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BIO-EFFICACY OF SOME INSECTICIDES AGAINST INSECT PESTS OF CHILLI

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ABSTRACT

The experiment on relative bio-efficacy of some insecticides against major insect pests of chili was conducted during *kharif*, 2012 at the Instructional Farm, Rajasthan College of Agriculture, MPUAT, Udaipur. The results revealed that two sprays of imidacloprid 17.8 SL at 22.5 g a.i./ha at seven days interval was most effective and significantly superior to all other treatments which caused 91.05, 88.64 and 90.02 per cent mean reduction in aphid, whitefly and jassid population, respectively; however, two sprays of fipronil 5 SC at 40g a.i./ha at seven days interval was effective against thrips (90.99%); while, two sprays of flubendiamide 480 SC at 72 g a.i./ha at seven days interval was significantly more effective against fruit borer, which recorded only 5.67 per cent fruit damage. Imidacloprid 17.8 SL at 22.5 g a.i./ha sprayed twice recorded significantly highest marketable yield of chilli (117.08 q/ha). None of the insecticides evaluated had any visible adverse effect on the natural enemy population.

Key words: Sucking pest, fruit borer, natural enemy, bio-efficacy

INTRODUCTION

Chilli, *Capsicum annuum* L. is one of the versatile spice and vegetable crops grown in India. It is used as vegetable, spice, condiment, sauce, pickles and medicine. Among the various factors responsible for low yield of chilli, the insect pests are of prime importance, which significantly affect the production verying from 60.5 to 74.3 percent. It is attacked by various insects and mite pests from seedling to fruiting stage. It was reported that a total of 293 insects and mite species attack the capsicum crop in the field as well as in storage (Anonymous, 1987).The major insect pests in Southern Rajasthan include sucking pests, *viz.,* thrips (*Scirtothrips dorsalis* Hood.), whiteflies (*Bemisia tabaci* Genn.) and fruit borer (*Helicoverpa armigera* Hub.). The major symptom associated with chilli thrips is upward curling of leaves with wrinkles and symptoms associated with whitefly are yellowing, drying and shedding of leaves. The damage caused by *Helicoverpa armigera* (Hubner) during flowering and fruit formation is of great concern. Reddy and Reddy (1999) reported that the loss caused by the fruit borers is to the extent of 90 per cent in chilli.

For managing the sucking pests of chilli, different methods have been used; however, to keep the pest population below economic injury level (EIL) use of insecticides seems to be the only remedy. The present agricultural scenario in India indicates that it is very difficult to manage insect pests without use of chemical pesticides. Several workers have tested different chemicals against the fruit borer still the problem continues. It has become necessary to evaluate newer insecticides for maximum mortality of sucking insect pests with least or no ill-effects on the plant, consumer and environment. Keeping all these facts in view, studies were carried out to evaluate some new insecticides for the management of sucking insect pests of chilli.

MATERIALS AND METHODS

The trial was laid out in a R.B.D. with 8 treatments including untreated control, for evaluating insecticides Tolfenpyrad 15 EC @ 125 g a.i./ha, Imidacloprid 17.8 SL @ 22.25 g a.i./ha, Fipronil 5 SC @ 40 g a.i./ha, Flubendiamide 480 SC @ 72 g a.i./ha, Novaluron 10 SC @ 75 g a.i./ha, Acephate 75 SP @ 585 g a.i./ha, and Buprofezin 25 SC @ 250 g a.i./ha, with three replications. The seedlings of chilli cv. Pusa Jwala were transplanted in 5m x 5m plot size with 60cm x 30cm spacing. In all, two sprays were given for managing the sucking insect pests at ten days interval, starting from 45 days after transplanting to minimize the protection cost, residual effect on consumer, development of resistance in insect and environment safety.

The treatments were applied as soon as the infestation of pests began. The population of jassids, thrips, whiteflies, aphids and fruit borers was recorded from five plants selected randomly and tagged. The observations were recorded 1-day before each spray and at 3, 5 and 7 days after spray. Insecticides were applied twice at 10-15 days interval. The population data was corrected by the correction factor given by Henderson and Tilton (1955) as under:

$$\text{Percent reduction in population} = 100 \left\{1 - \frac{Ta \times Cb}{Tb \times Ca}\right\}$$

Where;

Ta = Number of insects after treatment

Tb = Number of insects before treatment

Ca = Number of insects untreated check after treatment

Cb = Number of insects in untreated check before treatment

Jassids, whiteflies and thrips were counted visually from three leaves per plant during early hours of the day between 7 to 8 a.m.; aphids were counted from the top 10cm meristematic region of the plant. Number of grubs and adults of *Chrysoperla* sp. and coccinellid beetles were counted on each tagged plant and was analyzed with suitable statistical tools.

RESULT AND DISCUSSION

Thrips: The efficacy of insecticides against thrips showed that two applications of fipronil 5 SC at 40 g a.i./ha proved best with highest mean reduction of 90.99 per cent in thrips population. Among all the treatments novaluron 10 SC at 75 g a.i./ha was least effective with 53.49 per cent reduction and was at par with flubendiamide 480 SC at 72 g a.i./ha, which caused 56.35 per cent mean population reduction. These findings are in close conformity with the findings Reddy *et al* (2007) who reported that fipronil 5% SC at 2 ml/litre was found to be the best treatment against chilli thrips. Similarly, the effectiveness of fipronil 5 SC at 40 ml a.i./ha against thrips was also reported by Mahalingappa *et al* (2008) in chilli. However, Singh *et al* (2005) observed that imidacloprid 17.8 SL at 200 ml/ha was most effective against *Scirtothrips dorsalis on brinjal.* Similarly, Ameta and Sharma (2005) also reported the highest reduction in the population of thrips from the cotton plots treated with imidacloprid.

Aphids: Two applications of imidacloprid 17.8 SL at 22.5 g a.i./ha proved significantly superior over all other treatments as it resulted in 91.05 per cent mean reduction in population of aphids. The least effective treatment was novaluron 10 SC at 75 g a.i./ha with 50.31 per cent mean reduction and was at par with flubendiamide 480 SC at 72 g a.i./ha, which resulted in 53.07 per cent reduction. Earlier, Kumar *et al* (2001) reported that imidacloprid (70 g/ha) was the best treatment in controlling aphids (99.76% reduction). Ameta and Sharma (2005) reported that imidacloprid 70 WG at 35 g a. i. /ha recorded the highest reduction in the population of aphids followed by imidacloprid 200 SL at 125 ml/ha.

Whiteflies: Two applications of imidacloprid 17.8 SL at 22.5 g a.i./ha proved significantly superior over all other treatments as it resulted in 88.64 per cent mean reduction in population of whiteflies. The least reduction was observed in novaluron 10 SC at 75 g a.i./ha, which was 54.65 per cent and at par with flubendiamide 480 SC at 72 g a.i./ha causing 56.70 per cent mean reduction. Earlier Singh *et al* (2004) also reported that imidacloprid 17.8 SL at 250 ml/ha was observed to provide the maximum reduction of whitefly at 1, 3, 7 and 14 days after sprays (i.e. 89.86, 95.58, 81.50 and 58.98%, respectively), followed by acephate 75 SP at 1250 g/ha. The results are also comparable with the work of Mhaske and Mote (2005) who reported that higher doses of imidacloprid 17.5 SL at 18.0 and 22.5 g/ha were most effective against whiteflies on brinjal crop

Jassids: Imidacloprid 17.8 SL at 22.5 g a.i./ha proved superior over all other treatments as it resulted in 90.02 per cent mean reduction in population of jassids. The least effective treatment was novaluron 10 SC at 75 g a.i./ha with 52.13 per cent reduction and was at par with flubendiamide 480 SC at 72 g a.i./ha caused 53.78 per cent reduction. Bhargava *et al* (2003) who reported that application of imidacloprid at 20 g a.i. /ha in combination with beta cyfluthrin 12.50 g a.i./ha was most effective in reducing the population of *A. biguttula biguttula*.

Mean fruit damage caused by fruit borer: The findings of present investigation indicated that flubendiamide 480 SC at 72 g a.i./ha was most effective with minimum mean fruit damage of 5.67 per cent. Imidacloprid 17.8 SL at 22.5 g a.i./ha was the least effective treatment with 25.70 per cent mean fruit damage, as against 34.20 per cent in untreated control. Tatagar *et al* (2009) reported that among various dosages, flubendiamide 20 WG at 60 g a.i./ha recorded highest yield of 7.48 q/ha with lowest mean fruit damage of 3.45 per cent followed by flubendiamide 20 WG at 40 g a.i./ha (6.72 q/ha). Similarly, flubendiamide 480 SC 125 ml/ha against brinjal shoot and fruit borer during summer and *kharif* season was reported to be most effective by Ameta *et al* (2010[b]).

Effect of insecticides on major natural enemies: The mean population of natural enemies was recorded from the different treatments and there was no significant

Table 1. Bio-efficacy of insecticides against thrips infesting chilli during *kharif*, 2012

S.No.	Treatments	Dosage (ml or g/ha)	PTP	Mean reduction in population (%)					
				First spray			Second spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Tolfenpyrad 15% EC	125	2.48 [5.66]	56.38 (69.34)	60.39 (75.59)	58.17 (72.18)	59.79 (74.69)	63.75 (80.44)	66.14 (83.64)
2	Imidacloprid 17.8% SL	22.25	2.20 [4.33]	58.04 (71.98)	62.45 (78.61)	59.91 (74.87)	62.50 (78.68)	66.42 (84.00)	69.92 (88.22)
3	Fipronil 5% SC	40	2.34 [5.00]	59.06 (73.57)	63.84 (80.56)	61.62 (77.40)	64.53 (81.51)	69.61 (87.86)	72.53 (90.99)
4	Flubendiamide 480 SC	72	2.27 [4.67]	43.57 (47.51)	44.97 (49.95)	44.01 (48.27)	47.66 (54.64)	49.96 (58.61)	48.65 (56.35)
5	Novaluron 10 SC	75	2.52 [6.00]	42.24 (45.19)	43.34 (47.10)	42.80 (46.16)	45.72 (51.26)	48.24 (55.64)	47.00 (53.49)
6	Acephate 75 SP	585	2.27 [4.67]	54.70 (66.61)	57.30 (70.81)	55.94 (68.63)	57.23 (70.71)	59.38 (74.06)	61.50 (77.24)
7	Buprofezin 25 SC	250	2.61 [6.33]	51.27 (60.85)	54.07 (65.57)	52.27 (62.55)	55.34 (67.66)	57.14 (70.56)	60.05 (75.08)
8	Control		2.67 [6.67]	NA	NA	NA	NA	NA	NA
	S. Em. ±		0.12	0.75	1.14	0.67	0.73	1.00	1.36
	CD at 5%		NS	2.32	3.53	2.07	2.27	3.05	4.20

Note: 1) Figures in the parenthesis are retransformed per cent values; Figures in square brackets are retransformed population (x) values; 2) DAS- Days after spray; 3) PTP- Pre treatment population

Table 2. Bio-efficacy of insecticides against aphids infesting chilli during *kharif*, 2012

S.No.	Treatments	Dosage (ml or g/ha)	PTP	Mean reduction in population (%)					
				First spray			Second spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Tolfenpyrad 15% EC	125	3.49 [11.67]	58.02 (71.94)	62.40 (78.54)	60.61 (75.92)	62.99 (79.37)	65.84 (83.25)	69.58 (87.83)
2	Imidacloprid 17.8% SL	22.25	3.19 [9.67]	59.39 (74.07)	63.90 (80.64)	61.52 (77.27)	66.06 (83.53)	68.71 (86.82)	72.59 (91.05)
3	Fipronil 5% SC	40	3.29 [10.33]	55.60 (68.08)	58.45 (72.62)	56.84 (70.09)	60.45 (75.68)	62.79 (79.09)	66.07 (83.55)
4	Flubendiamide 480 SC	72	3.03 [8.66]	42.42 (45.50)	44.06 (48.36)	43.02 (46.55)	45.52 (50.91)	48.50 (56.09)	46.76 (53.07)
5	Novaluron 10 SC	75	3.39 [11.00]	41.67 (44.20)	43.02 (46.55)	42.42 (45.50)	43.71 (47.75)	47.17 (53.78)	45.18 (50.31)
6	Acephate 75 SP	585	3.34 [10.67]	53.55 (64.70)	57.30 (70.82)	54.41 (66.14)	59.20 (73.77)	60.85 (76.27)	63.65 (80.30)
7	Buprofezin 25 SC	250	3.14 [9.33]	52.42 (62.81)	55.12 (67.29)	53.29 (64.27)	57.59 (71.27)	59.23 (73.83)	62.10 (78.11)
8	Control		3.51 [12.00]	NA	NA	NA	NA	NA	NA
	S. Em. ±		0.10	1.02	1.38	1.03	1.17	1.07	1.40
	CD at 5%		NS	3.14	4.26	3.18	3.60	3.32	4.33

Note: 1) Figures in the parentheses are retransformed per cent values; Figures in square brackets are retransformed population (x) values; 2) DAS- Days after spray; 3) PTP- Pre treatment population

Table 3. Bio-efficacy of insecticides against whiteflies infesting chilli during *kharif*, 2012

S.No.	Treatments	Dosage (ml or g/ha)	PTP	Mean reduction in population (%)					
				First spray			Second spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Tolfenpyrad 15% EC	125	2.27 [4.67]	55.93 (68.62)	59.38 (74.06)	57.64 (71.36)	61.54 (77.29)	65.70 (83.06)	67.93 (85.88)
2	Imidacloprid 17.8% SL	22.25	2.41 [5.33]	57.80 (71.61)	61.43 (77.12)	59.19 (73.77)	62.85 (79.17)	66.52 (84.13)	70.30 (88.64)
3	Fipronil 5% SC	40	2.27 [4.67]	53.85 (65.21)	57.03 (70.38)	55.32 (67.62)	59.22 (73.81)	61.70 (77.53)	64.61 (81.62)
4	Flubendiamide 480 SC	72	2.12 [4.00]	43.79 (47.89)	45.39 (50.68)	43.85 (48.00)	47.86 (54.98)	50.47 (59.50)	48.85 (56.70)
5	Novaluron 10 SC	75	2.42 [5.33]	42.62 (45.85)	43.94 (48.15)	43.18 (46.83)	46.22 (52.13)	48.89 (56.77)	47.67 (54.65)
6	Acephate 75 SP	585	2.27 [4.67]	52.43 (62.83)	55.36 (67.69)	53.67 (64.90)	56.92 (70.22)	59.25 (73.85)	62.68 (78.94)
7	Buprofezin 25 SC	250	2.35 [5.00]	51.61 (61.40)	53.70 (64.95)	52.37 (62.72)	56.11 (68.92)	57.23 (70.71)	59.20 (73.78)
8	Control		2.47 [5.67]	NA	NA	NA	NA	NA	NA
	S. Em. ±		0.07	0.91	0.97	0.62	1.05	1.40	1.30
	CD at 5%		NS	2.82	2.99	1.93	3.24	4.33	4.12

Note: 1) Figures in the parenthesis are retransformed per cent values; Figures in square brackets are retransformed population (x) values; 2) DAS- Days after spray; 3) PTP- Pre treatment population

Table 4. Bio-efficacy of insecticides against jassids infesting chilli during *kharif*, 2012

S.No.	Treatments	Dosage (ml or g/ha)	PTP	Mean reduction in population (%)					
				First spray			Second spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Tolfenpyrad 15% EC	125	2.41 [5.33]	58.43 (72.59)	63.06 (79.47)	61.31 (76.96)	62.78 (79.08)	65.02 (82.17)	68.83 (86.95)
2	Imidacloprid 17.8% SL	22.25	2.27 [4.67]	59.85 (74.77)	64.84 (81.92)	62.17 (78.20)	66.33 (83.88)	67.98 (85.94)	71.59 (90.02)
3	Fipronil 5% SC	40	2.12 [4.00]	53.99 (65.44)	56.79 (70.00)	54.83 (66.82)	59.65 (74.46)	63.60 (80.23)	66.13 (83.62)
4	Flubendiamide 480 SC	72	2.61 [6.33]	42.69 (45.97)	44.24 (48.67)	43.24 (46.93)	45.88 (51.54)	48.87 (56.73)	47.17 (53.78)
5	Novaluron 10 SC	75	2.34 [5.00]	41.91 (44.62)	43.20 (46.86)	42.57 (45.76)	44.02 (48.29)	47.55 (54.44)	46.22 (52.13)
6	Acephate 75 SP	585	2.27 [4.67]	52.62 (63.14)	55.35 (67.67)	53.63 (64.84)	58.38 (72.51)	60.40 (75.60)	63.99 (80.77)
7	Buprofezin 25 SC	250	2.12 [4.00]	51.32 (60.94)	53.20 (64.12)	52.26 (62.53)	55.08 (67.23)	58.14 (72.13)	60.57 (75.86)
8	Control		2.60 [6.33]	NA	NA	NA	NA	NA	NA
	S. Em. ±		0.11	0.91	0.96	0.97	1.33	1.61	1.77
	CD at 5%		NS	2.80	2.97	3.00	4.10	4.96	5.45

Note: 1) Figures in the parentheses are retransformed per cent values; Figures in square brackets are retransformed population (x) values; 2) DAS- Days after spray; 3) PTP- Pre treatment population

Table 5. Bio-efficacy of insecticides against fruit borer on chilli during *kharif*, 2012

Treatments	Dosage (ml or g/ha)	Mean reduction in population (%)					
		First spray			Second spray		
		3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
Tolfenpyrad 15% EC	125	23.07 (15.36)	22.04 (14.09)	24.68 (17.44)	23.31 (15.66)	20.56 (12.33)	24.42 (17.10)
Imidacloprid 17.8% SL	22.25	25.12 (18.03)	24.92 (17.77)	26.79 (20.33)	28.19 (22.23)	27.34 (21.11)	30.45 (25.70)
Fipronil 5% SC	40	22.66 (14.85)	20.29 (12.03)	23.85 (16.36)	22.42 (14.55)	20.81 (12.63)	18.10 (9.66)
Flubendiamide 480 SC	72	20.56 (12.33)	18.46 (10.03)	21.19 (13.07)	18.01 (9.56)	15.60 (7.23)	13.77 (5.67)
Novaluron 10 SC	75	21.52 (13.46)	19.97 (11.67)	22.68 (14.88)	19.57 (11.23)	18.11 (9.67)	15.61 (7.24)
Acephate 75 SP	585	24.37 (17.03)	23.66 (16.11)	26.24 (19.55)	26.47 (19.88)	25.51 (18.55)	27.58 (21.44)
Buprofezin 25 SC	250	24.08 (16.65)	23.05 (15.33)	25.27 (18.23)	24.47 (17.16)	23.52 (15.92)	26.06 (19.30)
Control		28.12 (22.23)	29.77 (24.66)	30.87 (26.33)	32.15 (28.33)	34.37 (31.88)	35.78 (34.20)
S. Em. ±		0.25	0.29	0.28	0.32	0.34	0.33
CD at 5%		0.77	0.90	0.84	0.99	1.05	1.01

Note: 1) Figures in the parentheses are retransformed per cent values; 2) DAS- Days after spray

Table 6. Effect of insecticides on the natural enemy population on chilli during *kharif*, 2012

Treatments	Dosage (ml or g/ha)	Natural enemies/plant			
		Coccinella spp.		*Chrysoperla sp.*	
		Grub	Adult	Grub	Adult
Tolfenpyrad 15% EC	125	1.20 (0.95)	1.16 (0.85)	1.19 (0.90)	1.15 (0.82)
Imidacloprid 17.8% SL	22.25	1.18 (0.89)	1.15 (0.82)	1.17 (0.87)	1.15 (0.81)
Fipronil 5% SC	40	1.18 (0.89)	1.14 (0.81)	1.18 (0.89)	1.16 (0.84)
Flubendiamide 480 SC	72	1.20 (0.93)	1.16 (0.85)	1.17 (0.87)	1.14 (0.81)
Novaluron 10 SC	75	1.15 (0.83)	1.14 (0.79)	1.14 (0.80)	1.13 (0.77)
Acephate 75 SP	585	1.15 (0.83)	1.14 (0.79)	1.15 (0.82)	1.13 (0.79)
Buprofezin 25 SC	250	1.19 (0.93)	1.17 (0.86)	1.18 (0.89)	1.14 (0.81)
Control		1.19 (0.91)	1.17 (0.88)	1.18 (0.89)	1.15 (0.83)
S. Em. $\pm$	-	0.014	0.013	0.010	0.007
C.D. at 5%	-	NS	NS	NS	NS

Note: Figures in the parentheses are retransformed population (x) values difference with the population recorded in untreated control. Similar reports of Ameta and Sharma (2005) indicate that confidor 350 SC at 60 and 75 ml/ ha and confidor 200 SL at 100 and 125 ml/ ha did not cause any adverse effect on the grubs and adults of *Chrysoperla sp.* and *Coccinella* spp. when used or the management of aphids, jassids and thrips. Similarly, Satpute *et al* (2002) reported that imidacloprid (5, 7.5 and 10 g/ kg seeds) applied as seed treatment was not only safe but also attracted the population of *C. sexmaculata* and *C. carnea*. Ameta and Kumar (2008) reported that flubendiamide at 125ml/ha caused significantly high reduction in the population of *H. armigera* and *S. litura* without any adverse effect on the population of natural enemies. Aggarwal (2012) recorded higher hatching of eggs of *C. sexmaculata* and higher adult emergence in plots treated with buprofezin (76.66% egg hatching and 83.33% adult emergence) and imidacloprid (70.00% eggs hatching). Ishaaya *et al* (2002) reported that novaluron had no appreciable negative effect on parasitoids and phytoseiids, but had a mild effect on other natural enemies; hence, novaluron may be considered as a potential component in IPM programmes.

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