



Effectiveness of the Aroma of Marigold Plant Parts on The Power of Mosquito Repellion

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Abstract: - The transition season for mosquitoes is increasing. The *Aedes aegypti* mosquito can cause dengue fever. The response is to eradicate the vector's life cycle, by killing mosquito larvae, using fogging, abate powder, which has an effect on the environment. Researchers were looking for a natural larvicide solution that was safe and effective. Researchers looked at marigold plants at the research location. Marigold plants contain essential oils that are effective as larvicides on *Culex quinquefasciatus*, *Anopheles stephensi* and *Aedes aegypti* mosquitoes. Quasi-experimental research, cross sectional study design. The aim is to determine the effectiveness of the aroma of marigold plant powder on mosquito repellent as a repellent. The research location is in a room where there is a mosquito net box containing 140 mosquitoes. The results of the Chi-square analysis were obtained: P value = $0.043 < \alpha 0.05$, statistically there is significant effectiveness between soaking the powder marigold plant roots on mosquito repellent power, with odds ratio = 4.12 times. P value = $0.043 < \alpha 0.05$, statistically there is significant effectiveness between soaking marigold plant bark powder on mosquito repellent power, with odds ratio = 4.08 times. P value = $0.043 < \alpha$



0.05, statistically there is significant effectiveness between soaking powdered marigold flowers on mosquito repellent, with an odds ratio = 4.06 times. The suggestion is for students to get used to it by placing a soaked powdered root, bark and flowers in the room to repel mosquitoes.

Keywords: *Aroma, Effectiveness, Mosquitoes, Marigold Plant Parts*

1. Introduction

The transition season for the development of mosquitoes is increasing. Dengue hemorrhagic fever (DHF) in the community is a type of acute infectious disease which is still a health problem for individuals, families and communities. Dengue hemorrhagic fever is an acute viral febrile disease, which is transmitted through the bite of the *Aedes aegypti* mosquito, which transmits the dengue virus to the human body through its saliva which enters the bloodstream, causing dengue hemorrhagic fever (WHO, 2021).

Entering the transition period from the dry season to the rainy season, Dengue/DHF cases in Indonesia have been observed to increase. Based on records from the Directorate of Infectious Disease Prevention and Control (P2PM), as of March 1 2024, there were nearly 16,000 cases of Dengue Hemorrhagic Fever (DBD) in 213 districts/ City in Indonesia with 124 deaths, a total of 88,593 cumulative cases of dengue fever in Indonesia in 2024. (Directorate General of P2P. Ministry of Health of the Republic of Indonesia, Jakarta, 2024). In 2023, dengue fever cases in Indonesia were recorded at 28,579 cases. (Directorate General of P2P, Indonesian Ministry of Health, Jakarta, 2023).

As of Week 36, the cumulative number of confirmed dengue cases from January 2022 was reported at 87,501 cases (IR 31.38/100,000 population) and 816 deaths (CFR 0.93%). "In general, there has been an increase in Dengue cases. "Most cases occurred in the 14-44 year age group as much as 38.96 percent and 5-14 years as much as 35.61 percent," Director General of Disease Prevention and Control, Indonesian Ministry of Health, Jakarta. (2022).

Data on dengue fever cases in 2024 in Bengkulu Province. "In the 14th week, 101 dengue fever cases were recorded in Bengkulu Province, this has experienced a significant decrease of around 70% in the 14th week of 2024. Compared to the 12th week when 232 dengue fever cases were recorded," Head of the Disease Control and Eradication Division (P2P) Bengkulu Provincial Health Service (2024). Data on dengue fever cases in 2023 in Bengkulu Province is 48 cases. KBRN Head of Disease Control and Eradication (P2P) Bengkulu Provincial Health Service (2023).

Data on dengue fever cases in 2024, there are 50 cases. Based on reports from 21 health centers spread across 15 sub-districts in Rejang Lebong from January to mid-February 2024, Rejang Lebong Health Service. Monthly Report on DHF Incidents in Rejang (2024). The main strategy for eradicating dengue fever is to eradicate adult mosquitoes through fumigation, then the strategy is expanded by using larvicide which is sprinkled into water reservoirs (TPA). So far, these two methods have not shown satisfactory results. It is proven that the



number of dengue cases has increased and the number of areas infected with dengue fever. Ministry of Health of the Republic of Indonesia (2020).

Community behavior expected in 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 the public health movement, including organizing a healthy and healthy society. safe/safe community. Indonesian Ministry of Health. (2021). Research results of Aji et al. (2016) Environmental factors and indices related to dengue vector larvae in Rejang Lebong District.

Cases of dengue hemorrhagic fever (DBD) in Bengkulu Province, from January to August 2022 have reached 828 cases. This condition has forced the Bengkulu Provincial Government to take anticipatory steps so that the disease caused by the *Aedes aegypti* mosquito continues to increase. Head of the Disease Control and Eradication Division (P2P) of the Bengkulu Provincial Health Service. (2022)

"There were 76 cases of dengue fever that occurred in Rejang Lebong Regency from January to the end of October 2022, of which three people were declared dead," Head of the Rejang, (2022).

Results of previous research by Marini et al. (2018). The results of phytochemical tests using the color test method on marigold leaf extract succeeded in identifying alkaloid, flavonoid, saponin and tannin compounds. The results of the protective power test showed that marigold leaf extract lotion was not effective as a repellent against *Ae. aegypti* with protective power above 90% only lasts for two hours after application, namely at a concentration of 30%. The results of Aji (2017) research show that there is a significant influence of citronella on the presence of *Aeges aegypti* larvae in water reservoirs.

Research results from Kamelia et al. (2020): Based on research data, there is a very real influence on mortality resulting from each extraction concentration given. Based on research, a concentration of 2% produces the highest mortality effect of the *Aedes sp* mosquito. namely with an average of 92.5% with a death toll of 37 out of 40 mosquitoes. Extraction of *Tahi Kotok* (*T. erecta*) leaves can be used as an alternative in controlling *Aedes sp* mosquitoes. Conclusion: The research results can be used as a learning resource in module form and are suitable for use with validation results of 85.2%.

The results of Aji (2015) research show that there is an influence on the role of jumentik performance on the incidence of dengue hemorrhagic fever in Rejang Lebong Regency. Novelty in this research is to determine the side effects of soaking in the aroma of sliced leaves, bark, flower buds, flowers and roots of marigold plants, on mosquito repellent.

A survey conducted by researchers on Saturday, February 11 2023, saw that many Marigold plants were seen growing on the side of the road or in the yards of residents' houses as well as in the gardens of each class at State Elementary School 07 Rejang Lebong. However, people do not yet know the benefits and effects of marigold plants as a mosquito repellent.

The role of the community in eradicating dengue hemorrhagic fever mosquito nests at the



research location has not been fully realized optimally, because mosquitoes are still found, community habits when mosquitoes emerge in the rainy season, community behavior in killing mosquitoes using sprays, mosquito coils, mosquito rackets, and Avoid mosquito bites using nets, mosquito nets, etc., but mosquitoes are still there.

Based on the above background and considering that the highest number of suspected cases of dengue hemorrhagic fever were in the research location, the author was interested in conducting research: The Effectiveness of the Aroma of Marigold Plant Parts on Mosquito Repellent at State Elementary School 07 Rejang Lebong in 2023.

1.1. Research Purposes

This research aims to determine the effectiveness of the aroma of marigold plant parts Against Mosquito Repellent Power

2. Methods

This type of research is quasi-experimental, cross sectional study design, namely research that is close to a real experiment, to determine the effectiveness of the aroma of marigold plant parts on mosquito repellent as a mosquito repellent. Dependent variable, namely the number of mosquitoes that avoid and land on the aroma of sliced marigold leaves. The independent variable, namely giving sliced Marigold leaves, was analyzed using 2 x 2 cross tabulation, calculating the odds ratio, and the Chi square test. The research object sample was 140 mosquitoes in a mosquito net box. The research will take 3 (three) months.

The analysis used was univariate to determine the effectiveness of the aroma of marigold plant parts on mosquito repellent as a mosquito repellent and the proportion of each variable studied. Bivariate analysis to determine the positive effect of the independent and dependent variables.

2.1. Research Tools and Materials

The researcher used several tools as follows: knife, water, glass, scissors, blender and mash, cloth, drying cardboard, bowl, mosquito net, mosquito net box, stopwatch, clock, stationery and observation paper. Researchers used several research materials as follows: roots, flower stem bark, flower buds, and leaves of marigold plants.

2.1.1. Ways of Working

The process for making a powdered soak for the roots, bark, flowers, flower buds and leaves of marigold plants is as follows:

1. Prepare 1 glass of starfruit or 200 ml of water.
2. Take 2 grams of the roots, bark, flowers, flower buds and leaves of the marigold plant, wash them thoroughly, then mash them and blend them, then dry them in the sun.
3. Then put the dry powdered roots, bark, flowers, flower buds and leaves of the marigold plant into a bowl, each containing 2 grams of root powder, stem bark, flowers, flower buds and leaves of the marigold plant, then It is processed so that the aroma in the water is



soaked in powdered roots, bark, flowers, flower buds and leaves of the marigold plant.

Next, the water soaked in root powder, stem bark, flowers, flower buds and leaves of the marigold plant is placed in a bowl and put in a mosquito net box containing 140 mosquito nets. How mosquito collection works is as follows:

1. Mosquitoes were taken using mosquito nets, normal ones (legs present) were selected, totaling 140 mosquitoes.
2. Then 140 mosquitoes were put into the mosquito net box that had been prepared. Implementation of research procedures is as follows:
3. Prepare all the necessary equipment and materials.
4. Take each bowl containing the soaking powder for the roots, bark, flowers, flower buds and leaves of the marigold plant containing 200 ml of water.
5. Prepare a stopwatch or clock, writing utensils and observation paper.
6. Then take 140 mosquitoes and put them in the mosquito net box.
7. Take a stopwatch/clock and observe the effect of the soaking water. powdered roots, bark, flowers, flower buds and leaves of marigold plants.
8. Then note how many mosquitoes avoid and land on the bowl containing the powdered root, bark, flowers, flower buds and leaves of the marigold plant.
9. Tabulate the data obtained and then analyze it according to the statistical method used. Data obtained from observations were first analyzed using a cross sectional study design, analyzed using 2 x 2 cross tabulation, determining the positive effect of giving water soaked in root powder, stem bark and marigold flowers and calculating the odds ratio, and the Chi square test. with a significance level of 0.05. Reject Ho if $p < (0.05)$. (Nursalam, 2018). Research result Univariate Analysis Results.

Activities in this research included calculating the number of mosquitoes that avoided and landed on bowls containing powdered root, bark, flowers, flower buds and leaves of marigold plants, after treatment. The process of observing 140 mosquitoes for a maximum of 10 minutes, for each mosquito that avoided and landed on a bowl containing 2 grams of powder from the roots, bark and flowers of marigold plants, resulted in the results as shown in the following table: Effectiveness of the Aroma of Marigold Plant Parts on Mosquito Repellent.

Table 1: Effectiveness of the aroma of marigold plant root powder Marigold Plants Against Mosquito Repellent.

Effectiveness of Marigold Root Powder Aroma						
Effectiveness of Marigold Root Powder Aroma	Mosquito Reaction					
	Mosquitoes Refuse		Mosquitoes Approaching		Total	
	n	%	n	%	n	%
Yes	138	98,57	2	1,43	140	100
No	0	0	136	100	140	100



Source: Prepared by the author (2024)

Based on Table 1 above, it shows that almost all (98.57%) were found to be 138 mosquitoes. Avoid, reject and the remaining 2 (1.43%) mosquitoes approached and perched out of the total of 140 mosquitoes in the mosquito net box soaked in 2 grams of marigold root powder for the time below. 10 minutes.

Table 2: Effectiveness of Marigold Root Powder Soaking Aroma on Mosquito Repellent. Bivariate Analysis.

Positive Effect of Marigold Root Powder Soaking Aroma on Mosquito Repellent								
Effectiveness of Marigold Root Powder Soaking Aroma	Mosquito Reaction						OR	p
	Mosquitoes Refuse		Mosquitoes Approaching		Total			
	n	%	n	%	n	%		
Yes	138	98,57	2	1,43	140	100	4.12	0,043
No	0	0	140	100	140	100		

Source: Prepared by the author (2024)

Based on table 2 above, it shows that repulsion is what causes mosquitoes. Avoiding away with a p value = 0.043, has a positive effect on the Aroma of Marigold Root Powder Soaking, which is statistically significant in its effectiveness on mosquito repellent at an odds ratio = 4.12 times. Effectiveness of the Aroma of Marigold Plant Parts on Mosquito Repellent.

Table 3: Effectiveness of Marigold Bark Powder Soaking Aroma on Mosquito Repellent.

Effectiveness of Aroma Soaking in Marigold Bark Powder							
Effectiveness of Marigold Stem Bark Powder Soaking Aroma	Mosquito Reaction						
	Mosquitoes Refuse		Mosquitoes Approaching		Total		
	n	%	n	%	n	%	
Yes	127	90,71	13	9,28	140	100	
No	0	0	140	100	140	100	

Source: Prepared by the author (2024)

Based on table 3 above, it shows that almost all (90.71%) of the 127 mosquitoes were found. Avoiding, rejecting and the remaining 13 (9.28%) mosquitoes approaching and perching from a total of 140 mosquitoes in the mosquito net box soaked in 2 grams of Marigold Plant Bark Powder. time under 10 minutes.



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Table 4: Effectiveness of Marigold Bark Powder Soaking Aroma on Mosquito Repellent. Bivariate Analysis

Positive Effect of Marigold Bark Powder Soaking Aroma on Mosquito Repellent.								
Effectiveness of Bark Powder Soaking Aroma Plant <i>Marigold</i>	Mosquito Reaction						OR	p
	Mosquitoes Refuse		Mosquitoes Approaching		Total			
	n	%	n	%	n	%		
Yes	127	90,71	13	9,28	140	100	4.08	0,043
No	0	0	0	100	140	100		

Source: Prepared by the author (2024)

Based on table 4 above, it shows that repulsion is what causes mosquitoes. Avoiding away with a p value = 0.043, has a positive effect on the Aroma of Marigold Bark Powder Soaking, which is statistically significant in its effectiveness on mosquito repellent at an odds ratio = 4.08 times. Effectiveness of the Aroma of Marigold Plant Parts on Mosquito Repellent.

Table 5: Effectiveness of the Aroma of Marigold Flower Powder on Mosquito Repellent.

Effectiveness of Marigold Plant Flower Powder Aroma Slices						
Effectiveness of Marigold Flower Powder Aroma	Mosquito Reaction					
	Mosquitoes Refuse		Mosquitoes Approaching		Total	
	n	%	n	%	n	%
Yes	115	82.14	25	17.86	140	100
No	0	0	140	100	140	100

Source: Prepared by the author (2024)

According to the data in Table 5, it is evident that a majority (82.14%) of the 115 mosquitoes did not resist and avoided the mosquito net box. The remaining 25 mosquitoes (17.86%) approached and landed on the box out of a total of 140 mosquitoes during a time frame of less than 10 minutes. This observation was made when the box contained 2 grams of marigold flower powder.

Table 6: Effectiveness of Marigold Flower Powder Aroma on Mosquito Repellent.

Bivariate Analysis

Table 6 indicates that repulsion is what causes mosquitoes.



The usefulness of the aroma emitted by marigold flower powder in repelling mosquitoes								
Effectiveness of Marigold Plant Flower Powder Aroma	Mosquito Reaction						OR	p
	Mosquitoes Refuse		Mosquitoes Approaching		Total			
	n	%	n	%	n	%		
Ya	115	82.14	25	17.8	140	100	4.06	0,043
Tidak	0	0	0	100	14	100		

Source: Prepared by the author (2024)

Eliminating a p-value of 0.043 has a significant impact on the Aroma of Marigold Flower Powder, as evidenced by a statistically significant odds ratio of 4.06 times in its effectiveness as a mosquito repellent.

3. Results and Discussion

Based on the results of observations made from trials of soaking water in powder, roots, bark and flowers of marigold plants on the mosquito repellent power with the same formulation, causing different numbers of mosquitoes to avoid and land in the same time span, the results obtained are as follows:

The effectiveness of water soaked in the aroma of powdered roots, bark and flowers of marigold plants in repelling mosquitoes Based on table 1 above, it shows that almost all (98.57%) were found to be 138 mosquitoes avoiding rejecting and the remaining 2 (1.43%) mosquitoes were approaching and perched out of the total of 140 mosquitoes in the mosquito net box soaked in 2 grams of marigold root powder for the time below. 10 minutes.

Based on table 2 above, it shows that the repellent force that causes mosquitoes to stay away with a p value = 0.043, has a positive effect on the Aroma of Marigold Root Powder Soaking, which is statistically significant in its effectiveness on mosquito repulsion at an odds ratio = 4.12 times.

Based on table 3 above, it shows that almost all (90.71%) found 127 mosquitoes avoiding and rejecting and the remaining 13 (9.28%) mosquitoes approaching and perching from a total of 140 mosquitoes in the mosquito net box soaked in 2 grams of Marigold Plant Bark Powder. time under 10 minutes.



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Based on table 4 above, it shows that the repellent force that causes mosquitoes to stay away with a p value = 0.043, has a positive effect on the Aroma of Marigold Bark Powder Soak, which is statistically significant in its effectiveness on mosquito repulsion at an odds ratio = 4.08 times.

Based on table 5 above, it shows that almost all (82.14%) found 115 mosquitoes Avoiding and rejecting and the remaining 25 (17.86%) mosquitoes approached and landed from a total of 140 mosquitoes in the mosquito net box with 2 grams of marigold flower powder in under 10 minutes.

Based on table 6 above, it shows that the repellent force that causes mosquitoes to stay away with a p value = 0.043, has a positive effect on the Aroma of Marigold Flower Powder, which is statistically significant in its effectiveness on mosquito repulsion at an odds ratio = 4.06 times.

In line with the research results Aji et al. (2023) The purpose of knowing the positive effect of the aroma of marigold leaf slices on mosquito repellent as a repellent. The indoor research site provided mosquito net boxes containing 136 mosquitoes. The results of the Chi -square analysis obtained $P = 0.04 < \alpha 0.05$, statistically there was a significant positive effect between marigold leaf slices on mosquito repellent, with odds ratio = 4.10 times.

According to the research results of Suharno Zein (2020), there is a very real influence on mortality resulting from each extraction concentration given. Based on research, a concentration of 2% produces the highest mortality effect of the Aedes sp mosquito. namely with an average of 92.5% with a death toll of 37 out of 40 mosquitoes. Extraction of Tahikotok (T. erecta) leaves can be used as an alternative in controlling Aedes sp mosquitoes. Conclusion: The research results can be used as a learning resource in module form and are suitable for use with validation results of 85.2%.

Agree with the research results Fabrick et al. (2020) Assays indicated significantly reduced survival of both pest species on T. patula plants, and in diet incorporation assays containing aqueous and methanolic marigold foliar extracts. Mortality was concentration-dependent, indicating the presence of one or more extractable toxicants. These data suggest that T. patula plants have insecticidal constituents that mig.

In line with the opinion of Marini the results of phytochemical tests using the color test method on marigold leaf extract succeeded in identifying alkaloid, flavonoid, saponin and tannin compounds. The results of the protective power test showed that marigold leaf extract lotion was not effective as a repellent against Ae. aegypti with protective power above 90% only lasts for two hours after application, namely at a concentration of 30%.

Agrees with the research results of Irfayanti et al. (2023). The results of the research show



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that the repellent spray has repellent, control (-) power of 50.67%, 2.5% concentration of 68.33%, 5% concentration of 78.67%, 10% concentration. % was 96% and control (+) was 100%. The results of the protective power test showed that the repellent spray containing marigold flower essential oil had the highest activity at a concentration of 10%. and 1% and the results of the SNK (Newman Keuls) follow-up test showed that the 10% concentration was not significantly different from the control (+).

The researchers concluded that by immersing in root powder, almost all (98.57%) found 138 mosquitoes avoiding rejecting and the remaining 2 (1.43%) mosquitoes approaching and perching out of the total of 140 mosquitoes in the mosquito net box soaked in 2 grams of marigold root powder in the following time. 10 minutes. The results of the Chi-square analysis obtained a value of $P = 0.043 < \alpha 0.05$, statistically there was significant effectiveness between soaking in marigold root powder on mosquito repellent, with an odds ratio = 4.12 times. The researchers concluded that almost all (90.71%) of the 127 mosquitoes avoided rejecting the stem bark powder and the remaining 13 (9.28%) mosquitoes approached and landed out of the total of 140 mosquitoes in the mosquito net box soaked in 2 grams of Marigold stem bark powder for a period of time. under 10 minutes., The results of the Chi-square analysis obtained a value of $P = 0.043 < \alpha 0.05$, statistically there was significant effectiveness between soaking in marigold bark powder on mosquito repellent, with an odds ratio = 4.08 times.

1. The researcher's conclusion was that almost all (82.14%) of the flower powder soaked found 115 mosquitoes avoiding and resisting and the remaining 25 (17.86%) mosquitoes approached and landed out of the total of 140 mosquitoes in the mosquito net box soaked in 2 grams of marigold flower powder in under 10 minutes. The results of the Chi-square analysis obtained a value of $P = 0.043 < \alpha 0.05$, statistically there was significant effectiveness between soaking in marigold flower powder on mosquito repellent, with an odds ratio = 4.06 times.

4. Conclusion and Suggestion

Marigold plants contain essential oils that are effective as larvicides against *Culex quinquefasciatus*, *Anopheles stephensi* and *Aedes aegypti* mosquitoes. The researcher's conclusion was that almost all (98.57%) of the 138 mosquitoes found avoided resisting and the remaining 2 (1.43%) mosquitoes approached and landed from a total of 140 mosquitoes in the mosquito net box soaked in 2 grams of marigold root powder. time under 10 minutes. The results of the Chi-square analysis obtained a value of $P = 0.043 < \alpha 0.05$, statistically there was significant effectiveness between soaking in marigold root powder on mosquito repellent, with an odds ratio = 4.12 times. The researcher's conclusion was that almost all (90.71%) of the 127 mosquitoes avoided rejecting the stem bark powder and the remaining 13 (9.28%) mosquitoes approached and landed out of the total of 140 mosquitoes in the mosquito net box



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soaked in 2 grams of Marigold stem bark powder. in less than 10 minutes. The results of the Chi-square analysis showed a value of $P = 0.043 < \alpha 0.05$, statistically there was significant effectiveness between soaking in marigold bark powder on mosquito repellent, with an odds ratio = 4.08 times. The researcher's conclusion was that almost all (82.14%) of the flower powder soaked found 115 mosquitoes avoiding and resisting and the remaining 25 (17.86%) mosquitoes approached and landed out of the total of 140 mosquitoes in the mosquito net box soaked in 2 grams of marigold flower powder in under 10 minutes. The results of the Chi-square analysis obtained a value of $P = 0.043 < \alpha 0.05$, statistically there was significant effectiveness between soaking in marigold flower powder on mosquito repellent, with an odds ratio = 4.06 times. So that students get used to it, put sliced marigold leaves in the room to repel mosquitoes.

Authors Contributions

All proposed the topic of this research and designed the study, collected the data. All the authors contributed to preparation of the final draft of the manuscript was reviewed and revised critically for intellectual content, as well as drafting and revising the final manuscript. All authors approved the final version of this manuscript.

Conflicts of Interest

The authors declare there is no conflict of interest.

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