The Potential of Cigarette Butt Extract Against Bemisia Tabaci in Tomato

Sri Nur Aminah[1*], *Melina* Melina[1], and *Adelia* Kusuma[2]

[1]Department of Plant Pests and Diseases, Faculty of Agriculture, Hasanuddin University, 90245, Makassar, Indonesia
[2]Department of Plant Pests and Diseases, Faculty of Agriculture, Hasanuddin University, 90245, Makassar, Indonesia

Abstract. Innovation used cigarette butt extract added papaya leaves and banana stem against *Bemisia tabaci* Gennadius (Hemiptera: Aleyrodidae) become alternative reduce synthetic pesticide application in horticultural plant. The liquid do not produce residues on plant or soil. The aim of the research is to determine the effectiveness of cigarette butt, papaya leaves and banana stems in controlling *B. tabaci* on tomato. The research was conducted at the Basic Chemistry Laboratory, Faculty of Mathematics and Natural Sciences, Hasanuddin University to prepare cigarette butt, nicotine maceration and nutrient content tests. Field trials were conducted at the experimental site of the Department of Plant Pests and Diseases, Faculty of Agriculture, Hasanuddin University from September to December 2022. Five types of treatment applied on tomato plants: P0 (control), P1 (cigarette butt extract + papaya leaves), P2 (cigarette butt extract), P3 (banana stem waste) and P4 (cigarette butt extract + banana stem + papaya leaves). The result showed different results of each treatment. The highest *B. tabaci* attacked intensity at P0 (100%) and P3 (100%) while the lowest at P4 (33.3%). The highest growth height of tomato plant showed in P4 (33.3 cm) and the lowest in P3 (28.8 cm). The highest number of tomato leaves in P4 (49.7 leaves) and the lowest in P3 (36.3 leaves). The result indicated combine extract of cigarette butts, banana stem and papaya leaves increasing plant health and able reduce the attack intensity of *B. tabaci.*

1 Introduction

Bemisia tabaci Gennadius or tobacco whitefly (Hemiptera: Aleyrodidae) as the common insect pest on crops. In general, *B. tabaci* spread well in the tropical and subtropical region. Presence of *B. tabaci* in the field very important because its polyphagous and cause damaged of tomato, eggplant, chilli, legumes and etc [1, 2]. The agricultural field condition in dry and hot temperature supporting development of *B. tabaci.* In contrast, the rainy season caused decreased population of *B. tabaci* on the field. Commonly whitefly or *B. tabaci* active under host plant leaves and avoid the sunlight. The body measurement of *B. tabaci* adult about 1 - 1,5 mm, dominant white and the wings covered by wax layer. The life cycle of *B. tabaci*

* Corresponding author: nur-aminah@agri.unhas.ac.id

started from egg to adult approximately 21 – 24 days [3]. In general, *B. tabaci* damage divide into three types: a) direct effect [4] and b) indirect effect such as spread the very infective virus [5, 6, 7]. The immature stage as a nymph caused direct effect because sucking the leaves, chlorosis then leaves fall and death [8, 9]. The recent study [10] reported that more nitrogen fertilizer used possible increasing presence of *Aphis gossypii* in plants. This is need to be balanced with the application of botanical insecticides for safety environment.

Combination from cigarette butt extract, papaya leaves and banana stem waste has potential control presence *B. tabaci* on tomato. All of the material easier find around agricultural ecosystem and potential reduce synthetic insecticide application. Study on the past [11, 12] reported that natural metabolites originally from tobacco *Nicotiana tabacum* such as nicotine. There are most abundant and since long time known as toxic plant secondary metabolites. The compound able inhibit development of insect pest including *B. tabaci* or tobacco whitefly. Beside *B. tabaci*, another study reported that nicotine from cigarettes very poisonous for Colorado potato beetle (*Leptinotarsa decemlineata*) [9]. Also, papaya leaf extract able to control rose aphids (Macrosiphum rosaeformis) [13]. The aim of the research is to determine the effectiveness of cigarette butt, papaya leaves and banana stems in controlled *B. tabaci* on tomato.

2 Methodology

2.1 Research site

The research was conducted at the Basic Chemistry Laboratory, Faculty of Mathematics and Natural Sciences, Hasanuddin University to prepare cigarette butt, nicotine maceration and nutrient content tests. Field trials were conducted at the experimental site of the Department of Plant Pests and Diseases, Faculty of Agriculture, Hasanuddin University from September to December 2022.

2.2 Cigarette butt preparation and nicotine maceration

Collected of cigarette butt waste about 500 g was pulverized using a dry material blender. Nicotine maceration was started by soaked cigarette butt waste in the glass jar containing 10 L of 96% ethanol solvent for two times soaking (2 × 24 hours). During the first soaking, 8 L ethanol used and the second soaking used 7 L ethanol. Cigarette butts had been soaked in ethanol used 10 L glass jar were stirred used a spatula. Close the jar was tightly used aluminum foil on the lid. After soaking, the solution was filtered used filter paper. The solvent and nicotine were separated used a rotary evaporator to get pure nicotine. The Fourier Transform Infrared Spectroscopy (FTIR) test was carried out to determine the presence of nicotine in the extracted cigarette butt waste [14, 15].

2.3 Insecticide from cigarette butt extract and papaya leaves

The result of cigarette butts maceration is 5 g of nicotine extract diluted used 1 L of distilled water. One part mixed well with blended papaya leaves for treatment. Another alternative to make cigarette butts insecticide easier for farmers was soak 40 cigarette butts (about 40 g) in 1 L water in a glass jar mixed the papaya leaves (increasing poisoining ability). Stirred until the extract comes out and close tightly for 24 hours.

2.4 Banana stem waste as liquid fertilizer

The materials used 3 kg of chopped of banana stem waste, 250 g of brown sugar dissolved in 1 L of water, 1 L of coconut water, 1 L of rice washing water, EM-4 and clean water. All prepared ingredients put into the sack and allowed to sink. Close the plastic container and wrapped with duct tape to prevent entering air and insects. Insert the hose into the bottle filled water with the lid duct-taped. Liquid fertilizer ready to use after 21 days [14].

2.5 Treatment to tomato

Insecticide and banana stem waste liquid fertilizer was applied to tomato plant (30 day after planting) used 5 treatment and 3 replication. Each replication used 9 tomato plants. Five types of treatment applied on tomato plants: P0 (control), P1 (cigarette butt extract + papaya leaves), P2 (cigarette butt extract), P3 (banana stem waste) and P4 (cigarette butt extract + banana stem + papaya leaves).

2.6 Data analysis

Effectivity of cigarette butt extract used parameter intensity of insect pest attacked with the formula [16] :

$$I = a/b \times 100\% \quad (1)$$

with description I intensity of *B. tabaci* , a number of tomato plant in field attacked by *B. tabaci*, b total of tomato plant

3 Result and discussion

Based the result of research, the average tomato attacked intensity by *B. tabaci* showed in the Table 1.

Table 1. The average tomato attacked intensity by *B. tabaci*.

Treatment	Observation (day after planting)			
	30	**37**	**44**	**51**
P0	0	33.3^{a}	100^{c}	100^{c}
P1	0	0	33.3^{a}	66.7^{b}
P2	0	33.3^{a}	33.3^{a}	66.7^{b}
P3	0	33.3^{a}	66.7^{b}	100^{c}
P4	0	0	0	33.3^{a}

Treatment: P0 (control), P1 (cigarette butt extract + papaya leaves), P2 (cigarette butt extract), P3 (banana stem waste), P4 (cigarette butt extract + banana stem + papaya leaves)

The analysis content of nicotine on cigarette butt used Fourier Transform Infrared (FTIR) in the wavelength around 4000 showed nicotine has oxygen and nitrogen in form O-H, N-H, C=O detected in areas 1745.58 cm^{-1}. It showed presence of carbonil C=O and the areas 3410.15 detected NH/OH. The result was showed presence of nicotine in the extraction of cigarette butt [12].

Based on Table 1, treatment P4 showed the lowest intensity of *B. tabaci* in tomato 51 day after planting. In contrast, P0 showed full damage of plant started 44 to 51 day, such as P1 full damage in P3. Commonly *B. tabaci* attacked leaves and avoid phosynthesis on crops especially in tomato. Inhibit of nutrition will decreased of plant health and difficult for recovery. The research related to Siswoyo et al. [15] stated that plant health supporting by nutritious food from mineral surrounding plant growth. Damage caused by insect pest inhibit

plant development such as new plant shoot. It will impact to inhibit forming flower and fruit of crop then yield loss in future.

In general, plant growth need suitable environment and healthy condition. The tomato height in the different treatment showed in Table 2.

Table 2. Tomato height in the different treatment.

Treatment	Plant height (cm)				Mean
	30	37	44	51	
P0	14^{a}	23.2^{b}	36.8^{c}	56.2^{d}	32.6
P1	11.2^{a}	22.1^{b}	34.3^{c}	60.5^{d}	32
P2	11.5^{a}	20.6^{b}	33.9^{c}	58.7^{d}	31.1
P3	11.2^{a}	19.8^{b}	31.8^{c}	52.4^{d}	28.8
P4	13^{a}	23.6^{b}	37.5^{c}	59.1^{d}	33.3

Treatment: P0 (control), P1 (cigarette butt extract + papaya leaves), P2 (cigarette butt extract), P3 (banana stem waste), P4 (cigarette butt extract + banana stem + papaya leaves)

Based on Table 2 showed the highest average of tomato showed in treatment P4 (33.3 cm) and the lowest number of plant height in P3 (28.8 cm). We assumed that combination of cigarette butt extract, banana stem and papaya leaves giving the best result in plant growth. Research from Kliot et al. [11] stated that banana stem as the supporting more protein for plant giving more stimulus when combine with another plant material such as papaya leaves. Papain in papaya leaves able stimulate new cell and repel the pest insect with the bitter taste.

Table 3. Tomato leaves in the different treatment.

Treatment	Number of leaves				Mean
	30	37	44	51	
P0	19.9^{a}	26.6^{b}	41.7^{c}	80.6^{d}	42.2
P1	18.3^{a}	26.1^{b}	37.9^{c}	89.8^{d}	43.0
P2	16.5^{a}	24.5^{b}	49.1^{c}	76^{d}	41.5
P3	16.8^{a}	23.2^{b}	37.3^{c}	68.1^{d}	36.3
P4	17.6^{a}	23.6^{b}	56.8^{c}	100.8^{d}	49.7

Treatment: P0 (control), P1 (cigarette butt extract + papaya leaves), P2 (cigarette butt extract), P3 (banana stem waste), P4 (cigarette butt extract + banana stem + papaya leaves)

Based on Table 3 showed the highest average number of tomato leaves showed in treatment P4 (49.7 leaves) and the lowest number of plant leaves in P3 (36.3 leaves). Once again, the combination of cigarette butt extract, banana stem and papaya leaves giving the best result in plant growth. Research from Siswoyo et al. and Subhan et al. [15, 17] stated useful mineral such as sodium from organic fertilizer has ability increasing plant defense and recovery damage caused insect pest especially *B. tabaci.* Based on this study, the waste material such as cigarette butt and banana stem have ability increasing plant perform to be more healthy. This is ecofriendly product and not producing a residue for environment. Using plant waste from agricultural field will reduce cost of inorganic fertilizer and increasing farmers creativity manage waste from their field.

4 Conclusion

Conclusion of this study, the result indicated combine extract of cigarette butts, banana stem and papaya leaves increasing tomato health and able reduce the attacked intensity of *B. tabaci.*

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