B-ICON Proceeding

THE EFFECTIVENESS OF MARIGOLD LEAVES AND FLOWERS AS MOSQUITO REPELLENT

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Abstract

The importance of mosquito control lies in mosquitoes as vectors of dangerous diseases such as dengue fever. The use of chemical insecticides, although common, has a negative impact on human health and the environment. The *Aedes aegypti* mosquito can cause dengue fever. The response is to carry out the vector life cycle, by killing mosquito larvae, using fogging, abate powder, which has an impact on the environment. Researchers are looking for a safe and effective natural larvicide solution. The researchers observed marigold plants at the research site. Marigold plants contain essential oils that are effective as larvicides on *Culex quinquefasciatus*, *Anopheles stephensi* and *Aedes aegypti* mosquitoes. This study aims to test the effectiveness of squeezed leaves and flowers of marigold plants on mosquito repellent power. This study is a quasi-experimental study. The research location is in a room with a mosquito net box containing 140 mosquitoes. The results of the Chi-square analysis obtained the p-value = 0.039 indicates a statistically significant positive effect of marigold leaf slices as a mosquito repellent, with an odds ratio of 4.8 times. The effectiveness of marigold leaf juice on mosquito repellent. The chi-square analysis results obtained with a p-value = 0.040 indicate a statistically significant positive effect of marigold leaf slices as a mosquito repellent, with an odds ratio of 4.9 times. The effectiveness of marigold flower juice on mosquito repellent.

Keywords: Effectivenes, Marigold Leaf, Marigold Flower Juice

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INTRODUCTION

The Aedes aegypti mosquito can cause dengue fever. The response is to eradicate the vector's life cycle by killing mosquito larvae, using fogging and abate powder, which has an environmental impact. Researchers are seeking a safe and effective natural larvicidal solution. The researchers examined marigold plants at the study site. Marigold plants contain essential oils that are effective as larvicides against Culex quinquefasciatus, Anopheles stephensi, and Aedes aegypti mosquitoes. This study is quasi-experimental. Mosquito control impacts the spread of disease, as mosquitoes are the primary vectors of various deadly diseases that can cause death and disability, especially in tropical regions. Public health impacts include mosquito-borne disease outbreaks, which can burden health systems and disrupt socioeconomic activities. Prevention is necessary; effective mosquito control can reduce the spread of

disease and protect public health. (Aji, 2024)

The negative impact of chemical insecticide use can lead to mosquito resistance. Excessive use of insecticides can cause mosquitoes to become resistant, thus reducing their effectiveness. Regarding human health, chemical insecticide sprays can cause various health problems, such as respiratory problems, skin irritation, and poisoning. (Aji, 2024).

Improving sanitation, by eliminating mosquito breeding sites, such as stagnant water, is a crucial step in vector control. Natural insecticides can include plants or natural ingredients with mosquito-repellent properties, including citronella, lavender, mint, rosemary, marigold, and basil. These plants emit scents that mosquitoes dislike, making them effective in reducing mosquito populations around the home. (Aji, 2023).

The WHO recorded a significant increase in dengue fever cases in 2024. By the 17th week of 2024, Indonesia had recorded 88,593 dengue cases with 621 deaths. This increase was also seen in the January-April 2024 period, with the majority of cases originating in Brazil, according to the BBC. Details of Dengue Fever Cases in 2024. Global: A significant increase in dengue cases was reported worldwide, with more than 13 million cases in North, Central, South America, and the Caribbean in 2024, according to the CDC. (WHO, 2024).

Dengue cases in Indonesia, week 17 of 2024, recorded 88,593 cases of dengue fever with 621 deaths, cases increased by 119,709 with 777 deaths in week 22 (May 2024). The Ministry of Health recorded a 60% increase in dengue fever cases in September 2024 compared to 2023. The death rate due to dengue fever increased in 2024. Regions: Bali reported 15,570 cases of dengue fever in 2024, according to the Bali Health Office. Sumedang Regency recorded 2,341 cases of dengue fever with 7 deaths until October 2024, a sharp increase compared to the previous year. Depok City reported 4,825 cases of dengue fever with 10 deaths throughout 2024. (Ministry of Health of the Republic of Indonesia, 2024).

Based on data from the Director General of Disease Prevention and Control of the Indonesian Ministry of Health, in the 17th week of 2024 (around April 2024) there were 88,593 cases of dengue fever with 621 deaths in Indonesia, in the 22nd week (May 2024), the number of cases increased to 119,709 with 777 deaths. The increase in cases is due to the dry season which is expected to increase the frequency of mosquito bites, as well as the shortening of the annual cycle of dengue cases from 10 years to 3 years or less, which is caused by the El Nino phenomenon, according to the Ministry of Administrative and Bureaucratic Reform. Several important points regarding dengue cases in 2024.

There was a significant increase in dengue cases in 2024, especially from January to March, with a further increase in November and December, 2024. The cause of the increase is there, several factors that cause the increase in dengue cases include climate change, prolonged dry season, and shortening of the annual cycle of dengue cases. Prevention Efforts: The Ministry of Health continues to carry out various prevention efforts, including the 3M Plus Mosquito Nest Eradication program (Draining, Closing, and Recycling), as well as the implementation of the National Dengue Control Strategy (STRANAS) 2021-2025. Target in 2030. The Ministry of Health is targeting zero deaths from dengue fever by 2030 through various prevention efforts and earlier handling. So that the public is always alert in the dry season. And always remain vigilant against dengue fever, especially during the dry season which is expected to increase the risk of mosquito bites, according to the Ministry of Administrative and Bureaucratic Reform. Director General of Disease Prevention and Control, Ministry of Health of the Republic of Indonesia. (2024).

Dengue fever cases in Bengkulu in 2024, there were 1,537 cases, there were 7 deaths, dengue cases decreased by 481 cases. Mukomuko Regency affected by dengue fever: 587 cases, Bengkulu City: 255 cases with 4 deaths. The peak of cases in March 2024 recorded a spike in dengue fever cases with 481 cases, a downward trend. Despite the spike, dengue fever cases in Bengkulu began to show a downward trend in the 18th week of May 2024. The Head of the Bengkulu Provincial Health Office warned the public to be vigilant and continue to take preventive measures, using the 3Ms (Bengkulu Provincial Health Office, 2024).

Rejang Lebong Regency had 435 dengue fever cases in 2024 in 15 sub-districts in Rejang Lebong Regency, which is quite high. In 2023 there were 86 cases. Dengue fever remains a threat, considering that this dengue case resulted in three deaths. (Head of Prevention and Control of Infectious Diseases. Rejang Lebong Health Office, 2024).

During the transition period from the dry season to the rainy season, dengue fever cases in Indonesia increased. The expected public behavior in Healthy Indonesia 2025 is proactive behavior to maintain and improve health, prevent disease risks, protect oneself from the threat of disease and other health problems, be legally aware, and actively participate in public health movements, including organizing a healthy and prosperous society. safe/protected community. Ministry of Health of Indonesia. (2021).

Results by Kamelia et al. (2020): Based on research data, there is a very significant effect on mortality resulting from each concentration of extraction given. Based on the study, a concentration of 2% produced the highest mortality effect on Aedes sp. mosquitoes, with an average of 92.5% with a mortality rate of 37 out of 40 mosquitoes. Extraction of Tahi Kotok (T. erecta) leaves can be used as an alternative

to control Aedes sp. Conclusion: The results of the study can be used as a learning resource in the form of a module and are suitable for use with a validation result of 85.2%.

The results of Aji's study (2024), Effectiveness of Marigold Root Powder Aroma on Mosquitoes, almost all (98.57%) of the 138 mosquitoes avoided and the remaining 2 mosquitoes (1.43%) approached and landed out of a total of 140 mosquitoes in a mosquito net box soaked in 2 grams of marigold root powder for 10 minutes. Bivariate analysis showed that repellent power was the cause of mosquitoes. Avoidance 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 as a mosquito repellent with an odds ratio = 4.12 times. Effectiveness of Marigold Plant Parts Aroma on Mosquito Repellent.

The results of Aji's (2024) study, the effectiveness of the aroma of marigold bark powder soaked in mosquito repellent, almost all (90.71%) of 127 mosquitoes were found to avoid, reject, and the remaining 13 mosquitoes (9.28%) approached and landed out of a total of 140 mosquitoes in a mosquito net box soaked in 2 grams of Marigold Bark Powder. time under 10 minutes. Bivariate analysis, showed that repellent is the cause of mosquitoes. Avoidance with a p value = 0.043, has a positive effect on the aroma of Marigold Bark Powder, which is statistically significant in its effectiveness as a mosquito repellent with an odds ratio = 4.08 times. The Effectiveness of the Aroma of Marigold Bark Powder on Mosquito Repellent.

The results of Aji's (2024) study The Effectiveness of Marigold Flower Aroma Powder on Mosquito Repellent.shows that the majority (82.14%) of 115 mosquitoes did not resist and avoided the mosquito net box. The remaining 25 mosquitoes (17.86%) of the total 140 mosquitoes approached and landed on the mosquito net box in less than 10 minutes. This observation was made when the box contained 2 grams of marigold flower powder. Bivariate analysis showed that repellent power was the cause of mosquito avoidance with a p-value of 0.043 having 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.

A survey conducted on Saturday, April 19, 2025, revealed numerous marigold plants growing in the courtyard of State Senior High School 10 Rejang Lebong. The public is unaware of the benefits of marigolds as mosquito repellent.

Based on the above background and considering the highest number of suspected dengue fever cases in the study area, the author was interested in conducting a study: "The Effectiveness of Marigold Leaf and Flower Slices on Mosquito Repellent."

MATERIALS AND METHODS

Research Objectives

This study aims to test the effectiveness of squeezed marigold leaf and flower extracts on mosquito repellent. This study was conducted by comparing the repellent effectiveness of squeezed marigold leaf and flower extracts with a control (sliced leaves and flowers without extract). The results are expected to provide information on the potential of marigold plants as a natural mosquito repellent.

This study aims to determine the effectiveness of squeezed marigold leaf and flower extract on mosquito repellent.

Research Method

This study is a quasi-experimental study with a cross-sectional design, a study that approximates a true experiment. The aim is to determine the effectiveness of squeezed marigold leaf and flower extract on mosquito repellent.

The dependent variable is the number of mosquitoes that avoid and land on the area. The effectiveness of squeezed marigold leaf and flower extract on mosquito repellent is determined by the number of mosquitoes that are given.

The independent variable, the administration of the extract containing the squeezed marigold leaf and flower extract, was analyzed using a 2 x 2 cross-tabulation, odds ratio calculation, and Chi-square test. The sample size for this study was 140 mosquitoes in a mosquito net box. The study will last for 3 (three) months.

The analysis used was univariate to determine the effectiveness of squeezed marigold leaf and flower extracts on mosquito repellent properties, and the proportion of each studied variable. Bivariate analysis was used to determine the positive effect of the independent and dependent variables.

Research Tools and Materials

The researcher used the following tools: a knife, cotton wool, scissors, cloth, a drying box, a bowl, a mosquito net, a mosquito net box, a stopwatch, a clock, writing instruments, and observation paper. The researcher used the following research materials: squeezed marigold leaf and flower extracts.

Procedure

The process of making the extract of squeezed marigold leaf and flower extracts is by slicing the leaves and flowers, then squeezing them and placing them in a bowl. The steps are as follows:

1. Prepare a small bowl containing 1 gram of the squeezed leaves and flowers.
2. Take 1 gram of the squeezed marigold leaf and flower extract.
3. Place the squeezed marigold leaf and flower juice into a bowl, each containing 1 gram of squeezed marigold leaf and flower juice, then process it to create the aroma of the squeezed leaves and flowers.

4. Place the squeezed marigold leaf and flower juice into a bowl, then put it into a mosquito net box containing 140 mosquito nets

The mosquito collection procedure is as follows:

1. Mosquitoes are collected using a mosquito net, selecting 140 normal mosquitoes (with legs and wings).
2. Then, the 140 mosquitoes are placed in the prepared mosquito net box. The research procedure is as follows:
3. Prepare all necessary equipment and materials.
4. Take each bowl containing the squeezed marigold leaf and flower juice and place it in the bowl.
5. Prepare a stopwatch or clock, writing utensils, and observation paper.
6. Then, take 140 mosquitoes and place them in the mosquito net box.
7. Use a stopwatch/clock and observe the effect of the squeezed marigold leaf and flower juice on the bowl.
8. Then, record how many mosquitoes avoid and land on the bowl containing the squeezed marigold leaf and flower juice, which is then placed in the bowl.
9. Tabulate the data obtained and analyze it according to the statistical method used. The data obtained from the observation results were first analyzed using a cross-sectional study design, analyzed using 2 x 2 cross tabulations, to determine the positive effect of administering squeezed marigold leaf and flower juice, then put it in a bowl. And calculating the odds ratio, and Chi-square test, with a significance level of 0.05. Reject Ho if $p < (0.05)$. (Nursalam, 2018).

RESULTS AND DISCUSSION

Result

This study included counting the number of mosquitoes that avoided and landed on a bowl containing the squeezed marigold leaf and flower juice, which was then placed in the bowl.

After treatment, 140 mosquitoes were observed for a maximum of 10 minutes. For each mosquito that avoided and landed on a bowl containing 1 gram of squeezed marigold leaf and flower juice, which was then placed in the bowl, the results were as shown in the following table:

Table 1: Effectiveness of Sliced Marigold Leaf Juice, Placed in a Bowl on Mosquito Repellent Effectiveness of Sliced Marigold Leaf Juice on Mosquito Repellent

Effectiveness of Marigold Leaf Juice						
Effectiveness of Marigold Leaf Juice	**Mosquito Reaction**					
	Mosquito Reject		**Mosquitoes Approaching**		**Total**	
	n	%	n	%	n	%
Yes	134	95,71	6	4,3	140	100

No	0	0	136	100	140	100

Source: Compiled by Aji (2025)

Based on Table 1 above, it can be seen that almost all (95.71%) of the 134 mosquitoes found were repelled. Of the 140 mosquitoes in the mosquito net box coated with 2 grams of marigold leaf extract, 6 (4.3%) approached and landed. Of the 134 mosquitoes, 134 approached and landed on the mosquito net box. The mosquitoes approached and landed on the mosquito net box containing 1 gram of marigold leaf extract for 10 minutes

Table 2: Effectiveness of Marigold Leaf Extract on Mosquito Repellent. Bivariate Analysis.

The Positive Effects of Sliced Marigold Leaf Juice on Mosquito Repellent								
The Positive Effect Of Squeezed Marigold Leaf Juice On Mosquito Repellent	**Mosquito Reaction**						**OR**	**p**
	Mosquito Reject		**Mosquitoes Approaching**		**Total**			
	n	**%**	**n**	**%**	**n**	**%**		
Yes	134	95,71	6	4,3	140	100	4.8	0,039
No	0	0	136	100	140	100		

Source: Compiled by Aji (2025)

Based on Table 2 above, it shows that repulsion is a factor in mosquito repellent behavior. Avoidance, with a p-value of 0.039, has a positive effect on marigold leaf juice, which is statistically significant in its effectiveness as a mosquito repellent with an odds ratio of 4.8. Effectiveness of Marigold Leaf Juice as a Mosquito Repellent.

Table 3: Effectiveness of Marigold Flower Juice.

Effectiveness of Marigold Flower Juice Slices Marigold Plants						
Effectiveness of Marigold Flower Juice Slices Marigold Plants	**Mosquito Reaction**					
	Mosquito Reject		**Mosquitoes Approaching**		**Total**	
	n	%	n	%	n	%
Yes	135	96,43	5	3,57	140	100
No	0	0	135	100	140	100

Source: Compiled by Aji (2025)

Based on Table 3 above, it can be seen that almost all (96.43%) of the 135 mosquitoes found were present. Of the 140 mosquitoes in the mosquito net box containing 1 gram of marigold flower juice, 5 (3.57%) approached and landed on it. Of the 135 mosquitoes, 135 approached and landed on the mosquito net box. These mosquitoes approached and landed on the mosquito net box containing 1 gram of marigold flower juice for 10 minutes.

Table 4: Effectiveness of Marigold Flower Juice on Mosquito Repellent. Bivariate Analysis.

The Positive Effects of Marigold Flower Juice on Mosquito Repellent					
The Positive Effects of Marigold Flower Juice on Mosquito	**Mosquito Reaction**			**OR**	**p**
	Mosquito Reject	**Mosquitoes Approaching**	**Total**		

Repellent	n	%	n	%	n	%		
Yes	135	96,43	5	3,57	140	100	4.9	0,040
No	0	0	135	100	140	100		

Source: Compiled by Aji (2025)

Based on Table 4 above, it shows that repellent is a factor in mosquito repellent. Avoidance, with a p-value of 0.040, has a positive effect on marigold flower juice, which is statistically significant in its effectiveness as a mosquito repellent with an odds ratio of 4.9 times. Effectiveness of Marigold Flower Juice on Mosquito Repellent

Discussion

Based on observations from the trial of the effectiveness of Marigold leaf and flower extract on mosquito repellent, the same formulation caused different numbers of mosquitoes to avoid and land within the same timeframe. The following results were obtained: Effectiveness of Marigold Leaf and Flower Extract on Mosquito Repellent

Based on Table 3 above, it can be seen that almost all (96.43%) of the 135 mosquitoes found were mosquitoes. Of the 140 mosquitoes in the mosquito net box containing 1 gram of marigold flower juice, 5 (3.57%) approached and landed. Of the 135 mosquitoes, 135 approached and landed on the mosquito net box. These mosquitoes approached and landed on the mosquito net box containing 1 gram of marigold flower juice for 10 minutes.

This is in line with the results of research by Aji et al. (2023), which aimed to determine the positive effect of the aroma of marigold leaf slices on mosquito repellent as a mosquito repellent. The indoor research location provided a mosquito net box containing 136 mosquitoes.

Based on Table 2, it is clear that repulsion is the cause of mosquito repellent. Avoidance with a p value = 0.039, has a positive effect on the squeezed slices of marigold plant leaves which is statistically significant in its effectiveness as a mosquito repellent with an odds ratio = 4.8 times. The Effectiveness of Squeezed Slices of Marigold Plant Leaves on Mosquito Repellent.

Based on Table 4 above, it shows that repellent activity is a factor in mosquito repellent. Avoidance, with a p-value of 0.040, has a positive effect on marigold flower extract, which is statistically significant in its effectiveness as a mosquito repellent with an odds ratio of 4.9 times. Effectiveness of Marigold Flower Extract on Mosquito Repellent.

According to research by Suharno Zein (2020), there was a very significant effect on mortality resulting from each concentration of extract given. Based on the study, the 2% concentration produced the highest

mortality rate for Aedes sp. mosquitoes, with an average of 92.5%, with 37 deaths out of 40 mosquitoes. Tahi Kotok (T. erecta) leaf extract can be used as an alternative in controlling Aedes sp. mosquitoes. Conclusion: The results of this study can be used as a learning resource in the form of a module and are suitable for use with a validation result of 85.2%.

This agrees with the results of the study by Fabrick et al. (2020) Tests showed a significant decrease in the survival of both pest species on T. patula plants, and in tests of adding feed containing liquid marigold leaf extract and methanol.
Mortality depends on concentration, indicating the presence of one or more extractable toxicants. These data suggest that T. patula plants contain insecticidal constituents.

In line with Marini's opinion, phytochemical tests using the color test method on marigold leaf extract successfully identified alkaloids, flavonoids, saponins, and tannins. The protective efficacy test showed that marigold leaf extract lotion was ineffective as a repellent against Ae. aegypti, with protective efficacy exceeding 90%, lasting only two hours after application, at a concentration of 30%.

This is in accordance with the research results of Irfayanti et al. (2023). The results showed that the repellent spray had protective efficacy against the control (-) by 50.67%, the 2.5% concentration by 68.33%, the 5% concentration by 78.67%, the 10% concentration by 96%, and the control (+) by 100%. The results of the protective efficacy test showed that the repellent spray containing marigold essential oil had the highest activity at concentrations of 10% and 1%. Further SNK (Newman Keuls) tests showed that the 10% concentration was not significantly different from the control (+).

CONCLUSION

This indicates that repulsion is a cause of mosquito repellent. Avoidance, with a p-value of 0.039, has a positive effect on marigold leaf slices, which is statistically significant in its effectiveness as a mosquito repellent with an odds ratio of 4.8 times. Effectiveness of Marigold Leaf Juice on Mosquito Repellent.
This indicates that repulsion is a cause of mosquito repellent. Avoidance, with a p-value of 0.040, has a positive effect on marigold leaf slices, which is statistically significant in its effectiveness as a mosquito repellent with an odds ratio of 4.9 times. Effectiveness of Marigold Flower Slices on Mosquito Repellent.
Students are advised to practice placing marigold leaf and flower slices indoors to repel mosquitoes

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

DECLARATION OF INTEREST STATEMENT

The authors declare no conflict of interest.

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