BALTIC JOURNAL OF LAW & POLITICS
A Journal of Vytautas Magnus University
VOLUME 16, NUMBER 3 (2023)
ISSN 2029-0454

Cite: *Baltic Journal of Law & Politics* 16:3 (2023): 3176-3185
DOI: 10.2478/bjlp-2023-00000237

APPLICATION OF TOBACCO (Nicotiana tabacum L.) WASTE EXTRACT BIOPESTICIDE ON ATTACK INTENSITY OF Plutella xylostella L. PESTS ON FLOWER CABBAGE (Brassica oleracea var. Botrytis L.)

Lilis Irmawatie
Lecturer in the Agrotechnology Study Program, Faculty of Agriculture, UNINUS
Email: lilisirmawatie@uninus.ac.ic

Diman Sopian Sopandi
Students of the Agrotechnology Study Program, Faculty of Agriculture, UNINUS
Email: dimansopian@uninus.ac.id

Shilmuluk
Islamic University of Nusantara Bandung
Email: shilmuluk@uninus.ac.id

Siti Nurrahmawati
Islamic University of Nusantara Bandung
Email: sitinurrahmawati@uninus.ac.id

Taryandi Mustofa
Islamic University of Nusantara Bandung
Email: taryandimustofa@uninus.ac.id

Received: December 21, 2022; reviews: 2; accepted: January 10, 2023

ABSTRACT

Plutella xylostella L. (cabbage caterpillar) is one of the most damaging main pests on Brassica olerace ae (cabbage flower) plants. Synthetic pesticides can control pests quickly and are very practical in their use. However, it leaves damage to the environment, especially soil by killing soil microorganisms that are useful for plant growth. Therefore, an alternative control that is environmentally friendly and effective is needed to reduce the intensity of pest attacks. The aim of this study was to determine the most effective concentration of the tobacco stem waste extract, Nicotiana tabacum L, to suppress the intensity of P. xylostella attack on cauliflower plants. This research was conducted in Kp. Cipariuk, Ds. Srirahayu district. Cikancung Kab. Bandung West Java Province. The method used was a randomized block design (RBD) with 5 treatments and 5 replications. Cabbage plants without insecticide treatment as control (P0), first treatment using synthetic insecticide (P1) Cypermethrin 50 EC 1.5 ml/L water (as comparison), second treatment using tobacco stem waste extract 30 ml/L, third treatment stem waste extract tobacco 40 ml/L and the fourth treatment of tobacco stem waste extract 50 ml/liter of water. The results showed that the treatment of tobacco stem waste extract at a concentration of 50 ml/L of water had a significant effect on reducing the intensity of P. xylostella attack. with the lowest level of damage of 13.60 % compared to control (P0). But not significantly different from the treatment using synthetic insecticides (P1).

Keywords

Tobacco Waste, *Nicotiana tabacum, Plutella xylostella, Brassica oleracea,* Biopesticides.

Introduction

Cauliflower (Brassica *oleracea var. Botrytis L.)* comes from two Latin words, namely *caulis* which means cabbage and *floris* which means flower. The region of Italy is generally known as the origin of broccoli and cauliflower (Haryanti et al., 2020). *Brassica oleracea* including horticultural crops that can be consumed as a complementary vegetable for cooking, especially by the people of Indonesia.

Cauliflower plants are very rich in vitamins and other compounds that are beneficial to health. This plant contains compounds such as *lupeol, sinigrin,* and *sulforaphane* which can inhibit tumor growth and cancer. Vitamin K and anthocyanins can maintain brain condition and improve memory and concentration. Compounds of vitamin C and sulfur are very useful in removing toxins from the body that cause diseases such as arthritis, skin diseases, rheumatism, and gout.(Rukmana & Yudirachman, 2023).

Production of cauliflower has increased significantly, namely in 2019 to 2020 from 183,816 tons, an increase of 5.26% to 204,238 tons. Then it decreased in 2021 by 203,385 tons, and in 2022 production fell by 2.85% to 192,121 tons. Fluctuations in the production value (Badan Pusat Statistik, 2022).of cauliflower are inseparable from the risk of pest attack, including the pest *P. xylostella*.

P. xylostella belongs to the order *Lepidoptera,* family *Plutellidae* is one of the main pests that is most damaging to *Brassicaceae plants*(Huaripata & Sánchez, 2019). This is *because P. xyl ostella .* oligophagous _ (Farias et al., 2020). These pests will burrow into the crop and destroy the growing point (Erdiansyah et al., 2021). The yield loss caused *by P. xylostella* can reach 100% if control is not used using insecticides (Permadani and Sastrosiswojo, 1993;(Fifi andriani et al., 2022)

Synthetic insecticides have negative impacts, including the possibility of pests becoming resistant, resurgence occurring, the potential to create epidemics, killing natural predators, accumulation of chemical residues on plant parts that have the potential to poison livestock and other organisms, and cause environmental pollution. The use of synthetic insecticides also often causes operating accidents for users which can cause poisoning, blindness, infertility and other adverse effects (Nurmianti & Gusmarwani, 2020). So, farmers need to consider alternative ways that are more effective and safer for the environment, including using vegetable insecticides (Husein, 2022).

single or multiple active ingredients derived from plants that can be used to control Plant Pest Organisms (OPT). This vegetable insecticide usually functions as a repellent, attractant, antifertility (sterile), and killer. The properties of vegetable insecticides are generally harmless to humans or the environment and are easily decomposed compared to synthetic insecticides. (Nadila Kaimudin & Sumbono, 2020). Advantages Botanical insecticides or bioinsecticides have very low toxicity to humans, animals and the environment and do not interfere with non-target organisms (Puspa et al., 2022)

insecticide ingredients can be obtained from various plants, besides that there are some that can be obtained from agricultural waste such as tobacco stem waste (Sarjan et al., 2020). Tobacco stem waste (Nicotiana *tabacum)* is one of the ingredients that is thought to be used as a vegetable insecticide to suppress *P. xylostella* attack, because the results of one study stated that *antifeedant* activity *bio oil* from tobacco stem waste, namely in the application of 1% *bio oil, showed an antifeedant* percentage of *S. litura* of 80.65% within 24 hours after application. (Heri Prabowo et al., 2021). Furthermore, giving tobacco extract a volume of 30 ml (the highest concentration) had a more effective effect in suppressing the number of larvae, pupa, and imago (Muhiddin Palennari & Hartati, 2009).

This shows that the presence of vegetable insecticides themselves is important to serve as a source of parameters in an effort to replace synthetic insecticides that are not environmentally friendly, especially in the Cikancung District, Bandung Regency. The area contains a lot of tobacco stem waste resulting from harvesting which has the potential to be an alternative material for making vegetable insecticides. So, the purpose of this study was to determine the effect of tobacco stem waste extract and to determine the best concentration in suppressing attack intensity (*Plutella xylostella)* on cauliflower (*Brassica oleracea var. Botrytis L.*)

RESEARCH METHODS

This research was conducted in Kp. Cipariuk, Ds. Srirahayu district. Cikancung Kab. Bandung West Java Province. The location is located at an altitude of ± 942 masl at position 7 °south latitude 107 °east longitude with hilly topography in terms of geology. The average daily temperature is 21℃.

Based on the results of the preliminary test using the interview method, farmers in Kp. Cipariuk generally controls *P. xylostella pests* using synthetic insecticides with the active ingredient Cypermethrin 50g/L water.

Method Which used in study is Draft Random Group (RAK) with 5 (five) treatments and 5 replications. Treatment the concentration of the insecticide in question is

 ISSN 2029-0454

P 0: Control,
P 1: 1.5 ml / L water Cypermethrin 50 EC
P 2: 30 ml / L water tobacco stem waste extract
P 3: 40 ml / L of tobacco stem waste extract water
P 4: 50 ml / L of tobacco stem waste water extract.

PRODUCTION AND APPLICATION OF VEGETABLE INSECTICIDES

In the manufacture of tobacco stem waste extract, namely as much as 15 kg of wet tobacco, cut into 2-4 cm pieces after that it is put into a container to be pulverized using a blender plus 500 ml of water, the result is filtered and stored in a plastic bottle. As a comparative test using the active ingredient Sipermethrin 50 EC.

There were 7 (seven) applications of vegetable insecticides for extracts of tobacco stem waste and counted 1 (one) observation with the following schedule:

a. Application I : 10 days after planting (HST)
b. Application II : 15 days after planting (HST)
c. Application III : 20 days after planting (HST)
d. Application IV : 25 days after planting (HST)
e. Application V : 30 days after planting (HST)
f. Application VI : 40 days after planting (HST)
g. Application VII : 50 days after planting (HST)

The need for vegetable insecticides with a ratio for one treatment is: P0: 0 ml (control); P1: 5.25 ml; P2: 150 ml; P3: 200 ml; and P4: 250 ml.

RESEARCH PARAMETERS

Parameters observed were pest attack intensity, fresh chestnut weight, crop weight and crop diameter. The parameters of this study were divided into two parts, the first was the damage to the intensity of the attack caused by P. silostella, the second was the components of the results of the study, including fresh chestnut weight, crop weight and crop diameter.

attack intensity was carried out 1 week before harvest, so that the final results were tested using the ANOVA test and continued with Duncan's multiple range test at 5% level. The observation results also calculated the efficacy level of tobacco stem waste extract according to Kusnanto's research (2019) using the Abbott formula (Kusnanto et al., 2019; Martono, 1999):

$$EI = \frac{Ca - Ta}{Ca} \times 100\%$$

EI : Efficacy of tested insecticides (%)
Ta : The intensity of the target pest or the percentage of damage to plants in the insecticide treatment plots tested after spraying the insecticide.
Ca : The intensity of the target pest or the percentage of damage to plants in

the control plot after spraying insecticides.

An insecticide formulation is said to be effective if at least (1/2 n+1) observations (n=total number of observations after application), the insecticide efficacy level (EI) is ≥ 70% provided that the target pest population or plant damage level in the plot the insecticide treatment tested was lower or not significantly different from the pest population or the degree of damage to plants in the control insecticide treatment plots (5% significance level) and/or the target pest population or the level of plant damage in the insecticide treatment plots tested was significantly lower than the pest population or level of plant damage in the control plot (5% significance level).

Yield components consist of fresh chestnut weight, head weight and head diameter. Yield component data is collected at harvest time, such as weighing fresh chestnut weight and crop weight then measure the length of the crop diameter. The yield components were tested with ANOVA and Duncan's follow-up test at 5% level to determine the effect of the treatment given.

RESULTS AND DISCUSSION

Pest Attack Intensity

The results of the analysis of variance showed that the application of biopesticide extracts from tobacco stem waste had a significant effect. To determine the effect of each biopesticide concentration treatment on the intensity of *P. xylostella attack,* Duncan's 5% multiple range test was carried out which is presented in table 1 below.

Table 1. Intensity of Pest Attack

Treatment	***Plutella xylostella L.*** **average intensity (%)**
P0 (control) Without Treatment	37.60 [a]
P1 (Cypermethrin 1.5 ml/L water)	21.20 [ab]
P2 (tobacco stem waste extract 30ml/L water)	17.20 [b]
P3 (tobacco stem waste extract 40ml/L water)	14.00b –
P4 (tobacco stem waste extract 50ml/L water)	13.60 [b]

Note: Treatment followed by the same letter shows differently not significant at the 5% level of Duncan's multiple range test.

Table 1 Duncan's 5% Multiple Range Test, showing results that were not significantly different in the control concentration plot (P1) 1.5 ml/ L of water with the concentration being treated, namely (P2) 3 0 ml/ L water; (P3) 40 ml/L water; and (P4) 50 ml/ L of water, with%;e average attack intensity of each treatment plot, namely (P1) 21.2 % ; (P2) 17.2 0 % ; (P3) 4.00 %, and (P4) 13.6 % . However, the results showed a significant difference in the treatment of plant-based insecticides from tobacco stem waste

ISSN 2029-0454
2023

at a concentration (P2) of 30 ml/L of water; (P3) 17.20 ml/L water, (P4) 50 ml/L water with control plot (P0); with an average attack intensity (P2) of 17.20%; (P3) 14.00 % and 13.60 % (P4) and (P0) 37.60 %.

The results of the application of biopesticides in tobacco stem waste extract were not significantly different from those of synthetic pesticides at a concentration of 1.5 ml/L of water, indicating that the biopesticide tests could suppress the intensity of *P. xylostella attacks.* This is because the process of spraying biopesticide particles can affect the insect's skin and seep into the insect's skin cells (Purnamaningsih et al., 2017). In addition, nicotine compounds contained in tobacco stem waste assisted by the presence of saponin compounds will play a role in breaking down insect skin cell walls, so that nicotine compounds can enter the nucleus of nerve cells. The properties of saponin compounds which are similar to surfactants can reduce cell surface tension and damage cell and protein permeability (Purnamaningsih et al., 2017). The working characteristics of nicotine insecticides which are *similar* to carbamates will function to inhibit the enzyme hydroxy *cetylcholinesterase (* AChE). *Acetylcholinesterase* is an enzyme located in the central nervous system that hydrolyzes the acetylcholine neurotransmitter which works to continue nerve stimulation. (Asep Sukohar, n.d.). The disrupted work of acetylcholine will cause a delay in the distribution of nerve impulses and in the long term it will hamper the work of insect nerve cells. (Dhamayanti & Saftarina, 2018).

Based on the explanation above, it is suspected that the application of biopesticides to cauliflower plants has a significant effect on decreasing the nerve performance of *P. xylostella,* so that the intensity of attacks on cauliflower plants decreases.

Yield Component

The results of the analysis of variance showed that the concentration of biopesticide treatment did not give a significant difference to the average fresh stover weight, head weight and head diameter. To determine the effect of various concentration levels of biopesticides on growth components, Duncan's 5% multiple range test was carried out which is presented in table 2. below.

Table 2. Average Component Results

Treatment	Average Yield Component		
	Rata-rata Berat Brangkasan Segar (ons)	**Rata-rata Berat Krop (ons)**	**Rata-rata Diameter Krop (cm)**
P0 (control)	4.88 a	5.89 a	10.86 a
P1	7.39 a	4.71 a	9.76 a
P2	8.86 a	6.71 a	12.38 a
P3	8.63 a	5.68 a	12.04 a
P4	7.76 a	6,15 a	9.35a –

Note: Treatment followed by the same letter shows differently not significant at the 5% level of Duncan's multiple range test.

Table 2. Shows the administration of vegetable insecticide treatments with various concentrations, did not give a significant difference to the average fresh stover weight, head weight, and head diameter.

The lowest average fresh stover weight was found at P0 (control), which was 4.88 ounces. While the highest average was found at (P2) a concentration of 30 ml/L of water (P2), which was 8.86 ounces.

Treatment of biopesticide concentrations of tobacco stem waste extract on fresh stover with treatment P1 (1.5 ml/L water; weight of stover 7.39 ounces), P2 (30 ml/L water; weight of stover 8.86 ounces), P3 (40 ml /L water; stover weight 8.63 ounces) and P4 (50 ml/L water; stover weight 7.76 ounces) showed no significant difference with P0 (control; stover weight 4.88 ounces).

Treatment of biopesticide concentrations of tobacco stem waste extract on head weight with treatment P1 (1.5 ml/L water; crop weight 4.71 ounces), P2 (30 ml/L water; crop weight 6.71 ounces), P3 (40 ml /L water; head weight 5.68 ounces) and P4 (50 ml/L water; head weight 6.15) with P0 (control; head weight 5.89 ounces), also showed no significant difference.

Treatment of biopesticide concentrations of tobacco stem waste extract on crop diameter with treatment P0 (control; crop diameter 10.86 cm), P1 (1.5 ml/L water; crop diameter 9.76 cm), P2 (30 ml/L water; crop diameter 12.38 cm), P3 (40 ml/L water; crop diameter 12.04 cm) and P4 (50 ml/L water; crop diameter 9.35 cm) had the same results, that is, they did not show significant differences.

Based on observations, cabbage plants grow normally and healthy. There were no symptoms of phytotoxicity and other abnormal symptoms due to the application of biopesticide extracts of tobacco stem waste with different concentration levels. So, these results indicate the use of biopesticide extract of tobacco stem waste does not have a negative impact on the growth of cauliflower plants.

Although the growth process of this plant can also be influenced by the conditions of the place, land preparation, maintenance and application of synthetic fertilizers such as NPK which contain nutrients, nitrogen, phosphorus and potassium so as to support growth. (Kaya et al., 2020; Nurtika & Gunadi, 2009). but the use of biopesticide extract from tobacco stem waste can be said to be safe for the environment and does not interfere with the growth process of cabbage plants.

Based on the observations in table 2 above, it can be concluded that the application of bioinsecticide extract of tobacco stem waste had no effect on the three growth factors of cauliflower plants, namely fresh stover weight, head weight, and head diameter. These results are in line with previous studies that have been conducted Naikofi & Rusae, (2017)on the effect of PGPR applications and types of pesticides on the growth and yield of lettuce plants which show no effect of the application of biopesticides on the growth of lettuce plants.

CONCLUSION

Based on the research test results of each treatment application the concentration of tobacco stem waste extract can be said as follows, namely:

1. Testing the application of biopesticides with each treatment of the concentration of tobacco stem waste extract had an effect on suppressing the attack intensity of the caterpillar pest *Plutella xylostella* L. on cauliflower (Brassica *oleracea* var. Botritis L.)
2. The application of tobacco stem waste extract with a concentration of 50 ml/L of water was declared the best and most effective in suppressing the attack intensity of *Plutella xylostella* L. pests on cauliflower (Brassica *oleracea* var. Botritis L.).
3. Based on these results it can be concluded that the use of tobacco stem waste extract biopesticides has no effect on the growth process of cauliflower plants.

Suggestion

It is necessary to carry out further research on the application of bioinsecticides from tobacco stem waste extract on the mortality of *P. xylostella,* in different topography in order to determine the effectiveness of these bioinsecticides on cultivated plants.

BIBLIOGRAPHY

Asep Sukohar, D. (nd). *Neupharmacology-Acetylcholine and Nore Epinephrine.*

Central Bureau of Statistics. (2022). *Data on Vegetable Plant Production Results.* Bps. Go. Id. https://www.bps.go.id/site/resultTab

Dhamayanti, FA, & Saftarina, F. (2018). *Neurobehavioral Effects of Chronic Exposure to Organophosphates in Farmers.* In *J Agromedicine* | (Vol. 5).

Erdiansyah, I., Eliyatiningsih, E., Sari, V. K., & Nurahmanto, D. (2021). *Utilization of javanese ginseng and citronella for insect diversity in Pace village, Jember regency*. *IOP Conference Series: Earth and Environmental Science*, *672*(1), 012096. https://doi.org/10.1088/1755-1315/672/1/012096

Farias, E. S., Santos, A. A., Ribeiro, A. V., Carmo, D. G., Paes, J. S., & Picanço, M. C. (2020). *Climate and host plants mediating seasonal dynamics and within-plant distribution of the diamondback moth (Plutella xylostella). Crop Protection*, *134*, 105172. https://doi.org/10.1016/j.cropro.2020.105172

Fifi andriani, Tarmizi, & Ruth Stella. (2022). *Plutella Xylostella and Crocidolomia binotalis Pest Populations on Cabbage (Brassica oleracea L.) With Cover Net Treatment*. Agrocomplex Student Scientific Journal, 1(1), 29–37. https://doi.org/10.29303/jima.v1i1.1204

Haryanti, D., Efendi, D., & Sobir, D. (2020). *Morphological Diversity and Yield Components of Cabbage (Brassica oleracea var. botrytis L.) in the Highlands and Lowlands.* Indonesian Agronomy Journal (Indonesian Journal of Agronomy), 47(3), 291–298. https://doi.org/10.24831/jai.v47i3.25902

Heri Prabowo, Sigid Handoko, Miswarti, Sri Widyaningsih, Harwanto, & Susi Wuryantini. (2021). *Bio Oil of Waste Tobacco Stem: Extraction, Physicochemical Properties, and Its Biological Activities.* Drug and Alcohol Research, 10(3).

Huaripata, C., & Sánchez, G. (2019). *Life Cycle of the Diamondback Moth Plutella xylostella L. (Lepidoptera: Plutellidae), in Broccoli and Cauliflower under Laboratory Conditions.* Peruvian Journal of Agronomy, 3(1), 1. https://doi.org/10.21704/pja.v3i1.1132

Husein, IK (2022). *Efficacy of Concentration Variation of Jengkol Peel Extract (Pithecellobium Lobatum Benth) Against Cabbage Head Caterpillar (Crocidolomia Pavonana Fabricus* [Thesis]. Siliwangi University.

Kaya, E., Mailuhu, D., Kalay, AM, Talahaturuson, A., & Hartanti, AT (2020). *The Effect of Biological Fertilizers and NPK Fertilizers to Increase the Growth of Tomato Plants (Solanum lycopersicum) Planted in Soil Infected with Fusarium Oxysporum.* Agrologia, *9* (2), 81–94.

Kusnanto, J., Kurnia Dewi, TS, Budiyono, A., Suprapti, E., & Haryuni, H. (2019). *Efficacy Test of Insecticide Active Ingredients Permethrin 300 G/L Against Leaf Caterpillar Pest Populations (Plutella xylostella L) on Cabbage (Brassica oleracea). SCIENTIFIC JOURNAL OF AGRINECA, 19* (2). https://doi.org/10.36728/afp.v19i2.903

Martono, E. (1999). *Consideration of Population Fluctuations in Pesticide Efficacy Calculations*. Indonesian Journal of Plant Protection, 5(1), 60–66.

Muhiddin Palennari, & Hartati. (2009). *The Effect of Tobacco Extract as a Botanical Insecticide on the Development of Fruit Flies (Drosophila Melanogaster)* . Bionature, 10(2), 79–83.

Nadila Kaimudin, S., & Sumbono, A. (2020). *Toxicity Identification of Smilax Sp Solution on Culicidae Behavior*. *7* (2), 2406–8241.

Naikofi, YM, & Rusae, A. (2017). *The Effect of PGPR Application and Types of Pesticides on the Growth and Yield of Lettuce (Lactuca sativa, L.).* Journal of Dryland Conservation Agriculture International Standard of Serial Number (Vol. 2, Issue 4).

Nurmianti, L., & Gusmarwani, R. (2020). *Determination of Lethal Dose 50% (Ld50) of Botanical Pesticides from a Mixture of Bintaro Fruit, Lemongrass, Garlic, Galangal (Cooking Time Variables and Ratio of Each Ingredient).* Journal of Process Innovation, 5(1).

Nurtika, N., & Gunadi, and N. (2009*). Response of Tomato Plants to the Use of NPK 15-15-15 Compound Fertilizer on Latosol Soil in the Dry Season*. In J. Hort (Vol. 19, Issue 1).

Purnamaningsih, H., Nururrozi, A., & Indarjulianto, S. (2017). *Saponins: Impact on Livestock (Review) Saponins: Impact on Livestock* (A Review). In Sriwijaya Animal Husbandry Journal (Vol. 6, Issue 2).

Puspa, M., Anggraini, D., Susilowati, &, Histopathological Changes, RP, Anggraini, D., Sari, MP, & Susilowati, RP (2022). *Midgut Epithelial Cells of Aedes aegypti Mosquito Larvae Due to Exposure to Botanical Insecticides.* In Journal of MedScientiae (Vol. 1, Issue 1). Link. http://ejournal.ukrida.ac.id/ojs/index.php/ms/article/view/2440/version/2432

Rukmana, R., & Yudirachman, H. (2023). *Baby Vegetable Business and Cultivation* (I. Kurniawan, Ed.; 2nd ed.). Scholarly Nuance.

Sarjan, M., Fauzi, MT, Thei, RSP, & Wirdianingsih, M. (2020). *Introduction of Botanical Pesticides From Tobacco Stem Waste to Control Whitefly (Bemisia Tabaci) Pests on Potato Plants.* Journal of Service Master of Science Education, 3(2). https://doi.org/10.29303/jpmpi.v3i2.508