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MANAGEMENT OF SUCKING PEST COMPLEX IN COTTON ECOSYSTEM THROUGH NEW INSECTICIDES

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ABSTRACT

Bioefficacy studies were carried out at Agricultural Research Station,RCA, Udaipur for sucking pests of cotton with BY1 02960 SL 200 (spirotetramat 200 SL) @ 150 g, 200 g and 250 g a.i./ha Imidacloprid 200 SL at 20 g a.i./ha and Thiamethoxam 25 WG at 25 g a.i./ha, Acetamiprid 20 SP at 20 g a.i./ha and Monocrotophos 36 SL 360 g a.i./ha. The population of thrips, leafhoppers, white fly and aphids was brought below ETL with three sprays during 2011 and two sprays in 2012 with different dosages of new chemicals. Significantly highest seed cotton yield of 30.45 q/ha (2011) and 29.98 q/ha (2012) was harvested with higher dosage of BY1 02960 SL 200 (spirotetramat 200 SL) @ 250 gm a.i./ha followed by the dosage @ 200 g a.i./ha.

Key words: Spirotetramat, Cotton, Sucking pests

Cotton is an important fibre crop and is grown extensively in all parts of the country for use in the Indian textile industry. Main losses in cotton production are due to its susceptibility to about162 species of insect pests and a number of diseases (Manjunath, 2004). Among the key pests of cotton are the sucking pests *viz.,* leafhopper, *Amrasca biguttula biguttula* (Ishida), aphid, *Aphis gossypii* (Glover), whitefly *Bemisia tabaci* (Gennadius) and thrips, *Thrips tabaci* (Linnman) that cause severe damage and serious threat to the crop at early stage of the crop growth and can also affect the crop stand and yield of cotton. Heavy infestation at times reduces the crop yield to the extent of 21.20 per cent (Patil, 1998 and Dhawan and Sidhu, 1986). The introduction of synthetic pyrethriods, though brought desirable control of bollworms, resulted in resurgence of sucking pests *viz,* aphids, leafhoppers, thrips and whitefly (Ajri *et al*., 1986, Patil *et al*., 1986). Many insect pests are of economic importance and do cause considerable yield loss 57–80 per cent. Cotton growers in India rely mainly on synthetic pesticides to combat sucking pests. Continuous and indiscriminate use of insecticides resulted in resistance development to these insecticides which reflects the reliability of efficacy of these insecticides. To overcome these associated problems, discovery of novel molecules are essential. New molecules are effective at lower doses and have least exposure in the environment.

Spirotetramat is one such novel insecticide, belonging to the chemical class of ketoenols and is a tetramic acid derivative effective against a wide spectrum of sucking insects including aphids (Combs and Reissig, 2008), thrips (Alston *et al.,* 2008), psyllids (Fischer, 2008), mealybugs (Varela *et al.,* 2008). Spirotetramat is a new, fully systemic and ambimobile insecticide particularly effective against a broad range of sucking pests, including aphids, whiteflies, psyllids and scales. Due to the lack of any cross–resistance to existing chemical classes of insecticides, spirotetramat is an invaluable new tool to manage insecticide resistance by pests worldwide.

Its physicochemical properties are quite different and due to its mode of action particularly juvenile stages of sucking pest insects are directly affected. The fecundity of adult whiteflies and aphids is also strongly affected. Spirotetramat exhibits an excellent systemic and translaminar efficacy, whereas its contact efficacy is rather limited. Furthermore, spirotetramat has a very good residual activity. It is important to compare the efficacy of insecticides against pests for effective pest management and to reduce the indiscriminate use of insecticides. Thus, the present study was conducted to evaluate Spirotetramat at different doses for their efficacy against sucking pest complex of cotton.

MATERIALS AND METHODS

The bio–efficacy of BYI 02960 SL 200 @ 750, 1000 and 1250 ml/ha was evaluated against aphid, jassid and whitefly in cotton during *kharif* 2011 and 2012.The experiment was conducted in randomized block design with eight treatments replicated three times at RCA, Udaipur. Cotton variety KD CHH –621(BG–II) was sown on 25 June and 19 May during 2011 and 2012, respec-

tively. Each treatment was applied three times at interval of ten days.

The observations on the population of aphid, jassids and whitefly were recorded on three top and two middle leaves per plant (5 leaves/plant) on five plants selected randomly. The observation was recorded one day before and at three, seven and ten days after each spray and mean reduction in population was calculated at 3, 7 and 10 days after each spray.

The effect of BYI 02960 SL 200 along with other treatments on natural enemies was studied by counting the population of common predatory fauna *viz.;* population of grub and adults of *Coccinella* spp. and *Chrysoperla carnea* at regular interval in each replication.

The open bolls were picked from each treatment at regular intervals. The weight of seed cotton of all pickings was pooled together for each treatment separately and yield per hectare was computed.

RESULTS AND DISCUSSION

The data recorded on mean reduction in the population of jassid at 3, 7 and 10 days after first second and third 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 jassid was recorded in case of spray of BYI 02960 SL 200 at 1250 ml/ha. It was found superior to all treatments. It caused 69.48, 82.17, 72.76; 76.55, 91.49, 85.74; 85.99, 97.44, 95.27 and 72.66, 84.97, 78.02; 75.29, 94.33, 87.79; 84.99, 98.67 and 94.75 per cent reduction of jassid at 3, 7 and 10 days after first, second and third spray during 2011 and 2012, respectively.

It was followed by BYI 02960 SL 200 at 1000 ml/ha which caused 55.83, 74.67, and 63.23; 66.59, 79.99, 72.48; 75.66, 92.86, 90.09 and 56.66, 76.32, 65.50; 70.93, 81.66, 74.75; 78.85, 92.86 and 91.42 percent reduction at 3, 7 and 10 days after first, second and third spray during 2011 and 2012, respectively. It was followed by Imidacloprid 200 SL at 100 ml/ha and Thiamethoxam 25 WG at 100 g/ha were next in order of effectiveness and were at par to each other. These two treatments caused 87.36, 84.66; 86.52, 82.99; 86.14, 81.54; 84.66 and 80.94 per cent at 7 and 10 days after third spray during 2011 and 2012, respectively. Monocrotophos 36 SL at 1000 ml/ha and lowest dose of BYI 02960 SL 200 at 750 ml/ha were found at par to each other.

The data recorded on mean reduction in the population of aphid at 3, 7 and 10 days after first second and third sprays have 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 aphid was recorded in case of spray of BYI 02960 SL 200 at 1250 ml/ha. It was found superior to all treatments. It caused 65.95, 83.80, 75.13; 72.75, 85.72, 78.78; 83.19, 97.03, 92.53 and 67.89, 81.83, 74.96; 72.00, 87.85, 76.63; 83.67, 95.61 and 93.83 per cent reduction of jassid at 3, 7 and 10 days after first, second and third spray during 2011 and 2012, respectively.

It was followed by BYI 02960 SL 200 at 1000 ml/ha which caused 60.31, 75.77, 69.34; 68.99, 78.98, 73.07; 76.38, 89.90, 83.70 and 61.50, 77.07, 67.25; 70.76, 80.52, 74.86; 79.07, 89.27 and 82.49 percent reduction at 3, 7 and 10 days after first, second and third spray during 2011 and 2012, respectively. It was followed by Imidacloprid 200 SL at 100 ml/ha and Thiamethoxam 25 WG at 100 g/ha which were next in order of effectiveness and were at par to each other. These two treatments caused 86.84, 80.96; 84.20, 79.99; 79.91, 74.66; 80.15 and 73.92 per cent at 7 and 10 days after third spray during 2011 and 2012, respectively. Monocrotophos 36 SL at 1000 ml/ha and lowest dose of BYI 02960 SL 200 at 750 ml/ha were found at par to each other.

The data recorded on mean reduction in the population of whitefly at 3, 7 and 10 days after first second and third sprays have been presented in Table 5 and 6. All the treatments were significantly better over untreated control. The data reveals that the highest reduction in the population of whitefly was recorded in case of spray of BYI 02960 SL 200 at 1250 ml/ha. It caused 69.94, 82.09, 77.44; 76.35, 90.38, 85.50; 85.65, 94.72, 90.58 and 72.55, 87.17, 79.65; 75.51, 89.36, 84.70; 89.09, 96.03 and 91.32 percent reduction of whitefly at 3,7 and 10 days after first, second and third spray during 2011 and 2012, respectively.

It was followed by BYI 02960 SL 200 at 1000 ml/ha which caused 58.64, 76.84, 68.99; 71.51, 81.39, 75.14; 76.43, 90.26, 82.77 and 60.50, 79.05, 69.73; 72.30, 84.29, 78.36; 78.16, 92.54 and 84.79 percent reduction at 3, 7 and 10 days after first, second and third spray during 2011 and 2012, respectively. It was followed by Imidacloprid 200 SL at 100 ml/ha and Thiamethoxam 25 WG at 100 g/ha were next in order of effectiveness and were at par to each other. These two treatments caused 85.23, 78.49; 88.76, 81.60; 78.70, 70.50; 79.91 and 71.31 per cent at 7 and 10 days after third spray during 2011 and 2012, respectively. Monocrotophos 36 SL at 1000 ml/ha and lowest dose of BYI 02960 SL 200 at 750 ml/ha were found at par to each other.

Spirotetramat efficacy against scale on citrus is reported to be improved with use of a super spreader adjuvant (Grafton–Cardwell 2009). The findings confirm with the results of Patil *et al*. (2003) who observed that Imidacloprid as seed treating chemical reduced sucking pest population below the economic threshold level up to 40 days after sowing and 61 days after germination (Dandale *et al.*, 2001; Murugan *et al*., 2003). The reports

Table 1. Bioefficacy of BYI 02960 200 SL against jassid, *Amrasca biguttula biguttula* in cotton during kharif 2011

S. No.	Treatments g.a.i./ha	Formulation dose g or ml/ha	PTP/ plants	Mean reduction (%) in jassid population days after								
				First spray			Second spray			Third spray		
				3DAS	7DAS	10DAS	3DAS	7DAS	10DAS	3DAS	7DAS	10DAS
1	BYI2960 SL 200 at 150g.a.i./ha	750	12.80	44.22 (48.64)	48.68 (56.40)	46.20 (52.10)	46.40 (52.54)	50.98 (60.36)	49.96 (58.62)	47.47 (54.30)	52.13 (62.32)	49.44 (57.72)
2	BYI2960 SL 200 at 200g.a.i./ha	1000	12.00	48.35 (55.83)	59.78 (74.67)	52.67 (63.23)	54.69 (66.59)	63.43 (79.99)	58.36 (72.48)	60.44 (75.66)	74.50 (92.86)	71.65 (90.09)
3	BYI2960 SL 200 at 250g.a.i./ha	1250	14.67	56.46 (69.48)	65.02 (82.17)	58.54 (72.76)	61.04 (76.55)	73.03 (91.49)	67.81 (85.74)	68.02 (85.99)	80.80 (97.44)	77.43 (95.27)
4	Imidacloprid 200SL at20g.a.i./ha	100	12.33	45.69 (51.20)	53.81 (65.14)	50.27 (59.14)	52.47 (62.88)	60.89 (76.33)	56.45 (69.45)	57.02 (70.36)	69.18 (87.36)	66.94 (84.66)
5	Acetamiprid 20 SP at20g.a.i./ha	100	15.00	45.41 (50.72)	48.05 (55.31)	45.92 (51.60)	48.05 (55.31)	57.05 (70.42)	54.13 (65.67)	54.17 (65.74)	64.57 (81.57)	60.50 (75.75)
6	Thaimethoxam 25 WG at 25g.a.i./ha	100	14.33	45.96 (51.68)	50.93 (60.27)	48.03 (55.28)	47.84 (54.95)	56.02 (68.76)	53.45 (64.54)	57.03 (70.39)	68.14 (86.14)	64.55 (81.54)
7	Monocrotophos 36 SL at 360g.a.i./ha	1000	14.67	41.95 (44.68)	48.64 (56.34)	44.79 (49.64)	45.26 (50.45)	51.03 (60.45)	48.10 (55.40)	48.32 (55.78)	55.74 (68.30)	52.39 (62.76)
8	Untreated control	–	13.67	–	–	–	–	–	–	–	–	–
	S. Em ±			0.92	1.25	1.13	1.07	1.90	1.47	1.54	2.08	2.05
	C.D. at 5%			2.78	3.80	3.49	3.25	5.75	1.45	4.67	6.32	6.21

PTP: Pre treatment population

Table 2. Bioefficacy of BYI 02960 200 SL against jassid, *Amrasca biguttula biguttula* in cotton during kharif 2012

S. No.	Treatments g.a.i./ha	Formulation dose g or ml/ha	PTP/ plants	Mean reduction (%) in jassid population days after								
				First spray			Second spray			Third spray		
				3DAS	7DAS	10DAS	3DAS	7DAS	10DAS	3DAS	7DAS	10DAS
1	BYI2960 SL 200 at 150g.a.i./ha	750	14.67	42.92* (46.38)	47.59 (54.52)	44.17 (48.56)	44.79 (49.64)	48.55 (56.18)	46.30 (52.26)	48.23 (55.62)	49.78 (58.30)	48.11 (55.42)
2	BYI2960 SL 200 at 200g.a.i./ha	1000	15.33	48.83 (56.66)	68.88 (76.32)	54.03 (65.50)	57.37 (70.93)	64.64 (81.66)	59.84 (74.75)	62.62 (78.85)	75.65 (92.86)	72.97 (91.42)
3	BYI2960 SL 200 at 250g.a.i./ha	1250	16.33	58.48 (72.66)	67.19 (84.97)	62.04 (78.02)	60.19 (75.29)	76.22 (94.33)	69.55 (87.79)	67.21 (84.99)	83.37 (98.67)	76.75 (94.75)
4	Imidacloprid 200SL at20g.a.i./ha	100	12.00	47.47 (54.30)	55.01 (67.12)	51.64 (61.48)	55.80 (68.40)	62.14 (78.16)	57.67 (71.40)	59.56 (74.33)	68.46 (86.52)	65.65 (82.99)
5	Acetamiprid 20 SP at20g.a.i./ha	100	14.33	44.40 (48.96)	48.90 (56.78)	46.65 (52.88)	49.40 (57.64)	56.62 (69.72)	53.65 (64.86)	56.04 (68.79)	63.01 (79.40)	59.59 (74.37)
6	Thaimethoxam 25 WG at 25g.a.i./ha	100	13.67	47.18 (53.80)	52.06 (62.20)	49.86 (58.45)	49.55 (57.92)	56.98 (70.30)	53.10 (63.95)	58.23 (72.27)	66.94 (84.66)	64.11 (80.94)
7	Monocrotophos 36 SL at 360g.a.i./ha	1000	14.34	41.18 (43.35)	46.63 (52.85)	43.65 (47.65)	45.75 (51.30)	50.03 (58.73)	46.83 (53.20)	47.79 (54.86)	54.27 (65.90)	51.63 (61.47)
8	Untreated control	–	14.00	–	–	–	–	–	–	–	–	–
	S. Em ±			1.01	1.46	1.17	1.19	2.33	1.56	1.56	2.18	2.26
	C.D. at 5%			3.09	4.12	3.56	3.61	7.07	4.75	4.76	6.61	6.86

PTP: Pre treatment population

Table 3. Bioefficacy of BYI 02960 200 SL against aphids, *Aphis gossypii* in cotton during kharif 2011

S. No.	Treatments g.a.i./ha	Formulation dose g or ml/ha	PTP/ plants	Mean reduction (%) in Aphid population days after								
				First spray			Second spray			Third spray		
				3DAS	7DAS	10DAS	3DAS	7DAS	10DAS	3DAS	7DAS	10DAS
1	BYI2960 SL 200 at 150g.a.i./ha	750	52.33	39.99 (41.30)	42.48 (45.60)	41.39 (43.72)	42.99 (46.50)	46.78 (53.10)	44.53 (49.18)	43.42 (47.24)	49.43 (57.70)	45.17 (50.29)
2	BYI2960 SL 200 at 200g.a.i./ha	1000	51.67	50.95 (60.31)	60.51 (75.77)	51.38 (69.34)	56.16 (68.99)	62.71 (78.98)	58.74 (73.07)	60.92 (76.38)	71.47 (89.90)	66.19 (83.70)
3	BYI2960 SL 200 at 250g.a.i./ha	1250	53.00	54.30 (65.95)	62.26 (83.80)	60.09 (75.13)	58.53 (72.75)	67.80 (85.72)	62.57 (78.78)	65.79 (83.19)	80.07 (97.03)	74.14 (92.53)
4	Imidacloprid 200SL at20g.a.i./ha	100	52.67	49.87 (58.46)	59.56 (74.33)	56.97 (70.28)	54.25 (65.87)	60.94 (76.41)	57.97 (71.88)	59.51 (74.26)	68.73 (86.84)	64.13 (80.96)
5	Acetamiprid 20 SP at20g.a.i./ha	100	46.00	47.14 (53.72)	51.47 (61.00)	49.30 (57.47)	51.79 (61.74)	57.18 (70.62)	50.14 (58.92)	52.82 (63.49)	57.79 (71.58)	54.03 (65.51)
6	Thaimethoxam 25 WG at 25g.a.i./ha	100	43.67	47.44 (54.25)	55.91 (68.58)	52.72 (63.31)	53.69 (64.94)	58.87 (73.27)	54.91 (66.95)	57.88 (71.73)	63.37 (79.91)	59.78 (74.66)
7	Monocrotophos 36 SL at 360g.a.i./ha	1000	44.00	44.01 (48.27)	46.63 (52.85)	44.19 (48.59)	45.64 (51.12)	47.71 (54.72)	45.67 (51.17)	47.45 (54.27)	52.29 (62.58)	48.59 (56.25)
8	Untreated control	–	44.67	–	–	–	–	–	–	–	–	–
	S. Em ±			0.98	1.45	1.19	1.18	1.61	1.33	1.47	1.87	2.08
	C.D. at 5%			2.99	4.41	3.63	3.58	4.87	4.02	4.46	5.67	6.31

PTP: Pre treatment population

Table 4. Bioefficacy of BYI 02960 200 SL against aphids, *Aphis gossypii* in cotton during kharif 2012

S. No.	Treatments g.a.i./ha	Formulation dose g or ml/ha	PTP/ plants	Mean reduction (%) in Aphid population days after								
				First spray			Second spray			Third spray		
				3DAS	7DAS	10DAS	3DAS	7DAS	10DAS	3DAS	7DAS	10DAS
1	BYI2960 SL 200 at 150g.a.i./ha	750	51.33	42.33 (45.35)	44.79 (49.64)	42.96 (46.45)	44.28 (48.75)	47.50 (54.36)	45.20 (50.35)	43.93 (48.14)	49.87 (58.45)	46.52 (52.65)
2	BYI2960 SL 200 at 200g.a.i./ha	1000	48.67	51.65 (61.50)	61.39 (77.07)	55.09 (67.25)	57.26 (70.76)	63.81 (80.52)	59.91 (74.86)	62.78 (79.07)	70.88 (89.27)	65.26 (82.49)
3	BYI2960 SL 200 at 250g.a.i./ha	1250	45.00	55.49 (67.89)	64.77 (81.83)	59.97 (74.96)	58.05 (72.00)	69.60 (87.85)	61.09 (76.63)	68.34 (83.67)	77.91 (95.61)	75.62 (93.83)
4	Imidacloprid 200SL at20g.a.i./ha	100	48.67	50.76 (59.98)	59.12 (73.66)	55.85 (68.49)	56.95 (70.26)	62.42 (78.57)	58.34 (72.45)	61.01 (76.51)	66.58 (84.20)	63.43 (79.99)
5	Acetamiprid 20 SP at20g.a.i./ha	100	49.00	47.74 (54.77)	52.02 (62.12)	49.81 (58.36)	51.35 (60.99)	57.66 (71.38)	51.16 (60.67)	53.94 (65.35)	58.68 (72.97)	53.74 (65.02)
6	Thaimethoxam 25 WG at 25g.a.i./ha	100	51.67	48.83 (56.66)	57.01 (70.35)	52.70 (63.28)	54.10 (65.62)	59.56 (74.34)	56.30 (69.22)	59.01 (73.49)	63.54 (80.15)	59.29 (73.92)
7	Monocrotophos 36 SL at 360g.a.i./ha	1000	45.00	43.72 (46.76)	47.21 (53.85)	45.21 (50.36)	45.76 (51.32)	48.68 56.40)	47.09 (53.65)	46.71 (52.98)	53.05 (63.86)	49.79 (58.32)
8	Untreated control	–	49.67	–	–	–	–	–	–	–	–	–
	S. Em ±			1.02	1.44	1.18	1.26	1.71	1.33	1.61	1.83	2.27
	C.D. at 5%			3.12	4.36	3.60	3.82	5.20	4.05	4.90	5.54	6.88

PTP: Pre treatment population

Table 5. Bioefficacy of BYI 02960 200 SL against whitefly, *Bemisia tabaci* in cotton during kharif 2011

S. No.	Treatments g.a.i./ha	Formulation dose g or ml/ha	PTP/ plants	Mean reduction in whitefly population days after								
				First spray			Second spray			Third spray		
				3DAS	7DAS	10DAS	3DAS	7DAS	10DAS	3DAS	7DAS	10DAS
1	BYI2960 SL 200 at 150g.a.i./ha	750	48.67	43.81 (47.92)	47.39 (54.16)	42.66 (45.92)	44.77 (49.59)	48.30 (55.74)	45.93 (51.62)	48.11 (55.41)	52.10 (62.26)	48.85 (56.70)
2	BYI2960 SL 200 at 200g.a.i./ha	1000	50.00	49.97 (58.64)	61.23 (76.84)	56.16 (68.99)	57.74 (71.51)	64.44 (81.39)	60.09 (75.14)	60.96 (76.43)	71.81 (90.26)	65.48 (82.77)
3	BYI2960 SL 200 at 250g.a.i./ha	1250	51.33	56.75 (69.94)	64.96 (82.09)	61.64 (77.44)	60.90 (76.35)	71.93 (90.38)	67.62 (85.50)	67.74 (85.65)	76.72 (94.72)	72.13 (90.58)
4	Imidacloprid 200SL at20g.a.i./ha	100	49.67	47.97 (55.17)	59.62 (74.43)	54.42 (66.14)	57.41 (70.98)	63.93 (80.69)	60.62 (75.93)	58.25 (72.32)	67.40 (85.23)	62.37 (78.49)
5	Acetamiprid 20 SP at20g.a.i./ha	100	47.00	45.17 (50.30)	50.62 (59.75)	48.38 (55.89)	46.54 (52.68)	52.77 (63.40)	50.32 (59.23)	49.87 (58.46)	57.64 (71.35)	56.57 (69.64)
6	Thaimethoxam 25 WG at 25g.a.i./ha	100	49.67	47.29 (53.99)	58.36 (72.48)	57.11 (70.52)	54.05 (65.53)	61.07 (76.60)	57.37 (70.93)	53.98 (65.42)	62.51 (78.70)	57.10 (70.50)
7	Monocrotophos 36 SL at 360g.a.i./ha	1000	50.33	44.02 (48.30)	46.78 (53.10)	42.90 (46.34)	44.74 (49.55)	47.41 (54.20)	44.21 (48.63)	48.11 (55.41)	50.99 (60.37)	50.04 (58.75)
8	Untreated control	–	51.00	–	–	–	–	–	–	–	–	–
	S. Em ±			1.05	1.50	1.26	1.30	1.89	1.51	1.60	1.97	1.87
	C.D. at 5%			3.18	4.56	3.82	3.93	5.72	4.57	4.85	5.98	5.68

PTP: Pre treatment population

Table 6. Bioefficacy of BYI 02960 200 SL against whitefly, *Bemisia tabaci* in cotton during kharif 2012

S. No.	Treatments g.a.i./ha	Formulation dose g or ml/ha	PTP/ plants	Mean reduction in whitefly population days after								
				First spray			Second spray			Third spray		
				3DAS	7DAS	10DAS	3DAS	7DAS	10DAS	3DAS	7DAS	10DAS
1	BYI2960 SL 200 at 150g.a.i./ha	750	51.33	43.07 (46.64)	47.28 (53.98)	43.95 (48.17)	45.21 (50.36)	49.53 (57.87)	46.32 (52.30)	48.65 (56.36)	51.93 (61.98)	47.44 (54.25)
2	BYI2960 SL 200 at 200g.a.i./ha	1000	49.67	51.06 (60.50)	62.76 (79.05)	6562 (69.73)	58.25 (72.30)	66.65 (84.29)	62.27 (78.36)	62.14 (78.16)	74.15 (92.54)	67.04 (84.79)
3	BYI2960 SL 200 at 250g.a.i./ha	1250	50.00	58.40 (72.55)	69.01 (87.17)	63.19 (79.65)	60.34 (75.51)	70.96 (89.36)	66.97 (84.70)	70.71 (89.09)	78.51 (96.03)	72.87 (91.32)
4	Imidacloprid 200SL at20g.a.i./ha	100	49.33	48.65 (56.35)	60.93 (76.40)	56.13 (68.94)	57.99 (71.91)	65.26 (82.48)	61.43 (77.13)	60.42 (75.64)	70.41 (88.76)	64.60 (81.60)
5	Acetamiprid 20 SP at20g.a.i./ha	100	52.67	46.52 (52.65)	51.57 (61.36)	49.70 (58.17)	47.98 (55.19)	52.57 (63.06)	49.83 (58.38)	50.93 (60.27)	56.89 (70.16)	55.79 (68.39)
6	Thaimethoxam 25 WG at 25g.a.i./ha	100	50.33	48.39 (55.91)	59.18 (73.74)	55.81 (68.42)	55.52 (67.94)	62.37 (78.50)	58.18 (72.20)	52.71 (63.30)	63.37 (79.91)	57.62 (71.31)
7	Monocrotophos 36 SL at 360g.a.i./ha	1000	49.34	44.63 (49.36)	47.54 (54.43)	42.65 (45.90)	45.56 (50.98)	48.59 (56.24)	45.99 (51.72)	47.38 (54.15)	53.65 (64.87)	51.46 (61.18)
8	Untreated control	–	20.67	–	–	–	–	–	–	–	–	–
	S. Em ±			1.05	1.66	1.30	1.25	1.98	1.53	1.66	2.42	2.16
	C.D. at 5%			3.20	5.03	3.93	3.79	6.01	4.64	5.02	7.35	6.56

PTP: Pre treatment population

on the bioefficacy of the nicotinoide molecules *viz.*, Imidacloprid, Thiamethoxam and Acetamiprid in spray and seed dressing formulation against sucking pests of cotton and other crops has been well proved (Vastrad, 2003 : Patil *et al*., 2004).

Efficacy of acetamiprid against sucking pest has been documented by Brar and Naveen (2005) wherein the chemical was effective against whitefly and obtained highest seed cotton yield. Similar report were also made by Vastard (2003).

The data recorded on the population of grub and adults of *Coccinella* spp. and *Chrysoperla carnea* revealed that their population did not vary significantly and were at par to each other in different treatments. It indicates that sprays of BYI 02960 SL 200 at 750, 1000 and 1250 ml/ha and other treatments did not cause significant adverse effects on the common natural enemies present in cotton eco–system (Table 7).

The data presented in Table 7 revealed that all the treatments yielded significantly higher over untreated control. The seed cotton yield among different treatments ranged from 23.88 to 30.45 and 23.80 to 29.98 q/ha against 21.20 and 19.98 q/ha in untreated control during kharif 2011 and 2012, respectively. The highest seed cotton yield of 30.45 and 29.98 q/ha was recorded in case of spray of BYI 02960 SL 200 @ 1250 ml/ha during kharif 2011 and 2012, respectively. It was at par to spray of BYI 02960 SL 200 at 1000 and Imidacloprid 200 SL at 100 ml/ha which yielded 28.80, 27.95, 28.60 and 28.38 q /ha during kharif 2011 and 2012, respectively.

The present findings about these new molecules are in conformity with proven results elsewhere. These chemicals would be helpful in mitigating sucking pest problem, which are alarming in present situation and could be included in IPM of cotton. Spirotetramat being altogether a new chemistry would be a more ideal insecticide.

Table 7. Effect of BYI 02960 SL 200 on natural enemies and seed cotton yield

S. No.	Treatment	Formulation dose (ml or g/ha)	Natural enemies/plant (2011–2012) (Mean of two years)				Seed cotton Yield (q/ha)	
			Coccinella spp.		Chrysoperla carnea		2011	2012
			Grub	Adult	Grub	Adult		
1	BYI2960 SL 200 at 150g.a.i./ha	750	0.89 (0.29)	0.95 (0.3)	0.89 (0.30)	0.87 (0.25)	24.65	23.80
2	BYI2960 SL 200 at 200g.a.i./ha	1000	0.86 (0.24)	0.94 (0.38)	0.88 (0.28)	0.85 (0.22)	28.80	27.95
3	BYI2960 SL 200 at 250g.a.i./ha	1250	0.88 (0.28)	0.93 (0.36)	0.88 (0.28)	0.87 (0.25)	30.45	29.98
4	Imidacloprid 200SL at20g.a.i./ha	100	0.87 (0.26)	0.95 (0.40)	0.90 (0.31)	0.86 (0.24)	28.60	28.38
5	Acetamiprid 20 SP at20g.a.i./ha	100	0.88 (0.27)	0.95 (0.40)	0.90 (0.31)	0.87 (0.25)	27.48	26.60
6	Thaimethoxam 25 WG at 25g.a.i./ha	100	0.89 (0.29)	0.93 (0.36)	0.88 (0.28)	0.85 (0.22)	26.85	28.15
7	Monocrotophos 36 SL at 360g.a.i./ha	1000	0.88 (0.28)	0.95 (0.40)	0.90 (0.31)	0.85 (0.22)	23.88	24.75
8	Untreated control	–	0.89 (0.29)*	0.94 (0.38)	0.90 (0.31)	0.86 (0.24)	21.20	19.98
	S. Em -±	–	0.006	0.008	0.007	0.007	1.36	1.27
	C.D. at 5%	–	NS	NS	NS	NS	4.12	3.85

*Figures in parenthesis are square root transformed values of population

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