
The Effect of Clove Leaf Essential Oil (*Syzygium aromaticum*, L) on Mortality Level of *Aedes aegypti* Mosquitos

Iva ariska

Fakultas Kesehatan Masyarakat, Universitas Muhammadiyah Palu, Sulawesi Tengah, Indonesia

*Corresponding Author: E-mail: iva.ariska@gmail.com

ARTICLE INFO

Received: 30 March 2023

Accepted: 27 September 2023

Volume: 3

Issue: 3

DOI: [10.56338/jphp.v3i3.4415](https://doi.org/10.56338/jphp.v3i3.4415)

KEYWORDS

Effect;
Clove Leaf Essential Oil;
Mortality;
Aedes Aegypti

ABSTRACT

One of the big problems in Indonesia is dengue hemorrhagic fever caused by the *Aedes aegypti* mosquito. The use of natural materials as a safe control for health and environmentally friendly is an option for the community. Clove leaves contain compounds of eugenol, saponins, flavonoids, and tannins. The purpose of this study is to determine the effect of clove leaf essential oil, *Syzygium aromaticum*, L. on the level of *Aedes aegypti* Mosquito mortality.

This is an experimental research which aims to determine the ability of clove leaf oil in the form of an electric diffuser to kill *Aedes aegypti* mosquitoes. The objects of this study are the *Aedes aegypti* mosquitos and clove leaf essential oil. The number of samples in this study was 250 mosquitoes and 500 ml of clove leaf essential oil. The data collection method in this study used primary data and secondary data.

Based on the results of research that has been carried out on *Aedes aegypti* mosquitoes for 20 minutes of exposure and 24 hours holding with the treatment of 60 ml and 100 ml of clove leaf essential oil in two different chamber boxes, it can be concluded that clove leaf essential oil is *Syzygium aromaticum*, Linous. Can kill the *Aedes aegypti* mosquito and can be said to be effective.

This study suggests that it is possible to establish cooperation so that in the future students can apply the knowledge that has been obtained to the community, in order to improve the degree of Public Health.

INTRODUCTION

Indonesia is a country with a tropical climate so it is a place for disease transmission, one of which is the *Aedes aegypti* mosquito which transmits the dengue virus which causes dengue hemorrhagic fever (DHF) (1–3). Dengue Hemorrhagic Fever (DHF) is an infectious disease that is widespread in Indonesia, causing many fatalities, and its incidence is increasing from year to year (4–6). In Indonesia dengue fever was first reported in Jakarta and Surabaya in 1972. Since then dengue fever has spread to various regions, so that in 1980 all provinces in Indonesia were infected. One of the causes of the increase and spread of this disease is the increased transportation (movement) of people from one area to another, especially in densely populated urban environments (7).

Mosquitoes in general and *Aedes aegypti* in particular are a major public health problem in countries with tropical climates, including Indonesia. *Aedes aegypti* is one of the factors causing several serious diseases that attack humans, such as malaria, encephalitis, "yellow fever", dengue fever, dengue hemorrhagic fever, filariasis, and arbovirus. One of the big problems caused by the *Aedes aegypti* mosquito in Indonesia is dengue hemorrhagic fever (8,9).

DHF Cases In Central Sulawesi, Palu City, there were 637 cases of dengue fever from January to December 2016 and 3 people died, In 2017, dengue fever cases in the Palu City area decreased to 401 people and 2 people died, In 2018 the number of dengue fever cases decreased again with the number of cases being 398 people and 2 people dying, and in 2019 the number of dengue fever cases increased to 550 people and 9 people dying (Central Sulawesi Health Office, 2020).

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 50 of 2017, vector-borne diseases are still endemic and can cause outbreaks or unconventional events and have an impact on the community's economic losses, therefore efforts need to be made to control vector transmission (10). Vector control is an activity or action that aims to reduce the number of disease vectors as low as possible, so that there is no longer any risk of disease transmission, so that vector-borne diseases can be prevented. In Indonesia, diseases transmitted by mosquito larvae are endemic in several areas, such as dengue hemorrhagic fever (DHF) which is transmitted through mosquito bites (11).

Prevention of dengue hemorrhagic fever can be done by controlling and preventing mosquito vectors, namely reducing contact between humans and mosquito vectors or reducing the frequency of contact (12). A study shows that the best way to reduce contact with mosquitoes is to use mosquito repellent and wear closed clothing to prevent mosquito attacks (13,14). In Indonesia, anti-mosquito emulsions are circulating that contain 10-15% DEET (Diethyltoluamide), a compound which is a synthetic chemical that can be used to prevent mosquitoes. However, frequent use and overdose will affect human health. Several studies have reported that the use of DEET can cause mild (such as skin urticaria) to severe (such as encephalopathy) toxicities (15–17).

An effort to obtain an alternative insecticide that can kill insects but does not have side effects on the environment and human health is by using clove leaves. Clove plant leaves contain active ingredients such as eugenol, saponins, flavonoids and tannins. The active ingredients contained in clove leaves affect several physical activities of insects, such as inhibiting eating, breathing, growth and development, and the death or demise of insects. (18).

Clove leaves can be used as an anti-mosquito because clove leaf oil contains the compound eugenol (19). Eugenol is the most common compound in clove leaf extract. Eugenol has a unique smell and aroma, has a pungent taste, and can easily evaporate if placed in the open air, so it can be used as a repellent for the *Aedes aegypti* mosquito (20). Eugenol is neurotoxic and can cause insect inactivation. Neurotoxicity plays a role in inhibiting the nervous system of insects which is characterized by their bodies being soft and weak when touched.

The use of natural materials as a form of control that is safe for health and environmentally friendly is a choice for the community. The repellent power against mosquitoes is generally obtained from the pungent odor that comes from essential oil compounds.

Based on the above background, this research aims to determine the ability of *Syzygium aromaticum*, Linous Clove Leaf Oil, as the death of the *Aedes aegypti* mosquito. The reason the author chose clove leaves as a research object is because the author's home area is one of the cities that produces the most cloves, namely Tolitoli Regency, Central Sulawesi, so this research will be very easy.

METHOD

This research uses an experimental type of research method which aims to determine the effect of *Syzygium aromaticum*, Linous clove leaf essential oil. On the Motility Level of the *Aedes aegypti* Mosquito. This research was conducted on August 25 2021 at the Donggala Health Research and Development Office Laboratory.

RESULTS

This research was conducted to see the ability of clove leaf essential oil as a diffuser in killing *Aedes aegypti* mosquitoes. To carry out this research, essential oils from clove leaves and *Aedes aegypti* mosquitoes are needed. Clove leaf essential oil was obtained from an oil refinery in Lelean Nono Village, Toli-toli Regency and *Aedes aegypti* mosquitoes were obtained from the P2B2 Research and Development Center, Donggala Regency.

The research results were obtained by observing for 20 minutes and using a clove leaf essential oil diffuser used in a chamber box to control the *Aedes aegypti* mosquito. This research was planned to use 3 treatments to determine mosquito mortality from the results of the clove leaf essential oil diffuser experiment. Based on the results of the experiments carried out, the following results were obtained:

Table 1. Number and percentage of mosquito deaths at various concentrations of essential oils in clove leaves

Concentration (ml)	Number of Mosquitoes (Tail)	Repetition			Average Mosquito Deaths	Mosquito Mortality Percentage (%)
		1	2	3		
Control	25	0	0	0	0	0
60	25	22	23	24	23	92
100	25	25	24	25	24	96

From the results of the tests carried out, it can be seen in table 5.1 that the highest mortality rate for *Aedes aegypti* mosquitoes was at a concentration of 100 ml with an observation time of 20 minutes, namely 24 *Aedes aegypti* mosquitoes or 96%. Meanwhile, the average number of *Aedes aegypti* mosquitoes was low at a concentration of 60 ml in 20 minutes, namely 23 *Aedes aegypti* mosquitoes or 92%.

DISCUSSION

This study used 3 treatments with 225 *Aedes aegypti* mosquitoes, where in each treatment there were 3 chamber boxes and each chamber box was filled with a diffuser and 25 *Aedes aegypti* mosquitoes and one of them was used as a control chamber box. And each treatment has a time of 20 minutes, after 20 minutes it is followed by holding for 24 hours and given sugar water.

The first treatment was carried out using 75 *Aedes aegypti* mosquitoes which were put into three chamber boxes, each chamber box containing 25 *Aedes aegypti* mosquitoes and one diffuser. One diffuser in the chamber box uses 100ml of water and two diffusers in the other chamber box use clove leaf essential oil, namely 60ml and 100ml. In the first treatment, the death of *Aedes aegypti* mosquitoes was shown in each chamber box containing clove leaf essential oil at 15 minute intervals. Meanwhile, in the control box there were no dead mosquitoes found at all. In repetitions two and three the treatment was the same as the first treatment.

Based on the results of observations for 20 minutes in treatments one, two and three, it showed that the death of *Aedes aegypti* mosquitoes for each chamber box was different except for the control group, not a single mosquito died, After exposure to the diffuser containing clove leaf essential oil, it was held for 24 hours. During the holding period in the first treatment, 60 ml concentration showed 22 dead *Aedes aegypti* mosquitoes and 3 live mosquitoes, whereas in the 100 ml concentration 25 mosquitoes died and in the control there were no dead mosquitoes.

In the second repetition the mosquitoes that died were at 15 minute intervals and for the control group not a single mosquito died. After exposure for 20 minutes, holding was carried out for 24 hours. After holding for 24 hours, 60 ml of dead mosquitoes were concentrated, with 23 mosquitoes and 2 live ones. Concentrated with 100 ml, there were 24 dead mosquitoes and 1 live mosquito.

In the third repetition, the mosquitoes that died were at 15 minute intervals and for the control group, not a single mosquito died. After exposure for 20 minutes, holding for 24 hours was carried out. After holding for 24 hours, the dead mosquitoes were concentrated at 60 ml for 24 mosquitoes and 1 live one. Concentrated at 100 ml there were 25 dead mosquitoes.

The results of the percentage of *Aedes aegypti* mosquito deaths in all treatment groups after 20 minutes of treatment showed that the increase in the number of *Aedes aegypti* mosquito deaths was directly proportional to the increase in the concentration of clove leaf essential oil, The higher the concentration used and the longer the time, the more *Aedes aegypti* mosquitoes will die.

This research is in line with several previous studies with clove leaf essential oil which have been carried out stating that clove leaves are effective as an insecticide in the preparation of anti-mosquito burns (21–23).

Clove leaves contain active compounds such as flavonoids, saponins and tannins (24). The combination of the composition of these active compounds means that clove leaves can be used as an insecticide to minimize the toxic effects of synthetic insecticides.

Active compounds such as flavonoids are respiratory poisons that enter the mosquito's body through the respiratory system, This will then cause nerve problems and damage to the respiratory system, resulting in the mosquito being unable to breathe and ultimately resulting in the mosquito's death.

Insecticides made from clove leaf essential oil are safe for the environment, because they are non-persistent. This is because essential oils are easily broken down naturally.

CONCLUSION

This research concludes that clove leaf essential oil is effective as an insecticide (diffuser) against the mortality of the *Aedes aegypti* mosquito.

The concentration of clove leaf essential oil affects the death of *Aedes aegypti* mosquitoes. With a concentration of 60 ml, the mosquito death rate was 92%.

The concentration of clove leaf essential oil affects the death of *Aedes aegypti* mosquitoes. With a concentration of 100 ml, the mosquito death rate was 96%.

BIBLIOGRAPHY

1. Ristanto F, Kaunang WPJ, Pandelaki AJ. Pemetaan kasus demam berdarah dengue di Kabupaten Minahasa Utara. *J Kedokt Komunitas dan Trop*. 2015;
2. Yuningsih R. Kebijakan Penanggulangan Kejadian Luar Biasa Penyakit Demam Berdarah Dengue di Kabupaten Tangerang. *J Masal Masal Sos*. 2018;9(2):260–73.
3. Wole BD, Masluhiya S, Susmini S. Hubungan tingkat pengetahuan terhadap perilaku ibu dalam pencegahan demam berdarah dengue (DBD) pada anak di wilayah kerja puskesmas bareng kota malang. *Fakultas Ilmu Kesehatan Universitas Tribhuwana Tunggadewi*; 2020.
4. Respati T, Raksanagara A, Djuhaeni H, Sofyan A. Spatial distribution of dengue hemorrhagic fever (DHF) in urban setting of Bandung city. *GMHC*. 2017;5(3):212–8.
5. Karyanti MR, Uiterwaal CSPM, Kusriastuti R, Hadinegoro SR, Rovers MM, Heesterbeek H, et al. The changing incidence of dengue haemorrhagic fever in Indonesia: a 45-year registry-based analysis. *BMC Infect Dis*. 2014;14(1):1–7.
6. E Setiati T, FP Wagenaar J, D de Kruif M, TA Mairuhu A, CM van Grop E, Soemantri A. Changing epidemiology of dengue haemorrhagic fever in Indonesia. 2006;
7. Wowor R. Pengaruh kesehatan lingkungan terhadap perubahan epidemiologi demam berdarah di Indonesia. *e-CliniC*. 2017;5(2).
8. Rodrigues-Alves ML, Melo-Junior OA de O, Silveira P, Mariano RM da S, Leite JC, Santos TAP, et al. Historical perspective and biotechnological trends to block arboviruses transmission by controlling *Aedes aegypti* mosquitos using different approaches. *Front Med*. 2020;7:275.
9. Tolle MA. Mosquito-borne diseases. *Curr Probl Pediatr Adolesc Health Care*. 2009;39(4):97–140.
10. Padaga MC, Setianingrum A, Fatmawati M. Penyakit Zoonosa Strategis di Indonesia: Aspek Kesehatan Masyarakat Veteriner. Universitas Brawijaya Press; 2018.
11. Ningrum SA, Kartika D. MANAJEMEN PENGENDALIAN VEKTOR. *Uwais inspirasi Indonesia*; 2023.
12. Ishak H, Aisyah AS, Mallongi A, Astuti RDP. Risk factors and fogging effectiveness of dengue hemorrhagic fever incidence in the Pontap Public Health Center area in Palopo City, Indonesia. *Enferm Clin*. 2020;30:294–7.
13. Richards SL, Agada N, Balanay JAG, White A V. Permethrin treated clothing to protect outdoor workers: evaluation of different methods for mosquito exposure against populations with differing resistance status. *Pathog Glob Health*. 2018;112(1):13–21.
14. Mponzi WP, Swai JK, Kaindoa EW, Kifungo K, Eiras AE, Batista EPA, et al. Observing the distribution of

- mosquito bites on humans to inform personal protection measures against malaria and dengue vectors. PLoS One. 2022;17(7):e0271833.
15. Zhu T, Deng J, Xu M, Cai A, Ye C, Li J, et al. DEET degradation in UV/monochloramine process: Kinetics, degradation pathway, toxicity and energy consumption analysis. Chemosphere. 2020;255:126962.
 16. Alikhan FS, Maibach H. Topical absorption and systemic toxicity. Cutan Ocul Toxicol. 2011;30(3):175–86.
 17. Syahri W, Latief M, Utami A, Bemis R, Amanda H, Chaerunisaa AY. Screening and potential analysis of methanolic leaf extract of Mangrove plants at east coast Sumatera as repellent against *Aedes aegypti*. J Pharm Sci Res. 2018;10(9):2228–31.
 18. GETAS DRSI, Kristinawati E. Ekstrak Bunga Cengkeh sebagai Insektisida terhadap Mortalitas Nyamuk *Aedes Aegypti* Metode Semprot. J Penelit dan Kaji Ilm Kesehat Politek Medica Farma Husada Mataram. 2021;7(2):161–8.
 19. Lestari Y, Nukmal N. Potensi ekstrak daun cengkeh (*Syzygium aromaticum* L.) dalam bentuk lotion sebagai zat penolak terhadap nyamuk *Aedes aegypti*. In: Prosiding Seminar Nasional Pengembangan Teknologi Pertanian. 2014.
 20. Herawaty N, Prabandari S, Susiyarti S. FORMULASI DAN UJI SIFAT FISIK LILIN AROMATERAPI KOMBINASI MINYAK ATSIRI DAUN KEMANGI (*Ocimum sanctum* L) DAN SEREH (*Cymbopogon citratus*). Politeknik Harapan Bersama Tegal; 2021.
 21. Al Fatina A, Rochma NA, Salsabilah N, Eprilyanto AF, Aulia R, Sukaris S, et al. Pembuatan Minyak Sereh Dan Lilin Aromaterapi Sebagai Anti Nyamuk. DedikasiMU J Community Serv. 2021;3(2):837–47.
 22. Yusmitaria Y, Dewi B, Setya ER. FORMULASI DAN UJI EFEKTIVITAS SEDIAN LILIN AROMATERAPI (ANTINYAMUK) DARI MINYAK SEREH WANGI (*Cymbopogon nardus* L). Stikes Al-Fatah Bengkulu; 2020.
 23. Agustina M, Dewi B, Sari Y. FORMULASI DAN UJI EFEKTIVITAS SEDIAAN LILIN AROMATERAPI (ANTINYAMUK) DARI MINYAK CENGKEH (*Syzygium aromaticum* Linn). Stikes Al-Fatah Bengkulu; 2020.
 24. Batiha GE-S, Alkazmi LM, Wasef LG, Beshbishy AM, Nadwa EH, Rashwan EK. *Syzygium aromaticum* L.(Myrtaceae): traditional uses, bioactive chemical constituents, pharmacological and toxicological activities. Biomolecules. 2020;10(2).