EFFECTIVENESS TEST OF LARVACIDE FROM COCOR BEBEK LEAF EXTRACT (Kalanchoe pinnata L.) ON Aedes albopictus MOSQUITO LARVAE

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ABSTRACT

Dengue Hemorrhagic Fever (DHF) is a disease transmitted by female mosquitoes of the species Aedes aegypti, but sometimes also by Aedes albopictus, which has spread worldwide recently. The goal of this study was to find out how well Kalanchoe pinnata L. (life plant) leaf extract killed Aedes albopictus mosquito larvae. This study used 600 Aedes albopictus larvae in an experimental laboratory setting with a control group that only took the post-test. There were 6 treatment groups: Manila tamarind leaf extract concentrations of 0.2 mg/ml, 0.4 mg/ml, 0.6 mg/ml, and 0.8 mg/ml; a positive control group with temephos; and a negative control group with distilled water. Observations were conducted 24 hours after treatment, with larval mortality counted every hour. The probit analysis indicated that the LC90 for Kalanchoe pinnata L. leaf extract was 12.779 mg/ml, and the LT50 at 0.8 mg/ml, which was the concentration that killed the most quickly, was 48,058 hours. The results show that an extract from Kalanchoe pinnata L. leaves can kill Aedes albopictus mosquito larvae.

Keywords: *Aedes albopictus, biolarvicide, Kalanchoe pinnata L.*

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is an environmental health problem that tends to increase the number of sufferers and can spread more widely, equivalent to increasing mobility and population density. This dengue fever disease is often caused by the dengue virus, which is transmitted by the *Aedes aegypti* Linn and *Aedes albopictus* Skuse mosquitoes (Yudhastuti & Vidiyani, 2005). *Aedes aegypti* Linn plays a role in the transmission of this disease because it lives in and around the house, while *Aedes albopictus* Skuse is usually in the garden, so it rarely comes into contact with humans. Entering early 2023, the suspected and confirmed cases of DHF were almost three million cases throughout this year; recorded cases of dengue fever exceeded 2.8 million cases worldwide. As of July 1, 2023, the total number of dengue fever cases reported was 2,997,097 cases, confirmed in the laboratory 45% and classified as severe dengue fever as much as 0.13% (Simbolon et al., 2024).

The highest cases of dengue fever currently in 2023 are in Peru, Brazil, and Bolivia. In addition, the reported deaths were 1,302 with a Case Fatality Rate (CFR) of 0.04% in this region during the same period (Haider et al., 2024). According to data from the Ministry of Health, dengue fever in Indonesia in 2023 also increased in several regions. Until entering the middle of the year, the recorded dengue fever case data reached 35,694 cases (Hartini & Pawenang, 2023).

According to DBD data in South Kalimantan in 2023, there were 166 cases in Banjar Regency, 108 cases in Banjarbaru City, 76 cases in North Hulu Sungai Regency, 68 cases in Central Hulu Sungai, 53 cases in Tanah Laut, and 47 cases in Banjarmasin City. Then, South Hulu Sungai Regency had as many as 44 cases, Tanah Bumbu had as many as 35 cases, Kotabaru had as many as 29 cases, Barito Kuala had as many as 21 cases, Balangan had as many as 15 cases, Tapin had as many as 7 cases, and Balangan had three cases (Kemenkes, 2022).

Natural insecticides or larvicides can be used to replace chemical insecticides that are known

to have various harmful side effects for humans and the environment. An alternative way to kill mosquitoes that are still in the larval stage is with biolarvicides. This method can break the mosquito cycle in larvae so that they do not develop into adult mosquitoes. After being studied, biolarvicides and plants are safe for the environment, easily degraded, and specific to the target (Ghosh et al., 2012).

The results of previous research indicated that cocor bebek leaves contain secondary metabolites including alkaloids, phenols, flavonoids, and saponins (Qomaliyah et al., 2023). These compounds are known to be effective as larvicides. Based on these results, scientists want to find out how well cocor bebek leaf extract works as an alternative biolarvicide for Aedes albopictus mosquitoes that is safe for the environment.

METHODE

Tools

The tools often used for this research are plastic cups, measuring cups (*Pyrex*), test tubes (*Pyrex*), test tube racks, porcelain cups, metal spoons, watch glasses, analytical scales, jars, label paper, stirring rods, test tubes, tripods, spirits, wooden clamps, stopwatches, tissues, droppers, and volume pipettes.

Materials

The materials needed in this study were cocor bebek leaves (*Kalanchoe pinnata* L), Aedes albopictus mosquito larvae, 96% ethanol, 70% ethanol, distilled water, temephos, filter paper, ethyl acetate, $FeCl_3$, concentrated HCl, 2 N HCl, dragendorf reagent, mayer reagent, CH_3COOH, H_2SO_4.

Cocor Bebek Leaf Extract and Extraction

Cocor bebek leaves are washed thoroughly using running water, then cut into small pieces and dried using an oven, then ground to a size of 60 mesh. A total of 200 grams of cocor bebek leaf powder is poured into a maceration container, then 2000 mL of 96% ethanol (1:10) is added until the simplicia is submerged, then closed tightly, and do not expose to sunlight for 72 hours. The macerate obtained is then filtered using filter paper, and then the solvent is evaporated using a rotary evaporator at a speed of 60 rpm with a temperature of 40^0C.

Phytochemical screening tests were conducted on saponins, flavonoids, tannins, triterpenoids, and steroids.

Biolarvicide Test

The test solution used was cocor bebek leaf extract with concentrations of 20mg, 40mg, 60mg, 80mg. Weigh the cocor bebek leaf extract of each concentration and dissolve it in 100 ml of distilled water. Put it in a cup, then put in 25 Aedes albopictus larvae test animals and observe for 24 hours. In the negative control group, put the larvae in a cup containing distilled water. While in the positive control group, weigh 0.01 mg of temephos and dissolve it in 100 ml of distilled water. Put the larvae in a cup containing temephos and distilled water. Each test group was repeated 4 times, each cup containing 25 larvae, and observations were made by calculating the number of deaths of Aedes albopictus mosquito larvae for 24 hours.

Data Processing

RESULT AND DISCUSSION

Rendemen result

Thick extract of cocor bebek leaves was obtained using the maceration method. The percentage of yield obtained from the extraction of 200 grams of cocor bebek leaf simplicia using 96% ethanol solvent was 7.5%.

Phytochemical Screening Test Results

The results obtained for the secondary metabolite content of cocor bebek leaf extract are as follows:

Table 1. Phytochemical Screening Test Results

Compound	Result	Indicators
Saponins	+	Foam is formed, which lasts for 20 minutes.
Flavonoids	+	A yellowish color is formed
Tannins	+	A blackish green color is formed
Triterpenoids	+	Orange precipitate is formed (Dragendorff's reagent)
Steroids	-	No blue precipitate is formed

From the test results above, it is known that the active substances in cocor bebek leaves are saponins, flavonoids, tannins, triterpenoids, and steroids.

Biolarvicide Test Results

The mortality of Aedes albopictus mosquito larvae was observed after a 24-hour treatment, with four replications.

Table 2. Total time of death of Aedes albopictus larvae in 4 replications every 1 hour, 3 hours, 6 hours, 12 hours, and 24 hours.

Concentration (%)	Number of Larval Deaths (n=100)					
	1st hour	3rd hour	6th hour	12th Hour	24th Hour	Total
Control (-)	0	0	0	0	0	0
Control (+)	10	10	19	39	22	100
20 mg	0	1	4	8	8	21
40 mg	0	1	7	21	26	55
60 mg	1	6	10	22	27	66
80 mg	3	5	13	22	34	77

Table 3. Kruskal Wallis Test Results

Parameter	Sig.	Information
Intergroup Test	0.004	There is a difference

Table 4. Test result of LC^{90}

Value	Estimate	Lower Limit	Upper Limit
.900	12.779	9.775	19.628

Based on the table data above, the results of the LC90 probit test indicated that the concentration that can kill 90% of larvae is 12,779 mg/ml with a lower limit of 9,775 mg/ml and an upper limit of 19,628 mg/ml. Table 5 displays the results of the LT50 probit test.

Tabel 5. Test result of LT^{50}

Concentration	Value	Estimate	Lower limit	Upper limit
20 mg	.500	431.368	106.491	1105218
40 mg	.500	48.564	32.599	98.538
60 mg	.500	68.840	39.404	296.770
80 mg	.500	48.058	300.784	159.124

The results of the LT50 probit test indicated that the time that could kill 50% of larvae was at 80 mg/ml with a time of 48.058 hours with a lower limit of 30.784 hours and an upper limit of 159.124 hours.

According to the study, flavonoids found in cocor bebek leaves (*Kalanchoe pinnata* L.) can usually poison the respiratory tract. This compound works by wilting nerves, which can damage the insect's siphon and make its breathing system less effective (Reksa Saputra & Ngatin, 2017). The tannin compounds contained have a bitter, sharp taste and can cause irritation to the stomach if eaten by insects. Then, the effect of saponin compounds in cocor bebek leaves is seen in the physical disorders of the outer body of insects, namely washing the wax layer that protects the insect's body and causing death because insects will lose a lot of body fluids (Hidayati, 2016).

The biolarvicide test carried out using extract determined 6 test groups with different concentrations, each cup containing 25 larvae in 100 ml of solution. The negative control group had 100 mL of distilled water that did not contain any cocor bebek leaf extract (*Kalanchoe pinnata* L.). This meant that the distilled water did not kill any mosquito larvae for 24 hours. In the positive control group, 100% of the instar III Aedes albopictus mosquito larvae died because temephos is a poison that is often used to kill mosquito larvae.

The LC90 probit test, conducted within 24 hours of cocor bebek leaf extract yieof 12.779 mg/ml, capable of killing 90% of Aedes albopictus larvae. Probit LT50 test results at a concentration of 20 mg/ml for 431.368 hours, a concentration of 40 mg/ml for 48.564 hours, a concentration of 60 mg/ml for 68.840 hours, and the highest concentration of 80 mg/ml for 48.058 hours. Larval mortality increased at all concentrations, and the highest mortality was at a concentration of 80 mg/ml with an LT50 of 48.058 hours with a lower limit of 30.784 hours and an upper limit of 159.124 hours. In other studies, the LT50 results at the highest concentration of 10% were 22.798 hours, which means that even at the highest concentration, the time taken by the extract leaves did not reach LT50 (Fatimah et al., 2020).

KESIMPULAN

The results of the research that has been conducted can conclude that the extract of cocor bebek leaves (*Kalanchoe pinnata* L.) has a biolarvicidal effect on the mortality of Aedes albopictus mosquito larvae.

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