Toxicity of *Derris eliptica* Benth. on Mortality of *Aedes aegypti* Linn larvae

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ABSTRACT

The death of the three *Aedes aegypti* Linn larvae that were placed inside has been the subject of a study on the toxicity test of *Derris elliptica* (Benth). This study's objectives were to ascertain the effect of tuba root extract on the quantity of larval instars of three *Aedes aegypti* Linn, as well as to ascertain the concentration of tubal root extract that affected as larvaside by measuring Lethal Concentration (LC_{50}). Experiment-based research is the type used. With seven concentrations and three replications over the course of 24 hrs, the research was carried out in partnership using a Randomized Complete Random Design (RAL) design. The probit analysis yields the LC_{50} result. The findings demonstrated that *Derris eliptica* extract, with an LC_{50} value of 125.99 ppm, had an impact on the death of instar larvae of three *Ae. aegypti* Linn.

Keywords: Toxicity, *Derris eliptica*, larval mortality, *Aedes aegypti*

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INTRODUCTION

In Indonesia, dengue fever disease continues to be an issue for both children and adults. According to reports, there are apparently more patients with this ailment each year. As many as 1,192 persons died from dengue fever in Indonesia in 2021, according to data from the World Health Organization (WHO, 2022). The ailment known as dengue fever was originally discovered in Cilegon in 2020. (Carisma, 2020). The dengue virus is the cause of dengue hemorrhagic fever (DHF), an acute viral disease that primarily affects children and manifests as abrupt indications of high fever and bleeding that can be fatal. The female *Aedes aegypti* mosquito bite is the primary method of disease transmission (WHO, 2022).

Organophosphate chemical groups, specifically Malathion and Teepos, are those that are frequently utilized in the elimination of Aedes. Teepos is used to kill mosquito larvae, while Malathion is used to kill adult mosquitoes. However, the use of synthetic chemicals can have unfavorable effects, including vector resistance, secondary population explosion, killing of non-target animals, environmental pollution, risks to human health like poisoning, itchiness, or allergies, among others (Carisma *et al.*, 2021).

Indonesia is home to a wide variety of plants with medicinal uses, including members of the Leguminosae family like *Derris eliptica*, whose roots are thought to contain Rotenone. One of the metabolic poisons, rotenone, can stop electron transport from happening during aerobic respiration by inhibiting $NADH_2$ activity (Meyer, 2003). Tuba root, also known as *Derris eliptica* root, is a tropical plant native to Indonesia that may be grown anywhere. A study was then done to ascertain the toxicity of tubal root based on the above descriptionextract (*Derris eliptica* Benth) to *Ae. aegypti* larvae mosquito larvae Linn.

MATERIALS AND METHODS

The study was carried out in the Physiology Laboratory of the Faculty of Mathematics and Natural Sciences Education (FPMIPA), UPI Bandung, Department of Biology Education.

Preparation of Plant Extraction

The procedure for extracting the substance is as follows, utilizing a Rotary evaporator tool.

Test Animal Maintenance

A quarter of a tray of well water is used to hold filter paper holding *Ae. aegypti* eggs until they hatch. Larvae are fed with pellets or breadcrumbs after being allowed to hatch for two to three days. The larvae are then transferred to a new tray. After being given the go-ahead to develop into larvae, it took around 5–6 days for it to reach the third instar stage, when it showed signs of being very active and moving up and down to the container's surface as well as starting to plainly form black on the visible portion of its head.

Range finding test and Definitive test.

Definitive test

A tighter concentration range was utilized in the Definitive test to test the concentration of tubal root extract that was determined by the Range finding test; ideally, the concentration value used in the Definitive test was 50% of the entire Range finding test (Arambasic, 2014). Three separate 24-hrs periods make up the whole observation time.

Analysis of data

Probit analysis and regression analysis were employed in the data analysis to quantify the abiotic elements that affect the quantity of larval fatalities.

RESULTS AND DISCUSSION

Definitive test

According to conclusive research, there are no dead *Ae. aegypti* larvae on the control after 24 hrs. A 24 hrs period of time with an effective concentration of 160 ppm-240 ppm results in a death rate of 60–100%. The LC_{50} value, according to the Polo-Pc software, is 125.99 ppm. Abiotic parameters including water temperature and pH were measured for this investigation.

Table 1. Mortality *Ae. aegypti* larvae on root extracts of *D. eliptica* on definitive test. Number of larvae tested 1

Concentration (ppm)	**4 hours**	**10 hours**	**24 hours**
0	0	0	0
40	3.33	16.67	26.67
80	26.67	36.67	40
120	30.0	43.33	46.67
160	33.33	56.67	60.0
200	46.67	83.33	86.67
240	63.33	80.0	100

Table 2 displays the results of the distribution of water temperature and pH of the treatment medium *Ae. aegypti* at the start of the observation and during the investigation. Table 2 shows that there is little difference between the average temperature at each concentration of tuba root extract before and after the addition of *Ae. aegypti* larvae. Prior to treatment, the average water temperature was uniform at 23±0°C, whereas following treatment, the average temperature slightly raised to 23.95±0.13°C.

Table 2. Abiotic factors (temperature dan pH water) before and after treatment

concentrations (ppm)	**Temparature (ºc) before treatment**	**Temparature (ºc) after treatment**	**pH before treatment**	**pH after treatment**
0	23 ± 0	23,33 ± 0,5	6,51± 0,07	6.75± 0,42
40	23 ± 0	23.05 ± 0,8	6.7 ± 0.05	6.95 ± 0.75
80	23 ± 0	23 ± 0,85	6.6 ± 0.1	6.95 ± 0.75
120	23 ± 0	23 ± 0,85	6.53 ± 0.05	6.91± 0.72
160	23 ± 0	23 ± 0,85	6.53 ± 0.05	6.90 ± 0.72
200	23 ± 0	23 ± 0,85	6.5 ± 0.1	6.80 ± 0.7
240	23 ± 0	23 ± 0,85	6.8 ± 0.1	7,23 ± 0.53
Average	**23 ± 0**	**23.95 ± 0.13**	**6.59±0.11**	**6.93±0.15**

The ideal range of water temperature for *Ae. aegypti* larvae is 25–32°C, hence the temperature of the water at the time of treatment is not anticipated to have a significant impact on the larvae's demise.

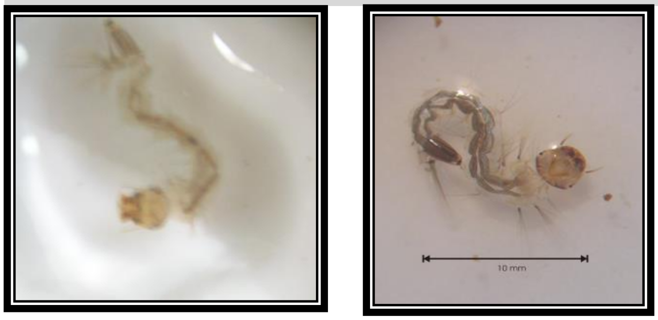

Figure 1. Comparison of Larvae normal of Ae. aegypti with Ae larvae and Ae. Aegypti that was damaged, A: *Ae. aegypti* larvae that has been given extract of *D. eliptica* root B: Larvae *Ae. aegypti* on control.

By preventing the passage of e- from NADH into cytochrome b in the respiratory chain, rotenone workability can limit an insects ability to take in oxygen (O_2) (Kurniawati, 2022). Additionally, rotenone can block glutamate oxidase, which can harm the neurological system. Insects poisoned with rotenone exhibit non-activity, erratic movement, refusal to eat, paralysis, and a gradual death. Reduced energy may occur from rotenone's ability to prevent the conversion of nutrients to energy during cellular respiration when it enters the respiratory tract (Lane *et al.*, 2023). It appears that the decreased energy in *Ae aegypti* larvae will indirectly result in active transport activities for uptake of ions like sodium, potassium, chloride, and phosphate by anal papillae (gill papilla) from the media to be suppressed. Electrolytes or dissolved ions in water are controlled in part by the anal papillae. The osmoregulation of *Ae. aegypti* larvae may be affected if anal papillae are damaged because they prevent ions from entering the body of the larvae. Food in the midgut is covered by a structure called the "perithropic matrix." In theory, "perithropic matrix" aids in the digestion process in the intestines, guards the midgut epithelium from mechanical harm, and shields insects from helminthes, bacteria, viruses, and protozoa (Jurenka, 2018). The method by which poisons enter the body and kill Ae larvae. There is still uncertainty and more research is required (Kurniawati *et al.*, 2022).

Lethal concentration (LC_{50}) of extract of tuba root to the overall mortality of larvae of *Ae. aegypti* instar three was determined by probit analysis using the Polo Program to be 125.99 ppm, with upper and lower limits of 166.35 ppm and 95.48 ppm, respectively. The addition of tuba root extract concentration can indirectly affect the pH value and water temperature at the treatment. The quantity of *Ae. aegypti* larvae will decline as the pH of the water becomes more crucial, and the synthesis of cytochrome oxidase, which is necessary for the metabolic process of *Ae. aegypti* larvae, may be hindered (Nanganye *et al.*, 2022).

The findings demonstrated that three *Ae. aegypti* Linn mosquito instar larvae died when treated with tuba root extract (*Derris eliptica* Benth). The death rate of *Ae. aegypti* larvae will increase as tuba root extract content increases. After a 24hrs period, effective concentration values of 125.99 ppm killed *Ae. aegypti* larvae in half the population of test mosquito larvae (LC_{50}).

REFERENCES

Anganye, T and Lelei, K. 2022 The Toxicity of Synthetic Pesticides in the Niger Delta Region: *A Review Archives of Ecotoxicology*, **4**(4):105-108

Arambasic, M and Akram M. 2014. Comparison of the methods of Finney and Miller-Tainter for the calculation of LD_{50} values. *World Applied Sciences Journal*, **32**(10):2167-2170

Charisma, A. M., Anwari, F and Farida Ea. 2021. Pemberdayaan Masyarakat dalam Penanaman Tanaman Melati (*Jasminum Sambac*) Sebagai Larvasida Alami untuk Pencegahan Demam Berdarah Dengue (DBD di Desa Lebakjabung Kec. Jatirejo Kab. Mojokerto. Vol. 1

David E Lane., Tegan J. Walker and Deborah, G. Grantham. 2023. IPM Adoption and Impacts in the United States. *Journal of Integrated Pest Management*, **14**(1):1–6

Jurenka, R. 2016. Insect Physiology and Biochemistry, *Florida Entomologist*, **99**(4);826. https://doi.org/10.1653/024.099.0449

Kurniawati, D. H. Martini., Wahyuningsih, N. E and Sutiningsih, D. 2022. Comparison analysis of leaf and flower extraction of clove which have the potential as larvacida. *International Research Journal of Public and Environmental Health,* **9**(4);110-119.

Nurmalasari, Wiwik Eko Pertiwi and Sadya Bustomi. 2021. Karakteristik Tempat Penampungan Air Bersih dengan Keberadaan Jentik Nyamuk *Aedes Aegypti. Journal Of Health Science Community*, **2**(2); 9-17.

Nurul, M., Purnomo, A., Khayan, Wardoyo, S and Taufik An. 2021. *Z. mauritiana* Leaves as Larvasidal. *Alternatives KEMAS*, **17**(1) 30.10.15294/kemas.v17i1.24377

WHO 2018. Dengue vaccines: WHO position paper – September 2018 Weekly epidemiological record; **36**(93): 457–476

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