# Utilization of Mint as a Natural Repellent for Aphid Populations

**Asni Johari[1]*, M. Farhan Arliansyah[2], Muswita[3], M. Naswir[4]**

Department of Mathematics and Natural Sciences, Faculty of Teacher Training and Education, Jambi University, Muaro Jambi 36361, Jambi, Indonesia

**DOI**: https://doi.org/10.56293/IJASR.2024.6213

**IJASR 2024**
**VOLUME 7**
**ISSUE 6 NOVEMBER – DECEMBER** **ISSN: 2581-7876**

**Abstract:** This study aims to analyze the effect of mint plants as a repellent on the abundance of aphid pests in eggplants. The study was conducted using an experimental method, with mint plants used as a repellent treatment in eggplant cultivation, while the control group did not use mint plants. Aphid abundance data were collected using a total sampling technique over 12 weeks of observation. Environmental data measurements included temperature, humidity, and wind speed. Analysis of aphid abundance data was performed using an independent sample t-test and further effect size analysis. The results showed that the use of mint plants as a repellent significantly affected the abundance of aphid pests on eggplants (Sig. 0.024 < 0.05).

**Keywords:** mint plants (*Mentha piperita*), repellent, abundance, aphids (*Aphis gossypii*).

## INTRODUCTION

Aphids (*Aphis gossypii G.*) are pests that attack various parts of plants, causing growth disturbances and even plant death. These insects damage plants by inserting their stylets to suck plant fluids. Their impact can lead to crop losses of up to 10-30%, reaching as high as 40% during the dry season, and they act as vectors in up to 90% of horticultural plants (Riley, 2011; Khodijah, 2014; Johari, 2015; Johari *et al.*, 2017).

Aphid control is often achieved through the use of synthetic chemical pesticides. However, chemical pesticides can kill beneficial insects such as pollinators, decomposers, predators, as well as pests (Ling, 2002; Johari *et al.*, 2019). Therefore, environmentally friendly pest control is needed (Johari *et al.,* 2023), one of which involves the use of repellent plants.

Repellent plants protect main crops from pests through chemical compounds called secondary metabolites. Mint plants (*Mentha piperita L.*) are known to repel pests due to their distinctive aroma, which pests dislike. Mint leaves contain essential oils (0.5-4%) rich in menthol (30-55%) and menthone (14-32%) (Setiawan *et al.*, 2013).

## MATERIALS AND METHODS

The study was conducted in a community vegetable farm using an experimental method. Mint plants were used as a repellent around eggplant crops, while the control area was left without mint plants. Aphid abundance data were collected using the total sampling technique, counting all aphid individuals found on 120 eggplants, with 60 plants in the control area and 60 plants in the experimental area. Data collection was conducted weekly for 12 weeks.

Data were analyzed using an independent sample t-test to observe the mean difference between two independent data populations, followed by an effect size test. Hypothesis testing and statistical analysis were performed using SPSS.

## RESULTS AND DISCUSSION

Over the 12-week observation period, the number of aphids found in the experimental and control areas was recorded (Figure 1).

 Copyright © 2024 IJASR All rights reserved

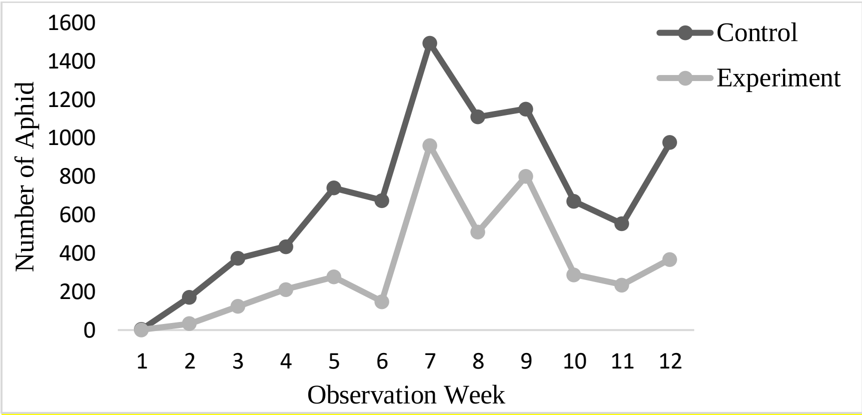


**Figure 1. Graph of Aphid Abundance in Experimental and Control Plots**

Figure 1 shows the variation in the number of aphids each week over the 12-week observation period, with the highest number recorded in week 7. The aphid count in the experimental area was consistently lower than in the control area each week. To verify the effect of mint plants as a repellent on the abundance of aphids in eggplants, hypothesis testing was conducted using an independent sample t-test. Prior to hypothesis testing, the data had to meet the prerequisites of normality (Kolmogorov-Smirnov test) and homogeneity (Levene's test). The results of the normality and homogeneity tests are presented in Tables 1 and 2.

**Table 1. Normality Test Results**

| **Aphid** | **Kolmogorov-Smirnov$^{b}$** | | |
|---|---|---|---|
| | Statistic | Df | Sig. |
| Control | 0,126 | 12 | 0,200 |
| Experiment | 0,222 | 12 | 0,104 |

The Kolmogorov-Smirnov test results indicate that the aphid abundance data on the experimental plot [D(12) = 0.222, p = 0.104] as well as on the control plot [D(12) = 0.126, p = 0.200] are normally distributed. The assumption of normality is met when p > 0.05

**Table 2. Homogeneity Test Results**

| Abundance | Levene's Test of Equality of Varians | | | | |
|---|---|---|---|---|---|
| | | F | Sig. | T | Df |
| Aphid | *Equal variances assumed* | 1,498 | 0,234 | 2,430 | 22 |
| | *Equal variances not assumed* | | | 2,430 | 19,439 |

The results of the Levene's test indicate that the aphid data from the experimental plot and the control plot are homogeneous, with [F = 1.498, p = 0.234]. Data variances are considered homogeneous when sig. > 0.05.

**Table 3. Group Statistics**

| Abundance | Levene's Test of Equality of Varians | | | | |
|---|---|---|---|---|---|
| | eggplant plant | N | Mean | Std. Dev | Std. Error Mean |
| Aphid | Control | 12 | 696,50 | 430,965 | 124,409 |
| | Experiment | 12 | 330,33 | 294,624 | 85,051 |
| | | | | | |


Copyright © 2024 IJASR All rights reserved (cc) BY

According to Table 3, there is a difference in the average aphid abundance, with the experimental plot (M = 330.33, SD = 294.624) being lower than that of the control plot (M = 696.50, SD = 430.965).

**Table 4. Independent sample t-test**

| | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | F | Sig. | T | Df | Significance | | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | One-Sided p | Two-Sided p | | | Lower | Upper |
| *Equal variances assumed* | 1,498 | 0,234 | 2,430 | 22 | 0,012 | 0,024 | 366,167 | 150,702 | 53,630 | 678,704 |

According to Table 4, the results of the hypothesis test using the independent sample t-test indicate that the use of mint plants as a repellent on eggplants has a significant effect on the abundance of aphid pests [t(22) = 2.430, p = 0.024].

**Table 5. effect size cohens'd**

| Abundance | | | | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | Standardizer[a] | Point Estimate | Lower | Upper |
| Aphid | Cohen's d | 369,143 | 0,992 | 0,130 | 1,834 |
| | Hedges' correction | 382,353 | 0,958 | 0,126 | 1,770 |
| | Glass's delta | 294,624 | 1,242 | 0,273 | 2,174 |

The effect size results (Cohen's d) in Table 5 show a value of d = 0.992, which, based on the independent sample effect size categories, indicates that mint plants as a repellent have a significant impact on the abundance of aphid pests. The abundance of aphids is influenced by various factors, such as the environment and food availability (Johari *et al*., 2020a; Johari *et al*., 2021a). Environmental factors, including temperature, humidity, and wind speed, also significantly affect insect life (Johari *et al*., 2022). These factors, along with other biotic elements, influence insect populations (Johari *et al*., 2024a).

Additionally, the age of the plants plays a role in the decrease of pest abundance, as the availability of young leaves for food diminishes over time, along with the plant's capacity to support the growth of aphid populations (Utami *et al*., 2014). Based on the data in Figure 1, it is evident that mint plants used as a repellent around eggplants effectively reduce the abundance of aphid pests.

Mint plants contain alkaloids, flavonoids, steroids, tannins, and phenolic compounds that can disrupt insect activities in seeking hosts (Wubie *et al.,* 2014). The essential oil content also acts as a respiratory toxin, contact poison, reduces appetite, inhibits growth, and prevents egg-laying in insects (Hartati, 2012). The flavonoid compounds in mint affect the respiratory system of insects by targeting their nerves and vital organs, causing insects to tend to avoid the plants (Hulwah *et al*., 2022).

The essential oil produced by mint plants, particularly menthol, has the potential to control pests such as aphids. Menthol, with its sharp aroma, is unappealing to aphids, thereby disrupting their movement toward the host (Setiawan *et al.,* 2013).


Copyright © 2024 IJASR All rights reserved (cc) BY

## CONCLUSION

Based on the research conducted, it can be concluded that mint plants as a repellent are effective in reducing the abundance of aphid pests on eggplants.

## AUTHORS' CONTRIBUTION

Research starting from preparation, implementation, data collection and analysis, editing paper (AJ); Field research performers and data collectors (MFA); editing paper (M; MN).

## DECLARATION

The authors declare that they have no conflict of interests.

## ACKNOWLEDGEMENTS

Authors would like to thank the leadership of Jambi University who has provided facilities for conducting research and authors would also like to thank the field coordinator of the botanical garden.

## REFERENSI

1. Hartati, S. Y. 2012. Prospects for Developing Essential Oils as Botanical Pesticides. *Perspektif Journal*. 11(1): 45-58.
2. Hulwah, D. O. Z., Bobsaid, J., Ramadhani, M., & Setiawati, Y. (2022). Effectiveness of Mouthwash Based on Extracts of *Camellia sinensis* and *Mentha piperita* as Antibacterial Agents Against Streptococcus mutans. *Meditek Medical Journal*. 28(1): 30–39.
3. Johari, A. 2015. Abundance of *Thrips palmi* karny and the phenomenon of *thrips* sp. (Thysanoptera: Thripidae) attack as pest and virus vectorat vegetables plantation in Jambi region. *ARPN J. Engg. Appl. Sci.*, **10**: 2570-76.
4. Johari, A., Lukman, A. and Muswita. 2017. The abundance of thrips (Thysanoptera) on vegetables plantation in Jambi region, Sumatera, Indonesia. *J. ent. Res.*, **41**: 25-32.
5. Johari, A., Muswita, Lukman, A., Dewi, R.S. and Tommy, M. 2019. The effect of yam seed (*Pachyrizus erosus* Urban) extract on the thrips feeding activity: laboratory scale. *J. ent. Res.*, **43**: 257-62.
6. Johari, A., Oktafiani, D.W. and Dewi, R.S. 2020. The presence of ladybug beetle (Coleoptera: Coccinellidae) as a predator on agriculture in Jambi region. *J. ent. Res.*, **44**: 45-50.
7. Johari, A., Hermanto, A.M. and Wulandari, T. 2021. Ant diversity inhabited oil palm plantations in a peatland in Sumatra, Indonesia. *Nusantara Biosci.*, **13**: 158-63.
8. Johari, A., Elina, Harlis and Naswir, M. 2022. The preference and abundance of thrips (Thysanoptera) on roses (*Rosa hybrida*) in several regions of Jambi. *J. ent. Res.*, **46**: 310-13.
9. Johari, A., Widianti, W., Zahwariah, V., Muswita, H. and Naswir, M. 2023. The effect of yam seed extract on the abundance of armyworms and diamondback moths on an experimental garden scale. *J. ent. Res.*, **46**: 968-72.
10. Johari, A. Nazilatun Rahmah, Tia Wulandari, Muswita and M. Naswir. 2024. Investigating insect pest diversity and feeding preferences on eggplants in Jambi, Indonesia. *J. ent. Res.*, **48**(2): 152-156.
11. Khodijah. 2014. Abundance of Predatory Insects of Aphis gossypii Aphids in Vegetable Cultivation Centers in South Sumatra. *Biosaintifika*. 6(2): 76-84.
12. Ling, N. 2002. Rotenon: a review of its toxicity and use for fisheries management. *Science for Conservation*, **211**: 40 p.
13. Riley, D.G., Joseph, S., Srinivasan, R. and Diffie, S. 2011. Thrips vectors of tospoviruses. *J. Integra. Pest Mgmt.*, **1**: 1-10.
14. Setiawan, A., Kunarto, B., & sani, E. Y. 2013. Extraction of Peppermint Leaves (*Mentha piperita* L.) Using Microwave-Assisted Extraction Method on Total Phenolics, Tannins, Flavonoids, and Antioxidant Activity. *Petrol Journal*. 369(1): 1-9.


Copyright © 2024 IJASR All rights reserved

15. Utami, N. A. T. A., Siadi, I. K., Nyana, I. D., & Gede, S. 2014. The Effect of Using Colored Nets on the Abundance of *Aphis gossypii* Insects on Chili Pepper (*Capsicum frutescens* L.) Plants. *J. Tropical Agrotechnology*. 3(4), 251-258.
16. Wubie, M., Negash, A., Guadie, F., Molla, G., Kassaye, K., & Raja, N. 2014. Repellent and insecticidal activity of *Mentha piperita* (L.) plant extracts against cabbage aphid (*Brevicoryne brassicae* Linn. (Homoptera: Aphididae). *American-Eurasian Journal of Scientific Research*. *9*(6): 150-156.


 Copyright © 2024 IJASR All rights reserved