

Research Article

Bio-Efficacy of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE against Sucking Pests Infesting Brinjal

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Abstract

A field experiment was conducted to evaluate newly introduced insecticides Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE at different doses used for controlling whitefly and other sap sucking insect pests in Brinjal with standard checks Clothianidin 50% WDG and Pyriproxyfen 10% EC at Horticulture Farm, Rajasthan College of Agriculture, Udaipur during *Kharif* 2016 and *Rabi* 2017. The result of present investigation revealed that Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5+120 g a.i. /ha showed maximum mortality in whitefly and other sap sucking insect pests followed by lower dosages of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE at 3, 7, 10 and 14 DAS during both the cropping seasons and proved significantly better than other treatments. The standard checks Clothianidin 50% WDG at 25 g a.i. /ha, Pyriproxyfen 10% EC at 100 g a.i. /ha also found significantly effective to reducing sap sucking insect pests in Brinjal. During the experiment it was also observed that the new molecule Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE did not show any significantly negative effects on the population of natural enemies.

Keywords: Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE, Brinjal, Sap sucking insect pests

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Introduction

Brinjal, *Solanum melongena* L. is a common and popular vegetable grown throughout the world including India. Brinjal also known as eggplant belongs to the family Solanaceae. The major impediments in increasing brinjal production are insect pests. Among the major factors that contribute towards low productivity of brinjal, insect pest is the major cause. The incidence of major insect pests of brinjal is white fly (*Bemisia tabaci*), aphid (*Aphis gossypii*), jassid (*Amrasca biguttula biguttula*), thrips and shoot and fruit borer (*Leucinodes orbonalis* Guenee) [1]. Among them sucking insect pests inflict dual damage to brinjal i.e. direct damage by sucking plant sap and indirect damage by vectoring the disease. The leafhopper sucks the nutrient sap from the xylem and severe infestation results in crinkling of leaves, hopper burn and cupping up symptoms. Farmers spray synthetic insecticides four to six times for managing these sucking pests, resulting in the reduction of natural enemies and beneficial organisms. Even though, insect growth regulators and neonicotinoids are widely used for managing the sap sucking insect pests, very little work on their side effects on natural enemy has been carried out. The aim of present investigation was evaluate the newer insecticidal molecules against the sucking pests of brinjal.

Materials and Method

The experiment on the bio-efficacy of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE against white fly, aphid, jassid and thrips was conducted in Randomized Block Design with three replications at Horticulture Farm, Rajasthan college of agriculture, Udaipur during *Kharif*, 2016 and *Rabi* 2017. Brinjal variety Kavach was transplanted in the plots each measuring 6.0 x 3.6 m. at row to row and plant to plant spacing of 60 cm x 45 cm, respectively. The Brinjal variety Kavach was transplanted on 11th July and 20th September during *Kharif*, 2016 and *Rabi* 2017, respectively. There were 8 treatments replicated three times. The test chemical, Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE was used at three doses viz. 35+80, 44+100 and 52.5+120 g a.i. /ha. Different doses of test chemical were tested in comparison with standard check treatments viz. Clothianidin 50% WDG at 25 g a.i. /ha, Pyriproxyfen 10% EC at 100 g a.i. /ha along with untreated check. Each treatment was applied three times initiating first spray as soon as the pest population crossed the ETL level and subsequent second and third spray were given at 15 days interval.

Observations

The observation on the population of aphids jassids and thrips were recorded on three randomly tagged plants on three leaves on top, middle and lower part of the plants. The observations on the population of aphids, jassids and thrips were recorded one day before (PTP) and 3, 7, and 10 days after first, second and third spray.

The percent corrected mortality of the pests was calculated from the formula given by Henderson and Tilton [2]:

$$\text{Percent corrected mortality} = 100 \left[1 - \frac{T_a \times C_b}{T_b \times C_a} \right]$$

T_a = Number of insects after treatment, T_b = Number of insects before treatment, C_a = Number of insects in control after treatment, C_b = Number of insects in control before treatment

Results and Discussion

Bio- efficacy against aphids:

The data recorded on the aphid population for pre and post spray period during present investigation and presented in **Table 1 & 2**, revealed that the population of aphid before first, second and third spray (PTP) ranged from 2.00 to 2.89, 1.35 to 2.67 and 2.32 to 4.56; 2.17 to 3.30, 2.20 to 4.67 and 2.12 to 4.47 aphid/plant and there was no significant difference in the population of aphid among the treatments during *Kharif*, 2016 and *Rabi*, 2017, respectively. The data presented in Table 1 and 2 reveals that during *Kharif*, 2016 and *Rabi*, 2017; all the treatments were found significantly superior to untreated control.

Table 1 Bioefficacy of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE against aphids on Brinjal *Kharif*, 2016

Treatment	Mean reduction (%) in aphid population, days after spray											
	I st spray				II nd spray				III rd spray			
	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day
T ₁ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 35+80 g/ml ha ⁻¹	1.59 (2.03)	54.18 (65.75)	53.18 (64.08)	51.98 (62.06)	1.45 (1.60)	57.03 (70.39)	56.25 (69.13)	55.00 (67.11)	2.17 (4.19)	52.49 (62.92)	58.20 (72.23)	52.10 (62.26)
T ₂ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 44+100 g/ml ha ⁻¹	1.82 (2.81)	54.86 (66.87)	54.08 (65.59)	52.88 (63.58)	1.62 (2.12)	58.01 (71.93)	57.23 (70.70)	55.95 (68.66)	2.20 (4.33)	54.34 (66.02)	60.15 (75.22)	53.20 (64.12)
T ₃ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5+120 g/ml ha ⁻¹	1.72 (2.46)	57.87 (71.71)	57.07 (70.44)	55.88 (68.53)	1.78 (2.67)	61.19 (76.78)	60.35 (75.52)	59.02 (73.51)	2.14 (4.06)	55.87 (68.52)	61.13 (76.68)	54.94 (67.00)
T ₄ 50% WDG @ 25 g/ml ha ⁻¹	1.58 (2.00)	49.20 (57.30)	48.48 (56.05)	47.31 (54.03)	1.54 (1.87)	52.20 (62.43)	51.43 (61.13)	50.24 (59.10)	1.87 (3.00)	45.73 (51.28)	50.06 (58.78)	44.29 (48.76)
T ₅ Pyriproxyfen 10% EC @ 100 g/ml ha ⁻¹	1.70 (2.39)	50.67 (59.84)	49.94 (58.58)	48.77 (56.56)	1.60 (2.06)	53.68 (64.91)	52.94 (63.68)	51.73 (61.64)	1.68 (2.32)	48.12 (55.43)	52.75 (63.36)	47.54 (54.43)
T ₆ Diafenthiuron 50 WP @ 300 g/ml ha ⁻¹	1.84 (2.89)	47.81 (54.90)	47.09 (53.64)	45.93 (51.63)	1.36 (1.35)	50.75 (59.98)	50.02 (58.71)	48.85 (56.70)	1.97 (3.40)	43.87 (48.03)	48.15 (55.48)	42.97 (46.47)
T ₇ Untreated Control	1.61 (2.09)	-	-	-	1.76 (2.60)	-	-	-	2.21 (4.56)	-	-	-
SEm±	0.10	0.783	0.975	1.281	0.16	1.099	1.121	0.611	0.21	1.049	1.384	1.218
C.D. at 5%	NS	2.468	3.072	4.036	NS	3.462	3.532	1.925	NS	3.305	4.362	3.838

PTP = Pre treatment population, Figures in parenthesis are retransformed per cent value

Table 2 Bioefficacy of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE against aphids on Brinjal *Rabi*, 2017

Treatment	Mean reduction (%) in Aphid population, days after spray											
	I st spray				II nd spray				III rd spray			
	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day
T ₁ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 35 +80 g/ml ha ⁻¹	1.63 (2.17)	51.90 (61.93)	56.15 (68.98)	49.98 (58.64)	1.67 (2.33)	51.05 (60.49)	56.69 (69.84)	50.66 (59.81)	2.12 (3.99)	52.03 (62.14)	57.70 (71.45)	51.64 (61.48)
T ₂ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 44 +100 g/ml ha ⁻¹	1.89 (3.07)	53.04 (63.84)	59.84 (74.76)	51.20 (60.74)	1.72 (2.47)	52.87 (63.57)	58.54 (72.77)	51.75 (61.68)	2.15 (4.13)	53.87 (65.24)	59.63 (74.44)	52.74 (63.34)
T ₃ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5+120 g/ml ha ⁻¹	1.87 (3.00)	56.81 (70.03)	61.73 (77.57)	52.30 (62.60)	1.64 (2.20)	54.33 (66.00)	59.42 (74.12)	53.41 (64.47)	2.09 (3.86)	55.38 (67.73)	60.60 (75.89)	54.46 (66.21)
T ₄ 50% WDG @ 25 g/ml ha ⁻¹	1.86 (2.97)	44.17 (48.55)	48.14 (55.47)	43.89 (48.06)	1.87 (3.00)	44.71 (49.49)	49.07 (57.07)	43.70 (47.74)	1.82 (2.80)	45.29 (50.50)	49.60 (58.00)	43.84 (47.98)
T ₅ Pyriproxyfen 10% EC @ 100 g/ml ha ⁻¹	1.75 (2.57)	47.30 (54.01)	51.79 (61.73)	45.99 (51.73)	1.68 (2.32)	47.44 (54.25)	51.60 (61.42)	46.65 (52.89)	1.62 (2.12)	47.67 (54.65)	52.29 (62.58)	47.10 (53.65)
T ₆ Diafenthiuron 50 WP @ 300 g/ml ha ⁻¹	1.90 (3.17)	40.90 (42.87)	46.17 (52.05)	43.72 (47.77)	1.93 (3.28)	43.27 (46.99)	47.02 (53.53)	41.84 (44.50)	1.92 (3.20)	43.42 (47.25)	47.70 (54.70)	42.52 (45.67)
T ₇ Untreated Control	1.94 (3.30)	-	-	-	2.25 (4.67)	-	-	-	2.18 (4.47)	-	-	-
SEm±	0.12	0.594	1.102	1.081	0.24	0.833	0.988	0.524	0.22	1.031	1.358	1.273
C.D. at 5%	NS	1.870	3.471	3.407	NS	2.624	3.112	1.650	NS	3.249	4.279	4.010

PTP = Pre treatment population, Figures in parenthesis are retransformed per cent value

The highest mean reduction in the population of aphid was recorded from the application of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5+120 g a.i. /ha which resulted in 71.71, 70.44 and 68.53; 76.78, 75.52 and 73.51; 68.52, 76.68 and 67.00 & 70.03, 77.57 and 62.60; 66.00, 74.12 and 64.47; 67.73, 75.89 and 66.21 per cent reduction over control at 3, 7 and 10 days after first, second and third spray during *Kharif*, 2016 and *Rabi*, 2017, respectively. There was a significant difference with lower dosage of 44+100 g a.i./ha (66.87, 65.59 and 63.58; 71.93, 70.70 and 68.66; 66.02, 75.22 and 64.12 & 63.84, 74.76 and 60.74; 63.57, 72.77 and 61.68; 65.24, 74.44 and 63.34) and the application of 35+80 g a.i. (65.75, 64.08 and 62.06; 70.39, 69.13 and 67.11; 62.92, 72.23 and 62.26 & 61.93, 68.98 and 58.64; 60.49, 69.84 and 59.81; 62.14, 71.45 and 61.48) at 3, 7 and 10 days after first, second and third spray during *Kharif*, 2016 and *Rabi*, 2017, respectively and these treatments differed significantly with other treatments. The application of standard check Pyriproxyfen 10% EC at 100 g a.i. /ha and Clothianidin 50% WDG at 25 g a.i. /ha also found effective to reduce the aphid population with 59.84, 58.58 and 56.56; 64.91, 63.68 and 61.64; 55.43, 63.36 and 54.43 & 54.01, 61.73 and 51.73; 54.25, 61.42 and 52.89; 54.65, 62.58 and 53.65 per cent reduction in aphid population at 3, 7 and 10 days after first, second and third spray and 57.30, 56.05 and 54.03; 62.43, 61.13 and 59.10; 51.28, 58.78 and 48.76 & 48.55, 55.47 and 48.06; 49.49, 57.07 and 47.74; 50.50, 58.00 and 47.98 per cent reduction in aphid population at 3, 7 and 10 days after first, second and third spray, during *Kharif*, 2016 and *Rabi*, 2017, respectively. The present results are in conformity with the findings of Khan *et al.* [3] who observed that Pyriproxyfen was found effective to reducing the aphid population with 91.6 per cent reduction on brassica plants. Similarly Kai *et al.* [4] reported that Pyriproxyfen demonstrated very good efficacy in reducing the aphid population in cabbage.

Bio- efficacy against jassids

The data recorded on the jassid population for pre and post spray period during present investigation and presented in **Table 3 & 4** revealed that the population of jassids before first, second and third spray (PTP) ranged from 2.19 to

3.19, 2.19 to 3.38 and 4.45 to 6.03; 3.31 to 6.13, 3.33 to 7.81 and 4.25 to 7.63 jassid/plant and there was no significant difference in the population of jassids among the treatments during *Kharif*, 2016 and *Rabi*, 2017, respectively. The data presented in Table 3 and 4 reveals that during *Kharif*, 2016 and *Rabi*, 2017; all the treatments were found significantly superior to untreated control.

Table 3 Bioefficacy of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE against jassids on Brinjal *Kharif*, 2016

Treatment	Mean reduction (%) in Jassid population, days after spray											
	I st spray				II nd spray				III rd spray			
	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day
T ₁ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 35+ 80 g/ml ha ⁻¹	1.89 (3.07)	54.97 (67.05)	54.32 (65.98)	53.17 (64.07)	1.89 (3.07)	57.81 (71.62)	56.91 (70.19)	55.30 (67.60)	2.55 (6.03)	50.74 (59.96)	59.67 (74.50)	45.61 (51.06)
T ₂ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 44+ 100 g/ml ha ⁻¹	1.83 (2.85)	55.65 (68.16)	55.23 (67.48)	54.08 (65.58)	1.85 (2.92)	58.81 (73.18)	57.91 (71.77)	56.26 (69.15)	2.38 (5.19)	52.78 (63.41)	61.11 (76.66)	46.65 (52.88)
T ₃ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5 +120 g/ml ha ⁻¹	1.64 (2.19)	58.70 (73.01)	58.27 (72.33)	57.06 (70.43)	1.64 (2.19)	62.05 (78.03)	61.06 (76.58)	59.34 (74.00)	2.45 (5.52)	53.89 (65.27)	63.23 (79.72)	48.29 (55.73)
T ₄ Clothianidin 50% WDG @ 25 g/ml ha ⁻¹	1.64 (2.19)	49.95 (58.60)	49.58 (57.95)	48.47 (56.04)	1.71 (2.42)	52.94 (63.69)	52.05 (62.19)	50.53 (59.59)	2.39 (5.20)	44.87 (49.78)	51.24 (60.80)	42.00 (44.78)
T ₅ Pyriproxyfen 10% EC @ 100 g/ml ha ⁻¹	1.80 (2.74)	51.43 (61.13)	51.05 (60.47)	49.93 (58.56)	1.80 (2.74)	54.43 (66.16)	53.57 (64.74)	52.02 (62.13)	2.34 (5.00)	48.20 (55.58)	55.72 (68.28)	45.33 (50.58)
T ₆ Diafenthiuron 50 WP @ 300 g/ml ha ⁻¹	1.66 (2.26)	48.56 (56.19)	48.18 (55.53)	47.08 (53.63)	1.66 (2.26)	51.49 (61.23)	50.63 (59.77)	49.14 (57.19)	2.22 (4.45)	42.58 (45.78)	48.72 (56.47)	41.02 (43.08)
T ₇ Untreated Control	1.92 (3.19)	-	-	-	1.97 (3.38)	-	-	-	2.37 (5.18)	-	-	-
SEm±	0.11	0.841	1.014	0.922	0.13	1.048	1.142	0.618	0.08	0.424	0.555	0.303
C.D. at 5%	NS	2.650	3.195	2.906	NS	3.302	3.600	1.946	NS	1.335	1.749	0.956

PTP = Pre treatment population,
Figures in parenthesis are retransformed per cent value

The highest mean reduction in the population of jassid was recorded from the application of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5+120 g a.i. /ha which resulted in 73.01, 72.33 and 70.43; 78.03, 76.58 and 74.00; 65.27, 79.72 and 55.73; 62.26, 75.25 and 60.81; 68.80, 77.30 and 54.93; 64.53, 78.97 and 54.93 per cent reduction over control at 3, 7 and 10 days after first, second and third spray during *Kharif*, 2016 and *Rabi*, 2017, respectively. There was a significant difference with lower dosage of 44+100 g a.i. /ha (68.16, 67.48 and 65.58; 73.18, 71.77 and 69.15; 63.41, 76.66 and 52.88 & 57.33, 72.71 and 58.03; 60.97, 74.21 and 52.10; 62.67, 75.87 and 52.10) and the application of 35+80 g a.i. (67.05, 65.98 and 64.07; 71.62, 70.19 and 67.60; 59.96, 74.50 and 51.06 & 54.56, 69.07 and 54.64; 57.52, 72.12 and 50.28; 59.20, 73.72 and 50.28) at 3, 7 and 10 days after first, second and third spray during *Kharif*, 2016 and *Rabi*, 2017, respectively and these treatments differed significantly with other treatments. The application of standard check Pyriproxyfen 10% EC at 100 g a.i. /ha and Clothianidin 50% WDG at 25 g a.i. /ha also found effective to reduce the jassid population with 61.13, 60.47 and 58.56; 66.16, 64.74 and 62.13; 55.58, 68.28 and 50.58 & 48.86, 64.05 and 48.23; 53.72, 66.64 and 48.84; 54.80, 67.52 and 49.80 per cent reduction in jassid population at 3, 7 and 10 days after first, second and third spray and 58.60, 57.95 and 56.04; 63.69, 62.19 and 59.59; 49.78, 60.80 and 44.78 & 46.74, 59.75 and 46.96; 48.68, 61.02 and 43.75; 49.00, 60.00 and 44.00 per cent reduction in jassid population at 3, 7 and 10 days after first, second and third spray, during *Kharif*, 2016 and *Rabi*, 2017, respectively. The minimum per

cent reduction was recorded in untreated control. The present findings are in conformity with the observations of Patel [5] who recorded that Pyriproxyfen + fenprothrin 500 ml/ha was most effective to reducing the infestation of jassid in brinjal after Emamectin benzoate @ 10 g.a.i/ha.

Table 4 Bioefficacy of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE against Jassid on Brinjal *Rabi*, 2017

Treatment	Mean reduction (%) in Jassid population, days after spray											
	I st spray				II nd spray				III rd spray			
	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day
T ₁ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 35+ 80 g/ml ha ⁻¹	2.30 (4.80)	47.62 (54.56)	56.21 (69.07)	47.66 (54.64)	2.16 (4.17)	49.32 (57.52)	58.13 (72.12)	45.16 (50.28)	2.52 (5.83)	50.30 (59.20)	59.16 (73.72)	45.16 (50.28)
T ₂ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 44+ 100 g/ml ha ⁻¹	2.06 (3.73)	49.22 (57.33)	58.51 (72.71)	49.62 (58.03)	1.96 (3.33)	51.34 (60.97)	59.48 (74.21)	46.20 (52.10)	2.34 (4.99)	52.34 (62.67)	60.58 (75.87)	46.21 (52.10)
T ₃ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5 +120 g/ml ha ⁻¹	1.91 (3.31)	52.10 (62.26)	60.17 (75.25)	51.24 (60.81)	2.04 (3.66)	52.42 (62.80)	61.54 (77.30)	47.83 (54.93)	2.41 (5.32)	53.45 (64.53)	62.71 (78.97)	47.83 (54.93)
T ₄ 50% WDG @ 25 g/ml ha ⁻¹	2.35 (5.00)	43.13 (46.74)	50.62 (59.75)	43.26 (46.96)	2.38 (5.17)	44.24 (48.68)	51.37 (61.02)	41.41 (43.75)	2.34 (5.00)	44.43 (49.00)	50.77 (60.00)	41.55 (44.00)
T ₅ Pyriproxyfen 10% EC @ 100 g/ml ha ⁻¹	2.32 (4.87)	44.35 (48.86)	53.16 (64.05)	43.99 (48.23)	2.33 (4.92)	47.13 (53.72)	54.72 (66.64)	44.33 (48.84)	2.30 (4.80)	47.75 (54.80)	55.25 (67.52)	44.89 (49.80)
T ₆ Diafenthiuron 50 WP @ 300 g/ml ha ⁻¹	2.18 (4.27)	41.35 (43.65)	48.43 (55.97)	41.57 (44.02)	2.23 (4.50)	41.74 (44.32)	47.75 (54.79)	39.97 (41.27)	2.18 (4.25)	42.13 (45.00)	48.27 (55.69)	40.57 (42.30)
T ₇ Untreated Control	2.54 (6.13)	-	-	-	2.83 (7.81)	-	-	-	2.80 (7.63)	-	-	-
SEm±	0.25	0.788	1.373	0.963	0.35	0.444	1.003	0.574	0.25	1.334	0.624	0.631
C.D. at 5%	NS	2.483	4.325	3.034	NS	1.398	3.161	1.809	NS	4.202	1.966	1.989

PTP = Pre treatment population.

Figures in parenthesis are retransformed per cent value

Bio- efficacy against thrips

The data recorded on the thrips population for pre and post spray period during present investigation and presented in **Table 5 & 6** revealed that the population of thrips before first, second and third spray (PTP) ranged from 0.57 to 0.87, 0.40 to 0.81 and 1.50 to 1.95; 1.20 to 2.70, 1.34 to 3.36 and 1.30 to 3.17 thrips/plant and there was no significant difference in the population of thrips among the treatments during *Kharif*, 2016 and *Rabi*, 2017, respectively. The data presented in Table 5 and 6 reveals that during *Kharif*, 2016 and *Rabi*, 2017; all the treatments were found significantly superior to untreated control.

The highest mean reduction in the population of thrips was recorded from plots treated with Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5+120 g a.i. /ha which resulted in 74.56, 73.23 and 72.14; 79.66, 78.14 and 76.90; 70.31, 75.69 and 53.84 & 63.55, 74.44 and 68.17; 67.69, 72.43 and 52.33; 69.63, 74.88 and 53.06 per cent reduction over control at 3, 7 and 10 days after first, second and third spray during *Kharif*, 2016 and *Rabi*, 2017, respectively. There was a significant difference with lower dosage of 44+100 g a.i. /ha (69.72, 68.38 and 67.14; 74.81, 73.34 and 72.05; 67.58, 73.67 and 53.03 & 61.87, 72.10 and 63.39; 65.20, 71.18 and 50.83; 66.81, 72.89 and 52.26) and the application of 35+80 g a.i. (68.61, 66.88 and 65.64; 73.28, 71.75 and 70.50; 64.36, 72.04 and 49.98 & 58.47, 71.68 and 58.10; 62.67, 70.74 and 48.55; 63.58, 71.25 and 49.20) at 3, 7 and 10 days after first, second and third spray during *Kharif*, 2016 and *Rabi*, 2017, respectively which significantly differed with other treatments. The application of standard

check Pyriproxyfen 10% EC at 100 g a.i. /ha and Clothianidin 50% WDG at 25 g a.i./ha also found effective to reduce the thrips population with 62.68, 61.38 and 60.12; 67.79, 66.31 and 65.03; 57.76, 64.67 and 46.38 & 53.40, 68.57 and 55.73; 55.60, 63.01 and 44.37; 56.98, 63.89 and 45.60 per cent reduction in thrips population at 3, 7 and 10 days after first, second and third spray and 60.14, 58.85 and 57.60; 65.33, 63.75 and 62.49; 53.78, 61.03 and 43.04 & 50.26, 66.35 and 52.19; 52.29, 59.46 and 41.58; 53.00, 60.25 and 42.24 per cent reduction in thrips population at 3, 7 and 10 days after first, second and third spray, during *Kharif*, 2016 and *Rabi*, 2017, respectively. The minimum per cent reduction was recorded in untreated control. The present results are in conformity with the findings of Amelendu [6] who found that the clothianidin found effective to reduce the thrips population in chili crop. Patel [5] also recorded that Pyriproxifen + fenpropethrin 500 ml/ha was most effective in reducing insect pests in brinjal after Emamectin benzoate @ 10 g.a.i/ha.

Table 5 Bioefficacy of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE against thrips on Brinjal *Kharif*, 2016

Treatment	Mean reduction (%) in thrips population, days after spray											
	I st spray				II nd spray				III rd spray			
	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day
T ₁ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 35+ 80 g/ml ha ⁻¹	1.14 (0.80)	55.92 (68.61)	54.87 (66.88)	54.11 (65.64)	0.98 (0.40)	58.87 (73.28)	57.89 (71.75)	57.10 (70.50)	1.41 (1.50)	53.35 (64.36)	58.08 (72.04)	44.99 (49.98)
T ₂ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 44+ 100 g/ml ha ⁻¹	1.03 (0.57)	56.61 (69.72)	55.78 (68.38)	55.02 (67.14)	0.96 (0.43)	59.87 (74.81)	58.91 (73.34)	58.08 (72.05)	1.61 (2.10)	55.29 (67.58)	59.13 (73.67)	46.74 (53.03)
T ₃ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5 +120 g/ml ha ⁻¹	1.17 (0.87)	59.71 (74.56)	58.84 (73.23)	58.14 (72.14)	1.14 (0.80)	63.19 (79.66)	62.13 (78.14)	61.27 (76.90)	1.48 (1.70)	56.99 (70.31)	60.46 (75.69)	47.20 (53.84)
T ₄ 50% WDG @ 25 g/ml ha ⁻¹	1.09 (0.60)	50.85 (60.14)	50.10 (58.85)	49.37 (57.60)	1.14 (0.67)	53.93 (65.33)	52.98 (63.75)	52.23 (62.49)	1.70 (2.40)	47.17 (53.78)	51.37 (61.03)	41.00 (43.04)
T ₅ Pyriproxyfen 10% EC @ 100 g/ml ha ⁻¹	1.14 (0.80)	52.35 (62.68)	51.58 (61.38)	50.84 (60.12)	0.95 (0.47)	55.42 (67.79)	54.52 (66.31)	53.75 (65.03)	1.72 (2.45)	49.46 (57.76)	53.53 (64.67)	42.92 (46.38)
T ₆ Diafenthuron 50 WP @ 300 g/ml ha ⁻¹	1.05 (0.69)	49.45 (57.74)	48.70 (56.43)	47.98 (55.20)	1.08 (0.80)	52.45 (62.86)	51.55 (61.33)	50.82 (60.10)	1.95 (3.32)	43.93 (48.13)	51.16 (60.67)	38.63 (38.98)
T ₇ Untreated Control	1.11 (0.73)	-	-	-	1.14 (0.81)	-	-	-	1.94 (3.40)	-	-	-
SEm±	0.05	0.836	1.033	1.386	0.07	1.175	1.188	0.660	0.21	0.615	0.614	0.368
C.D. at 5%	NS	2.633	3.256	4.368	NS	3.702	3.745	2.079	NS	1.939	1.934	1.161

PTP = Pre treatment population. Figures in parenthesis are retransformed per cent value

Marketeable fruit yield

The data presented in **Table 7** revealed that all the treatments yielded significantly higher marketable fruit yield over untreated control.

The highest fruit yeild was recorded in highest dosage of test chemical SCPC- 835 SE @ 52.5+120 g a.i. /ha (184.33 q/ha and 183.30 q/ha) followed by its lower dosage of SCPC- 835 SE @ 44+100 (179.50 q/ha & 179.00 q/ha) and @ 35+80 g a.i. /ha (175.33 q/ha & 174.50 q/ha) during 2016-17 and 2017-18, respectively. These treatments were superior over standard check Pyriproxyfen 10% EC at 100 g a.i. /ha (163.30 q/ha & 161.50 q/ha), Clothianidin 50% WDG at 25 g a.i. /ha (160.20 q/ha & 159.20 q/ha). The lowest fruit yield was harvested from untreated control (130.20 q/ha & 130.00 q/ha) during *Kharif* 2016 and *Rabi* 2017, respectively.

Table 6 Bioefficacy of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE against thrips on Brinjal *Rabi*, 2017

Treatment	Mean reduction (%) in Thrips population, days after spray											
	I st spray				II nd spray				III rd spray			
	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day	PTP	3 day	7 day	10 day
T ₁ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 35+ 80 g/ml ha ⁻¹	1.54 (1.87)	49.88 (58.47)	57.85 (71.68)	49.66 (58.10)	1.34 (1.33)	52.34 (62.67)	57.26 (70.74)	44.17 (48.55)	1.34 (1.30)	52.88 (63.58)	57.58 (71.25)	44.54 (49.20)
T ₂ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 44+ 100 g/ml ha ⁻¹	1.54 (1.93)	51.86 (61.87)	58.11 (72.10)	52.77 (63.39)	1.56 (1.93)	53.85 (65.20)	57.53 (71.18)	45.48 (50.83)	1.55 (1.90)	54.83 (66.81)	58.63 (72.89)	46.29 (52.26)
T ₃ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE @ 52.5 +120 g/ml ha ⁻¹	1.30 (1.20)	52.86 (63.55)	59.63 (74.44)	55.65 (68.17)	1.44 (1.67)	55.36 (67.69)	58.32 (72.43)	46.34 (52.33)	1.41 (1.50)	56.56 (69.63)	59.92 (74.88)	46.76 (53.06)
T ₄ Clothianidin 50% WDG @ 25 g/ml ha ⁻¹	1.64 (2.20)	45.15 (50.26)	54.54 (66.35)	46.25 (52.19)	1.70 (2.40)	46.31 (52.29)	50.45 (59.46)	40.15 (41.58)	1.64 (2.20)	46.72 (53.00)	50.91 (60.25)	40.54 (42.24)
T ₅ Pyriproxyfen 10% EC @ 100 g/ml ha ⁻¹	1.64 (2.20)	46.95 (53.40)	55.90 (68.57)	48.29 (55.73)	1.68 (2.34)	48.22 (55.60)	52.54 (63.01)	41.77 (44.37)	1.66 (2.25)	49.01 (56.98)	53.07 (63.89)	42.48 (45.60)
T ₆ Diafenthiuron 50 WP @ 300 g/ml ha ⁻¹	1.78 (2.70)	43.04 (46.59)	51.02 (60.43)	43.66 (47.66)	1.94 (3.36)	43.09 (46.68)	49.95 (58.60)	37.56 (37.15)	1.89 (3.12)	43.48 (47.35)	50.70 (59.88)	38.17 (38.19)
T ₇ Untreated Control	1.62 (2.13)	-	-	-	1.92 (3.34)	-	-	-	1.88 (3.17)	-	-	-
SEm±	0.19	0.565	1.321	1.216	0.58	0.846	1.147	0.431	0.22	1.185	0.627	0.966
C.D. at 5%	NS	1.779	4.163	3.832	NS	2.666	3.615	1.357	NS	3.733	1.975	3.044

PTP = Pre treatment population. Figures in parenthesis are retransformed per cent value

Table 7 Effect of Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE on fruit yield of brinjal crop during *Kharif*, 2016 and *Rabi*, 2017

Treatments	Dosage/ha g/ml (a.i.)	Mean Yield/ha (Quintals)	
		2016	2017
T ₁ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE	35+80	175.33	174.50
T ₂ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE	44+100	179.50	179.00
T ₃ Pyriproxyfen 8.0 SE + Clothianidin 3.5 SE	52.5+120	184.33	183.30
T ₄ Clothianidin 50% WDG	25	160.20	159.20
T ₅ Pyriproxyfen 10% EC	100	163.30	161.50
T ₆ Diafenthiuron 50 WP	300	145.60	144.33
T ₇ Untreated Control	-	130.20	130.00

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