a concentration of 5%. For each test at the given concentration, there is no difference in treatment for *Aedes aegypti* mosquitoes. The measurements are also the same; only differences in time, temperature, humidity are different when tested on the *Aedes aegypti* mosquito. This concurs with Minarwati *et al.* (2012) research, which states that the test determines the most effective concentration. The results showed that from several concentrations of 15%, 20%, 25%, 30%, and 35%, the most effective concentration as an electric mosquito repellent was 25%. Based on the results of this study, the effective engagement was not at the highest concentration (35%), but at a concentration of 25%, and so were the results of the researchers that the effective extract was at the lowest concentration (1.25%) not the highest (10%) with red betel leaf extract using the electric mat (plate) method.

Mortality Test Results

The results of the data normality test used were Shapiro-wilk because the number of samples taken was below <50 *Aedes aegypti* mosquitoes, showing a probability value of 4 concentrations and three repetitions of red betel leaf extract, a probability value of > 0.05, so the data is normally distributed (sig > 0.05) and so that the homogeneous test is knowing the mortality rate of *Aedes aegypti* mosquitoes which have the same data variant > 0.05 (sig, 235) as a condition in the One Way Anova test, the researcher has met the requirements.

The One Way Anova test results showed no significant difference in the treatment given to *Aedes aegypti* mosquitoes. This is evidenced by the value of P-value = 0.541, where the value of p> α with a degree of confidence 95% with or p value> 0.05. So that the concentration tested by the electric mat (plate) method shows that the death rate can be seen that the highest mortality rate is at a concentration of 1.25% and the lowest is 5%, so from these results, it can be seen that the One Way Anova test has no difference.

While the results of the probit test, the LC50 value obtained a concentration of 9.901 ppm and the LC90 value got a concentration of 19.524 ppm, indicating that the results of the probit analysis with linear regression calculations, the activity of red betel leaf extract usually obtained mortality rates in *Aedes aegypti* mosquitoes at a concentration of 1.25% and 2.5 %. In contrast, 5% and 10% gave a low mortality rate with the highest engagement with a 24 hour observation time. Using the electric mat (plate) method to cause an odor or insecticide gas that mosquitoes do not li[9] so that it can kill the Aedes aegypti mosquito. The results of research conducted by Puspa Julistia *et al.* (2018), that red betel leaf extract can inhibit *B. Subtilis* and *P. aeruginous* growth. Still, it cannot impede the development of *E. coli* and *S. aureus.*

Handayani *et al.* (2016) are not by the research conducted by researchers because of differences in betel leaves; researchers use red betel leaves so that differences in time[16]d different methods of exposure. Resea[16] on betel leaf extract (*Piper battle* L) was tested to determine the effectiveness of betel leaf extract bioinsecticide, which does not use an electric method. Still, the death of *Aedes aegypti* mosqu[1]es is very different from the electric mode. Betel leaf extract was tested in concentrations of 1500, 1000, 500, and 0 ppm (control) and analyzed with the One Way Anova test to determine which concentrations have bioinsecticide po[1]ntial and the probit test to determine LC50. The results showed that the average number of mosquitoes that died in control (0 ppm) was 0.67% (3.35%), while the control treatment with a concentration of 500 ppm was 2.67 (13.35%), a concentration of 1000 ppm. Namely 6.33 (31.65%[1] and a concentration of 1500 ppm, which is 10.67 (53.35%). The results of the analysis using the One Way ANOVA test showed an effect of betel leaf extract concentration on the death of *Aedes aegypti* mosquitoes with p = 0.000 (p <0.05). The researchers concluded that betel l[1]f extract was more effective as a bioinsecticide against *Aedes aegypti* mosquitoes starting at a concentration of 1000 ppm and contact time of 45 minutes with LC50 at a concentration of 1422.81 ppm.

The use of materials derived from plants can be used as an alternative to chemical (synthetic) insecticides which are often called vegetable pesticides or bioinsecticides. Vegetable pesticides contain bioactive compounds such as alkaloids, terpenoids, phenolics, and other secondary substances that can affect the nervous or muscular system, hormonal balance, reproduction, repulsive, withdrawal, antifeeding, and respiratory systems (Setyawaty, 2002). Liquid electric mosquito repellent is a mosquito repellent that uses electricity as a medium for vaporizing insecticide liquid into gas. Liquid electric mosquito repellent is more practical in its use (Aryani *et al.*, 2011)

In terms of environmental health, the use of natural insecticides includes chemical vector control using vegetable chemical compounds (derived from plants). This is by the opinion of Kardinan (2005). To avoid mosquito bites and eradicate mosquitoes, materials from nature can be used without using chemical insecticides to affect health. Materials derived from nature produce mosquito repellents, namely leaves, roots, stems, seeds, and flowers that [21]n be used and processed as mosquito repellents. Therefore, alternative insecticides that are safe for the[14]vironment, namely insecticides from plants.

According to the researchers' results, the highest effectiveness of red betel leaf extract with the electric method (plate) was at the lowest concentration (1.25%) in the control of the *Aedes aegypti* mosquito. The one-way ANOVA test results showed no difference between concentrations because the higher the concentration, there was no increase. death in the *Aedes aegypti* mosquito that there is a possibility that the saturated mass of the attention and the vapor produced by the extract is not measured, so there is no difference tested One Way Anova.

Conclusion

The most effective use[12] of red betel leaf insecticides (*Piper crocatum* Ruiz and Pav) with a concentration of 1.25% can kill 43.3% *Aedes aegypt*i mosquitoes 24 hours and given 10% sugar water to mosquitoes so that they don't die of starvation. The greater the concentration, the lower the mortality rate, and the

smaller the concentration, the greater the mortality rate for *Aedes aegypti* mosquitoes using the electric matrix method. Red betel leaf extract (*Piper crocatum* Ruiz & Pav) has a strong enough activity at the lowest concentration and weak at the highest concentration where the LC50 concentration value is 9.901 ppm, and LC90 is 19.524 ppm, so the smell of insecticide gas released by the electric mat is beneficial at the death of the *Aedes aegypti* mosquito.

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