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EFFECTIVENESS OF AROMATIC PANDAN AND GOLEK MANGO LEAVES AS HOUSEFLY (*Musca domestica*) REPELLENTS

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ABSTRACT

Effectiveness of Aromatic Pandan and Golek Mango Leaves as Housefly (Musca Domestica) Repellents*. Houseflies are a vector that can transmit diarrheal diseases. Diarrheal disease is the leading cause of under-five mortality in Indonesia at 10.3%, so fly control is a necessity. One method of fly control is the use of vegetable repellent. This study aims to determine the relative effectiveness of repellent solutions derived from fragrant pandanus leaf (Pandanus amaryllifolius Roxb.) and mango golek leaf (Mangifera indica) against houseflies (Musca domestica). This research used a true experiment with a posttest only control group design. The sample houseflies (Musca domestica) with 270 flies in 3 repetitions. Data was analyzed using a two-way ANOVA test. The results showed a difference in repellent effectiveness of fragrant pandanus leaf solution and golek mango leaf solution. The difference in repellent power of fragrant pandanus leaf solution with a concentration of 5% by 25%, 10% by 25%, 15% by 37.5% and 20% by 50%. While golek mango leaf solution with a concentration of 5% by 50%, 10% by 50%, 15% by 62.5%, and 20% by 75%. There is a difference in repellent effectiveness. It is recommended that the community utilize the golek mango leaf solution as an environmentally friendly alternative to repel houseflies (Musca domestica).*

INTRODUCTION

Houseflies (*Musca domestica*) are common vectors found in residential environments and are capable of transmitting various diseases through mechanical transmission. This occurs due to their ability to carry pathogenic agents to their hosts, a phenomenon known as vector competence [1]. Diseases such as dysentery, cholera, diarrhea, typhoid, and myiasis can be transmitted by flies [2]. When food and drinks are contaminated by flies and consumed, the risk of diarrheal infection increases [3].

Diarrhea remains an endemic disease in Indonesia and is a leading cause of death. According to the 2018 Basic Health Research, diarrhea ranked as the fourth leading cause of death across all age groups (6%), in infants (9%), and was the primary cause of death among children under five (11.5%) [5]. The 2021 Indonesian Health Index also reported diarrhea as the leading cause of under-five mortality at a rate of 10.3%. Specifically in South Kalimantan Province, diarrhea was recorded as the leading cause of death among children under five at 8.9% [4]. These data highlight the importance of controlling fly populations as disease vectors.

In general, people rely on commercially available synthetic insecticides to control flies. However, long-term use of chemical insecticides may lead to adverse effects such as insect resistance, environmental pollution, and human health risks [6]. Therefore, the development of environmentally friendly vector control methods is essential. One promising approach is the use of natural plant-based ingredients as insect repellents [7]. Plant-based repellents tend to be safer, as they leave no harmful residues and are biodegradable [8].

Plants contain various secondary metabolites such as flavonoids, saponins, and tannins, which serve as natural defense mechanisms, including insect repellency [9]. Flavonoids, in particular, are known for their strong aroma, which can disrupt the sensory systems of flies by irritating or interfering with their olfactory receptors, thereby driving them away from the odor source [10], [11]. These compounds are commonly found in leaves, including aromatic pandan and golek mango leaves.

Aromatic pandan (*Pandanus amaryllifolius* Roxb.) is widely known in traditional Indonesian cuisine for its distinctive fragrance. Beyond its culinary use, the leaves also contain flavonoids with potential insect-repellent properties. Research by Quyen et al. (2020) reported flavonoid content in aromatic pandan leaves at 11.79% [13].

Golek mango leaves (*Mangifera indica*), on the other hand, have also been found to contain significant flavonoid levels, with concentrations reaching approximately 11.25% in mature golek mango leaves [15], [16]. These compounds are believed to produce repellent effects on flies through similar sensory disruption mechanisms. The use of these two leaves as repellents represents a more natural and sustainable alternative for fly control [14].

Natural repellents can be applied in various forms, including topical lotions or sprays, depending on the formulation [17]. Spray formulations are considered more practical as they can be applied directly to fly-prone areas [18].

Based on this background, this study aims to determine the comparative effectiveness of aromatic pandan leaf solution (*Pandanus amaryllifolius* Roxb.) and golek mango leaf solution (*Mangifera indica*) as repellents against houseflies (*Musca domestica*).

MATERIALS AND RESEARCH METHODS

This research is a true experimental study using a post-test only control group design, aimed at evaluating the repellent effect by measuring the number of houseflies (*Musca domestica*) landing on bait, comparing treatment and control groups.

The independent variables are the type of repellent (aromatic pandan and golek mango leaf solutions) and concentration variations (5%, 10%, 15%, and 20%). The dependent variable is the number of flies landing on the bait. Controlled confounding variables include room temperature, humidity, and fly size.

The study population consisted of all houseflies found at the Bauntung Market Temporary Waste Disposal Site (TPS), Banjarbaru. The sample consisted of 270 adult houseflies captured using bait traps, selected through random sampling.

The primary materials used were fresh aromatic pandan and golek mango leaves. The leaves were washed, drained, and chopped. A total of 100 grams of each leaf type was blended with 100 mL of distilled water. The resulting mixture was filtered through fine cloth to remove pulp. The extract was diluted to prepare 5%, 10%, 15%, and 20% solutions, stored in labeled 100 mL spray bottles.

Tests were conducted using nine wire-mesh test cages (1,728 cm^3 volume). Each cage was randomly filled with 10 adult flies. There were five treatment groups—four concentration levels for each leaf extract and one control group (0%). Each treatment was replicated three times, totaling 270 flies (10 flies × 9 cages × 3 replications).

The repellent solution was sprayed five times (± 0.4 mL) onto 25 grams of chicken meat bait, which was then placed in the test cages. The number of flies landing on the bait was observed and recorded over 1 hour. Temperature and humidity were recorded during each replication.

Data were analyzed using Two-Way ANOVA to determine differences in repellent effectiveness by type and concentration. If significant differences were found, Least Significant Difference (LSD) tests were performed. Repellent efficiency (%) was calculated using the formula:

Repellent Efficiency = ((A - B) / A) × 100%
Where:
A = Number of flies landing in the control group
B = Number of flies landing in the treatment group

RESEARCH RESULTS AND DISCUSSION

The number of flies landing at each concentration of the aromatic pandan leaf solution (*Pandanus amaryllifolius* Roxb.) is presented in Table 1 below:

Table 1. Research Results: Number of Houseflies Landing on Aromatic Pandan Leaf Solution Repellent (*Pandanus amaryllifolius* Roxb.)

Concentration Variations	Replication			Number of Flies Landing (Individuals)	Averange
	R1	R2	R3		
0%	8	9	8	25	8
5%	6	7	5	18	6
10%	5	6	6	17	6
15%	4	6	6	16	5
20%	3	4	4	11	4

Based on Table 1, at a 5% concentration of aromatic pandan leaf solution, the highest number of flies recorded was 7 individuals during the second replication, with an overall average of 6 flies. Conversely, the 20% concentration showed the fewest flies landing, with 3 individuals observed in the first replication and an average of 4 flies. This indicates that the higher the repellent concentration, the fewer flies tend to land.
Subsequently, the number of flies landing at each concentration of the golek mango leaf solution (Mangifera indica) is presented in Table 2 below:

Table 2. Research Results: Number of Houseflies Landing on Golek Mango Leaf Solution Repellent (Mangifera indica) (Number of Flies)

Concentration Variations	Replication			Number of Flies Landing (Individuals)	Averange
	P1	P2	P3		
0%	8	9	8	25	8
5%	4	5	2	11	4
10%	3	6	2	11	4
15%	2	5	3	10	3
20%	1	4	0	5	2

Based on Table 2, the 10% concentration showed the highest number of flies landing, with 6 individuals recorded during the second replication, and an overall average of 4 flies. In contrast, the 20% concentration recorded no flies landing during the third replication, with an average of only 2 flies. These findings indicate that the golek mango leaf solution demonstrated higher effectiveness as a repellent compared to aromatic pandan, especially at higher concentrations.

The repellent efficiency of both types of solutions against houseflies (Musca domestica) is illustrated in Figure 1 below

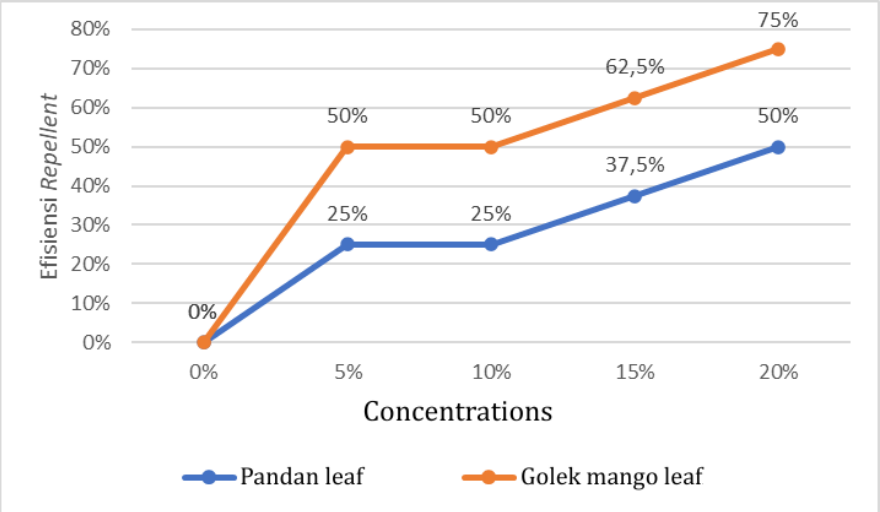

Figure 1. Repellent Efficiency Against House Flies (Musca domestica)

Figure 1 illustrates that the repellent solution made from Mangifera indica (Golek mango) leaves at a 15% concentration exhibited the highest efficiency, with a repellent effect of 62.5%. This value is higher than that of the Pandanus amaryllifolius (screwpine) leaf repellent at a 20% concentration, which showed only a 50% repellent effect. These findings indicate that at a lower concentration, the Golek mango leaf solution is more effective than pandan leaf extract.

Room temperature and humidity measurements during the testing process are presented in Table 3.

Table 3. Results of Room Temperature and Humidity Measurements

Replication	Temperature (°C)	Humidity (%)
1	25,9 °C	86%
2	26,3 °C	87%
3	26,7 °C	88%

Based on Table 3, the room temperature during the study remained within the optimal activity range for flies, ranging from 25.9°C to 26.7°C. Humidity was also relatively high and stable, between 86% and 88%. These values reflect environmental conditions that are ideal for fly activity, thereby allowing for a more accurate interpretation of repellent effectiveness, as the results are not influenced by extreme environmental variables.

To statistically determine whether there were differences in effectiveness based on the type of repellent and concentration variation, a Two-Way ANOVA test was conducted. The results of the analysis are presented in Table 4.

Table 4. Results of the Two-Way ANOVA Test

Tests of Between-Subjects Effects

Dependent Variable: Number of Landing Flies

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Type of Repellent	26,042	1	26,042	14,063	,001
Concentration Variation	17,792	3	5,931	3,203	,048
Type of Repellent * Concentration Variation	,125	3	,042	,023	,995

Based on Table 4, the significance value for the factor "type of repellent" was 0.001, which is smaller than α = 0.05, indicating a statistically significant difference in effectiveness between pandan leaf and Golek mango leaf repellents. Similarly, the concentration variation yielded a significance value of 0.048 (< 0.05), suggesting that the concentration level also had a

significant effect. However, no significant interaction was found between the type of repellent and concentration (p = 0.995), indicating that the two factors acted independently.
The analysis was followed by an LSD (Least Significant Difference) test to compare the effectiveness of each concentration level in pairwise combinations. The results are presented in Table 5.

Table 5. Results of LSD Test for Concentration Variation

Multiple Comparisons

LSD

(I) Concentration Variation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
0% & 5%	3,50000*	1,16287	,006	1,0883	5,9117
0% & 10%	3,66667*	1,16287	,005	1,2550	6,0783
0% & 15%	4,00000*	1,16287	,002	1,5883	6,4117
0% & 20%	5,66667*	1,16287	,000	3,2550	8,0783
5% & 20%	2,16667*	,94948	,033	,1976	4,1358
10% & 20%	2,00000*	,94948	,047	,0309	3,9691

*. The mean difference is significant at the 0.05 level.

Based on Table 5, all treatment groups showed significant differences compared to the control group (0%), particularly between the 5% and 20% concentrations, which showed the greatest difference. This indicates that higher concentrations tend to provide a more effective repellent effect. Therefore, the 20% concentration was the most effective among all treatments tested.
This study examined the effectiveness of two types of natural repellent solutions derived from Pandanus amaryllifolius Roxb (pandan leaf) and Mangifera indica (Golek mango leaf) in repelling house flies (Musca domestica). Both plants were selected due to their active compounds, particularly flavonoids, which are known to have insect-repelling effects. The repellent solutions were prepared by blending fresh leaves to extract the active compounds, followed by dilution into several concentrations.
The results showed that the pandan leaf solution at a 20% concentration yielded the highest repellent effect against house flies, with an average of only four flies landing. This finding aligns with Ismanto and Mubarok (2020), who reported that a 20% pandan leaf solution produced a repellent effect of 59.7%, with an average of six flies landing [19]. This effectiveness suggests that the volatile compounds in pandan disrupt the olfactory system of the flies, thereby reducing their attraction to odor sources.
The Golek mango leaf solution also demonstrated strong potential as a repellent. The 20% concentration resulted in the lowest number of flies landing, averaging only two flies. This supports the findings of Santi (2022), who stated that 10% and 20% concentrations of secondary metabolites from leaves were effective in repelling house flies [20]. The flavonoid content in mature Golek mango leaves, reportedly reaching 11.25%[15], is likely the key factor in this effectiveness, as mature leaves tend to have higher flavonoid content than younger ones[20].
Environmental factors such as temperature and humidity were controlled during the experiment. The temperature during observation ranged from 25.9°C to 26.7°C, and humidity ranged from 86% to 88%. These temperatures fall within the optimal range for fly activity, which is between 20°C and 30°C. [21] Likewise, the room humidity remained within the optimal threshold of 45%–90%, which supports the physiological activity of flies [22]. These stable environmental conditions strengthen the validity of the repellent effectiveness tests.
Graphical data indicated that an increase in solution concentration for both repellent types was inversely proportional to the number of flies landing. This means the higher the concentration, the more effective the solution was at repelling flies. Although the pandan leaf solution showed promising results, the effectiveness of the Golek mango leaf solution was more pronounced. At a 15% concentration, the repellent effect of the mango leaf solution reached 62.5%, which was higher than the 50% repellent effect of the 20% pandan leaf solution. This difference in effectiveness is likely due to variations in flavonoid content and

other active compounds. Flavonoids function by emitting a strong odor that disrupts the olfactory receptors of flies, thereby reducing their tendency to land [11,23].

Statistical analysis using Two-Way ANOVA showed that both the type of repellent and the concentration variation had a significant effect on the number of flies landing ($p < 0.05$). However, there was no significant interaction between the two ($p = 0.995$), indicating that the effects of repellent type and concentration variation operate independently. These findings further support the efficacy of Golek mango leaves—especially at higher concentrations—as a natural house fly repellent.

The LSD test revealed significant differences between the control group and all treatment groups, especially between the 5% and 20% concentrations. This suggests that while low concentrations are already somewhat effective, increasing the concentration enhances the repellent effect. These findings are consistent with Hafifah and Suparno (2023), who reported that the higher the concentration of repellent, the greater its effectiveness [26]

In general, the flavonoid compounds in both types of leaves exert their repellent mechanism by disrupting the sensory systems of flies, including their olfactory ability and egg-laying behavior[24,25]. In terms of availability and cost, Golek mango leaves are easier to obtain and more economical. With their higher effectiveness and more efficient use of materials, mango leaf-based repellents are recommended as a more practical and natural alternative for repelling house flies.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this study, both pandan leaf (Pandanus amaryllifolius Roxb) and Golek mango leaf (Mangifera indica) repellent solutions demonstrated effectiveness in repelling house flies (Musca domestica), with increased repellent effects observed at higher concentrations. The mango leaf solution exhibited higher effectiveness compared to the pandan leaf solution, particularly at 15% and 20% concentrations. Two-Way ANOVA results indicated that both the type of repellent and concentration variation significantly influenced the number of flies landing ($p < 0.05$), with no interaction between the two variables. Therefore, the Golek mango leaf repellent solution has been proven to be a more effective natural alternative for controlling house flies.

Overall, this study affirms that natural ingredients such as Golek mango leaves possess great potential as effective and environmentally friendly repellents. It is recommended that the public utilize Golek mango leaves as a safe and easily prepared alternative for fly control. Future researchers are encouraged to develop ready-to-use spray formulations based on Golek mango leaf repellent, and to conduct laboratory tests on microbial contamination of food media before and after repellent application to assess its protective impact. Further studies may also explore alternative extraction methods to increase the concentration of active compounds in the repellent solution.

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