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The Potential of Ethanol Extract of Jasmine Flowers (*Jasminum sambac L.*) as a Repellent Against Houseflies (*Musca domestica*)

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ABSTRACT

This research focuses on the need for environmentally suitable alternatives to chemical insecticides. This study aimed to determine the potential of ethanol extract of jasmine flowers (Jasminum sambac L.) as a repellent against houseflies (Musca domestica). The study employed a post-test only control-group design with ethanol extract concentrations of 15%, 20%, and 25%, along with a positive control (Venox fly repellent spray) and a negative control (distilled water). The effectiveness was assessed by counting the number of flies that landed and were repelled. Data were analyzed using probit regression to determine the ED_{50} and ED_{99} values. Higher extract concentrations resulted in more substantial repellent effects. At 15% concentration, the repellency rate was 34,37%; at 20%, 51'64%; and at 25%, 80,61%. The ED_{50} was found at 16.494%, and the ED_{99} at 38.222%. Ethanol extract of jasmine flowers has the potential to serve as an effective natural bioinsecticide for controlling houseflies.

Keywords: *Jasmine Flower, Musca domestica, Repellency, Bioinsecticide, Ethanol Extract.*

INTRODUCTION

Houseflies (Musca domestica) are insects of the order Diptera that often indicate poor sanitation in an environment. In addition to being a nuisance, houseflies as mechanical vectors that can transmit various diseases, particularly those spread through food (foodborne diseases). Flies can transfer pathogenic microorganisms to food, beverages, and eating utensils by moving from sources of filth or organic waste. This behavioural pattern makes humans highly susceptible to infection by pathogens carried on the bodies of flies (Fadhila et al., 2022).

One of the most common diseases transmitted by flies is diarrhoea, a foodborne illness. It is caused by pathogenic bacteria that contaminate food and is transmitted when flies carry these bacteria and land on food (2). In Indonesia, diarrhoea remains a serious public health issue and can lead to outbreaks (Disease Outbreak) accompanied by mortality. According to the Central Bureau

of Statistics (Badan Pusat Statistik, BPS) in 2023, East Java recorded 183,338 cases of diarrhoea, with Surabaya recording the highest number at 22,327 (BPS Jawa Timur, 2023).

The use of chemical insecticides to control houseflies often results in adverse effects on human health and the environment. A safer alternative is the use of bioinsecticides, which are insecticides derived from natural sources such as plants. Bioinsecticides act through secondary metabolities produced by plants, which can disrupt pest behaviour without harming humans or the environment. In addition to being environmentally friendly, bioinsecticides offer advantages such as a lower risk of resistance development and greater specificity toward target pests (Dahril.M, 2024).

Indonesia has rich biodiversity, including plant species with potential as bioinsecticides. One such plant is jasmine (Jasminum sambac L.), which contains bioactive compounds such as flavonoids, alkaloids, saponins, tannins, and essential oils that function as natural larvicides and repellents. Flavonoids, one of the major constituents, exhibit anti-feedant properties that prevent insects from feeding. Tannins are antimicrobial and bitter-tasting, which can deter insect feeding behaviour (Iwan et al., 2019). Jasmine flowers also contain chemical compounds such as methyl salicylate, cis-jasmine, linalool, nerol, and indole, which have potential as natural larvicides. These compounds are effective in inhibiting larval development and offer an eco-friendly solution for pest control (Lukiyono et al., 2024).

Previous studies have shown that jasmine flower extract is effective as a larvicide against various insect species. According to Dessy (2023), the ethanol extract of jasmine flowers acts as a natural insecticide against Aedes aegypti mosquitoes, resulting in up to 50% mortality. Another study showed that jasmine flower extract at concentrations of 10%, 15%, 20%, and 25% could cause up to 100% mortality in Aedes aegypti larvae. Meanwhile, research by Fira et al., (2020) demonstrated that starfruit leaf extract at 10% concentration repelled 42.22% of flies, 15% repelled 71.10%, and 20% repelled 95.55%. The novelty of the present study lies in the different concentrations of jasmine flower extract used compared with previous studies.

Based on the explanation above, this research aims to examine the potential of ethanol extract of jasmine flowers (Jasminum sambac L.) as a repellent against houseflies (Musca domestica) using natural ingredients, with the expectation of identifying a safer and more environmentally friendly alternative to synthetic insecticides—particularly in controlling vectors of diseases such as diarrhea—than chemical insecticides containing toxic compounds like N, N-diethyl-meta-toluamide (DEET).

MATERIAL AND METHODS

The jasmine flower extract was prepared by maceration. A total of 500 grams of dried jasmine flowers were placed in a dark container and soaked in 96% ethanol at a 1:10 (sample: ethanol) ratio for 4 days at room temperature, protected from direct light. During maceration, the solution was gently shaken daily to maximize the extraction of active compounds. The filtrate was then filtered and concentrated using a rotary evaporator at 40–50°C to obtain a thick extract. The extract was weighed and diluted with distilled water to prepare test solutions at concentrations of 15%, 20%, and 25%.

This study was an experimental study using a **post-test only control-group design**. A total of 500 houseflies (*Musca domestica*) were used as samples and divided into five treatment groups: jasmine flower extract at 15%, 20%, and 25%; a positive control (Venox fly repellent); and a negative control (distilled water).

The jasmine flower extract was prepared by **maceration method** with 96% ethanol for 4 days. The repellent test was conducted by spraying the extract solution onto the surface of a *fly grill*, then observing the number of flies that landed within 60 minutes. Data were analyzed using **probit regression** in SPSS software to determine the ED_{50} and ED_{99} values. The ethical aspect of this study followed the 3R principles: *replacement*, *reduction*, and *refinement*.

RESULT AND DISCUSSION

The findings indicate that higher concentrations of jasmine flower extract enhanced its repellence effect against houseflies. This effect is closely related to the secondary metabolites present in jasmine flowers. Flavonoids act as antifeedants by disrupting olfactory receptors and reducing insect landing behaviour. Essential oils such as linalool, indole, and methyl salicylate are volatile and produce a rapid repellent effect. Saponins and tannins impart bitterness and irritation, thereby suppressing insect feeding activity. The combined mechanism of these compounds highlights jasmine flowers as a potential eco-friendly bioinsecticide. These results are consistent with recent studies reporting the insect-repellent activity of plant essential oils.

This study has several limitations. First, the observation period was limited to 60 minutes, which does not represent long-term effects. Second, the maximum tested concentration was 25%, so the effectiveness at higher concentrations remains unknown. Third, the tests were conducted under laboratory conditions, which may not fully reflect field conditions. Moreover, the potential impact on non-target organisms and the surrounding environment was not assessed.

1. Results of the Potential of Jasmine Flower (*Jasminum sambac* L.) Extract on Houseflies (*Musca domestica*)

The evaluation of the potential of jasmine flower extract on Musca domestica in this study was carried out using the following treatments: positive control with Venox fly repellent spray, negative control with distilled water (aquades), and sample treatments using jasmine flower repellent spray at concentrations of 15%, 20%, and 25%.

Table 5.1. Number of Flies Landing on the *fly grill*.

N0	Kode Sampel	Jumlah Lalat Uji	Jumlah Lalat Hinggap					Total	Rata2
Pengulangan			P1	P2	P3	P4	P5		
1	K+	20	1	3	2	2	3	11	2
2	K-	20	16	18	15	17	17	83	17
3	15%	20	11	9	12	10	12	54	11
4	20%	20	9	7	7	8	9	40	8
5	25%	20	4	3	3	2	4	16	3

Based on Table 5.1, the average number of Musca domestica houseflies that landed on the fly grill from replication 1 to replication 5 was observed across five repetitions. The average number of flies landing, from highest to lowest, was recorded as follows: negative control, 15% concentration, 20% concentration, 25% concentration, and positive control, with averages of 17, 11, 8, 3, and 2 flies, respectively. The standard deviation (SD) values for the negative control, 15% concentration, 20% concentration, 25% concentration, and positive control were 1.14, 1.30, 1.00, 0.84, and 0.84, respectively.

Table 5.2 Repellent Effect of Jasmine Flower Extract Against *Musca domestica*

Perlakuan	P1	P2	P3	P4	P5	Rata-rata	SD
Kontrol (+)	93.75%	83.33%	86,67%	88,24%	82,35%	86,87%	4,53%
Kontrol (-)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Konsentrsai 15%	31.25%	50.00%	20.00%	41.18%	29.41%	34.37%	11.53%
Konsentrasi 20%	43.75%	61.11%	53.33%	52.94%	47.06%	51,64%	6.66%
Konsentrasi 25%	75.00%	83.33%	80.00%	88,24%	76,47%	80.61%	5.35%

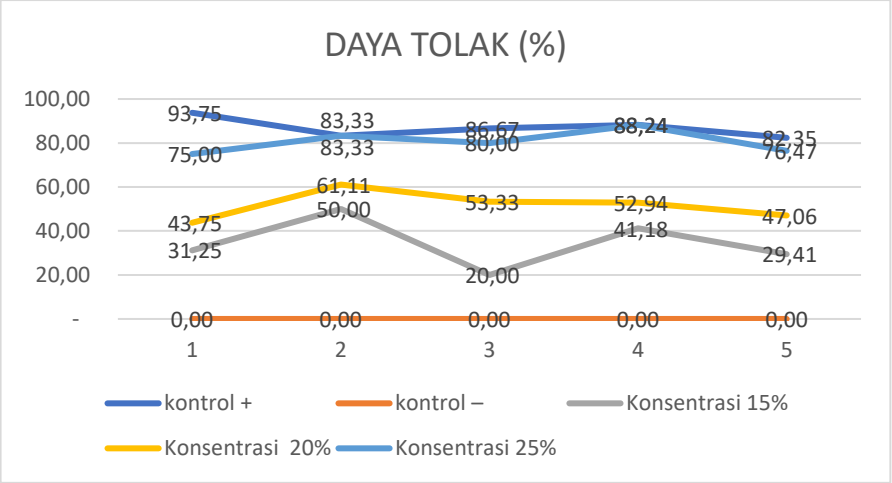

Figure 5.2 Repellent Effect of Jasmine Flower Extract Against *Musca*

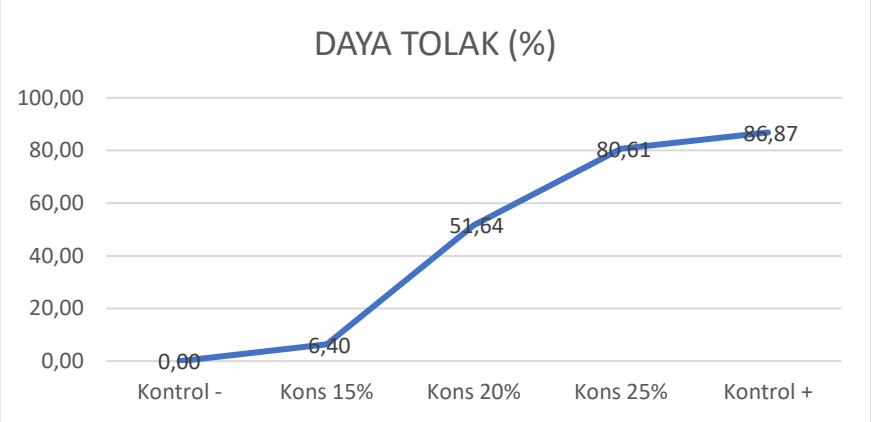

Figure 5.3 Average Repellent Effect of Jasmine Flower Extract Against *Musca domestica*

Based on Figure 5.3, the negative control showed the lowest average repellent effect against flies, at **0.00%**, while the positive control showed the highest average repellent effect, at **86.87%**.

2. Data Analysis Results

The observational results from this study were further analyzed statistically using SPSS (Statistical Package for the Social Sciences) version 21 through **probit regression analysis**. Probit regression analysis was used to estimate the concentration of jasmine flower extract that provides a protective effect against *Musca domestica* at **50% (ED_{50})** and **99% (ED_{99})** levels.

Table 5.3 Significance Results of Probit Regression Analysis

Probit	Parameter	Sig.
	Concentration	<,000

Based on Table 5.3, the probit regression analysis yielded a P-value of <0.000. Since this value is less than 0.05, the result indicates that the jasmine flower extract has a significant repellent effect against *Musca domestica*.

Tabel 5.4 Hasil Analisis Probit ED_{50} (*Effective Dose* 50) Dan ED_{99} (*Effectiv Dose* 99)

Effective Dose (%)	Concentration (%)	Confidence Level (%)	Lower Limit (%)	Upper Limit (%)
50	16,494	95,00	14,139	17,993
99	38,222	95,00	33,186	48,596

Based on the table, the probit regression analysis showed that the ED_{50} was obtained at a concentration of **16.494%** and the ED_{99} at a concentration of **38.222%.**

CONCLUSION AND SUGGESTION

The ethanol extract of jasmine flowers *(Jasminum sambac L.)* demonstrated potential as a natural repellent against houseflies (Musca domestica). The effectiveness increased with higher concentrations, with ED50 and ED99 values of 16.494% and 38.222%, respectively. These findings suggest that jasmine extract is effective even at relatively low concentrations. Future studies are recommended to test concentrations above 25%, conduct field trials under varying sanitation conditions, evaluate effects on non-target organisms, and develop practical formulations such as sprays or gels for daily use.

Based on the results of the study on the potential of ethanol extract of jasmine flowers (Jasminum sambac L.) as a repellent against houseflies (Musca domestica), it can be concluded that:

1. The ethanol extract of jasmine flowers (*Jasminum sambac L.*) shows potential as a repellent against houseflies (*Musca domestica*), with increasing effectiveness along with higher concentrations.
2. The 15% concentration produced a repellency of 34.37%; the 20% achieved 51.64%; and the 25% reached 80.61%. For comparison, the positive control (Venox) showed 86.87% repellency, while the negative control (distilled water) showed one.
3. Probit regression analysis showed that the jasmine flower extract had an ED50 value of 16.494% and an ED99 value of 38.222%. This proves that the ethanol extract of jasmine flowers has the potential to be effective as a natural repellent against houseflies at relatively low concentrations.

Further research is needed with higher concentration variations above 25% to determine the optimal concentration. It is also recommended for future studies to observe the long-term effects of the extract on houseflies and the surrounding environment.

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CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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