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Biosafety of Different Miticides and Botanicals against Field Abundance of *Stethorus spp*. Natural Enemies Attacking Host Mite, *Tetranychus cinnabarinus* (Boisd) on Okra

P. R. Kale*, D. B. Pawar and S. A. Mane

Department of Entomology, PGI, MPKV, Rahuri-413 722, Maharashtra, India

**Corresponding author*

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A B S T R A C T

Biosafety of six newer and selective miticides / insecticides, dicofol (standard check), abamectin (treated check) along with botanical and biopesticides viz., azadirachtin and *Lecanicilium lecani* were studied against natural enemies *Stethorus* spp. on prevailing okra crop during summer, 2015. Two rounds of subsequent foliar applications were given at an interval of two weeks. Observations on surviving natural enemies *Stethorus spp.* were recorded at 3, 7, 10 and 14 DAT. Mean pre-treatment count of *Stethorus spp.* was in the range 2.13 - 2.97 *Stethorus spp*. / leaves. azadirachtin, *Lecanicilium lecani*, and propargite were found comparatively safer to *Stethorus spp.* by recording 2.76, 2.57 and 2.46 *Stethorus spp.* / leaves; bifenazate (1.96), thiamethoxam (1.74), abamectin (1.64) and chlorfenapyr (1.53) were observed the next moderately safer treatments; profenophos + wettable sulphur (1.19) and fenazaquin (0.99) were noticed moderately toxic whereas, dicofol was found harmful by recording 0.57 *Stethorus spp.* / leaves.

Introduction

Okra (*Abelmoschus esculentus L.*) is important vegetable crop widely cultivated round the year in India. The crop is attacked by a number of pests and diseases. Among them, red spider mite, *Tetranychus cinnabarinus* (Boisd) is a polyphagous species and is now a serious menace causing yield losses up to the tune of 7 to 48 per cent (Anonymous, 1996).

Natural enemies being key component of IPM, often strategically used as the first line of the defense. Red mite has a number of natural enemies that comprises of many insect and mite predators. Invariably, the insect-predators fail to control them effectively due to low number and uneven distribution of host mite.

Under such circumstances, the field prevailing *Stethorus sp*. play crucial role. In view of their role in natural control, their conservation is of almost importance.

New miticides/insecticides claimed to be more selective, potent and have minimum impact on the *Stethorus sp*. along with botanical pesticide azadirachtin and biopesticides *Lecanicillium lecanii* and were constituted under the present investigations. The recommended conventional miticide, dicofol and the recommended selective miticide, abamectin were considered as a standard and treated check, respectively.

Materials and Methods

The present studies were undertaken in a summer season at the Research Farm of Department of Agricultural Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra state)

The seeds of okra variety: Phule Utkarsha was provided by Department of Agricultural Entomology, M.P.K.V., Rahuri. Miticides evaluated in the present investigations were obtained from the respective manufacturers and local market. The treatment details viz, common name, trade name, a.i. /ha and concentrations of spray solutions are given in Table

Manually operated knapsack sprayer (Aspee make) with hollow cone nozzle was used for spraying of miticides on okra crop.

Raising of okra crop

Ridges and furrows of 4.80 X 3.30 m. size were prepared. FYM @ 10 tons/ ha was added at the time of land preparation. Seeds of variety, Phule Utkarsha were dibbled at 45 x 15 cm spacing. Two seeds were dibbled at 2.0-2.5 cm deep per hill. After 7 days of sowing, thinning and gap filling was done to maintain one plant per hill per spot. Recommended dose of fertilizers @ 100:50:50 (N: P: K) kg/ ha were given as per the package of practices of crop cultivation, except the plant protection measures.

Application of miticides

Test treatments were applied as foliar sprays, initiating first application at the ETL of mites, synchronizing with the evenly distributed mite infestation in field. The second subsequent application was given 14th days after the first application at ETL. Spraying was carried out at early morning session and during the spray application care was undertaken to cover the maximum plant canopy thoroughly and to avoid the drift. In all, two rounds of subsequent foliar applications were given by using manually operated knapsack sprayer, keeping spray fluid discharge rate of 500 l /ha.

Method of recording observations

Since, the conservation of the predatory mites prevailing within okra is of immense importance, the impact of the test acaricides on their bio-safety was evaluated, simultaneously. The number of adult coccinelid beetles (*Stethorus sp.*) was counted from the leaves of already pre-selected plants within the experimental field at 3^{rd}, 7^{th}, 10^{th} and 14^{th} days after last spray.

Effect of test miticides on yield of okra fruits

Marketable yield of okra fruits was recorded at each picking and the sum was counted in t/ ha. Thereafter, the per cent increase of marketable okra yield in the treatment over the untreated check was computed.

Statistical analysis

Data on surviving mite population were transformed to square root value [(n+0.5)1/2] to stabilize the heterogeneous variances. The transformed data for the respective evaluation dates were analyzed as a randomized block design (RBD). The means of three replicates were compared by using the standard error (S.E.) and critical difference (C.D.) at 5 per cent to decide the significance of individual treatment effect (Panse and Sukhatme, 1985). The yield data were subjected to statistical analysis. Finally, an incremental cost benefit ratio (ICBR) of each treatment was worked out

Results and Discussion

Evaluation of miticides against the natural enemies *Stethorus* beetle

Effect of evaluated miticides on the abundance of *Stethorus* beetle was studied by comparing the survival population of predatory *Stethorus* beetle on treated and untreated okra plots. In field experiments on efficacy of miticides against mites, the status of natural enemies *Stethorus* beetle was recorded after 3rd, 7th, 10th and 14th spray by counting adults of *Stethorus* beetle. Initial count of *Stethorus* beetle before sprays was not significant.

Effect of miticides against the natural enemies *Stethorus spp.* after first spray on okra

Three days after first spray

The data presented in table indicates that three days after 1st spray, significantly higher (2.83 adults) survived population of predatory *Stethorus* beetle was observed in untreated plots than other treatments. The treatment of azadirachtin (2.76 adults) and *Lecanicilium lecanii* (2.37 adults) were safer treatment to *Stethorus* beetle next to untreated check. Then among the insecticidal treatments the safe insecticide in the order of biosafety were propargite 57 EC, bifenazate 50 WP, thiomethoxam 25 WG, abamectin 1.9 EC which have noted 2.26, 1.93, 1.58 and 1.54 adult *Stethorus* beetle /leaves, respectively.

However, dicofol 18.5 EC recorded least population (0.46 beetle) although remained to be efficient against the *Stethorus* beetle, it was found to be harmful to the *Stethorus* beetle

Seven days after spray

The data presented in table indicates that seven days after 1st spray, significantly higher (2.69 adults) survived population of predatory *Stethorus* beetle was observed in untreated plots than other treatments. The treatment of azadirachtin (2.43 adults) and *Lecanicilium lecanii* (2.03 adults) were safer treatment to *Stethorus* beetle next to untreated check. Then among the insecticidal treatments the safe insecticide in the order of biosafety were propargite 57 EC, bifenazate 50 WP, thiomethoxam 25 WG, abamectin 1.9 EC which have noted 1.95, 1.66, 1.54 and 1.50 adults *Stethorus* beetle /leaves, respectively. However, dicofol 18.5 EC recorded least population (0.33 beetle) although remained to be efficient against the *Stethorus* beetle, it was found to be harmful to the *Stethorus* beetle

Ten days after spray

The data presented in table indicates that ten days after 1st spray, significantly higher (3.03 adults) survived population of predatory *Stethorus* beetle were observed in untreated plots than other treatments. The treatment of azadirachtin (2.75 adults) and *Lecanicillium lecanii* (2.46 adults) were safer treatment to *Stethorus* beetle next to untreated check. Then among the insecticidal treatments the safe insecticide in the order of biosafety were propargite 57 EC, bifenazate 50 WP, thiomethoxam 25 WG, abamectin 1.9 EC which have noted 2.37, 2.06, 1.91 and 1.76 adult *Stethorus* beetle/leaves, respectively.

Fourteen days after spray

The data presented in table indicates that fourteen days after 1st spray, significantly higher (3.46 adults) survived population of predatory *Stethorus* beetle was observed in untreated plots than other treatments. The treatment of azadirachtin (3.38 adults) and *Lecanicillium lecanii* (3.33 adults) were safer treatment to *Stethorus* beetle next to untreated check. Then among the insecticidal treatments the safe insecticide in the order of biosafety were propargite 57 EC, bifenazate 50 WP, thiomethoxam 25 WG, abamectin 1.9 EC which have noted 3.19, 2.68, 2.57 and 2.44 adult *Stethorus* beetle /leaves, respectively.

However, dicofol 18.5 EC recorded least population (1.13 beetle) although remained to be efficient against the *Stethorus* beetle, it was found to be harmful to the *Stethorus* beetle.

Effect of miticides against the natural enemies *Stethorus spp*. after second spray on okra

Three days after spray

The data presented in table indicates that three days after second spray, significantly higher (2.46 adults) survived population of predatory *Stethorus* beetle was observed in untreated plots than the other treatments.

The treatment of azadirachtin (2.39 adults) and *Lecanicillium lecanii* (2.31 adults) were safer treatment to *Stethorus* beetle next to untreated check. Then among the insecticidal treatments the safe insecticide in the order of biosafety were propargite 57 EC, bifenazate 50 WP, thiomethoxam 25 WG, abamectin 1.9 EC which have noted 2.19, 1.57, 1.43 and 1.21 adult *Stethorus* beetle /leaves, respectively. However, dicofol 18.5 EC recorded least population (0.27 beetle) although remained to be efficient against the *Stethorus* beetle, it was found to be harmful to the *Stethorus* beetle.

Seven days after spray

The data presented in table indicates that seven days after second spray, significantly higher (2.65 adults) survived population of predatory *Stethorus* beetle was observed in untreated plots than other treatments. The treatment of azadirachtin (2.34 adults) and *Lecanicillium lecanii* (2.24 adults) were safer treatment to *Stethorus* beetle next to untreated check.

Then among the insecticidal treatments the safe insecticide in the order of biosafety were propargite 57 EC, bifenazate 50 WP, thiomethoxam 25 WG, abamectin 1.9 EC which have noted 2.02, 1.51, 1.08 and 1.20 adult *Stethorus* beetle /leaves, respectively.

However, dicofol 18.5 EC recorded least population (0.15 beetle) although remained to be efficient against the *Stethorus* beetle, it was found to be harmful to the *Stethorus* beetle

Ten days after spray

The data presented in table indicates that ten days after second spray, significantly higher (3.67 adults) survived population of predatory *Stethorus* beetle was observed in untreated plots than other treatments.

The treatment of azadirachtin (2.97 adults) and *Lecanicillium lecanii*(2.83 adults) were safer treatment to *Stethorus* beetle next to untreated check. Then among the insecticidal treatments the safe insecticide in the order of biosafety were propargite 57 EC, bifenazate 50 WP, thiomethoxam 25 WG, abamectin 1.9

Table.1 Treatment details for field trial on okra

Treatment	Chemical Name	Trade Name	Conc. (%)	Dose/ha
T_1	Bifenazate	Floramite	0.037	375ml
T_2	Fenazaquin	Magister	0.01	500ml
T_3	Thiamethoxam	Actara	0.01	250gm
T_4	Chlorfenapyr	Intrepid	0.01	500ml
T_5	Propargite	Omite	0.057	500ml
T_6	*Lecanicillium lecanii*	Phulebugicide	1.15	2500gm
T_7	Profenophos+ Wettable Sulphur	Curacron + sulfex	0.05+0.20	500ml +1000gm
T_8	Azadirechtin	Achook	300 ppm	2500ml
T_9	Abamectin	Vertimec	0.00076	200ml
T_{10}	Dicofol	Kelthane	0.1	500 ml
T_{11}	Untreated check	-	-	500ml

Table.2 Biosafety of miticides against the natural enemies *Stethorus* beetle after first sprays

Treatments	Mean number of *Stethorus* beetles / leaf					
	Pre-count	3 DAT	7 DAT	10 DAT	14 DAT	Mean
Bifenazate (0.037%)	2.20 (1.48)	1.93 (1.55)	1.66 (1.47)	2.06 (1.60)	2.68 (1.78)	2.08 (1.60)
Fenazaquin (0.01 %)	2.42 (1.55)	0.89 (1.18)	0.85 (1.16)	1.27 (1.32)	1.78 (1.50)	1.19 (1.29)
Thiamethoxam (0.01%)	2.66 (1.63)	1.58 (1.44)	1.54 (1.43)	1.91 (1.55)	2.57 (1.75)	1.90 (1.54)
Chlorfenapyr (0.01 %)	2.47 (1.57)	1.48 (1.41)	1.47 (1.40)	1.56 (1.43)	2.37 (1.69)	1.72 (1.48)
Propargite (0.057 %)	2.28 (1.51)	2.26 (1.66)	1.95 (1.57)	2.37 (1.69)	3.19 (1.92)	2.44 (1.71)
Lecanicillium lecanii(1.15%)	2.36 (1.53)	2.37 (1.69)	2.03 (1.59)	2.46 (1.72)	3.33 (1.96)	2.54 (1.74)
Profenophos+ Wettable Sulphur (0.05+0.20 %)	2.13 (1.46)	1.00 (1.22)	0.96 (1.21)	1.36 (1.36)	1.92 (1.55)	1.31 (1.33)
Azadirachtin(300ppm)	2.97 (1.72)	2.76 (1.80)	2.43 (1.71)	2.75 (1.80)	3.38 (1.97)	2.83 (1.82)
Abamectin (0.00076%)	2.83 (1.68)	1.54 (1.43)	1.50 (1.41)	1.76 (1.50)	2.44 (1.71)	1.81 (1.51)
Dicofol (0.1%)	2.38 (1.54)	0.46 (0.96)	0.33 (0.91)	1.09 (1.23)	1.13 (1.28)	0.75 (1.09)
Untreated check	2.66 (1.63)	2.83 (1.82)	2.69 (1.76)	3.03 (1.88)	3.46 (1.99)	3.00 (1.86)
S. E. ±	0.04	0.08	0.07	0.06	0.07	0.07
C. D. at 5 %	N.S	0.23	0.22	0.20	0.21	0.21

*Figures in the parentheses are ($\sqrt{x+0.5}$) transformations, DAT-Days after treatment

Table.3 Biosafety of miticides against the natural enemies *Stethorus* beetle after second spray

Treatments	Mean number of *Stethorus* beetles / leaf				
	3 DAT	**7 DAT**	**10 DAT**	**14 DAT**	**Mean**
Bifenazate (0.037%)	1.57 (1.44)	1.51 (1.41)	2.03 (1.59)	2.29 (1.67)	1.85 (1.52)
Fenazaquin (0.01%)	0.74 (1.10)	0.68 (1.07)	0.86 (1.16)	0.91 (1.17)	0.79 (1.12)
Thiamethoxam (0.01%)	1.43 (1.39)	1.08 (1.32)	1.82 (1.52)	2.01 (1.59)	1.58 (1.45)
Chlorfenapyr (0.01%)	1.18 (1.30)	1.14 (1.28)	1.39 (1.37)	1.68 (1.47)	1.34 (1.35)
Propargite (0.057%)	2.19 (1.64)	2.02 (1.59)	2.74 (1.80)	3.04 (1.87)	2.49 (1.72)
Lecanicillium lecanii(1.15%)	2.31 (1.68)	2.24 (1.65)	2.83 (1.82)	3.04 (1.88)	2.60 (1.75)
Profenophos + Wettable Sulphur (0.05+0.20%)	0.92 (1.18)	0.89 (1.17)	1.13 (1.28)	1.40 (1.37)	1.08 (1.25)
Azadirachtin(300ppm)	2.39 (1.70)	2.34 (1.68)	2.97 (1.86)	3.12 (1.90)	2.70 (1.78)
Abamectin (0.00076%)	1.21 (1.31)	1.20 (1.30)	1.59 (1.44)	1.94 (1.56)	1.48 (1.40)
Dicofol (0.1%)	0.27 (0.87)	0.15 (0.81)	0.42 (0.95)	0.78 (1.13)	0.40 (0.94)
Untreated check	2.46 (1.72)	2.65 (1.77)	3.67 (2.03)	3.78 (2.07)	3.14 (1.89)
S. E. ±	0.08	0.07	0.08	0.07	0.07
C. D. at 5 %	0.25	0.21	0.24	0.21	0.22

* Figures in the parentheses are ($\sqrt{x + 0.5}$) transformations, DAT-Days after treatment

Table.4 Overall biosafety of miticides against the natural enemies *Stethorus* beetle on okra

Treatments	Mean number of *Stethorus* beetles / leaf				
	3 DAT	**7 DAT**	**10 DAT**	**14 DAT**	**Mean**
Bifenazate (0.037%)	1.75 (1.49)	1.58 (1.44)	2.04 (1.59)	2.48 (1.72)	1.96 (1.56)
Fenazaquin (0.01%)	0.81 (1.14)	0.76 (1.11)	1.06 (1.24)	1.34 (1.33)	0.99 (1.20)
Thiamethoxam (0.01%)	1.50 (1.41)	1.31 (1.37)	1.86 (1.53)	2.29 (1.67)	1.74 (1.49)
Chlorfenapyr (0.01%)	1.33 (1.35)	1.30 (1.34)	1.47 (1.40)	2.02 (1.58)	1.53 (1.41)
Propargite (0.057%)	2.22 (1.65)	1.98 (1.58)	2.55 (1.74)	3.11 (1.89)	2.46 (1.71)
Lecanicillium lecanii(1.15%)	2.34 (1.68)	2.13 (1.62)	2.64 (1.77)	3.18 (1.92)	2.57 (1.74)
Profenophos + Wettable Sulphur (0.05+0.20%)	0.96 (1.20)	0.92 (1.19)	1.24 (1.32)	1.66 (1.46)	1.19 (1.29)
Azadirachtin(300ppm)	2.57 (1.75)	2.38 (1.69)	2.86 (1.83)	3.25 (1.93)	2.76 (1.80)
Abamectin (0.00076%)	1.37 (1.38)	1.35 (1.36)	1.67 (1.47)	2.19 (1.63)	1.64 (1.45)
Dicofol (0.1%)	0.36 (0.91)	0.24 (0.86)	0.75 (1.09)	0.95 (1.20)	0.57 (1.01)
Untreated check	2.64 (1.77)	2.67 (1.76)	3.35 (1.95)	3.62 (2.03)	3.07 (1.87)
S. E. ±	0.08	0.07	0.07	0.07	0.07
C. D. at 5 %	0.24	0.21	0.22	0.21	0.22

*Figures in the parentheses are ($\sqrt{x + 0.5}$) transformations, DAT-Days after treatment

EC which have noted 2.74, 2.03, 1.82 and 1.59 adult *Stethorus* beetle /leaves, respectively. However, dicofol 18.5 EC recorded least population (0.42 beetle) although remained to be efficient against the *Stethorus* beetle, it was found to be harmful to the *Stethorus* beetle.

Fourteen days after spray

The data presented in table indicates that fourteen days after second spray, significantly higher (3.78 adults) survived population of predatory *Stethorus* beetle was observed in untreated plots than other treatments. The treatment of azadirachtin (3.12 adults) and *Lecanicillium lecanii* (3.04 adults) were safer treatment to *Stethorus* beetle next to untreated check. Then among the insecticidal treatments the safe insecticide in the order of biosafety were propargite 57 EC, bifenazate 50 WP, thiomethoxam 25 WG, abamectin 1.9 EC which have noted 3.04, 2.29, 2.01 and 1.94 adult *Stethorus* beetle /leaves, respectively. However, dicofol 18.5 EC recorded least population (0.78 beetle) although remained to be efficient against the *Stethorus* beetle, it was found to be harmful to the *Stethorus* beetle.

Overall cumulative biosafety of miticides against the natural enemies *Stethorus* beetle (Av. of two sprays)

The data on cumulative per cent biosafety of different miticides after first and second sprays revealed that untreated control recorded 3.07 adults of *Stethorus* beetles per leaves which was at par with treatment of azadirachtin (2.76 adults of *Stethorus* beetles per leaves) and the treatment of *L. lecanii*1.15% WP (2.57 adults of *Stethorus* beetles per leaves).Next safer treatment is propargite 57 EC which recorded 2.46 adults of *Stethorus* beetles per leaves and which was at par with bifenazate 50 WP (1.96 adults) and thimethoxam 25 WG (1.74 adults). The remaining treatments in the order of biosafety were abamectin 1.9 EC (0.00076%), chlorfenapyr 10 SC(0.01%), profenophos 50 EC(0.05%) + wettable sulphur 50 WP (0.20%) and fenazaquin10 EC (0.01%) which have noted 1.64, 1.53, 1.19 and 0.99 adults of *Stethorus* beetles per leaves, respectively.

However, Dicofol 18.5 EC (0.1%) recorded least population of beetls (0.57 beetles) although remained efficient against the *Tetranychus cinnabarinus*, was harmful to the *Stethorus* beetle.

In the present studies, the population of field prevailing *Stethorus* beetle in untreated check was recorded in similar range with slight increase. Amongst the test treatments, azadirachtin, *L. lecanii* and propargite were observed to be comparatively safe and were found at par with the untreated check. The results in respect of azadirachtin are in confirmatory with those reported by Mansour *et al.*, (1987), Smitha (2002). Propargite (Omite), hexythiazox, and profenofos, as the safest acaricides for *Stethorus gilvifrons* compared to *T. urticae*. El-Adewy *et al.*, (2000). The results in respect of *L.lecanii* were found to be safe to the natural enemies. Kharbade (2011).

The next safer treatments were bifenazate, thiamethoxam, abamectin and chlorfenapyr, which were statically in the similar range. Bifenazate has been reported to be relatively safer by Mori and Gotoh (2009). Rahmani and Bandani (2003) reported that thiamethoxam was found moderately safer. Slightly harmful effect of abamectin has been reported by Reis *et al.*, (1999). Whereas, dicofol was found to be harmful and the results are in substantiated with that reported by Reis *et al.*, (1999).

References

Anonymous, 1996. Progress Report–AICRP (Agril. Acarology): V Group Meeting. Nov.6-7, Ludhiana.

El-Adewy, A. M., Yousri, H., Ahmed, Y. M., Tiilikkala, K. and El-Sharkawy, T. A. 2000. Estimation of general selective toxicity ratios of certain acaricides to *Stethorus gilvifrons* (Mulsant) and its prey Tetranychusurticae Koch. Egyptian Journal of Agricultural Research, 78:1081-1089

Kharbade, S. B. 2011. Management of sucking pests in Bt. cotton. Ph.D. Thesis MPKV, Rahuri (MH).

Mansour, F. A., Ascher, K. S. and Oman, N. 1987. Effects of neem (*Azadirachta indica*) seed kernel extracts from different solvents on the predacious mite *Phytoseiulus persimilis* and the phytophagous mite Tetranychus cinnabarinus. Phytoparasitica, 15:125-130.

Mori, K. and Gotoh, T. 2009. Effects of pesticides on the spider mite predators, Scolothripstakahashii (Thysanoptera: Thripidae) and Stethorus japonicas (Coleoptera: Coccinellidae) Publishing models and article 13:299-302.

Panse, V. G. and Sukhatme, P. V. 1985. Statistical methods for agricultural workers, IInd enlarged Edition. I.C.A.R., New Delhi, PP-135-136.

Rahmani, S. and Bandani, A.R. 2003. Effects of thiamethoxam in sub lethal concentrations, on life expectancy (ex) and some other biological characteristics of *Hippodamia variegata* (Goeze) (Coleoptera: Coccinellidae) Pestology 32(11):27-29

Reis, P. R., Souza, E. O. and Alves, E. B. 1999. Pesticide selectivity to predacious mite, *Euseius alatus* Revista Brasileira de froticultura, 21(3): 350-355.

Smitha, M. S. 2002. Management of yellow mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae) on chilli. M.Sc. (Agri.) Thesis, Uni. Agric. Sci., Dharwad (India).

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