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The Effect of Extract Papaya (*Carica papaya*) Seed on *Aedes aegypti* Larvae Mortality

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Abstract

Papaya plant is a plant originating from America with the scientific name Carica papaya. Papaya seeds contain flavonoids, glucotropaeolin, and phosphatidyl choline. Flavonoids are chemical compounds that have insecticidal properties. Flavonoids attack the nerves in several vital organs of insects, causing a weakening of the nerves, such as breathing and causing death. This study aims to examine the effect of papaya seed extract (Carica papaya) on the mortality of Aedes aegypti mosquito larvae and to determine the minimum inhibitory concentration of papaya (Carica papaya) seed extract required against Aedes aegypti mosquito larvae. The Aedes aegypti mosquito has a complete metamorphosis, and when it is in the larval stage, the Aedes aegypti mosquito has 4 phases, namely instar I, instar II, instar III, and instar IV larvae. The larvae used in this study were the larvae of the third instar Aedes aegypti mosquito. The research method used is a laboratory experimental method using a completely randomized design (CRD) where there are 4 treatments and 3 repetitions. The concentrations used in this study were 1 positive control, 10 ml, 30 ml, and 50 ml. The results were analyzed by One way ANOVA test followed by Post-Hoc LSD analysis. The results of the research that has been carried out show that the papaya seed extract (Carica papaya) which kills the most Aedes aegypti mosquito larvae is at a concentration of 50 ml, where in the first and second tests succeeded in killing 4 out of 5 larvae. In the last iteration managed to kill 5 out of 5 larvae. And it can also be seen that the minimum inhibitory concentration is at a concentration of 10 ml, where in 3 repetitions it can only kill 2 to 3 larvae from a total of 5 larvae. The 50 ml concentration is also the concentration that has the fastest effect, where on the fifth spray alone, there are already dead mosquitoes. While at a concentration of 10 ml, it takes a longer time, namely the seventh spray.

Introduction

In today's modern era there are still many health problems caused by insects, one of which is mosquitoes. Mosquitoes are one of the factors that cause disease that can be categorized as dangerous, because there are types of mosquitoes that can cause disease which can cause death for humans. Mosquitoes usually breed in places where there is standing water. Types of mosquitoes can be seen from the place of breeding. Mosquitoes are insects that can use water in their environment, both natural water and artificial water sources that are permanent or temporary (Elita, 2013).

The mosquito life cycle is influenced by the availability of water as a medium for their reproduction from eggs to adult mosquitoes. In their life cycle, mosquitoes need three kinds of places for their survival, the first is a place to breed, the second is a place to rest, and the third is a place to look for blood. The three types of places are a system that is interrelated with each other for the survival of mosquitoes (Elita, 2013).

So far, many cases of disease in humans are caused by mosquitoes, one of which is Dengue Hemorrhagic Fever (DHF). Dengue Hemorrhagic Fever (DHF) is a disease caused by a virus carried by the Aedes aegypti mosquito. Dengue fever is still a public health problem today. Since the first time this disease was discovered, until now the number of cases has shown an increasing percentage both in number and area of infected areas, and Extraordinary Events (KLB) always occur every year (Novitasari, 2014).DHF can also be influenced by several factors including the environment, and human behavior. Because most people still don't care about the cleanliness around their own homes, for example, they rarely drain the bathroom tub, let garbage pool in water such as used cans, used bottles, and so on so as to create a place that can be used for mosquitoes to breed. The weather conditions in Indonesia are not always stable, and also high rainfall in the rainy season is also a supporting factor for the breeding facilities of the *Aedes aegypti* mosquito (Silalahi, 2014).

The South Sumatra Health Office (Dinkes) recorded cases of Dengue Hemorrhagic Fever (DHF) in South Sumatra in 2020 reaching 2,326 people. This number has decreased compared to 2019, which reached 2,799 people. His party noted that the highest dengue cases in South Sumatra came from the city of Palembang as many as 435 people. While the lowest was in Empat Lawang Regency as many as 20 people. With details, namely Palembang 435 people, Banyuasin 271 people, Prabumulih 242 people, OKU Timur 183 people, Muara Enim 182 people, Musi Banyuasin 171 people, Lahat 154 people, Lubuklinggau 145 people, and Ogan Ilir 102 people. Then, PALI 101 people, Ogan Komering Ilir (OKI) 87 people, Pagar Alam 80 people, Musi Rawas 66 people, South OKU 39 people, North Musi Rawas 27 people, OKU 21 people, and Empat Lawang 20 people.

The number of free mosquito larvae in Indonesia in 2011 was 76.2%, and increased in 2012 by 79.3%. Although slightly, in 2013 there was another increase of 80.09%. The rise and fall of the larva-free rate in Indonesia every year has not yet reached the national target that has been set. *Aedes aegypti* mosquito that has sucked the dengue virus as a transmitter of dengue fever, transmission occurs when the mosquito bites a human. The *Aedes aegypti* mosquito has a very wide distribution of dengue, to almost all tropical and subtropical areas around the world. This has resulted in the spread of the disease being very wide, both in remote rural areas and in big cities (Silalahi, 2014).

The number of cases of dengue fever requires appropriate countermeasures or solutions to reduce it. Since 1976, Indonesia has been using synthetic abate products (*temephos*) to control mosquitoes. In 1980, this synthetic abate (*temephos*) was established as part of the *Aedes agypti* mosquito control program in Indonesia. However, it turns out that there is resistance from various species of mosquitoes which are vectors of disease. Reports of resistance of Aedes agypti larvae to abate (*thermophos*) have been found in several other countries such as Brazil, Bolivia, Argentina, Cuba, and Thailand (Andrian, 2008).

In addition to the impact caused is resistance, mosquito nest control using chemicals such as abate can cause environmental pollution because it contains chemicals that are difficult to decompose in nature. Therefore, to reduce the negative impact of using chemical insecticides, it is necessary to develop other safer alternatives that can inhibit the development of mosquitoes. One of them is to use biopesticides (botanical insecticides) (Yunita, 2009).

Biopesticides have advantages when compared to synthetic insecticides, namely their easily biodegradable nature. So it will not pollute the environment and also will not be harmful to humans because the residue content is easier to lose. Another plus is that it is renewable and also more affordable. Plants that can be used as a source of *biopesticides* usually contain various kinds of chemicals such as *alkaloids, flavonoids, glycosides*, and other compounds that are toxic (Dewi, 2007).

Plants that can be used as *biopesticide*s are Green Betel (Piper betle), Srikaya (*Annona squamosal*), and Papaya (*Carica papaya*). Betel leaves, srikaya seeds, and papaya seeds each contain different chemical compounds. The chemical compounds contained in these three plants can act as poison for mosquito larvae. In several studies that have been carried out, saponins and alkaloids have a way of working as stomach poisons on larvae. Meanwhile, *flavonoids* and essential oils act as respiratory poisons so that they can cause death for larvae (Cania & Setyaningrum, 2013).

The presence of *Aedes aegypti* larvae in an area is an indicator of the presence of *Aedes aegypti* mosquito populations in that area. The management of DHF has a fairly complex problem, because the cure for this disease has not yet been found. But there is the best way to prevent this disease, namely by eradicating the *Aedes aegypti* mosquito as the transmitter of this disease. This activity is commonly known as the Eradication of Dengue Hemorrhagic Fever Mosquito Nests (PSN-DBD) (Depkes RI, 2015).

Methods

This research will be conducted on 7-14 September 2021. The extraction process is carried out at the Biochemistry Laboratory of UIN Raden Fatah Palembang. The treatment with extract testing was carried out at the Basic Biology Lab at Raden Fatah State Islamic University Palembang.

Data collection technique

1. Primary Data

a) *Aedes aegypti* Larvae Mortality

The data obtained from the treatment of Aedes aegypti larvae by giving papaya seed extract (*Carica papaya*) 3 treatments with each different concentration. Aedes aegypti larvae were observed within 24 hours with every 1 hour spraying. By using a 50ml spray bottle as a tool to give mango skin extract (*Mangifera indica*) to *Aedes aegypti* larvae. Then after 24 hours you can observe how many larvae experience mortality.

2. Secondary Data

a) Validation Questionnaire

Questionnaire is one of the data collection techniques in the form of a set of written questions and statements that are asked to respondents to be answered (Sugiyono, 2019). In this study, a questionnaire was made to determine the feasibility of the module media as a supporting learning medium for growth and development materials.

b) Documentation

Documentation in the form of an activity to obtain data from the same source the same source through different activities produce documents in the form of images and writing (Sugiyono, 2018). In this study, documentation was carried out by collecting data which included group photos teachers and validation experts in certain fields.

Data Analysis Technique

Analysis of the data used in this study is quantitative data to determine growth and development using the Analysis of Variance (ANOVA) test using a software application, namely SPSS. The requirements of the one way ANOVA test in addition to numerical scale data are that the data must be normally distributed and the data variance must be homogeneous. If the data is not normally distributed and the data variance is not homogeneous, data transformation can be carried out (Dahlan, 2014).

If the results of the transformation data are successful, then the one-way ANOVA test is continued. If the results of the analysis show a significant difference, then analyze the data using the Past Hoc test (advanced test) LSD to find out where the differences are between the pairs of groups. The degree of significance used is = 0.05 (a significant difference if p 0.05) (Dahlan, 2014).

Results and Discussion

In the study of papaya seed extract (*Carica papaya*) on mortality of *Aedes aegypti* mosquito larvae, observations were made using various concentrations, namely 0 ml (positive control), 10 ml, 30 ml, and 50 ml. In 4 plates each containing 5 third instar larvae of *Aedes aegypti* mosquitoes with observations made for 24 hours by looking at the number of larvae experiencing mortality.

After making observations then accumulated in the observation table. The following is data on the number of *Aedes aegypti* mosquito larvae mortality:

Table 1. Aedes aegypti Mosquito Larvae Mortality Data

Sample	Extract Concentration	Aedes aegypti Mosquito Larva Mortality For 24 Hours			Average
		Repetition			
		I	II	III	
P0	0 ml	0	0	0	0
P1	10 ml	3	2	3	2,6
P2	30 ml	3	3	4	3,3
P3	50 ml	4	4	5	4,3
		Average			2,5

The test results of papaya seed extract (Carica papaya) with doses of 10 ml, 30 ml, and 50 ml for 24 hours can affect the mortality rate of Aedes aegypti larvae. The following is the average measurement before and after treatment.

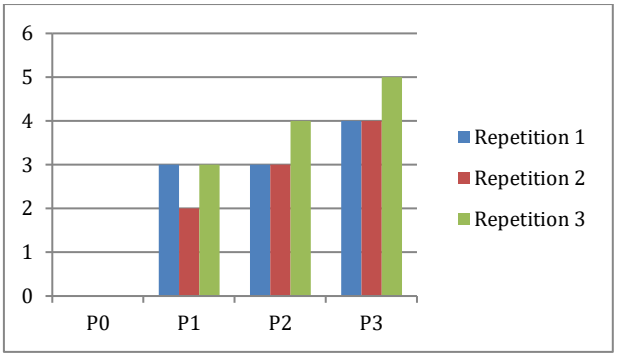

Figure 1. Mortality of *Aedes aegypti* Larvae Due to Concentration of *Carica papaya* Extracts

This study was conducted to determine the effectiveness of papaya seed extract (*Carica papaya*) as an inhibitor of mortality of *Aedes aegypti* mosquito larvae. In this study, papaya seed extract was used which was extracted by maceration method using 96% ethanol solvent which was intended to obtain *flavonoids* and *limonoids* contained in papaya seeds which were thought to have a *larvicidal* effect on *Aedes aegypti* mosquito larvae.

In this study, there were 4 treatments. 1 treatment as a positive control, and 3 treatments with each concentration of 10 ml, 30 ml, 50 ml, each control was tested by spraying on the larvae of the Aedes aegypti mosquito once every 1 hour for a period of 24 hours with each The treatment was repeated 3 times. During a period of 24 hours, the results showed that the positive control treatment was still alive.

At a concentration of 10 ml when the spraying test was carried out, the larvae movement was faster and more active than before, the mortality of *Aedes aegypti* larvae began to be seen at the seventh hour of spraying. The test showed 1 larvae died in the next hour. Then the tenth sprayed the number of larval deaths increased by 1 more. There were 2 larvae that remained alive for a period of 24 hours, while 3 larvae experienced mortality. Then a second iteration was carried out, where there were a total of 2 larvae that died during this repetition of the test. And in the third repetition the number of larvae that experienced mortality was 3 tails.

At a concentration of 30 ml larval death began to be shown in the sixth spray. Then in the next hour, namely at the seventh hour, 1 larvae again experienced mortality. And on spraying the nine larvae again experienced the death of 1 which in this test was the last larvae to die. Furthermore, in the second iteration of the larvae that died during the test there were as many as 3 tails, the same as the first test. And on the third repetition the number of dead larvae increased by 4 tails.

At a concentration of 50 ml where this is the treatment test that looks the most shows a very accurate significance. The results obtained that from the beginning of the repetition test showed great results, as many as 4 tails. In the second repetition, the same results were obtained, there were 4 larvae that died. So that in the first and second tests, only 1 live larva was left within 24 hours. And in the third repetition or the last repetition, it was found that all mosquito larvae died within 24 hours. This concentration is also the concentration with the fastest reaction, where on the fifth spray there was already one larva that died in each repetition. Then followed in the following hours there is always 1 larva that dies at every spraying.

*Limonoid*s are analogues of juvenile hormones in insects that function as regulators of larval cuticle growth. As a stomach poison, *limonoids* can enter the body of *Aedes aegypti* mosquito larvae. *Limonoids* enter the digestive tract through the ingestion of ingested extract concentrations. Insecticides will enter the digestive organs of insects and are absorbed by the intestinal wall and then circulate with the blood which will interfere with the mosquito's metabolism so that it will lack energy for its life activities which will cause the mosquito to spasm and eventually die.

Conclusions and Recommendations

Based on the results of research and data analysis that has been carried out, it can be concluded that papaya seed extract (C*arica papaya*) affects the mortality of *Aedes aegypti* mosquito larvae, this is because papaya seeds contain flavonoid compounds that have antibacterial activity. The mechanism of action of *flavonoids* is thought to denature bacterial cell proteins and damage cell membranes, causing poisoning of *Aedes aegypti* mosquito larvae. Based on the results of the research and the One Way ANOVA test, it was found that F count = 50,000 > F table (0.05) = 4 in other words there was an effect of papaya seed extract on *Aedes aegypti* mosquito larvae, and continued with the Post Hoc LSD further test, the results showed that there were differences which is significant, it states that Ha is accepted and Ho is rejected.

The minimum inhibitory concentration of papaya (*Carica papaya*) seed extract which was effective against the mortality of *Aedes aegypti* mosquito larvae was a concentration of 10 ml for a period of 7-10 hours which reached 3 of the total 5 *Aedes aegypti* mosquito larvae. The higher the concentration of the extract given, the higher the mortality rate experienced by the *Aedes aegypti* mosquito larvae.

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