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Short Research Article

Bio-efficacy of Modern Acaricides against Chilli Mite, *Polyphagotarsonemus latus* Banks

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Abstract

An experiment was conducted to evaluate some acaricides against chilli mite, *Polyphagotarsonemus latus* Banks under field condition. Acaricides *viz.* clofentezine, flufenzine, dicofol and sulfur were applied at recommended doses as a sole application and tank mix formulation of clofentezine and dicofol. The maximum reduction of eggs hatchability (53.03%) was recorded in clofentezine treated plots followed by dicofol (36.02%), flufenzine (27.37%) and sulfur (26.03%). The highest reduction of motile stage was observed in sulfur (78.35%) treated plots followed by dicofol (75.88%), flufenzine (42.08%) and clofentezine (25.65%). Tank mix formulation of clofentezine and dicofol at both low and high doses recorded higher mortality (87.80 and 97.66%) of mite as compared to sole application of individual acaricide, respectively. Yield of chilli was also higher in both doses of tank mix formulation treated plots (25.80 and 26.10 q ha^{-1}), respectively.

1. Introduction

Chilli (*Capsicum annuum* L.: Solanaceae) is one of the most important profitable spices crops grown all over India. However, the productivity of the crop is declining sharply day by day mainly due to leaf curl complex. This highly remunerative and useful crop is known to be attacked by several pests [over 20 insects and non-insect pests (Butani, 1976; Dey et al., 2001); 57 insect and non-insect pests (Reddy and Puttaswamy, 1984)] throughout its growth period. Among non-insect pests, the yellow mite, *Polyphagotarsonemus latus* (Banks) is a serious one causing severe damage to reproductive buds resulting in substantial yield loss. The nymphs and adults actively feed on the tender leaves causing elongation of leaf lamina, thereby causing yield loss up to 34.14% in India (Ahmed et al**.**, 1987). To control this dreaded pest, the farmers are applying insecticides indiscriminately with short spell between two consecutive sprays leading to pesticidal pollution, adverse effects on non-target organisms and high costs of cultivation. Keeping these views in mind, the present investigation was undertaken to evaluate the efficacy of different type of acaricide molecules for management of this pest of chilli under field condition.

2. Materials and Methods

The field experiment was conducted at District Seed Farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal during *rabi* season. The experiments were laid out in a randomized block design (RBD) with four replications. Four acaricides, viz*.,* clofentezine, flufenzine, dicofol and sulfur at recommended doses as sole application and tank mix formulation of clofentezine and dicofol (200+100 g a.i. ha^{-1} and 300+100 g a.i. ha^{-1}) were tested against chilli mite with separate experiments. The crop was raised in the nursery seed bed and then transplanted in the main field after one month. All the plots were left without any preventive measures for natural infestation of target pest. Four consecutive sprays were done at fifteen days interval after infestation of target pests. Observations were taken at 1 day before and on 1, 5 and 10 days after spraying for counting adult mite while eggs was counted on 1, 3 and 5 days after spraying. All observations were recorded from three leaves covering top, middle and bottom canopy $plant^{-1}$ (Jeyarani and Chandrasekaran, 2006) comprising randomly selected five tagged plants $plot^{-1}$. All leaves from each plant were plucked and kept in properly labeled polypropylene bag followed by examination of these leaves under stereo-binocular microscope for counting the number of mites and eggs per leaf. The critical difference (CD) at 5% level of significance was worked out from the data of mean population before the spraying and subsequent various days' intervals after spraying.

3. Results and Discussion

3.1. Ovicidal effect of acaricides against chilli mite, P. latus Banks

The efficacy of different acaricides viz. clofentezine, flufenzine, dicofol and sulfur against egg stage of chilli mite, *P. latus* is presented in Table 1. All the acaricidal treated plots significantly reduced the egg hatchability over untreated control plots. Clofentezine @ 350 g a.i. ha^{-1} reduced 63.42% of egg hatching at 5 days after treatment followed by flufenzine (40.30%), dicofol (39.50%) and sulfur (30.10%) but at 3 days after treatment, it was found that reduction of egg hatching was more in dicofol (42.22%) treated plots than flufenzine (28.45%) and sulfur (28.34%) treated plots. The highest mean percentage of reduction of egg hatching were recorded in case of clofentezine (53.03%) followed by dicofol (36.02%), flufenzine (27.37%) and sulfur (26.03%) while in control plots it was increased by 6.41%. Present findings are in conformity with the observations of Bhardwaj et al. (2007) who reported that clofentezine (0.01 and 0.02%) provided excellent control of motile and egg stages of European red mite, *Panonyehm ulmi* for more than 30 days. Dejan et al. (2009) recorded that more than >90% efficacy of clofentezine against spider mite which may be in compliance of high efficacy of clofentezine against this pest. Similar results presented by Sridhar and Rani (2011) who accounted that the efficacy of clofentezine 50 SC (300 g a.i ha^{-1}) was superior over dicofol (231.25 g a.i. ha^{-1}) against *Tetranychus urticae* on rose. Naik et al. (2006) reported effectiveness of flufenzin (100 g a.i. ha^{-1}) against red spider mite (*Tetranychus cinnabarinus*) on brinjal which may be corroborated with the present findings.

3.2. Effectiveness of acaricides against motile stage of P. latus Banks and on yield of chilli

The efficacy of clofentezine, flufenzine, dicofol and sulfur against motile stage of chilli mites, *P. latus* Banks is presented in Table 2. The average number of motile stage of mite per leaf was recorded from 25.75 to 37.85 $leaf^{-1}$ before application of acaricides. After one day of application, 75.35% of mite reduction was recorded with sulfur treated plots followed by dicofol (66.45%), flufenzine (34.40%) and clofentezine (19.40%). Similar trend of population reduction was found in all treatments after three days of application whereas at ten days of application maximum reduction (86.85%) of mite population was recorded in dicofol treated plots followed by sulfur (81.30%), flufenzine (49.60%) and clofentezine (33.20%). Mean reduction of mite was also highest (78.35%) in sulfur treated plots followed by dicofol (75.88%). Though, clofentezine (25.65% reduction) was less effective against the motile stage but was superior over untreated control (+15.23%). Highest yield was recorded in dicofol treated plots (23.4 q ha^{-1}) followed by sulfur (23.0 q ha^{-1}), flufenzine (22.3 q ha^{-1}) and clofentezine (21.7 q ha^{-1}) whereas in untreated control plots yield was only 11.1 q ha^{-1}.

Similar observation was reported by Smilts (1995) who observed that dicofol @ 0.05 kg a.i. l^{-1} was effective for management of *P. latus* Banks in chilli. Cho et al. (1996) reported more than 90% mortality of this mite by dicofol at 17 days after treatment which may be corroborated with the present findings. Higher efficacy of dicofol are in conformity with the results of Srinivasulu et al. (2002) who reported that application of 0.1% dicofol recorded 83.18% reduction of this mite. Findings are in agreement with Karmakar et al. (1996) who recommended wettable sulfur (Sulfex) @ 0.24% against chilli mite for its effective management. Similar reports on sulfur against this mite were also given by many workers (Hugon and Chaupin, 1986; Ochoa and Lindeman, 1988 and Lie et al., 1991). Though clofentezine showed low efficacy against motile stage but it has a good ovicidal effect, therefore, it may be recommended for effective management of target acari. The efficacy of clofentezine was recorded at 66.2% (25 DAT) and 30.9% (32 DAT) at two different places against summer population of European red mite (*Panonychus ulmi*) on apple (Marcic et al., 2013).

3.3. Effect of tank mix formulation (clofentezine+dicofol) against P. latus Banks and on yield of chilli

The efficacy of tank mix formulation (clofentezine+dicofol)

Table 1: Ovicidal effect of some acaricides against *P. latus* Bank in chilli (mean of four spraying)

Treatment	Dose (g a.i. ha^{-1})	Number of eggs $leaf^{-1}$ before spraying	% reduction/increase (+) of egg hatchability after spray at various time interval (days)			Pooled mean % reduction/increase (+) after spraying
			1	3	5	
Clofentezine 50 EC	350	31.3	36.23 (36.90)	59.44 (50.44)	63.42 (52.77)	53.03
Flufenzine 20 SC	100	19.6	13.36 (21.47)	28.45 (32.37)	40.30 (39.41)	27.37
Dicofol 18.5 EC	200	26.4	26.36 (30.92)	42.22 (40.51)	39.50 (38.94)	36.02
Sulfur (Share)	2.5 kg ha^{-1}	30.6	19.67 (26.35)	28.34 (32.14)	30.10 (33.27)	26.03
Untreated control	-	28.3	-	-	+19.25 (0.00)	+6.41
CD (p=0.05)	-	NS	4.63	7.32	6.96	-

Figures in parenthesis are angular transformed values; NS:Not Significant

against yellow mite is presented in Table 3. The average pre-treatment count of mite population varied from 26.25 to 36.70 leaf^{-1}. After one day of application, highest reduction (93%) of mite was observed in plots treated with clofentezine+dicofol @ 300+100 g a.i. ha^{-1}. However, after fifth and tenth day of application, both low (200 g a.i. ha^{-1}+100 g a.i. ha^{-1}) and high (300 g a.i. ha^{-1}+100 g a.i. ha^{-1}) doses of tank mix formulation recorded 100% reduction of mite followed by dicofol (80.35 and 95.50%) respectively. The combine effect of clofentezine and dicofol also reflected in higher yield at both high (26.10 q ha^{-1}) and low (25.80 q ha^{-1}) doses than other treatments (Table 3).

Literatures on tank mix formulation of these chemicals are scanty but results may be compared with the similar type of experiments against chilli mite. Sarkar et al. (2007) suggested that tank mixing of dicofol with IGR's like clofentezine and flufenzin did not affect the efficacy in controlling the yellow mite in chilli ecosystem under West Bengal context. Such type of observation was reported by Mar and Del (1983) who showed that 0.2% Trithion-Kelthane (8% carbofenthion+32% dicofol) gave more than 95% control of chilli mite at 9 days after application. Similar observation was recorded by Cross and Basett (1982) in egg plant who reported that the mixture of dicofol and tetradifon @ 400 and 125 g a.i. 100^{-1} liters of water provided effective control against target acari.

Table 2: Effectiveness of some acaricides against motile stage of *P. latus* Banks and on yield of chilli (Mean of four spraying)

Treatment	Dose (g a.i. ha^{-1})	Number of mites/leaf before spraying	% reduction/increase (+) of mite after spray at various time interval (days)			Pooled mean % of reduction/increase (+) after spraying	Yield (q ha^{-1})
			1	5	10		
Clofentezine 50 EC	350	27.40	19.40 (26.28)	24.35 (29.60)	33.20 (35.18)	25.65	21.7
Flufenzine 20 SC	100	26.45	34.40 (35.91)	42.25 (40.51)	49.60 (44.83)	42.08	22.3
Dicofol 18.5 EC	200	37.85	66.45 (54.57)	74.35 (59.54)	86.85 (68.78)	75.88	23.4
Sulfur (Share)	2.5 kg ha^{-1}	28.90	75.35 (60.27)	78.40 (62.31)	81.30 (64.38)	78.35	23.0
Untreated control	-	25.75	-	+11.37 (0.00)	+34.33 (0.00)	+15.23	11.1
CD (p=0.05)	-	NS	11.23	12.68	12.32	-	-

Figures in parenthesis are angular transformed values; NS:Not significant

Table 3: effectiveness of tank mix formulation (clofentezine+dicofol) against *P. latus* Banks and on yield of chilli (Mean of four spraying)

Treatment	Dose (g a.i. ha^{-1})	Number of mites/leaf before spraying	% reduction/increase (+) of mite after spray at various time intervals (days)			Pooled mean % of reduction/increase (+) after spraying	Yield (q ha^{-1})
			1	5	10		
Clofentezine 50 EC	300	36.70	21.20 (27.42)	29.40 (32.83)	23.35 (28.93)	24.65	21.60
Clofentezine 50 EC	350	29.60	24.60 (29.73)	34.30 (33.85)	37.55 (37.76)	32.15	21.75
Clofentezine+Dicofol	200+100	34.55	69.75 (56.66)	93.65 (75.46)	100.00 (90.00)	87.80	25.80
Clofentezine+Dicofol	300+100	26.25	93.00 (74.66)	100.00 (90.00)	100.00 (90.00)	97.66	26.10
Dicofol 18.5 EC	200	34.40	59.40 (50.42)	80.35 (63.72)	94.50 (76.44)	78.08	24.20
Untreated control	-	30.65	5.45 (13.56)	+19.65 (0.00)	+32.50 (0.00)	+15.56	12.50
CD (p=0.05)	-	NS	8.68	12.34	14.62	-	0.63

Figures in parenthesis are angular transformed values; NS:Not Significant

4. Conclusion

From the above experiment on chilli it may be concluded that all acaricidal treatments were effective against chilli mite over untreated control. Two IGRs, clofentezine and flufenzine were very effective against egg stage of this pest. Mix formulation of clofentezine and dicofol may be recommended for effective management of chilli mite instead of their sole application.

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