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EFFICACY OF ENTOMOPATHOGENIC FUNGI *Verticillium* (=*Lecanicillium*) *lecanii* Zimm. (Hypocreales:Clavicipitaceae) TOWARD CONTROLLING *Bemisiatabaci* Genn (Hemiptera:Aleyrodidae) ON SOYBEAN

Rangga Rakhmad[1], Sofia Ery Rahayu[1], Yusmani Prayogo[2]

[1]Biology Faculty of Mathemathic and Natural Science State University of Malang
JL Semarang 5 Malang 65145, Indonesia
[2]Indonesian Legumes and Tuber Crops Research Institute
Jl. Raya Kendalpayak km 8, PO Box 66 Malang 65101, Indonesia
E-mail: [1]ranggarakhmad@gmail.com, [2]manik_galek@yahoo.com

ABSTRACT

Bemisiatabaci Genn is a primary soybean pest in Indonesia. This pest infests soybean leaves, causing direct damage in the form of wilting leaves and necrosis, and indirect damage by the formation of powdery mildew and viral infections which decreases soybean production. Pest control using pesticide has diminishing effectiveness and also causes collateral pollution, which necessitate an alternative method of controlling *B. tabaci*. One such method is the use of entomopathogenic fungi *Lecanicilliumlecanii*. This research aims to find the effect of conidia density of the entomophatogenic fungi *Verticillium*(=*Lecanicillium*) *lecanii* (Hypocreales:Clavicipitaceae) Zimm towards *Bemisiatabaci* Genn under field conditions. This research uses the split plot method, with two factors, six treatments, and three replications. The treatment was done by spraying *L. lecanii* 10^7conidia/ml or 10^9conidia/ml every week or two weeks on soybean leaves. The results showed that *L. lecanii* application significantly decreased *B. tabaci* population. Conidia density of 10^9conidia/ml per week resulted the most significantly effective decreasing of *B. tabaci* population.

Keywords: *Bemisiatabaci*.*Lecaniclilliumlecanii*, *Ethomopathogenic fungi, Soybean*

INTRODUCTION

Soybean production in Indonesia has been in decline since 1992, with a declining average up to 64%. This condition is contradictory with the increasing consumption rate of soybean in Indonesia, that in 2004, the import value of soybean increase, becoming twice of the national production value (Marwoto, 2007). One reason for this decline is pest infestation, one example being *B. tabaci*. This insect is a primary soybean pest as it is a vector of important soybean viruses that has spread widely in Indonesia (Tengkano *et al*., 2007).

B. tabaci has become difficult to control as its optimal temperature sits at around 25° C, which is also the optimal temperature for soybean growth (Irawan, 2006; Nillson, 2001). *B. tabaci* control using pesticide succeeded for a time, until it was widely known that pesticide is detrimental to nature, whether economically or ecologically. *B. tabaci* has also been known to form resistances towards certain pesticides such as Bifenthrin, alpha-cypermethrin, pirimiphos-methyl, endosulfan, Imidacloprid, as reported by the Greeks (Roditakis *et al*., 2005).

One solution in dealing with *B. tabaci* control which is currently being developed is the use of entomophatogenic fungi *Lecanicillium lecanii. L. lecanii* has been known to be epizootic towards some insect species, especially form ordo Hemiptera. *L. lecanii* has been known to cause mortality on the aphid *Myzus persicae* up until 95% (Diaz et *at al*., 2009). Other pests such as *Ricania simulans*, *Coccus viridis, Fiorinia externa*,*Ceroplastes japoni-*

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cas, dan *Coccus hesperidium* has shown similar results to that of Aphids (Jackson dan Zemmenick, 2009; Marcelino et *at al*., 2009; Liu et *at al*., 2009 and Liu et *at al*., 2011). Some laboratory experiments has shown that *L. lecanii* as a pathogen of *B. tabaci* causes a high enough mortality (Wang et *at al*., 2007; Lazerg, 2007). However field experiments on this subject are not as common, and are therefore required to test the efficacy of *L. lecanii* in controlling *B. tabaci*. This research aims to find which formulation is most effective in controlling *B. tabaci*.

MATERIALS AND METHODS

L. lecanii Conidia Preparation

Isolate of *L. lecanii* LT-JTM11 obtained from culture grown on rice medium for 21 days. This culture is then crushed with blender and then filtered using filter. The result is then diluted to 1L, and then added with Tween-80 5 mL for each liter of *L. lecanii* conidia.

B. tabaci Population Measurement

Data collection is done using *yellow sticky trap* method. On day 13 after planting, before *L. lecanii* conidia are applied, a preliminary test is done using the *yellow sticky trap* to estimate the starting population of *B. tabaci.*

Field Experiment

The experiment was done from June, 14 until August, 28, 2011 in Muneng Experimental Garden, Indonesian Legumes and Tuber Crops Research Institute, Probolinggo East Java. This experiment used the split plot method, with two factors, six treatments, and three replications. The treatments used are conidia density and application frequency (once and twice a week).

Treatments on soybeans are carried out on evenings at 16.00 PM (avoiding direct sunlight). Treatment combinations on soybean are as follows; (1) 14, 21, 28, 35, 42, 47, 56, 61 and 70 days after planting (once a week) with conidia density of 10^7 conidia/mL. (2) 14, 28, 42, 56, and 70 days after planting (twice a week) with conidia density of 10^7 conidia/mL. (3) 14, 21, 28, 35, 42, 47, 56, 61 and 70 days after planting (once a week) with conidia density of 10^9 conidia/mL. (4) 14, 28, 42, 56, and 70 days after planting (twice a week) with conidia density of 10^9 conidia/mL. (5) tiametoksan (an insecticide) 141gr/L on day 14, 21 28, 38, 45, 52 and 59 after planting, and (6) control (without treatment). Spraying is done after diluting 1L of conidia concentrate into 2L, therefore there are 10L for each treatments. Data collection is done on day 15 after planting (a day after treatment using *L. lecanii*) and continued on day 22, 29, 36, 43, 48, 55, 62, and 70 after planting.

RESULTS AND DISCUSSION

Results

Based on ANOVA result, it was shown that conidia density treatment and application frequency on day 22 after planting has F score (4,06) > F table (2,71), while the main variety treatment and combination treatment did not show a significant difference, meaning that conidia application of *L. lecanii* effect *B. tabaci* population on day 22 after planting.

Table 1. ANOVA result of *B. tabaci* population on Soybean plants applied with *L. lecanii* on day15 until day 70 after planting

Treatment	Days after planting								
	15	22	29	36	43	48	55	62	70
Wilis and Argomulyo Variety treatment	2.63 (18.20)	3.50 (18.20)	2.07 (18.20)	0.09 (18.20)	4.87 (18.20)	0.15 (18.20)	0.96 (18.20)	0.05 (18.20)	2.27 (18.20)
Conidia treatment & aplication frequency	1.23 (2.71)	**4.06 (2.71)**	1.43 (2.71)	0.81 (2.71)	0.75 (2.71)	1.29 (2.71)	1.89 (2.71)	0.30 (2.71)	1.17 (2.71)
Combination treatment	0.36 (2.71)	0.35 (2.71)	0.87 (2.71)	1.40 (2.71)	2.30 (2.71)	0.77 (2.71)	1.17 (2.71)	1.06 (2.71)	0.73 (2.71)

Explanation: Numbers without brackets shows the F score
Numbers with brackets shows the F table
Bold numbers shows that the F score is significant compared to the F table.

Based on ANOVA result of day 22 after planting followed with LSD test with 5% rate to find which conidia density and application frequency shows significant difference, which formulation of *L. lecanii* is most effective can be concluded (Table 2)

Table 2. Results of LSD of day 22 after planting

Treatment	*B. tabaci* population day 22 after planting
10^7 conidia/mL & once week aplication	115.5^{ab}
10^7 conidia/mL & twice week aplication	115.5^{ab}
10^9 conidia/mL & once week aplication	90.3^{a}
10^9 conidia/mL & twice week aplication	126.3^{ab}
Tiametoxan	115.5^{ab}
Control	155.1^{b}

Explanation: Numbers followed by the same letter on different columns are not significantly different according to LSD 5%

Discussion

The result showed that the formulation of *L. lecanii* was able to decrease *B. tabaci* population after 14 days after planting significantly, with 7th days interval, until the 22nd day after planting. The time needed by *L. lecanii* to decrease the population of *B. tabaci* significantly, as shown by this research is incubation time. Incubation time is the time needed by an entomopathogenic fungi to cause death or epizootic on its host insect (Prayogo, 2012). Incubation time depends on germination rate of fungi on its host, where the host will finally be colonized by hyphae. This process happens in some steps before the fungi can kill the host. The result of LSD test (5%) showed that there was a significant difference only on treatment with 10^9conidia/mL and once a week application compare to the control treatment. Other

treatment were not proven to have a significant difference compare to control treatment, as each population of *B. tabaci* on table 1 had the same notation. Conidia density of 109 was the highest density of conidia used in this research. Previous research has shown that a high conidia density of *L. lecanii* can increase infection rate against *B. tabaci.* (Forero, 2006). A high conidia density increases the chance of conidia sticking into its host body. The same is also true for application frequency, which increases the chance of conidia sticking into the insect.

Results other than the 22nd day which are not significantly different showed that there are factoras that inhibit the infection of *L. lecanii* towards *B. tabaci*. Infection starts with the attachment of conidia to epicuticle of an insect. This process is helped by secretion from conidia that enable it to stick to insect cuticle (Schreiter *et al.*, 1994 and Askary *et al.*, 1999 in Liu *et al.*, 2011). The infection process of entomopathogenic fungi, if viewed from the outside will show the insect covered with *L. lecanii* hyphae (Liu *et al.*, 2009 dan Liu *at al.*, 2011).

Jackson and Zemenick, (2009) explains that wind can cause *L. lecanii* conidia that have stuck to *Coccus viriidis* integument to unstuck, decreasing effication of *L. lecanii* in the field. Research on *L. lecanii* effication was carried out in dry season, with strong wind condition. This condition could have affected *L. lecanii* conidia that have stuck on *B. tabaci*, hence there were no significant decrease in *B. tabaci* population after day 22. Humidity during research was 50-55%, while temperature ranged between 25^{o} C -35^{o} C.

Prayogo (2009) reported that *L. lecanii* can achieve optimal growth, causing mortality on *R. linearis* in temperatures ranging from 25^{o} C-29^{o} C. The temperature range of the experimental garden was around 25^{o} C -35^{o} C, which is within the range for optimal growth of *L. lecanii*.

CONCLUSION

There is was significant difference on day 22 after planting with once a week application, while there were no significant difference on day 15, 29, 36, 43, 48, 55, 62, and 70 days after planting. The significant difference on day 22 was found on the 10^{9} conida/mL with once a week application, while other treatments showed results that were not significantly different with control treatment.

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