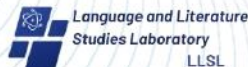




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Analysis of Lavender Flower Extract (*Lavandula Angustifolia*) as a Natural Larvicide for the Control of *Aedes Aegypti* Larvae

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Abstract

Dengue fever is a disease caused by a virus inside the *Aedes aegypti* mosquito. One way to prevent the spread of dengue fever is by breaking the life cycle of mosquitoes. One cycle that is very easy to break in the chain of mosquito life is the larval cycle. One of the powerful larvicides to kill *Aedes aegypti* larvae is extracted from lavender flowers (*Lavandula angustifolia*). The purpose of this study was to determine the effectiveness of lavender flower extract (*Lavandula angustifolia*) as a natural larvicide for *Aedes aegypti* larvae. The method used in this study was a sample of 60 larvae and distilled water. The results obtained show that lavender extract (*Lavandula angustifolia*) is effective in controlling the conclusion of this study is that lavender extract (*Lavandula angustifolia*) as a larvicide can kill *Aedes aegypti* mosquito larvae. The mortality rate of *Aedes aegypti* larvae, according to the results of the study, is strongly influenced by the number of concentrations drops of extract and the number of larvae in each container.

Keyword: Dengue fever; *Aedes aegypti*; Lavender flower

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INTRODUCTION

Aedes aegypti mosquitoes transmit the dengue virus, which causes dengue fever. (Syamsir, Daramusseng, & Rudiman, 2018) Dengue bleeding fever is one of the most contagious diseases, and people are worried about it because it is a rapidly spreading infectious disease that kills many people. (Susanti & Suharyo, 2017; Zikrullah, M., 2023).

The first case of dengue fever appeared in the Philippines in 1953; in Indonesia, it was first reported in 1968, with a total of 58 cases, 24 of which resulted in deaths in Surabaya. Due to the number of fatalities in Surabaya every year, this city is considered the endemic site of the disease. (Vidiani & Yudhastuti, 2005; Wijaya & Sahlan, M., 2021).

Symptoms include bleeding in the gums, nose, and mouth; pain in the veins of the heart; and bruising of the skin. This *Aedes aegypti* mosquito has a rapid growth rate and infects 390 million people every year. Because of the rapid spread of the disease and an increase in incidence every year, hemorrhagic fever has become a public health problem in Indonesia. (Butarbutar, Sumanpouw, & Pinontoan, 2019; Misbah, 2019).

Aedes aegypti mosquitoes can nest in various places, generally in hot and humid places. This disease can affect adults and even children. (Syahputra, Irsan, & Harsadi, 2020). Mosquitoes are one of the most annoying insects and can transmit dangerous diseases. In some countries, mosquitoes are vectors of various dangerous diseases such as malaria, dengue fever, filariasis, and chikungunya (Nindatu, Tuhumurt, Novita, II, & Kaihena, 2011).

Often, people use insecticides or mosquito repellents that are widely available and easily available, including mosquito coils, electricity, and so on. But it is only limited and momentary and has no preventive effect. Excessive use of chemicals can lead to increased insect resistance (Gama, Yanuwadi, Bagyo, Kurniati, & Handayani, 2010; Maulana, 2020).

Mosquitoes are insects that use water in the surrounding environment, including natural water and artificial source water that is permanent or only temporary. In particular, water conditions as a breeding ground for eggs for adult mosquitoes have an influence on the mosquito cycle itself. (Nardin, Santri, Fa'al, & Ashafil, 2019).

Aedes aegypti is a vector of the Zika virus that causes Zika, Chikungunya, and yellow fever (Adelvia, Mahmud, Armedina, Rahmasari, Mukhtarom, & Rio, 2020; Paull, J., 2024). When bitten by *Aedes* mosquitoes, red spots will appear, accompanied by other symptoms. This disease is also influenced by several factors, such as the environment and human character. One of four serotiv viruses of the flavivirus genus, the flaviviridae family, causes dengue fever (Nardin, Santri, Fa'al, & Ashafil, 2019; Seroja, 2019; Ibrahi, 2024).

The development of larvae into pupae occurs within a period of 7-9 days. The body of the larva consists of the head, abdomen, and chest. L and II larvae feed more on bacteria, while L and LV larvae eat more organic particles. The life of these larvae is affected by the state of the temperature and the density of the larvae. These larvae develop in places with a lot of water. We can break the chain of dengue spread at the larval stage. One way to kill mosquito larvae is by testing lavender flower extract as an exterminator of *Aedes aegypti* mosquito larvae.

This lavender plant is grown throughout Southern Europe, Bulgaria, the Russian Federation, the United States, and Yugoslavia after blooming in the Northern Mediterranean region. Lavender belongs to one of the 47 species of flowering plants in the Lamiaceae family.

This plant also belongs to the category of grasses and short shrubs. Lavender is a multipurpose plant. Lavender flowers are usually cultivated in the rainy season because lavender plants are happy with cool weather. Lavender can be grown indoors or outdoors. Lavender is best planted outdoors in soil that receives plenty of direct sunlight and has adequate drainage. Nerol, lavandulol, geraniol, limonene, camphene, ocimene allocation, linalolacetate, and monoterpenes are some of the chemicals found in lavender flowers. (Ramadan & Zettira, 2017; Cristina, 2024).

Lavender flowers are usually used as aromatherapy because lavender contains good properties to reduce excessive worry about someone and can also reduce pain and melt the atmosphere (Noviani, Praminingrum, & Raras, 2022; Johan, 2024).

METHOD

This section should not exceed 10% of the manuscript; it should be written briefly, concisely, and clearly, but adequately to allow others to replicate and build on the published results. This section contains an explanation of the research approach, subjects of the study, the conduct of the research procedure, use of materials and instruments, data collection, and analysis techniques. These are not theories. Such a description enables the reader to evaluate the appropriateness of the methods and the reliability and validity of the results.

In the case of statistical uses, formulas that are generally known should not be written down. Any specific criteria used by the researcher in collecting and analyzing the research data should be completely described, including the quality of the instruments, the material of the research, and the procedure of data collection. Interventional studies involving animals or humans, and other studies that require ethical approval, must list the authority that provided approval and the corresponding ethical approval code. Please bear in mind that readers must be able to recreate your study from the level of detail that you provide.

This research uses quantitative techniques based on experiments. This experiment was conducted in the MTsN 1 science laboratory in Banda Aceh. The experiment was conducted on 1 experimental plant with an extract concentration of 3 drops, namely 15, 20, and 25 drops, using the RAL technique (complete randomized design) with 2 repeats. Blenders and filters are research tools. Material: samples of *Aedes aegypti* larvae, lavender flowers, and Aquadest.

Quantitative and qualitative data analysis is carried out. To evaluate the accuracy of the media, quantitative data analysis is used. Descriptive methods are used to analyze qualitative data so that research results are presented in the form of tables, graphs, and figures.

1. Data analysis of the anti-mosquito larval activity of *Aedes aegypti* lavender extract. The data collected from the research findings are examined descriptively, and the findings are presented in the form of graphs and tables.
2. Analysis of evidence. This analysis was conducted to determine the percentage of lavender extract activity against *Aedes aegypti* mosquito larvae using the formula:

$$P = \frac{R}{N} \times 100 \%$$

Windu Erhansyah et al. (2012).

The study population was *Aedes aegypti* mosquito larvae collected from MTsN 1 Banda Aceh. Purposive sampling, or a sampling method that meets the requirements of the study, is the

methodology used in this study. The research requirements include 60 Aedes instar IV mosquito larvae collected at MTsN 1 Banda Aceh. The larvae of the Aedes instar IV mosquito are the specimens used. The techniques in this study consist of:

1. Breeding larvae of Aedes aegypti mosquitoes
Every mosquito larva is bred and potent and guarded until the mosquito larvae are aged instar IV. Bred to meet the number of needs in research.
3. Research tools to collect data are observation sheets of larval growth and development, the working power of lavender extract, and larval mortality.

FINDING AND DISCUSSION

Finding

1. Effect of lavender extract (*Lavandula angustifolia*) as a larvicide on *Aedes aegypti*

The following is the result of an observation table about the effect of lavender extract (*Lavandula angustifolia*), which is presented in table form.

Table 1. First Stage

Container	Total Number of Larvae	Extract Drops	Number of dead larvae
1	10 larvae	15	5
2	20 larvae	20	5
3	30 larvae	25	6

It can be seen in the first stage of the first container with 15 drops of extract; that is, mortality reaches 5% of the total initial larvae, as many as 10 larvae. In the second container with 20 drops of extract, mortality reaches 20% of the total initial larvae, or as many as 20 larvae. In the third container with 25 drops of extract, mortality reaches 25% of the total initial larvae, or as many as 30 larvae.

Table 2. Second Stage

Container	Total Number of Larvae	Extract Drops	Number of dead larvae
1	10 larvae	15	+1
2	20 larvae	20	+2
3	30 larvae	25	+2

Based on the table above: In the second stage, the first container with 15 drops of extract, namely the death of larvae, increases by 1 larva from the death of the first stage. In the second container with 20 drops of extract, the death of larvae increases by 2 larvae from the death of the first stage. In the 3rd container with 25 drops of extract, the death of larvae increased by 2 larvae from the total death of the first stage.

Based on the table above, there are differences in larval mortality in each container in the first and second stages. This difference is influenced by the number of larvae in each container and the number of extract droplets in each container.

Discussion

This study was conducted to test the power of lavender extract (*Lavandula angustifolia*), which reacts to the mortality of *Aedes aegypti* mosquito larvae. It was conducted in the science laboratory using purposive sampling techniques. This technique is suitable for use in quantitative experimental research using certain samples and considerations. The purpose of this study is related to testing the power of extracts against mosquito larvae death with the use of samples of 60 larvae separated in each container. The repetition stage in this study was two repetitions.

In the first stage, namely at the lowest concentration of 15 drops, the results of larval death for 24 hours were obtained, which were 5 larvae, 20 drops were 5 larvae, and 25 drops were 6 larvae. In the second stage, the concentration is 15 drops, the addition of 1 larva is 20 drops, the addition of 2 larvae is 25 drops, and the addition of 2 larvae is 25 drops.

The results showed that lavender (*Lavandula angustifolia*) is effective in controlling *Aedes aegypti* larvae because this plant contains essential oils in which active compounds such as linalool and linalyl acetate are contained. This is in line with the results of experiments (Kurniasari, 2021), which state that compounds such as linalool and linalyl acetate are the main active compounds found in essential oils. Essential oils also contain other active compounds, such as flavonoids. The active compound in lavender (*Lavandula angustifolia*) is generally used as aromatherapy, as stated by Dewi and Astuti (2022) that lavender aromatherapy is one way to treat and also heal using essential oil.

Besides being used as aromatherapy, lavender is also commonly used as an antianxiety, antibacterial, and mosquito repellent. This is because the fragrance of lavender flowers can affect mosquitoes. Mosquitoes are one of the vectors of DHF. This is in line with Gesriantuti, Badrun, & Fadillah (2017) which states that mosquitoes are vectors that cause dengue fever in Indonesia, namely mosquitoes or insects *Aedes aegypti* and *A. albopictus*. This type of insect or mosquito has its own geographical distribution in a certain number of places. DHF transmission is generally also influenced by the place of its parent in endemic areas.

The growth and development of mosquitoes are also influenced by several circumstances. This is explained by Razma, Purwanda, and Elita Augustina (2020): mosquitoes are a group of insects with excellent adaptability to changes in their environment, resting places, foraging sites, and breeding grounds.

In addition to the ability to adapt to mosquitoes, DHF is also influenced by the presence and development of larvae in mosquitoes. Many factors influence the presence of *Aedes aegypti* mosquito larvae. This is in line with Fakhriadi and Asnawati (2018) which state that the existence of *Ae.*

Aegypti in an area is an indication of the presence of *Ae.* The same is true for *Aegypti* in this area. Overcoming dengue fever is a social problem that is quite complex because this disease still has no cure. The best way to fight this disease is to destroy the mosquito larvae that transmit the disease.

CONCLUSION

Conclusion

Based on the results of the above research, it can be concluded that:

1. For further research carried out more effectively in killing mosquito larvae, *Aedes aegypti*.
2. The mortality rate in *Aedes aegypti* larvae, according to the results of the study, is strongly influenced by the amount of extract drop concentration and the number of larvae in each container.

Suggestion

It is recommended for further research, namely:

1. For future research, it can be made even more effective to kill *Aedes aegypti* mosquito larvae.
2. For further research, it is expected that the objects or samples in this study will be multiplied and expanded.

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