The 2nd International Conference On Indigenous Knowledge For Sustainable Agriculture 2023
ISBN : 978-623-161-062-1

EFFECTIVENESS OF PAPAYA LEAF EXTRACT ON MORTALITY AND INTENSITY OF ATTACKS BY LEAF INSECTS ON CHILI PLANTS

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ABSTRACT

Most of the organic waste produced is still not managed properly so it can hurt environment. The easiest technology that can be in liquid or solid form and is used to deliver organic matter to improve the physical, chemical, and biological qualities of the soil, largely or entirely consist of organic materials derived from plants or animals that have undergone an engineering process. This study used vermicompost from vegetable waste, tofu dregs and cow manure as reference material to assess the nutritional content of vermicompost for composting. The composting process lasted for 28 days. Based on the test results or nutrient analysis or vermicompost, the chemical quality parameter of tofu waste compos had pH 5,89 Nitrogen 0,20%, Phosphorus 2,03% and Potassium 11,95%. On the chemical quality of compost C/N, the ratio of vegetable waste had the highest value of 27,02. Tofu vermicompost had the best value on the physical quality of the compost with a blackish color, temperature of 30^0C and water content of 13,89%. This composting was done by using earthworms *Lumbricus rubellus* and the raw materials used were vegetable waste, tofu dregs and cow manure

Keywords:

Organic waste, vermicompost, worms, organic fertilizer

INTRODUCTION

Chili is a type of vegetable with a wide prospect for development due to its extensive market, both domestically and for export. Additionally, large chili peppers have a high economic value, as their prices can soar at certain times. Chili peppers can be easily grown and used for daily needs without having to purchase them from the market [1]. The demand for chili peppers in Indonesia is around 3 kg per capita per year. Therefore, there is a need for an annual increase in chili production. However, there are often challenges in chili plant

ISBN : 978-623-161-062-1
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cultivation, one of which is the presence of pests that attack chili plants, such as aphids (*Aphid* sp). Aphids are a type of pest that affects chili plants as well as various other types of vegetables. These insects attack by inserting their stylets and sucking the plant cell sap from the leaves and leaf stalks. Such attacks cause the plant's shoots or leaves to curl, abnormal leaf growth and rolling, and damage to the plant's tips, which can hinder its growth. The damage caused by these pests is not only due to the sap-sucking but also because they act as vectors for plant viruses. The honeydew excreted by the insects attracts ants and becomes a medium for the growth of sooty mold that covers the leaf surface, hindering the plant's photosynthesis by blocking sunlight. The damage caused by aphid infestation can reach 10-30% during the dry season and can go up to 40% during the rainy season. As vectors, they can cause losses of up to 90% [2].

The use of synthetic pesticides, which are considered practical for controlling pest infestation, has proven to have negative impacts on the surrounding environment and even on users themselves. Therefore, an alternative with minimal negative effects, such as botanical pesticides, is needed. Botanical pesticides are made from plant-based materials that are relatively easy to produce with limited resources, as they are easily biodegradable [3]. Chemical substances found in plants have bioactivity against insects, such as repellents, antifeedants, insect growth regulators, and oviposition deterrents. Pesticides are used to control pests that attack plants. Plant materials are usually processed into various forms, such as powders, extracts, or resins. Botanical pesticides can be made using simple technologies, such as solutions obtained from plant extracts, infusions, or papaya leaf extract. One of the plants that contain active ingredients that can be used as botanical pesticides is the papaya plant. Papaya is a plant with the potential to be used as a botanical pesticide to control insect pests. Papaya contains a substance called papain, which is a proteolytic enzyme capable of breaking down and digesting proteins, making it a potential pesticide [4]. Papain found in papaya leaves is toxic to caterpillars and sucking pests [5].

METHOD

Research Location and Time:

This research was conducted in the Kulo Sidenreng Rappang District. The research was carried out from January 2023 to April 2023.

Materials and Tools:

The materials used in this research were chili seeds, fresh papaya leaves, water, and detergent soap. The tools used in this research were a hoe, knife, weighing scale, blender, sieve, basin, sprayer, label paper, knife and stirrer, camera, stationery, a cloth cover, magnifying glass, wire, and bamboo.

Research Method:

This research used a randomized block design method, consisting of 6 treatments repeated 4 times, resulting in 24 experimental units. Each experimental unit consisted of 2 plant samples, resulting in a total of 48 plants. The treatments were as follows:

P0 = Control

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P1 = Application of papaya leaf extract at 10 ml per liter of water

P2 = Application of papaya leaf extract at 20 ml per liter of water

P3 = Application of papaya leaf extract at 30 ml per liter of water

P4 = Application of papaya leaf extract at 40 ml per liter of water

P5 = Application of papaya leaf extract at 50 ml per liter of water

The collected data were analyzed using analysis of variance (ANOVA). If the analysis showed significant differences, an honestly significant difference (HSD) test would be conducted at a 5% level of significance.

Implementation Method:

a. Preparation of Papaya Leaf Extract:

Papaya leaf extract was prepared by grinding 3 kg of fresh leaves with 3 liters of water using a blender. The mixture was then placed in a closed plastic jar and left to stand for 24 hours. After that, it was strained. For application, the stock solution was mixed with water according to the treatment concentration, and each concentration was put into a hand sprayer.

b. Inoculation of Aphids Leaf Insects:

Adult Aphids obtained from chili plants infested with Aphids were maintained and multiplied for three weeks until the number of Aphids exceeded 90 individuals to meet the requirements for the subsequent experiments. These insects were then infested on 4-week-old chili plants at a population of 30 insects per plant.

c. Application of Papaya Leaf Extract:

The application of papaya leaf extract was done according to the treatments. The spraying was carried out in the afternoon. The extract was sprayed on chili plants from 4 to 6 weeks after planting, and the application was done once a week.

Observed Parameters:

The parameters observed in this research were analyzed using the following formula:

- Mortality of Aphids (%)

$$M = \frac{n}{N} x\ 100\%$$

M = Mortality

n = Number of Dead Insects

N = Total Test Insects

- Damage intensity (%)

$$I = \frac{a}{b} x\ 100\%$$

I = Damage intensity

a = Number of affected leaves

b = Number of leaves observed

RESULT AND DISCUSSION

Percentage of Aphid (Aphids sp.*) Mortality*

Based on the observations and analysis of aphid mortality, it is evident that the application of papaya leaf extract does not significantly affect the infestation of aphids on chili plants.

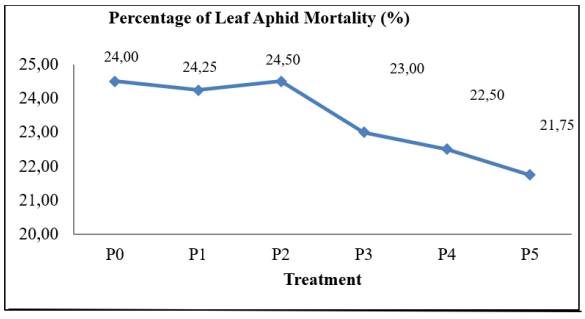

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Figure 1. Average Percentage of Papaya Leaf Extract Application on the Population Mortality of Aphids (*Aphids* sp) Infestation on Chili Plants

The above diagram shows that the use of papaya leaf extract exhibits the highest mortality rate of aphid infestation on chili plants in treatment P2 (20 ml of papaya leaf extract per plant) with an average of 24.50%. It is followed by P1 (10 ml of papaya leaf extract per plant) with an average of 24.255%, then P0 (Control) with an average of 24.50%. The subsequent results indicate that P3 (30 ml of papaya leaf extract per plant) has an average of 23.00% and P4 (40 ml of papaya leaf extract per plant) has an average of 22.50%. The lowest mortality rate of infestation is observed in P5 (50 ml of papaya leaf extract per plant) with an average value of 21.75%.

The Intensity of Aphid Infestation

Based on the observations and variance analysis, the intensity of aphid infestation shows that the treatment of papaya leaf extract application does not significantly affect the infestation of aphids on chili plants

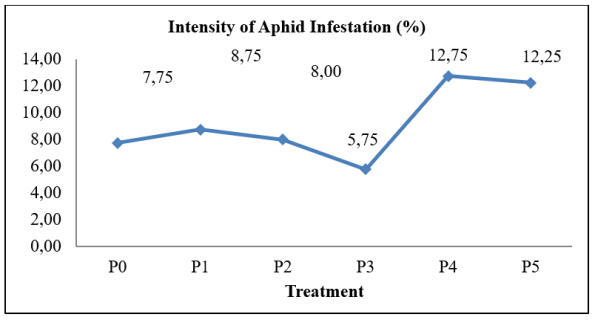

Figure 2. Average Percentage Diagram of Papaya Leaf Extract Application on the Population Intensity of Aphid Infestation (*Aphids* sp) on Chili Plants.

It can be observed that the use of papaya leaf extract shows the highest intensity of infestation in treatment P4 (40 ml papaya leaf extract per plant) with an average intensity of 12.75%. This is followed by treatment P5 (50 ml papaya leaf extract per plant) with an average intensity of 12.25%, and treatment P3 (120 ml papaya leaf extract per plant). The next highest result is observed in treatment P1 (10 ml papaya leaf extract per plant) with an average intensity of 8.75%, followed by P2 (20 ml papaya leaf extract per plant) with an average intensity of 8.00%, and P0 (control) with an average intensity of 7.75%. The lowest intensity of infestation is found in treatment P3 (30 ml papaya leaf extract per plant) with an average value of 5.75%.

DISCUSSION

Based on the analysis of variance, the application of papaya leaf extract on the population of aphids in chili plants did not have a significant effect on all parameters, including aphid mortality and intensity of aphid infestation.

Papaya leaf extract showed the highest mortality rate in treatment P2 (20 ml extract per plant) with an average mortality rate of 24.50%. This can be attributed to the presence of papain, a contact toxin found in papaya leaves. Papain acts as a contact poison that enters the insect's body through natural openings, such as breathing holes. It also acts as a stomach poison that enters the insect's digestive system through its mouthparts. The papain disrupts the insect's feeding activity and leads to a loss of appetite. [6] added that pesticide residues can cause a decrease in insect

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feeding activity and movement, eventually leading to their death. Additionally, the study by [7] demonstrated that papaya leaf extract can disrupt or inhibit the metamorphosis of insects with complete metamorphosis and can be lethal to insects with incomplete metamorphosis.

The highest intensity of aphid infestation was observed in treatment P4 (40 ml papaya leaf extract per plant) with an average infestation rate of 12.75%. This may be due to suboptimal application and dosage, as during the spraying process, the active aphids were actively sucking on the chili leaves, causing yellowing, spots, and ultimately resulting in holes in the leaves. Hence, the pesticide in papaya leaves is effective but not maximally efficient in controlling aphid infestation. Environmental factors such as high rainfall and intense sunlight can also contribute to the reduced effectiveness of the papaya leaf extract, as the active compounds may degrade under excessive sunlight or get washed away by rainwater. This leads to an increase in the intensity of aphid infestation on chili plants [8].

In conclusion, the application of papaya leaf extract had a non-significant effect on all observation parameters. This could be attributed to the dosage applied in the study, which may not have been sufficient to effectively control aphid infestation. The active compounds in papaya leaves degrade when exposed to excessive sunlight or washed away by rainwater, which limits their ability to affect aphid feeding patterns. This aligns with the statement by [9] that if aphids feed on plant leaves, they will lose their appetite and the plants will remain unaffected. Even when papaya leaf extract is used at concentrations that are not excessively high, it can act as a highly effective stomach poison to kill pests [10].

CONCLUSION

Based on the research findings, it can be concluded that the application of papaya leaf extract does not have a significant effect on aphids in chili plants. The higher the concentration applied to the plants, the more effective it is in influencing aphid mortality. The highest aphid mortality was observed in treatment P2 (20 ml per plant), with an average of 24.50%. Furthermore, the application of 40 ml of papaya leaf extract per plant (P4) resulted in a high percentage of damage intensity in chili plants. This is attributed to active feeding by aphids during spraying, leading to leaf discoloration, yellow spots, and perforations, with an average intensity of 12.75%. The active compounds in papaya leaves degrade rapidly when exposed to excessive sunlight or washed away by rainwater after application, thus not affecting the feeding behavior of aphids.

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