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Bioefficacy of Imidacloprid 350 SC against sucking insect-pests in chilli (*Capsicum annum* L.)

B. S. Rana, K. C. Ahir, M. M. Sonkamble* and S. D. Desai

Department of Entomology, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture & Technology, Udaipur-313001 (Rajasthan), INDIA
*Corresponding author. E-mail: milind.sonkambleento@gmail.com

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Abstract: A field experiment was conducted in a RBD at Horticulture farm, Rajasthan College of Agriculture, Udaipur to evaluate the bioefficacy of Imidacloprid 350 SC at 100, 125 and 150 ml/ha against sucking pests of chilli during *Kharif,* 2013 and 2014. The highest reduction in the population of aphid, jassids and thrips in chilli was recorded in case of two spray of Imidacloprid 350 SC at 150 ml/ha and also recorded highest marketable yield of 161.25 and 164.88 q/ha during 2013 and 2014, respectively. It was found at par to Imidacloprid 350 SC at 125 ml/ha.

Keywords: Aphid, Chilli, Imidacloprid 350 SC, Jassids, Sucking pests, Thrips

INTRODUCTION

Chilli (*Capsicum annum* L.) is an important vegetable and condiment crop in India. India is the largest consumer and exporter of chilli in the world with a production of 1492 MT from an area of 775 thousand ha and productivity 1.9 MT per ha (Anonymous, 2014). A number of factors are responsible for low yield that include adverse climate, poor quality seeds, diseases, insect and mites significantly affects both the quality and production of chilli. The yield losses range from 50-90 per cent due to insect pests of chilli (Nelson and Natrajan, 1994 and Kumar, 1995). Thrips (*Scirthothrips dorsalis* Hood), whiteflies (*Bemisia tabaci* Genn), aphids (*Aphis gossypii* Glover) and mites (*Polyphagotarsonemus latus* Banks) are the important sucking pests contributing to decrease in the crop yield (Hosmani, 1993). In order to avoid consequence of use and persistence of insecticides it becomes necessary to evaluate the newer and effective molecules which are safe to ecosystem. Thus, the present study was conducted to evaluate Imidacloprid 350 SC for its efficacy against sucking pest of chilli.

MATERIALS AND METHODS

The bioefficacy of Imidacloprid 350 SC at 100, 125 and 150 ml/ha was evaluated against aphid, jassid and thrips in chilli during *Kharif*, 2013 and 2014. The experiment was conducted in randomized block design (RBD) with six treatments replicated four times at Horticulture farm, Rajasthan College of Agriculture, Udaipur. Chilli variety Pusa Jwala was transplanted on 14th August and 15th July during 2013 and 2014, respectively. Transplanting was done in plots each measuring 5.0 x 5.0 sq.m. at row to row and plant to plant spicing of 60 cm x 45 cm. Each treatment was applied two times at an interval of 15 days. The first spray was done at appearance of the pests *i.e.* aphid (*Aphis gossypii*), jassids (*Amrasca biguttula biguttula*) and thrips (*Scirtothrips dorsalis*). The observation on the population of pest was recorded before and at 3, 5 and 7 days after each spray on five leaves per plant on five plants selected randomly in each treatment replicate. The data were subjected to statistical analysis after calculating the per cent reduction in the pest population at 3, 5 and 7 days after each spray. Efficacy of different treatments in controlling the insect pests (aphid, jassids and thrips) was analyzed by analysis of variance. The population data were corrected by the correction factor described by Henderson and Tiltion (1955).

The effect of Imidacloprid 350 SC along with other treatments on natural enemies was studied by counting population of common predatory fauna at regular interval in each replication. The periodic picking of chilli fruits was done at regular interval. The weight of healthy fruits of all pickings was pooled together and yield per hectare was calculated for each treatment separately.

RESULTS AND DISCUSSION

The data recorded on mean reduction in the population of aphid at 3, 5 and 7 days after first and second spray has been presented in Table 1 and 2. All the treatments were found significantly superior over untreated control. The data reveals that the highest reduction in the population of aphid was recorded in case of spray of Imidacloprid 350 SC at 150 ml/ha. It was found superior to all treatments. It caused 70.98, 67.62, 62.04; 82.88, 78.97, 73.52 and 71.99, 67.08, 62.27; 83.45,

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Table 1. Bioefficacy of Imidacloprid 350 SC against aphid, *Aphis gossypii* in chilli (2013).

S. No.	Treatments g a.i./ha	Formulation dosage ml or g/ha	PTP	Mean reduction (four replication) in aphid population (%)					
				I st spray			II nd spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Imidacloprid 350 SC at 35	100	1.88* (3.05)	50.26 (59.12)**	49.04 (57.01)	44.76 (49.59)	55.71 (68.31)	53.81 (64.96)	50.75 (59.88)
2	Imidacloprid 350 SC at 43.75	125	1.92 (3.20)	56.09 (68.77)	54.43 (66.08)	50.99 (60.38)	64.45 (81.10)	62.10 (77.78)	58.17 (72.08)
3	Imidacloprid 350 SC at 52.5	150	1.91 (3.15)	57.52 (70.98)	55.39 (67.62)	51.97 (62.04)	65.77 (82.88)	63.03 (78.97)	59.08 (73.52)
4	Imidacloprid 200 SL at 50	250	1.96 (3.35)	50.85 (60.05)	49.38 (57.58)	45.96 (51.67)	57.98 (71.59)	55.12 (67.17)	51.17 (60.65)
5	Fipronil 5% SC at 40	800	1.97 (3.40)	49.59 (57.91)	47.53 (54.37)	44.21 (48.64)	54.72 (66.60)	53.18 (64.06)	50.39 (59.31)
6	Untreated control	-	1.95 (3.30)	-	-	-	-	-	-
	S.Em±		0.03	1.73	1.58	1.65	2.01	2.20	1.73
	C.D. at 5%		NS	5.21	4.76	4.97	6.05	6.63	5.22

PTP- pre treatment population; DAS- days after spray; * Figures represent square root transformed values; **Figures in parenthesis are retransformed per cent value

Table 2. Bioefficacy of Imidacloprid 350 SC against aphid, *Aphis gossypii* in chilli (2014).

S. No.	Treatments g a.i./ha	Formulation dosage ml or g/ha	PTP	Mean reduction (four replication) in aphid population (%)					
				I st spray			II nd spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Imidacloprid 350 SC at 35	100	1.92* (3.20)	49.63 (58.04)**	48.90 (56.76)	45.32 (50.55)	56.60 (69.57)	54.62 (66.32)	51.79 (61.64)
2	Imidacloprid 350 SC at 43.75	125	1.95 (3.30)	56.91 (70.11)	54.12 (65.56)	51.37 (61.02)	65.07 (81.91)	62.72 (78.67)	58.73 (72.94)
3	Imidacloprid 350 SC at 52.5	150	1.90 (3.13)	58.17 (71.99)	55.06 (67.08)	52.11 (62.27)	66.35 (83.45)	63.71 (79.93)	59.69 (74.44)
4	Imidacloprid 200 SL at 50	250	1.96 (3.35)	51.30 (60.81)	49.46 (57.72)	46.15 (51.99)	58.43 (72.31)	55.87 (68.36)	52.84 (63.45)
5	Fipronil 5% SC at 40	800	1.99 (3.45)	48.64 (56.28)	47.20 (53.79)	44.88 (49.80)	55.44 (67.78)	54.08 (65.58)	50.94 (60.25)
6	Untreated control	-	2.00 (3.50)	-	-	-	-	-	-
	S.Em±		0.02	1.67	1.54	1.67	2.02	2.08	1.74
	C.D. at 5%		NS	5.03	4.65	5.05	6.08	6.27	5.25

PTP- pre treatment population; DAS- days after spray;* Figures represent square root transformed values; **Figures in parenthesis are retransformed per cent value

Table 3. Bioefficacy of Imidacloprid 350 SC against jassid, *Amrasca biguttula biguttula* in chilli (2013).

S. No.	Treatments g a.i./ha	Formulation dosage ml or g/ha	PTP	Mean reduction (four replication) in jassid population (%)					
				I[st] spray			II[nd] spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Imidacloprid 350 SC at 35	100	1.73* (2.50)	50.95 (60.30)**	49.62 (58.01)	45.32 (50.55)	56.40 (69.25)	55.20 (67.35)	51.50 (61.13)
2	Imidacloprid 350 SC at 43.75	125	1.77 (2.65)	56.68 (69.70)	55.10 (67.18)	51.67 (61.53)	64.83 (81.59)	62.86 (78.88)	58.78 (73.00)
3	Imidacloprid 350 SC at 52.5	150	1.72 (2.45)	58.26 (72.11)	56.15 (68.85)	52.40 (62.76)	66.14 (83.32)	63.66 (79.82)	59.70 (74.48)
4	Imidacloprid 200 SL at 50	250	1.76 (2.60)	51.42 (61.01)	50.02 (58.67)	46.54 (52.66)	58.67 (72.67)	55.82 (68.28)	51.85 (61.79)
5	Fipronil 5% SC at 40	800	1.79 (2.70)	50.08 (58.74)	48.29 (55.68)	44.71 (49.50)	55.23 (67.45)	53.95 (65.35)	50.73 (59.90)
6	Untreated control	-	1.77 (2.65)	-	-	-	-	-	-
	S.Em±		0.03	1.77	1.56	1.57	1.98	2.00	1.72
	C.D. at 5%		NS	5.33	4.70	4.73	5.98	6.02	5.19

PTP- pre treatment population; DAS- days after spray; * Figures represent square root transformed values; **Figures in parenthesis are retransformed per cent value

Table 4. Bioefficacy of Imidacloprid 350 SC against jassid, *Amrasca biguttula biguttula* in chilli (2014).

S. No.	Treatments g a.i./ha	Formulation dosage ml or g/ha	PTP	Mean reduction (four replication) in jassid population (%)					
				I[st] spray			II[nd] spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Imidacloprid 350 SC at 35	100	1.72 (2.45)*	50.25 (59.10)**	49.46 (57.73)	45.77 (51.33)	57.21 (70.53)	55.28 (67.39)	52.34 (62.57)
2	Imidacloprid 350 SC at 43.75	125	1.76 (2.60)	57.51 (71.05)	54.58 (66.32)	51.91 (61.93)	65.73 (82.76)	63.48 (79.72)	59.42 (73.99)
3	Imidacloprid 350 SC at 52.5	150	1.75 (2.55)	58.76 (72.93)	55.76 (68.22)	52.61 (63.12)	67.30 (84.74)	64.31 (80.73)	60.26 (75.31)
4	Imidacloprid 200 SL at 50	250	1.73 (2.50)	51.89 (61.80)	50.14 (58.87)	46.76 (53.05)	59.22 (73.52)	56.57 (69.49)	53.41 (64.39)
5	Fipronil 5% SC at 40	800	1.77 (2.65)	49.06 (57.02)	47.93 (55.09)	45.45 (50.78)	55.76 (68.31)	54.71 (66.62)	51.59 (61.35)
6	Untreated control	-	1.79 (2.70)	-	-	-	-	-	-
	S.Em±		0.02	1.61	1.40	1.64	1.98	2.09	1.69
	C.D. at 5%		NS	4.85	4.22	4.93	5.97	6.31	5.09

PTP- pre treatment population; DAS- days after spray; * Figures represent square root transformed values; **Figures in parenthesis are retransformed per cent value

Table 5. Bioefficacy of Imidacloprid 350 SC against thrips, *Scirtothrips dorsalis* in chilli (2013).

S. No.	Treatments g a.i./ha	Formulation dosage ml or g/ha	PTP	Mean reduction (four replication) in thrips population (%)					
				I st spray			II nd spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Imidacloprid 350 SC at 35	100	1.66* (2.25)	49.06 (57.05)**	47.83 (54.92)	43.48 (47.38)	54.44 (66.07)	52.41 (62.63)	49.53 (57.81)
2	Imidacloprid 350 SC at 43.75	125	1.70 (2.40)	54.74 (66.56)	53.04 (63.74)	49.90 (58.51)	63.05 (79.17)	60.67 (75.74)	56.82 (69.96)
3	Imidacloprid 350 SC at 52.5	150	1.67 (2.30)	56.14 (68.81)	54.25 (65.76)	50.79 (60.03)	64.22 (80.82)	61.50 (76.83)	57.63 (71.27)
4	Imidacloprid 200 SL at 50	250	1.72 (2.45)	49.49 (57.73)	48.14 (55.44)	44.70 (49.49)	56.58 (69.41)	53.98 (65.31)	50.28 (59.12)
5	Fipronil 5% SC at 40	800	1.64 (2.20)	48.32 (55.73)	46.30 (52.23)	42.98 (46.49)	53.43 (64.47)	51.94 (61.97)	49.09 (57.09)
6	Untreated control	-	1.69 (2.35)	-	-	-	-	-	-
	S.Em±		0.03	1.71	1.60	1.66	1.98	2.20	1.73
	C.D. at 5%		NS	5.15	4.83	4.99	5.97	6.63	5.22

PTP- pre treatment population ; DAS- days after spray; * Figures represent square root transformed values; **Figures in parenthesis are retransformed per cent value

Table 6. Bioefficacy of Imidacloprid 350 SC against thrips, *Scirtothrips dorsalis* in chilli (2014).

S. No.	Treatments g a.i./ha	Formulation dosage ml or g/ha	PTP	Mean reduction (four replication) in thrips population					
				I st spray			II nd spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Imidacloprid 350 SC at 35	100	1.67 (2.30)*	48.37 (55.86)**	47.66 (54.62)	44.01 (48.28)	55.21 (67.32)	53.56 (64.53)	50.40 (59.29)
2	Imidacloprid 350 SC at 43.75	125	1.69 (2.35)	55.61 (68.01)	52.76 (63.31)	50.22 (59.05)	63.77 (80.19)	61.29 (76.64)	57.52 (71.07)
3	Imidacloprid 350 SC at 52.5	150	1.70 (2.40)	56.79 (69.84)	53.73 (64.91)	51.04 (60.46)	64.95 (81.76)	62.10 (77.73)	58.30 (72.31)
4	Imidacloprid 200 SL at 50	250	1.73 (2.50)	49.97 (58.55)	48.15 (55.47)	45.13 (50.23)	57.11 (70.27)	54.60 (66.32)	51.51 (61.21)
5	Fipronil 5% SC at 40	800	1.69 (2.35)	47.09 (53.62)	45.87 (51.50)	43.71 (47.75)	54.09 (65.56)	52.18 (62.39)	49.63 (58.02)
6	Untreated control	-	1.66 (2.25)	-	-	-	-	-	-
	S.Em±		0.03	1.67	1.52	1.66	1.96	2.19	1.68
	C.D. at 5%		NS	5.05	4.58	4.99	5.91	6.61	5.07

PTP- pre treatment population ; DAS- days after spray; * Figures represent square root transformed values; **Figures in parenthesis are retransformed per cent value

Table 7. Bioefficacy of Imidacloprid 350 SC on natural enemies and marketable yield of chilli.

S. No.	Treatments g a.i./ha	Formulation dosage ml or g/ha	Natural enemies population/plant (2013-2014) (Mean of two years) *Coccinella spp.* Grub	*Coccinella spp.* Adult	*Chrysoperla cornea* Grub	*Chrysoperla cornea* Adult	Marketable yield 2013	Marketable yield 2014
1	Imidacloprid 350 SC at 35	100	0.89* (0.30)	0.91 (0.34)	0.85 (0.22)	0.87 (0.27)	121.63	127.05
2	Imidacloprid 350 SC at 43.75	125	0.88 (0.27)	0.92 (0.36)	0.84 (0.21)	0.86 (0.25)	155.30	152.38
3	Imidacloprid 350 SC at 52.5	150	0.89 (0.29)	0.92 (0.36)	0.85 (0.23)	0.87 (0.25)	161.25	164.88
4	Imidacloprid 200 SL at 50	250	0.89 (0.29)	0.92 (0.35)	0.85 (0.22)	0.87 (0.26)	126.40	133.75
5	Fipronil 5% SC at 40	800	0.89 (0.30)	0.92 (0.34)	0.84 (0.21)	0.88 (0.28)	122.55	113.75
6	Untreated control	-	0.88 (0.28)	0.93 (0.37)	0.85 (0.23)	0.87 (0.25)	84.75	87.25
	S.Em±		0.006	0.003	0.004	0.005	4.86	5.32
	C.D. at 5%		NS	NS	NS	NS	14.65	16.03

* Figures represent square root transformed values

79.93 and 74.44 per cent reduction of aphid at 3, 5 and 7 days after first and second spray during 2013 and 2014, respectively. It was followed by Imidacloprid 350 SC at 125 ml/ha. Both the treatments were found at par with each other. The next effective treatments were Imidacloprid 200 SL at 250 g ml/ha, Imidacloprid 350 SC at 100 ml/ha and Fipronil 5% SC at 800 ml/ha, which were found least effective and at par with each other.

The data recorded on mean reduction in the population of jassids at 3, 5 and 7 days after first and second spray has been presented in Table 3 and 4. All the treatments were found significantly superior over untreated control. The data reveals that the highest reduction in the population of jassid was recorded in spray of Imidacloprid 350 SC at 150 ml/ha. It caused 72.11, 68.85, 62.76; 83.32, 79.82, 74.48 and 72.93, 68.22, 63.12; 84.74, 80.73 and 75.31 per cent reduction of jassid at 3, 5 and 7 days after first and second spray during 2013 and 2014, respectively. It was followed by Imidacloprid 350 SC at 125 ml/ha, which were found at par with each other. It was followed by Imidacloprid 200 SL at 250 ml/ha, Imidacloprid 350 SC at 100 ml/ha and Fipronil 5% SC at 800 ml/ha being next in order of effectiveness and were at par to each other.

The data recorded on mean reduction in the population of thrips at 3, 5 and 7 days after first and second spray has been presented in Table 5 and 6. All treatments were found significantly superior over untreated control. The data reveals that the highest reduction in the population of thrips was recorded in case of spray of Imidacloprid 350 SC at 150 ml/ha. It was found superior to all treatments. It caused 68.81, 65.76, 60.03; 80.82, 76.83, 71.27 and 69.84, 64.91, 60.46; 81.76, 77.73 and 72.31 per cent reduction of thrips at 3, 5 and 7 days after first and second spray during 2013 and 2014, respectively. Next effective treatment was Imidacloprid 350 SC at 125 ml/ha and found at par with each other. While, spray of Imidacloprid 200 SL at 250 ml/ha, Imidacloprid 350 SC at 100 ml/ha and Fipronil 5% SC at 800 ml/ha were found least effective and at par to each other.

The present findings agree with the findings of Kumar *et al.* (2001), who reported that the imidacloprid (70 g/ha) and acephate (1500 g/ha) were the most effective treatment against aphid (99.76%) and thrips (87.22%) reduction, respectively. Similary, Patil *et al.* (2002) evaluated that the imidacloprid at 125 and 150 ml/ha was highly effective against sucking pest complexes of chilli and proved to be better than monocrotophos and dimethoate and reported highest yield from imidacloprid at 150 ml/ha treated plots. While, Singh *et al.* (2004) observed the imidacloprid 17.8 SL at 250 ml/ha provided maximum reduction of whitefly at 1, 3, 7 and 14 days after sprays *i.e.* 89.86, 95.58, 81.50 and 58.98 per cent, respectively. Imidacloprid was most effective insecticide against sucking pests of chilli and other crops has been well proved (Mhaske and Mote, 2005;

Mishra *et al*., 2005; Jain and Ameta, 2006; Hosamani, 2007; Manyam and Byadgi, 2013; Prabhu *et al.*, 2014). The data recorded on the population of grub and adults of *Coccinella* spp. and *Chrysoperla carnea* revealed that their population did not vary significantly. It indicates that spray of Imidacloprid 350 SC at 100, 125 and 150 ml/ha and other treatments did not cause significant adverse effect on the common natural enemies present in chilli eco-system. The data presented in Table 7 revealed that all the treatments yielded significantly higher over untreated control. The highest marketable chilli yield of 161.25 and 164.88 q/ha was recorded in case of spray of Imidacloprid 350 SC at 150 ml/ha during *Kharif,* 2013 and 2014, respectively. It was at par to spray of Imidacloprid 350 SC at 125 ml/ha which yielded 155.30 and 152.38 q/ha during *Kharif,* 2013 and 2014, respectively.

Conclusion

The experiment revealed that spray of Imidacloprid 350 SC @ 52.5 g a.i./ha (150 ml/ha) caused highest reduction of aphid, jassids and thrips in chilli and also yielded the highest marketable yield and was found at par to Imidacloprid 350 SC @ 43.75 g a.i./ha (125 ml/ha). The spray of Imidacloprid 200 SL @ 50g a.i./ha (250 ml /ha), Imidacloprid 350 SC @ 35 g a.i./ha (100 ml/ha) and Fipronil 5% SC @ 40 g a.i./ha (800 ml/ha) were found as the next effective treatment.

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