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ELECTRIC MOSQUITO REPELLENT EFFECT OF MALE BREADFRUIT FLOWER MAT CAUSES MOSQUITO MORTALITY *Anopheles sp.*

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mosquito bites; Malaria; *Anopheles sp*.; male breadfruit flower

ABSTRACT

Through mosquito bites, parasites of the genus Plasmodium spread the disease known as malaria. Malaria-carrying mosquitoes of the genus *Anopheles sp*. One secure method of controlling the *Anopheles sp.* mosquito population is biological mosquito control. Since the biological method does not use chemicals but rather the phytochemicals found in plants, one of which contains compounds from the male breadfruit flower and is capable of acting as a vegetable larvicide or mosquito repellent. The aims of the study is to evaluate the effectiveness of electric mosquito mats that contain male breadfruit flowers to kill or cause mosquitoes (*Anopheles sp*.) to die. A completely randomized design (CRD) was used for the experiment. The results showed a change in the mortality of Anopheles sp. mosquito larvae. After exposure to breadfruit flower mat doses of 0.5gr, 1gr, 1.5gr, 2gr compared to no administration. Thus, it was concluded that male breadfruit flower mats with concentrations of 0.5gr, 1gr, 1.5gr, and 2gr had an insecticidal effect on the mortality of Anopheles sp. mosquitoes. with an effective concentration of 2gr (96.5% mortality), of which 50% mortality (LC50) of Anopheles sp. larvae. Occurred at a concentration of ethanol extract of male breadfruit flowers dose 0.36gr.

INTRODUCTION

Malaria is a disease transmitted by parasites from the genus Plasmodium through mosquito bites (Yunidasari, 2017). Of these types of mosquitoes, it turns out that there are 20 types of *Anopheles sp.* mosquitoes, which can transmit malaria (Sembel, 2009). In general, efforts to control malaria are still focused on finding and treating sufferers, while the vector aspect has not been optimally implemented. The development of natural insecticides is the best solution at this time because the continuous use of chemical insecticides can cause environmental pollution, the death of several types of living creatures, and the resistance of insects that are eradicated, so it is necessary to use natural insecticides that do not pollute the environment and are relatively safe for humans because they will quickly disappears in nature (Kardinan, 2011; Saputri et al., 2023).

Biological mosquito control is a safe way to control the Anopheles sp. mosquito population. because the biological method does not use chemicals but contains plant phytochemicals which have the ability of vegetable larvicidesor mosquito repellent (Asrianto et al., 2023).Breadfruit is a plant that is spread evenly because it can grow almost all over Indonesia. This plant produces female flowers (fruits) which are usually used as food because the flesh of the fruit is thick so it can be eaten (Sumadji et al., 2022). Breadfruit plants can be used as mosquito repellents because they contain flavonoids which are respiratory inhibitors or respiratory poisons (Djojosumarto, 2008). Other male breadfruit flower compounds, namely tannins and saponins, also have an effectinterfere with digestion and absorption of food so that insects can experience death (Moniharapon et al., 2023). Therefore it is necessary to carry out

laboratory tests to determine the effectiveness of electric mosquito repellents for male breadfruit mats that cause mortality/ death of *Anopheles sp.* mosquitoes. The aims of the study is to evaluate the effectiveness of electric mosquito mats that contain male breadfruit flowers to kill or cause mosquitoes (*Anopheles sp*.) to die.

RESEARCH METHOD

Research design

This laboratory experimental study was conducted at the Zoology Laboratory, Faculty of Mathematics and Natural Sciences, Pattimura University from September to November 2022, using a completely randomized design (CRD) with 5 treatments and 3 replications. The population in this study were Anopheles sp. larvae. obtained from mosquito larvae breeding places in the house (in door). The samples in this study were 300 Anopheles sp. larvae. instar III each was placed in 15 plastic cups, each of which contained 20 Anopheles sp. larvae. instar III.

Collection of *Anopheles sp.* Mosquito Larvae

Larval retrieval was carried out following Lestri et al. (2023) namely sampling of mosquito larvae inside the house (in door), observation of mosquito larvae inside the house is carried out at the breeding sites of mosquito larvae, then the larvae are taken by the single larva method (one scoop) using a dipper from a water reservoir (pot). flowers) then put into bottles and labeled for further transport to the laboratory for identification. After that, an examination of Anopheles sp. mosquito larvae was carried out. following Lestri et al(2023)namely mosquito larvae taken using a dropper pipette, placed on a glass object and covered with a cover glass, then identified mosquito larvae using a microscope with an objective lens magnification of 10x.

Manufacture of Breadfruit Flower Powder and Mat

Breadfruit flowers are taken then washed as much as 1 kg then dried and then crushed using a blender until it becomes breadfruit flower powder then mat is made as follows:

1) Breadfruit flowers are wrapped in tissue paper containing 0 gr, 0.5 gr, 1 gr, 1.5 gr, 2 gr each to form an electric anti-mosquito plate (mat).
2) The packaging of the breadfruit flower mat is dripped with 1 ml of clean water.
3) The next 1.5 hours are carried out again on the mat. Dropping water is done every 1.5 hours up to 12 drops.
4) After drying, the breadfruit flower mat is ready to be used and attached to an electric heating device.

Treatment

The mosquito repellent experiment required 300 Anopheles sp. larvae. which were divided into 5 groups, where each group consisted of 20 Anopheles sp. mosquito larvae. which was repeated 3 times, then reared until it became Anopheles sp. After that, they were exposed to breadfruit flower powder using an electric heater until the mosquitoes fainted and died.

Observations on Biolarvicides and Mosquito Repellents

Mosquito repellent observations were carried out on samples with a modified Lumowa (2013) working procedure as follows:

1) Make sure the Glass Chamber is not contaminated

2) Heat the mosquito coil in the glass chamber for 3 minutes, and wait another 3 minutes before testing.
3) Remove and remove the mosquito coil from the glass chamber testing.
4) Release 20 mosquitoes into the glass chamber for testing.
5) Observe and record mosquitoes that die during exposure. Observations were made every 1.5 hours and the number of dead larvae stages was recorded in each treatment for 6 hours.
6) After 20 minutes of exposure, all mosquitoes were transferred to a plastic cup, stored or held for 24 hours.
7) Count or record the number of dead mosquitoes.

Data analysis

The results obtained were analyzed by Analysis of Variance (ANOVA) and continued with the Duncan test at real ratesα= 0.05 using SAS software and continued with the smallest significant difference test to determine the difference in the treatment given.

RESULTS AND DISCUSSION

The results showed that there was a change in larval mortalityAnopheles sp. mosquitoes. after exposure to breadfruit matdoses of 0.5gr, 1gr, 1.5gr, 2gr compared without administration (0gr)which is presented in table 1. The results of the 1.5 hour observation showed that there was a significant difference betweendosage 0.5gr, 1gr, 1.5gr, 2grwith 0gr (control) ($P<0.05$).The results of the 3rd hour observation showed that there was a significant difference betweendosage 0.5gr, 1gr, 1.5gr, 2grat 0% dose (control) ($P<0.05$). The same thing happened at the 4.5 hour observation time ($P<0.05$). Whereas at the 6th hour of observation, the doses of 0.5gr, 1gr, 1.5gr, and 2gr were significantly different from 0gr ($P<0.05$) (control), but 1gr and 1.5gr were not significantly different ($P>0.05$). This shows that the longer the exposure time of the breadfruit mat, the 1gr and 1.5gr doses have the same effect on mosquito mortality, where the 2gr dose shows a high mortality percentage of 96.5% (Figure 1)

Table 1. The average mortality of Anopheles sp. at various concentrations of breadfruit mat every 3 hours

Treatment (gr)	Observation Time (i-Hour)				Mortality Percentage (%)
	1.5	3	4,5	6	
0	0.0± 0e	0.7± 0.57e	1.0± 0e	1.3±0.57s	6.5
0.5	1.0±0s	1.7±0.57s	3.0±0s	3.7± 0.57c	18.5
1	2.0±0c	4.0± 0c	6.3± 0.57c	8.3± 0.57b	41.5
1.5	3.3± 0.57b	5.3± 0.57b	7.3± 0.57b	9.3± 0.57b	46.5
2	7.3± 0.57a	11.3± 0.57a	15.3± 0.57a	19.3± 0.57a	96.5

Information : Different superscript letters in one column showed significantly different results ($P < 0.05$) between treatment groups. 0 = not given breadfruit mat, 0.5 = given breadfruit mat dose of 0.5gr, 1 = given breadfruit mat dose of 1gr, 1.5 = given breadfruit mat dose of 1.5gr, 2 = given breadfruit mat dose of 2gr.

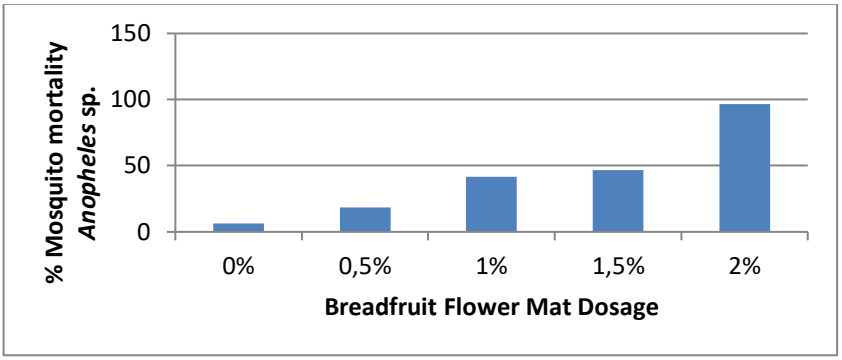

Figure 1. Mosquito mortality percentage graph *Anopheles sp*. in each treatment group

Anopheles sp. mosquito mortality. showed that the male breadfruit mat has an insecticidal effect. This happens because male breadfruit flowers contain active substances such as saponins, tannins and flavonoids. These compounds play an important role in the evaporation process of breadfruit mats which have a function as a vegetable insecticide. Mosquito mortality occurred because the compound emitted a pungent odor when exposed to breadfruit mats and filled the entire room of the experimental box until *Anopheles sp.* unable to survive. The death of Anopheles sp. caused by poisoning when the electric mat is turned on due to evaporation of the active substances contained in breadfruit flowers which emit an aroma that mosquitoes do not like and can attack the mosquito's respiratory system (Lumowa, 2013).

Saponins are compounds found in male breadfruit flowers which can attack the mosquito's nervous system. Breadfruit flower mat has saponins which can interfere with the mosquito's nervous system so that it can repel mosquitoes, the longer the exposure, the higher the mosquito mortality (Hamsir & Fahmi, 2019).

Flavonoids are one of the ingredients found in male breadfruit flowers which function as anticholinesterase. Anticholinesterase causes the cholinesterase enzyme to phosphorylate and become inactive. With the inactivity of the cholinesterase enzyme, it will cause an obstacle to the degradation process of acetylcholine resulting in the accumulation of acetylcholine in the synaptic cleft. Furthermore, there is an increase in the transmission of stimuli, which causes the respiratory muscles to contract continuously resulting in respiratory muscle spasms and causes the death of the mosquito. According to Lumowa (2013), flavonoids function as respiratory poisons or respiratory inhibitors so that when the Aedes mosquito breathes, the flavonoids will enter with the air (O2) through their breathing apparatus.

Tannins have a mechanism of action in inhibiting or beven kill mosquitoes (Aseptianova et al., 2017). There isthe difference in the amount of the active substance in each breadfruit flower level causes a difference in the amount of the active substance that enters the mosquito's respiratory system which is tested when the electricity is turned on. Tannins are disliked and avoided by insects, have insecticidal properties that can attack the mosquito's respiratory system. When using the electric method, tannins will have a direct impact on interfering with mosquito breathing and causing mosquito mortality (Qinahyu & Cahyati, 2016). One of the factors that might influence the number of mosquito deaths is due to the breadfruit powder mat which is finer without fibers so that the water content dissolves more easily in the breadfruit powder mat and can affect the shape of the mat density.

Probit analysis is used to determine the LC50, which is 50% mortality of Anopheles sp. mosquito larvae. In line with Ahdiyah and Purwani (2015) which states that the LC50 value was obtained using Probit Analysis, which shows that the effectmosquito repellent matMale breadfruit flowers cause 50% mortality of Anopheles sp. mosquito larvae. occurs at

concentration0.36 gr (figure 6), where is this doseis still a low concentration in this study. This explains that male breadfruit mat at low doses has been able to become an anti-mosquito.

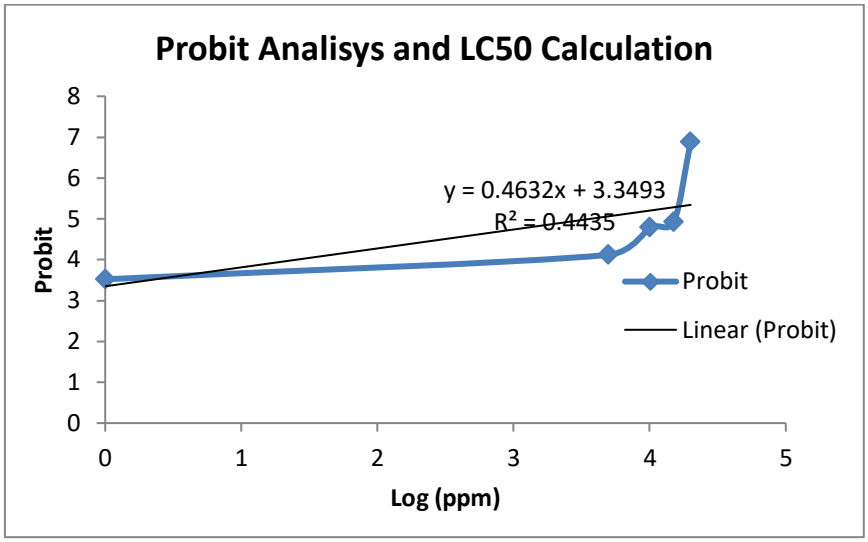

Figure 2. LC50 Concentration analysis probit graphMale Breadfruit Mat

Equality	y =	ax + b
	5 =	0.463246x + 3.349297
	x =	3.563337
LC50 = antilog (x)	=	3658,789 ppm
LC50	=	0.365879 gr

The use of plant-based insecticides is an alternative that can be done, because plant-based insecticides are safer because their residues are easily lost and easily decomposed (biodegradable) so they don't pollute the environment (Kardinan, 2002). The use of breadfruit flower powder as an electric mosquito repellent in killing mosquitoes is one of the most effective alternatives for reducing environmental pollution. In addition, vegetable insecticides leave little residue on environmental components, so they are considered safer than chemical insecticides. Plant-based insecticides decompose more quickly in nature, so they do not cause resistance to targets. Besides that, it can be made yourself in a simple way, one breadfruit flower that is formed can produce more mats, the ingredients are easy to get around the house, and are more economical. The use of vegetable insecticides has both advantages and disadvantages, namely that they do not or only slightly leave residues on environmental components and foodstuffs, so they are considered safer than synthetic/chemical insecticides (Qinahyu & Cahyati, 2016).

CONCLUSION

Based on the research results obtained, it was concluded that male breadfruit mat concentrations of 0.5gr, 1gr, 1.5gr, and 2gr had an insecticidal effect causing mortality of Anopheles sp. with an effective concentration of 2gr (96.5% mortality), where50% mortality (LC50)larvae of Anopheles sp. occurred at the concentration of male breadfruit ethanol extract at a dose of 0.36gr.

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