



RESEARCH ARTICLE :

Bioefficacy of certain acaricides against chilli mite, *Polyphagotarsonemus latus*

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ARTICLE CHRONICLE :

Received :

15.07.2017;

Accepted :

30.07.2017

SUMMARY : Investigation on bio efficacy of certain newer acaricides against chilli mite, *Polyphagotarsonemus latus* Banks was carried out at Main Vegetable Research Station, Anand Agricultural University, Anand (Gujarat) during *Kharif* and *Rabi* 2013. Results revealed that fenpyroximate (0.005%) significantly suppressed the mite followed by diafenthiuron (0.06%). Both these acaricides registered significantly low incidence (7.85 to 8.74 mites/3 leaves) of the pest as compared to rest of the acaricides. Fenazaquin stood at third position next to fenpyroximate and diafenthiuron. Spiromesifen (0.02%) and fenpropathrin (0.018%) found moderately effective against *P. latus*. Plots treated with fenpyroximate produced significantly highest (105.80 q/ha) green chilli yield than rest of the treatments. Increase in yield over control was highest (74.92 %) in fenpyroximate followed by diafenthiuron, fenazaquin and spiromesifen. Maximum (1:11.87) ICBR was registered in fenpyroximate followed by fenpropathrin (1:11.40) and hexythiazox (1:7.03).

KEY WORDS :

Fenpyroximate,
Diafenthiuron,
Acaricides, Chillimite

How to cite this article : Sangle, P.M., Antu, Mithu, Pawar, S.R., Panpatte, D.G. and Korat, D.M. (2017). Bioefficacy of certain acaricides against chilli mite, *Polyphagotarsonemus latus*. *Agric. Update*, 12(TECHSEAR-5) : 1384-1389; DOI: 10.15740/HAS/AU/12.TECHSEAR(5)2017/1384-1389.

BACKGROUND AND OBJECTIVES

Chilli, *Capsicum annum* L. is one of the important commercial spices crop grown in India. Over 35 species of insects and mite have been reported as pests of chilli which includes thrips, aphid, whitefly, fruit borer, cutworm, plant bug, mite and other minor pests. Among all the sucking pests attacking chilli, thrips (*Scirtothrips dorsalis* Hood), mite (*Polyphagotarsonemus latus* Banks) and aphids (*Myzus persicae* Sulzer, *Aphis gossypii* Glover) are dominant pests (Ananthakrishnan, 1971; Krishna Kumar *et al.*, 1996). Application of acaricides is one of

the management options to substantially reduce yield losses caused by mites. Now- a-days, a large number of newer acaricides are available in market. Bioefficacy of these acaricides need to be studied for formulating effective and economical management strategies of mite. There is a paucity of information about the efficacy of newer acaricides against mites infesting chilli and therefore present studies was undertaken.

RESOURCES AND METHODS

The relative bioefficacy of certain newer acaricides was evaluated against mites

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infesting chilli (GVC-111) under field conditions at Main Vegetable Research Station, Anand Agricultural University, Anand (Gujarat) during *Kharif and Rabi* 2013 along with untreated control (water spray). There were eight acaricidal treatment *i.e.* Fenpropathrin 30 EC (0.018%), Propargite 57 EC (0.17%), Chlorfenapyr 10 SC (0.015%), Diafenthiuron 50 WP (0.06%), Fenazaquin 10 EC (0.025%), Fenpyroximate 5 EC (0.005%), Hexythiazox 5.45 EC (0.004%) and Spiromesifen 22.9 SC (0.02%) along with control (water spray). All treatments were replicated thrice in a Randomized Block Design having net plot size of 4.2 x 3.0 sq. m. The row-to-row and plant-to-plant spacing was 60 cm. All the standard agronomic practices were followed during the whole season. The miticides were applied thrice with manually operated knapsack sprayer using 350 to 500 litres of water per hectare. In order to record the incidence of mite, five plants were randomly selected from net plot area of each plot and tagged. Observations on population of mites were recorded from three tender leaves of tagged plants. Such observations were recorded a day before the spray as well as 3, 5 and 7 days after each spray. The data thus obtained were converted into average population of mites per 3 leaves and subjected to statistical analysis of variance after $(\sqrt{x + 0.5})$ transformation. Green chilli fruits were harvested at proper maturity stage. In all the pickings, treatment-wise fruits were weighed separately during each picking. The yields of healthy and marketable fruits were recorded and converted to quintal per hectare. An attempt was made to work out the diminution of sucking pest population and consequential increases in yield over control. Increase in yield over control was calculated by using below mentioned formula. The significance of difference between treatment means were compared using least significant difference (LSD) at 5 per cent probability level. In order to know economics of different treatments, Incremental Cost Benefit Ratio (ICBR) was worked out.

$$\text{Increase in yield (\% over control)} = \frac{T - C}{C} \times 100$$

where,

T = Yield of respective treatment (q/ha)

C = Yield of untreated control (q/ha)

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well

as discussions have been summarized under following heads:

Kharif :

Date on mite population (Table 1) recorded before impose of sprays showed non-significant differences among different treatments indicate homogenous distribution of the pest in all the experimental plots. Data computed for first spray indicated that fenpyroximate and diafenthiuron proved most effective against mite as these acaricides registered significantly least (8.32 to 8.86 mites/3 leaves) number of mites when compared to remaining acaricides. Fenazaquin, spiromesifen and fenpropathrin also proved better acaricides in controlling the pest and stood next to fenpyroximate and diafenthiuron. On the other hand chlorfenapyr and hexythiazox proved least effective against mite, however these acaricides exhibited significantly low incidence of mite than the untreated check.

Superiority of fenpyroximate, diafenthiuron and fenazaquin over rest of the treatments in controlling the mite was also noticed in pooled data computed for second spray. Spiromesifen also proved relatively better acaricide and registered mite population significantly lesser than the fenpropathrin, propargite, chlorfenapyr and hexythiazox. Amongst the acaricides evaluated, hexythiazox and chlorfenapyr proved less effective against mite infesting chilli.

Data worked out for third spray indicated that the mite population in chilli crop was significantly suppressed in all the treated plots over untreated plots (control). Minimum incidence (6.63 mites/3 leaves) of the pest was found in plots sprayed with fenpyroximate followed by diafenthiuron (7.40 mites/3 leaves) and fenazaquin (7.91 mites/3 leaves). These treatments exhibited significantly low population of the pest in comparison to rest of the acaricides. Spiromesifen and fenpropathrin found moderately effective against chilli mite and exhibited significantly lower population (10.66 to 11.47 mites/3 leaves) than hexythiazox (14.02 mites/3 leaves) and chlorfenapyr (13.79 mites/3 leaves). Hexythiazox and chlorfenapyr proved inferior in controlling the mite incidence in chilli crop.

Pooled over period and spray data computed for *Kharif* season indicate that least numbers of mites (7.57 mites/3 leaves) were found in plots treated with fenpyroximate followed by diafenthiuron (8.14 mites/3 leaves). Both these acaricides differed significantly from

rest of the acaricides, except fenazaquin. Amongst the acaricides, maximum (15.10 mites/3 leaves) incidence of the pest was observed in plots sprayed with hexythiazox followed by chlorfenapyr (15.02 mites/3 leaves) and propargite (13.50 mites/3 leaves).

Rabi:

Pooled data worked out for first spray indicated significantly less number of mites (7.77 to 8.92 mite/3 leaves) in the plots sprayed with fenpyroximate and diafenthiuron over other acaricides. Spiromesifen and fenazaquin also proved better chemicals for mite control and stood next to fenpyroximate and diafenthiuron. Amongst the acaricides, chlorfenapyr and hexythiazox proved inferior in suppressing the mite incidence in chilli, however these acaricides exhibited significantly less number of mites in comparison to unsprayed plots.

Data computed for second spray revealed significant

reduction in mite population in all the treated plots than the untreated check (control). The reduction in mite population was significantly higher in plots treated with fenpyroximate than rest of the acaricides treated plots. Diafenthiuron and fenazaquin stood next to fenpyroximate and proved better acaricides for controlling the mite incidence in chilli. Among the acaricides, chlorfenapyr proved least effective against *P. latus* followed by hexythiazox. Spiromesifen, fenpropathrin and propargite found moderately effective against the pest.

Data worked out for third spray indicated minimum (8.88 mites/3 leaves) population of mite in fenpyroximate followed by diafenthiuron (9.56 mites/3 leaves) and fenazaquin (10.36 mites/3 leaves). Chlorfenapyr and hexythiazox found inferior in managing the mite incidence however, they exhibited significantly less numbers of mites (14.31 to 14.40 mites/3 leaves) than untreated control (17.72 mites/3 leaves). Spiromesifen, fenpropathrin and

Table 1 : Bio-efficacy of newer acaricides evaluated against mite, *P. latus* infesting chilli

Treatments	Mean numbers of mite/ 3 leaves														POSP
	Kharif							Rabi							
	First spray		Second spray		Third spray		PP	First spray		Second spray		Third spray		PP	
	B.S.	P	B.S.	P	B.S.	P		B.S.	P	B.S.	P	B.S.	P		
Fenpropathrin 30 EC	4.00*	3.72bc	3.85	3.76c	4.02	3.46bc	3.64d	4.01	3.57bc	4.13	3.62de	3.76	3.57cd	3.58cd	3.61c
	(15.50)	(13.34)	(14.32)	(13.64)	(15.66)	(11.47)	(12.75)	(15.56)	(12.24)	(16.56)	(12.60)	(13.64)	(12.24)	(12.32)	(12.53)
Propargite 57 EC	3.94	3.74c	3.94	3.90c	4.09	3.61cd	3.75de	4.06	3.79c	4.09	3.79ef	3.84	3.81de	3.79de	3.77d
	(15.02)	(13.49)	(15.02)	(14.71)	(16.23)	(12.53)	(13.56)	(15.96)	(13.86)	(16.23)	(13.86)	(14.22)	(13.98)	(13.86)	(13.71)
Chlorfenapyr 10 SC	4.02	4.03d	4.10	4.01c	4.02	3.78d	3.94e	4.07	3.92d	4.14	3.97f	3.80	3.85e	3.91e	3.93e
	(15.66)	(15.74)	(16.31)	(15.58)	(15.66)	(13.79)	(15.02)	(16.09)	(14.87)	(16.64)	(15.26)	(13.94)	(14.31)	(14.79)	(14.94)
Diafenthiuron 50 WP	3.89	3.06a	3.75	2.97a	4.13	2.81a	2.94ab	3.98	3.07a	4.06	3.14b	3.88	3.17a	3.13ab	3.04a
	(14.63)	(8.86)	(13.56)	(8.32)	(16.56)	(7.40)	(8.14)	(15.33)	(8.92)	(15.98)	(9.36)	(14.57)	(9.56)	(9.30)	(8.74)
Fenazaquin 10 EC	4.06	3.48b	3.85	3.01a	4.22	2.90a	3.13bc	3.82	3.53b	4.09	3.28bc	3.97	3.30ab	3.37bc	3.25b
	(15.98)	(11.61)	(14.32)	(8.56)	(17.31)	(7.91)	(9.30)	(14.08)	(11.96)	(16.23)	(10.26)	(15.28)	(10.36)	(10.86)	(10.06)
Fenpyroximate 5 EC	3.98	2.97a	3.76	2.89a	4.18	2.67a	2.84a	3.89	2.88a	4.18	2.90a	3.93	3.06a	2.95a	2.89a
	(15.34)	(8.32)	(13.64)	(7.85)	(16.97)	(6.63)	(7.57)	(14.64)	(7.79)	(16.97)	(7.91)	(14.93)	(8.88)	(8.20)	(7.85)
Hexythiazox 5.45 EC	3.98	3.99d	4.10	4.04d	4.10	3.81d	3.95e	4.02	3.90d	4.18	3.96f	3.84	3.86e	3.91e	3.93e
	(15.34)	(15.42)	(16.31)	(15.82)	(16.31)	(14.02)	(15.10)	(15.66)	(14.71)	(16.97)	(15.18)	(14.28)	(14.40)	(14.79)	(14.94)
Spiromesifen 22.9 SC	3.86	3.52bc	3.81	3.38b	4.18	3.34b	3.41c	4.06	3.50b	4.14	3.48cd	3.93	3.54bc	3.51cd	3.46c
	(14.40)	(11.89)	(14.02)	(10.92)	(16.97)	(10.66)	(11.13)	(15.97)	(11.75)	(16.64)	(11.61)	(14.93)	(12.05)	(11.82)	(11.47)
Control (Water spray)	4.12	4.42d	4.52	4.57e	4.45	4.18e	4.39e	4.26	4.43e	4.38	4.32g	4.22	4.27f	4.34f	4.37f
	(16.47)	(19.04)	(19.93)	(20.38)	(19.30)	(16.97)	(18.77)	(17.63)	(19.12)	(18.68)	(18.16)	(17.31)	(17.72)	(18.34)	(18.60)
S. E. ± T	0.20	0.08	0.19	0.09	0.18	0.09	0.07	0.18	0.09	0.17	0.08	0.19	0.09	0.10	0.05
Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T x Y	-	0.16	-	0.16	-	0.17	-	-	0.16	-	0.15	-	0.16	-	-
C.D. (P=0.05) T	NS	0.24	NS	0.27	NS	0.25	0.20	NS	0.24	NS	0.23	NS	0.24	0.29	0.15
Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T x Y	-	NS	-	NS	-	NS	-	-	NS	-	NS	-	NS	-	-
C. V. %	8.56	7.42	8.37	7.82	7.35	8.60	7.55	7.90	7.69	7.02	7.26	8.44	7.53	6.85	5.98

NS = Non-significant BS = Before spray P = Pooled PP=Pooled over periods POSP=Pooled over season and periods

*Figures are $\sqrt{x + 0.5}$ transformed values whereas those in parentheses are re-transformed values
Treatment means with letter(s) in common are not significant by Lsd at 5 % level of significance

propargite found moderately effective against chilli mite.

Excellent performance of fenpyroximate and diafenthiuron in controlling mite incidence in chilli observed during *kharif* season also revealed during *Rabi* season (Table 1). Chilli plots treated with these acaricides exhibited significantly low (8.20 to 9.30 mites/3 leaves) population of mite, *P. latus* than rest of the acaricides, except fenazaquin. With respect to mite numbers, fenazaquin found at par with spiromesifen and fenpropathrin. Among the acaricides, plots treated with hexythiazox and chlorfenapyr registered maximum (14.79 mites/3 leaves) incidence of mite and proved least effective against the pest.

Overall pooled data (Table 1) worked out for both

the seasons indicated significant reduction in mite, *P. latus* population due to the spray application of fenpyroximate and diafenthiuron. These treatments exhibited significantly low incidence (7.85 to 8.74 mites /3 leaves) of the pest as compared to rest of the treatments. Fenazaquin also found a better treatment next to fenpyroximate and diafenthiuron. Spiromesifen and fenpropathrin found moderately effective against chilli mite and registered 11.47 and 12.53 mites/3 leaves, respectively. Chlorfenapyr and hexythiazox proved inferior in mitigating the mite population as they recorded significantly highest (14.94 mites/3 leaves) population of the pest.

Excellent performance of fenpyroximate against chilli mite noticed in present study is in conformity with

Table 2 : Effect of certain newer acaricides on green chilli fruit yield during 2013

Treatments	Yield (q/ha)			Increase in yield over control (%)
	<i>Kharif</i>	<i>Rabi</i>	Pooled	
Fenpropathrin 30 EC	84.65	72.82	78.73	30.17
Propargite 57 EC	83.62	77.28	80.45	33.01
Chlorfenapyr 10 SC	85.82	73.86	79.86	32.01
Diafenthiuron 50 WP	100.10	91.07	95.58	58.03
Fenazaquin 10 EC	99.13	87.58	93.36	54.35
Fenpyroximate 5 EC	113.25	98.34	105.80	74.92
Hexythiazox 5.45 EC	78.16	72.55	75.36	24.59
Spiromesifen 22.9 SC	98.48	82.99	90.73	50.01
Control (Water spray)	63.56	57.41	60.48	-
S. E. \pm	4.01	4.80	2.92	-
C.D. (P=0.05)	12.03	14.39	8.35	-
C.V. (%)	7.75	10.48	9.07	-

Table 3 : Economics of acaricides evaluated against mite, *P. latus* infesting chilli

Treatments	Yield (q/ha)	Gross income (Rs./ha)	Quantity of acaricides required for three sprays (L or Kg/ha)	Total cost of plant protection including labour charges (Rs./ha)	Gross realization (Rs./ha)	Net realization (Rs./ha)	ICBR
Fenpropathrin	78.73	86603	0.90	1722.00	84881.00	19625.00	1:11.40
Propargite	80.45	88495	4.50	5727.00	82768.00	17512.00	1:3.06
Chlorfenapyr	79.86	87846	2.25	6651.75	81194.25	15938.25	1:2.40
Diafenthiuron	95.58	105138	1.80	6492.00	98646.00	33390.00	1:5.14
Fenazaquin	93.36	102696	3.75	8772.00	93924.00	28668.00	1:3.27
Fenpyroximate	105.80	116380	1.50	3972.00	112408.00	47152.00	1:11.87
Hexythiazox	75.36	82896	0.42	2196.00	80700.00	15444.00	1:7.03
Spiromesifen	90.73	99803	1.26	6942.00	92861.00	27605.00	1:3.98
Control (Water spray)	60.48	66528	-	1272.00	65256.00	-	-

Note: Labour charge:Rs. 212/- day, Price of chilli green fruits: Rs. 1100/ quintal

Price of acaricides:

Fenpropathrin	: Rs. 500/L	Fenazaquin	: Rs. 2000/L
Propargite	: Rs. 990/L	Fenpyroximate	: Rs. 1800/Kg
Chlorfenapyr	: Rs. 2391/L	Hexythiazox	: Rs. 2200/Kg
Diafenthiuron	: Rs. 2900/Kg	Spiromesifen	: Rs. 4500/L

the earlier reports of Smitha and Girradi (2006); Bhushan (2009) and Mallapur *et al.* (2013). Bhaskaran *et al.* (2007) reported that the diafenthiuron 50 EC and 50 WP both at 450 g a.i./ha recorded highest reduction in mite population in bhendi. These reports are in the line of present results wherein diafenthiuron evolved as effective acaricide next to fenpyroximate in reducing mite population in chilli. Fenazaquin proved effective acaricide and controlled the mite, *P. latus* population at appreciable level in chilli crop. This is in accordance with the findings of Walunj and Pawar (2000) and Nagaraj *et al.* (2007). Spiromesifen proved as moderately effective acaricide in controlling mite, *P. latus* population in present investigation which is in conformity with the findings of Kavitha *et al.* (2006) and Nagaraj *et al.* (2007). Kavitha *et al.* (2006) found that spiromesifen at 120 g a.i./ha was superior in the control of chilli mite.

Data (Table 2) indicated that the plots sprayed with fenpyroximate produced significantly highest (105.80 q/ha) yield of fruits in comparison to rest of the acaricidal treatments. Diafenthiuron, fenazaquin and spiromesifen also found to be good acaricides and produced 90.73 to 95.58 q/ha fruit yield. Increase in yield over control was highest (74.92 %) in fenpyroximate followed by diafenthiuron (58.03 %), fenazaquin (54.35 %) and spiromesifen (50.01 %). Minimum (24.59 %) increase in yield over control was found in hexythiazox followed by fenprothrin (30.17 %), chlorfenapyr (32.01 %) and propargite (33.01 %).

Superior performance of fenpyroximate in producing higher yields noticed in present study is in conformity with the reports of Smitha and Girradi (2006) and Mallapur *et al.* (2013). Smitha and Girradi (2006) reported that highest dry chilli yield was obtained with dicofol followed by fenpyroximate. Mallapur *et al.* (2013) also recorded highest dry pod yield of chilli in higher doses (0.75 ml/L) of fenpyroximate 5 EC followed by ethion and lower doses (0.50 ml/L) of fenpyroximate. Tatagar (2004) showed the promising effect of diafenthiuron in controlling chilli mite and increasing the yield of green chilli fruits. Similarly, promising role of fenazaquin in suppressing chilli mites and consequently increasing the yield of chilli fruits has been reported by Walunj and Pawar (2000) and Nagaraj *et al.* (2007). As per the report of Nagaraj *et al.* (2007), the spiromesifen 24 SC evolved as best acaricide by registering higher dry chilli yield. All the reports are in the line of present findings.

Economics :

Maximum (1:11.87) ICBR (Table 3) was registered in fenpyroximate followed by fenprothrin (1:11.40) and hexythiazox (1:7.03). The treatment of fenpyroximate also proved best exhibiting highest (Rs. 47152/ha) net realization value. Diafenthiuron, spiromesifen, propargite and chlorfenapyr exhibited 1:5.14, 1:3.98, 1:3.06 and 1:2.40 ICBR, respectively. Though, the treatment of diafenthiuron, fenazaquin and spiromesifen showed good net realization values but failed to exhibit appreciable level of ICBR because of their relatively higher market price. According to Bhushan (2009), the fenpyroximate found to be effective in controlling chilli mite and recorded higher Cost Benefit Ratio (CBR) compared to dicofol. As per the report of Kumar *et al.* (2009), the highest fruit yield and CBR were recorded in dicofol followed by fenpyroximate. These reports are accordance with the present findings.

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