

Potential Use of *Beauveria bassiana* for Biological Control of Thrips in Peppers

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Abstract: Biological control of vegetable pests is an important goal for growers and IPM practitioners alike. Currently, the naturally occurring minute pirate bug, *Orius insidiosus* (Say) (MPB) is the major biological control agent for managing thrips in peppers (*Capsicum annuum* L.). Alternatives to this biological control agent are needed to manage thrips during winter months when MPB enter diapause, and during the citrus bloom period when massive flights of thrips can overwhelm the ability of MPB to provide satisfactory thrips control. A commercial formulation of the fungal entomopathogen, *Beauveria bassiana* (Balsamo) Vuill., was evaluated for biological control of thrips. Infected thrips occurred in plots receiving the commercial fungal formulation, and also occurred naturally in the untreated areas. Infected MPB were also found. The potential utility of this fungus is discussed.

Introduction

Thrips have affected yield and quality for Florida vegetable growers since before the turn of the century (Quaintance, 1898). These pests have become increasingly difficult to manage in recent years. This difficulty has increased due to the introduction of economically damaging pest species, including the western flower thrips, *Frankliniella occidentalis* (Pergande) in the mid 1980's (Denmark, 1986, Frantz and Mellinger, 1990) and the melon thrips, *Thrips palmi* Karny, in 1990 (Faust, 1992). These species have caused severe economic losses resulting from transmission of Tomato Spotted Wilt Virus and from their feeding and oviposition wounding of fruits. Thrips management is difficult because of high levels of pesticide resistance, resulting from years of exposure to many different active ingredients.

A desirable management strategy includes biological control as a central component. In many

pest situations, preservation of naturally occurring predators, such as the minute pirate bug, MPB, provides adequate suppression or control of thrips populations (Frantz and Mellinger 1997). However, during periods of high thrips immigration into crops, or reduced predator populations from insecticides applied to control other pests, such biological control is inadequate (Frantz and Mellinger, 1997). In these cases, the use of biorational insecticides, such as entomopathogens, would be advantageous.

The purpose of these studies was to evaluate the efficacy of the biological control agent, *Beauveria bassiana*, for controlling thrips in peppers and for the effect on MPB.

Materials and Methods

Two tests were conducted in 1996, using the entomopathogenic fungus, *Beauveria bassiana* (Mycotrol, Mycotech Corporation, 630 Utah Avenue, Butte, MT) as a biological agent against thrips. The first test site was a bell pepper field in Boynton Beach, FL. The field was selected because, in addition to the resident thrips population, a large population of minute pirate bugs was also present in the field, and the effect of *Beauveria bassiana* on this beneficial insect could be observed.

The fungus was provided by Mycotech Corporation formulated as Mycotrol WP Biological Insecticide. This product was applied at 1 lb per acre in 50 gallons of spray per acre with the grower's commercial spray rig, fitted with drop nozzles that directed the spray onto the sides and top of the crop canopy. Silwet L77 silicone wetting agent (Setre Chemical Company, Memphis, TN) was added at 0.04% of the final spray volume for the first two applications and Kinetic wetting agent (Setre Chemical Company, Memphis, TN) was substituted for Silwet L77 in the final application. Three weekly applications were made beginning 22 February 1996 to a 2-acre plot with the adjacent 3 acres of peppers serving as the untreated control. The field was approximately 17 weeks old at the time the trial began.

The effects of Mycotrol WP on thrips and MPB were evaluated by collecting pre- and post-application samples of blooms. At each of four randomly selected sites within a treatment, 50 blooms were collected. Of these, 25 were placed in a plastic bag to evaluate thrips infectivity. The second lot of 25 blooms was placed in another plastic bag for species determination and population counts to evaluate the effects of the fungus on insect numbers. Samples were collected immediately before each application and 7 days after the final application. The samples for the efficacy evaluation were flooded with 70% isopropyl

alcohol immediately after collection. The samples for infectivity evaluation were placed in a cooler with artificial ice and shipped overnight to the Mycotech laboratory in Butte, MT for culturing. Insects in the efficacy evaluation were identified and counted using a dissecting microscope with 40X magnification. Selected specimens were slide-mounted to confirm the identifications under a compound microscope.

The second test was begun in an 18-week-old field of bell peppers in Jupiter, FL on 29 April 1996. Applications, sample collection and analysis in the second test were carried out using the same procedures as in the first test. An improved formulation of the fungus, Mycotrol WP9503, was substituted, which provided for enhanced dispersion of the fungus in the spray tank. Silwet L77 was added at 0.04% to the applications.

A 10-acre treated plot and a 10-acre untreated control plot were used. The decision to test the fungus in larger plots was made due to detecting infected MPB in the untreated area in the first test. Approximately 550 feet separated the two plots in the second test.

Results and Discussion

Both test sites were infested with melon thrips, western flower thrips and the Florida flower thrips, *Frankliniella bispinosa* (Morgan). The results of the two tests are presented in Tables 1-4.

Table 1

In the first test, where thrips numbers were low and MPB were numerous, the efficacy of *B. bassiana* against thrips is not readily apparent (Table 1). Infected thrips were detected in both the treated and the untreated plots (Table 2). A significant result was the infection of MPB by *B. bassiana*. Infection increased steadily throughout the four sampling dates, with levels reaching approximately 20%. This high infection level, occurring in both the treated and untreated plots, suggests that either infected insects migrated into the untreated check, or naturally infected insects occurred in the untreated check. This observation led to increased plot separation and size for the second test.

Table 2

Table 3

In the second test, thrips numbers dropped markedly following the first application of Mycotrol WP9503 (Table 3). In subsequent samplings, the differences between the treated and untreated plots were not significant. Incompatibility between the fungus and the grower's use of the fungicide maneb may explain the lack of differences. Maneb is known to be harmful to *B. bassiana* (Mycotech, personal communication).

Table 4

High numbers of thrips were infected with *B. bassiana*, even in the pretreatment samples taken 24 April 1996 (Table 4). This clearly indicated that some level of natural infection of thrips occurs in Florida pepper fields. Infection rates increased in both plots after the first application. In subsequent sampling dates infected thrips were only found in the treated area.

The numbers of MPB in the second test were low. The apparent increase in their numbers in the treated area and the differences between the treated and untreated populations are probably not significant (Table 3). As in the thrips population, infection of MPB was detected in both the treated and untreated plots, indicating naturally occurring pathogenic *B. bassiana*.

The formulation of *B. bassiana* in this test has also been successfully tested against whiteflies, thrips, and other insects in several crops. These tests showed that *B. bassiana* reduced the thrips populations, although fungicide incompatibility may have reduced its overall efficacy. Incompatibility with a commonly used fungicide is a major limiting factor for expanded use of this fungus for control of thrips or other insects in Florida vegetable crops (S. Jaronski, Mycotech, personal communication).

Our tests indicate that *B. bassiana* naturally infects both thrips and MPB. These infections occurred in fields treated with the incompatible fungicide, maneb. Screening strains of this fungus collected from fungicide-treated commercial fields may yield a commercial product with greater compatibility with other pesticides. Recently published data (Castineiras et al., 1996) indicate that *B. bassiana* occurs in Florida soils, and that these strains will infect thrips under laboratory conditions. Our tests show that infection can occur under ambient field conditions. Screening field-collected isolates of *B. bassiana* may yield a more commercially viable product than the isolate currently used in Mycotrol.

Literature Cited

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Table 1. Insects collected from pepper blooms treated with *Beauveria bassiana*. Boynton Beach, FL Winter 1996.

Date (1996)	Insects per bloom									
	Treatment									
	Mycotrol WP 1 lb per acre					Untreated Check				
	<i>F. bispinosa</i> Adults	<i>T. palmi</i> Adults	<i>F. occidentalis</i> Adults	Total thrips	<i>O. insidiosus</i>	<i>F. bispinosa</i> Adults	<i>T. palmi</i> Adults	<i>F. occidentalis</i> Adults	Total thrips	<i>O. insidiosus</i>
22 Feb.	0.05	0.00	0.02	0.10	0.44	0.00	0.00	0.00	0.05	0.30
29 Feb.	0.01	0.00	0.00	0.02	0.28	0.00	0.02	0.00	0.03	0.35
7 Mar.	0.43	0.00	0.00	0.48	0.17	0.29	0.00	0.00	0.36	0.40
15 Mar.	0.24	0.00	0.00	0.41	0.14	0.15	0.00	0.00	0.17	0.32

Table 2. Infection rates of thrips and *Orius insidiosus* by *Beauveria bassiana* after application of Mycotrol WP to peppers Boynton Beach, FL, Winter 1996.

Date (1996)	Infection rate (%)			
	Treatment			
	Mycotrol WP 1 lb per acre		Untreated Check	
	Thrips all ages	<i>O. insidiosus</i>	Thrips all ages	<i>O. insidiosus</i>
22 Feb.	0.00	0.00	0.00	0.00
29 Feb.	0.00	5.00	0.00	0.00
7 Mar.	1.47	10.90	0.00	19.13
12 Mar.	0.00	20.28	0.00	6.92

Table 3. Insects collected from pepper blooms treated with *Beauveria bassiana*. Jupiter Florida, Spring 1996.

Date (1996)	Insects per bloom									
	Treatment									
	Mycotrol WP9503 1 lb per acre					Untreated Check				
	<i>F. bispinosa</i> Adults	<i>T. palmi</i> Adults	<i>F. occidentalis</i> Adults	Total thrips	<i>O. insidiosus</i>	<i>F. bispinosa</i> Adults	<i>T. palmi</i> Adults	<i>F. occidentalis</i> Adults	Total thrips	<i>O. insidiosus</i>
24 Apr.	4.95	0.08	0.00	10.01	0.03	5.97	0.36	0.20	12.82	0.02
1 May	0.23	0.15	0.20	1.16	0.08	3.10	0.00	0.76	11.07	0.41
8 May	0.22	0.42	0.11	0.98	0.11	0.41	0.25	0.08	1.08	0.02
15 May	0.75	0.30	0.04	1.86	0.27	0.38	0.45	0.09	1.95	0.15

Table 4. Infection rates of thrips and *Orius insidiosus* by *Beauveria bassiana* after application of Mycotrol WP9503 to peppers. Jupiter FL, Spring 1996.

Date (1996)	Infection rate (%)							
	Treatment							
	Mycotrol WP9503 1 lb per acre				Untreated Check			
	Thrips larvae	Thrips adults	Thrips all ages	<i>O. insidiosus</i>	Thrips larvae	Thrips adults	Thrips all ages	<i>O. insidiosus</i>
24 Apr.	1.19	0.78	0.94	0.00	11.04	6.38	8.08	0.00
1 May	5.21	27.34	17.28	5.56	8.71	23.23	15.78	18.06
8 May	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15 May	0.00	1.92	1.56	0.00	0.00	0.00	0.00	8.33