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## 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 mosquito *Aedes aegypti* is capable of transmitting dengue fever. The solution is to eliminate the mosquito's life cycle by employing fumigation and abate powder to remove mosquito larvae, although it might have environmental consequences. The researchers were seeking a dependable and efficient organic pesticide option. Scientists at the research facility analyzed marigold plants. Marigold plants possess crucial chemicals that are highly efficient as pesticides against *Culex quinquefasciatus*, *Anopheles stephensi*, and *Aedes aegypti* mosquitoes. The research was quasi-experimental with a Cross-sectional study design. The objective is to assess the efficacy of marigold plant powder fragrance as a mosquito repellent. The investigation is conducted in a room that has a mosquito net box housing 140 mosquitoes. The Chi-square analysis yielded the following results:  $P \text{ value} = 0.043 < \alpha 0.05$ , indicating a statistically significant impact of immersing the powder marigold plant roots in mosquito repellent powder, with an odds ratio of 4.12. Statistically, there is a significant efficacy between the soaking of marigold plant bark powder and mosquito repellent powder, with an odds ratio of 4.08 times ( $P \text{ value} = 0.043 < \alpha 0.05$ ). Statistically, soaking powdered marigold flowers in mosquito repellent has been found to be significantly effective, with an odds ratio of 4.06 ( $P \text{ value} = 0.043 < \alpha 0.05$ ). Students should expose themselves to the scenario by laying a concoction of moistened, pulverized root, bark, and flowers in the room to deter mosquitoes.

**Keywords:** Effectiveness of aroma, marigold plant parts, mosquitoes.

### INTRODUCTION.

The transition season for the development of mosquitoes is increasing. Dengue hemorrhagic fever (DHF) is a rapidly spreading transmissible illness that remains a significant health threat

to people of all ages in the surrounding area. Dengue hemorrhagic fever is a rapid-onset viral illness that is spread by the *Aedes aegypti* mosquito. The dengue virus is carried to humans by this mosquito through its liquid saliva, which reaches the circulatory system and causes the development of dengue hemorrhagic fever (WHO, 2021).

As Indonesia transitions from the dry to the rainy season, there has been a noticeable rise in instances of Dengue Hemorrhagic Fever (DHF). According to data from the Directorate of Infectious Disease Prevention and Control (P2PM), as of March 1, 2024, there were approximately 16,000 instances of Dengue Hemorrhagic Fever (DBD) in 213 districts/cities in Indonesia, resulting in 124 fatalities. In total, there were 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, 816 deaths (CFR 0.93%) and 87,501 confirmed dengue cases (IR 31.38/100,000 population) were recorded. "Generally, the number of dengue has risen. "Most cases occurred in the age category of 14-44 years, accounting for 38.96 percent, followed by the age group of 5-14 years, which accounted for 35.61 percent," said 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)

In 2024, there were a total of 50 reported cases of dengue fever. According to data collected from 21 healthcare facilities located in 15 sub-districts in Rejang Lebong, between January and mid-February 2024, the Rejang Lebong Health Service has obtained reports. Monthly report on incidents of Dengue Hemorrhagic Fever (DHF) in Rejang Lebong Regency. (2024)

The primary approach for eliminating dengue disease involves the eradication of adult mosquitoes through fumigation. This strategy is further enhanced by the utilization of larvicide, which is dispersed into water reservoirs (TPA). Thus far, these two approaches have failed to yield adequate outcomes. Empirical evidence confirms a rise in the incidence of dengue cases and the geographical spread of dengue disease. Ministry of Health of the Republic of Indonesia (2020).

The expected community participation in Healthy Indonesia 2025 includes proactive measures to preserve and enhance health, mitigate the risk of diseases, safeguard oneself from health threats, comply with legal regulations, and actively engage in public health initiatives, such as promoting a healthy and well-being society and secure and protected community. Indonesian Ministry of Health. (2021).

The study conducted by Aji et al. (2016) investigated the correlation between environmental conditions and indices associated with dengue vector larvae in the Rejang Lebong District. The number of dengue hemorrhagic fever (DBD) cases in Bengkulu Province has reached 828 from January to August 2022. The Bengkulu Provincial Government has been compelled to implement proactive measures to prevent the further escalation of the disease triggered by a mosquito called *Aedes aegypti*. Head of the Disease Control and Eradication Division (P2P) of the Bengkulu Provincial Health Service. (2022)

"Between January and October 2022, a total of 76 instances of dengue fever were reported in Rejang Lebong Regency, resulting in three fatalities." Head of the Rejang Lebong Health Service (2022).

Results of Marini's prior investigation, (2018) Alkaloid, flavonoid, saponin, and tannin compounds were successfully identified in the phytochemical experiments conducted on marigold leaf extract using the color test method. The findings from the protective powder test indicate that the ointment made from marigold leaf extract does not effectively repel *Ae. aegypti* mosquitoes. The lotion's protective efficacy, which exceeds 90%, only lasts for two hours after it is applied, specifically at a dosage of 30%.

Aji's research findings from 2017 demonstrate a substantial correlation between the existence of *Aedes aegypti* larvae in water reservoirs and the influence of citronella.

Findings from Suharno Zen's research in 2020: Research data indicates a significant impact on mortality based on the concentration of each extraction. According to a study, a concentration of 2% has the greatest lethal impact on the *Aedes sp* mosquito, resulting in an average mortality rate of 92.5%, with 37 out of 40 insects dying. The leaves of *Tahi Kotok* (*T. erecta*) can be utilized as a substitute for suppressing *Aedes sp* mosquitoes. It can be concluded that the research findings can be used as a teaching material in a modular manner and are suitable for deployment accompanying validation results of 85.2%.

Aji's research findings from 2015 demonstrate a correlation between the performance of jumantik and the occurrence of dengue hemorrhagic fever in Rejang Lebong Regency. The novelty of this research lies in investigating the potential side effects of exposing mosquitoes to the perfume of various parts of marigold plants, including sliced leaves, bark, flower buds, flowers, and roots, as a kind of mosquito repellent.

A survey done on Saturday, February 11, 2023, revealed the widespread presence of Marigold plants along the roadside, in residents' yards, and the gardens of each class at State Elementary School 07 Rejang Lebong. Nevertheless, the advantages and impacts of marigold plants as a mosquito repellent remain unknown to the general public.

The community has not yet achieved the total removal of dengue hemorrhagic fever mosquito breeding sites at the research area. Despite the community's efforts to combat mosquitoes during the rainy season by using sprays, mosquito coils, mosquito rackets, and protective measures such as mosquito nets, mosquitoes continue to persist.

Based on the available information and the high number of alleged cases of dengue hemorrhagic fever, the author was motivated to conduct a study titled "The Effectiveness of the Aroma of Marigold Plant Parts as a Mosquito Repellent at State Elementary School 07 Rejang Lebong in 2023".

#### RESEARCH PURPOSES

The objective of this investigation is to ascertain the efficacy of the aroma of marigold plant parts in response to mosquito-repellent powder.

#### METHOD

This research employs a quasi-experimental, cross-sectional study methodology to assess the efficacy of marigold plant parts' scent as a mosquito repellent. The dependent variable is the amount of mosquitoes that are repelled or attracted to the scent of sliced marigold leaves. The independent variable, which involved providing sliced Marigold leaves, was examined using a 2 x 2 cross-tabulation, where the odds ratio and Chi-square test were calculated. The research

sample consisted of 140 mosquitoes contained within a mosquito net box. The duration of the research project is set at three months.

The analysis employed a univariate approach to assess the efficacy of marigold plant parts' scent as a mosquito repellent, as well as the proportion of each variable examined. Conducting bivariate analysis to ascertain the beneficial impact of the independent and dependent variables.

#### RESEARCH TOOLS AND MATERIALS

The researcher utilized a variety of items including a knife, water, glass, scissors, blender, mash, cloth, drying cardboard, container, mosquito net, mosquito net box, stopwatch, clock, stationery, and observation paper.

The researchers utilized several research materials, including the roots, flower stem bark, flower buds, and leaves of marigold plants.

#### WAYS OF WORKING

The procedure for creating a powdered infusion using the roots, bark, flowers, flower buds, and leaves of marigold plants is as outlined below:

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, mash them, and blend them, then dry them in the sun.
3. Next, combine 2 grams of powdered marigold root, stem bark, flowers, flower buds, and leaves in a container. Process the mixture to allow the water to absorb the aroma from the powdered marigold components.
4. Subsequently, the water-based solution infused with powdered roots, stem bark, flowers, flower buds, and leaves of the marigold plant is transferred into a receptacle and placed within a container specifically designed to hold 140 mosquito nets.

The process of mosquito collection operates as follows:

1. A total of 140 mosquitoes were captured using mosquito nets, specifically selecting those with intact legs.
2. A total of 140 mosquitoes were placed within the prearranged mosquito net box.

The execution of research techniques is as outlined below:

1. Gather all the requisite equipment and tools.
2. Gather individual bowls, each filled with a 200 ml water solution of soaking powder for the roots, bark, flowers, flower buds, and leaves of the marigold plant.
3. Take a stopwatch or clock, writing equipment, and observation paper.
4. Next, transfer a total of 140 mosquitoes into the designated container for mosquito nets.
5. Observe the impact of the soaking water, powdered roots, bark, flowers, flower buds, and foliage of marigold plants using a stopwatch or clock.
6. Subsequently, quantify the quantity of mosquitoes that evade and alight on the bowl that contains the powdered root, bark, flowers, flower buds, and leaves of the marigold plant.
7. Compile the data and subsequently analyze it by the statistical methodology employed.

The data collected from observations was initially analyzed using a cross-sectional study design. The analysis involved performing a 2 x 2 cross-tabulation to determine the positive impact of administering water soaked in root powder, stem bark, and marigold flowers. The odds ratio was calculated, and the Chi-square test was conducted with a significance level of 0.05. Reject the null hypothesis (Ho) if the p-value is less than 0.05. (Nursalam, 2018).

#### Research result

##### Univariate Analysis Results

The analysis was performed by calculating the total of mosquitoes that following treatment, escaped and touched down the bowls which contain powdered root, bark, flowers, flower

buds, and marigold plant leaves. During the observation period, a total of 140 mosquitoes were monitored for a maximum duration of 10 minutes. Each mosquito that managed to escape and landed on the bowl containing 2 grams of powder was taken into account from the roots, bark, and flowers of marigold plants. The results are presented as follows:

Effectiveness of the Marigold Plant Parts Aroma on Mosquito Repellent.

Table 1 Effectiveness of marigold plant root powder aroma 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

The abovementioned data in Table 1 reveals that nearly all (98.57%) of the data were 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.

Table 2 indicates that repulsion is what causes mosquitoes

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		

It can be seen from table 2 that the Marigold Root Powder Soaking Aroma is positively impacted by avoiding away ( $p = 0.043$ ), and this effect is statistically significant in terms of its effectiveness as a mosquito repellent (odds ratio = 4.12 times).

Effectiveness of the Marigold Plant Parts Aroma 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	Mosquito Reaction			
	Mosquitoes Refuse	Mosquitoes Approaching	Total	

Bark Powder Soaking Aroma	n		%		n		%	
Yes	127	90,71	13	9,28	140	100		
No	0	0	140	100	140	100		

According to Table 3, nearly all (90.71%) of the 127 mosquitoes were found. Avoiding, rejecting and the remaining 13 of 140 (9.28%) mosquitoes approaching and perching in the mosquito net box soaked in 2 grams of Marigold Plant Bark Powder. time under 10 minutes.

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

Bivariate Analysis

Table 4 indicates that repulsion is what causes mosquitoes.

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		

Eliminating a p value of 0.043 has a substantial favorable impact on Marigold Bark Powder Soaking Aroma. The ability of this effect to repel mosquitoes is statistically significant, as indicated by an odds ratio of 4.08.

Effectiveness of Marigold Plant Parts Aroma on Mosquito Repellent.

Table 5 Effectiveness of Marigold Flower Powder Aroma 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

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 4 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				Total		OR	p
	Mosquitoes Refuse		Mosquitoes Approaching		n	%		
	n	%	n	%	n	%		
Ya	115	82.14	25	17.8	140	100	4.06	0,043
Tidak	0	0	0	100	14	100		
					0			

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.

### Research discussion

The results obtained from studies of soaking water in powder, roots, bark, and flowers of marigold plants to test their mosquito repellent effectiveness with the same formulation indicate that varied numbers of mosquitoes were deterred and landed within the same time range as presented below:

The effectiveness of water soaked in the aroma of powdered roots, bark, and flowers of marigold plants in repelling mosquitoes

The data in Table 1 reveals that nearly all (98.57%) of the data were 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.

It can be seen from table 2 that the Marigold Root Powder Soaking Aroma is positively impacted by avoiding away ( $p = 0.043$ ), and this effect is statistically significant in terms of its effectiveness as a mosquito repellent (odds ratio = 4.12 times).

According to Table 3, nearly all (90.71%) of the 127 mosquitoes were found. Avoiding, rejecting and the remaining 13 of 140 (9.28%) mosquitoes approaching and perching in the mosquito net box soaked in 2 grams of Marigold Plant Bark Powder under 10 minutes.

Table 4 shows that eliminating a p-value of 0.043 has a substantial favorable impact on the Marigold Bark Powder Soaking Aroma. This effect is statistically significant in its ability to repel mosquitoes, with an odds ratio of 4.08 times.

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 indicates that 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.

*In line with the research results Aji (2023) The objective is to understand the beneficial impact of marigold leaf slices' scent as a mosquito repellent. The indoor research site contained*



mosquito net boxes that accommodated a collective total of 136 mosquitoes. The Chi-square analysis resulted in a p-value of 0.04, which is lower than the significance level of 0.05 ( $\alpha = 0.05$ ). The data reveals a substantial and positive correlation between marigold leaf slices and their ability to repel mosquitoes, with an odds ratio of 4.10.

According to the research results of Suharno Zein (2020), each extraction concentration has a significant impact on mortality. According to this study, a concentration of 2% has the greatest impact on killing *Aedes* sp mosquitoes, resulting in an average mortality rate of 92.5%, with 37 out of 40 mosquitoes dying. The utilization of Tahi Kotok (*T. erecta*) leaf extraction can serve as a viable alternative for managing *Aedes* sp mosquitoes. Conclusion: The research findings can be utilized as a learning tool in a modular format and are appropriate for implementation alongside validation results of 85.2%.

Concur with the findings of the research by Jeffrey (2020), experiments demonstrated a notable decrease in the survival rates of both pest species when exposed to *T. patula* plants. Additionally, diet inclusion experiments that included aqueous and methanolic marigold foliar extracts also showed reduced survival rates. The mortality rate was directly influenced by the concentration of toxic substances, suggesting the existence of one or more extractable harmful substances. The data indicate that *T. patula* plants possess insecticidal components that may migrate.

It is following Marini, et al (2018), the phytochemical tests conducted on marigold leaf extract using the color test method successfully detected alkaloid, flavonoid, saponin, and tannin components. The findings from the protective powder test revealed that the lotion made from marigold leaf extract did not exhibit effectiveness in repelling *Ae. aegypti* mosquitoes. The efficacy of the protective powder, which was over 90%, was shown to diminish within two hours of application, particularly at a concentration of 30%.

Concurs with the research findings of Alfiah Nur (2022) that the repellent spray exhibits a repelling power of 50.67% for control (-), 68.33% for a concentration of 2.5%, 78.67% for a concentration of 5%, 96% for a concentration of 10%, and 100% for control (+). The results of the protective power test indicated that the repellent spray, which contained marigold flower essential oil, demonstrated the greatest efficacy when used at a concentration of 10%. Additionally, the SNK (Newman Keuls) follow-up test results revealed that the 10% concentration did not show any significant difference compared to 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 Chi-square analysis generated a P-value of 0.043, which is below the significance level  $\alpha$  of 0.05. The data shows that soaking in marigold root powder is highly effective as a mosquito repellent, with a considerable statistical advantage, as indicated by an odds ratio of 4.12.

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 while. under 10 minutes. The Chi-square analysis resulted in a P-value of

0.043, which is smaller than the significance level of  $\alpha = 0.05$ . This indicates a statistically significant effectiveness of bathing in marigold bark powder as a mosquito repellent, with an odds ratio of 4.08.

1. The researcher concluded that almost all (82.14%) of the flower powder-soaked 115 mosquitoes avoided and resisted 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 Chi-square analysis resulted in a P-value of 0.043, which is lower than the significance level  $\alpha$  of 0.05. This indicates a statistically significant effectiveness of bathing in marigold flower powder as a mosquito repellent, with an odds ratio of 4.06.

## **CLOSING**

### **Conclusion**

2. Marigold plants have essential oils that effectively repel *Culex quinquefasciatus*, *Anopheles stephensi*, and *Aedes aegypti* mosquitoes.

3. The researcher concluded 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 Chi-square analysis yielded a P-value of 0.043, which is less than the significance level  $\alpha$  of 0.05. This indicates a statistically significant effectiveness of soaking in marigold root powder as a mosquito repellent, with an odds ratio of 4.12.

4. The researcher 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. in less than 10 minutes. The Chi-square analysis resulted in a P-value of 0.043, which is smaller than the significance level of  $\alpha = 0.05$ . This indicates a statistically significant effectiveness of bathing in marigold bark powder as a mosquito repellent, with an odds ratio of 4.08.

5. The researcher concluded that almost all (82.14%) of the flower powder-soaked 115 mosquitoes avoided and resisted 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 Chi-square analysis resulted in a P-value of 0.043, which is lower than the significance level  $\alpha$  of 0.05. This indicates a statistically significant effectiveness of bathing in marigold flower powder as a mosquito repellent, with an odds ratio of 4.06.

### **Suggestion**

To acclimate students, place sliced marigold leaves in the room to deter mosquitoes.

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