THE EFFECT OF PLASTIC MULCHING, SOME BOTANICAL INSECTICIDES AND *TRICHODERMA KONINGII* ON TOMATO PLANT

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Abstract

This study aims to determine the effect of the use of plastic mulch combined with some botanical insecticide extracts as well as the use of the fungus Trichoderma koningii on several variables observations, including (1) the percentage of diseased leaf by Liriomyza sativae, (2) symptoms and diseases that attack tomato plants. Research arranged in a randomized block design (RBD) which consists of six treatments and each treatment was repeated five times. The treatments are as follows: (A) Derris elliptica extracts + plastic mulch + T. koningii; (B)Melia azedarach extracts+plastic mulch + T. koningii; (C) Aglaia odorata extract + plastic mulch + T. koningii; (D) Curacron only (without plastic mulch and T. koningii); (E) Plastic mulch + T. koningii without spray; (F) Control (without spray, plastic mulch and T. koningii). Results indicated that the highest percentage of leaves infested by pests L. Sativae found in the control treatment (64.99%). The highest peak attacks by L. sativae in nine weeks after planting and declined after the following weeks in all treatments. Analysis of variance results on the observation of the seventh or ninth week after planting showed that the treatments effect is very real to attack L. sativae. The average percentage of attacks on treatments A, B and C are relatively low (24.89%, 27.38%, and 28.45% respectively), compared to treatments D, E and F (52.48%, 57.06% , and 64.99% respectively).

Key words: *Trichoderma koningii, Liriomyza sativae,* Plastic mulch

INTRODUCTION

The use of plastic mulch is one of the techniques to control pathogens that live in the soil and weeds on farm. Mulch system does not require much maintenance e.g weeding, fertilizing. It is only to control the pests and diseases that may attack tomato plants.

Research on the use of natural ingredients for crop protection more incentive over the past three decades. One of the Meliaceae plant species are widely studied and has been shown to have insecticidal activity of *Aglaia odorata* [3; 23; 5; 13]. Some parts of the plant extract contains active compounds rokaglamida (Benzofurans class) and some of its compounds have been proved effective as *antifeedant,* growth inhibitors and insecticides [23; 8; 10; 5; 6; and 13]. *Melia azedarach* (chinaberry), reported to contained several active compounds from the class of limonoids that have repellent activity of eating (antifeedant) and hampered the development of robust against insects [9]. The chinaberry leaves extract that using water solvent can affect as antifeedant *Bemicia tabaci* that has efficiency to reduce the transmission of the virus (BGMV) by 95% [18]. The EtOAc fraction of seed extracts *of M. Azedarach* has insecticidal activity against the larvae *of C. Binotalis* with LC_{50} of 0.37% [1]. Results of several studies indicated that the plant *Derris elliptica* effective for controlling leaf-eating beetles and some caterpillars [19]. The 30% water extract of *Derris* spp. can result 93.23% mortality of larvae *of A.aegypti* [22]. The chloroform extract of the roots of *D. Elliptica* at a concentration of 10^4 ppm could inhibit egg hatching *Callosobruchus analyst* at 40.26% and the LC_{50} value is achieved at a concentration of 17.51 ppm [12

The mechanism action of *T. koningii* in the control of plant pathogens are as follows: (1) competition (these microorganisms more

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efficient use of space and nutrients), (2) antibiosis (producing one or more toxic chemicals), (3) parasitism (using the target as a source of food or a place to reproduce), and (4) induce plant resistance [26]. Some research indicates that the fungus *T. Koningii* has an antagonistic power to white root fungus on rubber if sulphur is added [24].

This study aims to determine the effect of the use of plastic mulch combined with some botanical extracts insecticides as well as the use of fungus *Trichoderma koningii* on several variables, including *(i)* the percentage of diseased leaf *Liriomyza* sativae, *(ii)* attack symptoms and diseases that attack tomato plants.

MATERIALS AND METHODS

Materials and Equipment

Materials used are : tomato seed of apples jewel varieties, *L. sativa* fly, urea, chicken manure, SP 36, KCl (fertilizer), *T. koningii*, synthetic insecticides, plant extraction *(Melia azedarach, Aglaia odorata,* and *Derris elliptica),* methanol, ethyl acetate, hexane, distilled water, pulp saws, and polybags. The tools are: pruning shears, counters, microscopes, loupe, plastic bags, aspirator, yellow sticky traps*),* digital balance, GR-200, blender, Mohr pipette (0.5, 1, and 5) ml, glass cup, flask, magnetic stirrer TC-2, rotary evaporator Eyela N-1000, cork borer, disk mill FFC-15, oven, vacuum pump VP-16, pumpkin filter, separator funnel, Buchner funnel, petri dish, box plastics (35x25x6) cm, Whatman no. 41& coarse filter paper, sifter, loupe, glass jars, erlenmeyer flask, allumunium foil, 3 ml glass vials, blotting paper, brushes, cotton buts, scissors.

Research Methods

The study is based on a Randomized Block Design (RBD) pattern, which consists of six treatments and each treatment was repeated five times for a total of 30 units. The treatments are as follows:

A. *Derris eliptica extract* + plastic mulch + *Trichoderma koningii*.

B. *Melia azedarach extract* + plastic mulch + *Trichoderma koningii*.

C. *Aglaia odorata* extract + plastic mulch + *Trichoderma koningii.*

D. Curacron only (without plastic mulch and *Trichoderma koningii*).

E. Without spray + plastic mulch + *Trichoderma koningii*.

F. Control (without spray, plastic mulch and *Trichoderma koningii*).

***The propagation of Trichoderma koningii* isolates Modoinding.**

Propagation of of *T. koningii* in corn media, by mixing 30 kg chicken manure + 200 g *T. koningii* and then incubated at room temperature for 10 days, (blended every 2 days). Each dose mixture evenly sprinkled on the soil surface is then covered (backfilled with soil).

Observations

(1) The percentage of leaves infested by *Liriomyza sativae*

Observations percentage of leaves infested by *L. sativae* is done by selecting a random sample of 10 plants as replication plant. Observed number of affected leaves and total leaves per plant trees. Total plants per treatment were observed as many as 50 plants. Observation of leaf damage by pests *L. sativae* began in the third week until the 12th week after planting (WAP).

(2) Symptoms and types of diseases that attack tomato plants

Observation was made during one week after planting to six weeks after planting. Tomato plants that showing symptoms of disease was removed and destroyed. Calculated the infected tomato plants and not differentiated by type.

The percentage of diseased tomato plants is calculated by the formula:

P = n / N

P = percentage of attacks

n = number of plants attacked

N = Number of plants observed

Data Analysis

Data *of* damage leaves due to attacks of L. *sativae* were analyzed by analysis of variance using Minitab Ver application program 14 [7]. The Least Significant Difference Test (LSD) is used if the treatments is significance.

RESULTS AND DISCUSSIONS

Observation of leaf damage by pests *L. sativae* began in the third week until the 12th week after planting (WAP). In Figure 1, the observation of tomato leaves attacked by pests *L. sativae* in each treatment were varies.

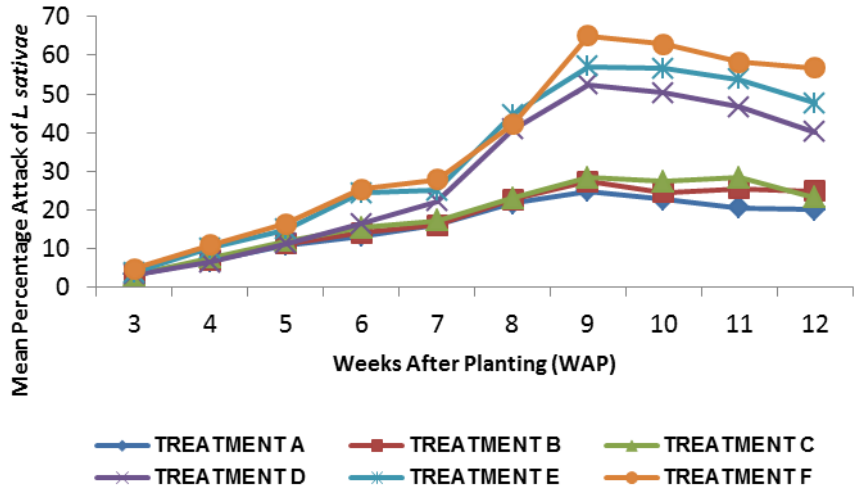

Fig. 1 Charts percentage of *L. sativae* attacks on various treatments

Description:
Treatment A = Extracts *Derris elliptica*+plastic mulch+*T. koningii*
Treatment B = Extracts of *Melia azedarach*+plastic mulch+ *T. koningii*
Treatment C = Extracts of *Aglaia odorata*+plastic mulch+ *T. koningii*
Treatment D = Curacron (without plastic mulch+without *T. koningii)*
Treatment E = Without spray+plastic mulch+ *T. koningii*
Treatment F = Control (without spray+without plastic mulch+without *T. koningii)*

From Figure 1 it can be seen that the average percentage of leaves infected by *L. sativae* highest peak, occurs at nine weeks after planting and declined after following weeks. The tendency of the average highest percentage of diseased leaf found in the F treatments (control) on plants that are not sprayed with pesticides, do not use plastic mulch and not applied *T. koningii.* The highest *L. sativae* attack on this treatment allegedly caused the *L. sativae* evolve freely without any pressure factor that pest populations *of L. sativae* tends to increase. Furthermore, Figure 1 gives also information that the treatments A, B, and C, all of whom use a vegetable insecticide, the average percentage of leaves infected by *L. sativae* relatively lower compared to treatment D, E and F, which does not use botanical insecticide. The botanical insecticide *D. elliptica, M. Azedarach* and *A. Odorata* populations play a role in suppressing the development of *L. sativae.* The application extracts of leaves and twigs of *A. Odorata* cause high mortality effect against the larvae *of C. Binotalis* [25]. Based on LC_{50} values, the root extract of *D. Elliptica* is more toxic than the seed extract *of M. Azedarach* on the larvae of *C. binotalis* [1]. Rotenone content of the extract contained in *D. Elliptica* very toxic [17]. The content of rotenone was allegedly instrumental in suppressing the development of pests, especially pests *L. sativae* that attack tomato plants. The generally broad-spectrum insecticide plant compared to synthetic insecticides that are more specific so as to turn off the natural enemies of *L. sativae* [21]. This condition indicates that a plant-based insecticides, *D. elliptica, M.azederach* and *A. odorata* can pressed the attack of *L. sativae* in tomato at Toure village.

According to the analysis of variance, seventh or ninth week after planting showed that the treatment effect to attack *L. sativae.* The average percentage of *L. sativae* attack can be seen in Table 1.

Table 1 Average percentage of attacks *L. sativae* on tomato plants in the village of Toure

Treatments	Average (%)	Notation*)
A (Extracts *Derris elliptica*+plastic mulch+*T. koningii*)	24.89	a
B (Extracts of *Melia azedarach*+plastic mulch+ *T. koningii*)	27.38	a
C (Extracts of *Aglaia odorata*+plastic mulch+ *T. koningii*)	28.45	a
D (Curacron+without plastic mulch+without *T. koningii*)	52.48	b
E (Without spray+plastic mulch+ *T. koningii*)	57.06	b
F (Without spray+without plastic mulch+without *T. koningii*)	64.99	b

**) Number of followed by the same letter are not significant*

Table 1 shows that the average percentage of attacks *L. sativae* among treatments A, B and C has no significancy, and also between D, E and F treatments. However, there are significancy between A, B, and C treatments to the D, E, and F treatments. The mean percentage of attacks on treatment A, B and C are relatively low (24.89%, 27.38%, and 28.45%) compared to treatment D, E and F (52.48%, 57.06%, and 64.99%). This was due to treatment A, B and C, the tomato plants were sprayed with insecticide plant and in treatment D, E and F are not sprayed with insecticide plant, but in treatment D, which is a treatment that scheduled spraying with the insecticide Curacron each two weeks. Curacron insecticide used to plot farmers can reduce the *L. sativae* attacks, compared to the control treatment (treatment F), but in contrast to the use of plant-based insecticide third, *L. sativae* attacked relatively lower than in plots treated with Curacron insecticide spraying (treatment D) and in the control treatment (treatment F).

Spraying with synthetic insecticides Curacron (treatment D), suspected to be a contact poison so deadly natural enemy pressure factor on the development of *L. sativae* be reduced compared to the use of plant-based insecticides, which does not kill natural enemies. *L. sativae* was parasitized by several parasitoids to parasitism by *Hemiptarsenemus varicornis* level of 20.30% on the usual tomato crop synthetic insecticides sprayed on Toure [11]. Parasitized leaves eater by parasitoids *H. Varicornis* parasitoids with an average rate of 40.20% at the plot without spraying and 38.14% in plots with insecticide spraying. The use of plant-based insecticides are generally not lethal natural enemies as natural insecticides are toxic when gave through feed. In general, secondary compounds produced by plants that are insecticides, will be more toxic when gave through the feed than the contacts application [16]. Further more, the effect of extracts of leaves and twigs contract with *A. odorata* against imago female parasitoid *E.argenteopilosus* apical contacts that applied, showed that the extract is relatively non-toxic, non-lethal parasitoid [25].

Symptoms and types of diseases that attack tomato plants

The results showed that tomato plants attacked by several diseases including Fusarium wilt disease and attacks CMV *(cucumber mosaic virus).* Fusarium wilt disease is not found attacking tomatoes in raised beds that applied to the *T. koningii* treatment, (treatment A, B, C, E), but attack tomatoes on the bed not treatment *T. koningii* (treatment D and F). Allegedly fungus *T. koningii*, able to inhibit the growth of pathogens. Bottom soil pathogens such as *Fusarium sp.*, *Phytium sp.*, and other causes wilt disease have been reported by several investigators that the addition of *Trichoderma koningii*, able to suppress wilt disease caused by *Fusarium*, because *Trichoderma koningii* produce enzymes β-(1-3) glucanase and chitinase which causes exolysis pathogens causing the destruction of the cell wall of the fungus *Fusarium* [2]. After the death of pathogenic fungi antagonists appears that grow continuously cover the surface of pathogenic fungi colonies. This proves that the antagonistic

fungus *Trichoderma koningii* can be used to control fungal pathogens. *Trichoderma koningii* able to suppress or inhibit the growth of Fusarium up 56.07% at 3 days after inoculation. Tomato plants, both CMV and affected by fusarium wilt, immediately removed and immersed in the soil [4].

Symptoms of CMV-infected tomato plants showed the plant's leaves begin to turn yellow, the plant leaves shrink over time, and eventually roll crimp. CMV disease was found attacking tomato plants in the third week after transplanting. All the beds affected by CMV treatment with a relatively low percentage of attacks, an average of 2.25 plants per plot or about 5.67% of the total crop.

Fusarium wilt disease that attacks tomato plants observed in the treatment without *T. koningii*, namely treatment D and F. The symptoms begin to appear three weeks after transplanting, with a very low percentage of attacks (an average of 3.25 plants per plot), or 2.17% of the total tomato plants were grown without treatment *Trichoderma koningii*. The attack on the young plants will cause the plants to wilt and die soon due to stem damage or cancer menggelang. When the plants mature, the infected plants can still survive to form the fruit, but the fruit produced small [24]. Tomato plant death occurs due to Fusarium attack began on day 28 after the first visible symptoms, which is shown in the overall plant wilt and dry up [20].

CONCLUSIONS

Based on the results of the study can be summarized as follows:

The highest percentage of leaves infested by *L. Sativae* found in the control treatment (F - 64.99%) and the lowest in treatment A (24.29%).

The results showed that tomato plants Fusarium wilt disease and CMV (cucumber mosaic virus). Fusarium wilt disease is not found attacking tomatoes in raised beds that applied to the treatment of *T. koningii*, (treatment A, B, C, E), but found attacking tomatoes in beds without treatment *T. Koningii* (treatment D and F). The disease is found attacking tomato plants in the third week after transplanting. All beds affected by CMV treatment with an attack percentage of the average of 2.25 plants per plot or about 5.67% of the total crop, whereas the percentage of Fusarium wilt attacks average of 3.25 plants per plot, or 2.17% of the total tomato plants grown without reatment *T. koningii.*

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