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Relative Efficacy of Different Insecticides on Chilli Thrips and their Natural Enemies

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A B S T R A C T

The investigation was carried out at Horticulture research farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during Rabi-summer, 2014-15 and 2015-16. The mean data revealed that among the treatments, during first season DIFACE 600 ml/ha (Difenthiuron50% WP + Acetamiprid 20% SP) recorded the mean of lowest population 3.29 and 3.35 thrips/3 leaves per plant as against 9.33 and 9.43 thrips in untreated check, respectively after first and second spray. During second season (Rabi-summer 2015-16) after 1st and 2nd spray almost similar trends were observed and minimum mean population of thrips (1.57 and 1.97) were recorded in DIFACE 600 ml/ha treatment. In both seasons, field experiment revealed that among the various treatment Fenpropathrin 30% EC @ 340 ml/ha recorded maximum mean coccinellid and spider population.

Introduction

Chilli (*Capsicum annum* L.) belongs to the family Solanaceae. Chilli is one of the important vegetable and commercial spice crops (Mondal *et al.*, 2012). In India, chilli is mainly grown for its fruits which are used prior to its maturity in various culinary preparations and also in stuffing, pizza and burger. Both green and dry chillies are produced world over from the chilli crop. Nearly 25 insects pests have been recorded attacking chilli leaves and fruits in India, of which thrips, *Scirtothrips dorsalis* Hood (Thripidae: Thysanoptera) is considered as the most serious and important pest (Ananthakrishnan, 1971; Butani, 1976; Krishna Kumar, 1995 and Krishna Kumar *et al.*, 1996). Chilli leaf curl is one of the most destructive syndromes affecting chilli growth in India and considered to be caused by thrips. Nymphs and adults of thrips suck the cell-sap from tender crop canopy, resulting shriveling of leaves. Patel and Gupta (1992) reported that thrips *S. dorsalis* was responsible for cause of leaf curling in chilli.

Now-a-days buildup of thrips in chillies is so much that farmers have many spray of chemical insecticides. Number of sprays has increased over the years, but in vain and on the contrary, cost of cultivation has increased enormously 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,

pesticides residue and menace to natural enemy fauna David (1986). In view of this indiscriminate use of chemical pesticides and public concerns, the rise of new generation insecticides provides an alternative to reduce the ill effects of conventional insecticides.

The new insecticides are more tissue-specific, activated in unique ways inside the target cells of insects resulting in reduced threat to other organisms. Selective toxicity to insects and safety to natural enemies have made the new class of insecticides more user and eco-friendly. The present field experiment was carried out to study the bio-efficacy of these newer insecticides and acaricides against the sucking pests of chilli and their safety to natural enemies of chilli.

Materials and Methods

The investigation was carried out at Horticulture research farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during 2014-15 and 2015-16. A field experiment was laid out in randomized block design with three replications. One month old seedlings of chilli *cv*. Shilpa (435/7) were transplanted during the first week of February during rabi-summer 2014-15 and second week of January during rabi–summer 2015-16 in plots of $5m^2$ area at spacing of 50 x45 cm^2.

All the management practices except plant protection against sucking pests were adopted as per the recommended package of practices. Different insecticides viz., DIFACE (Difenthiuron 50% WP + Acetamiprid 20% SP) 400 ml/ha, DIFACE (Difenthiuron 50% WP + Acetamiprid 20% SP) 500 ml/ha, DIFACE (Difenthiuron 50% WP + Acetamiprid 20% SP) 600 ml/ha Difenthiuron 50% WP 600 gm/ha, Acetamiprid 20% SP 100 gm/ha (Neo-nicotinoid), Fenpropathrin 30% EC 340 ml/ha (synthetic pyrethroid) was evaluated against *S. dorsalis*.

A measured quantity of insecticidal solution or powder was mixed with a little quantity of water and stirred well, after which the remaining quantity of water was added to obtain the required concentration of spray fluid. Sprayings were given by using a hand compression knapsack high volume sprayer during morning hours. The plot in each treatment was sprayed with respective insecticides ensuring uniform coverage of insecticide.

The sprayer and the accessories were thoroughly washed before changing the insecticides and also rinsed with the spray fluid of the chemical to be applied next. The first spraying of insecticides was done during the vegetative phase of the crop. The second spraying of insecticides was done during the reproductive phase of the crop. The insecticides were applied on the basis of damage symptoms appeared in the crop. Observations on the thrips incidence were recorded one day before the spraying as pre-treatment count and fifth, tenth and fifteenth after spraying as the post- treatment counts. The population of both nymphs and adults of thrips were counted during early morning hours on terminal six leaves from 5 randomly selected plants in each plot to get a representative sample of that plot. To study the effect of insecticides on natural enemies *viz.* coccinellids and spiders were observed from five randomly selected plants per plot, 24 hours before spraying as pre-treatment and the post treatment after 1, 3, 7 days of application

Results and Discussion

In pretreatment observation (Table 1 and 2) there were significant differences in thrips population/3 leaves/plant during the season-I. The mean data revealed that among the treatments, DIFACE 600 ml/ha (Difenthiuron50% WP +Acetamiprid 20% SP) recorded the mean of lowest population 3.29

and 3.35 thrips/3 leaves per plant as against 9.33 and 9.43 thrips in untreated check, respectively after first and second spray.

The standard check Difenthiuron 50% WP @ 600 gm/ha, Acetamiprid 20% SP @ 100 gm/ha and Fenpropathrin 30% EC @ 340 ml/ha which recorded the population of 6.45,6.58 and 6.89, 7.03,7.18 and 7.36 thrips/3 leaves per plant during 1st and 2nd spray, respectively.

Thus the treatment dose DIAFACE 600 ml/ha was most effective in reduction of thrips population, respectively after first and second spray (Table 1).

During second season (Rabi-summer 2015-16) after 1st and 2nd spray almost similar trends were observed and minimum mean population of thrips (1.57 and 1.97) were recorded in DIFACE 600 ml/ha treatment The maximum mean population of thrips 6.95 and 4.76 were recorded in untreated plots (Table 2).

Tatagar, 2004 also tested three different dosages of diafenthiuron 50% WP *viz.*, 0.60 g/l, 0.9 g/l and 1.2g/l against thrips *S. dorsalis* in chilli ecosystem.

Among the different dosages, diafenthiuron 50% WP @ 0.9 g/l recorded better yield with least leaf curl incidence due to thrips (0.62 leaf curling index per plant), which was found equally good as compared to its higher dosage and recommended practices.

Similarly, Patel *et al.,* (2009) evaluated the different insecticidal treatments among them ethion + cypermethrin (0.045 per cent), methomyl (0.04 per cent) and diafenthiuron (0.05 per cent) proved to be most effective treatments. Nandini (2010) also reported that the significantly minimum thrips population (0.65 thrips per 5 leaves) was recorded on chilli plant treated with thiamethoxam and diafenthiuron (0.7 thrips per 5 leaves). Almeida (2013) observed that spinosad 0.015 per cent was found most effective in reducing the population of *S. dorsalis* as well as in increasing yields followed by diafenthiuron 0.045 per cent. Zala *et al.,* 2014 also reported that diafenthiuron 50 WP @ 300 g.a.i./ha was highly effective in reducing the population of aphid, jassid, thrips and whitefly in cotton.

Whereas, Nagaraj *et al.,* (2007) found comparatively more population of thrips in acetamiprid 20% SP (3.95 thrips per leaf and 2.92 leaf curl index). In another study, acetamiprid 20 SP @ 40 g and 80 g a.i. ha-1 were effective in reducing the sucking pests of chilli, followed by acetamiprid 20 SP @ 20 g a.i.ha-1 which also recorded maximum green chilli yield (Jayewar *et al.,* 2003).

Recently, Patil *et al.,* 2018 found that treatment of fipronil 0.005 per cent (2.08 thrips/leaf) and fenpropathrin 0.03 per cent (2.92 thrips/leaf) found significantly superior in controlling the chilli thrips population.

Coccinellid beetles

In both seasons, field experiment revealed that among the various treatment fenpropathrin 30% EC @ 340 ml/ha recorded maximum mean coccinellid population of 1.81 no./plant and 1.78 as against 3.74 no/plant and 3.43 in untreated plot during 1st spray

Similarly, after second spray also the maximum mean coccinellid population recorded in plots treated with fenpropathrin 30% EC @ 340 ml/ha (0.69 and 0.84) as against 0.76 no/plant and 1.22 in untreated plot during 2nd spray.

Similarly, Brow *et al.,* (1983) reported that cypermethrin (synthetic pyrethroid) to be less toxic against coccinellid predators (Table 3 and 4).

Table.1 Effect of different insecticides on thrips population per plant during 2014-15

		First Spray					Second Spray				
Insecticides	**Dose (ml or g/ha)**	**Pre treatment**	**Post treatment**			**Mean Thrips Population**	**Pre treatment**	**Post treatment**			**Mean Thrips Population**
		31.30 (5.59)	5 DAS	10 DAS	15 DAS			5 DAS	10 DAS	15 DAS	
IIL- DIFACE	400 ml/ha		3.53 (2.01)	7.86 (2.89)	6.67 (2.67)	6.02	8.43 (2.99)	5.23 (2.39)	7.86 (2.89)	6.67 (2.67)	6.58
IIL- DIFACE	500 ml/ha	30.63 (5.53)	4.73 (2.28)	8.06 (2.92)	6.43 (2.63)	6.40	8.13 (2.93)	6.46 (2.63)	8.06 (2.92)	6.43 (2.63)	6.98
IIL- DIFACE	600 ml/ha	30.77 (5.55)	1.63 (1.45)	**3.03 (1.87)**	**5.23 (2.39)**	**3.29**	**8.50 (3.00)**	**1.80 (1.51)**	**3.03 (1.87)**	**5.23 (2.39)**	**3.35**
Difenthiuron 50% WP	600 gm/ha	31.17 (5.58)	4.13 (2.15)	**8.13 (2.93)**	**7.10 (2.75)**	**6.45**	**8.33 (2.97)**	**5.86 (2.52)**	**8.13 (2.93)**	**7.10 (2.75)**	**7.03**
Acetamiprid 20% SP	100 gm/ha	31.63 (5.62)	4.86 (2.31)	8.76 (3.04)	6.13 (2.57)	6.58	8..67 (3.02)	6.66 (2.07)	8.76 (3.04)	6.13 (2.57)	7.18
Fenpropathrin 30% EC	340 ml/ha	30.90 (5.56)	5.46 (2.44)	8.63 (3.02)	6.60 (2.66)	6.89	7.97 (2.91)	6.86 (2.71)	8.63 (3.02)	6.60 (2.66)	7.36
Control	-	31.77 (5.64)	8.76 (3.04)	9.33 (3.13)	9.90 (3.22)	9.33	8.03 (2.92)	9.06 (3.09)	9.33 (3.13)	9.90 (3.22)	9.43
	CD (5%)	**NS**	**0.13**	**0.04**	**0.27**		**NS**	**0.02**	**0.04**	**0.27**	

Note: - Figure in parentheses is square root transform value
DAS- Days after Spraying.

Table.2 Effect of different insecticides on thrips population per plant during 2015-16

Insecticides	Dose (ml or g/ha)	First Spray					Second Spray				
		Pre treatment	Post treatment			Mean Thrips Population	Pre treatment	Post treatment			Mean Thrips Population
		5.33 (2.31)	5 DAS	10 DAS	15 DAS			5 DAS	10 DAS	15 DAS	
IIL- DIFACE	400 ml/ha		2.13 (1.56)	2.73 (1.79)	4.13 (2.02)	2.99	6.00 (2.55)	2.13 (1.62)	2.33 (1.68)	5.00 (2.34)	3.15
IIL- DIFACE	500 ml/ha	5.60 (2.35)	2.53 (1.66)	2.93 (1.82)	4.33 (2.06)	3.26	5.00 (2.34)	2.13 (1.62)	2.67 (1.77)	4.00 (2.12)	2.93
IIL- DIFACE	600 ml/ha	6.60 (2.56)	0.93 (1.07)	1.60 (1.32)	2.20 (1.47)	1.57	4.00 (2.11)	0.93 (1.09)	**2.00 (1.58)**	3.00 (1.86)	1.97
Difenthiuron 50% WP	600 gm/ha	**5.73 (2.39)**	**1.33 (1.21)**	**1.73 (1.42)**	**2.40 (1.53)**	**1.82**	**5.00 (2.34)**	**1.20 (1.17)**	**2.00 (1.58)**	**4.67 (2.27)**	**2.62**
Acetamiprid 20% SP	100 gm/ha	6.07 (2.46)	1.20 (1.17)	1.53 (1.33)	2.33 (1.52)	1.68	6.00 (2.54)	**1.07 (1.16)**	2.67 (1.77)	5.00 (2.34)	2.91
Fenpropathrin 30% EC	340 ml/ha	**5.67 (2.37)**	**2.00 (1.50)**	**2.40 (1.70)**	**3.73 (1.92)**	**2.71**	**6.00 (2.54)**	**2.00 (1.58)**	**2.00 (1.58)**	4.00 (2.12)	2.66
Control	-	5.33 (2.29)	7.10 (2.76)	7.30 (2.79)	6.45 (2.64)	6.95	6.33 (2.89)	5.95 (2.54)	3.00 (1.87)	5.33 (2.41)	4.76
	CD (5%)	**NS**	**0.05**	**0.06**	**0.07**		**NS**	**0.06**	**0.30**	**0.27**	

Note: - Figure in parentheses is square root transform value
DAS- Days after Spraying.

Table.3 Relative population of Coccinelid beetle on different dates of observation (mean population /plant) on Chilli after first spray

S. No.	Insecticides	Dose ml/ha	First year (2014-15)				Mean	Second year (2015-16)				Mean
			Pre treatment	3 DAS	7 DAS	10 DAS		Pre treatment	3 DAS	7 DAS	10 DAS	
1.	IIL- DIFACE	400 ml/ha	3.53 (2.00)	1.26 (1.32)	1.20 (1.30)	1.13 (1.27)	1.19	2.35 (1.68)	1.07 (1.25)	1.07 (1.25)	1.10 (1.26)	1.08
2.	IIL- DIFACE	500 ml/ha	3.83 (2.08)	0.93 (1.19)	0.76 (1.12)	0.80 (1.14)	0.83	2.51 (1.73)	0.70 (1.09)	0.70 (1.09)	0.83 (1.15)	0.74
3.	IIL- DIFACE	600 ml/ha	3.00 (1.87)	0.83 (1.15)	0.70 (1.09)	0.73 (1.10)	0.75	2.69 (1.78)	0.63 (1.06)	0.63 (1.06)	0.76 (1.12)	0.67
4.	Diafenthiuron 50% WP	600 g/ha	3.67 (2.04)	1.33 (1.35)	1.13 (1.27)	1.20 (1.30)	1.22	2.65 (1.77)	1.10 (1.26)	1.20 (1.30)	1.10 (1.26)	1.13
5.	Acetamiprid 20% SP	100 ml/ha	3.70 (2.04)	1.40 (1.37)	1.26 (1.32)	1.33 (1.35)	1.33	2.40 (1.70)	1.16 (1.51)	1.16 (1.28)	1.26 (1.32)	1.19
6.	Fenpropathrin 30 % EC	340 ml/ha	3.60 (2.02)	1.83 (1.52)	1.76 (1.50)	1.86 (1.53)	1.81	2.10 (1.61)	1.80 (1.51)	1.80 (1.51)	1.76 (1.50)	1.78
7.	Untreated control (Water only)	-	3.83 (2.08)	3.53 (2.00)	3.80 (2.07)	3.90 (2.09)	3.74	2.19 (1.64)	3.40 (1.97)	3.50 (1.87)	3.40 (1.97)	3.43
CD at 5%		-		**0.08**	**0.06**	**0.09**		**NS**	**0.07**	**0.09**	**0.06**	

Figure is parenthesis in square root transformed values
DAS – Days after spraying

Table.4 Relative population of Coccinelid beetle on different dates of observation (mean population /plant) on Chilli after second spray

S. No.	Insecticides	Dose ml/ha	First year				Mean	Second year				Mean
			Pre - treatment	3 DAS	7 DAS	10 DAS		**Pre- treatment**	**3 DAS**	**7 DAS**	**10 DAS**	
1.	IIL- DIFACE	400 ml/ha	1.53 (1.42)	0.46 (0.97)	0.53 (1.01)	0.76 (1.12)	0.58	1.03 (1.23)	0.80 (1.15)	0.63 (1.06)	0.73 (1.49)	0.72
2.	IIL- DIFACE	500 ml/ha	1.40 (1.37)	0.76 (1.12)	**0.60 (1.04)**	**0.66 (1.07)**	0.67	1.00 (1.22)	0.83 (1.15)	0.76 (1.12)	0.86 (1.12)	0.81
3.	IIL- DIFACE	600 ml/ha	1.53 (1.42)	**0.53 (1.01)**	0.70 (1.09)	0.73 (1.10)	0.65	1.06 (1.24)	**0.66 (1.07)**	0.63 (0.87)	0.60 (1.04)	0.63
4.	Diafenthiuron 50% WP	600 g/ha	1.26 (1.372	**0.50 (1.00)**	**0.53 (1.01)**	0.73 (1.10)	0.58	0.90 (1.18)	1.00 (1.22)	0.76 (1.12)	0.60 (1.04)	0.78
5.	Acetamiprid 20% SP	100 ml/ha	1.33 (1.35)	0.66 (1.07)	**0.53 (1.01)**	**0.60 (1.04)**	0.59	0.97 (1.20)	0.90 (1.18)	0.56 (1.06)	0.63 (1.06)	0.69
6.	Fenpropathrin 30 % EC	340 ml/ha	1.33 (1.35)	0.83 (1.15)	0.76 (1.12)	0.70 (1.09)	0.69	0.86 (1.16)	1.03 (1.23)	0.90 (1.18)	1.73 (1.49)	0.84
7.	Untreated control (Water only)	-	**1.26 (1.32)**	0.83 (1.15)	**0.53 (1.01)**	0.73 (1.10)	0.76	0.97 (1.20)	1.00 (1.22)	0.90 (1.18)	0.63 (1.06)	1.22
CD at 5%		**-**	**NS**	**NS**	**NS**	**NS**		**NS**	**NS**	**NS**	**NS**	

Figure is parenthesis in square root transformed values
DAS – Days after spraying

Table.5 Relative population of spider on different dates of observation (mean population /plant) on Chilli after first spray

S. No.	Insecticides	Dose ml/ha	First year				Mean	Second year				Mean
			Pre treatment	3 DAS	7 DAS	10 DAS		Pre treatment	3 DAS	7 DAS	10 DAS	
1.	DIFACE	400 ml/ha	0.33 (0.91)	0.60 (1.04)	0.80 (1.14)	0.70 (1.09)	0.7	1.00 (1.22)	1.03 (1.23)	0.90 (1.18)	1.33 (1.53)	1.08
2.	DIFACE	500 ml/ha	0.40 (0.94)	0.70 (1.09)	0.93 (1.19)	0.90 (1.18)	0.84	1.03 (1.23)	1.00 (1.22)	0.83 (1.15)	1.66 (1.63)	1.16
3.	DIFACE	600 ml/ha	0.50 (1.00)	0.73 (1.10)	0.87 (1.17)	0.70 (1.09)	0.76	0.93 (1.19)	0.90 (1.18)	0.80 (1.14)	1.33 (1.53)	1.01
4.	Diafenthiuron 50% WP	600 g/ha	0.37 (0.93)	0.63 (1.06)	0.80 (1.14)	0.83 (1.15)	0.75	0.97 (1.21)	1.00 (1.22)	1.00 (1.22)	1.00 (1.41)	1.00
5.	Acetamiprid 20% SP	100 ml/ha	0.30 (0.89)	0.80 (1.14)	0.67 (1.08)	0.77 (1.09)	0.74	0.80 (1.14)	1.03 (1.23)	0.97 (1.21)	1.00 (1.41)	1.00
6.	Fenpropathrin 30 % EC	340 ml/ha	0.40 (0.94)	0.83 (1.15)	0.93 (1.19)	0.80 (1.14)	0.85	0.90 (1.18)	1.00 (1.22)	0.93 (1.19)	1.33 (1.53)	1.08
7.	Untreated control (Water only)	-	0.47 (0.98)	0.63 (1.06)	0.83 (1.15)	0.90 (1.18)	0.78	0.93 (1.19)	1.03 (1.23)	0.87 (1.17)	2.00 (1.72)	1.3
CD at 5%		-	**NS**	**NS**	**NS**	**NS**		**NS**	**NS**	**NS**	**NS**	

* Figure is parenthesis in square root transformed values.
DAS – Days after spraying

Table.6 Relative population of spider on different dates of observation (mean population /plant) on Chilli after second spray

S. No.	Insecticides	Dose ml/ha	First year					Second year				
			Pre treatment	3 DAS	7 DAS	10 DAS		Pre treatment	3 DAS	7 DAS	10 DAS	
1.	IIL- DIFACE	400 ml/ha	0.80 (1.14)	1.53 (1.42)	1.33 (1.35)	0.47 (0.98)	1.11	0.80 (1.14)	0.80 (1.14)	0.87 (1.17)	0.53 (1.01)	0.73
2.	IIL- DIFACE	500 ml/ha	0.60 (1.04)	1.47 (1.41)	1.20 (1.30)	**0.40 (0.94)**	1.02	1.20 (1.17)	0.93 (1.19)	1.17 (1.28)	0.80 (1.14)	0.96
3.	IIL- DIFACE	600 ml/ha	0.93 (1.19)	0.80 (1.14)	1.13 (1.27)	0.47 (0.98)	0.8	1.80 (1.51)	0.57 (0.75)	1.01 (1.22)	0.53 (1.01)	0.70
4.	Diafenthiuron 50% WP	600 g/ha	0.93 (1.19)	1.40 (1.37)	1.33 (1.35)	0.47 (0.98)	1.06	1.00 (1.22)	1.00 (1.22)	1.00 (1.22)	0.47 (0.98)	0.82
5.	Acetamiprid 20% SP	100 ml/ha	0.60 (1.04)	1.47 (1.41)	1.40 (1.37)	0.43 (0.96)	1.1	1.60 (1.44)	0.75 (1.11)	0.90 (1.18)	**0.40 (0.94)**	**0.68**
6.	Fenpropathrin 30 % EC	340 ml/ha	1.07 (1.25)	1.73 (1.49)	1.40 (1.37)	0.80 (1.14)	1.31	2.07 (1.59)	1.33 (1.35)	1.26 (1.32)	0.93 (1.19)	1.17
7.	Untreated control (Water only)	-	0.73 (1.10)	1.73 (1.49)	1.67 (1.61)	0.93 (1.18)	1.44	1.20 (1.17)	1.47 (1.41)	1.63 (1.28)	1.53 (1.42)	1.54
CD at 5%		-	NS	0.41	0.35	0.21		NS	0.22	0.34	0.20	

* Figure is parenthesis in square root transformed values.
DAS – Days after spraying

Spider population

In both seasons, field experiment revealed that among the various treatments the spider population was more or less same among all treatments during 1st spray.

After second spray also the maximum mean spider population was recorded in plots treated with Fenpropathrin 30% EC @ 340 ml/ha (1.31 and 1.17) as against 1.44 no/plant and 1.54 in untreated plot during 2nd spray (Table 5 and 6).

Similarly, Varghese and Mathew (2013) studies revealed that the use of newer insecticides like Spiromesifen and Acetamiprid were effective in reducing the sucking pests of chilli viz. mites and thrips, without significantly affecting the natural enemies in the chilli ecosystem.

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