



Research Article

EFFICACY OF NEW INSECTICIDE MOLECULES FOR THE MANAGEMENT OF MAJOR SUCKING PESTS OF COTTON

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Abstract: An experiment was conducted at Agricultural Research Station, Sriganganagar, (SKRAU, Bikaner) to evaluate the bio-efficacy of new molecules for managing the important sucking pests of cotton viz., jassid, whitefly and thrips during the *Kharif*, 2014 and 2015. The insecticides viz., spirotetramat 150 OD (Movento 150 OD) @ 500, 600- & 700-ml ha⁻¹, imidacloprid 17.8 % SL (Confidor 17.8 SL) 125 ml ha⁻¹ and spiromesifen 240 SC (Oberon 240 SC) @ 600 ml ha⁻¹ were applied two times at ETL during both the seasons. Among all the treatments, spirotetramat 150 OD @ 700 ml ha⁻¹ was found most effective to control the jassid, whitefly and thrips while, imidacloprid 17.8 % SL @ 125 ml ha⁻¹ was least effective. The order of bioefficacy on the basis of percent reduction of jassid, whitefly and thrips over control was: spirotetramat > spiromesifen > imidacloprid. The highest seed cotton yield of 22.42 and 19.32 q ha⁻¹ was obtained from the treatment of spirotetramat 150 OD @ 700 ml ha⁻¹ during *Kharif*, 2014 and 2015, respectively.

Keywords: Spirotetramat, Spiromesifen, Jassid, Whitefly, Thrips

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Introduction

Cotton is the most important commercial cash crop of India, which have global significance. Sucking pests cause considerable losses during seedling stage, their heavy infestation reduces the crop yield to a great extent. The estimated loss due to sucking pests is up to 21.20 percent [1]. Among the sucking pests, leafhoppers *Amrasca biguttula biguttula* (Ishida), thrips *Thrips tabaci* (Linn) and whitefly *Bemisia tabaci* are major pests. Cotton growers in India heavily used synthetic insecticides to control sucking pests. Due to continuous and indiscriminate use of synthetic insecticides, resurgence, outbreak and resistance problems have been reported. To overcome with such type of problems discovery of novel substances with different mode of action are needed. Novel insecticides are effective at low doses and have less impact on the environment. The new insecticide spirotetramat 150 OD is a broad-spectrum insecticide belonging to Ketoenoles class with "spirotetramat" as active ingredient and is said to be suitable to all type of crops. In the present investigation these insecticides have been evaluated for their effectiveness against major sucking pests of cotton in comparison with imidacloprid 17.8 SL and spiromesifen 240 SC as standard checks.

Material and Methods

The field experiment was carried out to check the bio-efficacy of spirotetramat 150 OD (Movento 150 OD) on cotton crop against sucking pests of cotton during *Kharif*, 2014 and 2015 at ARS, Sriganganagar (SKRAU, Bikaner). The experiment was laid out in randomized block design including control there were six treatments and each treatment was replicated thrice with plot size of 4.05 x 6.0 m². The cotton variety RST-9 was sown on 21st May, 2014 and 19th May, 2015 during *Kharif*, 2014 and 2015, respectively. The row to row and plant to plant distance of 67.5 cm and 30 cm, respectively was maintained in both the seasons. Two applications of prescribed treatments were given at ETL by using knapsack sprayer. Pre and post treatment observations on sucking pests population viz. white fly, jassids and thrips were recorded on three leaves selected from top, mid and bottom of five randomly selected tagged plants in each plot on 3, 5 and 7

days after each spray. Seed cotton yield was also recorded at picking time. The population data were corrected by the correction factor described by [2] given as under:

$$\text{Percentage reduction} = 100 \left[1 - \frac{T_a \times C_b}{T_b \times C_a} \right]$$

Where,

T_a = Number of insects after treatment

T_b = Number of insects before treatment

C_a = Number of insects in untreated control after treatment

C_b = Number of insects in untreated control before treatment

Results and Discussion

Jassid (*Amrasca biguttula biguttula*)

The data presented in [Table-1] showed that during *Kharif*, 2014 the maximum jassid population reduction was recorded in the treatment of Spirotetramat 150 OD (Movento150 OD) @ 700 ml ha⁻¹ (77.28, 79.88 and 75.24 percent reduction at 3rd, 5th and 7th days after first spray, respectively while 77.80, 83.04 and 73.79 percent reduction at 3rd, 5th and 7th days after second spray, respectively) followed by Spirotetramat 150 OD (Movento150 OD) @ 600 ml ha⁻¹ with 76.34, 78.71 and 72.70 percent reduction at 3rd, 5th and 7th days after first spray, respectively while 75.81, 79.16 and 70.45 percent reduction at 3rd, 5th and 7th days after second spray, respectively. The treatment of Spiromesifen 240 SC (Oberon 240 SC) @ 600 ml ha⁻¹ was found next in order of effectiveness against jassid followed by Spirotetramat 150 OD (Movento150 OD) @ 500 ml ha⁻¹ and Imidacloprid 17.8 SL (Confidor 200 SL) @ 125 ml ha⁻¹ at 3rd, 5th and 7th days after first and second spray. All the treatments were found superior over control. During *Kharif*, 2015 the maximum jassid population reduction was recorded in the treatment of Spirotetramat 150 OD (Movento150 OD) @ 700 ml ha⁻¹ (73.88, 76.73 and 72.45 percent reduction at 3rd, 5th and 7th days after firsts spray, respectively while 76.01, 81.49 and 72.29 percent reduction at 3rd, 5th and 7th days after second spray,

Table-1 Bio-efficacy of new insecticide molecules against jassid on cotton during Kharif, 2014 and 2015 (First and Second spray)

S	Treatments	Dose ml/ha	Percent population reduction of jassid during <i>Kharif</i> , 2014							Percent population reduction of jassid during <i>Kharif</i> , 2015								
			Days after first spray			Mean	Days after second spray			Mean	Days after first spray			Mean	Days after second spray			Mean
			Three	Five	Seven		Three	Five	Seven		Three	Five	Seven		Three	Five	Seven	
1	Control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Spirotetramat 150 OD (Movento 150 OD)	500	67.9 (55.58)	69.03 (56.22)	62.98 (52.52)	66.63	66.05 (54.37)	69.87 (56.71)	63.19 (52.65)	66.37	63.07 (52.58)	66.84 (54.88)	61.92 (51.9)	63.94	64.03 (53.17)	67.89 (55.47)	62.1 (51.99)	64.67
3	Spirotetramat 150 OD (Movento 150 OD)	600	76.34 (60.9)	78.71 (62.51)	72.7 (58.49)	75.91	75.81 (60.63)	79.16 (62.97)	70.45 (57.09)	75.14	71.46 (57.71)	74.75 (59.86)	70.74 (57.24)	72.32	74.34 (59.67)	78.04 (62.11)	69.03 (56.18)	73.8
4	Spirotetramat 150 OD (Movento 150 OD)	700	77.28 (61.51)	79.88 (63.38)	75.24 (60.15)	77.47	77.8 (61.95)	83.04 (65.68)	73.79 (59.23)	78.21	73.88 (59.3)	76.73 (61.14)	72.45 (58.32)	74.35	76.01 (60.87)	81.49 (64.65)	72.29 (56.18)	76.6
5	Imidacloprid 17.8 SL (Confidor 200 SL)	125	67.3 (55.16)	68.99 (56.16)	62.13 (52.03)	66.14	64.29 (53.35)	68.44 (55.89)	61.71 (51.76)	64.81	62.9 (52.47)	66.51 (54.65)	59.65 (50.57)	63.02	62.55 (52.33)	67.71 (55.46)	61.38 (51.65)	63.88
6	Spiromesifen 240 SC (Oberon 240SC)	600	73.37 (58.97)	75.94 (60.67)	68.72 (56.1)	72.68	73.01 (58.76)	78.36 (62.38)	68.03 (55.92)	73.33	70.26 (57.11)	73.09 (58.9)	70 (56.68)	71.12	73.36 (58.94)	77.01 (61.35)	68.66 (55.96)	73.01
	S.E.m±		2.7	2.3	2.95	-	2.93	2.54	2.06	-	3.34	2.98	2.64	-	3.37	2.71	3.2	-
	CD at 5%		8.15	6.94	8.9	-	8.83	7.65	6.21	-	10.06	8.97	7.96	-	10.15	8.18	9.66	-

Figures in parentheses are angular transformed values

Table-2 Bio-efficacy of new insecticide molecules against whitefly on cotton during Kharif, 2014 and 2015 (First and Second spray)

S	Treatments	Dose ml/ha	Percent population reduction of whitefly during Kharif, 2014							Percent population reduction of whitefly during Kharif, 2015								
			Days after first spray			Mean	Days after second spray			Mean	Days after first spray			Mean	Days after second spray			Mean
			Three	Five	Seven		Three	Five	Seven		Three	Five	Seven		Three	Five	Seven	
1	Control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Spirotetramat 150 OD (Movento 150 OD)	500	65.04 (53.8)	68.31 (55.77)	63.07 (52.58)	65.84	63.85 (53.02)	66.11 (54.39)	61.29 (51.51)	63.75	63.43 (52.93)	66.49 (54.71)	61.22 (51.55)	63.71	61.12 (51.42)	63.76 (53.03)	59.52 (50.5)	61.47
3	Spirotetramat 150 OD (Movento 150 OD)	600	74.26 (59.51)	77.68 (61.79)	71.38 (57.66)	74.44	72.25 (58.21)	75.38 (60.26)	70.65 (57.18)	72.76	72.13 (58.19)	75.5 (60.35)	69.51 (56.52)	72.38	70.15 (56.91)	72.68 (58.5)	68.6 (55.9)	70.48
4	Spirotetramat 150 OD (Movento 150 OD)	700	76.14 (60.77)	79.72 (63.22)	73.57 (59.07)	76.47	74.28 (59.27)	77.45 (61.66)	72.64 (58.48)	74.79	74.57 (59.92)	78.22 (62.31)	71.61 (57.79)	74.8	72.41 (58.34)	75.15 (60.18)	70.59 (57.23)	72.72
5	Imidacloprid 17.8 SL (Confidor 200 SL)	125	64.72 (53.6)	68.82 (56.06)	62.72 (52.42)	65.42	63.19 (52.63)	65.03 (53.73)	60.97 (51.32)	63.06	62.31 (52.32)	66.11 (54.56)	60.89 (51.38)	63.1	60.4 (51.01)	62.92 (52.48)	58.6 (49.92)	60.64
6	Spiromesifen 240 SC (Oberon 240SC)	600	72.6 (58.5)	75.69 (60.51)	69.6 (56.59)	72.63	71.08 (57.54)	73.5 (59.08)	68.01 (55.64)	70.86	71.04 (57.5)	74.39 (59.7)	68.49 (55.85)	71.31	69.21 (56.3)	71.64 (57.88)	66.12 (54.55)	68.99
	S.E.m±		2.47	2.3	2.31	-	2.39	2.17	2.36	-	4.05	3.97	3.53	-	2.86	3.02	3.9	-
	CD at 5%		7.41	6.93	6.97	-	7.21	6.55	7.13	-	12.2	11.96	10.65	-	7.28	9.1	11.76	-

Figures in parentheses are angular transformed values

Table-3 Bio-efficacy of new insecticide molecules against thrips on cotton during Kharif, 2014 and 2015 (First and Second spray)

S	Treatments	Dose ml/ha	Percent population reduction of thrips during <i>Kharif</i> , 2014								Percent population reduction of thrips during <i>Kharif</i> , 2015							
			Days after first spray			Mean	Days after second spray			Mean	Days after first spray			Mean	Days after second spray			Mean
			Three	Five	Seven		Three	Five	Seven		Three	Five	Seven		Three	Five	Seven	
1	Control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Spirotetramat 150 OD (Movento 150 OD)	500	62.24 (52.07)	65.8 (54.2)	60.81 (51.23)	62.95	63.48 (52.81)	67.19 (55.08)	60.53 (51.07)	63.73	59.69 (50.58)	63.05 (52.58)	58.2 (49.72)	60.32	61.69 (51.79)	64.85 (53.66)	58.2 (49.71)	61.58
3	Spirotetramat 150 OD (Movento 150 OD)	600	70.63 (57.21)	74.68 (59.84)	69.01 (56.22)	71.44	71.96 (58.04)	76.3 (60.98)	68.93 (56.14)	72.4	67.43 (55.19)	71.85 (57.95)	66.65 (54.77)	68.64	69.44 (56.45)	72.43 (58.41)	65.67 (54.19)	69.18
4	Spirotetramat 150 OD (Movento 150 OD)	700	73.13 (58.8)	76.89 (61.27)	71.41 (57.66)	73.81	74.12 (59.41)	78.57 (62.41)	71.46 (57.73)	74.72	70.83 (57.38)	74.1 (59.47)	69.38 (56.5)	71.44	72.33 (58.28)	75.11 (60.07)	68.41 (55.86)	71.95
5	Imidacloprid 17.8 SL (Confidor 200 SL)	125	61.67 (51.74)	64.42 (53.38)	59.6 (50.52)	61.9	62.63 (52.33)	66.43 (54.64)	59.5 (50.47)	62.85	58.81 (50.09)	61.78 (51.87)	57.56 (49.37)	59.38	60.94 (51.33)	63.55 (52.88)	58.1 (49.65)	60.86
6	Spiromesifen 240 SC (Oberon 240SC)	600	68.8 (56.03)	72.66 (58.51)	66.46 (54.62)	69.31	69.58 (56.52)	73.64 (59.09)	66.79 (54.82)	70	66.94 (54.96)	70.95 (57.39)	65.64 (54.14)	67.84	68.22 (55.72)	71.94 (57.99)	64.2 (53.34)	68.12
	S.E.m±		2.2	2.17	2.19	-	2.22	2.35	2.59	-	3.34	3.64	4.08	-	3.05	2.82	3.81	-
	CD at 5%		6.63	6.55	6.6	-	6.68	7.09	7.8	-	10.06	10.97	12.29	-	9.2	8.51	11.49	-

Figures in parentheses are angular transformed values

Table 4 Impact of new insecticide molecules on seed cotton yield during Kharif, 2014 and 2015

SN	Treatments	Dose ml/ha	Seed cotton yield (q/ha)	
			2014	2015
1	Control	-	18.08	16.08
2	Spirotetramat 150 OD (Movento 150 OD)	500	20.02	18.02
3	Spirotetramat 150 OD (Movento 150 OD)	600	22.3	18.8
4	Spirotetramat 150 OD (Movento 150 OD)	700	22.42	19.32
5	Imidacloprid 17.8 SL (Confidor 200 SL)	125	19.84	17.61
6	Spiromesifen 240 SC (Oberon 240SC)	600	21.83	18.58
	S.E.m±		0.98	0.86
	CD at 5%		2.96	2.59

respectively) followed by Spirotetramat 150 OD (Movento 150 OD) @ 600 ml ha⁻¹ with 71.46, 74.75 and 70.74 percent reduction at 3rd, 5th and 7th days after first spray, respectively while 74.34, 78.04 and 69.03 percent reduction at 3rd, 5th and 7th days after second spray, respectively, all the treatment were found superior over control. Minimum jassid population reduction was recorded in the treatment of Imidacloprid 17.8 SL (Confidor 200 SL) @ 125 ml ha⁻¹ followed by Spirotetramat 150 OD (Movento150 OD) @ 500 ml ha⁻¹ and Spiromesifen 240 SC (Oberon 240 SC) @ 600 ml ha⁻¹ at 3rd, 5th and 7th days after first and second spray.

White Fly (*Bemisia tabaci*)

The data presented in [Table-2] revealed that during Kharif, 2014 maximum

whitefly population reduction was recorded in the treatment of Spirotetramat 150 OD (Movento150 OD) @ 700 ml ha⁻¹ (76.14, 79.72 and 73.57 percent reduction at 3rd, 5th and 7th days after first spray, respectively and 74.28, 77.45 and 72.64 percent reduction at 3rd, 5th and 7th days after second spray, respectively) while minimum whitefly population reduction was recorded in Imidacloprid 17.8 SL (Confidor 200 SL) @ 125 ml ha⁻¹ with 64.72, 68.82 and 62.72 percent reduction at 3rd, 5th and 7th days after first spray, respectively and 63.19, 65.03 and 60.97 percent reduction at 3rd, 5th and 7th days after second spray, respectively. The treatment of Spirotetramat 150 OD (Movento150 OD) @ 600 ml ha⁻¹ and Spiromesifen 240 SC (Oberon 240SC) @ 600 ml ha⁻¹ and Spirotetramat 150 OD (Movento150 OD) @ 600 ml ha⁻¹ was found in middle order of efficacy against

whitefly after first and second spray. During *Kharif*, 2015 maximum reduction in whitefly population was recorded in the treatment of Spirotetramat 150 OD (Movoento150 OD) @ 700 ml ha⁻¹ (74.57, 78.22 and 71.61 percent reduction at 3rd, 5th and 7th days after first spray, respectively and 72.41, 75.15 and 70.59 percent reduction at 3rd, 5th and 7th days after second spray, respectively) followed by Spirotetramat 150 OD (Movoento150 OD) @ 600 ml ha⁻¹ with 72.13, 75.50 and 69.51 percent reduction at 3rd, 5th and 7th days after first spray, respectively while 70.15, 72.68 and 68.60 percent reduction at 3rd, 5th and 7th days after second spray, respectively. The treatment of Spiromesifen 240 SC (Oberon 240 SC) @ 600 ml ha⁻¹ was next in order of effectiveness against whitefly with 71.04, 74.39 and 68.49 percent reduction and 69.21, 71.64 and 66.12 percent reduction at the 3rd, 5th and 7th days after first and second spray, respectively. The minimum reduction in whitefly population was recorded in the treatment of Imidacloprid 17.8 SL (Confidor 200 SL) @ 125 ml ha⁻¹ after first and second spray. All the treatments were found superior over control after both the sprays.

Thrips (*Thrips tabaci*)

During *Kharif*, 2014 [Table-3] maximum thrips population reduction was recorded in treatment of Spirotetramat 150 OD (Movoento150 OD) @ 700 ml ha⁻¹ (73.13, 76.89 and 71.41 percent reduction at 3rd, 5th and 7th days after first spray, respectively and 74.12, 78.57 and 71.46 percent reduction at 3rd, 5th and 7th days after second spray, respectively) followed by Spirotetramat 150 OD (Movoento150 OD) @ 600 ml ha⁻¹ with 70.63, 74.68 and 69.01 percent reduction at 3rd, 5th and 7th days after first spray, respectively while 71.96, 76.30 and 68.93 percent reduction at 3rd, 5th and 7th days after second spray, respectively. The treatment of Spiromesifen 240 SC (Oberon 240 SC) @ 600 ml ha⁻¹ was found next in order of effectiveness against jassid followed by Spirotetramat 150 OD (Movoento150 OD) @ 500 ml ha⁻¹ and Imidacloprid 17.8 SL (Confidor 200 SL) @ 125 ml ha⁻¹ at 3rd, 5th and 7th days after first and second spray. During *Kharif*, 2015 maximum thrips population reduction was also recorded in the treatment of Spirotetramat 150 OD (Movoento150 OD) @ 700 ml ha⁻¹ (70.83, 74.10 and 69.38 percent reduction at 3rd, 5th and 7th days after first spray, respectively and 72.33, 75.11 and 68.41 percent reduction at 3rd, 5th and 7th days after second spray, respectively) followed by Spirotetramat 150 OD (Movoento 150 OD) @ 600 ml ha⁻¹ with 67.43, 71.85 and 66.65 percent reduction at 3rd, 5th and 7th days after first spray, respectively while 69.44, 72.43 and 65.67 percent reduction at 3rd, 5th and 7th days after second spray, respectively). The treatment of Imidacloprid 17.8 SL (Confidor 200 SL) @ 125 ml ha⁻¹ gave minimum thrips population reduction followed by Spirotetramat 150 OD (Movoento150 OD) @ 500 ml ha⁻¹ and Spiromesifen 240 SC (Oberon 240SC) @ 600 ml ha⁻¹ at 3rd, 5th and 7th days after first and second spray.

Seed Cotton yield

The data presented in [Table-4] revealed that seed cotton yield was recorded significantly higher in all the insecticidal treated plots over control. Highest Seed cotton yield was recorded in the plots treated with Spirotetramat 150 OD (Movoento150 OD) @ 700 ml ha⁻¹ (22.42 q ha⁻¹) followed by Spirotetramat 150 OD (Movoento 150 OD) @ 600 ml ha⁻¹ (22.30 q ha⁻¹). During *Kharif*, 2015 the highest Seed cotton yield was recorded in the plots treated with Spirotetramat 150 OD (Movoento150 OD) @ 700 ml ha⁻¹ (19.32 q ha⁻¹) followed by Spirotetramat 150 OD (Movoento150 OD) @ 600 ml ha⁻¹ (18.80 q ha⁻¹). Superiority of spiromesifen and imidacloprid against sucking pests of cotton has been well documented by [3], [4], [5] and [6].

Application of research: It was proved that the spirotetramat is effective in mitigating sucking pest problems in cotton, which are alarming in present situation and could be included in IPM strategy of cotton. [5] and [7] also found spirotetramat as an effective treatment against major sucking pests of cotton.

Research Category: Insecticide

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Study area / Sample Collection:

Cultivar / Variety / Breed name: Cotton

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