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BIOEFFICACY OF NEWER ACARICIDES AGAINST TWO SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* AND PHYTOSEIID PREDATOR, *NEOSEIULUS LONGISPINOSUS* ON BRINJAL UNDER FIELD CONDITION

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Abstract

Phytophagous mites are serious pests on crops, fruits and vegetables and frequently cause considerable losses in plant yields. The field experiment was conducted to evaluate the newer acaricides against *Tetranychus urticae* on brinjal plants in the University of Agricultural Sciences, GKVK, Bangalore during 2013. All the tested acaricides affected the two mites survival. In propargite (0.78 mites/leaf) and spiromesifen (1.05 mites/leaf) reduced the overall mite population more significantly than other acaricides with in three days of application and this will leads to corresponding increase in higher fruit yield. Buprofezin, spiromesifen and HMO treated plots quit safe to predatory mite population.

Key words : Acaricides, *Tetranychus urticae, Neoseiulus longispinosus,* brinjal.

Introduction

Brinjal (*Solanum melongena* L.), a member of family Solanaceae is a native of India, grown throughout the country and grown in all seasons (Choudhary, 1970). In India, brinjal is prone to attack by 44 pests (Lal, 1975). Among them, shoot and fruit borer, leafhoppers, stem borer, leaf webber, aphids, whitefly, thrips and the non-insect pest like mites especially, the spider mites are the main bottlenecks in brinjal productivity (Rizvi, 1996). Among the non-insect pests, mites are notably notorious pests and gaining tremendous importance in recent years owing to their devastating nature and severe damage potential. Basu and Pramanik (1968) ranked red spider mites as a major threat next to fruit and shoot borer in brinjal crop. Altogether, 25 tetranychid mite species have been reported on brinjal from different parts of the world (Bolland *et al*., 1998).

The two spotted spider mite, *Tetranychus urticae* Koch is a cosmopolitan agricultural pest belonging to an assemblage of web-spinning mites. These mites are minute, found in large colonies on the underside of leaves underneath fine silky webs and feed using piercing-sucking process that damages plant cells and tissues. This behaviour leads to the appearance of characteristic yellow chlorotic spots on leaves, photosynthesis declines, stomata remains closed and transpiration decreases, finally affecting the quality and quantitative yield of brinjal crop (Martinez *et al*., 2006). In 2013, estimated avoidable loss in the yield of brinjal ranged from 26 to 39% under Bangalore conditions (Mutthuraju, 2013).

Apart from the use of conventional acaricide dicofol against spider mites, many chlorinated hydrocarbons, organophosphates, carbamates and pyrethroids are being used for the control of insect pests in brinjal crop. Most of the newer acaricides are preferred over the conventional ones because these compounds are reasonably promising against a wide range of mite pests (like propargite) with excellent activity on almost all stages of the mites (fenazaquin, fenpyroximate) at relatively lower dosages (milbemectin @ 2-4 g a.i./ha). However, their selectivity towards beneficial insects and natural enemies need to be ascertained. Judicious use of some of these acaricides (with diverse mode of action) will help us to manage the mite pests more effectively, simultaneously reducing the risk of resistance build up in mite pests (Aji, 2005).

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Materials and Methods

Field efficacy of selected acaricides against TSSM *T. urticae* infesting brinjal

Field experiments were carried out to evaluate 12 different acaricides against *T. urticae* on brinjal during *kharif* (August-December, 2013) at University of Agricultural Sciences, G.K.V.K., Bangalore (Karnataka), India. The experiment was laid out in Randomized Completely Block Design (RCBD) with 14 treatments as mentioned in table 1 including untreated (water-sprayed) control and with two replications.

To ascertain the field efficacy of various acaricides against *Tetranychus urticae* observations on mite population were recorded by randomly selecting three plants from each plot. From each plant, three leaves one each from top, middle and bottom canopies were sampled and spider mite population including eggs and motile stages were recorded one day before spraying (pre-treatment) and 3, 7, 10 and 14 days after spraying using a stereo-binocular microscope. The abundance of natural enemies in different treatments was also recorded at different intervals.

The data from the field experiments were subjected to √X+0.5 transformation and analyzed statistically for comparing treatments following Analysis of Variance technique (ANOVA) for Randomized Complete Block Design (RCBD) and the results were interpreted at 5% level of significance. To compare the efficacy of different chemicals, per cent reduction in the population of the mites (eggs or active stages or eggs + active stages) over control (water spray) was calculated using Henderson and Tilton's formula (1955).

Per cent reduction in mite over control =

$$1-\left[\frac{T_a}{T_b}\times\frac{C_b}{C_b}\right]\times 100$$

Where,

T_a = Population in treated plot after spray or treatment.

T_b = Population in treated plot before spray or treatment.

C_a = Population in control plot after spray or treatment.

C_b = Population in control plot before spray or treatment.

Overall effectiveness of different acaricides against *T. urticae* on brinjal crop was determined based on the marketable fruit yield data recorded.

Table 1 : Treatment details of field experiments conducted during *Kharif* (October 2013).

Treatment no.	Chemical	Dose g a.i./ha	Source
T_1	Abamectin	6	Abacin 1.9EC
T_2	Buprofezin	150	Applaud 25EC
T_3	Chlorfenapyr	75	Intrepid 10EC
T_4	Diafenthiuron	400	Pegasus 50WP
T_5	Fenpropathrin	30	Rodi 10EC
T_6	Fenpyroximate	30	Neon 5EC
T_7	Fenazaquin	125	Magister 10EC
T_8	Hexythiazox	25	Maiden 5.45EC
T_9	Propargite	570	Omite 57EC
T_{10}	Spiromesifen	100	Oberon 240SC
T_{11}	Dicofol	2.5ml/L	Colonel 18.5EC
T_{12}	HMO	1%	MAK All Season
T_{13}	HMO	2%	MAK All Season
T_{14}	Control	Water spray	-

*Spray volume of 750 lit./ha

Results and Discussion

Efficacy of acaricides against *T. urticae* (eggs + active stages) and effect on *Neoseiulus longispinosus* was ascertained in terms of the marketable fruit yield

General abundance of *T. urticae* in the experimental plots was uniform before the imposition of different acaricidal treatments. Three days after application, propargite (0.78 mites/leaf) and spiromesifen (1.05 mites/leaf) reduced the overall mite population more significantly than other acaricides and were closely followed by dicofol treatment. By 7th day effectiveness of fenazaquin, buprofezin, diafenthiuron, abamectin, chlorfenapyr, hexythiazox and propargite was statistically on par, which recorded less number of mites ranging from 0.89 to 1.33 mites/leaf. After 14 days acaricide treated plots (as well as water-sprayed control plots) harboured negligible number of mites (<1/leaf), which revealed overall reduction in mite population within two weeks with any acaricidal application (table 2).

Overall abundance of predator (eggs and active stages) in the experimental plots was more or less uniform. In each of the acaricide treated plots the activity of predators declined (at least up to one week), which was evident with reduced number of eggs as well as

Table 2 : Bioefficacy of selected acaricides against TSSM, *Tetranychus urticae* (eggs + active stages) infesting brinjal.

Acaricides	Mean number of mites (eggs + active stages)/leaf				
	Pre-treatment	**3 DAS**	**7 DAS**	**10 DAS**	**14 DAS**
Abamectin @6g a.i./ha	9.72 (3.15)	1.72 (1.49)^{bcd}	1.16 (1.28)^{abc}	0.44 (0.97)^{bc}	0.00 (0.71)^{a}
Buprofezin @150g a.i./ha	12.44 (3.56)	2.50 (1.73)^{de}	0.89 (1.17)^{a}	0.50 (0.99)^{bc}	0.00 (0.71)^{a}
Chlorfenapyr @75 g a.i./ha	10.27 (3.28)	1.78 (1.50)^{bcd}	1.33 (1.35)^{abcd}	2.00 (1.57)^{d}	0.83 (1.12)^{bc}
Diafenthiuron @400 g a.i./ha	33.89 (5.26)	1.72 (1.49)^{bcd}	1.00 (1.22)^{ab}	0.11 (0.78)^{ab}	0.00 (0.71)^{a}
Fenpyroximate @30 g a.i./ha	26.05 (5.14)	1.72 (1.48)^{bcd}	2.05 (1.59)^{cde}	0.00 (0.71)^{a}	0.00 (0.71)^{a}
Fenpropathrin @30 g a.i./ha	18.77 (4.38)	3.05 (1.88)^{e}	3.88 (2.09)^{f}	3.16 (1.91)^{e}	0.05 (0.74)^{a}
Fenazaquin @125 g a.i./ha	17.56 (4.02)	2.05 (1.59)^{cd}	0.83 (1.14)^{a}	0.22 (0.84)^{ab}	0.05 (0.74)^{a}
Hexythiazox @25 g a.i./ha	10.22 (3.22)	2.16 (1.63)^{cde}	1.33 (1.35)^{abcd}	0.27 (0.87)^{abc}	0.00 (0.71)^{a}
Propargite @570 g a.i./ha	7.56 (2.83)	0.78 (1.13)^{a}	1.05 (1.24)^{ab}	0.22 (0.84)^{ab}	0.00 (0.71)^{a}
Spiromesifen @100 g a.i./ha	12.28 (3.57)	1.05 (1.24)^{ab}	1.88 (1.53)^{bcd}	0.44 (0.97)^{abc}	0.00 (0.71)^{a}
Dicofol @0.05%	16.05 (3.86)	1.55 (1.42)^{bc}	2.28 (1.66)^{de}	2.83 (1.82)^{e}	0.61 (1.05)^{bc}
Horticultural Mineral Oil @1%	12.83 (3.56)	2.61 (1.76)^{de}	4.00 (2.12)^{f}	1.50 (1.40)^{d}	0.44 (0.96)^{abc}
Horticultural Mineral Oil @2%	11.27 (3.42)	2.44d (1.71)^{e}	3.16 (1.91)^{ef}	0.78 (1.13)^{c}	0.27 (0.87)^{ab}
Control (Water spray)	7.89 (2.87)	15.55 (4.00)^{f}	10.50 (3.31)^{g}	6.44 (2.63)^{f}	0.89 (1.17)^{c}
F test	**NS**	*	*	*	*
SEM ±	**(0.74)**	**(0.08)**	**(0.10)**	**(0.08)**	**(0.08)**
CD at P = 0.05	**-**	**(0.25)**	**(0.30)**	**(0.24)**	**(0.25)**

DAS: Days After Spraying; Figures in parentheses are √x+0.5 transformed values; **NS**: Non-significant; *: Significant; Treatments with same alphabetical superscript within the column are statistically on par.

Table 3 : Effect of selected acaricides on the abundance of phytoseiid predator, *Neoseiulus longispinosus* on brinjal.

Acaricides	Mean number of predators (eggs + active stages)/leaf		
	Pre-treatment	**7 DAS**	**14 DAS**
Abamectin @6 g a.i./ha	6.61 (2.64)	0.83 (1.15)^{cd}	0.66 (1.02)
Buprofezin @150 g a.i./ha	6.38 (2.59)	1.06 (1.23)^{cd}	1.39 (1.29)
Chlorfenapyr @75 g a.i./ha	5.22 (2.37)	0.33 (0.90)^{d}	0.72 (1.04)
Diafenthiuron @400 g a.i./ha	5.17 (2.37)	0.16 (0.80)^{d}	0.00 (0.71)
Fenpyroximate @30 g a.i./ha	5.94 (2.52)	3.61 (2.01)^{ab}	0.00 (0.71)
Fenpropathrin @30 g a.i./ha	12.72 (3.63)	1.66 (1.44)^{abcd}	1.11 (1.17)
Fenazaquin @125 g a.i./ha	9.00 (2.98)	0.78 (1.07)^{cd}	0.00 (0.71)
Hexythiazox @25 g a.i./ha	10.39 (3.21)	1.17 (1.26)^{bcd}	0.39 (0.91)
Propargite @570 g a.i./ha	4.50 (2.19)	0.72 (1.08)^{cd}	0.00 (0.71)
Spiromesifen @100 g a.i./ha	3.61 (2.02)	0.67 (1.08)^{cd}	2.22 (1.51)
Dicofol @0.05%	6.17 (2.53)	2.66 (1.72)^{abc}	1.00 (1.14)
Horticultural Mineral Oil @1%	14.22 (3.81)	1.94 (1.56)^{abcd}	2.11 (1.57)
Horticultural Mineral Oil @2%	3.94 (1.99)	2.05 (1.58)^{abcd}	0.00 (0.71)
Control (Water spray)	5.28 (2.40)	5.77 (2.05)^{a}	1.28 (1.32)
F test	**NS**	*	**NS**
SEM ±	**(0.45)**	**(0.22)**	**(0.33)**
CD at P = 0.05	**-**	**(0.69)**	**-**

DAS: Days After Spraying; Figures in parentheses are √x+0.5 transformed values; **NS:** Non-significant; * : Significant; Treatments with same alphabetical superscript within the column are statistically on par.

Table 4 : Effectiveness of selected acaricides against TSSM, *Tetranychus urticae* on brinjal in terms of marketable fruit yield.

Acaricides	Per cent reduction in mite population over control		Marketable fruit yield (quintals/acre)
	7 DAT	14 DAT	
Abamectin @6 g a.i./ha	90.98	100.00	62.69[abc]
Buprofezin @150g a.i./ha	94.63	100.00	40.44[cd]
Chlorfenapyr @75 g a.i./ha	90.25	28.04	64.97[abc]
Diafenthiuron @400 g a.i./ha	97.78	100.00	55.51[abcd]
Fenazaquin @125 g a.i./ha	90.20	97.19	73.07[ab]
Fenpropathrin @30 g a.i./ha	84.44	97.37	51.94[abcd]
Fenpyroximate @30 g a.i./ha	96.43	100.00	64.44[abc]
Hexythiazox @25 g a.i./ha	94.07	100.00	46.62[bcd]
Propargite @570 g a.i./ha	89.50	100.00	77.68[a]
Spiromesifen @100 g a.i./ha	88.44	100.00	62.43[abc]
Dicofol @0.05%	89.34	66.22	56.66[abc]
Horticultural Mineral Oil @1%	76.58	69.26	46.08[bcd]
Horticultural Mineral Oil @2%	78.90	78.14	48.20[abcd]
Control (Water spray)	0.00	0.00	31.71[d]
F test			*
SEM±			**4.72**
CD at P = 0.05			**14.42**

DAT: Days after treatment; *: Significant
Treatments with same alphabetical superscripts within column are statistically on par.

their active stages recorded from treated plots (table 3), while in control the predator activity was more or less similar (5.28; 5.77 predator/leaf). By 14th day the predator population showed recovery in few of the acaricidal treated plots namely buprofezin, chlorfenapyr, spiromesifen and HMO @ 1% compared to other acaricides (table 3). This difference in the abundance of predators may be attributed to reduced availability of prey mites (spider mites) in treated plots. However, reduction in predator population in control plots after 14 days was due to non-availability of prey mites and probable movement of predators to other plots where prey mites might be available.

The overall effect of different acaricidal treatments on the control of spider mite infestation was ascertained in terms of the marketable fruit yield. Seven days after application in most of the acaricide treatments, reduction in mite population (eggs and active stages) was significant and superior to untreated control. However, acaricides, fenpyroximate and diafenthiuron recorded the maximum reduction (96-98%) (table 4). Further after 14 days, significant reduction in mite population in propargite and fenazaquin treatments could be related to corresponding higher fruit yields of 77.68q/acre and 73.07q/acre (table 4).

The present study was comparable with Tomar and Singh (2011). They observed that application of propargite 57% EC @ 1000ml/ha and fenpyroximate 5%EC @500ml/ha was significantly more effective in reducing *T. urticae* population to 1.6 to 1.8 mites/4cm^2 leaf area compared to 8.8 mites/4cm^2 leaf area in untreated control 15 days after application on brinjal, which could increase the fruit yield significantly (>80q/acre *vs* 64q in control). Chinniah (2013) also reported that spiromesifen 240SC @0.7ml/lit., abamectin 1.8%EC @ 0.5ml/lit., propargite 57% EC @3ml/lit. and fenpyroximate 5%EC @ 0.8ml/lit. were equally effective in suppressing spider mite population.

References

Aji, C. S. (2005). Evaluation of selected newer molecules against *Tetranychus urticae* Koch (Acari: Tetranychidae) infesting tomato. *M.Sc. (Agri.) Thesis,* Univ. Agril. Sci., Bangalore pp. 67.

Basu, A. C. and L. M. Pramanik (1968). Acaricidal tests of nine pesticides against two spotted spider mite, a serious pest of brinjal in West Bengal. *J. Econ. Entomol,* **61:** 768-770.

Bolland, H. R., J. Gutierrez and C. H. W. Flechtmann (1998). World catalogue of the spider mite family (Acari : Tetranychidae). Leiden. *Brill Academic Publishers*: 392 p.

Chinniah, C. (2013). Field evaluation of certain new acaricide/ insecticide molecules for their bio-efficacy against two spotted spider mite *Tetranychus urticae* Koch on brinjal (*Solanum melongena* L.). *Pestology,* **37(3)** : 34-38.

Choudhury, B. (1970). *Vegetables*. National Book Trust, New Delhi, pp. 25-50.

Henderson, C. F. and E. W. Tilton (1955). Tests with acaricides against the brow wheat mite. *J. Econ. Entomol*., **48** : 157-161.

Lal, O. P. (1975). A compendium of insect pests of vegetables in India. *Entomol. Bulletin*, **16** : 52 – 58.

Mutthuraju, G. P. (2013). Investigations on host plant resistance mechanisms in brinjal (*Solanum melongena* Linn.) to two spotted spider mite, *Tetranychus urticae* Koch (Acari : Tetranychidae). *Ph.D. Thesis,* Univ. Agril. Sci., Bangalore, pp. 154.

Rizvi, S. M. A. (1996). Management of insect pests of okra and brinjal. *In: Plant Protection and Environment*, pp. 173 – 188.

Tomar, A. S. and S. P. Singh (2011). Efficacy of selected acaricides against mites, *Tetranychus urticae* Koch (Acarina : Tetranychidae) on okra. *Pestology*, **35(5)** : 27-29.