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The Effect of Jasmine Flower Extract (Jasminum sambac) on the Lethal Dose Effect of LT on *Aedes aegypti* Mosquito Larvae

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ABSTRACT

Introduction: Dengue Fever Dengue fever (DHF) has developed into a major health problem for Indonesian society. Vector control to stop the chain of transmission of dengue fever is one way to prevent dengue fever. One effective way to control dengue fever is to control larvae using insecticides. Continuous use of insecticides can cause side effects that are harmful to the environment. Therefore, natural insecticides are needed by utilizing materials around us that contain substances as insecticides, one of which is jasmine flowers (Jasminum sambac). **Method:** This study aims to determine the effect of jasmine flower extract on Aedes aegypti larvae with concentrations of 10%, 15%, 20%, 25% with contact times of 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes, 30 minutes, 35 minutes, 40 minutes,45 minutes,50 minutes,55 minutes,60 minutes. This type of research is an experiment with a completely randomized plan. How to make extraction by ceration using 96% ethanol. The samples are third instar Aedes aegypti larvae. **Results:** The results of this research showed that the concentration that caused a 50% knockdown effect based on estimates was at a concentration of 14,019%. The results of statistical analysis with anova p=0.05 showed a significant effect of the interaction of concentration and contact time (p=0.19) on the death of Aedes aegypti larvae. **Conclusion:** This research has proven that jasmine flower extract (jasminum sambac) is effective as a larvicide. From the results of the probit analysis, it was found that the concentration that caused a 50% knockdown effect based on estimates was a concentration of 14,019%.

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INTRODUCTION

Dengue Hemorrhagic Fever (DHF) has become a major public health problem in Indonesia. One of the primary strategies for preventing DHF is vector control, which aims to stop the transmission of the disease by reducing mosquito populations. Traditionally, people have relied on mosquito repellents containing N-diethyl-m-toluamide (DEET) to avoid mosquito bites. However, the use of DEET-based repellents can lead to adverse

effects, including hypersensitivity reactions, skin irritation, and urticaria (M Arsita., *et al* 2022).

According to the World Health Organization (WHO), the number of reported DHF cases globally increased more than eightfold over the past four years, reaching 4.2 million cases in 2019. In Indonesia, the Ministry of Health recorded 13,683 DHF cases and 133 deaths as of January 29, 2019, with the number rising to 16,692 cases and 169 deaths by February 3, 2019. The regions most affected included East Java, Central Java, East Nusa Tenggara (NTT), and Kupang.

The dengue fever outbreak occurred in the world for the first time in the 1780s, precisely in Africa, Asia and North America. Then it first spread in the 1950s in the Southeast Asian region, namely in the Philippines. While the first dengue fever case in Indonesia was reported in Jakarta and Surabaya in 1968. Currently, these cases are spread across 472 districts or cities in 34 provinces (Ummah, 2018). In Malang City, the highest dengue fever cases occurred in 2019 with 527 cases in 16 health centers and 5 sub-districts. Blimbing District experienced the highest number of pneumonia cases, with 1,914 cases reported between 2017 and 2020. Most people in Malang City are between 15 and 64 years old and in 2019, there were 2,716 cases of pneumonia in 16 health centers and 5 districts (Masluhiya AF, Wibowo, & Luthfin, 2022).

Prevention of Aedes aegypti mosquitoes with insecticides is the main choice for people to avoid mosquito bites. Insecticides are chemicals that can be used to eradicate various types of insects that are harmful to human health, but vector control using chemical-based insecticides can cause health problems in the form of respiratory problems and cause the skin to turn red. In addition, the use of chemicals can cause resistance to these insects or mosquitoes. In addition to chemical insecticides, there are also natural insecticides from plants that can be an option to overcome this problem (Tabriz, Rusmartini, & Argadiredja, 2019). As a result, plant-based natural insecticides are being explored as a safer and more environmentally friendly alternative.

Natural insecticides can come from organic materials that are very easy to decompose so that the effects of the poison do not last long, and do not accumulate and do not even cause resistance. One of the plants that can be used for natural insecticides is jasmine flowers (Mulyani *et al*., 2021), which contains active compounds such as flavonoids, alkaloids, saponins, and tannins.

Natural insecticides can come from organic materials that are very easily decomposed so that the toxic effects do not last long, and do not accumulate or even cause resistance. One of the plants that can be used for natural insecticides is jasmine flowers (Mulyani *et al*., 2021). These compounds are known to disrupt insect nervous systems, leading to death effectively.

Since Indonesia has many plants that can function as natural insecticides, the use of natural insecticides can be the right choice. Jasmine flowers (Jasminum Sambac.) are one of the plants that can be used as natural insecticides. This plant contains chemical compounds such as methyl salicylate, cis jasmine, linalool, neurol idol, and indole, which can be used as natural larvicides (Husna., *et al* 2020). Jasminum Sambac or known as jasmine is a plant that has a fragrant aroma.

Lethal Dose (LT) can be used to determine the effectiveness of a substance used as an insecticide based on the category of killing effect produced. The faster the killing effect, the more effective a substance is as an insecticide. In insecticide research, Lethal Dose is used when a substance or compound stops or kills the activity of an organism within a certain period of time. Parameters such as (LT), which indicate the time it takes for an organism to stop its activity (Ummah, 2018).

LITERATURE REVIEW

Based on previous research by (Rozak *et al.*, 2021) research related to the Effectiveness Test of Ethanol Extract of Angsana Leaves (Pterocarpus Indicus Willd) as a Biolarvicide Against Cullex SP Mosquito Larvae stated that angsana leaves contain many secondary metabolite compounds, such as tannins, polyphenols, flavonoids, saponins, and triterpenoids, where these compounds are the same as the compounds contained in jasmine flowers. And the results of this study showed the biolarvicide ability of angsana leaf extract is effective as a biolarvicide (Rozak *et al.,* 2021)

The results of the study by Dias et al, 2019) in Jombang. Researchers conducted a Papaya Seed Extract Test (Carica Papaya L) which was incubated for 60 minutes using animal experiments of 25 larvae, then the results of the effectiveness of the extract in killing Aedes aegypti mosquito larvae at concentrations of 10%, 15%, 20%, 25% had the ability to kill 100% within 60 minutes (Dias *et al.,* 2019)

Based on previous research by (Mariyana et al., 2022) research related to the Antibacterial Activity Test of Methanol Extract of Jasmine Flowers (Jasminum sambac L.) Against Staphylococcus aureus and Formulation in Anti-Acne Gel Preparations In this study, methanol solvent was used to extract jasmine flowers. Using the well diffusion method, antibacterial activity was tested with extract concentrations of 5, 10, and 15 percent. The gel was made by mixing 5% extract concentration with 2% carbomer 934 as a gelling agent. The results showed that the three concentrations had weak antibacterial power.

The results of research by Dias in Jombang. Researchers conducted a Papaya Seed Extract Test (Carica Papaya L) which was incubated for 60 minutes using animal experiments of 25 larvae, then the results of the effectiveness of the extract in killing Aedes aegypti mosquito larvae at concentrations of 10%, 15%, 20%, 25% had the ability to kill 100% within 60 minutes (Dias *et al.,* 2019)

METHOD

This type of research is a pure experimental research. This research was conducted at the Integrated Laboratory and Halal Center at the Islamic University of Malang in June 2024. Starting from the research licensing stage, then continued with the pre-analytical stage, namely the manufacture of jasmine flower extract, then the steps to calculate the concentration starting from 10%, 15%, 20% and 25%. The next analytical stage is the stage of treating jasmine flower extract *(Jasminum sambac)* on *Aedes aegypti* mosquito larvae. Then the post-analytical stage where this stage observes whether jasmine flower extract *(Jasminum sambac)* is able to provide a knockdown effect on Aedes aegypti mosquito larvae. The last stage is data collection in this study, the data obtained from observations will be processed using the SPSS application.

The research design was a Completely Randomized Design (CRD) using six treatment groups, namely positive control, negative control and four experimental groups, namely concentrations of 10%, 15%, 20%, and 25% to determine the effect of jasmine flower extract *(Jasminum Sambac)* on the knockdown effect on *Aedes argypti* mosquito larvae. Population is all objects in an area and meet certain requirements related to the research problem, or all units or individuals within the scope to be studied. The population in this study is *Aedes aegypti* mosquito larvae. Samples are part of the objects taken from all objects studied and are considered to represent the entire population. The samples used in this study were Aedes aegypti instar III mosquito larvae. The number of samples used was 400. Each treatment required 25 larvae based on references from the book Guidelines For Laboratory and Field Testing Of Mosquito Larvacide in 2005 (Larvicides, 2005).

In this study, the data obtained from observations will be processed using the SPSS application by passing the effectiveness test if the data is normally distributed then the homogeneity test is continued, if it is homogeneous, the One way ANOVA test is continued after that it is continued with probit analysis, then presented in table form accompanied by information on the number of deaths at each concentration with a recorder at each specified contact time and the number of deaths of *Aedes Aegypti* larvae. To determine the effectiveness of jasmine flowers on Aedes aegypti larvae, the data was tested using the one way ANOVA test method with a significance of 0.05 comparing the response of Aedes aegypti between concentrations of 10%, 15%, 20%, 25%.

RESULT AND DISCUSSION

The average that gave the most knockdown effect was at the A4 concentration (25%) at the 5th minute as much as 2.25, then at the 10th minute as much as 3, the 15th minute as much as 3.25, the 20th minute as much as 3.35, the 25th minute as much as 3, the 30th minute as much as 7.75, the 35th minute as much as 9, the 40th minute as much as 11, the 45th minute as much as 12, the 50th minute as much as 13, the 55th minute as much as 15.5, the 60th minute as much as 20.25, while the KN comparison (negative control) had no dead Aedes aegypti larvae and the KP comparison (positive control) had 25 dead larvae (100%).

Table 1. Average knockdown effect of *Aedes aegypti* larvae by jasmine (*Jasminum sambac*) extract across trials

Conc	NoL	IT (min)	AE	% AE	Conc	NoL	IT (min)	AE	% AE
KN	**25**	-	0	0.00	**A3**	**25**	5	1.25	1.36
A1	**25**	5	2	1.95			10	2.75	3.00
		10	1.5	1.46			15	4.25	4.63
		15	2.5	2.43			20	4.75	5.18
		20	9.5	9.25			25	5.75	6.27
		25	9.5	9.25			30	7	7.63
		30	10.25	9.98			35	7.75	8.45
		35	10.5	10.22			40	9.5	10.35
		40	10.5	10.22			45	11.25	12.26
		45	11.5	11.19			50	11.5	12.53
		50	11.75	11.44			55	12	13.08
		55	10	9.73			60	14	15.26
		60	13.25	12.90	**A4**	**25**	5	2.25	2.83
A2	**25**	5	1.25	1.57			10	4.5	5.66
		10	2.25	2.83			15	1.75	2.20
		15	4.5	5.66			20	5.75	7.23
		20	1.75	2.20			25	6.5	8.18
		25	5.75	7.23			30	7	8.81
		30	6.5	8.18			35	8.25	10.38
		35	7	8.81			40	8.5	10.69
		40	8.25	10.38			45	9.5	11.95
		45	8.5	10.69			50	10	12.58
		50	9.5	11.95			55	20.25	15.76
		55	10	12.58	**KP**	**25**	-	25	19.46
		60	14.25	17.92					

Abbrevation: Conc= concentration; NoL= number of larvae; IT= interval time; AE= average knockdown effect; min= minute

Table 2 Results of Normality Test of Jasmine Flower Extract (*Jasminum sambac*) on Knockdown Effect on *Aedes aegypti* Mosquito Larvae

		Shapiro-Wilk		
	Concentration	**Statistic**	**Df**	**Sig.**
Repetition1	A1	.967	12	.878
	A2	.857	12	.045
	A3	.898	12	.148
	A4	.956	12	.719
Repetition2	A1	.867	12	.060
	A2	.935	12	.439
	A3	.948	12	.606
	A4	.914	12	.239
Repetition3	A1	.934	12	.425
	A2	.900	12	.159
	A3	.864	12	.055
	A4	.955	12	.713
Repetition4	A1	.952	12	.668
	A2	.907	12	.195
	A3	.937	12	.461
	A4	.924	12	.317

Table 3 Results of Homogeneity Test of Jasmine Flower Extract (*Jasminum sambac*) on Knockdown Effect on *Aedes aegypti* Mosquito Larvae

		Levene Statistic	**df1**	**df2**	**Sig.**
Repetition1	Based on Mean	1.700	3	44	.181
	Based on Median	.741	3	44	.533
	Based on Median and with adjusted df	.741	3	37.181	.534
	Based on trimmed mean	1.631	3	44	.196
Repetition2	Based on Mean	.804	3	44	.498
	Based on Median	.692	3	44	.562
	Based on Median and with adjusted df	.692	3	35.736	.563
	Based on trimmed mean	.823	3	44	.488
Repetition3	Based on Mean	4.058	3	44	.012
	Based on Median	2.420	3	44	.079
	Based on Median and with adjusted df	2.420	3	29.909	.086
	Based on trimmed mean	3.872	3	44	.015
Repetition4	Based on Mean	3.003	3	44	.040
	Based on Median	2.509	3	44	.071
	Based on Median and with adjusted df	2.509	3	36.989	.074
	Based on trimmed mean	2.952	3	44	.043

From the results of the normality data test above, it shows that the data is normally distributed or parametric, which means that the sig value is greater than 0.05. If the probability value for each group is greater than 0.05, the normality assumption is met. A homogeneity test is also carried out. The homogeneity test is carried out to determine

whether the variance of a particular population is the same. As a requirement for ANOVA analysis, this test is carried out based on the assumption that the population variance is the same. If the significant value of the homogeneity test is greater than 0.05, the data is considered homogeneous, while if the significant value is less than 0.05, the data is considered inhomogeneous.

Based on the results of the homogeneity test above, all data show homogeneity with a significant value > 0.05 so that it can be interpreted that all data variants are homogeneous. Then a further test will be carried out, namely a parametric test using the One Way Anova test with the aim of determining whether the four additional concentrations of jasmine flowers and their positive controls have a significant effect.

Table 4 Results of One Way Anova Test of Jasmine Flower Extract (*Jasminum sambac*) on Knockdown Effect on *Aedes aegypti* Mosquito Larvae

		Sum of Squares	Df	Mean Square	F	Sig.
Repetition1	Between Groups	377.102	4	94.275	4.001	.007
	Within Groups	1036.898	44	23.566		
	Total	1414.000	48			
Repetition2	Between Groups	348.227	4	87.057	5.236	.002
	Within Groups	731.610	44	16.627		
	Total	1079.837	48			
Repetition3	Between Groups	626.485	4	156.621	7.385	.007
	Within Groups	933.148	44	21.208		
	Total	1559.633	48			
Repetition4	Between Groups	423.632	4	105.908	3.283	.019
	Within Groups	1419.470	44	32.261		
	Total	1843.102	48			

Based on the One Way Anova test conducted, the results obtained were that all test groups had a significant value <0.05, which indicates that there are significant differences in the four jasmine flower extracts (Table 4).

Probit analysis is an analysis to show the effectiveness of jasmine flower extract (Jasminum sambac). As a knockdown effect on Aedes aegypti mosquito larvae expressed by the LC50 (Lectal concentration) value. LC50 is the concentration of jasmine flower extract that can kill 50% of Aedes aegypti mosquito larvae from the total larvae. From the results of the probit analysis in table 5.5, it was found that the concentration that caused a 50% knockdown effect based on the estimate was at a concentration of 14.019%, which means that jasmine flower extract (*Jasminum sambac*) at a concentration of 14.019 had shown effectiveness on *Aedes aegypti* larvae (Table 5).

Table 1 shows that the average mortality experienced by instar III larvae with jasmine flower extract (*Jasminum sambac*) is as follows, that the average concentration of A1 (10%) at the highest minute, namely the 60th minute, was obtained on average as much as 13.25. Then the average concentration of A2 (15%) at the 60th minute was 14.25. Continued with the average concentration of A3 (20%) at the 60th minute as much as 14, and the average at the concentration of A4 (25%) as much as 20.25. While the KN comparison (negative control) had no *Aedes aegypti* larvae that died and the KP comparison (positive control) had 25 that died (100%). There are several factors that can affect the death of instar III larvae in general, namely, Larval death can occur due to poor water quality. For example, temperatures that are too high or too low can cause larval death. Then PH, Research shows

that unstable pH can affect larval mortality and larval death can occur due to poor oxygen availability in the water (Ardian, 2022).

Table 5. Probit Analysis of Jasmine Flower Extract (*Jasminum sambac*) on the Knockdown Effect of Results on *Aedes aegypti* Mosquito Larvae

Probability	95% Cinfidence Limits for consentration			95% Cinfidence Limits for log (consentration)[a]		
	Estimate	Lower Bound	Upper Bound	Estimate	Lower Bound	Upper Bound
PROBIT 0.01	8.226	.678	11.917	.915	-.169	1.076
0.02	8.757	.868	12.364	.942	-.061	1.092
0.03	9.111	1.016	12.658	.960	.007	1.102
0.04	9.386	1.143	12.885	.972	.058	1.110
0.05	9.617	1.258	13.072	.983	.100	1.116
0.06	9.817	1.366	13.235	.992	.135	1.122
0.07	9.997	1.467	13.379	1.000	.166	1.126
0.08	10.160	1.564	13.510	1.007	.194	1.131
0.09	10.311	1.658	13.631	1.013	.220	1.135
0.1	10.452	1.749	13.743	1.019	.243	1.138
0.15	11.055	2.183	14.221	1.044	.339	1.153
0.2	11.560	2.603	14.617	1.063	.415	1.165
0.25	12.011	3.026	14.970	1.080	.481	1.175
0.3	12.432	3.463	15.299	1.095	.539	1.185
0.35	12.834	3.923	15.615	1.108	.594	1.194
0.4	13.228	4.415	15.926	1.122	.645	1.202
0.45	13.621	4.947	16.240	1.134	.694	1.211
0.5	14.019	5.531	16.562	1.147	.743	1.219
0.55	14.428	6.179	16.902	1.159	.791	1.228
0.6	14.857	6.911	17.267	1.172	.840	1.237
0.65	15.313	7.749	17.673	1.185	.889	1.247
0.7	15.809	8.728	18.143	1.199	.941	1.259
0.75	16.362	9.896	18.717	1.214	.995	1.272
0.8	17.001	11.320	19.481	1.230	1.054	1.290
0.85	17.777	13.088	20.649	1.250	1.117	1.315
0.9	18.804	15.253	22.885	1.274	1.183	1.360
0.91	19.060	15.726	23.611	1.280	1.197	1.373
0.92	19.343	16.209	24.499	1.287	1.210	1.389
0.93	19.659	16.700	25.600	1.294	1.223	1.408
0.94	20.018	17.202	26.990	1.301	1.236	1.431
0.95	20.436	17.718	28.787	1.310	1.248	1.459
0.96	20.938	18.262	31.192	1.321	1.262	1.494
0.97	21.571	18.860	34.596	1.334	1.276	1.539
0.98	22.443	19.573	39.933	1.351	1.292	1.601
0.99	23.890	20.587	50.465	1.378	1.314	1.703

From the results of the normality data test in table 2, it shows that the data is normally distributed or parametric, which means that the sig value is greater than 0.05. If the probability value for each group is greater than 0.05, then the normality assumption is met. The results of the homogeneity test in table 3 show that all data shows homogeneity with a sig value in repetition 1 of 181, then in repetition 2 a sig value of 498 is obtained, then in repetition 3 a sig value of 0.12 is obtained, and in repetition 4 a sig value of 0.43 is obtained. So it can be interpreted that all data variants are homogeneous. Then a further test will be carried out, namely a parametric test using the One Way Anova test. Based on

table 4, the statistical test with the One Way Anova test shows that the significance value in repetition 1 is 0.07, then repetition 2 is 0.02, then repetition 3 is 0.07 and repetition 4 is 0.19. This shows that there is an effect of jasmine flower extract (*Jasminum sambac*) on the knockdown effect on *Aedes aegypti* mosquito larvae. Thus, larvicide has an impact on the knockdown effect of *Aedes aegypti* mosquito larvae. Then continued with probit analysis. From the results of the probit analysis in table 5, it was found that the concentration that caused a 50% knockdown effect based on the estimate was at a concentration of 14,019%.

Based on the observation results, the fastest knockdown effect on larvae in this study occurred at 40 minutes after being given jasmine flower extract treatment *(Jasminum sambac*) with an average death in repetition 1 10.22% repetition 2 10.38% repetition 3 10.35% and repetition 4 9.34%, and the highest knockdown effect occurred at 60 minutes with an average death in repetition 1 12.90% repetition 2 17.92% repetition 3 15.26% and repetition 4 15.76%. The knockdown effect of larvae correlated with the length of time and concentration given, indicating that higher concentrations and longer exposure times had a greater knockdown effect on test larvae (Klencki & Nelemans, 2019).

CONCLUSION

Based on the results of the research that has been done, it can be concluded that the knockdown effect on Aedes aegypti mosquito larvae with jasmine flower extract (*Jasminum sambac*) is as follows: There is an effect of the concentration of Jasmine Flower Extract (*Jasminum sambac*) and contact time on the level of knockdown effect on Aedes aegypti larvae with a significant level of 0.19 p> 0.05. Which means that there is a significant effect between the administration of jasmine flower extract concentration (*Jasminum sambac)* and contact time on the mortality of Aedes aegypti larvae. The results of the One-way ANOVA test with a p value = 0.000 indicate that jasmine flower extract (*Jasminum sambac*) has a knockdown effect on *Aedes aegypti* mosquito larvae. The lowest concentration occurs at concentration A1 (10%) or 75%, and the highest concentration that causes a 50% knockdown effect based on the estimate is at a concentration of 14.019%.

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