# Potential of Ethanol Extract of Lantana (*Lantana camara* L.) Leaf as *Aedes aegypti* Mosquitoes Repellent

Jafriati Jafriati*[1], Asnia Zainuddin[1], Nani Yuniar[1] and Wa Neli[1]

[1] Public Health Study Program, Public Health Faculty, Halu Oleo University, Kendari 93232, Indonesia
jafriati@uho.ac.id

**Abstract.** Dengue Hemorrhagic Fever (DHF) is caused by the Dengue virus, transmitted through the bite of *Aedes aegypti* mosquito. Dengue Hemorrhagic Fever (DHF) is one of the infectious diseases that remains a public health problem up to this day. Lantana plant (*Lantana camara* L.) is a type of wild plant that has colorful flowers and unpleasant smell. This study aimed to determine the potential of lantana leaf extract (*Lantana camara* L.) to repel (Repellent) *Aedes aegypti* mosquitoes at various concentrations. The form of the research was quasi-experimental with posttest only control group design and completely randomized design (CRD) in the use. The samples used were 20 *Aedes aegypti* mosquitoes for each of concentrations. The results of statistical analysis using the One Way ANOVA test showed that lantana leaf extract (*Lantana camara* L.) has the potential as an *Aedes aegypti* mosquito repellent, with the repellent average for concentration of 10% is 60%, 20% is 75%, and 30% is 90%. In addition, based on the results of the LSD test, the number of mosquitoes that resisted among concentrations of lantana leaf extract (*Lantana camara* L.) also had a significant difference that is ($p < 0.05$). The conclusion of this study is that lantana leaf extract has the potential as an *Aedes aegypti* mosquito repellent in various concentrations.

**Keywords:** *Lantana camara*, *Aedes aegypti,* Mosquito.

## 1 Introduction

Dengue Hemorrhagic Fever (DHF) is an infectious disease caused by the dengue virus and transmitted by the *Aedes aegypti* mosquito, which is characterized by a sudden fever of 2 to 7 days with unclear causes, lethargy, restlessness, heartburn, and some signs of bleeding on the skin in the form of bleeding spots (petechiae), bruising (echymosis) or rash (purapura) [1]. Dengue Hemorrhagic Fever (DHF) is caused by the Dengue virus, which is transmitted through the bite of the *Aedes aegypti and Aedes* mosquitoes. Dengue hemorrhagic fever is often found especially in tropical areas and often causes an outbreak. What affects the emergence of dengue hemorrhagic fever (DHF) is the low immune status of community groups, the population density of


K. J. Banda and S. Susanty (eds.), *Proceedings of the 1st International Conference Medical and Health Science Halu Oleo (IMHO 2023)*, Advances in Health Sciences Research 76,
https://doi.org/10.2991/978-94-6463-392-4_11

transmitting mosquitoes due to the large number of mosquito breeding spots that usually occur in the rainy season [2].

According to the data of World Health Organization (WHO) in 2019, about 390 million dengue virus infections occurred every year, of which 96 million cases had severe clinical symptoms. Currently, cases of DHF are spreading in 472 districts/cities of 34 provinces. Deaths due to DHF occurred in 219 districts/cities [3]. Data of dengue hemorrhagic fever (DHF) in Indonesia in 2019 was recorded as many as 138,127 cases. This number increased compared to 2018 which was 65,602 cases. With the Incidence Rate (IR) in 2019 was 51.48 per 100,000 citizens, there is an increase compared to the previous two years, which of 2016 and 2017 [4]. Based on the profile of the Southeast Sulawesi Health Office, in 2018 the number of DHF cases reportedly was 655 cases. In 2019 DHF cases doubled as many as 1,510 people with 5 deaths. And in 2020 DHF cases decreased compared to 2019. The number of DHF cases in 2020 was 905 people with 9 deaths [5]. Based on data from the Kendari City Health Office, DHF cases in 2018 were reported as many as 111 cases. In 2019, there were 450 DHF cases with 2 deaths. In 2020 DHF cases decreased compared to 2019. The number of DHF cases in 2020 was 307 cases with 6 deaths. And in 2021 the number of DHF cases was 142 cases with 3 deaths [6].

Factors that cause the DHF occurrence can be categorized into 4 factors, namely environment, behavior, health services and genetics. The factors related to the DHF occurrence are the role of community behavior and environmental factors. There are two environmental factors, such as landfills/waste and the presence of a water reservoir both inside and outside the house. A water reservoir can increase the risk of DHF occurrence because it has the potential to become a breeding spot for mosquito vectors [7].

## 2 Research Method

The type of this research was in the form of quasi-experimental that examined the potential of the ethanol extract of lantana (*Lantana camara* L.) leaf as a repellent for *Aedes aegypti* mosquito, using posttest only control group design and a completely randomized design (CRD). This study aimed to determine the potential of lantana leaf extract (*Lantana camara* L.) to repel *Aedes aegypti* mosquitoes at various concentrations. The population in this study was *Aedes aegypti* mosquitoes that still actively moved. The samples used were 20 *Aedes aegypti* mosquitoes for each concentration.

## 3 Results

Based on Table 1, out of 20 *Aedes aegypti* mosquitoes in the test cage, it can be seen that the average of mosquito that resisted after 10 minutes at concentration of 0 (control) was 0%, concentration of 10% was 12 mosquitoes (60%), concentration of 20% was 15 mosquitoes (75%) and concentration of 30% was 18 mosquitoes (90%).

**Table 1.** The number of *Aedes aegypti* mosquitoes that resisted after being treated with lantana leaf extract in various concentrations after 10 minutes.

| Concentration of lantana leaf extract (%) | Number of mosquitoes tested each treatment | Number of mosquitoes that resisted | | Number of mosquitoes in total that resisted from the treatment | Average | |
|---|---|---|---|---|---|---|
| | | Examination | | | n Repellent | % Repellent |
| | | 1 | 2 | | | |
| 0 (Control) | 20 | 0 | 0 | 0 | 0 | 0% |
| 10% | 20 | 12 | 12 | 24 | 12 | 60% |
| 20% | 20 | 14 | 16 | 30 | 15 | 75% |
| 30% | 20 | 17 | 19 | 36 | 18 | 90% |

**Table 2.** Shapiro-Wilk test result.

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | Df | Sig. | Statistic | df | Sig. |
| Number of *Aedes aegypti* Mosquitoes That Resisted | ,291 | 8 | ,045 | ,829 | 8 | ,057 |

Based on Table 2, the results of the Tests of Normality above, the Shapiro-Wilk Test showed that the significance value for the number of *Aedes aegypti* mosquitoes that resisted was 0.057, because 0.057 >α (0.05), it can be concluded that the data is normally distributed.

**Table 3.** Homogeneity of variance test results.

| Levene statistic | df1 | df2 | Sig. |
|---|---|---|---|
| 25944787726736360,000 | 3 | 4 | ,000 |

Based on Table 3, the results of the Test of Homogeneity of Variances above, it is known from the value of Sig. (p-value) levence test was 0.000 because the p-value (0,000) < α(0,05), it can be concluded that the data variance is homogeneous.

**Table 4.** One Way ANOVA test results of lantana (*Lantana camara* L.) leaf extract against *aedes aegypti* mosquito that resists.

| | Sum of squares | Df | Mean square | F | Sig. |
|---|---|---|---|---|---|
| Between groups | 373,500 | 3 | 124,500 | 124,500 | ,000 |
| Within groups | 4,000 | 4 | 1,000 | | |
| Total | 377,500 | 7 | | | |

Based on Table 4, the test results based on the ANOVA table above, it is found that the P-value (0,000) < α(0,05), so it can be concluded that the four concentrations of lantana leaf extract gave different average values for *Aedes aegypti* mosquitoes that resisted, or

there were significant differences of *Aedes aegypti* mosquitoes that resisted among all groups compared.

**Table 5.** Significant test results on the group with the least significance difference (LSD).

| (I) Concentration of lantana leaf extract | Mean difference (I-J) | Std. error | Sig. |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 10 | -12,000* | 1,000 | ,000 |
| 20 | -15,000* | 1,000 | ,000 |
| 30 | 18,000* | 1,000 | ,000 |

Based on Table 5, the results of the Posthoc Tests Least Significance Difference analysis, there were differences in the number of mosquitoes that resisted between the treatment in the control group (0%) and all treatments at various levels of concentration of lantana leaf extract (*Lantana camara* L.) which was marked with an asterisk (*).

## 4 Discussion

The lantana plant is a wild shrub that has been considered a weed by people because of its very fast growth. It is able to grow in the lowlands to highlands with an altitude of 1700 meters above sea level, both in tropical and subtropical climates 28,29 [8]. The concentrations used in this study which were 10%, 20%, and 30% of the ethanol extract of lantana leaf resulted in different repellent ability at each concentration used. Meanwhile in the control group, it could not repel the *Aedes aegypti* mosquito. The mosquito repellent parameter is that the concentration of the extract is considered repellent if it can cause mosquito repellent between 10-95%. This study was conducted to determine the potential of lantana leaf extract (*Lantana camara* L.) as an *Aedes aegypti* mosquito repellent. The potential of lantana leaf extract (*Lantana camara* L.) as an *Aedes aegypti* mosquito repellent and used as the effort to control the occurrence of dengue hemorrhagic fever (DHF) has been carried out using lantana leaf extract (*Lantana camara* L.) with various concentrations.

Based on the observations in Table 1, there was no mosquito repellent at 0% concentrations, so the control group in this study was ignored. In contrast to the treatment group, after the observation of 10 minutes, it was found that there was a repellent of the *Aedes aegypti* mosquitoes; this indicates that the *Aedes aegypti* mosquito repellent occurs due to the lantana leaf extract (*Lantana camara* L.). The number of mosquitoes that resisted was different at each concentration treatment. The number of resisting mosquitoes increased significantly at concentrations of 10%, 20%, 30%. The duration used for each treatment concentration which 10 minutes caused the number of mosquitoes to resist respectively at 60%, 75%, 90%, so the higher the concentration level of lantana leaf extract (*Lantana camara* L.) given, the greater the percentage of *Aedes mosquitoes* repellent. Meanwhile, at a concentration of 0% (control), there was no resisting of mosquitoes.

Based on the Table 2, the normality test using the Shapiro-wilk test showed that the number of mosquitoes resisted was >q (0.05), so it can be concluded that the data was normally distributed to test the data variance. It can be said so because the results of statistical analysis using the One Way ANOVA test showed that there were differences in mosquito resistance in each group of lantana leaf extract concentration (*Lantana camara* L.). In addition to the results of the study being tested with One Way ANOVA, it is also followed by using the posthoc LSD test, and it is found that there were significant differences among each treatment group. The repellent of *Aedes aegypti* mosquito after being given lantana leaf extract (*Lantana camara* L.) occurred because the lantana leaf (*Lantana camara* L.) contains Alkaloids, Terpenoid, Flavonoids, and Steroids that have an unpleasant smell that can keep the mosquitoes away.

Essential oils and flavonoids work as respiratory poisons, while the alkaloids have a bitter taste that can inhibit the larvae's eating power (anti-fedant) and saponins which work as poisons to the stomach. Besides being safe for the skin, another consideration is that this material is easily decomposed by the environment so that it does not cause residues that pollute the environment [9]. Many benefits of lantana are influenced by the chemical elements contained therein or known as secondary metabolites. Secondary metabolite compounds can be in the form of flavonoids, alkaloids, tannins, sapponins, steroids and triterpenoids. There is a type of secondary metabolites that acts as anti-microbial, anti-biotic, anti-oxidant, anti-cancer, anti-blood coagulant and it can inhibit carcinogenic effects. The test to secondary metabolite as anti-bacterial is always preceded by solvent extraction which aims to attract secondary metabolites that are anti-bacterial [10]. Terpenoid compounds are derivative compounds of essential oils that have a pungent smell. In addition, terpenoid compounds are believed to also have insect repellent effects. Essential oils which included in the terpenoid compounds functions to give plants a distinctive smell. During the 14-day shelf life, the hedonic value of the smell tends to decrease [11].

Flavonoids are polyphenolic compounds, hence phenolic compounds chemically, which characterized as slightly acidic and soluble in bases, and because they are polyhydroxy compounds (Hydroxyl Groups) they are also polar so they can dissolve in polar solvents such as methanol, ethanol, acetone, water, butanol, dimethyl sulfoxide and dimethyl formamide. Besides, because flavonoids are bound in the form of glycosides, the above solvent mixture along with water is a good solvent for flavonoid glycosides. Flavonoids are compounds consisting of 15 carbon atoms that function as plant pigments. The function of flavonoids is to protect cell structure, increase the effectiveness of vitamin C, anti-inflammatory and as an antibiotic [11]. This is in line with a research conducted by Sumual [12] entitled The Potential of Lantana Leaf Extract (*Lantana camara* L.) as Repellent for *Aedes aegypti* Mosquitoes. The results of this study showed that lantana leaf extract was proven to have potential as a repellent for *Aedes aegypti* mosquitoes starting from low concentrations (12%) with the percentage of the number of mosquitoes that did not perch ranging from 77.78% - 90%; persistence (length of time) of lantana leaf extract (*Lantana camara* L.) still persisted in the arm test until the 6th hour with the percentage of the number of mosquitoes that did not perch from low to high concentrations was 77.78%, 86.67%, 67, 78%.

This is also in line with a research conducted by Mappau et al. [13]. The laboratory test results of the solution showed that a concentration of 10% could kill an average of 14 larvae (71.65%), a concentration of 20% could kill an average of 15 larvae (76.65%), a concentration of 30% could kill an average of 16 larvae (81.65%), a concentration of 40% could kill an average of 16 larvae (80%) and a concentration of 50% could kill an average of 17 larvae (85%). One of the factors that caused the lantana extract to be able to kill larvae well was due to the presence of alkaloids, flavonoids and tannins in the extract. So, it can be concluded that the higher the concentration of the solution, the higher the number of dead larvae. Based on the results of this research supported by the theory of previous studies, it can be concluded that the repellent to *Aedes aegypti* mosquitoes is the effect of Alkaloid, terpenoids, flavonoids, and steroids compounds that are toxic thus can repel *Aedes aegypti* mosquitoes. The number of mosquitoes that resisted was different in each treatment, so it can be concluded that the high and low concentrations given at the time of treatment will affect the *Aedes aegypti* mosquitoes that resist.

# 5 Conclusion and Suggestion

## 5.1 Conclusion

Based on the results of the study The Potential of Lantana Leaf Extract (*Lantana camara* L.) as a Repellent for *Aedes aegypti* Mosquitoes concluded that lantana leaf extract (*Lantana camara* L.) has the potential as an *Aedes aegypti* mosquitoes repellent with the average repellent ability at the concentration of 10% is 60% mosquitoes resisted, concentration of 20% is 75% mosquitoes resisted, and at the concentration of 30% is 90% mosquitoes resisted. Meanwhile, the control did not show any repellent to the *Aedes aegypti* mosquitoes.

## 5.2 Suggestions

1. Considering the limitations of this study, it is suggested to carry out further research that is similar in samples, better in control content and methods, and effective tests to find out more in detail about the repellent of *Aedes aegypti* mosquitoes.
2. Further research to be carried out on the number of leaves used in the making of the extracts, so it can be known how much extract can be produced from each of lantana leaf.
3. Further research is needed to find out more on how to apply lantana leaf extract (*Lantana camara* L.).

# References

1. WHO Homepage, https://www-who-int.translate.goog/news-room/fact-sheets/detail/dengue-and-severe-dengue, last accessed 2023/01/13

2. Ministry of Health Republic of Indonesia Homepage, http://p2p.kemkes.go.id/kesiapsiagaan-menghadapi-peningkatan-kejadian-demam-berdarah-dengue-tahun-2019/, last accessed 2023/01/23
3. Ministry of Health Republic of Indonesia Homepage, https://sehatnegeriku.kemkes.go.id/baca/umum/20201203/2335899/data-kasus-terbaru-dbd-indonesia/, last accessed 2023/01/23
4. Lesar, E., Joseph, W. B. S., Pinontoan, O. R.: Gambaran pengetahuan dan tindakan masyarakat tentang pengendalian vektor demam berdarah dengue di Desa Touure Kabupaten Minahasa tahun 2020. KESMAS: Jurnal Kesehatan Masyarakat Universitas Sam Ratulangi 9(7), 168–175 (2020).
5. Dinkes Sultra: Profil Dinkes Kota Kendari 2020 kejadian demam berdarah dengue Kota Kendari. Dinkes Sultra, Kendari (2020).
6. Kendari City Health Office: Profil Dinkes Kota Kendari kejadian demam berdarah dengue Kota Kendari. Dinas Kesehatan Kota Kendari, Kendari (2021).
7. Dompas, B. E., Sumampouw, O. J., Umboh, J. M. L.: Apakah faktor lingkungan fisik rumah berhubungan dengan kejadian demam berdarah dengue? Indonesian Journal of Public Health and Community Medicine 1(2), 011–015 (2020).
8. Marini, M., Sitorus, H.: Beberapa tanaman yang berpotensi sebagai repelen di indonesia. Spirakel 11(1), 24–33 (2019).
9. Wardani, I. G. A. A. K., Rahayu, N. P. S., Udayani, N. N. W.: Efektivitas sediaan spray ekstrak bunga tembelekan (*Lantana camara* l.) sebagai repellent nyamuk *Aedes aegypti*. Jurnal Ilmiah Medicamento 8(1), 8–13 (2022).
10. Parwati, P., Ridhay, A., Syamsuddin, S.: Uji aktivitas antibakteri ekstrak bunga tembelekan (*Lantana camara* Linn) dari beberapa tingkat kepolaran pelarut. Kovalen: Jurnal Riset Kimia 5(1), 39–47 (2019).
11. Sumartini, S., Ratrinia, P. W.: Pengaruh antioksidan daun mangrove terhadap hasil pengujian hedonik dan fat bloom pada coklat batang selama masa simpan. Aurelia Journal 3(1), 47–57 (2021).
12. Sumual, C. Z. Potensi ekstrak daun tembelekan (*Lantana camara* L.) sebagai penolak (repellent) nyamuk *Aedes aegypti* L. [Bachelor's thesis]. University of Lampung, Lampung (2012).
13. Mappau, Z., Akbar, F., Adam, A., Mamuju, P. K.: Effectiveness of tembelekan plants (*Lantana camara* Linn) to *Aedes aegypti* larvae mortality. Indian Journal of Public Health Research & Development 9(1), 379–384 (2018).