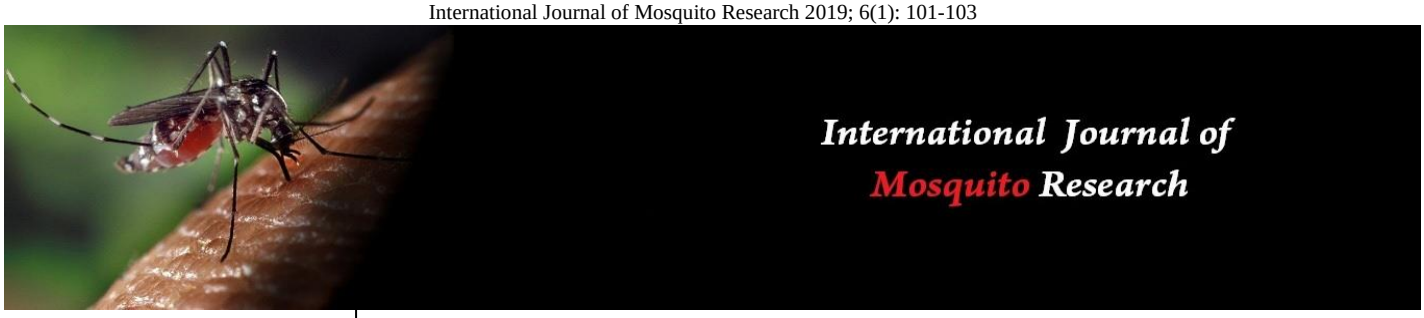

ISSN: **2348-5906**
CODEN: **IJMRK2**
IJMR 2019; 6(1): 101-103

Received: 06-11-2018
Accepted: 10-12-2018

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The effect of lemongrass (*Cymbopogon nardus*) extract as insecticide against *Aedes aegypti*

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Abstract
Background: Various methods have been conducted either chemically or naturally to reduce mosquito population, with the aim of preventing transmission of diseases caused by mosquitoes. However, it should be endeavored in mosquito control activities not to cause harm to humans and the environment by utilizing mosquito repellent plants, such as lemongrass. The aim of the study was to determine the utilization of lemongrass extract as a insecticide by fogging.
Materials and Methods: It was an experimental research, the number of samples for each experiment used 20 mosquitoes for treatment and control with 5 repetitions. The study was conducted in August 2015. Data analysis used a one-way ANOVA test.
Results: The average number of dead mosquitoes was 18 (90%). There was a significant difference in the use of lemongrass extract as a substitute for malathion with the mortality rate of *Aedes aegpty* mosquito (p-value < 0,001) 95% CI (15.69-18.31).
Conclusion: Lemongrass leaves and stems can be used as a substitute for malathion in carrying out fogging activities. We recommend that extracts be made in the form of oil rather than liquid because they are easily soluble in diesel fuel.

Keywords: lemongrass extract, insecticide, *Aedes aegypti*

Introduction
Indonesia as a tropical country is a fertile breeding ground for mosquitoes such as *Aedes aegypty* [1] Concerns about the outbreak and spread of dengue infection disease, has resulted in humans using chemical based insect repellents to eradicate the development of mosquitoes. The natural host of dengue infection is human, the agent is a virus that belongs to the *Flavio* family and the genus *Flavivirus*, consisting of 4 serotypes namely Den-1, Den-2, Den3 and Den -4 [2, 3] transmitted to humans through the bite of infected mosquitoes, especially the ingredients of *Aedes aegypti* and *Aedes albopictus* [3, 4] which is found in almost all of Indonesia [1].
Various ways have been done either naturally or chemically to reduce or reduce the mosquito population, with the intention of preventing or eradicating mosquito-borne diseases, or disturbances caused by these mosquitoes [4, 5] However, it should be endeavored in mosquito control activities not to cause harm to humans and the environment. Chemical cope with mosquitoes, among others, by using mosquito repellent spray or mosquito repellent lotion that has been circulating in the market [6, 7]
One of the efforts to reduce the rate of transmission of dengue disease is to reduce the vector density of DHF chemically known as fogging [3, 8], which uses chemical active ingredients. The number of cases of dengue fever requires proper prevention to reduce it. Resistance of *Aedes aegypti* against insecticidal insects is a national phenomenon faced by disease control programs in Indonesia. The occurrence of resistance will cause problems due to mosquito borne diseases [3, 4, 9] Resistance to malathion has been reported in several locations in Indonesia such as in Semarang City, Purbalingga, Kendal and Grobogan [10] and Medan, North Sumatera [8]
Therefore, to reduce the negative impact of the use of insecticides from chemicals (synthetic), other safer alternatives need to be developed so that the development of the life cycle of mosquitoes can be hampered and cannot develop until adulthood. One of them is using biopesticides (botanical insecticides). Biopesticides have advantages compared to synthetic insecticides which are biodegradable so they do not pollute the environment and are safe for

human health because the residual content is easily lost. Biopesticides have the advantage of being renewable and more affordable [11]. Plants that can be used as a source of biopesticides usually have a variety of chemicals such as alkaloids, glycosides, and other compounds that are toxic or toxic [12].

The need for environmental friendly insecticides that are safe for health can also kill mosquitoes and eradicate the larvae of *Aedes aegeypti* and *Aedes albopictus* mosquitoes, many studies have examined the use of vegetable isecticides [13]. The use of chemical insecticides is now beginning to shift to the utilization of the secondary metabolites of plants as vegetable insecticides. Naatural insecticides are safer for human health, leaving no residue in nature, thus reducing pollution [14] The chemical compounds in several types of plants can be used as repellent, for example in the form of mosquito repellents such as lavender, eucalyptus, lemongrass, fragrant roots, cloves, and neem [15].

Lemongrass leaves are used as a repellent because fragrant lemongrass leaves are easily obtained in the community as well as in the market and are also cheap. Research on the protection of lemongrass (*Cymbopogon nardus*) as a repellent against *Aedes aegypti* mosquitoes mixed with liquid paraffin diluents on concentrations of 2.5%, 10%, and 20% and the results of the research show that lemongrass protection is used repellent against *Aedes aegypti* mosquito at a concentration of 2.5% [15].

In addition, the research has only focused on the use of extracts as a repellent for mosquito bites, there is no use as fogging material as a substitute for malation, the use of malathion often causes odor, and the price is expensive and unsafe for the residential environment. lemongrass. The purpose of the study was to determine the effect of insecticides from lemongrass extract (*Cymbopogon nardus*) on fogging to kill the *Aedes aegypti* mosquito.

Material and Methods

This was a quasi-experiment with the design of posttest only control group design. The research subjects was *Aedes aegypti* obtained by the colony of the mosquitoes which were breeding from larvae to become adult mosquitoes following the natural cycle of mosquitoes. The sample size for each treatment was 20 mosquitoes. The study was conducted in June-August 2015 in the Laboratory of Environmental Health Department, Banda Aceh, Indonesia. Lemongrass extract was made with 1 kg of lemongrass powder mashed and soaked with 250 ml of aquades, soaked for 1 day, the juice is 100% lemongrass extract. Then make a solution (mixing the extract solution) by measuring the lemongrass extract and the solvent according to the concentration and volume of the desired solution using the formula:

$$Q = \frac{SxAxD}{C}$$

Q: volume of pure extract (high concentration)
S: liquid concentration
A: liquid volume
D: specific gravity of solvent (fuel)
C: extract concentration

The pesticides was mixed with the solvents on the jerrycan and shaked evenly until it dissolved then prepare all the necessary equipment and checked the cages that will be fogging. Then 20 mosquitoes was puted in the confinement. Put the cage in the room let stand for 15 minutes so that the mosquitoes are stable and can adjust to the environment, then aim the swingfong towards the cage with a nozzle distance of 1 meter from the cage, do the smoke until evenly throughout the cage. Fumigation is carried out in every confinement. After 3 minutes the smoke was gone, and then the number of dead mosquitoes was counted and the process was carried out until 5 repetitions.

The efficacy criteria for an insecticide were determined based on the percentage of mosquito deaths tested. Effective efficacy in accordance with WHO criteria, if the percentage of mosquito mortality was equal to or greater than 80%. The mortality of the test mosquitoes was the number of test mosquito deaths when checked multiplied by 100%. If there were deaths in the control group of 5-20%, the percentage of mosquitoes obtained will be corrected by the Abbot formulation.[16] Data were analyzed using one-way ANOVA analysis and continued with the LSD test.

Results

The results of the study of the number of mortality of *Aedes aegypti* after fogging with lemongrass extract as a substitute for malathion can be seen in Table 1 below:

Table 1: Number of died mosquitoes after being fogged by using lemongrass extract

Repitition	No. of mosquito	Control (%)	Lemongrass extract (%)
1	20	1 (5)	18 (90)
2	20	2 (10)	17 (85)
3	20	0 (0)	18 (90)
4	20	1 (5)	20 (100)
5	20	1 (5)	17 (85)
Average		1 (5)	18 (90)

Table 1 showed the average mortality of mosquitoes in the use of lemongrass extract was 18 (90%). The highest percentage of dead mosquitoes was in the fourth repetition (100%) of the lemongrass extract. Since the death in the control group more than 5%, so the Abbot correction was conducted. It means that the death in the treatment group occurred due to other factors. Because it has been eliminated by the Abbot formula, and the results were as follows:

$$X = \frac{\%\ Mortality\ of\ test\ group - \%\ mortality\ control\ group}{100 - \%\ mortality\ control\ group}$$

$$X = \frac{90\% - 5\%}{100 - 5}$$

$$X = \frac{85}{95}$$

X = 0,89

Thus, it would be 18-0.89 = 17.11 death of *Aedes aegypti*. Statistical test was conducted to determine the difference in mortality in lemongrass extract as a malathion substitute insecticide. The result can be shown on Table 2.

Table 2: Statistical test result of death Aedes aegypti

Variable	Mean	SD	SE	95% CI	P Value
Control	1.00	0.707	0.316	0.12-1.88	0.000
Lemongrass	18.00	1.225	0.548	16.48-19.52	

The average number of dead mosquitoes in the use of lemongrass extract is 18 mosquitoes. The statistical test results obtained p-value <0.001 it means there is a significant difference between the use of lemongrass extract as a substitute for malation with the death of *Aedes aegpty* mosquito.

Discussion

The results of the study on the use of lemongrass leaf extract showed that the average number of dead mosquitoes in the use of lemongrass extract was 18. The highest percentage of died mosquitoes was at the fourth replication (100%), and after the Abbot correction the total number of dead mosquitoes became 17. These results showed that all treatments resulted dead mosquitoes as well as controls, which only use solar as a mixer. However, after the Abbot correction showed that the difference is only a little, and proves that lemongrass extract can kill the *Aedes aegypti* mosquito by fogging.

The results of statistical test showed that the differences in mosquito deaths between the use of lemongrass extract as a malation substitute and the mortality rate of *Aedes aegpty*, on lemongrass which was 18 mosquitoes so that the lemongrass extracted could be applied as an insecticide because its compound had lethal effect on the body condition of the mosquitoe that can lead to the death.

Mosquitoes mortality after administration of lemongrass extracts due to the activity of essential oils in lemongrass works against the respiratory system. The main lemongrass content is volatile oil with lemongrass components, and geraniol. The larvacidal effect of lemongrass powder is suspected from the lemongrass content found in lemongrass stems and leaves. Lemongrass has a poisonous nature (desiscant), according to the way this poison works like a contact poison that can give death, due to continuous loss of fluid so that the body lacks fluids, the mechanism of lemongrass inhibits the acetylcholinesterase enzyme by carrying out serine phosphorylation serine at the center of the enzyme concerned [17]. Symptoms of poisoning, because of the accumulation of acetylcholine which causes special poisoning that is characterized by central nervous system disorders, convulsions, respiratory paralysis, and death [18, 19]

According to the way it works, these chemical compounds in the lemongrass extract are like contact poisons that can give death due to continuous loss of fluids, so that the body of the mosquito lacks of fluids [20]. At first this insecticide enters the insect's body through the surface of the body, especially the thin part of the skin, for example in parts of the area that are related to segments, indentations formed from the body's plates, at the base of the hair and respiratory tract. Toxins that have been attached to insects will immediately enter the body and this is where poisoning begins [17].

Conclussion

The average number of dead mosquitoes by using lemongrass extracts was 18 (90%). There is an effect of the use of lemongrass extract as a malation substitute insecticide in fogging with the mortality rate of *Aedes aegpty* mosquito.

Suggestion

Lemongrass leaves and stems can be used as a substitute for malation in carrying out fogging activities, besides being cheap and environmentally friendly the smell is also liked by the community, We recommend that you make extracts in oil preparations rather than liquid because they are easily soluble in diesel fuel.

References

1. Ministry of Health Indonesia. Guideline for prevention and control of dengue fever, 2017.
2. Mubarok MA, Wahyuningsih NE, Riani DA, Putri R, Budiharjo A. The relationship between healthy hygiene behavior and dengue haemorrhagic fever (DHF) incidence in Semarang. In Journal of Physics: Conference. 2018, 6-11 doi:doi :10.1088/1742-6596/1025/1/012062
3. WHO. Prevention and Control of Dengue and Dengue Hemorrhagic Fever. WHO Reg. Publ. Searo, 2009, 29
4. Malavige GN, Fernando S, Fernando DJ, Seneviratne SL. Dengue viral infections. Postgr. Med J. 2004; 80:588-601.
5. Guzman MG, Harris E Dengue. Lancet. 2015; 385:453-65
6. West PA, *et al.* Indoor Residual Spraying in Combination with Insecticide-Treated Nets Compared to Insecticide-Treated Nets Alone for Protection against Malaria : A Cluster Randomised Trial in Tanzania, 2014, 11.
7. Majeed S. Odour-mediated Host Preference in Mosquitoes: The Role of the Maxillary Palps in Host Recognition. Swedish University, 2013.
8. Sitepu FY, Supriyadi T. Evaluation of dengue hemorrhagic fever control and prevention program in North Sumatra, 2010-2012. Balaba 2013; 9:1-6
9. Ghosh A, Dar L. Dengue vaccines: challenges, development, current status and prospects. Indian J Med. Microbiol. 2015; 33:3-15.
10. Sunaryo, Bina Ikawati RDW. Status resistensi vektor demam berdarah dengue 0,25% di Provinsi Jawa Tengah. J Ekol. Kesehat. 2014, 13.
11. Dewi IR. Prospek Insektisida yang berasal dari Tumbuhan untuk Menanggulangi Organisme Pengganggu Tanaman. Universitas Padjadjaran, 2007.
12. Thamrin. *Potensi Ekstrak Flora Lahan Rawa Sebagai Pestisida Nabati.* Balai Pertanian Lahan Gambut, 2004.
13. Aditama W, Zulfikar, Sitepu FY. The effectiveness of arabica coffee (*Coffea arabica* L) grounds on mortality and growth of Aedes aegypti Larva. Int. J Mo. 2019; 6:34-37.
14. Anonim. Tumbuhan Wikipedia Bahasa Indonesia, Ensiklopedia Bebas, Wikimedia Foundation, Inc. 2008.
15. Wahyuningtyas E. Study Daya Proteksi Serai Wangi (*Cymbopogon nardus*) sebagai Repellent terhadap Nyamuk Ae.aegypti. IPB, 2004.
16. Komisi Pestisida. Metoda standar Pengujian Efikasi Pestisida. Kementrian Pertanian, 1995.
17. Pinheiro PF. *et al.* Insecticidal Activity of Citronella Grass Essential Oil on Frankliniella schultzei and Myzus persicae. Cienc. agrotec, Lavras. 2013; 37:138-144.
18. Arif Dwi Nugroho. Kematian Larva Aedes Aegypti Setelah Pemberian Abate Dibandingkan Dengan Pemberian Serbuk Serai. J Kesehat. Masy. 2011; 7:91-96.
19. Agus Kardinan. Tanaman Pengusir dan Pembasmi Nyamuk. Agromedia Pustaka, Jakarta, 2003.
20. Wells D. The Power of Lemongrass to Repel Mosquitoes and Biting Insects, 2019. Available at: http://mosquitorepellentinsider.com/power-lemongrass-repel-mosquitoes-biting-insects/. (Accessed: 28th January 2019).