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Efficacy of Entomopathogenic Fungi against Aphids on Okra

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A B S T R A C T

The field experiment was conducted during *Kharif* season of 2013 to study the Efficacy of *Entomopathogenic fungi* against Aphids 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 Aphids 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 aphids was studied during the investigation. Thus, the results indicated that combination of *Entomopathogenic fungi* as *V. lecanii* 1.15 % WP + *M. anisopliae* 1.15 % WP was the most effective treatment as compared to standard check dimethoate for suppression of Aphids population on Okra.

Keywords

Beauveria bassiana, *Metarhizium anisopliae*, *Verticillium lecanii*, Aphids, Okra.

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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 area 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 meager information is available on the effect of *Entomopathogenic fungi* against okra Aphids. In this background, the present studies were carried out to evaluate the efficacy of *Entomopathogenic fungi* against okra Aphids.

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, and 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 Aphids 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 Aphids 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 indicated that, all the treatments were found superior in suppressing the aphid's population as compared to untreated control. The treatment dimethoate 30 EC was significantly superior over other treatment recorded 5.19 aphids/leaves/plant. Among biopesticides the treatment was combinations of *V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP spray in controlling aphids with survival population of 8.96 aphids/leaves/plant which were at par with the treatment *V. lecanii* 1.15 % WP, *B. bassiana* 1.15% WP + *M. anisopliae*1.15% WP + *V. lecanii* 1.15% WP and *M. anisopliae* 1.15% WP recorded 9.68, 9.80 and 10.25aphids/leaves/plant respectively. It was followed by the treatments *V. lecanii* 1.15% WP + *B. bassiana*1.15% WP 1.15% WP (10.51aphids/leaves/plant), *B. bassiana* 1.15% WP +*M. anisopliae* 1.15 % WP (11.01aphids/leaves/plant) and *B. bassiana* 1.15%WP (14.61 aphids/leaves/plant), respectively (Table 1).

Table.1 Efficacy of *Entomopathogenic fungi* against aphid on okra after first spray

Tr. No.	Treatments	Number of aphids/leaves/plant					
		Dosage	I Spray				
		Qty/ lit.	DBS	5 DAS	10 DAS	15 DAS	Average
T_1	B. bassiana 1.15% WP	5 gm/lit	18.09 (4.3)	14.12 (3.86)	13.10 (3.68)	16.4 (4.10)	14.61 (3.89)
T_2	M. anisopliae 1.15% WP	5 gm/lit	17.57 (4.24)	11.91 (3.52)	8.77 (3.04)	10.07 (3.25)	10.25 (3.28)
T_3	V. lecanii 1.15% WP	5 gm/lit	18.56 (4.32)	11.68 (3.49)	8.71 (3.03)	9.08 (3.09)	9.68 (3.18)
T_4	V. lecanii 1.15% WP + M. anisopliae 1.15% WP	5 gm/lit. each	18.59 (4.36)	11.26 (3.37)	7.44 (2.82)	7.77 (2.86)	8.96 (3.06)
T_5	B. bassiana 1.15% WP +M. anisopliae 1.15 % WP	5 gm/lit. each	17.51 (4.24)	12.57 (3.61)	10.20 (3.26)	10.95 (3.38)	11.01 (3.39)
T_6	V. lecanii 1.15% WP + B. bassiana1.15% WP 1.15% WP	5 gm/lit. each	19.32 (4.43)	12.05 (3.54)	9.71 (3.19)	10.66 (3.34)	10.51 (3.32)
T_7	B. bassiana 1.15% WP + M. anisopliae1.15% WP + V. lecanii 1.15% WP	5 gm/lit. each	18.20 (4.29)	11.48 (3.46)	8.52 (3.00)	9.41 (3.14)	9.80 (3.21)
T_8	Dimethoate 30EC	1.5 ml/lit	19.25 (4.44)	6.13 (2.57)	3.54 (2.01)	5.88 (2.53)	5.19 (2.38)
T_9	Untreated control	-	19.48 (4.45)	23.12 (4.86)	27.15 (5.26)	27.9 (5.33)	26.06 (5.15)
	SE ±	-	0.23	0.17	0.10	0.12	0.08
	CD at 5%	-	NS	0.51	0.30	0.36	0.24
	CV %	-	9.46	8.26	9.81	10.14	8.16

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 aphid on okra after Second spray

Tr. No.	Treatments	Number of aphids/leaves/plant				
		Dosage	II Spray			
		Qty/ lit.	5 DAS	10 DAS	15 DAS	Average
T_1	B. bassiana 1.15% WP	5 gm/lit	12.81 (3.64)	14.26 (3.84)	13.05 (3.68)	13.37 (3.72)
T_2	M. anisopliae 1.15% WP	5 gm/lit	9.20 (3.11)	8.91 (3.06)	8.99 (3.07)	9.03 (3.09)
T_3	V. lecanii 1.15% WP	5 gm/lit	8.29 (2.96)	7.51 (2.82)	8.66 (3.03)	7.78 (2.88)
T_4	V. lecanii 1.15% WP + M. anisopliae 1.15% WP	5 gm/lit. each	7.18 (2.77)	6.95 (2.72)	7.84 (2.88)	7.70 (2.86)
T_5	B. bassiana 1.15% WP +M. anisopliae 1.15 % WP	5 gm/lit. each	10.51 (3.31)	9.26 (3.12)	12.49 (3.60)	10.75 (3.35)
T_6	V. lecanii 1.15% WP + B. bassiana1.15% WP 1.15% WP	5 gm/lit. each	10.03 (3.24)	9.96 (3.23)	9.44 (3.14)	9.81 (3.21)
T_7	B. bassiana 1.15% WP + M. anisopliae1.15% WP + V. lecanii 1.15% WP	5 gm/lit. each	8.63 (3.01)	8.84 (3.05)	9.33 (3.13)	8.93 (3.07)
T_8	Dimethoate 30EC	1.5 ml/lit	4.64 (2.26)	5.74 (2.49)	7.54 (2.83)	5.98 (2.54)
T_9	Untreated control	-	24.64 (5.01)	23.33 (4.88)	26.18 (5.16)	24.72 (5.02)
	SE ±	-	0.12	0.11	0.08	0.06
	CD at 5%	-	0.37	0.33	0.23	0.17
	CV %	-	9.17	10.71	11.16	8.05

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 aphid on okra after Third spray

Tr. No.	Treatments	Dosage	Number of aphids/leaves/plant				Average of three sprays
			III Spray				
		Qty/ lit.	5 DAS	10 DAS	15 DAS	Average	
T_1	B. bassiana 1.15% WP	5 gm/lit	11.33 (3.44)	10.16 (3.26)	8.36 (2.96)	9.95 (3.23)	11.06 (3.40)
T_2	M. anisopliae 1.15% WP	5 gm/lit	7.46 (2.82)	7.00 (2.74)	7.39 (2.81)	7.28 (2.79)	7.87 (2.89)
T_3	V. lecanii 1.15% WP	5 gm/lit	6.44 (2.63)	5.96 (2.54)	6.04 (2.54)	6.15 (2.57)	7.02 (2.74)
T_4	V. lecanii 1.15% WP + M. anisopliae 1.15% WP	5 gm/lit. each	6.40 (2.62)	5.14 (2.37)	5.84 (2.52)	5.80 (2.51)	6.73 (2.69)
T_5	B. bassiana 1.15% WP +M. anisopliae 1.15 % WP	5 gm/lit. each	10.65 (3.34)	8.85 (3.06)	8.24 (2.95)	9.25 (3.12)	9.31 (3.13)
T_6	V. lecanii 1.15% WP + B. bassiana1.15% WP 1.15% WP	5 gm/lit. each	7.59 (2.84)	7.36 (2.80)	7.72 (2.87)	7.56 (2.84)	8.18 (2.95)
T_7	B. bassiana 1.15% WP + M. anisopliae1.15% WP + V. lecanii 1.15% WP	5 gm/lit. each	7.15 (2.76)	6.60 (2.64)	6.48 (2.64)	6.74 (2.69)	7.51 (2.82)
T_8	Dimethoate 30EC	1.5 ml/lit	1.96 (1.56)	0.98 (1.21)	1.82 (1.52)	1.59 (1.44)	3.61 (2.03)
T_9	Untreated control	-	24.28 (4.98)	20.50 (4.58)	20.97 (4.63)	21.92 (4.73)	21.64 (4.71)
	SE ±	-	0.08	0.09	0.07	0.06	0.06
	CD at 5%	-	0.24	0.27	0.32	0.18	0.18
	CV %	-	13.96	14.98	10.50	7.73	7.42

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

At average second spray indicated that, all the treatments were found superior in suppressing the aphids' population as compared to untreated control. The treatment dimethoate 30 EC was significantly superior over other treatment recorded 4.64 aphids/leaves/plant. The next promosing treatment was combination of *V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP spray in controlling aphids with survival population 7.70 aphids/leaves/plant which were at par with the treatments *V. lecanii* 1.15 % WP 7.78 aphids/leaves/plant and. It was followed by the treatment of *B. bassiana* 1.15% WP +*M. anisopliae* 1.15 % WP + *V. lecanii* 1.15% WP recorded (8.93aphids/leaves/plant). The performing treatments in order to their merit were *M. anisopliae* 1.15% WP, *V. lecanii* 1.15% WP + *B. bassiana* 1.15% WP, *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP and *B. bassiana* 1.15 % were recorded of survival population in the range of 9.03 to 13.37 aphids/leaves/plant, respectively (Table2).

At average of third spray after treatments, the mean aphids' population after third spray revealed that the least aphids count was recorded in standard check dimethoate 30 EC treatment (1.59aphids/leaves/plant) was statistically found superior over other treatments. The next best treatment was combination of *V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP in controlling aphids with survival population of (5.80 aphids/leaves/plant), which were at par with the treatments *V. lecanii* 1.15% WP and *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15% WP recorded 6.15 and 6.74 aphids/leaves/plant. It was followed by the treatments *M. anisopliae* 1.15% WP (7.28 aphids/leaves/plant), *V. lecanii* 1.15% WP + *B. bassiana* 1.15% WP (7.56 aphids/leaves/plant) and *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP (9.25 aphids/leaves/plant). The least significant treatment was *B. bassiana* 1.15% WP was recorded 9.95 aphids/leaves/plant respectively (Table 3).

The present findings are in agreement with Dromph *et al.,* (1996) who studied the pathogenicity of *V. lecanii* and *B. bassiana* against cereal aphid, *Rhopalosiphum padi* and *Metalophium dirhodium* and found that *V. lecanii* was more effective than *B. bassiana.*

Safavi *et al.,* (2002) showed that *V. lecanii* significantly increased aphid mortality due to mycosis from 45.55 per at dose of 10^4 conidia/ml to 95.55 per cent at 10^8 conidia/ml.

Neelam *et al.,* (2003) tested the *L. lecanii* at the concentration of 10^6, 10^7,10^8 conidia ml^{-1} against *L.* erysimi and reported the highest mortality of 80 per cent 96hrs of treatment at the concentration of 10^8 conidia ml^{-1}. The results obtained in could support the earlier finding of Grunberg *et al.,* (1988), karinadah *et al.,* (1996).

Efficacy of mycopathogen against aphids is in accordance with Nirmala *et al.,* (2006), according to whom the V11 isolate of *V. lecanii* recorded maximum mortality of A. *Craccivora* and *A. gossypii*. Further, more efficacy of M.anisopliae against aphid was in accordance with Masuda and Kikuchi. (1992), Ekeshi *et al.,* (2000) and B.basiana was found effective in controlling the aphids supported by Liu-yin-Quan *et al.,* (1999) and Zang *et al.,* (2001).

The combination of *V. lecanii* 1.15% WP + *M. ansiopliae*1.15% WP was found to be the most effective treatment for suppression of Aphids population of O

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