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Original Research Article

Efficiency of Salam Leaf (Syzygium Potyanthum) Extract on Death of *Aedes aegypti* Mosquito

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Abstract: The Aedes aegypti mosquito is the main vector of dengue fever in Indonesia. Control using synthetic chemical insecticides has a bad impact. Vegetable insecticides from salam leaf extract are a solution to reduce the negative impact of synthetic chemical insecticides. the aim of this study is To determine the efficacy of salam leaf extracts against the death of the Aedes aegypti mosquito. This research was carried out experimentally with the Post-test design with a control group (Post Test Only Control Group), namely, the experimental group receive treatment or intervention (X) followed by a second measurement or observation (O2), with the study population being all Aedes aegypti mosquitoes which were bred in the Laboratory and Workshop of the Environmental Health Department of the Health Polytechnic of the Ministry of Health of Aceh. The results of the efficacy test of salam leaf ethanol extract by spraying obtained LC 50 = 69.103% and LC 90 = 299.972%, by fogging LC 50 = 43.937% and LC 90 = 311.879%. Salam leaves are very effective, the efficacy of Aedes aegypti mosquito mortality is carried out by spray or fogging at a concentration of 90 LC. It is hoped that the results of this study can be applied in the community for efforts to eradicate Aedes aegypti mosquitoes by using vegetable insecticides that can reduce the effects of synthetic chemicals.

Keywords: Efficacy of Aedes aegypti, Salam Leaf.

INTRODUCTION

One of the factors that can affect public health status is the environment [1, 2]. An environmental-based disease is a disease phenomenon that occurs in a community group, which is related, rooted, or has a close relationship with one or more environmental components in a space where the community lives. Environmental-based diseases can be caused by vectors [3, 4]. Aedes sp. is a vector of several serious diseases that attack humans including encephalitis, yellow fever, dengue fever, and dengue hemorrhagic fever [5]. Dengue Hemorrhagic Fever (DHF) is a disease caused by infection with the dengue virus. This disease is an acute disease with clinical manifestations in the form of bleeding, which can cause shock and death. Viruses can enter the human body through Aedes aegypti and Aedes albopictus. The Aedes aegypti mosquito is generally found domestically, namely in the house and around the house, in densely populated residential areas, while the Aedes albopictus mosquito is often found outside the home for example in yards that are densely overgrown with plants, both in rural areas and in rural areas. urban [6-8]. Based on data from the Ministry of Health of the Republic of Indonesia, there were 138,127 cases of dengue fever in 2019, this number increased compared to 2018 of 65,602 cases. The death rate also increased compared to 2018 from 467 to 919 deaths. The incidence of Dengue Hemorrhagic Fever (DHF) in Indonesia until July 2020 reached 71,633, with 459 deaths [9, 10]. The Aedes aegypti mosquito is generally found domestically, namely in the house and around the house, in densely populated residential areas, while the Aedes albopictus mosquito is often found outside the home for example in yards that are densely overgrown with plants, both in rural areas and in rural areas. urban [6-8]. Based on data from the Ministry of Health of the Republic of Indonesia, there were 138,127 cases of dengue fever in 2019, this number increased compared to 2018 of 65,602 cases. The death rate also increased compared to 2018 from 467 to 919 deaths. The incidence of Dengue Hemorrhagic Fever (DHF) in Indonesia until July 2020 reached 71,633, with 459 deaths [9, 10]. The Aedes aegypti mosquito is generally found domestically, namely in the house and around the house, in densely populated residential areas, while the Aedes albopictus mosquito is often found outside the home for example in yards that are densely overgrown

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Aceh province is also one of the provinces with the most dengue cases. the number of dengue fever in 2019 to 2021 reached 2,386 with the number of deaths as many as six people in the distribution of dengue fever in the cities of Banda Aceh, Abdya, Bireuen, Nagan Raya, Aceh Jaya, and Langsa [11]. The high rate of dengue fever in Indonesia makes this disease one that needs special attention to prevent its spread in the community. Efforts to control both chemical and natural have been carried out to break the contact between vectors and humans. By far the most common preventive action taken by the community is to use insecticides [12]. However, insecticides that are widely circulated in the community are in the form of synthetic insecticides derived from toxic chemicals [13]. The continuous use of synthetic insecticides has several weaknesses, namely, it can affect human health and pollute the environment which causes damage to natural elements (soil, air, and water) and can lead to populations that are resistant to insecticides [14, 15]. Safe for the environment, does not cause poisoning, is difficult to develop immunity to insects because the residue left by the environment is quickly lost, and is also easily biodegradable in nature. Natural insecticides can be derived from plants containing essential oils, and active ingredients like eugenol, azadirachtin, Nimbin, salanin, saponins, and flavonoids to eradicate insects [16]. One of the plants that can be used as a natural insecticide is salam leaf (Syzygium polyanthum). Salam leaf is one type of spice plant that is known by the public. Salam leaves have long been used and used as a remedy for excessive bowel movements. Salam plants can also be used to treat gout, stroke, high cholesterol, blood circulation, stomach ulcers, itching, and diabetes or to improve the taste of food [17]. The use of larvicides or chemical pesticides can cause environmental pollution. An alternative way is that people can use natural pesticides that are environmentally friendly. Considering the high number of dengue cases in several areas in Indonesia and to reduce the use of chemicals in eradicating the Aedes aegypti mosquito. This study aims to analyze the efficacy of Salam Leaf Extract on the death of Aedes aegypti mosquitoes

MATERIALS AND METHODS

His research was carried out experimentally with a Post design with a control group (Post Test Only Control Group), namely the experimental group received treatment or intervention (X) followed by a second measurement or observation (O2). The results of these observations were then controlled or compared with the results of observations in the control group who did not receive the program or intervention. This research was conducted in the Laboratory and Workshop of the Environmental Health Department, Health Polytechnic of the Ministry of Health of Aceh. The research population was all Aedes aegypti mosquitoes which were bred in the Laboratory and Workshop of the Environmental Health Department of the Health Polytechnic of the Ministry of Health of Aceh. The research subjects were broadly divided into two, namely for treatment and control. The treatment subjects were Aedes aegypti mosquitoes, totaling 128 groups consisting of 72 treatments and 56 controls. Each group contains 20 Aedes aegypti mosquitoes, so the total number of mosquitoes is 3560 individuals. The treatment groups consisted of: Pre-test 6 groups for the ethanolic extract of salam leaves using the spray method, / 6 groups for the noni leaf ethanol extract using the fogging method, and 6 groups for the combined ethanol extract using the fogging method. The main test was 6 groups for LC 90 ethanol extract of salam leaves, using spray and fogging methods. The materials used in this study were ethanol extract from mosquito colonies, aqua dest, water, and liquid mist.

While the tools used, among others; Blender, 1000 ml Erlenmeyer tube, Buchi evaporator, Stirrer, Scales, cage from gauze with a size of 25 x 25 x 20 cm, Spray tool, and Fogging tool. The data obtained were analyzed descriptively and analytically. The research variables were analyzed using statistical tests with a 95% confidence level. The analysis was in accordance with its objectives, including the Analysis of determining LC50 and LC90 was carried out by the Probit Test. The mortality percentage of Aedesaegyti mosquitoes was corrected using the Abbot formula if in the control group there was a mortality of 5% - 20%.

The formula is:

Pt(%) = x $100\frac{Po-Pc}{100-Pc}$

Pt = Corrected Mortality

P0 = Percentage of treatment mortality

Pc = Percentage of control mortality

RESULTS

The research was carried out by conducting experiments to determine the efficacy of salam leaf extract on the death of the Aedes aegypti mosquito. Each experimental group was repeated 6 (six) times for each concentration and type of extract. The results of the research that has been done and gets results for each treatment and control. The treatment was carried out in two ways, namely by spraying in liquid form (spray) and spraying fumigation (fogging). Treatment by spraying, namely; spraying of salam leaf ethanol extract. Likewise, the implementation by means of fogging, namely; spraying salam leaf ethanol extract.

Salam Leaf Ethanol Extract by spraying.

The results of treatment using ethanol extract of salam leaves against the death of Aedes aegypti mosquitoes by spraying, based on table 1 below, the highest concentration was 60% with an average of 13.17 mosquitoes from 20 mosquito samples per treatment or 65.83%. Meanwhile, the lowest concentration of 10% ethanol extract was 8.67 mosquitoes (43.33%) and no Aedes aegypti death was found in the control sample.

Table 1: Distribution of Amount and Percentage of Dose of Sala Leaf Ethanol Extract to Aedes aegypti Death by Spraying

No	ekp- ke	Sample Quantity	Mosquito mortality at extract dose													
			Control		10%		20%		30%		40%		50%		60%	
			Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
1	1	20	0	0	7	35	9	45	9	45	11	55	13	65	15	75
2	2	20	0	0	9	45	9	45	11	55	12	60	13	65	13	65
3	3	20	0	0	7	35	9	45	10	50	13	65	11	55	12	60
4	4	20	0	0	11	55	11	55	10	50	13	65	15	75	13	65
5	5	20	0	0	7	35	11	55	10	50	13	65	11	55	13	65
6	6	20	0	0	11	55	11	55	10	50	13	65	15	75	13	65
Amount		120	0	0	52	43.33	60	50, 00	60	50, 00	75	62, 50	78	65.00	79	65.83
Average		20	0	0	8.67	43.33	10	50, 00	10	50, 00	12.50	62, 50	13	65.00	13, 17	65.83

Probit analysis for ethanol extract of Salam Leaf by spraying the results obtained LC50 = at a concentration of 69.103% and LC90 = 299.972% as shown in table 2 below.

Table 2: Distribution of Amount and Percentage of Dose of Salam Leaf Ethanol Extract to Aedes aegypti Death by Spraying

Confidence Limits							
	Probability	95% Confidence Limits for Concentration of ethanol extract of Salam Leaf Spray			95% Confidence Limits for log(Concentration of sprayed salam leaf ethanol extract)a		
		Estimate	Lower Bound	Upper Bound	Estimate	Lower Bound	Upper Bound
PROBIT	,500	69,103	.	.	1,839	.	.
	,900	299.972	.	.	2,477	.	.

a. Logarithm base = 10.

Table 3: Results of Efficacy Test of Salam Leaf Ethanol Extract against Death of Aedes aegypti by spraying

	Parameter	Estimate	Std. Error	Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PROBITA	Concentration of spraying salam leaf ethanol extract	2.010	1.263	1,592	,111	-,465	4,485
	Intercept	-3.697	2,362	-1.565	,118	-6.060	-1,335

a. PROBIT model: PROBIT (p) = Intercept + BX (Covariates X are transformed using the base 10,000 logarithm.)

The results of the treatment based on the LC50 and LC90 tests can be seen in table 4. below, that the mortality rate of Aedes agypti mosquitoes is highest at the LC90 concentration with an average of 19.33 mosquitoes from 60 mosquito samples or 96.67% compared to the concentration LC50 ethanol extract that is an average of 6 mosquitoes (19.33%), and no Aedes aegypti mortality was found in the control sample.

Table 4: LC50 and LC90 Test Results of Salam Leaf Extract against Aedes aegypti mosquitoes by spraying

No	**ep-to**	**Number of samples**	**Mosquito Death**					
			Control		LC50		LC90	
			Amount	%	Amount	%	Amount	%
1	1	20	0	0	16	80	18	90
2	2	20	0	0	16	80	20	100
3	3	20	0	0	16	80	20	100
Amount		60	0	0	48	240	58	290
Average			0	0	16	80	19.33	96.67

Salam Leaf Ethanol Extract by fogging

The results of treatment using ethanol extract of salam leaves against the death of Aedes aegypti mosquitoes by fogging, based on table 4.5 the highest concentration was 60% with an average of 14.67 mosquitoes from 20 mosquito samples or 73.33%. While the lowest was at 10% ethanol extract concentration, which was an average of 9 mosquitoes (45%), and no Aedes aegypti mortality was found in the control sample.

Table 5: Distribution of Amount and Percentage of Dose of Salam Leaf Ethanol Extract on Death of Aedes aegypti by Fogging Method

No	**ekp- ke**	**Number of Samples**	**Mosquito mortality at extract dose**													
			Control		**10%**		**20%**		**30%**		**40%**		**50%**		**60%**	
			Amount	**%**	**Amount**	**%**	**Amount**	**%**	**Amount**	**%**	**Amount**	**%**	**Amount**	**%**	**Amount**	**%**
1	1	20	0	0	8	40	9	45	12	60	14	70	13	65	14	70
2	2	20	0	0	10	50	11	55	14	70	13	65	13	65	16	80
3	3	20	0	0	8	40	10	50	11	55	13	65	11	55	13	65
4	4	20	0	0	11	55	11	55	10	50	13	65	15	75	13	65
5	5	20	0	0	8	40	12	60	12	60	14	70	12	60	16	80
6	6	20	0	0	9	45	11	55	13	65	15	75	15	75	16	80
Amount		120	0	0	52	54	45.00	64	53.33	72	60.00	82	68.33	79	65.83	88
Average		20	0	0	8.67	9.00	45.00	10.67	53.33	12	60.00	13.67	68.33	13.17	65.83	14.67

Probit analysis for ethanol extract of Salam leaves by fogging obtained results of LC50 at a concentration of 43.937% and LC90 311.879% as shown in table 6 below.

Table 6: Distribution of Amount and Percentage of Dose of Salam Leaf Ethanol Extract to Aedes aegypti Death by Fogging Method

Confidence Limits							
	Probability	95% Confidence Limits for Concentration of ethanol extract of Salam Leaf Fogging			95% Confidence Limits for log(Concentration of ethanol extract of Salam Fogging Leaf)a		
		Estimate	Lower Bound	Upper Bound	Estimate	Lower Bound	Upper Bound
PROBIT	,500	43.937	.	.	1,643	.	.
	,900	311,879	.	.	2,494	.	.

a. Logarithm base = 10.

Table 7: Test resultsEfficacy of Salam Leaf Ethanol Extract on the Death of Aedes aegypti by fogging

	Parameter	Estimate	Std. Error	Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PROBITA	Concentration of Fogging Salam Leaf Ethanol Extract	1,506	1,223	1,231	,218	-,891	3,903
	Intercept	-2.474	2,569	-,963	,336	-5.042	,095

a. PROBIT model: PROBIT (p) = Intercept + BX (Covariates X are transformed using the base 10,000 logarithm.)

The results of the treatment based on the LC50 and LC90 tests can be seen in table 8 that the mortality rate of Aedes agypti mosquitoes is highest at LC90 concentrations with an average of 12.67 mosquitoes from 60 samples (96.67%) compared to LC50 which is an average of 2 ,67 mosquitoes (13,33%), and no Aedes aegypti mortality was found in the control sample.

Table 8: Test results LC50 and LC90 against Aedes aegypti mosquitoes salam leaf extract by fogging

No	ep-to	Number of samples	Mosquito Death					
			Control		LC50		LC90	
			Amount	%	Amount	%	Amount	%
1	1	20	0	0	0	0	10	50
2	2	20	0	0	0	0	16	80
3	3	20	0	0	8	40	12	60
Amount		60	0	0	8	40	38	190
Average			**0**	**0**	**2.67**	**13.33**	**12.67**	**63.33**

DISCUSSION

This study was conducted to test the efficacy of salam leaf extract against the death of adult Aedes aegypti mosquitoes with various test concentrations, namely concentrations of 10%, 20%, 30%, 40%, 50%, and 60% by means of liquid spray (spray) and fogging (fogging). Each concentration was repeated six times. The efficacy test for salam leaf extract was carried out by spraying six times with each concentration, namely: 6 x 6 = 36 times, as well as by fogging for 36 treatments so that for the salam leaf extract group, 72 treatments were carried out. The results of the efficacy test of salam leaf ethanol extract by spraying obtained LC 50 = at a concentration of 69.103% and LC 90 = 299.972%, while by fogging it was obtained LC 50 = at a concentration of 43.937% and LC 90 = 311.879%. Treatment with fogging is very effective for the efficacy of higher mosquito mortality, compared to spraying. The higher the concentration, the higher the mosquito mortality efficacy. This result is supported by previous research which states that various concentrations of salam leaf extract (Syzygium polyanthum) in solid wax as a repellent have an effect on Aedes sp. Mosquitoes [18]. Based on the results of research that has been carried out for 24 hours, it can be seen that the concentration of salam leaf extract (Syzygium polyanthum) given has insecticidal potential against Aedes aegypti mosquitoes with the spray method. Each salam leaf extract (Syzygium polyanthum) has different results. Utilization of secondary metabolites of salam leaf extract is relatively safe for the environment, humans, and livestock, this is because the natural ingredients in salam leaves are easily decomposed, and this type of insecticide will quickly cause resistance. Biological insecticides used in high doses will still be biodegradable and the insecticidal compounds will not interfere with other organisms that are not targeted [19]. The Aedes aegypti mosquito is the main vector of dengue fever in Indonesia. Control using synthetic chemical insecticides has a bad impact. Vegetable insecticides from salam leaves can be a solution to suppress the negative impact of synthetic chemical insecticides. Salam leaves contain terpenoid compounds that are repellent to mosquitoes. Rejection of mosquitoes is due in general to four volatile compounds that work as contact poisons and respiratory poisons that affect mosquito sensory nerve activity [20]. In the salam leaf, there is a tannin compound that prevents insects from digesting food and also causes interference with water absorption in organisms. Plants by inhibiting eating insects and are also toxic, besides that, essential oils and flavonoids can work as a respiratory poison compound [21]. The most effective concentration of salam leaf extract (Syzygium polyanthum) in killing Aedesagypti larvae was 32 ml. Based on the results of this study, it can be seen that salam leaf extract (Syzigium polyanthum) has the potential as a larvicide against Aedes aegypti larvae.

CONCLUSION

Salam leaves are very effective; the efficacy of Aedes aegypti mosquito mortality is carried out by spraying or fogging at a concentration of LC 90. Salam leaf ethanol extract by spraying the results obtained is LC50 = at a concentration of 69.103% and LC90 = 299.972 %. Probit analysis for ethanol extract of Salam leaves by fogging showed that LC50 = at a concentration of 43.937% and LC90 = 311.879%.

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