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Detrimental Effect of Entomopathogenic Fungi on Coccinellid Predatorson Okra

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Abstract: *The field experiment was conducted during Kharif season of 2013 to study the detrimental effect of entomopathogenic fungi on coccinellid predators 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 coccinellid predators 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 coccinellids predators was studied during the investigation. Thus, the results indicated that B. bassiana 1.15% WP alone and in combination with other entomopathogenic fungi was detrimental for the coccinellids predators as it recorded lower number of survival lady bird beetle population, as compared to other entomopathogenic fungi.*

Keywords: *Beauveria bassiana, Metarhizium anisopliae, Verticillium lecanii, Coccinellids, 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).

To tackle the pest menace, a number of chemical insecticides areliberally sprayed on this vegetable crop which leads to several problems like toxic residues, elimination of natural enemies, environmental disharmony and development of resistance.Demand is ever increasing for organically produced agricultural commodities all round the globe and biological agents havevital role to contain the pest damage. During export there is alsoa risk of rejection of whole consignment due to presence ofpesticide residues. To overcome these problems application of my coin secticides would be better option and thus forms integral part of IPM.

MATERIALS AND METHODS

The experiment was laid out in a randomized block design with three replications in plots measuring the 3.0 × 2.7mand with a spacing of 30 cm between rows and 15 cm between plants. Phule Utkarsha Okra variety was raised during *kharif* by following all the

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

Tr.No.	Treatments	Dosage	Number of coccinellids/plant				
			I Spray				
		Qty/ lit.	DBS	5 DAS	10 DAS	15 DAS	Average
T_1	*B. bassianna* 1.15% WP	5 gm/lit	1.82(1.52)	1.80(1.51)	1.99(1.58)	1.97(1.56)	1.93(1.56)
T_2	*M. anisopliae* 1.15% WP	5 gm/lit	3.31(1.94)	2.79(1.81)	2.76(1.80)	3.03(1.88)	2.86(1.83)
T_3	*V. lecanii* 1.15% WP	5 gm/lit	2.50(1.71)	2.79(1.81)	2.67(1.78)	3.29(1.94)	2.91(1.85)
T_4	*V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP	5 gm/lit. each	2.84(1.81)	2.85(1.83)	3.03(1.88)	3.63(2.03)	3.17(1.91)
T_5	*B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP	5 gm/lit. each	2.92(1.83)	2.56(1.75)	2.76(1.81)	2.96(1.86)	2.67(1.78)
T_6	*V. lecanii* 1.15% WP + *B. bassiana* 1.15% WP	5 gm/lit. each	2.65(1.77)	2.66(1.78)	2.66(1.78)	2.67(1.78)	2.66(1.78)
T_7	*B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15% WP	5 gm/lit. each	2.74(1.80)	2.73(1.79)	2.95(1.86)	3.46(1.99)	3.05(1.88)
T_8	Dimethoate 30EC	1.5 ml/lit	2.41(1.70)	1.68(1.47)	1.71(1.48)	1.07(1.25)	1.49(1.41)
T_9	Untreated control	–	3.08(1.85)	3.21(1.93)	3.22(1.93)	3.81(2.07)	3.41(1.98)
	SE ±	–	0.20	0.12	0.08	0.07	0.04
	CD at 5%	–	0.26	0.22	0.16	0.18	0.14
	CV %	–	11.45	7.69	5.34	6.74	4.20

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

recommended package of practices except the plant protection measures. Nine treatments of the three fungi and its combination *viz, M. anisopliae, B. bassiana* and *V. lecanii* were tested along with the standard chemical check, Dimethoate 30 EC and untreated check. The spray fluid was applied with hand operated knapsack sprayer. Total three sprays were given. First spray given at 45 days after sowing and subsequent sprays were applied at the fortnightly interval. Average numbers of predatory *coccinellids* grubs and beetles were counted on five randomly selected plants from each treatment plot before first application and 5^{th}, 10^{th} and 15^{th} day after each application. The datawere obtained and analysed statistically suggested by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Effect of evaluated biopesticides on the abundance of *Coccinella spp*. was studied by comparing the survival population of predatory coccinellids on treated and untreated okra plots. In field experiments on effect of biopesticides on coccinellid predators, the status of natural enemies was recorded after 1^{st}, 2^{nd} and 3^{rd} spray by counting grubs and adults of *Coccinella spp*. Initial count of coccinellid predators before sprays was no significant.

At average of first spray after treatment, untreated control recorded 3.41 grubs of lady bird beetles which were significantly higher than the remaining treatments. However, treatment of *V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP, *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15% WP, *V. lecanii* 1.15%WP + *B. bassiana* 1.15% WP, *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP, *V. lecanii* 1.15% WP and *M. anisopliae* 1.15% WP were found at par with untreated control. These treatments recorded survival lady bird beetle grubs per plant in the range of 2.66 to 3.17, respectively. Whereas, *B. bassiana* alone and in combination with *V. lecanii* 1.15% WP and *M. anisopliae* 1.15% WP showed significant reduction in coccinellids due to adverse effect. Among the treatments the standard checke insecticide, there was reduction in coccinellid population at 5 days after spraying. Whereas, increasing trend was noticed at 10 and 15 days after application, respectively (Table 1).

At average of second spray after treatment, untreated control recorded 4.50 grubs of lady bird beetles which were significantly higher than the remaining treatments. However, treatment of *V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP, *V. lecanii* 1.15% WP + *B. bassiana* 1.15% WP + *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, *V. lecanii* 1.15% WP and *M. anisopliae* 1.15% WP were found at par with untreated control. These treatments recorded survival lady bird beetle grubs per plant in the range of 3.36 to 4.13, respectively. Whereas, *B. bassiana* alone and in combination with *V. lecanii* 1.15% WP and *M. anisopliae* 1.15% WP showed significant reduction in coccinellids due to adverse effect. Among the treatments the standard check insecticide, there was reduction in coccinellid population at 5 days after spraying. Whereas,

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

Tr.No	Treatments	Dosage	Number of coccinellids/plant			
			II Spray			
		Qty/ lit.	5 DAS	10 DAS	15 DAS	Average
T_1	*B. bassianna* 1.15% WP	5 gm/lit	1.76(1.50)	1.83(1.52)	1.87(1.54)	1.82(1.52)
T_2	*M. anisopliae* 1.15% WP	5 gm/lit	2.94(1.85)	2.97(1.86)	2.98(1.86)	2.96(2.01)
T_3	*V. lecanii* 1.15% WP	5 gm/lit	3.03(1.88)	3.09(1.89)	2.95(1.85)	3.02(1.82)
T_4	*V. lecanii* 1.15% WP + *M. anisopliae* 1.15% WP	5 gm/lit. each	3.35(1.95)	3.29(1.93)	3.21(1.91)	3.28(1.94)
T_5	*B. bassiana* 1.15% WP +*M. anisopliae* 1.15 % WP	5 gm/lit. each	2.771.80)	2.89(1.84)	2.73(1.80)	2.79(1.81)
T_6	*V. lecanii* 1.15% WP + *B. bassianna* 1.15% WP	5 gm/lit. each	2.90(1.84)	2.85(1.83)	2.80(1.82)	2.85(1.83)
T_7	*B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15% WP	5 gm/lit. each	3.18(1.92)	3.17(1.91)	3.16(1.91)	3.17(1.91)
T_8	Dimethoate 30EC	1.5 ml/lit	1.66(1.46)	1.15(1.28)	1.25(1.32)	1.35(1.36)
T_9	Untreated control	–	3.64(2.03	3.65(2.03)	3.69(2.04)	3.66(2.03)
	SE ±	–	0.07	0.09	0.10	0.05
	CD at 5%	–	0.21	0.29	0.24	0.16
	CV %	–	6.86	9.43	7.90	3.61

Figures in the parentheses are $\sqrt{x+0.5}$ transformations, DBS-Day before spraying DAS-Day Safter spraying

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

Tr.No	Treatments	Dosage	Number of coccinellids/ plant			
			III Spray			
		Qty/ lit.	5 DAS	10 DAS	15 DAS	Average
T_1	*B. bassianna* 1.15% WP	5 gm/lit	1.59(1.44)	1.78(1.51)	1.81(1.52)	1.72(1.49)
T_2	*M. anisopliae* 1.15% WP	5 gm/lit	2.98(1.86)	3.07(1.89)	2.79(1.81)	2.95(1.85)
T_3	*V. lecanii* 1.15% WP	5 gm/lit	2.59(1.75)	2.92(1.84)	2.94(1.85)	2.82(1.82)
T_4	*V. lecanii* 1.15 % WP + *M. anisopliae* 1.15% WP	5 gm/lit. each	2.75(1.80)	2.93(1.85)	3.09(1.89)	2.92(1.85)
T_5	*B. bassiana* 1.15 % WP +*M. anisopliae* 1.15 % WP	5 gm/lit. each	2.79(1.81)	2.89(1.84)	2.72(1.79)	2.80(1.82)
T_6	*V. lecanii* + *B. bassiana* 1.15% WP	5 gm/lit. each	2.78(1.81)	2.86(1.83)	2.87(1.83)	2.84(1.83)
T_7	*B. bassiana* 1.15 % WP + *M. anisopliae* 1.15 % WP + *V. lecanii* 1.15% WP	5 gm/lit. each	3.00(1.87)	3.03(1.86)	2.89(1.84)	2.97(1.86)
T_8	Dimethoate 30EC	1.5 ml/lit	1.22(1.31)	1.21(1.29)	1.22(1.31)	1.22(1.31)
T_9	Untreated Plot	–	3.29(1.94)	3.46(1.98)	3.88(2.08)	3.54(2.01)
	SE +	–	0.07	0.11	0.08	0.O5
	CD at 5%	–	0.21	0.32	0.25	O.15
	CV %	–	7.07	10.28	8.20	4.84

Figures in the parentheses are $\sqrt{x+0.5}$ transformations, DBS-Day before spraying DAS-Day Safter spraying

increasing trend was noticed at 10 and 15 days after application, respectively (Table 2).

At average of third spray after treatment, untreated control recorded 3.54 grubs of lady bird beetles which were significantly higher than the remaining treatments. However, treatment of *V. lecanii* 1.15% WP + *M. anisopliae*1.15% WP, *V. lecanii* 1.15% WP + *B. bassiana* 1.15% WP + *M. anisopliae* 1.15% WP + *V. lecanii* 1.15% WP, *V. lecanii* 1.15% WP + *B. bassiana* 1.15% WP, *B. bassiana* 1.15%WP + *M. anisopliae* 1.15% WP, *V. lecanii* 1.15% WPand *M. anisopliae* 1.15% WP were found at par with untreated control. These treatments recorded survival lady bird beetle grubs per plant in the range of 2.80 to 2.95, respectively. Whereas, *B. bassiana* alone and in combination with *V. lecanii* 1.15% WP and *M. anisopliae* 1.15% WP showed significant reduction in coccinellids due to pathogenic effect.

Figures in the parentheses are () transformations, DBS-Day before spraying DAS-Days after sprayingAmong the treatments the standard check insecticide, there was reduction in coccinellid population at 5 days after spraying. Whereas, increasing trend was noticed at 10 and 15 days after application, respectively (Table 3).

All the biopesticides except *B. bassiana* 1.15% WPwere found safer to predatory lady bird beetles as they showed near about equal population of lady bird beetle grubs per plant even up to 15 days after foliar sprays as it was observed in untreated plot.

There was no significant difference among the treatments in respect of lady bird beetle count. Similar, results were reported by Chambers and Helyer (1988), Kaethner (1991) and Helyer (1993).Whereas, susceptibility of ladybird beetles to *B. bassiana* in laboratory studies reported by Masarrat and Humayun (1996), Haseeb and Murad (1997, Jaronski *et al.* (1998) and Cagan and Uhlik (1999). These results are in conformity with present results. It is concluded that several numerous a biotic and biotic factors may help to protect non target insects from mycoinsecticides.

CONCLUSIONS

All the entomopathogenic fungal treatments except *B. bassiana* were found safe to coccinellids, while *B. bassiana* showed pathogenic effect on predatory coccinellids at 10 and 15 days after application

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