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Evaluation of field efficacy of some selected acaricides against *Tetranychus urticae* Koch on okra

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Abstract

An experiment was conducted to evaluate the field efficacy of some selected acaricides against two spotted spider mites, *Tetranychus urticae* Koch at Regional Research Station (Hill Zone), Uttar Banga Krishi Viswavidyalaya, Kalimpong, West Bengal, India during 2020 and 2021. Among the various acaricidal treatments, spiromesifen 22.9 SC@120 g a.i/ha was found to be the best treatment in terms of mean per cent reduction of mite population as well as providing the highest yield during both the years of study. This treatment was followed by hexythiazox 5.45EC @25 g a.i./ha and fenazaquin 10 EC @ 125 g a.i./ha. Propagite 57 EC @ 850 g a.i./ha was found to be the least effective treatment although it was significantly superior to the control.

Key words: Red spider mite, *Tetranychus urticae,* spiromesifen, hexythiazox, bio-efficacy, okra.

Introduction:

India is the second largest producer of vegetables in the world (Anonymous, 2018). In India, the contribution of vegetables remains the highest (59 – 61%) in horticulture crop productions over the last five years (Anonymous, 2018).This may be due to significant progress in area expansion and production of vegetables. The production of vegetables was 101.2 Million Tonnes during 2004-05 whereas during 2017-18 it has increased to 184.40 Million Tonnes (Anonymous, 2018). Among various vegetables, the area as well as production of okra has increased significantly in last few years in India due to its unique taste, flavour and nutritional values as human food. As per the second advance estimate during 2019-20, okra was grown in 519000 ha area producing about 6371000 MT (Anonymous, 2019). In spite of these increase in area and production, the productivity of this crop is also very low in some states of India. Apart from several reasons, incidence of insect and acarine pest is one of the key factors for low productivity. Okra crop is infested by numerous insect and mite pests (Kumar, 2004). Among various pests infesting okra, *Tetranychus urticae* is an important and major biological constraint in okra production (Sarkar *et al*, 1996). It is a highly polyphagous acarine pest with a global distribution. It has also wide host range (more than 900 host plants) and it has been described as a serious pest of at least 150 economically important agricultural and ornamental plants (Kavitha *et al*, 2007). They usually colonize in the lower surface of leaves and both the nymph and adult suck the sap resulting yellowing and speckling of leaves, webbing, premature leaf fall, stunting of growth, reduction in photosynthetic activity and ultimately death of the whole plant in case of severe infestation (Varadaraju, 2010). To manage this acarine pest, farmers routinely spray various acaricides. In spite of routine acaricide spray, sometimes this pest becomes difficult to control. A major problem in the management of *T. urticae* is their ability to develop acaricide resistance rapidly because of their polyphagous in nature, high reproductive potential and short life cycle. Apart from these, frequent use of acaricides has aggravated the situation. Control failure of this pest has been reported from various countries including India due to development of resistance against acaricides. Continuous use of an ineffective chemical will ultimately increase the resistance, increase the cost of production, increase the residue problem and will lead to environmental pollution. Therefore, considering problems of management of this acarine pest, the present experiments were conducted to evaluate the field level efficacy of some selected acaricides for effective management.

Materials and methods:

The present experiment was conducted during 2020 and 2021 at Regional Research Station (Hill Zone), Uttar Banga Krishi Viswavidalaya, Kalimpong, West Bengal, India. The experiment was laid out in Randomized Block Design with seven treatments including control and each treatment was replicated thrice. The insecticides/acaricides evaluated were fenazaquin 10 EC @125 g a.i./ha, fenpyroximate 5 SC @30 g a.i/ha, hexythiazox 5.45%EC@25 g a.i/ha, spiromesifen 22.9 SC@120 g a.i./ha, diafenthiuron 50WP@300 g a.i/ha and propargite 57 EC@850 g a.i/ha. Okra seeds (Mahyco 10) were dibbled at 60×45 cm spacing between rows and plants respectively. All standard agronomic practices were followed along with proper disease control measures. Two rounds of sprayings of treatments were done using high volume knapsack sprayer fitted with hollow cone nozzle and using 500 litre of spray fluid per hectare. The spraying was done when the pest population reached at Economic Threshold Level (2 mites/leaf). Control plots were sprayed with equal volume of water. The number of mites was counted from 3 leaves per plant (top, middle and bottom) from five randomly selected and tagged plats per plot. The observations were recorded a day before spray as well as 3,7,10 and 14 days after each spray. The reduction or increase (+) of population was expressed in per cent. Yield of okra fruits was recorded at each picking and total yield per plot was calculated and converted to yield (quintal) per hectare. The data of per cent population reduction or increase (+) and yield increase (+) or decrease were subjected to analysis of variance after making necessary transformation (angular transformation) except in case of yield.

Results and discussion:

The pre-treatment count of red spider mite before first spray during 2020 ranged from 14.48 to 15.85 mites/leaf. The mite population started to decline from the pre-spray count in different insecticidal treatment but the per cent reduction varied from treatment to treatment. The results obtained after first spray and second spray during the first season (2020) are presented in Table-1. It was observed that all the insecticide treated plots gave significant mean per cent reduction of the mite population over control. But the best results was obtained from the plots treated with spiromesifen 22.9SC @ 120 g a.i./ha as it recorded the highest mean per cent reduction (91.20%) after 1st spray during 2020. The efficacy of this treatment was followed by the efficacy of hexythiazox 5.45 EC @ 25 g a.i./ha and fenazaquin 10EC @125 g a.i./ha. The result of the fenpyroximate 5SC and diafenthiuron 50WP was statistically at par. Propargite 57EC was found to be the least effective treatments showing about 81.19 mean per cent reduction of mite population. In untreated control plots, the mite population increased up to 112.47% (14 days after spray). The results of the second spray also showed the similar trend of efficacy. Spiromesifen 22.9 SC was found to be the best effective treatment resulting about 94.49 mean per cent reduction of mite population and propargite 57 EC was found to be the least effective treatment although it brought about 87.01% reduction of the mite population. The population in the untreated control plot increased up to 154.12 %.

During the second year of study (2021) the pretreatment count of the mite population ranged from 17.89 to 18.85 mite/leaf. After first spray, the population started to decline in insecticide treated plots although the per cent reduction varied in different treatments. Spiromesifen 22.9SC was again found to be the best treatment resulting 92.25 mean per cent reduction of the population followed by hexythiaxox 5.45 EC which showed 87.92 mean per cent reduction of the mite population. Propargite 57EC was found to be least effective treatment showing 82.21 mean per cent reduction of mite population (Table-2). Similar trends of result were found after second spray.

All the insecticides treated plots showed significantly higher yield as compared to the untreated control. During the first year of study, the highest yield was obtained from the spiromesifen 22.9 SC treated plots (77.85 q/ha) followed by hexythaizox 5.45EC treated plots (75.34 q/ha). Propargite 57 EC was found to be the least effective insecticides treatment providing 71.66 q/ha of yield. The similar trend of result was observed during the second year of study (2021). Spiromesifen 22.9 SC again was found to be the best effective treatment (78.35 q/ha) followed by hexythiazox 5.45 EC (76.43 q/ha). Propargite 57EC was found to be the least effective treatments in terms of yield (72.76 q/ha). The lowest yield was observed from the control plots during both the years of study (2020 and 2021).The descending chronological order of effectiveness of treatments based on yield and per cent reduction of mite population was spiromesifen 22.9 SC > hexythiazox 5.45 EC > fenazaquin 10 EC> diafenthiuron 50 WP> fenpyroximate 5 SC> propargite 57 EC.

The present study revealed that spiromesifen 22.9 SC @120 g a.i/ha was found to be the best treatment. Almost similar findings were reported by Baloch *et al*., 2016 who revealed that oberon (Bayer) resulted in the overall average efficacy of 96.27 percent reduction. Elbert *et al*. (2005) also reported that Oberon (spiromesifen) showed excellent activity against spider mites in vegetables and field crops in USA. The excellent efficacy of spiromesifen may be due to the unique mode of action of the chemical. It acts on lipid synthesis by inhibiting acetyl CoA carboxylase (Singh *et al.*, 2016**)** and causes a significant decrease in total lipids (Ghanim and Ishaaya, 2011; Bensafi-Gheraibia *et al*., 2013). Hexythiazox 5.45 EC was found to be the second best treatment in the present experiment. The effectiveness of hexythiazox was also revealed by Shulka, (2018). The study also revealed the better performance of fenpyroximate 5 EC @ 25g a.i./ha for management of red spider mite. The present study indicated that fenazaquin also provided excellent control of the mite population. The good efficacy of fenazaquin 10 EC (150g a.i./ha) was also reported by Wale *et al*. (2010) on okra. Sangeetha and Ramaraju (2013) reported that fenazaquin 10 EC at 125 and 150 g a.i./ha caused the highest reduction in numbers of mites in pot culture and field experiments. Bhaskaran *et al* (2007) reported that diafenthiuron 50 WP at 450 g a.i./ha recorded the highest mean reduction of mite population after first and second round of spraying. Thus, the present findings are more or less similar with the findings of the past workers. The dissimilarity within results may be due to the variation in environmental factors or dose of the treatments or may be due to the lower susceptibility to the chemical.

It can be concluded from the results of the present experiment that the tested chemicals are effective for management of the red spider mite. The use of spiromesifen 22.9SC, hexythiazox 5.45EC and fenazaquin 10EC may be continued for management red spider mite on okra. Care should be taken to use the chemicals in rotation based on mode of action. The Pre-harvest interval period of the chemicals should also be considered before use of these chemicals. The susceptibility level of the chemicals should be evaluated periodically for effective management of the pest. Otherwise, frequent use of the chemicals having same mode of action may lead to development of resistance within a short span of time.

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Table-1: Effect of 1st and 2nd spray of different treatments on incidence of red spider mite of okra during 2020 (Mean of three replications).

Treatments	Dose (ga.i./ha)	PTC	% reduction after 1st spray				Mean	PTC	% reduction after 2nd spray				Mean	Yield (q/ha)
			3DAS	7DAS	10DAS	14DAS			3DAS	7DAS	10DAS	14DAS		
Fenazaquin 10 EC	125	15.23	80.36 (63.70)	84.21 (66.59)	87.82 (69.58)	86.83 (68.72)	84.81 (67.06)	5.66	89.45 (71.06)	90.25 (71.81)	91.36 (72.91)	89.21 (70.83)	90.07 (71.63)	73.28
Hexythiazox 5.45 EC	25	14.87	82.37 (65.18)	85.61 (67.71)	90.38 (71.93)	89.13 (70.75)	86.87 (68.76)	5.87	90.10 (71.66)	91.32 (72.88)	92.84 (74.48)	91.85 (73.42)	91.53 (73.08)	75.34
Spiromesifen 22.9 SC	120	15.28	89.28 (70.93)	90.40 (71.96)	92.75 (74.39)	92.35 (73.97)	91.20 (72.74)	4.85	93.75 (75.52)	94.13 (75.98)	95.30 (77.48)	94.78 (76.80)	94.49 (76.42)	77.85
Fenpyroximate 5 SC	30	14.48	77.36 (61.59)	82.54 (65.31)	87.16 (69.00)	86.14 (68.14)	83.30 (65.88)	6.56	88.12 (69.84)	90.12 (71.68)	90.98 (72.53)	88.25 (69.96)	89.37 (70.97)	72.84
Propargite 57 EC	300	14.89	76.37 (60.92)	79.71 (63.23)	84.74 (67.00)	83.95 (66.38)	81.19 (64.30)	6.33	85.37 (67.51)	87.28 (69.11)	87.93 (69.67)	87.45 (69.25)	87.01 (68.87)	71.66
Diafenthiuron 50WP	850	15.85	79.39 (63.00)	82.74 (65.45)	85.48 (67.61)	85.87 (67.93)	83.37 (65.93)	5.47	86.24 (68.23)	89.25 (70.87)	90.54 (72.09)	89.24 (70.86)	88.82 (70.46)	73.15
Untreated control (Water spray)	-	15.23	+35.26 (0.00)	+65.35 (0.00)	+95.63 (0.00)	+112.47 (0.00)	+82.18 (0.00)	5.87	+120.24 (0.00)	+135.89 (0.00)	+167.52 (0.00)	+192.83 (0.00)	+154.12 (0.00)	63.54
S.Em(±)		-	0.47	0.30	0.23	0.27	0.10	-	0.25	0.29	0.51	0.32	0.11	1.42
CD at 5%		NS	1.46	0.93	0.71	0.81	0.32	NS	0.76	0.90	1.55	0.99	0.35	4.26

N.B.:- **PTC**-Pre-treatment count (No. of motile stage/leaf); **DAS**-Days after spraying. Figures in parentheses are angular transformed values.

Table-2: Effect of 1st and 2nd spray of different treatments on incidence of red spider mite of okra during 2021 (Mean of three replications).

Treatments	Dose (ga.i./ha)	PTC	% reduction after 1st spray				Mean	PTC	% reduction after 2nd spray				Mean	Yield (q/ha)
			3DAS	7DAS	10DAS	14DAS			3DAS	7DAS	10DAS	14DAS		
Fenazaquin 10 EC	125	18.25	81.37 (64.44)	85.27 (67.44)	88.84 (70.49)	87.84 (69.59)	85.83 (67.89)	5.42	88.65 (70.32)	91.46 (73.01)	92.22 (73.82)	90.15 (71.71)	90.62 (72.17)	74.82
Hexythiazox 5.45 EC	25	17.89	83.37 (65.94)	86.70 (68.61)	91.49 (73.05)	90.13 (71.69)	87.92 (69.66)	5.28	89.29 (70.90)	92.38 (73.99)	93.97 (75.79)	92.78 (74.42)	92.11 (73.68)	76.43
Spiromesifen 22.9 SC	120	18.54	90.38 (71.99)	91.46 (73.02)	93.80 (75.59)	93.36 (75.09)	92.25 (73.84)	5.54	92.97 (74.63)	95.14 (77.27)	96.17 (78.73)	95.68 (78.00)	94.99 (77.07)	78.35
Fenpyroximate 5 SC	30	18.63	78.55 (62.41)	83.59 (66.11)	87.99 (69.72)	87.18 (69.02)	84.33 (66.68)	5.21	87.37 (69.19)	91.13 (72.68)	90.68 (72.22)	89.28 (70.90)	89.62 (71.20)	73.48
Propargite 57 EC	300	17.97	77.41 (61.63)	80.72 (63.96)	85.71 (67.79)	85.01 (67.22)	82.21 (65.05)	6.24	84.56 (66.86)	88.28 (69.98)	89.11 (70.74)	88.41 (70.10)	87.59 (69.37)	72.76
Diafenthiuron 50WP	850	18.52	80.56 (63.84)	83.75 (66.23)	86.59 (68.52)	86.88 (68.77)	84.45 (66.77)	5.38	85.54 (67.65)	90.42 (71.99)	91.13 (72.68)	90.17 (71.74)	89.32 (70.92)	74.51
Untreated control (Water spray)	-	18.85	+42.58 (0.00)	+63.52 (0.00)	92.38 (0.00)	+124.65 (0.00)	+80.78 (0.00)	5.98	+134.53 (0.00)	+148.58 (0.00)	+178.59 (0.00)	+190.27 (0.00)	+162.99 (0.00)	64.45
S.Em(±)		-	0.48	0.31	0.26	0.28	0.13	-	0.25	0.34	0.32	0.31	0.14	1.49
CD at 5%		NS	1.49	0.97	0.78	0.84	0.39	NS	0.78	1.05	0.99	0.95	0.43	4.47

N.B.:- **PTC**-Pre-treatment count (No. of motile stage/leaf); **DAS**-Days after spraying. Figures in parentheses are angular transformed values.

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