



The Effectiveness of Various Aromatic Vegetable Extracts to Control Fruit Fly (*Bactrocera dorsalis*) Pests in Chili

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ARTICLE INFO

e-ISSN: 2548-5148
p-ISSN: 2548-5121
Vol. 7 No. 1, June 2022
URL: <https://doi.org/10.31327/atj.v7i1.1741>

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Abstract

Chili is one of the most valuable horticultural commodities, yet production is declining year after year. Fruit fly pests, which cause losses of 30-60%, are a stumbling block to growing chili production. Several types of aromatic vegetable extracts were used in this investigation, including clove leaves, babadotan, citronella leaves, and basil leaves, all of which have been found to contain methyl eugenol components. The goals of this study were to find the most efficient form of aromatic vegetable extract for usage as a fruit fly pest attractant and to see how different aromatic vegetable extracts affected the intensity of fruit fly pests. The treatments were set up in a completely random order and were repeated three times. Planting chilies, creating aromatic vegetable extracts, making traps, deploying traps in the field, estimating the number of trapped fruit fly populations, and finally assessing the results were all part of this study. P1 = clove leaf extract, P2 = babadotan leaf extract, P3 = citronella leaf extract, and P4 = basil leaf extract are the therapies that will be provided. *Bactrocera dorsalis* was identified as the captured fruit fly species. The clove leaf extract treatment had the most fruit flies captured (35.67), while the babadotan leaf extract had the least (29.76), but none of the treatments were substantially different

Keywords: chili, effectiveness, vegetable extracts, methyl eugenol, *Bactrocera dorsalis*

A. Introduction

Chili is one of the vegetable commodities that has a number of advantages, which is why it is extensively grown by Indonesian farmers. The demand for chili in everyday life continues to rise, driving up the price of chili on the market. According to the Central Statistics Agency, chili production in Southeast Sulawesi Province decreased from 25,595 quintals to 11,068 quintals from 2016 to 2018. (BPS Sultra, 2020). Pests, illnesses, and weeds are examples of OPT (Plant Disturbing Organisms) that can make expanding chili production difficult.

Fruit flies are one of the major pests responsible for the fall in chili production, and they have become a national issue since, in addition to producing low production, they also act as a trade barrier, forcing other nations to reject export commodities (Kardinan, 2019). Symptoms of the initial attack, which include puncture marks in the form of black spots on the female ovipositor. The eggs that have been deposited into the fruit will hatch into larvae, which will eat the entire contents of the fruit and cause fruit rot, as well as being very easy to fall when handled, causing significant quality and quantity loss. Fruit fly infestations can result in yield losses of 30-60%. (Sunarno, 2011).

Clove leaf is one of the most widely cultivated plants in Indonesia, especially in Kolaka Regency. Clove plants are producers of essential oils containing several chemical compounds such as eugenol, eugenol acetate, kariophyllene, sesquiterpenol, and naphthalene, which have long been known for their potential as vegetable insecticides (Setiawati, W., Rini, M., Neni, G., Tati, R., 2008). Basil leaves are also reported as one of the plants that produce methyl eugenol in their leaves and flowers, ranging from 50% to 55% (Kardinan, 2019). Efendy, T.A., Rafida, R., Sunar, S., (2010) also reported that methyl eugenol compounds were found in celery plants. Setiawati et al. (2008) stated that plant-based pesticides containing essential oils containing methyl eugenol and eugenol were babadotan, ghost pine, cloves, slobber, jeringau, galangal, basil, lemongrass, betel leaf, suren leaf, and tembelekan.

Plant extracts are still infrequently used in research without going through the distillation process. Various undistilled fragrant vegetable extracts were utilized in this investigation, with the goal of luring fruit flies into the trap and killing them before they laid eggs on chilies. Based on this description, the authors are interested in and feel compelled to conduct research in this area, specifically to determine the type of aromatic vegetable extract that is most effective as a source of attractant for fruit fly pests, as well as the effect of these vegetable extracts on the intensity of fruit fly attacks on chili.

B. Methodology

1. Research Methods

This is an experimental investigation that used different aromatic vegetable extracts that were shown to contain methyl eugenol molecules. A completely randomized design (CRD) with four treatments and three replications was utilized in the study. P1 = clove leaf extract, P2 = babadotan leaf extract, P3 = citronella leaf extract, and P4 = basil leaf extract, were the four treatments employed. The type and number of fruit flies trapped, and the intensity of fruit fly bites on chili plants, are all observed factors.

Land preparation and processing are the first steps in the chili planting process. Weeds are removed from the area, which is then hoed and loosened before being divided into 12 beds, each measuring 1 x 6 meters. The spacing is 60 x 60 cm, which means each bed has 20 plants. Each plot is covered with black plastic mulch to keep weeds at bay and keep the soil moist. Chili seeds were sowed in pot trays and transplanted into beds at the age of 3 WAP (21 days). Stakes are installed three days after the plants are planted.

The fruit flies were captured and placed in a death bottle containing 70% alcohol. Calculating the average number of fruit fly populations caught from each replication in the traps installed can be used to estimate the number of fruit fly populations. The total fruit, the number of infected fruits, and the number of uninfested fruits were calculated, and the absolute attack intensity formula was used to quantify the intensity of the fruit fly pest attack:

$$P = \frac{a}{a + b} \times 100\%$$

Where :

P = Percentage of fruit fly attacks

a = Number of large chilies that are attacked

b = Number of healthy chili (Hidayat, 1982).

2. Data Analysis

The data obtained were analyzed using ANOVA (*Analysis of Variance*) and continued with the BNJ test at a 5% significance level.

C. Result

1. Number of Trapped Fruit Flies Population

The results of the study on the number of fruit flies trapped in each of the four types of aromatic vegetable extracts are shown in Table 1 below:

Table 1. Average number of trapped fruit flies

Types of Vegetable Extracts	Average (tail)
Clove leaf extract	35.67
Babadotan leaf extract	29.67
Lemongrass leaf extract	33.33
Basil leaf extract	31.33

Treatment with different vegetable extracts affected the number of fruit fly catches in chili plantations. The highest average number of fruit fly catches was found in the clove leaf extract treatment, which was 35.67, and the lowest in the babadotan leaf extract treatment, which was 29.67, but all treatments did not show a significant difference. The results of observing the average number of fruit flies with the use of various aromatic vegetable extracts can be visualized in graphic form as :

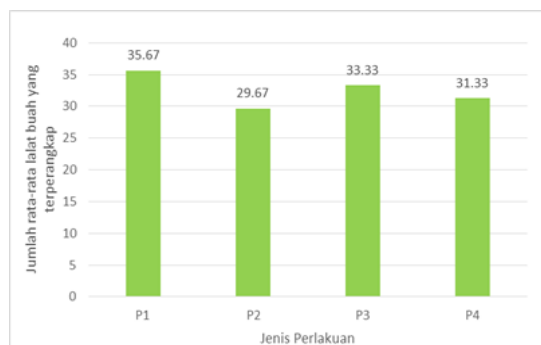


Figure 1. Average number of fruit fly catches

3. Intensity of Fruit Flies on Red Chili

The application of various aromatic vegetable extracts showed differences in the level of attack on chili, which can be seen in Table 2.

Table 2. Intensity of fruit fly attack

Treatment	Total Fruit	Attacked	Percentage	Attack Intensity (%)	Attack Category
P1	1340	20	1.49	0.19	ringan
P2	1237	18	1.46	0.18	ringan
P3	1285	14	1.09	0.14	ringan
P4	1076	40	3.72	0.46	ringan

Source: Primary data after processing, 2022.

Table 2 shows the highest attack intensity at P4, which is 0.46%, and the lowest at P3, which is 0.14%. There was no significant difference in the intensity of fruit fly attack on all types of aromatic vegetable extract treatments and they were included in the category of mild damage.

D. Discussion

The number of fruit fly catches using aromatic vegetable extracts from the highest to the lowest yields was the treatment of clove leaves, fragrant lemongrass leaves, basil leaves, and babadotan leaves. Treatment with babadotan leaf extract showed the lowest catch of all treatments, namely 29.67 fish, while treatment with clove leaf extract showed the highest yield of 35.67 fish. Differences in the content of methyl eugenol compounds in each aromatic vegetable extract caused differences in the number of trapped fruit fly populations. The content of methyl eugenol in clove leaves was higher than the other three plants. According to Bhuiyan, M.Z.I., J. Begum, N.C. Nandi and F. Akter (2010), the main component in clove oil is 70–96% eugenol ($C^{10}H^{12}O^2$), while in citronella leaf, the main component is citronellal ($C^{10}H^{18}O$) of 32–45%. Melisa and Muchtaridi (2017) found that the eugenol content in babadotan was only 0.4%. This is why the treatment of babadotan extract (*Ageratum conyzoides*) has the least amount of catch. The higher the methyl eugenol content, the more fruit flies are attracted to the compound.

The use of various aromatic vegetable extracts in controlling fruit fly pests on chili plants has several advantages, namely it is easy to obtain, environmentally friendly and does not cause contamination of chili fruit because it comes from natural ingredients. The difference in the ability of each attractant to attract fruit flies occurs because of the different active ingredients. The results showed that all the aromatic vegetable extracts used in this study could be used to control fruit fly pests on chili plants.

The trapped fruit fly population is decreasing every day. This is due to the reduced content of methyl eugenol due to evaporation of the essential oil. Effendy et al. (2010) stated that the number of trapped fruit fly imago is decreasing day by day along with the evaporation of methyl eugenol or eugenol from the attractant used. But it can be done by changing the extract every 4–5 days as long as the chili plants bear fruit. This will be very beneficial for farmers in reducing the population of fruit fly pests so that the productivity of crops obtained by farmers returns to normal (Humaira, Tasik, S.B., Masriatun, 2013).

The application of various aromatic vegetable extracts can reduce the intensity of fruit fly pests on red chili plants. The highest attack intensity was found in the basil leaf extract treatment, which was 0.46%, and the lowest was in the citronella leaf extract treatment, which was 0.14%. However, the four treatments did not show significant differences but had an effect on the intensity of fruit fly pests. This is because the four aromatic vegetable extracts each contain methyl eugenol compounds that can attract fruit flies, so they are less likely to attack chili plants. The low intensity of fruit fly attacks can also be caused by the distance between the traps. Hasanah (2018) stated that the distance of the traps that are too close can make fruit flies very easily trapped and do not attack chili fruit.

The number of red chili plants did not show a significant difference because the age of the plant was uniform, and the nutrients obtained by each plant were the same, while the number of trapped fruit fly imago was influenced by the percentage of methyl eugenol and eugenol content in the plant extracts used. The higher the methyl eugenol content in the vegetable extract, the more fruit flies were trapped. This will reduce the intensity of attacks on chili plants, so that the productivity of chili will increase. This is in accordance with the results of Hasanah's research (2018), which states that the lower the intensity of the attack, the higher the production yield.

E. Conclusion

The following conclusions were reached based on the findings of a study on the usefulness of several fragrant vegetable extracts in controlling fruit fly pests (*Bactrocera dorsalis*) on chili: The quantity of fruit flies captured in chili crops was considerably reduced when aromatic vegetable extracts made from clove leaves, basil leaves, babadotan leaves, and fragrant lemongrass leaves were used. The vegetable extract that traps the most fruit flies is clove leaf extract, which is 35.67 individuals.

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