Agriculture, Forestry and Fisheries
2016; 5(5): 181-185
http://www.sciencepublishinggroup.com/j/aff
doi: 10.11648/j.aff.20160505.16
ISSN:2328-563X (Print); ISSN:2328-5648 (Online)

Efficacy of BotaniGard (*Beauveria bassiana*) Against Whiteflies on Poinsettia and Dahlia

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To cite this article:
Gashawbeza Ayalew. Efficacy of BotaniGard (*Beauveria bassiana*) Against Whiteflies on Poinsettia and Dahlia. *Agriculture, Forestry and Fisheries*. Vol. 5, No. 5, 2016, pp. 181-185. doi: 10.11648/j.aff.20160505.16

Received: August 6, 2016; **Accepted**: August 17, 2016; **Published**: September 10, 2016

Abstract: Efficacy of the entomopathogen fungus, *Beauveria bassiana* (BotaniGard) was compared with conventional insecticides against whiteflies on Poinsettia (*Euphorbia pulcherrima*) and Dahlia (*Dahlia coccinea*) in Maranque plant located at Doni in Eastern Shoa zone of Ethiopia between December 2010 and March 2011. The experimental site measuring 1250 m² was divided in 6 bays. Three bays in alternative fashion were allocated for treatment with the test pesticide, BotaniGard and the other three for spraying with the conventional insecticides according to the routine practice of the farm. BotaniGard was applied at the concentration of 0.15% by mixing 150 ml of the product with 100 l of water weekly for the first ten weeks and twice weekly thereafter until the termination of the experiment. Mean whitefly number per treatment was calculated to examine population fluctuation in adjacent BotaniGard and control treatments of both Dahlia and poinsettia. To assess presence of statistical differences in whitefly population between treatments as well as between plant species, a student t-test was used using counts recorded from each of the 12 cards per treatment at the different weeks. Population of whiteflies was generally low in both plant species until 17 January 2011 without appreciable difference in whiteflies number between the BotaniGard and the conventional insecticides. Whiteflies number increased after 17 January in both plant species and peaked on 7 February 2011. Pest population in BotaniGard treated bed was lower than conventional insecticides treated bed during this period in both plant species. Whiteflies population in Poinsettia fluctuated between 3.9 and 42 per trap compared to between 0.6 and 24.8 in Dahlia in the conventional insecticide treatment. On BotaniGard treated plot, whiteflies number fluctuated between 2.5 and 17.6 in poinsettia and between 1.8 and 12.5 in Dahlia. This difference between Dahlia and poinsettia was significant ($P<0.05$) in 5 out of 12 sampling dates in the conventional treatment and in 7 out of 12 weeks in BotaniGard treatment. Dahlia was less susceptible to whiteflies and BotaniGard resulted in lower number of whiteflies than the conventional insecticide treatment. Hence, BotaniGard may be used as a viable alternative to reducing the use of chemical insecticides in the management of whiteflies in green house produced plants.

Keywords: BotaniGard, *Beauveria bassiana*, Conventional insecticide, Dahlia, Poinsettia, Whiteflies

1. Introduction

Whiteflies (Homoptera: Aleyrodidae) are common pests of field and green house crops worldwide [4]. Whiteflies are common insect pests in flower farms of Ethiopia affecting production of various groups of plants including different cuttings, flowers, herbs, etc. [1]. Various insecticides are used in rotation against these insect pests as a means of delaying the onset of pesticide resistance. However, the need to produce pest free product necessitate frequent application of pesticides, which in turn aggravates development of pesticide resistance, and hence decline in pesticides efficacy [5, 7]. Because of this and other related problems, there is a growing need to promote use of biocontrol agents including parasitoids, predators and entomopathogens in an Integrated Pest Management (IPM) program.

The success obtained with the use of the predatory mite *Phytoseiulus persimilis* [2] against red spider mites in cut roses has raised great interest in exploring biocontrol based IPM in the management of green house pests among flower farms. *Beauveria bassiana* is an entomopathogenic fungus which infects several insect species. Different strains of the fungus isolated from a variety of insect species are

commercially available. One such commercially available product is BotaniGard. *B. bassiana* infects insects directly through the body wall when conidia contact and become attached to the cuticle. The conidia germinate and penetrate the insect body wall by a combination of mechanical force and production of enzymes that digest the cuticle. Parasitoids and predators such as the predatory mite, *Amblyseius swirski* (Acarina: Phytoseiidae) are currently in use in the biological control of green house whiteflies in Ethiopia [6] as they are in several countries [15]. Entomopathogens such as *Beauveria bassiana* are used to aid this effort particularly in situation where whitefly population are large and out of control [9]. This experiment was therefore conducted to compare the performance of BotaniGard with the conventional insecticides against whiteflies in poinsettia and Dahlia with the aim of strengthening the biological control of whiteflies in green house produced plants of Ethiopia.

2. Materials and Methods

The experiment was conducted between December 2010 and March 2011 in Maranque plant greenhouse located at Doni in central Ethiopia. The experimental field measured 2500 m² where two types of mother-stock plants were grown, Dahlia and Poinsettia each in an area of 1250 m². This area was divided in 6 bays. Three bays in alternative fashion were allocated for treatment with the test pesticide, BotaniGard and the other three for spraying with the conventional insecticides according to the routine practice of the farm.

Details of the insecticide used in the conventional treatments are shown in table 1. BotaniGard was applied at the concentration of 0.15% by mixing 150 ml of the product with 100 l of water weekly for the first ten weeks and twice weekly thereafter until the termination of the experiment. Adult whitefly population was monitored using yellow sticky card. Twelve cards per treatment and per bay were used. Traps were changed every three weeks. Mean adult population from per sticky card per treatment was calculated from each plant species to examine population fluctuation and differences in pest number from both the test (BotaniGard) and conventional insecticide (control treatment).

Data were collected weekly every Monday starting from week 49 (6 December 2010) through week 8 (21 February 2011). Mean whitefly number per treatment was calculated to examine population fluctuation in adjacent BotaniGard and control treatments of both Dahlia and poinsettia. To assess presence of statistical differences in whitefly population between treatments a t-test was used using counts recorded from each of the 12 cards per treatment at the different weeks. A pooled method for equal variance and Satterthwaite method for unequal variance [12] was used.

Table 1. *Type, rate and frequency (week) of application of insecticides in conventional pesticides treatment against whiteflies on Dahlia and Poinsettia at Maranque plant, 2010/11.*

Pesticide Common name	Active Ingredient	a.i. per 100 ml	Amount used (ml or g)	Week applied											
				1	2	3	4	5	6	7	8	9	10	11	12
Abamectin	Avid	50	50	x	X	x	x		x	x	x	x	x	x	x
Azadiractin	Nimbecidin	100	200							x	x				
Boscolid	Collis	50	50		X			x			x			x	
Buprofezin	Applaud	30	22.5		X	x									
Deltamethrin	Decis	75	75	x		x	x	x	x		x	x	x	x	x
Nexter	Pyridaben	70	52.5					x	x	x	x				
Pyriproxyfen	Tiger	25	25									x	x		
Sulphur	Sulphur	50	50	x	X	x	x	x	x	x		x	x		x

3. Results and Discussion

3.1. Treatments Effect

Whiteflies number fluctuated between 3.9 and 34.3 and between 2.5 and 26.4 on conventional insecticide and BotaniGard treated Poinsettia, respectively (Fig. 1). On Dalhia, it fluctuated between 0.6 to 22.8 on conventional treatment and between 1.8 to 9.1 on BotaniGard treatment (Fig. 2.). Whiteflies number in BotaniGard treated Dahlia was significantly higher on the first ($t= 2.69$; $p =0.0154$) and second ($t=2.10$; $p= 0.0474$) samplings. Differences were insignificant ($P > 0.05$) between the 3rd and 6th sampling weeks and on the 9th week. In the rest of the sampling weeks, whiteflies number in BotaniGard treatment was significantly lower ($P < 0.05$) than the conventional insecticide treated plots. Differences between BotaniGard and conventional insecticide treated Poinsettia was minimal without significant difference in the first seven weeks. In the latter weeks, BotaniGard treated plots showed significantly ($P <0.05$) lower number of whiteflies than the conventional insecticide treatments with the exception of the 10th ($t = 1.34$; $p = 0.1938$) and 12th week ($t =0.95$; $p = 0.3521$). The observed effect of BotaniGard is in agreement with several reports [11, 13]. Two to three weekly applications of different formulation of *Beauveria bassiana* had reduced the F1 adult population to levels that were significantly lower than the untreated control [11]. In the current study however, BotaniGard was applied throughout the experimental period to enable valid comparison as other synthetic insecticides were applied weekly during the entire experimental period. The observed significantly lower number of whiteflies in BotaniGard treatment in the latter weeks of the experimental period on both plant species could possibly be due to the low acting nature of entomopathogenic fungi.

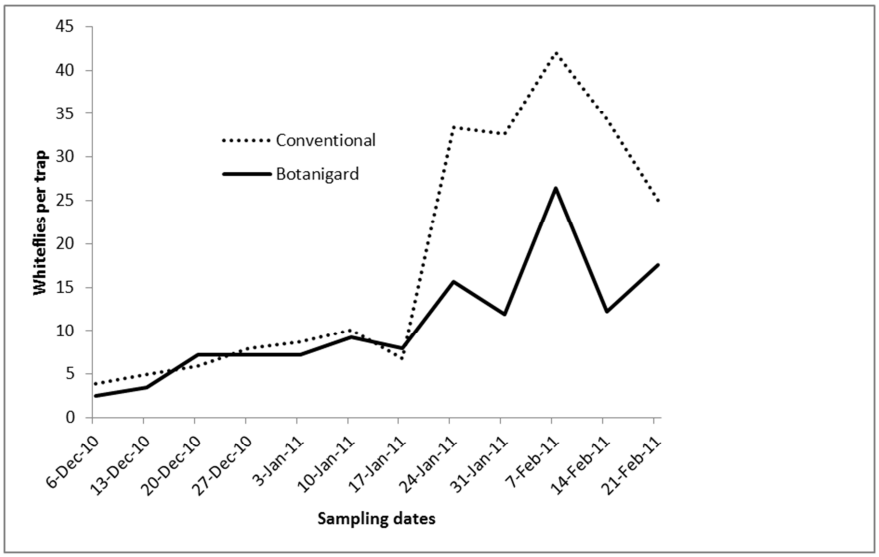

Fig. 1. *Number of whiteflies trapped on different weeks on poinsettia treated with conventional insecticides and BotaniGard.*

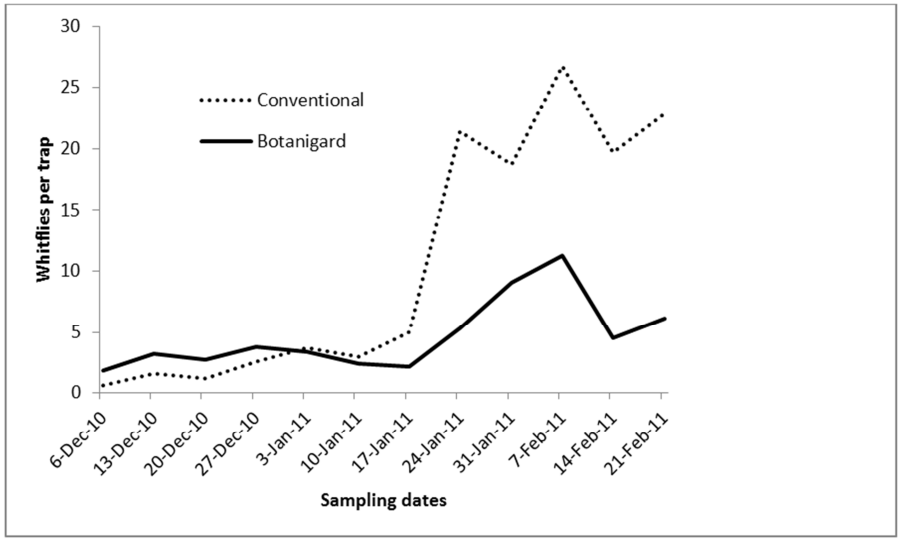

Fig. 2. *Number of whiteflies trapped on different weeks on Dahlia treated with conventional insecticides and BotaniGard.*

3.2. Plant Species Effect

Whiteflies number fluctuated between 0.6 and 26.8 in Dahlia and between 3.9 and 42.0 on poinsettia treated with conventional insecticides (Table 2).

Table 2. *Differences in the level of whitefly population per trap on different weeks on Dahlia and Poinsettia treated with conventional insecticides on different weeks, Doni, 2010/11.*

Date	Dahlia	Poinsettia	t-value	Level of significance
6-Dec-10	0.58	3.92	3.31	0.0061
13-Dec-10	1.58	5.00	2.65	0.0181
20-Dec-10	1.17	5.92	2.37	0.0348
27-Dec-10	2.58	7.92	3.48	0.0035
3-Jan-11	3.67	8.75	1.69	0.1140
10-Jan-11	3.00	10.08	2.50	0.0279
17-Jan-11	5.00	6.75	1.12	0.2262
24-Jan-11	21.42	33.33	1.22	0.2352
31-Jan-11	18.75	32.67	1.64	0.1151
7-Feb-11	26.75	42.00	1.29	0.2174
14-Feb-11	19.67	34.33	1.65	0.1199
21-Feb-11	24.83	25.00	0.30	0.7658

On BotaniGard treated plot, population fluctuated between 1.8 and 11.2 in Dahlia and between 2.5 and 26.4 in Poinsettia (Table 3). In all the sampling weeks, whitefly population was lower in Dahlia than in poinsettia both in conventional (Table 2) and BotaniGard (Table 3) treatments. This difference was significant in five out of the 12 sampling weeks in the conventional treatments (Table 2) and in 6 out of 12 treatments in BotaniGard treatments (Table 3).

Table 3. *Differences in the level of whitefly population per trap on different weeks on Dahlia and poinsettia treated with BotaniGard, Doni 2010/11.*

Date	Dahlia	Poinsettia	t-value	Level of significance
6-Dec-10	1.83	2.50	0.73	0.4730
13-Dec-10	3.25	3.50	0.20	0.8429
20-Dec-10	2.75	7.16	1.89	0.0806
27-Dec-10	3.75	7.25	1.42	01776
3-Jan-11	3.41	7.25	2.28	0.0410
10-Jan-11	2.42	9.25	2.62	0.0226
17-Jan-11	2.17	7.92	3.30	0.0054
24-Jan-11	5.33	15.67	3.80	0.0010
31-Jan-11	9.08	11.92	1.03	0.3125
7-Feb-11	11.25	26.42	2.92	0.0079
14-Feb-11	4.50	12.25	4.09	0.0005
21-Feb-11	6.17	17.58	1.95	0.0722

This suggests that Dahlia is less susceptible to whiteflies than poinsettia. A study on tritrophic effect of host plants on susceptibility of flower thrips to the entomopathogenic fungi *Beauveria bassiana* showed that significantly greater levels of fungal infection were observed when thrips were treated on beans (*Phaseolus vulgaris*) than on impatiens (*Impatiens wallerana*) [14].

4. Conclusion

The performance of BotaniGard was comparable with the conventional insecticides during the first few weeks. As the season progressed and whiteflies number increased, BotaniGard resulted in better control than the conventional insecticides as evidenced by appreciably lower number of whiteflies in BotaniGard treated beds than in conventional insecticide treated beds. Microbial insecticides such as the one tested in this study reduce the risks associated with the use of synthetic insecticides including mammalian and environmental toxicity and can be well integrated with other biological control programs [3, 8, 10]. Hence, BotaniGard may be used as a viable alternative to reducing the use of chemical insecticides in the management of whiteflies in green house produced plants.

Acknowledgements

I thank the assistance of Jos Groenewgen and his group for their assistance in data collection and Maranque plant for providing experimental plots.

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