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Bio-efficacy of newer pesticides against mite population on summer okra

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ABSTRACT

The bio-efficacy results obtained after first spray, from the pooled data with respect to effect of different treatments against mite infestation revealed that propargite @ 1500ml a.i./ha proved to be the best treatment showing maximum reduction of mites in 6.25cm^2 leaf area/ 3 leaves followed by fenazaquin, spiromecifen and dicofol which were also highly effective against mites indicating results at par with the best treatment in reducing mite population on okra while during second spray fenazaquin was the best pesticide followed by propargite, spiromesifen, dicofol, diafenthiuron and chlorfenapyr which were highly effective and at par with the best treatment against mites.

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INTRODUCTION

Okra in sanskrit is designated as 'Tindisha' and 'Gandhmula', originated from Africa and commonly known as "Lady's finger" or "Okra" which is a flowering plant under Malvaceae family producing high valued edible green pods showing good nutritional and multipurpose crop value. India ranks first in okra cultivation and production with an area of 532.64 thousand hectares and production of 6346.40 thousand tones alongwith productivity of 13.14 mt/ha (Anonymous, 2013).

Okra is also known as the house of pests due to its two distinct *i.e.* vegetative and fruit growing stages. As high as 72 species of insects have been recorded on okra hence known as the house of pests mostly due to its two distinct *i.e.* vegetative and fruiting growing stages. Important pests of okra reported by Jambhale and Nerkar (2005) are jassid (*Amrasca biguttula biguttula* Ishida), aphid (*Aphis gossypi* Glover), spotted bollworm (*Earias* sp.), whitefly (*Bemisia tabaci* Gennadius), mites (*Tetranychus* spps.) and root knot nematode. Besides insect pests, several species of mites belonging to the genus *Tetranychus* causes a loss of 7 to 48 per cent in okra fruit yield (Kumaran *et al*., 2007). Failure to control them in the initial stages was reported to cause an yield loss to the tune of 54.04 per cent (Chaudhary and Dadeech, 1989).

To tackle this pest menace, a number of chemical insecticides and acaricides are liberally sprayed on this vegetable crop, which led to several problems like toxic residues, elimination of natural enemies, environmental disharmony and development of resistance. To overcome these problems, various types of new molecules of insecticides and acaricides are on the scene, therefore periodical evaluation for their comparative effectiveness, specificity, selectivity and economics of control operations is essential.

MATERIAL AND METHODS

A field experiment was conducted at Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani to study the bio-efficacy of newer pesticides against okra mites during summer 2013 and summer 2014.

The field design was RBD with two replications and fourteen treatments in which Mahyco Popular okra number 1 variety was sown keeping spacing of 60cm x 60cm plant to plant. Observations were made by randomly selecting 5 plants from each plot and top, middle and bottom leaves, number of mites in 6.25 cm^2 (2.5 cm x 2.5 cm) leaf area/ three (3) leaves of each randomly selected plants were considered. Pretreatment observations were recorded one day before the application of pesticide and post- treatment observations were recorded on 1, 3, 7 and 14 days after spraying. The data were averaged and subjected to square root transformation and then statistically analyzed and the results were interpreted at five per cent level of significance by using ICAR wasp 2 software. To compare the bio-efficacy of different newer pesticides, per cent reduction in the population of mite over untreated control (water spray) was calculated using Henderson and Tilton (1955) formula.

RESULTS AND DISCUSSION

The pooled bio-efficacy data was recorded during summer 2013 and 2014 regarding mite population on okra with an objective to develop economically feasible management strategy, to reduce unwarranted pesticide load in the environment and to gain knowledge on safer pesticides.

Mite (*Tetranychus macfarlanei* Baker and Pritchard):

First spray :

A day after first spray pooled data of two consecutive years as per Table 3 revealed that, among the evaluated treatments T_9 (spiromesifen 22.9SC) recorded the lowest mites population of 0.81 mites in 6.25cm^2 leaf area/ 3 leaves whereas the highest mites population of 4.59 mites in 6.25cm^2 leaf area/ 3 leaves was recorded in untreated check. The treatment spiromesifen 22.9SC was followed by propargite 57EC and fenazaquin 10EC which were found at par with each other. Whereas treatment T_{10} also showed results at par with T_8, T_1 and T_{12} (Table 1).

Three days after spray in the pooled data T_{10} (propargite 57EC) was found significantly superior treatment with 0.44 mite in 6.25cm^2 leaf area/ 3 leaves followed by the next best treatments of fenazaquin 10EC (0.75 mite in 6.25cm^2 leaf area/ 3 leaves) and spiromesifen 22.9SC (1.05 mites in 6.25cm^2 leaf area/ 3 leaves) which were at par with each other. Among the different pesticides tested, dimethoate 30EC (3.32 mites in 6.25cm^2 leaf area/ 3 leaves) was found to be ineffective pesticide in reducing the mite population.

The pooled data at 7 days after the first spray showed no change in the trend of superior treatment *i.e.*, fenazaquin 10EC recording the lowest mites population of 0.42 mite in 6.25cm^2 leaf area/ 3 leaves and was found at par with T_{10}, T_9, T_{12}, respectively. The treatment T_4 (fipronil 5SC) with 3.34 mites in 6.25cm^2 leaf area/ 3 leaves showed the least effectiveness followed by T_5 and T_7.

Pooled data on mites population at 14 days after the first spray ranged from 1.84 to 7.03 mites in 6.25cm^2 leaf area/ 3 leaves. Treatment propargite 57EC showed the lowest number of mites population (1.84 mites in 6.25cm^2 leaf area/ 3 leaves) which was followed by dicofol 18.5 EC (2.49 mites in 6.25cm^2 leaf area/ 3 leaves) showing results at par with superior treatment alongwith $T_9 > T_8 > T_1 > T_{11}$. The ineffective treatment recorded was T_4 (Fipronil 5SC) showing maximum population incidence of 4.65 mites in 6.25cm^2 leaf area/ 3 leaves as to untreated check of 7.03 mites in 6.25cm^2 leaf area/ 3 leaves.

The efficacy of propargite 57 EC reported by Singh *et al.* (2004) was highly effective against *T. cinnabarinus* infesting okra. Shivanna *et al.* (2012) also opined that propargite recorded significant reduction in the mites population.The effectiveness of fenazaquin 10 EC reported by Dhar *et al*. (2000) indicated that fenazaquin 10 EC @ 2ml/lit and1ml/lit was found to be the most effective treatment against the motile stages of red spider

Table 1 : Bio-efficacy of newer pesticides against mites, *Tetranychus* sp. after first spray on okra (pooled of summer 2013 and 2014)

Tr. No.	Treatments	Dose (a.i./ha)	Number of mites in 6.25 cm² leaf area/ 3 leaves														
			1 DBS			1 DAS			3 DAS			7 DAS			14 DAS		
			2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled
T_1	Diafenthiuron 50WP	600 g	2.87	4.26	3.57	0.96	1.89	1.43	0.86	1.53	1.20	0.68	2.13	1.41	3.01	3.77	3.39
			(1.66)	(2.04)	(1.89)	(0.98)	(1.37)	(1.18)	(0.93)	(1.24)	(1.08)	(0.81)	(1.46)	(1.41)	(1.72)	(1.94)	(1.84)
T_2	Thiamethoxam 25WG	100 g	2.60	4.00	3.30	1.12	1.89	1.51	1.68	2.23	1.96	1.53	3.90	2.72	3.58	4.27	3.93
			(1.61)	(2.00)	(1.82)	(1.04)	(1.38)	(1.22)	(1.30)	(1.49)	(1.40)	(1.24)	(1.97)	(1.61)	(1.89)	(2.05)	(1.98)
T_3	Imidacloprid 70WG	35 g	2.69	4.84	3.77	1.98	2.08	2.03	0.90	1.97	1.44	2.03	2.59	2.31	3.89	3.89	3.89
			(1.63)	(2.19)	(1.93)	(1.40)	(1.44)	(1.43)	(0.95)	(1.40)	(1.18)	(1.43)	(1.60)	(1.52)	(1.97)	(1.97)	(1.97)
T_4	Fipronil 5SC	1000 ml	2.83	4.22	3.53	1.24	2.04	1.64	1.76	2.82	2.29	2.71	3.97	3.34	4.77	4.52	4.65
			(1.68)	(2.05)	(1.88)	(1.11)	(1.43)	(1.27)	(1.33)	(1.68)	(1.50)	(1.65)	(1.99)	(1.82)	(2.18)	(2.11)	(2.16)
T_5	Buprofezin 25SC	300 ml	2.94	4.96	3.95	1.86	3.04	2.45	1.93	2.98	2.46	2.90	3.62	3.26	4.96	4.18	4.57
			(1.71)	(2.21)	(1.98)	(1.36)	(1.74)	(1.55)	(1.39)	(1.72)	(1.56)	(1.70)	(1.90)	(1.80)	(2.23)	(2.04)	(2.14)
T_6	Fenpropathrin 30EC	200 ml	3.05	5.76	4.41	1.29	2.64	1.97	1.67	3.19	2.43	2.51	3.86	3.19	4.69	4.21	4.45
			(1.74)	(2.40)	(2.10)	(1.14)	(1.63)	(1.38)	(1.29)	(1.79)	(1.54)	(1.58)	(1.96)	(1.77)	(2.17)	(2.05)	(2.11)
T_7	Dimethoate 30EC	1000 ml	3.21	5.05	4.13	2.10	2.79	2.45	2.23	3.32	2.78	2.63	3.86	3.25	4.61	4.63	4.62
			(1.79)	(2.25)	(2.03)	(1.44)	(1.67)	(1.56)	(1.49)	(1.82)	(1.66)	(1.62)	(1.96)	(1.79)	(2.15)	(2.15)	(2.15)
T_8	Fenazaquin 10EC	1000 ml	2.36	5.21	3.79	0.69	1.12	0.91	0.58	0.91	0.75	0.16	0.68	0.42	3.64	2.17	2.91
			(1.53)	(2.28)	(1.94)	(0.83)	(1.05)	(0.94)	(0.72)	(0.95)	(0.86)	(0.40)	(0.83)	(0.61)	(1.91)	(1.45)	(1.69)
T_9	Spiromesifen 22.9SC	400 ml	2.79	5.17	3.98	0.40	1.22	0.81	0.17	1.92	1.05	0.09	1.53	0.81	2.54	2.92	2.73
			(1.67)	(2.22)	(1.98)	(0.63)	(1.10)	(0.87)	(0.41)	(1.39)	(0.90)	(0.26)	(1.23)	(0.77)	(1.58)	(1.71)	(1.65)
T_{10}	Propargite 57EC	1500 ml	3.09	4.22	3.66	0.85	0.90	0.88	0.22	0.66	0.44	0.13	0.87	0.50	2.26	1.41	1.84
			(1.76)	(2.05)	(1.91)	(0.92)	(0.94)	(0.94)	(0.45)	(0.81)	(0.64)	(0.35)	(0.93)	(0.65)	(1.47)	(1.18)	(1.35)
T_{11}	Chlorfenapyr 10SC	750 ml	3.61	4.61	4.11	1.08	1.98	1.53	0.96	1.82	1.39	0.72	1.48	1.10	3.81	3.00	3.41
			(1.89)	(2.15)	(2.02)	(1.04)	(1.41)	(1.22)	(0.95)	(1.35)	(1.16)	(0.84)	(1.20)	(1.03)	(1.95)	(1.73)	(1.84)
T_{12}	Dicofol 18.5EC	1250 ml	2.88	4.36	3.62	0.95	1.96	1.46	0.82	1.41	1.12	0.59	1.23	0.91	2.72	2.26	2.49
			(1.70)	(2.09)	(1.90)	(0.98)	(1.40)	(1.19)	(0.90)	(1.18)	(1.05)	(0.73)	(1.10)	(0.94)	(1.65)	(1.49)	(1.58)
T_{13}	Azardirachtin 3000ppm	1250 ml	3.19	5.03	4.12	1.19	3.00	2.10	1.38	3.15	2.27	2.11	3.99	3.05	4.13	4.89	4.51
			(1.78)	(2.24)	(2.03)	(1.09)	(1.73)	(1.41)	(1.17)	(1.75)	(1.48)	(1.45)	(2.00)	(1.73)	(2.03)	(2.21)	(2.12)
T_{14}	Untreated check	-	3.27	5.23	4.25	3.81	5.37	4.59	4.40	5.82	5.11	4.69	8.65	6.67	7.18	6.87	7.03
			(1.81)	(2.28)	(2.06)	(1.95)	(2.31)	(2.14)	(2.09)	(2.39)	(2.26)	(2.16)	(2.94)	(2.55)	(2.67)	(2.62)	(2.65)
	S.E.±		0.13	0.19	0.11	0.09	0.10	0.08	0.11	0.13	0.10	0.10	0.12	0.11	0.14	0.16	0.09
	C.D. (P=0.05)		NS	NS	NS	0.28	0.30	0.26	0.35	0.41	0.30	0.31	0.37	0.34	0.41	0.48	0.29
	CV %		11.13	12.47	7.87	11.41	9.69	9.04	14.82	12.71	10.74	12.75	10.41	11.19	9.81	11.62	6.98

DAS – Days after spraying   Figures in the parentheses are square root transformed values   NS= Non-significant

Table 2 : Bio-efficacy of newer pesticides against mites, *Tetranychus* sp. after second spray on okra (pooled of summer 2013 and 2014)

Tr. No.	Treatments	Dose (a.i./ha)	Number of mites in 6.25 cm^2 leaf area/ 3 leaves														
			1 DBS			1 DAS			3 DAS			7 DAS			14 DAS		
			2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled
T_1	Diafenthiuron 50WP	500 g	8.90 (2.94)	3.92 (1.93)	6.41 (2.53)	2.42 (1.55)	1.47 (1.21)	1.95 (1.38)	1.33 (1.12)	1.00 (0.99)	1.17 (1.08)	0.81 (1.14)	0.78 (1.13)	0.80 (1.14)	0.75 (1.12)	0.72 (1.07)	0.74 (1.11)
T_2	Thiamethoxam 25WG	100 g	9.59 (3.09)	4.31 (2.07)	6.95 (2.63)	3.42 (1.85)	1.61 (1.27)	2.52 (1.56)	4.01 (2.00)	2.05 (1.43)	3.03 (1.72)	4.27 (2.18)	3.79 (2.06)	4.03 (2.13)	5.03 (2.35)	4.09 (2.14)	4.56 (2.25)
T_3	Imidacloprid 70WG	35 g	9.04 (3.01)	4.08 (2.02)	6.56 (2.56)	2.91 (1.71)	1.64 (1.27)	2.28 (1.49)	2.89 (1.70)	1.36 (1.17)	2.13 (1.43)	3.92 (2.10)	2.03 (1.59)	2.98 (1.85)	4.08 (2.14)	3.47 (1.99)	3.78 (2.07)
T_4	Fipronil 5SC	1000 ml	9.11 (3.02)	4.52 (2.11)	6.82 (2.51)	3.84 (1.96)	2.11 (1.44)	2.98 (1.71)	4.79 (2.19)	2.93 (1.71)	3.86 (1.95)	4.39 (2.21)	3.99 (2.12)	4.19 (2.17)	5.11 (2.37)	4.71 (2.28)	4.91 (2.33)
T_5	Buprofezin 25SC	300 ml	8.99 (3.00)	4.27 (2.05)	6.63 (2.57)	4.42 (2.10)	1.92 (1.38)	3.17 (1.74)	4.84 (2.20)	2.31 (1.52)	3.58 (1.86)	5.06 (2.35)	3.28 (1.93)	4.17 (2.15)	5.37 (2.42)	3.86 (2.09)	4.62 (2.26)
T_6	Fenpropathrin 30EC	200 ml	9.71 (3.07)	4.36 (2.08)	7.04 (2.63)	3.53 (1.88)	1.76 (1.32)	2.65 (1.60)	4.47 (2.11)	2.29 (1.51)	3.38 (1.81)	5.21 (2.39)	2.91 (1.85)	4.06 (2.12)	4.98 (2.34)	3.28 (1.94)	4.13 (2.14)
T_7	Dimethoate 30EC	1000 ml	9.18 (3.03)	4.16 (2.03)	6.67 (2.58)	3.38 (1.84)	1.61 (1.27)	2.50 (1.55)	3.82 (1.95)	2.73 (1.65)	3.28 (1.80)	3.34 (1.96)	3.23 (1.93)	3.29 (1.95)	4.60 (2.26)	3.57 (2.02)	4.09 (2.14)
T_8	Fenazaquin 10EC	1000 ml	9.26 (3.04)	3.01 (1.67)	6.14 (2.47)	1.87 (1.37)	0.82 (0.90)	1.35 (1.14)	0.48 (0.68)	0.25 (0.50)	0.37 (0.60)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
T_9	Spiromesifen 22.9SC	400 ml	8.89 (2.96)	3.52 (1.85)	6.21 (2.59)	1.59 (1.25)	1.16 (1.03)	1.38 (1.15)	1.34 (1.13)	0.57 (0.74)	0.96 (0.96)	1.03 (1.23)	0.54 (1.00)	0.79 (1.13)	1.03 (1.20)	0.42 (0.96)	0.73 (1.10)
T_{10}	Propargite 57EC	1500 ml	8.83 (2.97)	3.12 (1.77)	5.98 (2.44)	1.33 (1.15)	1.98 (1.40)	1.66 (1.28)	0.92 (0.95)	0.33 (0.57)	0.63 (0.77)	0.03 (0.73)	0.40 (0.94)	0.22 (0.84)	0.00 (0.71)	0.13 (0.79)	0.07 (0.75)
T_{11}	Chlorfenapyr 10SC	750 ml	8.95 (2.99)	3.26 (1.80)	6.11 (2.47)	2.53 (1.59)	1.86 (1.36)	2.20 (1.48)	1.71 (1.31)	0.81 (0.90)	1.26 (1.10)	1.14 (1.28)	0.96 (1.21)	1.05 (1.24)	0.11 (0.78)	1.01 (1.21)	0.56 (1.11)
T_{12}	Dicofol 18.5EC	1250 ml	9.08 (3.01)	3.37 (1.83)	6.23 (2.49)	2.39 (1.55)	1.38 (1.17)	1.89 (1.36)	1.21 (1.10)	0.83 (0.91)	1.02 (1.01)	0.73 (1.11)	0.75 (1.09)	0.74 (1.11)	0.59 (1.01)	0.72 (1.10)	0.66 (1.07)
T_{13}	Azardirachtin 3000ppm	1250 ml	9.13 (3.00)	4.71 (2.16)	6.92 (2.62)	3.33 (1.80)	1.84 (1.35)	2.59 (1.59)	3.75 (1.94)	1.73 (1.32)	2.74 (1.63)	4.13 (2.14)	4.01 (2.12)	4.07 (2.14)	4.48 (2.23)	6.53 (2.65)	5.51 (2.44)
T_{14}	Untreated check	-	9.19 (3.03)	4.57 (2.14)	6.88 (2.62)	9.00 (3.00)	4.68 (2.15)	6.84 (2.58)	11.08 (3.33)	4.97 (2.21)	8.03 (2.78)	11.91 (3.51)	5.95 (2.54)	8.93 (3.03)	10.06 (3.25)	7.05 (2.74)	8.56 (3.00)
	S.E.±		0.25	0.24	0.15	0.12	0.10	0.13	0.14	0.09	0.12	0.13	0.12	0.16	0.12	0.10	0.14
	C.D. (P=0.05)		NS	NS	NS	0.38	0.29	0.40	0.42	0.28	0.38	0.38	0.36	0.48	0.36	0.31	0.43
	CV %		11.78	16.96	8.33	9.97	10.46	11.87	11.36	10.94	11.94	9.94	10.51	13.03	9.27	8.66	11.36

DAS – Days after spraying   Figures in the parentheses are square root transformed values   NS=Non-significant mite on okra.

Second spray :

After 1 day of second spray, the pooled data as per Table 2 recorded mite population which ranged from 1.35 to 6.84 mites in 6.25cm^2 leaf area/ 3 leaves. The most effective treatments in controlling the mite was T_8 (fenazaquin 10EC) with maximum reduction of population to 1.35 mites in 6.25cm^2 leaf area/ 3 leaves which were found at par with T_9, T_{10}, T_{12}, T_1, T_{11} and T_3 showing mite population of 1.38, 1.66,1.89,1.95, 2.20 and 2.28 mites in 6.25cm^2 leaf area/ 3 leaves, respectively.

The pooled data collected on 3 DAS revealed that all the treatments had significant differences with control. The least number of mite were recorded in fenazaquin 10EC with 0.37 mite in 6.25cm^2 leaf area/ 3 leaves followed by T_{10} and T_9 which showed the results at par with each other. Among different treatments, fipronil 5SC (T_4) recorded the highest (3.86 mites in 6.25cm^2 leaf area/ 3 leaves) population of mite, next being untreated control with 8.03 mites in 6.25cm^2 leaf area/ 3 leaves.

The pooled data at 7 days after the second spray showed no change in the trend of superior treatment *i.e.*, fenazaquin 10EC recording cent per cent reduction in mites population and was found at par with T_{10}, T_{12}, T_9, T_1 treatments. The treatment T_4 (fipronil 5SC) with 4.19 mites in 6.25cm^2 leaf area/ 3 leaves showed the least effectiveness followed by untreated check.

By observing the pooled mean data regarding 14 DAS, it was evident that with the similar treatment *i.e.*, T_8 (fenazaquin 10EC) recorded cent per cent reduction in mite population followed by propargite 57EC (0.07 mite in 6.25cm^2 leaf area/ 3 leaves), chlorfenapyr 10SC (0.56 mite in 6.25cm^2 leaf area/ 3 leaves), dicofol 18.5 EC (0.66 mite in 6.25cm^2 leaf area/ 3 leaves), spiromesifen 22.9SC (0.73 mite in 6.25cm^2 leaf area/ 3 leaves) and diafenthiuron 50WP (0.74 mite in 6.25cm^2 leaf area / 3 leaves), respectively, whereas T_{13} (azardirachtin 3000ppm) proved to be the ineffective in controlling mite population.

The effectiveness of fenazaquin 10 EC was reported by Dhar *et al*. (2000) who indicated that fenazaquin 10 EC @ 2ml/ lit and1ml/ lit ml was found the most effective treatment against the motile stages of red spider mite on okra. Kumar and Singh (2005) indicated that Omite @ 2 ml/lit alone proved significantly best in control of mites (*T. urticae* and *T. neocacedonicus*) on okra. Elbert *et al.* (2005) reported that oberon (spiromesifen) had an excellent acaricidal activity against spider mites in vegetables and field crops in USA. Spiromesifen was highly active against tetranychid mite, *T. urticae* (Nauen and Konanz, 2005).The effectiveness of dicofol in reducing mite (*Tetranychus* spp) population was reported by several workers *viz.*, Mani *et al.* (2003) against *T. urticae* on okra; Ramaraju (2004) against *T. urticae* on bhendi; Singh and Singh (2005) against spider mite (*T. urticae*) on okra; Rai and Singh (2008) against the two spotted mite, *T. urticae* on okra. Similar work related to the present investigation was also carried out by Desai *et al.* (2014); Kachhawa and Rahman (2014) and Patil *et al.* (2014).

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