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Efficacy of Biopesticides, Insect Growth Regulators and Insect Growth Regulator Along with Insecticides Ready Combi Products Against Aphid in Okra

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ABSTRACT

Eight insecticidal treatments (including biopesticides, IGR, IGR and insecticides ready combi products) were evaluated against aphids (*Aphis gossypii* Glover) in okra. The results revealed that buprofezin 15% + acephate 35% WP proved effective in minimizing the *A. gossypii*. However, it was found at par with pyriproxyfen 5% + fenpropathrin 15% EC. Among biopesticides, azadirachtin 1% EC (10000 ppm) and *Lecanicillium lecanii* 1.15 % WP were effective at reducing aphid population and better option for managing pest in organic farming. No deleterious effect of these tested treatments was observed on the natural enemies. Maximum okra pod yield was obtained with buprofezin 15% + acephate 35% WP (77.58 q/ha) and it proved to be the economically viable.

Key words: *Okra, Aphid, Insecticides, Biopesticides, IGR, Buprofezin, Pyriproxyfen, Acephate, Fenpropathrin, Azadirachtin*

Introduction

Okra, *Abelmoschus esculentus* (L.) Moench known by several names, such as gumbo, bhindi, lady's finger is a green fresh fruit vegetable that is native to India's tropical and subtropical regions. Okra thus plays a major part in a healthy human diet since it is low in fat, high in minerals and provides carbohydrates. Okra is a perineal vegetable crop that is grown in India throughout the *Kharif*, *Rabi* and Summer season. Growers are getting benefit from a short growing season and high output, which increase their income per unit area so there is great need for vegetable like okra. One of the main things that hinders the production of okra is the destruction caused by insect pests. Aphids and leafhoppers are major pests that weaken, destroy, and reduce crop yield in the early stages of the crop. According to Chaudhary and Dadeech (1989), yield losses would have been 54.04% if they hadn't been reduced at an early stage. The use of insecticides to counter this results in environmental problems (Moreira *et al.*, 1996). Such issues can be resolved with more environmentally friendly techniques that are more selective and less harmful to organisms that are not intended (Faria, 2009). Low doses of biopesticides are still effective and are permitted in organic farming. These are reasonably straight forward to get, less destructive to natural enemies and insect pollinators and environmentally favorable (Jan *et al.*, 2022). IGRs are the newest method for commercial and operational insect control. They provide a good alternative for a selective insect pest control that is compatible with current IPM program due to their

(*[1]Ph.D. Scholar, [2]Professor, 3Assistant Prof., [4]Former Head) species or stage-specificities that were higher in use than those of conventional pesticides. IGRs typically have a high degree of non-target biota safety (Hasan and Nedim, 2004). Keeping these in view, the present study evaluates the efficacy of some of these biopesticides, IGRs and IGRs insecticide combi products against aphids (*Aphis gossypii* Glover) on okra.

Materials and Methodology

The present study was conducted at the experimental farm of Department of Entomology of Mahatama Phule Krishi Vidyapeeth, Rahuri, District Ahmednagar during *Kharif* 2022 & *Kharif* 2023. The trial was laid out in a randomized block design (RBD) with eight treatments including control, each replicated thrice. The okra hybrid (Ankur-2338) was dibbled at 30 x 30 cm spacing in plot size about 3 m x 3 m. All recommended package and practices were followed, with four treatment sprays applied at 10 days interval. The data on the incidence of *A. gossypii* were collected 24 hr pretreatment and 3, 10 and 14 days of post-treatment. The treatments included *Lecanicillium lecanii* 1.15 % WP, *Beauveriabassiana* 1.15 % WP, *Metarhiziumanisopliae* 1.15 % WP, Azadirachtin 1% EC (10000 ppm), Buprofezin 25% SC, Acephate 75% SP, Buprofezin 15% + Acephate 35% WP, Pyriproxyfen 10% EC, Fenpropathrin 30% EC, Pyriproxyfen 5% + Fenpropathrin 15% EC and untreated control. The data obtained were subjected to appropriate transformations before statistical analysis to test the level of significance as per Gomez and Gomez (1984).

Effect of biopesticides and insecticides on aphid population of okra (*Kharif* 2022 & 2023)

The pooled analysed data presented in Table 1 showed that no significant difference before conducting first spray and significant difference was observed after application of insecticides and biopesticides on population of aphid in okra at 3,5 and 10 DAS.

After average pooled mean analysis of two years, significantly the least aphid population was observed in the treatment buprofezin 15% + acephate 35% WP and pyriproxyfen 5% + fenpropathrin 15% EC recording 2.85 and 3.47 aphids/3 leaves/plant. The next superior treatments with acephate 75% SP, buprofezin 25% SC and pyriproxyfen 10% EC with 5.81, 6.78 and 7.58 aphids/3 leaves/plant subsequently followed by other treatments fenpropathrin 30% EC, azadirachtin 1% EC (10000 ppm), *Lecanicillium lecanii* 1.15 % WP recording 8.34, 8.84, 10.67 aphids/3 leaves. Among biopesticides, treatment *Lecanicillium lecanii* 1.15 % WP were at par with *Beauveria bassiana* 1.15 % WP and *Metarhizium anisopliae* 1.15 % WP recording 10.67, 11.56 and 12.60 aphids/3 leaves/plant. However, among all treatment untreated control recorded highest aphid population 24.69 aphids/3 leaves/plant. However, The average marketable yield and per cent increase in yield (q/ha) of okra was obtained in ready insecticide combination product buprofezin 15% + acephate 35% WP (77.58 q/ha, 56.66 per cent) which was at par with other ready combi product pyriproxyfen 5% + fenpropathrin 15% EC (76.00 q/ha), buprofezin 25% SC (70.90 q/ha, 53.47 per cent).

The following are authors are in conformity with findings of research, Nazir (2008) revealed that spinosad and vertimec were found to be most outstanding treatment followed by *M. anisopliae*, *L. lecanii* (17.66 aphids/3 leaves), dashparni extract and *B. bassiana* in order of efficacy against aphids in Bt cotton. Naik *et al.* (2012) reported *Lecanicillium lecanii* @ 2.5 g/l was superior among Biopesticides and was on par with *Metarhizium anisopliae* (2.5g/l) in controlling aphids in okra. According to Konar *et al*. (2013) found imidacloprid 17.8 SL (@ 30 g a.i./haand acephate 75% SP @ 300 g a.i./ha were the most effective treatments for lowering the aphid population in okra. In chilli, Acephate 75 SP topped over buprofezin 25 SC in terms of aphid, leafhopper and whitefly control (Kumawat *et al*., 2015). Patil *et al*. (2016) and Mahale *et al*. (2017) evaluated effectiveness of acephate 75 SP against aphid in okra and cotton. According to Nemade *et al*. (2017), flonicamid 50% WG @ 100 g a.i./ha was the most effective treatment for aphids in okra followed by diafenthiuron 50% WP @ 300 g a.i./ha, buprofezin 25% SC @ 250 g a.i./ha, NSKE 5% and *Lecanicillium lecanii* @ 5 g/l. Raghunandan *et al.* (2018) assessed the efficacy of *Lecanicillium lecanii* @ 4 g/l and *Beauveriabassiana* @ 4 g/l against aphids in Bt cotton. Naveena and Sharanabasappa (2019) revealed superiority of acephate 75SP over buprofezin 25 SC against sucking pests of cotton like aphids. Similar results reported by Ramalakshmi *et al*. (2020). According to Sahar (2019), pyriproxyfen 10% EC (74.03 and 69.77 per cent) andbuprofezin 25% SC (70.59 and 66.84 per cent) showed the highest mean reduction percentage of *Aphis gossypii* in cotton.

Table 1. Cumulative effect of biopesticides and insecticides on aphid of okra after four spray and pooled mean (*Kharif* 2022 & 2023)

Tr. No.	Treatment details	Dose (g or ml/lit)	No. of aphids/3 leaves/plant														Yeild (q/ha)	Per cent increase over control (%)
			Kharif 2022					*Kharif* 2023					Pooled mean					
			DBS	3 DAS	5 DAS	10 DAS	Mean	DBS	3 DAS	5 DAS	10 DAS	Mean	3 DAS	5 DAS	10 DAS	Mean		
T_1	*Lecanicilliumlecanii* 1.15 % WP	5	14.30 (3.85)	15.50 (4.00)	14.80 (3.91)	13.55 (3.75)	14.62 (3.89)	20.17 (4.54)	12.16 (3.54)	11.09 (3.39)	10.17 (3.26)	11.14 (3.40)	11.68 (3.49)	10.67 (3.34)	9.67 (3.19)	10.67 (3.34)	60.90	22.98
T_2	*Beauveriabassiana* 1.15 % WP	5	16.57 (4.13)	16.30 (4.10)	15.57 (4.01)	14.67 (3.89)	15.51 (4.00)	18.54 (4.36)	13.15 (3.69)	12.03 (3.54)	11.05 (3.38)	12.08 (3.54)	12.54 (3.61)	11.60 (3.48)	10.55 (3.32)	11.56 (3.47)	57.33	15.77
T_3	*Metarhiziumanisopliae* 1.15 % WP	5	16.30 (4.10)	17.53 (4.25)	16.87 (4.17)	15.75 (4.03)	16.72 (4.15)	19.95 (4.51)	14.15 (3.83)	12.97 (3.67)	12.03 (3.53)	13.05 (3.68)	13.57 (3.75)	12.60 (3.62)	11.61 (3.48)	12.60 (3.62)	59.54	20.23
T_4	Azadirachtin 1% EC (10000 ppm)	2	15.67 (4.02)	10.74 (3.35)	8.95 (3.07)	11.23 (3.42)	10.31 (3.29)	19.84 (4.50)	9.60 (3.18)	8.39 (2.98)	9.92 (3.23)	9.30 (3.13)	9.07 (3.09)	7.93 (2.90)	9.51 (3.16)	8.84 (3.06)	62.36	25.93
T_5	Buprofezin 25% SC	0.6	16.84 (4.15)	9.20 (3.11)	6.93 (2.73)	10.80 (3.36)	8.98 (3.08)	20.60 (4.59)	7.44 (2.82)	5.99 (2.55)	8.09 (2.93)	7.17 (2.77)	6.87 (2.71)	5.61 (2.47)	7.85 (2.89)	6.78 (2.70)	70.90	43.17
T_6	Acephate 75% SP	0.8	17.50 (4.22)	8.73 (3.04)	5.90 (2.53)	9.75 (3.20)	8.13 (2.94)	19.23 (4.44)	6.27 (2.60)	4.94 (2.33)	7.15 (2.77)	6.12 (2.57)	5.94 (2.54)	4.67 (2.27)	6.81 (2.70)	5.81 (2.51)	69.50	40.35
T_7	Buprofezin 15% + Acephate 35% WP	1.5	16.37 (4.11)	3.95 (2.11)	3.19 (1.92)	4.80 (2.30)	3.98 (2.12)	18.35 (4.33)	2.86 (1.83)	2.05 (1.60)	3.81 (2.08)	2.91 (1.85)	2.82 (1.82)	2.03 (1.59)	3.70 (2.05)	2.85 (1.83)	77.58	56.66
T_8	Pyriproxyfen 10% EC	1.7	17.10 (4.16)	9.50 (3.16)	6.85 (2.71)	10.95 (3.38)	9.10 (3.10)	18.70 (4.38)	8.24 (2.95)	6.67 (2.68)	8.73 (3.04)	7.88 (2.89)	7.84 (2.89)	6.32 (2.61)	8.57 (3.01)	7.58 (2.84)	68.75	38.83
T_9	Fenpropathrin 30% EC	0.3	16.90 (4.17)	10.45 (3.31)	7.83 (2.89)	11.40 (3.45)	9.89 (3.22)	17.87 (4.29)	9.31 (3.13)	7.22 (2.78)	9.84 (3.22)	8.79 (3.05)	8.75 (3.04)	6.90 (2.72)	9.37 (3.14)	8.34 (2.97)	66.78	34.85
T_{10}	Pyriproxyfen 5% + Fenpropathrin 15% EC	1	17.73 (4.27)	4.23 (2.17)	3.50 (2.00)	5.53 (2.46)	4.42 (2.22)	18.55 (4.36)	3.82 (2.08)	2.76 (1.81)	4.47 (2.23)	3.68 (2.04)	3.55 (2.01)	2.57 (1.75)	4.31 (2.19)	3.47 (1.99)	76.00	53.47
T_{11}	Untreated control	_	16.70 (4.15)	23.50 (4.90)	24.87 (5.04)	25.00 (5.05)	24.46 (5.00)	19.45 (4.47)	23.62 (4.91)	23.69 (4.92)	23.58 (4.91)	23.63 (4.91)	24. 61 (5.01)	24.79 (5.03)	24.67 (5.02)	24.69 (5.02)	49.52	-
SE (m) ±		0.12	0.18	0.19	0.18	0.14	0.13	0.15	0.15	0.16	0.13	0.14	0.15	0.15	0.13	2.25		
CD at 5%		NS	0.55	0.56	0.54	0.42	NS	0.46	0.44	0.48	0.40	0.43	0.45	0.46	0.39	6.68		
CV (%)		NS	9.51	10.42	9.29	8.37	NS	8.57	8.87	8.73	8.70	8.29	9.07	8.63	8.51	5.96		

*Figures in the parentheses are √(x+0.5) transformed values

Lecanicillium lecanii 1x10[8] CFU/ml performed over *Metarhizium anisoplie* 1x10[8] CFU/ml in cotton for aphid control (Wawdhane *et al*. 2020). According to Navi *et al*. (2021), pyriproxifen 10% EW at 200 g a.i/ha resulted in the highest percentage reduction in aphids (90.04 per cent) which was followed by spraying cotton with pyriproxifen 10% EW at 125 g.a.i/ha. The findings of Kamble *et al*. (2022b) showed that buprofezin 25% SC was effective in reducing *A. gossypii* and proved to be equal to pyriproxyfen 10% EC in cotton. Swami *et al*. (2018) reported the highest reduction of aphids in chilli which was at par with pyriproxyfen 10% EC @ 1250 g/l/ha, pyriproxyfen 10% EC @ 1000 g/l/ha, pyriproxyfen 10% EC @ 750 g/l/ha followed by fenpropathrin 30% EC @ 340 g/l/ha.

Conclusion

The ready insecticide combi product buprofezin 15% + acephate 35% WP and pyriproxyfen 5% + fenpropathrin 15% EC were reduces aphids, also gaves highest yield and incremental cost with sustainability in maintaining population of natural enemies in okra cropping system. The biopesticides azadirachtin 1% EC (10000 ppm) and *Lecanicillium lecanii* 1.15 % WP can be better alternative to insecticides in organically pest management.

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Conflict of Interest- None

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