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Intensity of Thrips Attacks On Eggplant As A Result of Plant-Based Pesticides Treatment

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ABSTRACT

Eggplant (Solanum melongena L.) is a vegetable that is quite popular among various groups in Indonesia. Eggplant production in Indonesia in 2023 reached 699,896 tons and decreased to 675,397 tons in 2024 (BPS, 2025). With this level of productivity, eggplant plants are more susceptible to pests, one of which is Thrips. Thrips palmi usually attacks the leaves, flowers, and fruit. Damage caused by Thrips attacks on eggplant plants is characterized by silvery spots and physiological disorders on the leaves, leading to the growth of fungi that spread disease. This study was conducted in Nanggela Village, Mandirancan District, Kuningan Regency, at an altitude of ±200-300 m above sea level with a tropical climate ranging from 24°C to 33°C and an average temperature of 28°C. This study used a randomized block design (RBD) consisting of types of plant-based pesticides and their concentrations, namely clove leaf extract, garlic extract, and lemongrass extract, each of which had concentrations of 50ml/L water, 100ml/L water, and 150ml/L water. The results of the experiment showed that plant-based pesticides from garlic extract with a concentration of 100 ml/L of water had a significant effect on the intensity of attacks and damage caused by thrips, plant height, number of leaves, and crop yield in eggplant plants.

Keywords: Eggplant, Thrips Pests, Plant-Based Pesticides

1. INTRODUCTION

Eggplant is a vegetable that is widely loved by Indonesians. Eggplant production in Indonesia in 2023 reached 699,896 tons and decreased to 675,397 tons in 2024 (BPS, 2025). This fact proves that eggplant productivity is lower than in the previous year. With this level of productivity, eggplant plants are more susceptible to pests, one of which is Thrips. This is due to the anthocyanin content, the smooth surface of the leaves and fruit, and the aroma that is more attractive to Thrips. Thrips pests cause losses for farmers, reducing crop yields by up to 23%.

Several local studies show that *Thrips palmi* has a relatively high population level, reaching 64.06% in intercropping systems and 67.6% in monoculture systems. The dominance of this pest is influenced by factors such as cropping patterns, season, temperature, and environmental humidity. Although the spread of *Thrips palmi* has been reported in various regions, national population data in percentage form is still limited. Therefore, further understanding of the distribution and population levels of *Thrips palmi* in various regions is needed to support effective and sustainable pest control strategies (Haerul *et al.*, 2021).

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Thrips pest control can be carried out using pesticides, including chemical pesticides that suppress plant pest populations. However, the use of chemical pesticides has the potential to cause adverse effects on the ecosystem, such as killing natural enemies of pests and polluting the environment due to residues left behind as a result of incorrect dosages. Therefore, organic-based natural materials can be used as an alternative control method, one of which is through the use of plant-based pesticides.

One important control measure is to use extracts from plant-based pesticides, including cloves, garlic, and lemongrass. Cloves have the advantage of high production and resistance to pests and diseases. Clove methanol extract acts as an antimicrobial and treats several types of diseases (Taher *et al.*, 2018). Clove leaf extract is considered effective as a plant-based pesticide for eggplant because it contains *eugenol*, *flavonoids*, and *saponins*, which are toxic to thrips pests, damaging their nervous system and inhibiting their reproduction. Clove leaf extract functions as a repellent and is environmentally friendly, leaving no harmful residues.

Pest and disease control in eggplants can be done by using plant-based pesticides, one of which is garlic extract. The use of garlic as a plant-based pesticide has been proven to support plant health due to its active compounds, including *allicin, aliin, essential oils, saltivine, scordinin, and methyl allyl trisulfide*. These compounds have insecticidal properties that repel and suppress insects and pests. Garlic is an easy-to-cultivate plant that grows and thrives well in temperate climates. In general, garlic consists of several types or subspecies, mainly hardneck and softneck garlic. Garlic contains about 65% water, 28% carbohydrates in the form of fructans, 2.3% organosulfur compounds, 2% protein (*alliinase*), 1.2% free amino acids such as arginine, and 1.5% fiber. In addition to this composition, garlic is also known to have various biological activities, including antifungal, antiviral, antibacterial, anticancer, anthelmintic, antihypertensive, antiatherosclerotic, antiseptic, and anti-inflammatory properties (Kristiananda *et al.*, 2022).

In addition, lemongrass extract can also be used as a natural pesticide. Lemongrass oil (*citronella oil*) derived from the lemongrass plant (*Cymbopogon nardus* L.) is a type of essential oil that contains compounds with antifungal, anticonvulsant, antiparasitic, anti-inflammatory, and antioxidant properties. Lemongrass leaf essential oil contains monoterpene compounds such as citronellal, citronellol, limonene, geraniol, and α-pinene, which play a role in killing insect pests on eggplant plants. The main components of lemongrass oil include 35.97% *citronellal*, 17.28% *geraniol*, 10.03% *citronellol*, 4.44% *geranyl acetate*, 4.38% *elemol*, 3.98% *limonene*, and 3.51% *citronellyl acetate*.

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In addition to essential oils, lemongrass leaves also contain phytochemical compounds such as *flavonoids, saponins, tannins, steroids, phenolics*, and polyphenols, which also act as insecticides (Nopriansyah & Rustam, 2024). The compounds citronellal and geraniol can enter the insect's body through a contact poison mechanism, namely through natural openings such as the mouth, anus, and gaps between abdominal segments. Once inside, these compounds attack the nervous system, inhibiting larval activity. Using simple extraction and distillation methods, lemongrass essential oil can be produced on a household scale, enabling communities to produce it independently. This organic pesticide alternative is expected to be a more effective solution for controlling pests and diseases in plants (Nurmawati *et al.*, 2022)

2. RESEARCH METHOD

This study will be conducted in Nanggela Village, Mandirancan Subdistrict, Kuningan Regency, at an altitude of ±200-300 m above sea level. The climate is classified as type A according to Schmidt and Ferguson, which is tropical with a temperature range of 24°C to 33°C and an average temperature of around 28°C. The research method used is a Randomized Block Design (RBD) with one factor, namely the type of plant-based pesticide and the concentration of plant-based pesticide, with the following design:

Treatment of Various Plant-Based Pesticides and Concentrations:

P0 = Control (No treatment)

P1 = Clove leaf extract concentration 50 ml/L water

P2 = Clove leaf extract concentration 100 ml/L water

P3 = Clove leaf extract concentration 150 ml/L water

P4 = Garlic extract concentration 50 ml/L water

P5 = Garlic extract concentration 100 ml/L water

P6 = Garlic extract concentration 150 ml/L water

P7 = Lemongrass extract concentration 50 ml/L water

P8 = Lemongrass extract concentration 100 ml/L water

P9 = Lemongrass extract concentration 150 ml/L water

On the 21st, 28th, and 35th days after planting (DAP), plant-based pesticides from clove leaves, garlic, and lemongrass were applied to control thrips pests on eggplant plants, and observations were conducted on the 27th, 34, and 41 days after planting, exactly one week after the application of plant-based pesticides. The intensity of pest/pathogen attacks in this journal is

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defined as the severity of the attack based on the extent of damage observed on the plants, which is calculated quantitatively using the formula (Afrizal *et al.*, 2018). The percentage of plants or parts of plants showing pest attacks to calculate how many plants are attacked can be calculated using the formula:

$$IS = (a/b) \times 100\%$$

Based on this formula, IS is the intensity of attack, a is the number of plants attacked, and b is the number of plants in the plot observed. The intensity of pest damage in a scientific context refers to the percentage of damage caused by pests to plants, calculated based on the number or severity of symptoms observed on the plant parts. Damage category scale values based on symptom criteria from (0-5):

0 = Normal, no color change/no curling (healthy leaves),

1= Color change (light yellow or small spots), some leaves begin to wrinkle/curl, leaves have not yet curled (mild attack > 0-25%),

2 = Leaf color change is more pronounced (silvery yellow or brown spots), some leaves are wrinkled/curled and begin to curl slightly at the edges (moderate attack >20-40%),

3 = Leaves change color more extensively (dark yellow/brown), many leaves are wrinkled and some leaves are moderately curled (moderate attack >40-50%),

4 = Almost all leaves change color, leaves are severely curled/wrinkled, and most leaves are severely curled, disrupting growth and stunting the plant (moderately severe attack >50-75%),

5= All leaves have changed color, resulting in severe curling and total rolling, causing many leaves to fall off/die, stunting the plant and eventually killing it (severe attack >75-100%).

According to the formula, the intensity of damage caused by pest attacks is calculated using the Natawigena (1993) formula as follows:

$$IK = \frac{\Sigma\,(n \; x \; v)}{N \; x \; Z} \text{ x } 100\%$$

Based on this formula, IK is the intensity of damage, n is the number of plants/parts observed from the attack category, v is the value of the attack category scale, N is the total number of plants, and Z is the scale value of the highest attack category (0-5).

The observation data will be processed using analysis of variance using Randomized Block Design (RBD) analysis, which is used to determine the effect of the interaction of the treatments being tested, with a linear model according to Wijaya (2023), as follows:

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$$Y_{ij} = \mu + A_i + B_j + \varepsilon_{ij}$$

Based on this formula, Y_{ij} represents the response to the first repetition, Y_{ij} is the general average, Ai = the effect of the first repetition, Bj is the effect of treatment j, and Y_{ij} is the effect of experimental error.

Further testing is carried out if the data is real in the analysis of variance, then it will be continued with the DMRT (Duncan Multiple Range Test) at a 5% level. The Duncan multiple test formula according to Wijaya (2023) is as follows:

$$\text{Test LSR : LSR} = \text{SSR}0,05 \times \sqrt{(KTG/r)}$$

Based on this formula, LSR stands for Least Significant Range, SSRp is the value from the New Multiple Range Test table, KTG is the Mean Square Error, and R = Repetition.

3. RESULTS AND DISCUSSION

Supporting observations

A. Plant Height

The analysis shows that differences in the type of plant-based pesticide and concentration applied to eggplant plants result in significant differences in plant height.

Table 1. Effect of plant-based pesticides and concentration on eggplant plant height.

Treatment	Average Plant Height (cm)					
	27 DAP		34 DAP		41 DAP	
P0	11.35	a	14.21	a	14.83	a
P1	11.68	a	16.65	c	18.70	c
P2	12.30	b	14.63	a	16.91	b
P3	13.70	c	14.76	a	16.71	b
P4	14.09	d	17.33	d	19.27	d
***P5**	**14.66**	**d**	**18.03**	**e**	**20.58**	**e**
P6	14.41	d	18.02	e	19.75	d
P7	13.76	c	14.61	a	19.61	d
P8	11.93	a	15.45	b	18.12	c
P9	12.12	b	17.32	d	18.65	c

Note: Different average numbers in the columns indicate significant differences.

Based on the table above, it shows that all treatments (P1 to P9) had a significant positive effect on plant height growth compared to the control (P0) at all observation ages. However, treatment P5 emerged as the most optimal and consistently superior treatment from the beginning to the end of the study. This can be seen from the plant height in P5, which reached 14.66 cm at 27

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DAP, increased to 18.03 cm at 34 DAP, and peaked at 20.58 cm at 41 DAP. Based on further testing (letter notation), P5 was statistically significantly different and was in the highest group (notation 'e') compared to the other treatments.

Primary Observations

A. Intensity of Attacks and Damage

The analysis shows that the difference in plant-based pesticides and their concentration on eggplant plants results in a significant difference in the intensity of attacks and damage.

Table 2. Effect of plant-based pesticides and concentration on the yield weight of eggplant crops.

Treatment	Average Intensity Attack and Damage (%)				
	27 DAP	34 DAP	41 DAP	Average	
P0	19.07	19.75	24.83	21.22	e
P1	19.26	21.58	17.67	19.50	c
P2	21.42	20.81	20.91	21.05	e
P3	20.33	19.37	21.58	20.43	d
P4	18.03	17.18	15.64	16.95	bc
***P5**	**15.76**	**12.92**	**11.37**	**13.35**	**a**
P6	13.43	17.26	13.18	14.62	b
P7	24.16	11.54	24.43	20.04	b
P8	19.33	12.53	15.86	15.91	d
P9	15.65	18.88	23.59	19.37	c

Note: Different average numbers in the columns indicate significant differences.

Based on the table above, it can be seen that treatment P5 proved to be the most effective treatment in reducing damage levels compared to all other treatments. This is indicated by the downward trend in the intensity of attacks on P5, which started at 15.76% at 27 DAP, decreased to 12.92% at 34 DAP, and reached its lowest point of 11.37% at 41 DAP. Statistically, P5 has the smallest overall average value of 13.35% with a notation of 'a', which indicates a significant difference in providing optimal protection for plants. Conversely, the highest damage rate was found in the control treatment (P0) with a damage rate of 21.22% in notation 'e'. Environmental conditions that support pest development tend to increase the intensity of damage, while plant defense factors such as trichome density and the presence of natural enemies can suppress the attack rate (Gautrat *et al*., 2024).

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B. Number of Leaves

The analysis shows that, overall, growth and leaf count are significantly affected by differences in the type and concentration of plant-based pesticides applied.

Table 3. Effect of plant-based pesticides and concentration on the number of leaves on eggplant plants.

Treatment	Average Number of Leaves (pieces)					
	27 DAP		34 DAP		41 DAP	
P0	5.20	a	6.53	a	7.63	a
P1	6.20	b	7.53	b	8.67	ab
P2	5.47	a	7.07	ab	8.33	ab
P3	5.40	a	7.47	ab	9.33	b
P4	6.33	d	8.07	c	10.04	c
***P5**	**7.60**	**c**	**9.07**	**d**	**11.07**	**d**
P6	6.53	bc	8.87	cd	10.87	cd
P7	6.27	b	8.00	c	10.07	c
P8	5.93	ab	7.33	ab	9.40	b
P9	6.27	b	6.67	a	9.77	bc

Note: Different average numbers in the columns indicate significant differences.

Based on the table above, Treatment P5 proved to be the most effective method because it was able to reduce the average damage intensity to the lowest level of 13.35% (notation a), with attacks consistently decreasing from 15.76% at 27 DAP to only 11.37% at 41 DAP. The effectiveness of protection in P5 correlates positively with the vegetative productivity of plants, where P5 produces the highest number of leaves at each observation stage, reaching 11.07 leaves at 41 DAP (notation d). In contrast, the control treatment (P0) showed the least effective treatment with the highest damage rate reaching 21.22% and the fewest number of leaves, namely only 7.63 leaves at the end of observation. Overall, the data indicate that the P5 treatment not only provides the best protection against thrips attacks but is also the most optimal in supporting plant leaf growth.

C. Harvest Weight

The analysis shows that crop productivity is significantly influenced by the concentration of plant-based pesticides at each stage of growth.

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Table 4. The effect of plant-based pesticides and concentration on the yield weight of eggplant crops.

Treatment	Harvest Weight (Gram)	
P0	2,145	a
P1	3,695	c
P2	3,245	b
P3	3,555	bc
P4	3,524	bc
***P5**	**6,654**	**f**
P6	5,521	e
P7	3,724	c
P8	3,373	bc
P9	4,220	d

Note: Different average numbers in the columns indicate significant differences.

Based on the data above, Treatment P5 showed the best results with the highest weight of 6,654 grams, far exceeding the average of the other treatments. Conversely, P0 (control) produced the lowest weight of 2,145 grams. The majority of other treatments, such as P1, P2, P3, P4, P7, and P8, showed relatively stable results in the range of 3,245 grams to 3,724 grams. Meanwhile, P9 showed moderate performance with a result of 4,220 grams. Overall, these data indicate that treatment P5 had the most significant impact on increasing crop yield compared to other treatments.

4. CONCLUSIONS

The ingredients and concentration of plant-based pesticides have a significant effect on the intensity of thrips (*Thrips palmi*) attacks on eggplant (*Solanum melongena* L.) plants. Plant-based pesticide ingredients such as clove leaf, garlic, and lemongrass extracts can affect the intensity of attacks and damage to eggplant plants caused by thrips. Plant-based pesticides with significant concentrations have been proven to reduce thrips infestation by up to 35.13%. The use of natural ingredients such as garlic, clove, and lemongrass extracts can be an environmentally friendly alternative to reduce dependence on chemical pesticides.

Of the three pesticide ingredients used, namely clove leaf extract, garlic, and lemongrass, there is a pesticide that is superior in controlling thrips pests. The pesticide ingredient that gave the best

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results against thrips pest attacks was treatment P5 (garlic extract with a concentration of 100 ml/L of water).

Treatment with 100 ml/l water concentration of garlic extract pesticide was the most effective treatment for suppressing thrips infestation. This was proven by the plants reaching the highest height of 20.58 cm, The number of leaves produced the highest number of leaves, namely 11.07 leaves at 41 DAP observation, The harvest weight produced the highest weight of 6,654 grams, and The intensity of attack and damage had the lowest damage rate, with an average of 13.35% compared to the control (P0) which reached 21.22%.

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