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Efficacy of Entomopathogenic Fungi Against Whiteflies on Okra

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ABSTRACT: *The field experiment was conducted during* Kharif *season of 2013 to study the Efficacy of Entomopathogenic fungi against whiteflies on okra. During the course of present investigation, three entomopathogenic fungi were tested for their effect at various combinations with each other at same concentrations and compared with chemical insecticide dimethoate 30EC, with a view to find out most effective treatment (s) on Whiteflies on okra. The experiment was conducted at P.G. Research Farm of Agril. Entomology Department, Mahatma Phule Krishi Vidyapeeth, Rahuri. The influence of different biopesticides and their combinations on Whiteflies was studied during the investigation. Thus, the results indicated that combination of entomopathogenic fungi as* B. bassiana *1.15 % WP + V. lecanii 1.15 % WP was the most effective treatment as compared to standard check dimethoate for suppression of whiteflies population on okra.*

Key words: *Beauveria bassiana, Metarhizium anisopliae, Verticillium lecanii, Whiteflies, Okra.*

INTRODUCTION

Okra (Bhendi) *Abelmoschus esculentus* (L.) Moench is one of the most important vegetable grown throughout the tropics and warmer parts of temperate zone. It is widely cultivated as a summer season crop in North India and Maharashtra. Okra is especially valued for its tender delicious fruits in different parts of country. Though it is mainly used as a fresh vegetable, it is also consumed as canned, dehydrated and frozen forms. Dry okra seeds contain 18 to 20 per cent oil, 20 to 23 per cent crude protein and good source of iodine (Barry *et al*., 1988). It has good export potential accounting for 60 per cent of fresh vegetable (Sharman and Arora, 1993). Though okra finds its origin in Central Africa, India stands top in area and production. It is cultivated in an area of 5.8 lakh hectares with an annual production 63.50 lakh tones with a productivity of 12.0 Mt/ha (Anonymous, 2013). In Maharashtra, okra cultivated in an aera of 0.22 lakh hectares with an annual production 3.28 lakh tones/ ha with a productivity of 14.90 Mt/ha (Ann, 2012-13). The major okra growing states include Andhra Pradesh, Uttar Pradesh, Bihar, Orissa, Karnataka, Maharashtra and Assam (Anonymous, 2013).

One of the most important constraints in production of okra is insect pests. As high as 72 species of insects have been recorded on crop (Srinivasa Rao and Rajendra, 2003) among which, the sucking pest complex consisting of aphids (*Aphis gossypii* Glover), leafhopper (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemisia tabacii.* Gennadius) and Thrips (*Thrips tabaci Lindeman*) are major pest and causes 17.46 per cent yield loss in okra (Sarkar *et al*., 1996). To tackle the pest menace, a number of chemical insecticides are liberally sprayed on this vegetable crop which leads to several problems like toxic residues, elimination of natural enemies, environmental disharmony and development of resistance. The demand is ever increasing for organically produced agricultural commodities all round the world and biological control agents have vital role to reduce the pest damage.

Okra being a fresh vegetable that is harvested at regular interval, it is critical to evaluate safer alternatives like botanicals and mycopathogens which possess no residual toxicity, is best suited for vegetables like okra, where we use fresh vegetables for consumption. Earlier workers tested bio-efficacy of some of the indigenous materials against pests of okra (Jayakumar, 2002 and Dhanalakshmi, 2006) and reported their effect in reducing the pest population. Very meagre information is available on the effect of entomopathogenic fungi against okra Whiteflies. In this background, the present studies were carried out

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to evaluate the efficacy of entomopathogenic fungi against okra Whiteflies.

MATERIALS AND METHODS

The field trial was carried out at the experimental farm of Department of Agricultural Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidhyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra during *Kharif* 2013-14 on variety of okra Phule Utkarsha in a randomized block design with three replications. Treatments of *B. bassiana* 1.15% WP @ 5 gm/lit, *M. anisopliae* 1.15% WP @ 5 gm/lit and *V. lecanii* 1.15% WP @ 5 gm/lit and their combinations were tested in comparison with Dimethoate 30 EC 1.5ml/lit and untreated control (Table 1). Three sprays were imposed on need basis. Observations on whiteflies was recorded one day before and 5, 10 and 15 days after spraying, on five randomly selected plants covering three leaves, one each from top, middle and bottom portion of the plant. The data were obtained and analysed statistically suggested by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

The data on the efficacy of various biopesticides treatments on reducing whitefly population after first, second and third spraying are furnished in table 1, 2 and 3, respectively. The pretreatment counts were made a day before spraying indicated that there was no significant difference among the treatments.

At average of first spray after treatments evaluated entomopathogenic fungi proved to be highly pathogenic to whiteflies and they maintained their superiority against whiteflies at 10 days after spray. The treatment was combination of *B. bassiana* 1.15% WP +*V. lecanii* 1.15% WP was in more effective controlling whiteflies with survival population of 2.40 whiteflies/leaves/plant, which were at par with the treatment with *B. bassiana* 1.15% WP (2.67 whiteflies/ leaves/plant). The treatment of dimethoate 30 EC treatment (1.38 whiteflies/leaves/plant) was found siginficantly superior over other treatments. The next best treatments as per their order to merit *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15 % WP, *M. anisopliae* 1.15% WP, *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP and *V. lecanii* 1.15 % WP was recorded of survival population range 3.29 to 4.02 whiteflies/leaves/plant, respectively Table 1.

At average of second spray after treatments all evaluated entomopathogenic fungi proved to be highly pathogenic to whiteflies and they maintained their superiority against whiteflies at 5 days after spray. The treatment with combination of *B. bassiana* 1.15% WP + *V. lecanii* 1.15% WP in controlling whiteflies with survival population of (2.47 whiteflies/leaves/plant), which was at par with the treatment with *B. bassiana* 1.15% WP 2.87 whiteflies/ leaves/plant. It was followed by the treatments *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15 % WP, *M. anisopliae* 1.15% WP, *V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP, *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP and *V. lecanii* 1.15% WP was recorded of survival population in the range of 3.55 to 4.51 whiteflies/leaves/plant, (Table 2).

Table 1
Efficacy of entomopathogenic fungi against whiteflies on okra after first spray

Tr. No.	Treatments	Dosage Qty/lit.	*Number of whiteflies/leaves/plant* — *I Spray* DBS	5 DAS	10 DAS	15 DAS	Average
T_1	*B. bassiana* 1.15% WP	5 gm/lit	4.42(2.21)	2.94(1.85)	2.40(1.70)	2.68(1.78)	2.67(1.78)
T_2	*M. anisopliae* 1.15% WP	5 gm/lit	4.02(2.13)	3.41(1.97)	2.99(1.86)	3.72(2.05)	3.37(1.97)
T_3	*V. lecanii* 1.15% WP	5 gm/lit	4.38(2.20)	4.01(2.12)	3.96(2.11)	4.09(2.13)	4.02(2.12)
T_4	*V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP	5 gm/lit. each	4.14(2.15)	3.61(2.02)	3.37(1.96)	3.93(2.10)	3.64(2.03)
T_5	*B. bassiana* 1.15% WP +*M. anisopliae* 1.15% WP	5 gm/lit. each	4.77(2.29)	3.75(2.05)	3.82(2.08)	4.00(2.11)	3.86(2.09)
T_6	*V. lecanii* 1.15% WP + *B. bassiana*1.15% + WP 1.15% WP	5 gm/lit. each	4.03(2.11)	2.64(1.75)	2.27(1.66)	2.31(1.68)	2.40(1.70)
T_7	*B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15% WP	5 gm/lit. each	4.44(2.22)	3.64(2.03)	2.93(1.85)	3.30(1.95)	3.29(1.95)
T_8	Dimethoate 30EC	1.5 ml/lit	4.41(2.21)	1.30(1.34)	0.90(1.18)	1.93(1.56)	1.38(1.37)
T_9	Untreated control	–	4.70(2.28)	4.57(2.25)	6.01(2.55)	7.21(2.77)	5.93(2.54)
	SE $\pm$	–	0.13	0.10	0.09	0.10	0.05
	CD at 5%	–	NS	0.30	0.26	0.29	0.14
	CV %	–	14.13	12.89	10.91	8.24	7.03

Figures in the parentheses are ($\sqrt{x+0.5}$) transformations, DBS-Day before spraying & DAS-Days after spraying.

Table 2
Efficacy of entomopathogenic fungi against whiteflies on okra after second spray

Tr. No.	Treatments	Dosage Qty/lit.	Number of whiteflies/leaves/plant II Spray 5 DAS	10 DAS	15 DAS	Average
T_1	*B. bassiana* 1.15% WP	5 gm/lit	3.03(1.85)	2.31(1.67)	3.27(1.93)	2.87(1.83)
T_2	*M. anisopliae* 1.15% WP	5 gm/lit	4.17(2.16)	3.48(1.99)	3.88(2.09)	3.84(2.08)
T_3	*V. lecanii* 1.15% WP	5 gm/lit	4.45(2.22)	4.25(2.17)	4.82(2.30)	4.51(2.23)
T_4	*V. lecanii* + *M. anisopliae* 1.15% WP	5 gm/lit. each	4.19(2.15)	3.61(2.03)	3.95(2.10)	3.92(2.09)
T_5	*B. bassiana* 1.15% WP +*M. anisopliae* 1.15 % WP	5 gm/lit. each	4.34(2.19)	3.96(2.11)	4.03(2.13)	4.11(2.15)
T_6	*V. lecanii* 1.15% WP + *B. bassiana* 1.15% WP	5 gm/lit. each	2.53(1.75)	2.01(1.57)	2.87(1.83)	2.47(1.72)
T_7	*B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15% WP	5 gm/lit. each	3.99(2.12)	2.89(1.84)	3.79(2.07)	3.55(2.01)
T_8	Dimethoate 30EC	1.5 ml/lit	0.76(1.12)	1.65(1.47)	2.09(1.60)	1.50(1.41)
T_9	Untreated control	–	8.01(2.92)	4.83(2.31)	8.02(2.92)	6.95(2.73)
	SE ±	–	0.12	0.09	0.11	0.07
	CD at 5%	–	0.37	0.28	0.32	0.21
	CV %	–	10.35	8.36	8.90	6.04

Figures in the parentheses are ($\sqrt{x+0.5}$) transformations, DBS-Day before spraying & DAS-Days after spraying.

Table 3
Efficacy of entomopathogenic fungi against whiteflies on okra after third spray

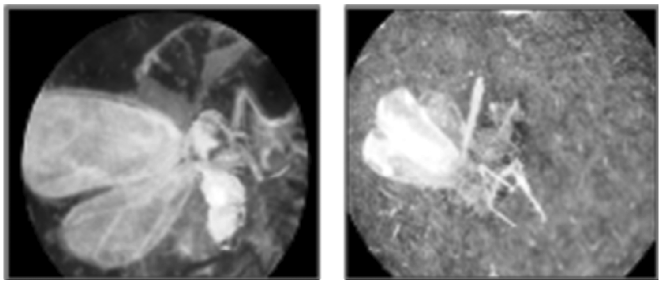
Tr. No.	Treatments	Dosage Qty/lit.	Number of whiteflies/leaves/plant III Spray 5 DAS	10 DAS	15 DAS	Average	Average of three sprays
T_1	*B. bassiana* 1.15% WP	5 gm/lit	3.08(1.89)	2.42(1.71)	2.85(1.82)	2.78(1.81)	2.77(1.81)
T_2	*M. anisopliae* 1.15% WP	5 gm/lit	4.04(2.12)	3.62(2.03)	3.06(1.88)	3.57(2.01)	3.60(2.02)
T_3	*V. lecanii* 1.15% WP	5 gm/lit	5.10(2.37)	5.14(2.37)	4.18(2.16)	4.81(2.30)	4.44(2.22)
T_4	*V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP	5 gm/lit. each	4.28(2.17)	4.31(2.19)	4.08 (2.14)	4.23(2.17)	3.93(2.10)
T_5	*B. bassiana* 1.15% WP +*M. anisopliae* 1.15 % WP	5 gm/lit. each	4.88(2.32)	4.28(2.18)	3.51(2.00)	4.22(2.17)	4.06(2.14)
T_6	*V. lecanii* 1.15% WP + *B. bassiana* 1.15% WP	5 gm/lit. each	2.85(1.82)	2.13(1.61)	2.59(1.76)	2.52(1.73)	2.46(1.72)
T_7	*B. bassiana* +1.15% WP *M. anisopliae* 1.15% WP + *V. lecanii* 1.15% WP	5 gm/lit. each	3.88(2.08)	3.00(1.85)	2.97(1.85)	3.28(1.94)	3.38(1.97)
T_8	Dimethoate 30EC	1.5ml/lit	0.39(0.93)	0.31(0.89)	0.46(0.96)	0.39(0.93)	1.09(1.26)
T_9	Untreated control	–	7.29(2.79)	6.85(2.71)	6.78(2.70)	6.98(2.73)	6.62(2.67)
	SE ±	–	0.10	0.09	0.11	0.06	0.04
	CD at 5%	–	0.31	0.26	0.35	0.18	0.12
	CV %	–	13.70	12.66	10.34	4.91	2.50

Figures in the parentheses are ($\sqrt{x+0.5}$) transformations, DBS-Day before spraying & DAS-Days after spraying.

At average of third spray after treatments, the mean whiteflies population after third spray revealed that the least whitefly count was recorded in standard check dimethoate 30 EC treatment (0.39 whiteflies/leaves/plant) was statistically found superior over other treatments. The next best treatment was combination of *B. bassiana* 1.15% WP + *V. lecanii* 1.15% WP in controlling whiteflies with survival population of (2.52 whiteflies/leaves/plant), which was at par with the treatments with *B. bassiana* 1.15% WP 2.78 whiteflies/leaves. It was followed by the treatment *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15% WP, *M. anisopliae* 1.15% WP, *V. lecanii 1.15%* WP + *M. anisopliae* 1.15% WP, *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP and *V. lecanii* 1.15% WP were recorded of survival population in the range of 3.28 to 4.81 whiteflies/leaves/plant, respectively (Table 3).

The present findings are in agreement with Ota *et al*., (1999) evaluated the two formulation of the *B. bassiana* as an emulsifiable suspension and wettable powder against whitefly on tomato. The result showed that both the formulation of *B. bassiana* were useful for the management of whiteflies.

Zaki (1998) reported that *B. bassiana* was effective in controlling *B. tobaci* and *A. craccivora* infesting cucumber and noted that a dose of 1 mg ml-1 caused 100 per cent mortality in both the pests and mortality decreased with decreasing concentration.



Mycosis on whitefly by *B. bassiana* **Mycosis on whitefly by *M. anisopilae***

Figure 1: Development of mycosis on whiteflies

CONCLUSIONS

The combination of *B. bassiana* 1.15% WP + *V. lecanii* 1.15% WP was found to be the most effective treatment for suppression of whiteflies population on okra.

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