Research Article

Effectiveness of Cempedak Stem Bark as Electric Mosquito Repellent towards *Aedes Aegypti* Mosquito

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Abstract

Dengue Hemorrhagic Fever (DHF) is a disease transmitted through Aedes aegypti mosquitoes and almost always occurs in several regions in Indonesia every year. One alternative to overcome this problem is to use an anti-mosquito mat which is generally made from synthetic chemicals. The more environmentally friendly method is to use cempedak stem bark as a mosquito repellent mat. This study aims to determine the effectiveness of electric mosquito repellent mat from cempedak stem bark with varying concentrations. This research was carried out at the Chemistry Laboratory of FMIPA Medan State University with extraction methods namely socletation. Cempedak stem bark extract was obtained from socletation with methanol which was evaporated to produce thick cempedak stem bark extract. Then, the extract is dissolved into concentrations of 15%, 20%, 25%, 30%, and 35%. The research data obtained was the death of *Aedes aegypti* which was then analyzed by Variant Analysis Statistics Test (ANOVA) and Post Hoc Test. The ANOVA test results obtained that between treatments have a significant value of 0.0002. This indicates that there are significant (real) differences from the five treatment groups. Post Hoc test to determine the most effective concentration. The results show that the most effective concentration as an electric mosquito repellent mat is 30%.

Keywords: mat, extraction, flavonoid, cempedak stem bark, DBD

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Introduction

Today various kinds of tropical diseases are transmitted by mosquitoes. For example, dengue fever is transmitted by the mosquito Aedes aegypti. A. aegypti is a diurnal (active daytime) mosquito and acts as an infectious (vector) flavivirus, which is a virus that causes dengue fever which has caused many losses. Female mosquitoes need blood to stimulate the formation and maturation of eggs, while male mosquitoes do not need blood in their lives. Dengue mosquitoes spread the virus very quickly, because they can bite many times and move around. As a result, the risk of transmission of the virus becomes increasingly large [1].

Many researchers have reported the presence of transovarial transmission of dengue virus in the body of *Aedes aegypti* female mosquitoes into the eggs of their eggs. With the proven existence of transovarial transmission of dengue virus in the body of *Aedes aegypti* mosquito, it is strongly suspected that this mosquito in nature plays a significant role in maintaining the dengue virus [2].

Bloody fever goes hand in hand with the arrival of the rainy season which causes a lot of water puddles. Various alternatives have been made to overcome dengue fever. The eradication of mosquitoes can be done in two ways, namely the chemical method and environmental management. Vector control by chemical means such as fogging to kill adult mosquitoes while for eradicating larvae it can be used abate [3]. Excessive and repetitive use of insecticides can cause undesirable effects such as environmental pollution, so one way to obtain environmentally friendly chemicals is to utilize the natural potential of plants containing bioinsecticides (natural insecticides). Bioinsecticide is an insecticide whose basic ingredients come from biodegradable nature in nature, so that it does not pollute the environment and is relatively safe for humans and livestock, because the residue will be decomposed and easily lost [4]. Vegetable insecticides can kill or interfere with pests and diseases through a unique way of working, which can be through a combination of various methods or singular [5].

One of the plants that has the potential to be developed as bioinsecticide is cempedak stem bark. Cempedak bark contains various types of flavonoids. besides, in this plant triterpenic triterpenoid compounds have been found [6]. The content in the skin of cempedak stem has a very strong odor and is not liked by mosquitoes so that it can affect nerves in mosquitoes and cause mosquitoes to experience instability and eventually die [7].

Materials and Methods

This research was conducted at the Chemistry Laboratory of FMIPA Medan State University for 3 months starting from April to June 2019.

Tools and Materials

The tools used in this research are blender, Erlenmeyer flask, soclet, beaker, measuring cup, aspirator, rotavor, separating funnel, screen printing, analytic balance, stirring rod, knife, bucket, paper cup, gauze, and electric mosquito repellent.

The materials used in this study are cempedak, methanol, aquadest, NaOH, concentrated HCl, Mg tape, starch, and pulp.

Work Procedures

The first step is to take cempedak bark samples. Then dry the skin of cempedak stem using direct sunlight, then chop it into small pieces and then mashed with a blender and sifted. 200 grams of refined sample was extracted by socletation using 70% methanol for ± 6 hours. Then the extract was evaporated with the evaporator to separate the cempedak bark extract with methanol for ± 7 hours until all the methanol was completely gone and all that remained was pure cempedak bark extract. Next it accommodates the thick extract obtained in the Erlenmeyer flask. Dilute the thick extract of cempedak bark into several concentrations of 15%, 20%, 25%, 30%, and 35%. Next, the extract is printed on the screen printing screen. The mold is dried using direct sunlight

Figure 1 Taking Cempedak Stem Bark In Klambir Village, Pantai Labu District

The second step is to find a location that has the potential to become a habitat for the Aedes Aegypti mosquito. The larvae are then maintained until they become Aedes Aegypti mosquitoes. During maintenance, larvae are fed in a sugar solution. The container is changed every other day. After the larvae become pupae, the container is transferred into the maintenance cage to become an adult mosquito. So that obtained sterile adult Aedes Aegypti mosquitoes aged 2-5 days were ready to test as many as 120 tails.

After preparing the electric mosquito repellent mat that has been made and preparing the Aedes Aegypti mosquito to test the effectiveness of the electric mosquito repellent mat. Then counted the number of unconscious Aedes Aegypti mosquitoes in the anti-mosquito stem of the cempedak stem bark in the 30th minute and counted the number of dead Aedes Aegypti mosquitoes in the anti-mosquito bark of the cempedak stem after 8 hours. In the research

parameters measured were the number of dead Aedes aegypti after being given an electric mosquito repellent from cempedak bark extract with different concentrations.

The method of data analysis in this study is Variant analysis (Anava) which is classified as a comparative analysis of more than two variables which aims to compare more than two variables [8]. This method serves to determine whether there is a significant (significant) difference from the extract of cempedak stem bark to the measured parameters, namely the number of dead Aedes aegypti mosquitoes after being given an electric mosquito repellent from different concentrations of cempedak bark extract.

Results and Discussion

Natural insecticide (bioinsecticide) is an insecticide whose basic ingredients come from biodegradable nature in nature, so it does not pollute the environment and is relatively safe for humans and livestock, because the residue will decompose and be easily lost [9]. [6] suggested that bioinsecticides are natural products from plants, such as leaves, flowers, fruit, seeds, and stems that contain secondary metabolites or bioactive compounds [9]. One of the plants indicated ethnobotany can be used as a vegetable insecticide is cempedak. In this study, the bioinsecticide used was using cempedak bark as an electric mosquito repellent because it contains secondary metabolites, one of which is flavonoids. These compounds are thought to be able to kill the Aedes aegypti mosquito.

Electric Mosquito Repellent Effectiveness Test

In this study using test animals Aedes aegypti mosquitoes aged 2-5 days because at that age mosquito body resistance is still strong and productive. This is in accordance with the Biological Insecticide Test Guidelines for Households, that the age of mosquitoes used for testing household insecticides is 2-5 days [10]. The results of the electric mosquito repellent test from cempedak bark extract are shown in **Table 1**.

Table 1 The Number Of Aedes Aegypti Mosquitoes That Fainted On The Electric Mosquito Repellent Mat Cempedak Stem In The 30th Minute

No.	Concentration (%)	Number of Mosquitoes Test	The Number of Mosquitoes That Fainted at the Deuteronomy-			Mean
			I	II	III	
1.	35	20	4	4	5	4,33
2.	30	20	4	5	5	4,67
3.	25	20	4	3	5	4
4.	20	20	3	4	4	3,67
5.	15	20	2	4	3	3

Table 2 The Number Of Aedes Aegypti Mosquitoes That Die On Electric Mosquito Repellent Cempedak Stem Bark After 8 Hours

No.	Concentration (%)	Number of Mosquitoes Test	The Number of Mosquitoes That Fainted at the Deuteronomy-			Mean
			I	II	III	
1.	35	20	7	7	8	7,33
2.	30	20	9	7	7	7,67
3.	25	20	5	5	4	4,67
4.	20	20	5	4	3	4
5.	15	20	4	4	3	3,67

Based on the data in the table above, it can be seen that each concentration of cempedak bark extract has a different ability to the death of Aedes aegypti mosquito so that it gives different results, so that the concentration variation is slightly capable of determining a good concentration to kill Aedes aegypti mosquitoes. The results of the observation also showed that electric mosquitoes made from the skin of cempedak stem proved to be able to kill Aedes aegypti mosquitoes.

To determine whether or not there is a significant (real) difference between the concentrations, a test is performed using a one-way analysis of variance (ANOVA) with $\alpha = 0.05$ as shown in **Table 3**.

Table 3 List of Anava Aedes Aegypti Mosquito Deaths with α = 0.05

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	43,06667	4	10,76667	16,15	0,000231	3,478049691
Within Groups	6,666667	10	0,666667			
Total	49,73333	14				

Based on Table 3, it can be seen that between treatments have a significant value of 0.001 which is smaller than α = 0.05 and F hit is greater than F table. This indicates that there are significant (real) differences from the five treatment groups, in other words the five concentrations have quite different effectiveness in killing Aedes Aegypti mosquitoes.

To find out from the five groups that had significant differences, a further test was performed using statistical tests, namely the Post Hoc test using the Scheffe method so that the results of the calculations can then determine the most effective concentration in killing *Aedes Aegypti* mosquitoes. The results of the calculations are shown in **Table 4**.

Table 4 Post Hoc Test Results

Group 1	Group 2	Scheffe Stat	Scheffe Crit
35%	30%	0,25	13,9122
30%	25%	20,25	
25%	20%	1	
20%	15%	0,25	
15%	35%	30,25	
35%	25%	16	
25%	15%	2,25	
15%	30%	36	
30%	20%	30,25	
20%	35%	25	

The results of the Post Hoc test with the Scheff method show that between 30% and 35% concentrations are not significantly different or insignificant, it means that the two concentrations have the same ability to kill *Aedes aegypti* mosquitoes, but it can be seen that 30% concentration is the most effective concentration. Because effective concentration is a small concentration but can kill more *Aedes aegypti* mosquitoes.

Figure 2 Mat Repellent Electric Mosquitoes From The Cempedak Stem Bark

The ability of electric mosquito repellent from cempedak bark to kill Aedes aegypti mosquitoes is thought to be caused by the presence of active compounds. Cempedak bark contains a complex mixture of various types of flavonoids namely types: flavanone, flavone, 3-prenylflavone, pyranoflavone, oxepinoflavone, dihydrobenzoxanthone and furanodihid robenzosanton [11-13].

[7] found that the content in the skin of cempedak stem can affect nerves in mosquitoes and the result is that mosquitoes experience instability and eventually die. But besides that, it is also suspected that the chemical compounds contained in concentrated concentrations of 35% predominantly are caused by differences in molecular weight between the two compounds so that they do not synergize in increasing the stability of cempedak bark extract as a natural insecticide and result in concentration the number of dead mosquitoes is less than the concentration of 30%.

Conclusion

Based on the results of the research, it can be concluded that the electric mosquito repellent made from cempedak bark extract with several concentrations turned out to be able to kill Aedes aegypti mosquitoes and the concentration of cempedak bark extract which was most effective at killing Aedes aegypti mosquitoes was 30% compared to other concentrations.

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