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Bio-efficacy of novel insecticides against chilli whitefly, *Bemisia tabaci genn*, in Malwa Region of Madhya Pradesh

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ABSTRACT

The experiment was carried out in rabi season of 2016 at experimental farm, College of Agriculture, Indore (M.P.) in randomized block design with seven treatments and 3 replications on chilli (Capsicum annum)hybrid Priya. Four doses of chlorfenapyr 240 SC @ 144, 192, 240 and 288 g.a.i. ha^{-1},emamectin benzoate 5% SG@ 10 g.a.iha^{-1} and imidacloprid 17.8 SL @ 50 g.a.i ha^{-1} including untreated control were sprayed thrice at 10 days interval. After all the sprays whitefly population reduction was recorded. Results revealed that overall population reduction of whitefly (91.66%) was recorded maximum in higher dose ofchlorfenapyr240 SC @288g.a.i.ha^{-1}followed by second higher dose of chlorfenapyr 240 SC @ 240 g.a.i.ha^{-1}(88.16%) and emamectin benzoate 5% SG@ 10 g.a.i ha^{-1}(87.47%).The green chilli yield was also noted maximum in higher dose of chlorfenapyr 240 SC @ 288 g.a.i.ha^{-1}(16.0 t ha^{-1})followed by second higher dose of chlorfenapyr 240 SC @ 240 g.a.i. ha^{-1} (15.4 t ha^{-1}) and emamectin benzoate 5% SG@ 10 g.a.i ha^{-1}(14.8 t ha^{-1})as compared to untreated control(8.0 t ha^{-1}).The cost benefit ratio was recorded higher in emamectin benzoate 5% SG@ 10 g.a.iha^{-1} (3.20) followed by imidacloprid 17.8 SL @ 50 g.a.i ha^{-1} (2.99).

Key words: Chilli, *Bemisia tabaci Genn*, Insecticides, Malwa region

INTRODUCTION

Chilli (*Capsicum annuum*L.) is one of the important spice crop of India and also widely cultivated throughout warm temperate, tropical and subtropical countries and famous for its pleasant aromatic flavour, pungency and high colouring substance.The crop has got great export potential besides huge domestic requirement but a number of limiting factors have been attributed for low productivity. Among them, occurrence of viral diseases as well as ravages caused by insect pests is significant ones. The pest spectrum of chilli crop is complex with more than 293 insects. Whitefly recognized as a major pest of chilli and cause leaf curl disease Dhanalakshmi *et al. (2016)*. Similarly, Berke and Sheih (2000) also reported that white fly (*Bemisia tabaci* Genn.) and thrips (*Scirtothirps dorsalis* Hood) are serious production constraints.Besides, a number of viruses are transmitted by whiteflies (Gundannavar *et al.* 2007).Economic yield loss due to these pests may be 11-75% quantitatively and 60-80% qualitatively in the event of serious infestation (Ghosh *et al.* 2009)**.**Now-a-days build-up of these sucking pests in chilli are so much and for their control number of sprays have increased by the cultivators over the years resulting cost of cultivation has increased enormously and making cultivation of chilli highly risky. In addition to this, pesticidal sprays became a threat to chilli ecosystem causing problems of resistance, resurgence of pests, pesticidal residues and menace to natural enemies fauna. Pesticide residues in chilli are of great concern from the point of domestic consumption and exports as well (Awasthi *et al.* 2011).In order to impede the development of insecticide resistance efforts are always being made but due to misuse and continuous repeated use of recent and even novel insecticides, insect resistance is increased day by day. In present scenario, to increase the efficacy of insecticides highly effective and safer products are being used. Viewing the above facts the experiment was planned to test the efficacy of novel insecticides against whitefly in chilli.

MATERIALS AND METHODS

The experiment was carried out in randomized block design with seven treatments and 3 replications in *rabi* season of 2016 at experimental farm, College of Agriculture, Indore (M.P.). Chilli hybrid *Priya* was transplanted on 10th November, 2016 with 45 x 60 cm spacing. Insecticidal spray was started at the ETL of insects @ 500 litre water/ hectare with knapsack sprayer fitted with a flood jet nozzle. The six treatments consist of four doses of chlorfenapyr 240 SC @ 144, 192, 240 and 288 g.*a.i*.ha^{-1},emamectin benzoate5% SG@ 10 g.*a.i*ha^{-1} and imidacloprid 17.8 SL @ 50 g.*a.i*ha^{-1} including untreated control. Each treatment was sprayed thrice at 10 days interval. Whitefly population was counted one day before and 10 days after each spray from five randomly selected plants of each plot and population was counted on five leaves per plant with two top, two middle and one lower leaf using hand lens. Per cent population reduction was calculated for each spray, averaged for three sprays and finally overall population reduction was calculated.The yield of the green chilli was also recorded in each plot after each picking and converted into tonnes per hectare. Finally the cost benefit ratio was also calculated. Thus data obtained from the observations for each character were tabulated and analyzed statistically.

RESULTS AND DISCUSSION

Reduction in whitefly population

The whitefly population was recorded in the range of 11.06 to 13.55/leaf in pre treatment observation, which was found non significant. After first spray the minimum whitefly population (4.22/leaf) was recorded in highest dose of chlorfenapyr 240 SC @ 288g.*a.i*.ha^{-1}(Table1) which exhibited no significant difference with second highest dose of chlorfenapyr 240 SC @ 240g.*a.i*. ha^{-1}(4.43) and emamectin benzoate 5% SG@ 10 g.*a.i* ha^{-1}(4.64/leaf) although all the treatments differed significantly with untreated control. After second spray again maximum efficacy was recorded in highest dose of chlorfenapyr 240 SC @ 288g.*a.i*.ha^{-1} (1.57/leaf) and found at par with second higher dose of chlorfenapyr 240 SC @ 240g.*a.i*.ha^{-1} (2.26/leaf) and emamectin benzoate5% SG@10 g.*a.i*ha^{-1} (2.26/leaf). The similar trend was also recorded after third spray repeatedly in the highest dose of chlorfenapyr 240SC @ 288g.*a.i*.ha^{-1} (1.13/leaf) which showed maximum effectiveness and no significant difference was noted with second lower dose of chlorfenapyr 240 SC @ 240g.*a.i*.ha^{-1} (1.57/leaf) and emamectin benzoate5% SG@ 10 g.*a.i*ha^{-1}(1.64/leaf) for whitefly population. Further, the mean and overall insect population reduction was noted maximum again in higher dose of chlorfenapyr 240 SC @ 288g.*a.i*.ha^{-1} (53.22% and 91.66%) followed by chlorfenapyr 240 SC @ 240 g.*a.i* ha^{-}

Table 1: Effect of treatments after three sprays against chilli whitefly

Treatments	whitefly population after								Mean population reduction (%)	Overall population reduction (%)
	1st spray			2nd spray		3rd spray				
	Pre-treatment	10 DAS	Population reduction (%)	10 DAS	Population reduction (%)	10 DAS	Population reduction (%)			
T_1	11.06 (3.40)	6.63 (2.67)	40.05	3.80 (2.07)	42.66	3.12 (1.90)	17.89		33.53	71.79
T_2	11.85 (3.51)	6.35 (2.62)	46.41	3.64 (2.04)	42.67	2.58 (1.76)	29.12		39.40	78.22
T_3	13.27 (3.71)	4.43 (2.22)	66.61	2.26 (1.66)	48.98	1.57 (1.44)	30.53		48.70	88.16
T_4	13.55 (3.47)	4.22 (2.17)	68.85	1.57 (1.43)	62.79	1.13 (1.28)	28.02		53.22	91.66
T_5	13.09 (3.68)	4.64 (2.27)	64.55	2.26 (1.66)	51.29	1.64 (1.46)	27.43		47.75	87.47
T_6	12.83 (3.65)	5.94 (2.53)	53.70	3.25 (1.94)	45.28	2.03 (1.59)	37.53		45.50	84.17
T_7	11.95 (3.53)	12.64 (3.62)	-	14.42 (3.86)	-	14.61 (3.88)	-		-	-
SEm±		0.16		0.07		0.06				
CD(p=0.05)	NS	0.19		0.23		0.18				
CV %		5.35		7.95		6.89				

The values in parentheses are square root transformed values, DAS = Days after spray, Treatments detail: T_1- Chlorfenapyr 240 SC @ 144 g.a.i. ha^{-1} ,T_2- Chlorfenapyr 240 SC @ 192 g.a.i ha^{-1}, T_3- Chlorfenapyr 240 SC @ 240 g.a.i. ha^{-1} ,T_4- Chlorfenapyr 240SC @ 288 g.a.i. ha^{-1},T_5 - Emamectin Benzoate5% SG@ 10 g.a.iha^{-1},T_6- Imidacloprid 17.8 SL @ 50 g.a.i.ha^{-1}, T_7- Untreated ControL

^{1} (48.70% and 88.16%) and emamectin benzoate5% SG @ 10 g.*a.i* ha^{-1}(47.55% and 87.47%) respectively. Treacy et. (1991) reported that chlorfenapyr has poor plant systemic properties but exhibits good translaminar movements in plants. Ditya *et al.* (2010) stated that chlorfenapyr as a member of pyrrole group of insecticides, found effective against whiteflies, thrips, caterpillars, mites, leaf miners, aphids, etc in chilli. Similarly Kumar and Singh (2014) determined the laboratory bioassay of six insecticides including, chlorfenapyr, against first instar nymphs of the greenhouse whitefly, infesting tomato and found effective against this pest. Said and Inayatullah (2015) revealed that the lowest population of whitefly was recorded with the treatment of emamectin benzoate (1.07 whitefly/plant) as compared to other insecticides and botanicals. Further, The findings of these researchers are in the line agreement with the present study.

Yield and economics

The present study revealed that the maximum green chilli yield (Table 2) was obtained with highest dose of chlorfenapyr 240 SC @ 288 g.*a.i.* ha^{-1} (16.0 t ha^{-1}) which was at par with second highest dose of chlorfenapyr 240 SC @ 240g.*a.i* ha^{-1} (15.4 t ha^{-1}) followed by emamectin benzoate5%SG @ 10 g.*a.i* ha^{-1} (14.8 t ha^{-1}), imidacloprid 17.8SL @ 50 g.*a.i* ha^{-1} (14.0 t ha^{-1}), chlorfenapyr 240 SC @192 g.*a.i* ha^{-1} (12.7t ha^{-1}), chlorfenapyr 240 SC @ 144 g.*a.i* ha^{-1} (12.3t ha^{-1}) and untreated control (8.0 t ha^{-1}.).The maximum net returns and cost-benefit ratio were obtained with emamectin benzoate5%SG @ 10 g.*a.i* ha^{-1} (Rs.169425 ha^{-1} and 3.20) followed by imidacloprid 17.8SL @ 50 g.*a.i* ha^{-1} (Rs 157425 ha^{-1} and 2.99), chlorfenapyr 240 SC @ 288 g.*a.i.* ha^{-1} (Rs.176040 ha^{-1} and 2.75), chlorfenapyr 240 SC @ 240 g.*a.i* ha^{-1} (Rs.169200 ha^{-1} and 2.73), chlorfenapyr 240 SC @ 144 g.*a.i* ha^{-1} (Rs.127100 ha^{-1} and 2.21) and chlorfenapyr 240 SC @ 192 g.*a.i* ha^{-1} (Rs.130860 ha^{-1} and 2.19). Chatterjee and Mondal (2012) showed less effectiveness of chlorfenapyr compared to spinosad in relation to increases chilli yield. This might be due to application of higher dose of spinosad in new area with changed climatic conditions. Hossain *et al.* (2016) noted highest marginal benefit cost ratio with the spraying of chlorphenapyr @ 1ml/litre of water + white sticky trap @ 40 traps/ha against chilli pests followed by emamectin benzoate and chlorfenapyr alone against chickpea pests. Patel *et al.* (2015) reported highest fruit yield with emamectin benzoate @ 10 g.*a.i.* ha^{-1} (120.66 q ha^{-1}) and highest cost benefit ratio (1:9.06) against brinjal sucking pest. The above results exhibited parial support to the present study.

Table 2: Yield and economics of different treatments

Treatment	Green chilli yield (t/ha.)	Cost of treatment (Rs.ha^{-1})	Net gain (Rs.ha^{-1})	CBR
T_1	12.3	57400	127100	2.21
T_2	12.7	59640	130860	2.19
T_3	15.4	61800	169200	2.73
T_4	16.0	63960	176040	2.75
T_5	14.8	52860	169425	3.20
T_6	14.0	52575	157425	2.99
T_7	8.0	50000	70000	1.40

Remark: *1. Rate of green chilli fruit was @ Rs 1500/qt. 2. Labour charge @ Rs 500/labour/day. (Spraying) 3. Cost of Chlorfenapyr 240 SC @ Rs 3600/liter 4. Cost of Emamectin Benzoate 5% SG @ Rs 4600/ kg 5. Cost of Imidacloprid 17.8SL @ Rs 2100/liter*

It may be concluded that in all the three sprays the minimum whitefly population and maximum green chilli yield was recorded in highest dose of chlorfenapyr 240 SC @ 288g.*a.i.*ha^{-1} which exhibited no significant difference with second highest dose of chlorfenapyr 240 SC @ 240g.*a.i.* ha^{-1} and emamectin benzoate 5% SG@ 10 g.*a.i* ha^{-1} but the maximum net return and cost-benefit ratio was obtained in emamectin benzoate5%SG @ 10 g.*a.i* ha^{-1} followed by imidacloprid 17.8SL @ 50 g.*a.i* ha^{-1} and chlorfenapyr 240 SC @ 288 g.*a.i.* ha^{-1}.

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