*Journal of Crop and Weed, **9**(1):188-192(2013)*

Arylpyrrole acaro-insecticide chlorfenapyr-a tool for managing yellow thrips *Scirtothrips dorsalis* Hood) and broad mite (*Polyphagotarsonemus latus* Banks) of chilli

P. K. SARKAR, G. P. TIMSINA, H.VANLALDIKI AND S. CHAKRABORTY

Department of Agricultural Entomology
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741 252, Nadia, West Bengal

Received: 23-4-2013, Revised: 18-5-2013, Accepted: 27-5-2013

ABSTRACT

Two most obnoxious invisible enemies of chilli include yellow mite or broad mite (Polyphagotarsonemus latus) and thrips (Scirtothrips dorsalis) in Indian sub-continent. Dry weather during crop growth period increases the intensity of infestation of thrips vis-a-vis global warming from January last fortnight onwards, favours the attack of yellow mite. These two types of agro-climatic parameters prevail during pre-monsoon months in eastern part of Indian sub-continent. Hence, both the species appear simultaneously in chilli. Damage intensity due to their attack may reach to the tune of 25-100 %. Under this context selectivity of chlorfenapyr 10SC , was evaluated for two consecutive years i.e. 2009-2010 and 2010-2011 in a farmer's field (8.75m above msl) at Gangetic Alluvial plains of West Bengal@ 50, 75, 100 and 125 g a.i. ha^{-1} along with recommended check fenazaquin 10 EC (@ 100 g a.i. ha^{-1}) and imidacloprid 17.8 SL (@ 20 g a.i). On the basis of post treatment on mite and thrips population, chlorfenapyr @ 100 and 125 g a.i. ha^{-1} were found to be most effective against the pests. There was significantly less infestation at both the stated concentration (100 and 125 g a.i. ha^{-1}) up to 15 days after treatment. It was also found to be "moderately toxic" to beneficials in chilli including different coleopteran beetles. The molecule did not produce any phytotoxic symptom in chilli.

Keywords: Beneficial, chilli yellow mite, chilli yellow thrips and chlorfenapyr

The most important chilli growing states in India are Andhra Pradesh (49%), Karnataka (15%), West Bengal (12%), Maharashtra (6%) and Tamil Nadu(3%), which together constitute nearly 75 per cent of the total area. Surveys conducted by AVRDC in Asia revealed that Chilli (*Capsicum annum* L. and *Capsicum frutescens* L.) the universal spice, belonging to the family- solanaceae and is known to be infested by several insect and non-insect pests of which the tarsonemid mite, *Polyphagotarsonemus latus* Banks (Acari: Tarsonemidae) and yellow thrips, *Scirtothrips dorsdalis* Hood are the most destructive and are considered as major pests (Berke and Sheih, 2000). They have got some bio-ecological advantages than the other pests, due to having, very small size, high biotic potential, lack of effective natural enemies, capacity to adopt newer environment quickly and quick resistance development against toxicants (Venkatesalu *et al.*, 2009). They cause a havoc economic loss each year especially in the southern districts of West Bengal and have become a threat to the chilli growers (Sarkar *et al.*, 2008).

Chilli thrips and mites affected leaves curl "upward" and "down ward" resulting in a typical damage known as "leaf curl syndrome". Economic yield loss may be 11-75% quantitatively and 60-80% qualitatively in the event of serious infestation (Ghosh *et al*., 2009). To get rid of their infestation, farmers used to apply minimum of 5 to 6 rounds of pesticide sprays, and the number of sprays are increasing over the years, and hence, cost of cultivation has increased enormously making cultivation of chilli highly risky and non-profitable. This results in abatement in bio-diversity of natural enemies vis-à-vis outbreak of secondary pests. In recent past, development of resistance to pesticides, pesticide induced resurgence and contamination of food and eco-system are problems incurred due to pesticide management. Pesticide residues in chilli are also of great concern from the point of domestic consumption and exports as well. Traditional insecticides can check the populations build up of thrips but not the mite. Resulting in to spraying of a specific acaricide on the next day, which culminates another monetary involvement in terms of labour and spray chemicals. Hence the present study had been attempted with an actinomycetes bacterium, chlorfenapyr 10SC, to study its relative toxicity at different dosages against two sucking pests as well as its effect on naturally occurring predators in chilli eco-system along with phytotoxicity of the dosages on chilli plants.

MATERIALS AND METHODS

The experiment was conducted during January 2008-2009 followed by a confirmatory trial during 2009-2010 in a farmer's field (8.75m above msl) at Gangetic Alluvial plains of West Bengal, following RBD. Altogether seven treatments comprising of four dosages of test pesticide (chlorfenapyr 10SC @ 50, 75, 100 and 125g a.i. ha^{-1}) with two standard checks *viz*., fenazaquin 10EC (100 g a.i. ha^{-1}) and imidacloprid 17.8 SL (20 g a.i. ha^{-1}) and one untreated control. The chilli seedlings of cv. Bullet (Local) were transplanted during Jan 25, 2008

Email: pijushkly@gmail.com

and Jan 27, 2009 respectively in $4.2 \times 3.15m^2$ plots at spacing of 60 cm between rows and 45 cm between plants. Crop was raised following recommended package of practices. The seedlings were kept in vigil against the attack of different pest's infestation (thiamethoxam @ 0.2g l^{-1} was applied as blanket spray at 10 th DAT) After attaining one-month of age they were allowed to be infested naturally with yellow mite and yellow thrips. The population started to build up from second fortnight of March and regular record on population was monitored at an interval of three days. The seedlings were treated with fungicide mixture (mancozeb 3 g + carbendazim 1g per litre of water) at the early stages of crop growth. When the population was almost evenly distributed, different treatments were initiated at an interval of 15 days with pneumatic knap-sack sprayer (ASPEE) with flat spray nozzle delivering 0.2 litre min^{-1} at 15 psi.

The whole experimental plot was divided into 4 equal quadrates. Population of thrips or mites was recorded with little modification of method described by Patel *et al.* (2009) from the under surface: for yellow mite and upper surface: for thrips at weekly interval from 3 terminal leaves of 5 randomly selected plants in each quadrate. Such observations were initiated with the appearance of thrips and continued up to last picking of the crop. The data thus obtained were converted as average number of thrips and mite per leaf. The samples were placed individually in zip-lock bag (6"×4") and taken to the laboratory for further counting under stereo-zoom binocular microscope (Olympus SZ-41, Japan). Leaves were washed with 70% ethanol to dislodge thrips and motile stages of mites from the leaves. Thrips or mite number from such five plants were recorded (randomly selected) at 24 hrs before (pre-treatment count), and 3 rd, 10 th and 15 th after spraying (post-treatment) and 10 th and 15 th day for evaluation of percentage leaf curl with little modification of Niles (1980) . Yield of green chillies from different plucking were revealed from each treated plots and computed as q ha^{-1}. The percentage reduction in mite and thrips population was assessed by adopting the formula given by Henderson and Tilton (1955).

% reduction = $\{1 - (Ta \times Cb / Tb \times Ca)\} \times 100$

Where,

Ta = mite population in treated plant after treatment.

Tb = mite population in treated plant before treatment.

Ca = mite population in control plants after treatment.

Cb =mite population in control plant before treatment.

The data were then subjected to Analysis of Variance (ANOVA) after making angular transformation by $\sin^{-1}$ p (where p is % mortality / 100).

RESULTS AND DISCUSSION

The relative effect of different dosages of chlorfenapyr 10 SC along with standard fenazaquin 10EC and imidacloprid 17.8 SL and untreated check on chilli thrips has been recorded and presented in table–1. The average number of chilli thrips $leaf^{-1}$ before application of insecticides varied between 4.80-5.60. It is evident that on the 3 rd day of application, 85.5 % reduction of thrips population was noticed in chlorfenapyr @125 g a.i. ha^{-1} and imidacloprid 20g a.i. ha^{-1} (83.40%). The percent reduction in thrips population dwindled from10th day onwards and up to 15th day after spraying. After 10th day of application, it was noticed that, chlorfenapyr at 100 and125 g a.i./ha maintained their efficacy with reduction in population to the tune of 82.3 -85.5 % respectively. This pattern reduction was recorded even up to 15th day after application when only chlorfenapyr at 100 and 125 g a.i. ha^{-1} continued to maintain their effectiveness registering 68.7 -72.3 % reduction in thrips population. Whereas, the standard dose failed to provide minimum reduction of thrips population (21.6 and 45.3 %). Likewise, the average number of yellow mite /leaf varied between 5.67-6.34 (Table 2).Among all the treatments, after 3 rd day of application, significant lower mite population was recorded in chlorfenapyr 75 g a.i. ha^{-1} treated plots (71.5% reduction) but it was significantly superior to standard check imidacloprid 20 g a.i ha^{-1} (52.4%), but inferior to the other standard check fenazaquin 100 g a.i. ha^{-1} (85.3 % reduction). After 10 th day of imposition reduction in yellow mites, population with lower dosages of chlorfenapyr 10SC (50 and 75 g a.i. ha^{-1}) the reduction was 51.7 and 62.30% which were superior to one of the staqndard check imidacloprid 20g a.i. ha^{-1} (41.70), but they were inferior to the other standard check fenazaquin 100 g a.i. ha^{-1} (78.40 %). The standard dosages of chlorfenayr (100 and 125 g a.i. ha^{-1}) registering 78.7 -80.4 % reduction even up to 15th day of spraying and had proven the persistency of this pro-insecticide and work by uncouplers of oxidative phosphorylation via disruption of H proton gradient. These two dosages recorded 83.84 and 86.40 percent overall mean percent increase in yield over the untreated control.

Table 1: Relative efficacy of different dosages of chlorfenapyr 10SC against thrips of chilli (mean of three sprayings)

Treatments	Thrips leaf^{-1} before spray	Reduction or increase of thrips population (%)			Overall mean reduction or increase of thrips population (%)	Yield (q ha^{-1})	Increase in yield over control (%)
		3rd	10th	15th			
Chlorfenapyr 10SC @50g a.i. ha^{-1}	5.20	58.7 (50.01)	43.7 (41.38)	36.5 (37.16)	46.3	12.00	45.84
Chlorfenapyr 10SC@75g a.i. ha^{-1}	5.60	62.5 (52.23)	50.4 (45.23)	44.8 (42.01)	52.67	12.69	48.78
Chlorfenapyr 10SC@100g a.i. ha^{-1}	9.40	86.3 (68.27)	82.3 (65.12)	68.7 (55.98)	79.1	14.01	53.60
Chlorfenapyr 10SC@125g a.i. ha^{-1}	4.80	88.5 (70.17)	85.5 (67.61)	72.3 (58.24)	82.1	15.30	57.51
Fenazaquin 10EC@100g a.i. ha^{-1}	5.00	45.7 (42.53)	32.6 (34.81)	21.6 (27.69)	33.3	8.7	25.28
Imidacloprid 17.8 SL@20g a.i. ha^{-1}	5.40	83.4 (65.95)	78.5 (62.37)	45.3 (42.30)	69.07	13.4	51.49
Untreated control	5.60	+15.9 (0.00)	+29.9 (0.00)	+56.6 (0.00)	0.00	6.5	
SEm (±)		**2.71**	**4.87**	**2.96**		**1.01**	
LSD (0.05)	**NS**	**3.12**	**5.61**	**3.41**		**1.17**	

Table 2: Relative efficacy of different dosages of chlorfenapyr 10SC against yellow mite of chilli (mean of three sprayings)

Treatments	Yellow mite leaf^{-1} before spray	Reduction or increase of yellow mite population (%)			Overall mean reduction or increase of yellow mite population (%)
		3rd	10th	15th	
Chlorfenapyr 10SC @50g a.i. ha^{-1}	5.93	60.2 (50.88)	51.7 (45.97)	47.50 (43.50)	53.14
Chlorfenapyr 10SC@75g a.i. ha^{-1}	6.14	71.5 (57.74)	62.3 (52.12)	51.6 (45.91)	61.80
Chlorfenapyr 10SC@100g a.i. ha^{-1}	6.00	89.32 (70.92)	83.5 (66.03)	78.7 (62.52)	83.84
Chlorfenapyr 10SC@125g a.i. ha^{-1}	5.80	92.5 (74.01)	86.3 (68.27)	80.4 (63.73)	86.40
Fenazaquin 10EC@100g a.i. ha^{-1}	6.34	85.3 (67.46)	78.4 (62.30)	69.70 (56.60)	77.80
Imidacloprid 17.8 SL@20g a.i. ha^{-1}	6.14	52.4 (46.37)	41.7 (40.23)	32.6 (34.81)	42.24
Untreated control	5.67	+24.9 (0.00)	+151.30 (0.00)	+116.70 (0.00)	
SEm (±)		**2.26**	**2.45**	**4.46**	
LSD (0.05)	**NS**	**2.60**	**2.81**	**5.13**	

Note: Figures in parentheses are angular transformed values

Table 3: Effect of chlorfenapyr 10 SC on population of predatory insects in chilli ecosystem

Treatments	Mean number of predatory insects plant^{-1} before spray			Mean reduction or increase after 15th day (%)			Overall reduction of predatory population (%)
	Menochilus sp.	*Coccinella septempunctata*	*Chielomenes sexmaculatus*	*Menochilus* sp.	*C. septempunctata*	*C. sexmaculatus*	
Chlorfenapyr 10SC @50g a.i. ha^{-1}	1.86	1.14	0.67	15.30 (23.02)	12.90 (21.04)	18.10 (25.17)	15.44
Chlorfenapyr 10SC@75g a.i. ha^{-1}	2.14	0.80	0.80	21.50 (27.62)	26.70 (27.76)	20.30 (26.78)	22.84
Chlorfenapyr 10SC@100g a.i. ha^{-1}	1.94	0.94	0.60	22.30 (28.17)	30.50 (33.52)	23.70 (29.14)	25.50
Chlorfenapyr 10SC@125g a.i. ha^{-1}	2.27	1.00	0.73	32.50 (34.75)	35.40 (36.52)	26.70 (31.12)	31.54
Fenazaquin 10EC@100g a.i. ha^{-1}	1.74	1.13	0.87	35.70 (36.69)	29.30 (32.78)	28.40 (32.21)	31.13
Imidacloprid 17.8 SL@20g a.i. ha^{-1}	1.94	1.16	0.80	46.80 (43.17)	43.20 (41.09)	41.70 (40.23)	43.90
Untreated control	2.00	0.94	0.74	+7.35 (0.00)	+9.42 (0.00)	+11.56 (0.00)	
SEm (±)				**3.96**	**3.03**	**2.36**	
LSD (0.05)	**NS**	**NS**	**NS**	**4.04**	**3.10**	**2.72**	

Table: 4. Impact of different dosages of clorfenapyr 10SC on the incidence of chilli leaf curl due to yellow mite and thrips (mean of 3 sprayings)

Treatment	Mites leaf^{-1}	Upward leaf curl (%)			Thrips leaf^{-1}	Downward leaf curl (%)			Mean leaf curl due to mite (%)	% reduction of downward leaf curl over control	Mean leaf curl due to thrips (%)	% reduction of upward leaf curl over control
		Before	After 10th	After 15th		Before	After 10th	After 15th				
Chlorfenapyr 10SC @50g a.i. ha^{-1}	5.93	56.5 (48.73)	45.0 (42.13)	42.7 (40.80)	5.20	52.5 (46.26)	35.6 (36.63)	30.2 (33.34)	43.85	17.02	32.90	53.82
Chlorfenapyr 10SC@75g a.i. ha^{-1}	6.14	59.3 (50.35)	44.6 (41.89)	31.3 (34.01)	5.60	49.6 (44.48)	30.30 (33.39)	21.7 (27.76)	37.95	28.19	26.00	63.50
Chlorfenapyr 10SC@100g a.i. ha^{-1}	6.0	60.0 (50.76)	37.5 (37.76)	12.8 (20.96)	9.40	50.10 (45.05)	28.70 (32.39)	16.8 (24.19)	25.15	52.41	22.75	67.59
Chlorfenapyr 10SC@125g a.i. ha^{-1}	5.80	58.7 (50.01)	36.6 (37.22)	11.6 (19.91)	4.80	48.20 (43.96)	24.60 (29.73)	13.50 (21.55)	24.10	54.39	19.05	68.07
Fenazaquin 10EC@100g a.i. ha^{-1}	6.34	62.1 (52.00)	32.8 (34.93)	9.7 (18.14)	5.00	51.7 (45.97)	49.50 (44.71)	47.30 (43.45)	21.25	59.79	48.40	32.54
Imidacloprid 17.8 SL@20g a.i. ha^{-1}	6.14	60.3 (50.94)	55.4 (48.11)	50.3 (45.17)	5.40	46.20 (42.82)	26.20 (30.78)	14.30 (22.21)	52.85	35.84	13.75	80.83
Untreated control	5.67	61.7 (51.77)	78.50 (62.37)	86.25 (68.23)	5.60	48.00 (43.85)	63.60 (52.89)	78.90 (62.65)	82.37		71.75	
SEm (±)			**1.83**	**1.33**	**---**	**---**	**2.16**	**1.65**				
LSD (0.05)	**NS**	**NS**	**2.07**	**1.51**	**NS**	**NS**	**2.45**	**1.87**				

Note: Figures in parentheses are angular transformed values

The efficacy of different treatment schedules of chlorfenapyr 10 SC against the predatory insects has been presented in table-3. Here, the treated dosages of chlorfenapyr 10 SC vis-a-vis the standard check like fenazaquin 10EC have got very low to moderate impact on predatory fauna. Only imidacloprid was unsafe reducing population of predators up to 43.90 %. The higher dose of chlorfenapyr (125g a.i. ha^{-1}) and the other check fenazaquin 10EC (100g a.i ha^{-1}) was at par in reducing the predatory population level to the tune of 31.13-31.54 % respectively. Hence, from this part of study, it can be concluded that, chlorfenpyr at 75-100 g a.i. ha^{-1} was safe for the predatory insects in chilli eco-system.

Mean percent upward curled leaves due to thrips before application of pesticide ranged between 46.2-52.5% in different plots. The mean percent leaf curl after three rounds of spray suddenly declined in various treated plots. Only 19.05 % curled leaves were recorded in chlorfenapyr (125g a.i ha^{-1}) treated plots followed by 100g a.i ha^{-1} (22.75).Whereas in untreated plots the damaged leaf curl percentage was raised up to 71.75. The highest percent reduction in leaf curl over control was recorded in chlorfenapyr 125g a.i ha^{-1} (68.07%) followed by 100g and 75g a.i ha^{-1}.

Percentage of downward curled leaves due to yellow mite infestation has been presented in table-5. Mean percent downward curl leaves due to yellow mite infestation before spray varied between 56.5-62.1%. After three round of spraying percent downward curl leaves significantly declined in different treated plots. The plots treated with chlorfenapyr @ 100, 125g a.i ha^{-1} and fenazaquin 100 g a.i. ha^{-1} exhibited minimum reduction in percent curled leaves (21.25-25.15%). In the untreated plots the percent leaf curl was maximum (82.37%).

Plant phytotoxic parameters *viz*. necrosis, epinaty, hyponasty, leaf tip injury, leaf surface injury, wilting, vein clearing was considered for the study as per CIB&RC (Central Insecticide Board and Registering Committee, Govt. of India). It was found that, chlorfenapyr 10SC at 50, 75, 100 and 125g a.i ha^{-1} did not produce any phytotoxic symptoms as discussed before.

Very scanty information are available on the relative efficacy of chlorfenapyr against chilli thrips and mites, however research works on thrips and mites on other crops(ornamental and strawberies) are available. Chlorfenapyr @ 2ml per litre of water, were found effective in reducing the tetranychid mites, *Tetranychus urticae* on rose and recorded good quality flowers (19.16, lakhs ha^{-1}, respectively) (Dhananjay Kumar, 2007). Subsequently, Ibrahim and Baspinar (2005) found chlorfenapyr as effective chemisrey against strawberry spider mite at Turkey and was safe agaist predatory arachnids. Further, in Pakistan, Malik *et al.* (2012) recorded 'Pirate'(chlorfenapyr) as the best acaricide with a good persistency even up to 168 h of application of insecticides. These findings are in conformity of the findings of the present authors.

It is evident from this study that three rounds of sprays of chlorfenapyr 10% SC @ 100-125 g a.i. ha^{-1} gave excellent control of chilli yellow thrips, *S. dorsalis* and yellow mite, *P. latus* . This chemistry was moderately toxic to natural enemies and did not produce any phytotoxic symptoms on fruits and plants. Hence, chlorfenpyr can be a nice fit for the recent global urge of IPM.

ACKNOWLEDGEMENT

Special thanks to M/S.Crystal Crop Protection Pvt. Ltd., Delhi for financial assistance.

REFERENCES

Ibrahim, A., Baspinar, H. S. 2005. Control of the carmine spider mite, *Tetranychus cinnabarinus* Boisduval by the Predatory mite *Phytoseiulus persimilis* (Athias-Henriot) in protected strawberries in AydÝn, Turkey. *Turk J. Agric. For.*, **29**: 259-65.

Berke, T. and Sheih, S. C. 2000. Chilli peppers in Asia. *Capsicum Egg Plant NewslNewsletter*, **19**:38-41.

Dhananjaya Kumar, K. S. 2007. Incidence and management of mites and thrips of rose under naturally ventilated polyhouse condition. *M. Sc. (Ag.)Thesis*, Department of Agril. Entomology, University of Agricultural Sciences, Dharwad, Bangalore, pp.52.

Ghosh, A., Chatterjee, M. L., Chakraborti, K. and Samanta, A. 2009. Field evaluation of insecticides against chilli thrips (*Scirtothrips dorsalis* Hood). *Ann. Pl. Protec. Sci*., **17**: 69-71.

Henderson, C. F. and Tilton, E. W. 1955. Tests with acaricides against the brown wheat mite. *J. Econ. Entomol.*, **48**: 157-61.

Malik, Abid A. MehmoodM., Fiaz Shah, F., Haider Karar, H., Asifa Hameed, A. and Muhmmad Saleh Saleem, M. S. 2012. Performance of different insecticides against flower thrips (thysanoptera: thripidae) on rose cultivar 'Wisky Mac'. *Pakistan J. Entomol*., **34**: 173-77.

Niles, G. A. 1980. Breeding cotton for resistance to insect pests. *In. Breeding Plant Resistance to Insects* (Eds. MacWell, F. G. and Jennings, P. R.), John Wiley and Sons, New York, pp. 337-69.

Patel, B. H., Koshiya. D. J. and Korat, D. M. 2009. Population dynamics of chilli thrips, *Scirtothrips dorsalis* Hood in relation to weather parameters. *Karnataka J. Agric. Sci.*, **22**: 108-10.

Sarkar, H., Mahato, S., Somchoudhury, A. K. and Sarkar, P. K. 2008. Management of Yellow mite, *Polyphagotarsonemus latus* (Banks) infesting chilli (*Capsicum annum* L.) in Gangetic alluvial plains of West Bengal. *J. Ent. Res.*, **32**:127-30.

Venkateshalu, Srinivas, A. G., Nadagouda, S. and Hanumantharaya, L. 2009. Bio-efficacy of plant product, Stanza against chilli thrips, *Scirtothrips dorsalis* Hood and chilli mite, *Polyphagotarsonemus latus* (Banks) *Karnataka J. Agric. Sci.*, **22**: 559-60.