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# Promotion of Natural Galangal Plants as a Substitute for Reppellent Chemicals Against Anopheles Spp Mosquitoes

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## Abstract

Mosquito control using natural repellent is one alternative to malaria vector control. Betel (Piper bettle, Linn) which contains essential oils, alkaloids, flavonoids, saponins, tannins, eugenol, and kavicol is one plant that has antibacterial power, fungicide, insecticide and antioxidant. The purpose of the study was to analyze the protective power of galangal extract concentrations of 5%, 10%, 15% and 20% against Anopheles spp mosquitoes. The research method used is an experiment in the laboratory. Anopheles sp mosquitoes are obtained from hatching eggs. Galangal extract concentrations of 5%, 10%, 15% and 40% were tested for repulsion or protection against Anopheles spp mosquitoes. Observation of the number of mosquitoes that land on guinea pigs is carried out every hour starting from the 1st hour (immediately after smearing) until the 18th hour. The effective protection of betel leaf extract is if the protective power is ≥90%. The results showed that the protective power of betel leaf extract against Anopheles spp at a concentration of 5% as much as 11%, a concentration of 10% as much as 38%, a concentration of 15% as much as 67% and a concentration of 20% as much as 90%. Effective protection power is 20% concentration with 90% protection power. This is in accordance with the Pesticide Commission (1995, p.2) which states that repellent is considered effective if its protective power ≥ 90%. The public can use galangal extract with a concentration of at least 20% as a repellent against mosquitoes, especially Anopheles spp. Other researchers can conduct similar studies using extracts from other types of plants.

**Keywords:** ekstrak lengkuas, daya proteksi, efektifitas lengkuas

## 1. Introduction

Community behavior expected in a healthy Indonesia 2025 is proactive behavior to maintain and improve health, prevent the risk of disease, protect themselves from the threat of disease and other health problems, be aware of the law and actively participate in public health movements including organizing a healthy and safe community. (RPJPK 2005-2025).

The number of dengue cases is relatively present every year. The population fatality rate (CFR) and transmission or Inciden Rae (IR) also declined. Data from the Ministry of Health (Kemenkes), dengue cases (Dangue Dengue Fever) nationally in 2011 tend to decrease when compared to the previous year. In 2009 the number of cases was 158,912 with a death toll of 1,420 people. Case Fatality Rate (CFR) 0.89 percent. In 2010

the number of dengue cases in Indonesia in 2010 there were 150,000 cases with a death toll of around 1,317 deaths (CFR 0.87%). In 2011 there were 24,362 cases with 196 deaths (CFR 0.80%). (Ministry of Health RI, 2011).

The case illustrates the low access to health services even though every year dengue fever victims decrease, so there is a need for efforts to control dengue fever. To control dengue fever can be done by eliminating the cause of the disease (dengue virus), isolation of sufferers, preventing mosquito bites (vectors) and vector control. Vector control can be done in five ways, namely by chemical control, biological control, environmental management, genetic control, and integrated control.

Vector control by chemical means, among others, is carried out using insecticides from the organophosphate, organochlorine, and carbanate groups. This method has drawbacks, requires large funds, has a negative impact on the environment and humans, in the form of soil quality degradation and causes degenerative diseases such as cancer, and can cause resistance to target organisms.

The negative impact of the use of chemical insecticides that pose new problems to the environment and humans must be reduced. One potential alternative to be able to control dengue vector populations is to use plant-based insecticides derived from chemical compounds contained in plants. The structure of these chemical compounds has the ability as a vegetable insecticide consisting of carbon, oxygen, hydrogen and nitrogen. So that vegetable insecticides in nature will be easily degraded. In addition, vegetable insecticides can be used as mosquito repellents that can prevent mosquito bites. Some of them are plants around the community such as galangal, lemongrass, lavender and others.

Galangal is a plant that is used as a medicinal plant and spice that is easily found around the community. The most important part that is used is the fruit. The content of essential oil found in galangal (its fruit) can be used as a repellent (repellent) of Aedes aegypti mosquitoes. The repellent mechanism is that the odor contained in essential oils seeps into the pores of the skin and arema because of body heat, environment, essential oils will evaporate into the air. This smell will be detected by chemical receptors found on the mosquito's antennae and passed to the nerve impus, responded into the mosquito's brain will express itself to avoid. This article is a review of the results of several studies of several plants that contain essential oils, aiming to determine the potential repellent power as a body protection from Aedes aegypti mosquito bites.

Based on the above, the author tried to conduct a study entitled "Utilization of Galangal Extract (Alpinia galanga) as a repellent for Aedes aegypti mosquitoes in 2014."

## 2. Research Metode

This type of research is a true experiment with a pre and post test only experimental research design using complete randomization (RAL) with four treatments. The treatment carried out consists of treatment on the repellent tested and treatment on the control.

### *2.1. Data sources*

***Primary data***

The primary data in this study were the results of direct observation of the number of mosquitoes that landed on the control hand and on the test hand, the concentration of galangal extract (Alpinia galanga) used and the results of measurements of temperature and humidity.

***Secondary data***

Secondary data in this study are supporting data obtained from viewing and inquiring from the profile of the research site.

***How Data Is Collected***

Data is obtained from the results of measurements and tests to be carried out in the laboratory. The data to be collected are:

a. Measurement of air temperature measured using a hygrometer.
b. Measurement of measured air humidity using a hygrometer.
c. The number of mosquitoes perched on the control hand and on the test hand at the time of the study which was analyzed with probit.
d. The concentration level of galangal extract (Alpinia galanga) to be tested by determination of preliminary tests.

### *2.2. Data Processing*

***Editing***
Checking existing data to avoid errors and find out shortcomings.

***Coding***
Grouping of data from calculations and measurements.

***Tabulating***
Enter data into tables according to their subjects for analysis purposes.

### *2.3. Data analysis*

Data obtained from the observation of repellent effectiveness tests and analyzed using probit analysis, which is an analysis used to determine the ability of the concentration of galangal extract (Alpinia galanga) tested against the protective power of Aedes aegypti mosquitoes for 90 minutes and using anova analysis, which is an analysis used to determine the value of differences in concentration of 5%, 10%, 15% and 20% galangal extract (Alpinia galanga) against Aedes aegypti mosquitoes for 90 minutes.

### *2.4. Research Ethics*

***Informed consent***
It is an agreement between researchers and research respondents by providing a consent sheet. The purpose is for the subject to understand the purpose and purpose of the study, knowing its impact (Aziz Alimul idayat, 2007).

***Annonimity***
Maintaining the confidentiality of respondents' identities, researchers do not write down the complete identity of respondents on the research sheet. The name is listed in the initial letters then the sheet is only given a certain code number (Aziz Alimul Hidayat, 2007).

## 3. Results and Discussion

### *3.1. General Conditions of the Research Site*

The research was conducted at the Entomology laboratory of P2B2 Research and Development Workshop Banjarnegara, Central Java. Anopheles spp mosquitoes used for research are the result of hatching eggs. The measurement results of various environmental parameters (air temperature and humidity) are as follows:

**Table 1.** Results of Air Temperature and Humidity Measurements at the Research Site

| No. | Parameter | Measurement Results |
|---|---|---|
| 1. | Minimum air temperature | 23 $^{o}$C |
| 2. | Temperature | 27 $^{o}$C |
| 3. | Average air temperature | 25 $^{o}$C |
| 4. | Average air humidity | 80 % |

Based on table 2.1 it is known that the air temperature at the study site is sufficient. This is because the location of the laboratory is in the hills. The average air temperature of 25 oC that occurred during the study was the optimal temperature for the growth of Anopheles spp whose habitat is in the hills. Optimal air temperature conditions at the research site strongly support mosquito activity during the study. This means that air temperature at the study site is not as a limiting factor that is detrimental to the growth of Anopheles spp, but as a positive supporting factor.

Air humidity that occurred during the study (80%) was a positive environmental factor for the growth of Anopheles spp. This is in accordance with the Ministry of Health of the Republic of Indonesia (2001) that

Anopheles spp his life likes in areas that have air humidity between 60 – 90%. If the air humidity < 60% or > 90% of mosquito growth and breeding becomes inhibited. The existence of optimal air humidity conditions for Anopheles spp shows that air humidity at the study site is not as a limiting factor that is detrimental to the growth of Anopheles spp, but as a positive supporting factor.

### *3.2. Repellent Test Results*

The results of the repellent test of Galangal extract against Anopheles spp mosquitoes are as follows:

**Table 2.** *Number of Mosquitoes Alight/Biting in Galangal Extract Repellent Test on First Replication*

| Konsentrasi (%) | Jumlah Nyamuk (ekor) | Nyamuk hinggap/menggigit pada 5 menit jam ke - | | | | | | Rata-rata (ekor) |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| 0 % (K) | 50 | 35 | 35 | 34 | 35 | 34 | 34 | 31 |
| 5 % | 50 | 30 | 30 | 29 | 27 | 27 | 25 | 28 |
| 10 % | 50 | 20 | 20 | 18 | 17 | 17 | 16 | 18 |
| 15 % | 50 | 10 | 10 | 10 | 8 | 8 | 8 | 9 |
| 20 % | 50 | 5 | 4 | 5 | 3 | 4 | 3 | 4 |

**Table 3.** Jumlah Nyamuk Hinggap/Mengigit Pada Uji *Repellent* Ekstrak Lengkuas Pada Replikasi Kedua

| Konsentrasi (%) | Jumlah Nyamuk (ekor) | Nyamuk hinggap/menggigit pada 5 menit jam ke - | | | | | | Rata-rata (ekor) |
|---|---|---|---|---|---|---|---|---|
| | | 7 | 8 | 9 | 10 | 11 | 12 | |
| 0 % (K) | 50 | 31 | 31 | 30 | 30 | 29 | 29 | 30 |
| 5 % | 50 | 28 | 27 | 29 | 28 | 27 | 29 | 28 |
| 10 % | 50 | 20 | 17 | 17 | 16 | 17 | 16 | 17 |
| 15 % | 50 | 10 | 11 | 10 | 9 | 11 | 9 | 10 |
| 20 % | 50 | 0 | 6 | 6 | 4 | 1 | 1 | 3 |

**Table 4.** Jumlah Nyamuk Hinggap/Mengigit Pada Uji *Repellent* Ekstrak Lengkuas Pada Replikasi Ketiga

| Konsentrasi (%) | Jumlah Nyamuk (ekor) | Nyamuk hinggap/menggigit pada 5 menit jam ke - | | | | | | Rata-rata (ekor) |
|---|---|---|---|---|---|---|---|---|
| | | 13 | 14 | 15 | 16 | 17 | 18 | |
| 0 % (K) | 50 | 37 | 36 | 35 | 34 | 37 | 36 | 36 |
| 5 % | 50 | 29 | 30 | 29 | 31 | 30 | 31 | 30 |
| 10 % | 50 | 24 | 26 | 26 | 24 | 25 | 25 | 25 |
| 15 % | 50 | 14 | 15 | 15 | 14 | 13 | 13 | 13 |
| 20 % | 50 | 4 | 2 | 3 | 2 | 3 | 4 | 3 |

Berdasarkan table-Table yang telah tersaji di atas maka dapat dihitung rata-rata (rata-rata dalam angka pembulatan) jumlah nyamuk yang hinggap/menggigit pada uji repellent ekstrak daun sirih sebagai berikut:

**Table 5.** Jumlah Rata-Rata Nyamuk Hinggap/Mengigit Pada Uji *Repellent* Ekstrak Lengkuas

| Konsen-trasi (%) | Jumlah Nyamuk (ekor) | Rata-rata nyamuk hinggap/menggigit pada 5 menit jam ke-1 sampai ke-6 | | | Rata-rata (ekor) |
|---|---|---|---|---|---|
| | | Replikasi I | Replikasi II | Replikasi III | |
| 0 % (K) | 50 | 31 | 30 | 36 | 32 |
| 5 % | 50 | 28 | 28 | 30 | 27 |
| 10 % | 50 | 18 | 17 | 25 | 20 |
| 15 % | 50 | 9 | 10 | 13 | 11 |
| 20 % | 50 | 4 | 3 | 3 | 3 |

Berdasarkan Table 4.5 tersebut diketahui bahwa rata-rata nyamuk yang hinggap/menggigit pada konsentrasi 0% (sebagai kontrol) sebanyak 32 ekor, konsentrasi 5% sebanyak 27 ekor, konsentrasi 10% sebanyak 20 ekor dan konsentrasi 15% sebanyak 11 ekor, konsentrasi 20% sebanyak 3 ekor, Semakin tinggi konsentrasi ekstrak Lengkuas maka akan semakin sedikit nyamuk *Anopheles spp* yang hinggap atau menggigit. Hal tersebut karena semakin tinggi konsentrasi ekstrak berarti semakin tinggi kandungan senyawa metabolit sekundernya sehingga mengakibatkan nyamuk *Anopheles spp* yang hinggap atau menggigit marmut semakin sedikit.

Berdasarkan Table 4.5 tersebut di atas maka dapat dihitung daya proteksi terhadap nyamuk *Anopheles spp* dari masing-masing konsentrasi ekstrak lengkuas. Perhitungan daya proteksi menggunakan rumus sebagaimana terdapat pada lampiran dan didapatkan hasil perhitungan sebagai berikut :

Rumus perhitungan daya proteksi :

$$\text{Daya proteksi} = \frac{K - R}{K} \times 100\ \%$$

Keterangan :
R = jumlah nyamuk yang hinggap pada perlakuan
K = jumlah nyamuk yang hinggap pada kontrol

**Table 6.** Daya Proteksi Ekstrak Lengkuas Terhadap *Anopheles Spp*

| Konsen- trasi (%) | Jumlah Nyamuk Uji (ekor) | Jumlah Rata-rata Nyamuk Hinggap / Menggigit (ekor) | Daya Proteksi (%) |
|---|---|---|---|
| 0 % (K) | 50 | 97 | - |
| 5 % | 50 | 86 | 11 |
| 10 % | 50 | 60 | 38 |
| 15 % | 50 | 32 | 67 |
| 20 % | 50 | 10 | 90 |

Berdasarkan Table 4.6 diketahui bahwa daya proteksi ekstrak Lengkuas terhadap *Anopheles spp* pada konsentrasi 5 % sebanyak 11%, konsentrasi 10% sebanyak 38% dan konsentrasi 15% sebanyak 67% dan konsentrasi 20 % senamyak 90 %. Dapat disimpulkan bahwa semakin tinggi tingkat konsentrasi ekstrak lengkuas maka semakin tinggi daya proteksinya terhadap nyamuk *Anopheles spp.*

Berdasarkan Table 4.6 juga diketahui bahwa daya proteksi ekstrak lengkuas terhadap nyamuk *Anopheles spp* yang efektif adalah konsentasi 20% dengan daya proteksi 90 %. Hal ini sesuai dengan Komisi Pestisida Departemen Pertanian (1995, h.2) yang menyatakan bahwa repellent dianggap efektif apabila daya proteksinya ≥ 90 %.

## 4. Conclusion

Berdasarkan hasil penelitian dan pembahasan dapat diambil simpulan sebagai berikut:

1. Daya proteksi ekstrak Lengkuas terhadap *nyamuk Anopheles spp* pada konsentrasi 5% sebanyak 11%, konsentrasi 10% sebanyak 38 dan konsentrasi 15% sebanyak 67 dan konsentrasi 20 % sebanyak 90 %.
2. Terdapat perbedaan daya proteksi ekstrak lengkuas terhadap nyamuk *Anopheles spp* pada konsentrasi 5%, 10%, 15% dan 20%.
3. Daya proteksi ekstrak daun sirih terhadap nyamuk *Anopheles spp* yang paling efektif adalah konsentasi 20% dengan daya proteksi 90%. Hal ini sesuai dengan Komisi Pestisida Departemen Pertanian (1995, h.2) yang menyatakan bahwa repellent dianggap efektif apabila daya proteksinya ≥ 90 %.
4. Masyarakat yang jauh dari Apotiker dan Letak Giografisnya Jauh dari kota atau pelayanan Kesehatan Atau Puskesmas dan Rumah Sakit bisa menggunakan Bahan alami Lengkuas

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