Vol. 8 (2025) No.1
ISSN:2655-3023

JERAMI
Indonesian Journal of Crop Science

Research Article

OPEN ACCESS

# Infestation of Aphids in Tomato Plantations After Application of Tobacco Leaves Mixtures With Other Botanical Insecticides

**Betari Safitri, Dila Febria, Sekar Utami Putri, Wika Anrya Darma**

*Department of Crop Cultivation, Lampung State Polytechnic, Bandar Lampung, Indonesia*

**Article Info**

**Received:**
17 April 2025

**Accepted:**
24 June 2025

**Published:**
31 August 2025

**Competing Interest:**
The authors have declared that no competing interest exists.

**Corresponding Author:**
Betari Safitri, Department of Crop Cultivation, Lampung State Polytechnic, Bandar Lampung, Indonesia
*Email: betarisafitri@polinela.ac.id*



**Abstract**

Pest attacks are still a major problem in tomato cultivation. Aphids are one of the main pests of tomatoes. The main symptoms of aphids on tomatoes are stunted plants, distorting leaves and stems, and causing necrotic spots. This research will examine the population and attacks of aphids on tomato fields where there have been applied tobacco pesticides. This research uses tobacco pesticides that have been combined with citronella and Javanese chili. The combination of botanical pesticide ingredients is as follows: tobacco 100% (A), tobacco 50% + citronella 50% (B), tobacco 75% + citronella 25% (C), tobacco 50% + Javanese chili 50% (D), tobacco 75% + Javanese chili 25% (E), tobacco 35% + Javanese chili 30% + citronella 35% (F). The results showed that aphids only appeared in the 1st and 2nd weeks after application. From the 3rd week to the last week of observation, no aphids were found on any plants at all. The aphids damage intensity on tomatoes until 100% by applying a plant-based pesticide made from tobacco leaves.

Keywords: aphids, citronella, javanese chili, pesticides, tobacco

## 1. Introduction

Tomatoes are one of vegetable that have high demand on the market. Tomato can consumed directly or used as a complimentary ingredient in cooking. The results of qualitative phytochemical tests on tomato fruit extract stated that tomatoes contain flavonoids, alkaloids and saponins (Junnaeni *et.al*, 2019). Hasfikasari *et. al* (2024) stated that tomatoes contain lycopene and flavonoids, the level of these compounds is influenced by the environmental conditions where tomatoes grow. The flavonoids, lycopene and vitamin C contained in tomatoes act as antioxidants to ward off free radicals so that consumption of tomatoes continues to increase.

Tomato cultivation can be done from the lowlands to the highlands. Tomato production based on BPS data (2022) in Lampung Province in 2021: 159,338 quintals, in 2020: 190,957 quintals, in 2019: 186,686 quintals and in 2018: 196,038 quintals. Tomato productivity experiences fluctuations which are influenced by many factors, including pest and disease attacks, inappropriate cultivation processes and land conversion. The tomato production process is often disrupted due to pest and disease attacks. Pest attacks are still one of the main causes of fluctuations in tomato productivity. Paruntu, *et. al* (2016) also explained the types of insect pests that are often found in tomato planting areas in the form of brownish green ladybugs (*Nesidiocoris tenuis*: Hemiptera), *Acrida turita* L. (Orthoptera), Aphids (Aphis sp: Homoptera), *Liriomyza sativae* (Diptera), Whitefly (*Bemisia tabaci*), Helicoverpa armigera (Lepidoptera) and green ladybug (*Nezara viridula*: Hemiptera). Aphids (Aphids) are often found on the lower leaves of tomato plants. This aphid attack causes curling and curling of the leaves so that the plant wilts and the further symptoms are that the plant dies (Arsi *et al.*, 2021).

Farmers usually control pests using chemical (synthetic) pesticides. The impact of environmental damage caused by the continuous use of chemical pesticides has begun to become the focus of attention of researchers. The residue left behind even pollutes the soil, water and even the production of these plants. Residues that stick to consumed agricultural products will endanger health. According to Amilia *et al.* (2016), pesticide residues in horticultural center areas have residue analysis values of around 10%, 20%, 60% and 82%, this has exceeded the MMR (Minimum Residue Limit) standard, namely 2 ppm. Apart from that, there is data that 10% of the 80 thousand types of pesticides and other chemicals circulating in the world cause around 1.4 million cancers (Shaleha *et al.* 2023). Previously it has also been reported that the dose used and frequency of pesticide application are related to the pesticide content attached to agricultural products (Suluh *et al.*, 2021). The negative impact of using chemical pesticides is what makes botanical pesticides (environmentally friendly and not harmful to health) the focus of researchers until now.

Farmers usually control pests using synthetic pesticides. The impact of environmental damage caused by the continuous use of synthetic pesticides has begun to become the focus of attention of researchers. The residue left behind even pollutes the soil, water and even the production of these plants. Residues that stick to consumed agricultural products will endanger health. According to Amilia *et al.* (2016), pesticide residues in horticultural center areas have residue analysis values of around 10%, 20%, 60% and 82%, this has exceeded the MMR (Minimum Residue Limit) standard, namely 2 ppm. Apart from that, there is data that 10% of the 80 thousand types of pesticides and other chemicals circulating in the world cause around 1.4 million cancers (Shaleha *et al.* 2023). Previously it has also been reported that the dose used and frequency of pesticide application are related to the pesticide content attached to agricultural products (Suluh *et al.*, 2021). The negative impact of using chemical pesticides is what makes botanical pesticides (environmentally friendly and not harmful to health) the focus of researchers until now.

The development of botanical pesticides, more commonly known as botanical pesticides, was developed by utilizing plants that have the potential to repel and kill insect pests. Fitri and Migunani (2014) have made tobacco-based pesticides which are used to control, repel, attract and eradicate various types of plant pest organisms. Tobacco leaf extract is able to prevent flea attacks on plants, prevent leaf curl disease and prevent borer pests. Nurmawati *et al.* (2022) have also developed the use of citronella extract as an ingredient in making botanical pesticides. Several studies have also used Javanese chili extract to control aphids and whitefly which attack many tomato plants. Therefore, the aim of this research is to determine the distribution of aphid pest insect populations in tomato planting areas where tobacco-based botanical pesticides with several formulations have been applied.

## 2. Materials and Methods

This research was done in horticultural experimental field, Budidaya Tanaman Pangan Department, Politechnic State of Lampung from April until October 2024. This research method is using by descriptive method. The materials that used were Tomato Servo F1 cultivated, tobacco leaves, Javanese chilies, citronella, lerak, water, alcohol 75%, manure, NPK fertilizer and silver black mulch. The research was carried out using a randomized block design arranged individually with the following combination of botanical pesticides: 100% tobacco (A), 50% tobacco+50% citronella (B), 75% tobacco+25% citronella (C), tobacco 50%+ Javanese chili 50% (D), tobacco 75%+ Javanese chili 25% (E), tobacco 33% + Javanese chili 33% + citronella 33% (F). In total there were 6 treatments which were repeated 4 times with each experimental unit consisting of 5 tomato plants.

The research procedure included seeding tomato plants, making botanical pesticides from tobacco leaves, citronella and dried Javanese chilies with a formulation following a combination of treatments (A, B, C, D, E and F). 100 grams of pesticide base ingredients are weighed and then soaked in 5 liters of water for 1 x 24 hours (botanical pesticide formulations can be seen in Table 1). After soaking for 24 hours, the extract is filtered and ready to be applied. 250 ml of extract was added to 750 ml of water by adding water soaked in 1 lerak fruit which functions as glue for botanical pesticides. Botanical pesticides were ready to be applied 2 times a week starting 3 weeks after transplanting. Parameter observed intensity of pest attacks, the incidence of curly disease and the pest population of *Aphids* sp. in the planting area is carried out every week and is calculated using the formula:

Intensity of *Aphids* sp. attacks:

$$IS = \frac{\Sigma(nxv)}{Z\ x\ N}\ x\ 100\%$$

Info: IS : Attacks intensity
n : Number of damaged leaves in each attack category
v : Damaged scale value
Z : The highest category scale value
N : Number of leaves observed

Diseases occurance : $\frac{n}{N} x\ 100\%$

Info : n : The number of plants with curl symptoms from the sample plants in each experimental unit
N : Total sample plants observed in the experimental unit

Table 1. Botanical pesticide formulations for each treatment

| Treatment | Component of Botanical Pesticides | Weight | Volume |
|---|---|---|---|
| A | Tobacco 100 % | 100 grams tobacco | 5 litre |
| B | Tobacco 50 % + Citronella 50 % | 50 grams tobacco + 50 grams citronella | 5 litre |
| C | Tobacco 75 % + Citronella 25 % | 75 grams tobacco + 25 grams citronella | 5 litre |
| D | Tobacco 50 % + Javanese chili 50 % | 50 grams tobacco + 50 grams Javanese chili | 5 litre |
| E | Tobacco 75 % + Javanese chili 25 % | 75 grams tobacco + 25 grams Javanese chili | 5 litre |
| F | Tobacco 33 % + Citronella 33 % + Javanese chili 33 %. | 33 grams tobacco + 33 grams citronella + 33 grams Javanese chili | 5 litre |

## 3. Results and Discussion

Botanical pesticides are poisons used to control plant pest organisms (OPT) with raw materials derived from plants which contain active ingredients that are toxic to OPT. The application of botanical pesticides with formulations A to F was able to reduce the population of aphids in the tomato plantation so that in the third to final week of observation not a single aphid pest was found on the leaves of the tomato plants (Figure 1. The use of botanical pesticide formulations B (tobacco 50% + citronella 50%), and F (tobacco 33% + citronella 33% + Javanese chili 33%) showed a tendency to increase the population of aphids from the first week to the second week of observation, but in the third week to the final week of observation can suppress the population so that no aphids were found in the tomato plantation. Formulations C, D and E showed that the total population in the first and second weeks of observation remained the same, while formulation A (100% tobacco) was proven to be able to reduce the population from the first week (Figure 1). Application of vegetable pesticides twice a week by following the spraying pattern commonly used by farmers shows very effective results in eradicating aphids.

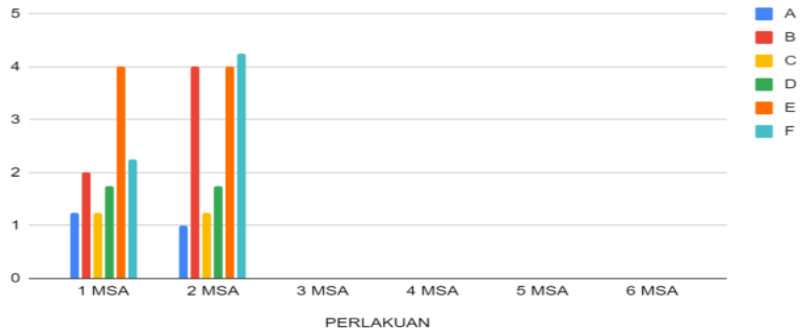


**Figure 1.** Aphid population in the 1st to 6th week of observation. (A:100% tobacco, B: tobacco 50% + citronella 50%, C: tobacco 75% + citronella 25%, D: tobacco 50% + javanese chili 50%, E: tobacco 75% + Javanese chili 25%, F: tobacco 33% + citronella 33% + Javanese chili 33%)

Tobacco-based botanical pesticides have been proven to be able to eradicate aphids in mixed or single formulations. Prabowo *et al.* (2024) stated that tobacco contains compounds that are toxic to insect pests. Some of the compounds contained in tobacco are acids, alcohols, aldehydes, ketones, alkaloids, amino acids, carbohydrates, esters and terpenoids. The results of testing compound content using Gas Chromatography-Mass Spectrometry (GC-MS) show that chemical compounds obtained from liquid tobacco smoke contain ketone, pyrolytic and acetic acid compounds (Suhendi, 2012). The highest compounds produced by liquid tobacco smoke are compounds from the phenol group (Booker *et al.* 2010).

The application of this tobacco botanical pesticide shows that the toxic content does not kill all herbivorous insects on the land. The insect population found in tomato planting areas consists of aphids (*Aphis gossypii),* whitefly (*Bemisia tabaci*), coccinellid and their larvae and armyworm larvae (*Spodoptera litura*) as shown in Figure 2. Coccinellid and their larvae and armyworm larvae It is more commonly found on the upper surface of tomato leaves so it is very easy to observe and control. Meanwhile, aphids and whitefly pests are found on the underside of tomato leaves, so careful observation and control measures are needed. This is in line with the attack pattern of whitefly and aphid pests which have piercing-sucking mouthparts. Aphids and whiteflies are often ignored by farmers because their position is always on the underside of the leaf surface so their presence is often not noticed. These two pests are virus vectors that will spread/transmit the virus from one plant to another. In line with the research results of Prabaningrum, *et al.* (2014), there are 10 main pests that attack tomato plants, namely earthworms, worms, snakebites, thrips, aphids, cutter flies, whitefly, fruit caterpillars and armyworms.

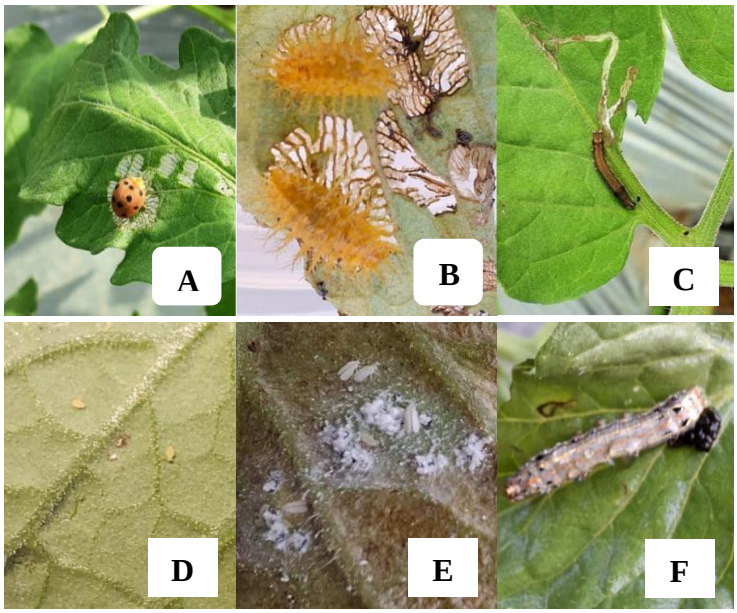


**Figure 2**. Herbivore insects found in tomato plantation areas. A. Coccinellid B. Coccinellid larvae, C. *Spodoptera*, sp. D. Green aphids, E. Whitefly (*Bemisia tabaci*), F. Armyworm larvae.

Symptoms of damage caused by aphids include curled plant leaves. This is what differentiates the characteristics of aphid attacks from thrips, both pests both cause symptoms of curling on the leaves. Aphids cause the leaves to roll to the bottom, while the symptoms of thrips attacks are leaves that roll to the top and a silver color appears on the bottom of the leaves (Figure 4). The level of damage from all pesticide formulations applied is still categorized as very low due to the intensity of aphid attacks. The incidence of curly disease was only found in the 1st and 2nd weeks (Figure 3), after which the tomatoes did not cause any further symptoms. This shows that the toxins or active ingredients in tobacco pesticides are able to inhibit the development of disease symptoms in tomato plants. According to Khanday *et al.* (2024), the phenol content of secondary plant metabolites can be used to control pests by inducing target plants to produce phenol to increase plant defense against pests.

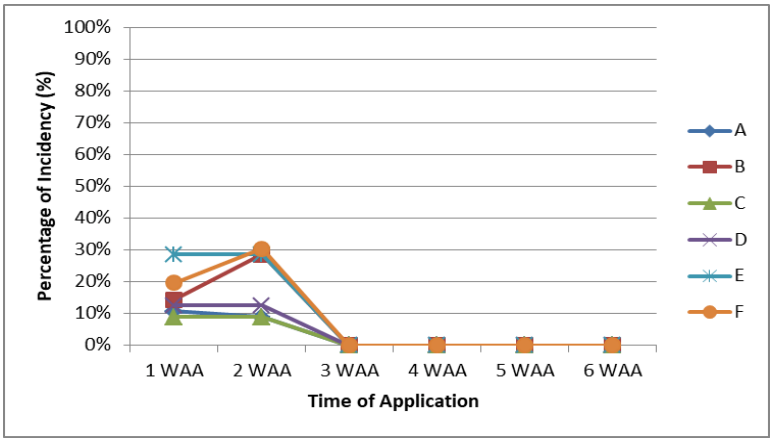


**Figure** 3. Incidency of Curly Sympyoms on Tomato After Application of Botanial Pesticides

**Figure 4**. Curl symptoms by *Aphis gosypii*

The intensity of the attacks was only found in the first and second weeks of observation (Figure 4). This correlates with the aphid population which was also found in the first and second weeks of observation. From the third to last week of observation, the intensity of attacks was able to be reduced to 0% by applying tobacco-based pesticide formulations in general with various formulations (A, B, C, D, E and F) in particular. The difference in formulation does not really show a different effect on the intensity of aphid attacks on tomato plants. This requires further testing to obtain the best formulation and dosage. However, the application of 100% tobacco-based botanical pesticides has shown a reduction in the aphid population and the intensity of aphid attacks starting from the first week of observation.

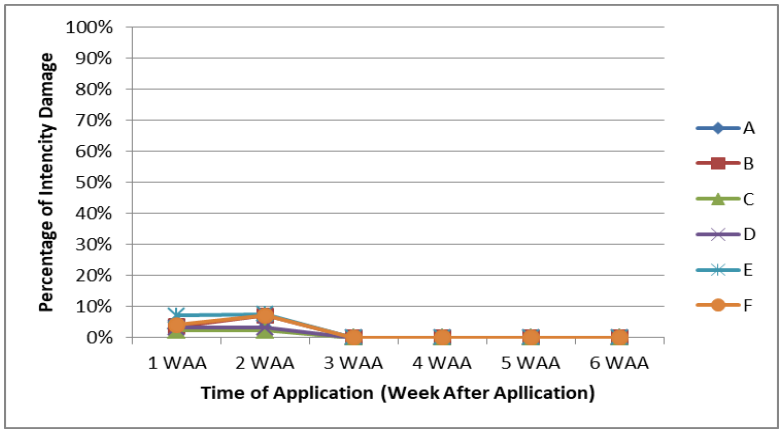


**Figure 5**. The damage intensity of aphids pesticide on tomato plant leaf damage from week 1st until the 6th week after applications

## 4. Conclusions

The application of tobacco-based botanical pesticides is very effective in suppressing the population of aphid. The spread of aphids in the tomato planting area was very low with the application of each pesticide formulation. The population aphids only 1-5 species appeared in the 1st and 2nd weeks after application. The disease incidence and intensity of aphid attacks were also able to be reduced to 100% from the 3rd week to the last of observation.

## 5. Conclusions

The authors would like to thank the Lampung State Polytechnic for providing research funding through applied lecturer research grants.

## References

[1] Amilia, E., Benny J., Sunardi. 2016. Residu Pestisida pada Tanaman Hortikultura (Studi Kasus di Desa Cihanjuang Rahayu Kecamatan Parongpong Kabupaten Bandung Barat). *Jurnal Agrikultura* Vol 27 No.1 : 23-29

[2] Arsi, Andika, T.S., Kevin C.B.P , M. Rafii F, Fitra G, Irmawati , Suparman SHK , Harman H, Yulia P, Bambang G, Abu U, Nurhayati. 2021. Keanekaragaman Arthropoda dan Intensitas serangan pada Tanaman Cabai (Capsicum Annum L,) Di Desa Tanjung Pering Kecamatan Indralaya Utara. *Jurnal Ilmiah Matematika dan Ilmu Pengetahuan Alam*. Vol. 18 No. 2: 183-198

[3] Central Berau of Statistic (CBS). 2024. Produksi sayur-Sayuran di Indonesia Th 2018-2021.

[4] Booker, C.J., Bedmutha, R., Vogel, T., Berruti, F., Briens, C., Yeung, K.K.-C., Scott, I., Conn, K. Characterization of the pesticides properties of tobacco Bio-oil. *International Journal of Chemical Reactor Engineering*. Vol. 8, Article A.26: 1-14.

[5] Fitri, M. dan Migunani, S. 2014. Pembuatan pestisida menggunakan tembakau. Jurnal Inovasi dan Kewirausahaan.

[6] Vol. 3. No. 2: 68-71.

[7] Hasfikasari, P., Faradiba, Amin, A. 2024. Review Artikel: Aktivitas antioksidan ekstrak buah tomat (*Solanum lycopersicum* L). *Makassar Natural Product Journal*. Vol. 1. No. 5: 43-50.

[8] Junnaeni, Hahati, E., Maharani, N. 2019. Ekstrak tomat (*Lycopersicon esculentum* Mill) menurunkan kadar glutation darah tikus wistar hiperurisemia. *Jurnal Kedokteran Diponegero*. Vol. 8. No. 2: 758-767.

[9] Khanday, A.H., Irfan B., Nasir, A.W., Shah R. 2024. Plant Phenolics in Biotic Stress Management : Role of Phenolic Compounds in Disease Resistance to Plants. DOI: 10.1007/978-981-99-3334-1_19

[10] Nurmawati, A., Anggraeni, I.F., Raditya, D.W., Pradana, N.S., Puspitawati, I.N., Saputro, E.A. 2022. Pengenalan pemanfaatan ekstrak serai wangi sebagai bahan pestisida organik di Desa Bocek Karangploso Malang. Vol. 3. No. 1: 110-116.

[11] Paruntu, M., Pinontoan, O., Mamahir, E. 2016. Jenis dan populasi serangga hama pada pertumbuhan dan perkembangan beberapa varietas tomat (*Lycopersicum esculentum* Mill.). *Jurnal Bioslogos*. Vol. 6 No.1: 7-14.

[12] Prabaningrum, L., Moekasan, T.K., Adiyoga, W., De Putter, H. Panduan Praktis Budidaya Tomat Berdasarkan Konsep Pengendalian Hama Terpadu (PHT). Penebar Swadaya Group. 66 hal.

[13] Prabowo, H., Damaiyani, J., Nurnasari, E., Adikadarsih, S. 2024. Diversifikasi tembakau sebagai pestisida nabati untuk mendudkung pertanian berkelanjutan. *Warta BSIP Perkebunan*. Vol. 2 No. 1: 1-6.

[14] Shaleha, B.A., Afifah, F., Salamah, N.P., Nursehha, S., Rozni, Z.H.N., Sulistyorini, D. 2023. Potensi dampak kandungan residu pestisida pada sayur dan buah. *Indonesian Journal of Biomedical Science and Health*. Vol. 3. No. 1: 1-10

[15] Suluh, D. G., Telan, A. B., Sadukh, J. J. P. 2021. Analisa Faktor Yang Mempengaruhi Kandungan Pestisida pada Hasil Pertanian Di Wilayah Kabupaten Kupang Tahun 2019. Jurnal.Poltekeskupang 4 (2): 1–10.

[16] Suhendi, E. 2012. Pirolis limbah batang daun tembakau. Tesis Teknik Kimia Universitas Gadjah Mada. https://etd.repository.ugm.ac.id/penelitian/detail/57168 diakses 17 Oktober 2024.