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EFFICACY OF SOME NEW ACARICIDES FOR THE MANAGEMENT OF CAPSICUM YELLOW MITE, *POLYPHAGOTARSONEMUS LATUS* BANKS ON BELL PEPPER (*CAPSICUM ANNUM* L.) UNDER PROTECTED CULTIVATION

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ABSTRACT : Bio-efficacy of selected acaricides was tested against mite population on bell pepper under protected condition. Fenpyroximate 5 SC proved to be effective acaricide in reducing the mite population followed by followed by diafenthiuron 50 WP and chlorfenapyr 10 EC. The least effective acaricide was dicofol 18.5 EC. The order of efficacy of these acaricides against mite population was fenpyroximate 5 SC >diafenthiuron 50 WP >chlorfenapyr 10 EC >spiromesifen 22.9 SC >propargite 57 EC >fenazaquin 10 EC >dicofol 18.5 EC. The results of the crop loss estimation indicated that, significantly higher fruit yield of 37,882 kg/acre, net returns of Rs. 6,98,788.67/acre and BC ratio of 1:2.81 was obtained in fenpyroximate 5 SC and the lower fruit yield of 29,325 kg/acre, net return of Rs. 4,84,877.67/acre and benefit cost ratio of 1:1.95 was obtained in dicofol 18.5 EC treated plots.

Key words : Management, sweet pepper, *Polyphagotarsonemus latus*, protected cultivation.

INTRODUCTION

Protected (polyhouse) cultivation is gaining popularity in India and is recognized as a useful technology to augment production of high quality vegetables. Sweet pepper, *Capsicum annuum* L., is one of the vegetables commercially suited for polyhouse cultivation, yielding 100 to 120 t ha^{-1} compared to 20 to 40 t/ha in open field (Prabhakara *et al*, 2004). Among different pests reported on sweet pepper, the yellow mite, *Polyphagotarsonemus latus* (Banks) is a major pest causing yield loss upto 96.4% in North Karnataka (Borah, 1987) and 25% in West Bengal (Ahmed *et al*, 1987) under open field is reported. Adults and nymphs suck the sap from terminal leaves, auxiliary shoots and developing fruits. Affected leaves become narrow and twisted resulting in downward curling (Eswara Reddy, 2005). Information on yield loss due to *P. latus* infestation and its management on sweet pepper grown under protected cultivation is lacking in the tropics. Hence, a study was carried out to study the effect of new acaricides against *P. latus* on sweet pepper.

MATERIALS AND METHODS

The experiment was conducted under protected condition with drip irrigation system at the College of Horticulture, Hiriyur, Chithradurga district, Karnataka during 2015-16. The experiment was laid out in Randomized Complete Block Design (RCBD). There were nine treatments including with water spray and without water spray with three replications. The treatments are as mentioned in Table 1.

Seedlings of capsicum, hybrid Indra were raised in nursery in raised bed during the secondweek of July. Thirty five days old, vigorous and uniform size seedlings were selected for transplanting in main field of size 5 m × 3 m with spacing of 60 cm × 45 cm during the third week of August 2015–16. In experimental plot, all the recommended agronomic practices were followed as per the package of practices except the plant protection measures.

The first spray was taken up when the crop was uniformly infested with natural mite population. Total three sprays were given at 15 days interval during study period. The data on population of egg and active stage was recorded from five tagged plants at random. Five leaves were sampled from top, middle and bottom canopy from tagged plants. The observations on mite population including eggs and active stages (Nymph and adult) were recorded before spraying as pre-count and at third, seventh and tenth days after spray as post count.

Table 1 : Details of new acaricides evaluated against *P. latus*.

S. No.	Treatments	Trade name	Dosage
1.	Chlorfenapyr 10% EC	Intrepid	1.5 ml/l
2.	Diafenthiuron 50% WP	Pegasus	1.2 g/l
3.	Dicofol 18.5% EC	Dicofol	2.5 ml/l
4.	Fenpyroximate 5% SC	Pyromite	1 ml/l
5.	Propargite 57% EC	Simbaa	3 ml/l
6.	Spiromesifen 22.9% SC	Oberon	0.8 ml/l
7.	Fenazaquin 10% EC	Magister	3 ml/l
8.	With water spray	-	-
9.	Without water spray (control)	-	-

The yield was recorded during the time of each picking from each plot separately. The cumulative yield was expressed in terms of tonnes (t) per hectare. Based on the yield data and cost of each treatment, the gross returns and net returns were calculated. The benefit cost ratio (B: C) per hectare was determined.

RESULTS AND DISCUSSION

The pre-treatment sampling indicated that population was high and uniform in all experimental plots. There was non-significant difference in all the treatments before the imposition of acaricides during the first spray. The number of mites sharply decreased in all treatments (including a marginal decrease in untreated control plot) after application of different treatments.

Chlorfenapyr 10 EC recorded total mite population of 42.17 per leaf before spraying chemicals and gradually its population decreased to 16.97, 13.43 and 11.18 mites per leaf at three, seven and ten days after first spray, respectively. Further, the mite population was reduced to 6.02, 5.18 and 3.34 mite from 11.87 mitesper leaf (before second spray) at three, seven and ten days after second spray, respectively. While, the mite population was drastically reduced to 1.50, 1.28 and 0.33 mite from 3.92 mites per leaf (before spray) at three, seven and ten days after third spray, respectively. The present findings were in agreement with the findings of Sarkar *et al* (2013), who reported that chlorfenapyr at 100 and 125 g a.i./ha found to be most effective against the yellow mite on chilli.

In diafenthiuron 50 WP treated plots, total population of mite was gradually reduced to 11.02 mites per leaf at ten days after first spray from the initial population of 43.25 mites per leaf. Similar trend in the reduction of mite population was observed ten days after second spray where the population of mites was reduced to 3.41 mites per leaf from 11.37 mites per leaf. Even after the third spray also the same trend in the reduction of mite population was observed where the mites were reduced to 0.29 per leaf from initial population of 3.59 mites per

Table 2 : Bio-efficacy of acaricides against yellow mite, *Polyphagotarsonemus latus* on capsicum.

Tr. No.	Treatment	Dosage per litre	Mean population of mites (eggs + active stages) per leaf											
			1st spray				2nd spray				3rd spray			
			Precount	3DAS	7DAS	10DAS	Precount	3DAS	7DAS	10DAS	Precount	3DAS	7DAS	10DAS
T_1	Chlorfenapyr 10 % EC	1.5 ml	42.17	16.97	13.43	11.18	11.87	6.02	5.18	3.34	3.92	1.50	1.28	0.33
T_2	Diafenthiuron 50 % WP	1.2 g	43.25	17.26	13.28	11.02	11.37	5.82	4.72	3.41	3.59	1.45	0.87	0.29
T_3	Dicofol 18.5 % EC	2.5 ml	41.76	34.54	31.44	25.55	23.67	20.82	18.61	16.16	18.15	13.11	11.25	10.38
T_4	Fenpyroximate 5 % SC	1 ml	40.28	16.39	13.26	10.20	10.98	5.93	4.94	3.35	3.43	1.45	1.05	0.29
T_5	Propargite 57 % EC	3 ml	42.47	32.21	29.93	25.94	20.76	17.62	16.21	14.38	15.44	12.24	9.12	8.44
T_6	Spiromesifen 22.9 % SC	0.8 ml	41.69	19.35	14.98	12.34	13.09	7.35	5.80	4.54	4.73	3.02	2.23	0.61
T_7	Fenazaquin 10 % EC	3 ml	42.59	36.12	29.09	22.68	23.46	18.32	15.19	12.97	15.42	12.90	10.85	9.59
T_8	With water spray	-	41.12	41.37	42.74	45.53	47.21	48.67	50.19	48.27	47.45	44.61	40.47	44.77
T_9	Without water spray (control)	-	40.76	43.55	45.14	48.10	50.78	52.81	53.98	51.76	50.61	46.9	44.05	47.19
	S.Em.±		-	0.533	0.351	0.312	0.343	0.219	0.310	0.227	0.241	0.198	0.190	0.190
	C.D. at 5%		NS	1.599	1.055	0.935	1.028	0.659	0.929	0.681	0.723	0.594	0.572	0.572

DAS- Days after spray.

Table 3 : Cost economics of mite management on capsicum under protected cultivation.

Tr. No.	Treatment	Yield (kg/acre)	Cost of protection (Rs./acre)	Total cost of production (Rs./acre)	Gross returns (Rs./acre)	Net returns (Rs./acre)	B C ratio
T1	Chlorfenapyr 10% EC	37,450	3,069	2,48,505.33	9,36,250	6,87,744.67	1:2.76
T2	Diafenthiuron50 % WP	37,732	3,123	2,48,559.33	9,43,300	6,94,740.67	1:2.79
T3	Dicofol 18.5 % EC	29,325	2,811	2,48,247.33	7,33,125	4,84,877.67	1:1.95
T4	Fenpyroximate 5 % SC	37,882	2,825	2,48,261.33	9,47,050	6,98,788.67	1:2.81
T5	Propargite57 % EC	33,230	2,974	2,48,410.33	8,30,750	5,82,339.67	1:2.34
T6	Spiromesifen 22.9 % SC	35,645	3,154	2,48,590.33	8,91,125	6,42,534.67	1:2.58
T7	Fenazaquin 10 % EC	32,850	3,325	2,48,761.33	8,21,250	5,72,488.67	1:2.30
T8	With water spray	25,020	00	2,45,736.33	6,25,500	3,79,763.67	1:1.54
T9	Without water spray(control)	20,212	00	2,45,436.33	5,05,300	2,59,863.67	1:1.05

Gross returns = Yield × Market price (Rs. 25/kg); Net returns = Gross return – Total cost.

leaf. Diafenthiuron 50 WP recorded effective reduction in mites population at three and seven days after first, second and third spray. The results are in agreement with Chakrabarti and Sarkar (2014) who reported that diafenthiuron 50 WP (300 g a.i./ha) showed the best efficacy against motile stages of yellow mite in chilli.

Fenpyroximate 5 SC treated plots, recorded significant reduction in the mite population during each spray with acaricides. The population of mites reduced significantly from the initial population of 40.28 per leaf to 16.39, 13.26 and 10.20 mites per leaf at three, seven and ten days after first spray, respectively. Similar trend was observedfor second and third spray with a drastic reduction in the mites population to 3.35 mites from 10.98 mites per leaf ten days after second spray and to 0.29 mites per leaf from 3.43 mites per leaf ten days after third spray. The result of the present investigation are in confirmation with the findings of Pathipati *et al* (2012) who reported that the fenpyroximate 5 EC (500 ml/ha) recorded maximum mean mortality of 92.55% of *P. latus* on chilli crop (Table 2). The results are also in conformity with the findings of Mishra (2014), Kumar *et al* (2005).

In spiromesifen 22.9 SC treated plots, the population of mites reduced significantly from the initial population of 41.69 mites per leaf to 19.35, 14.98 and 12.34 mites per leaf at three, seven and ten days after first spray, respectively. Similar trend was observed for second and third spray with significant reduction in the mites population to 4.54 mites per leaf from the initial population of 13.09 mites per leaf, ten days after second spray. In case of third spray, the population was reduced to 0.61 mites per leaf from the initial population of 4.73 mites per leaf ten days after chemical application. In the plots treated with dicofol 18.5 EC, propargite 57 EC and fenazaquin 10 EC, similar trend in the reduction of total mite population was observed. But reduction in the total mite population was not high as observed in other treatments like chlorfenapyr 10 EC, diafenthiuron 50 WP, fenpyroximate 5 SC and spiromesifen 22.9 SC treated plots. In dicofol treated plots, the population of mite was reduced to 25.55, 16.16 and 10.38 mites per leaf ten days after first, second and third spray, respectively from initial population of 41.76 mites per leaf (Table 2).

Among all the acaricides, Fenpyroximate 5 SC was found to be superior in reducing the mite population followed by followed by diafenthiuron 50 WP and chlorfenapyr 10 EC. The least effective acaricide was dicofol 18.5 EC. The order of efficacy of these acaricides against mite population was fenpyroximate 5 SC >diafenthiuron 50 WP >chlorfenapyr 10 EC > spiromesifen 22.9 SC > propargite 57 EC > fenazaquin 10 EC > dicofol 18.5 EC (Table 2).

Chlorfenapyr 10 EC showed a variable effect on mite and this might be due to its unique mode of action as it acts as uncoupler of oxidative phosphorylation via disruption of the proton gradient in the mitochondria, resulting in disruption of production of ATP, causing cellular death and ultimately organism mortality (Jaydeep *et al*, 2015).

In view of the above results observed, it can be concluded that fenpyroximate 5 SC is found to be effective in reducing mite population followed by diafenthiuron 50 WP and chlorfenapyr 10 EC. Fenpyroximate is an inhibitor of mitochondrial electron transport at complex I. It has quick knockdown activity against immature and adult, mainly by contact and ingestion and moulting inhibitory activity on nymphs. Diafenthiuron 50 WP, which inhibits mitochondrial respiration and kills larvae, nymphs and adult by contact and stomach action; also shows some ovicidal action. This unique mode of action of these newer molecules of acaricides might be responsible for the higher toxicity against mites. Another advantage of these newer molecules is that most of these are required in relatively lower doses than the conventional ones.

Cost economics

Among the different treatments, highest gross return of Rs. 9,47,050/acre was estimated in fenpyroximate 5 SC treated plots whereas, the lowest gross return of Rs. 7,33,125/acre was obtained in dicofol 18.5 EC treated plots. The highest net return of Rs. 6,98,788.67/acre was obtained in fenpyroximate 5 SC treated plots and the lowest net return of Rs. 4,84,877.67/acre was obtained in dicofol 18.5 EC. Finally, the higher benefit cost ratio of 1:2.81 was obtained in fenpyroximate 5 SC and the lowest benefit cost ratio of 1:1.95 was obtained in dicofol 18.5 EC. However, untreated control plots recorded lowest benefit cost ratio than rest of the acaricidal treatments (Table 3).

The present findings are in line with Jaydeep *et al* (2015), who reported that the maximum cost benefit ratio of 1:8.36 was recorded in chlorfenapyr 10 SC treated plots in chilli under open field conditions. In addition, chlorfenapyr 10 SC was found to be the most effective treatment in reducing mite population and recorded the highest yield among all the treatments. Gundannavar *et al* (2007) recorded that diafenthiuron (0.75 g/l) gave the highest yield (6.90 q/ha) in chilli crop.

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