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Field efficacy of newer insecticide formulation Ampligo 150 ZC against bollworm complex in cotton

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ABSTRACT : Present study investigated the bioefficacy of Ampligo 150 ZC (Chlorantraniliprole 9.3% + Lambda cyhalothrin 4.6% ZC) in cotton. Ampligo 150ZC at 37.5, 45 and 60 g a.i./ ha was highly effective in checking the larval population of *Earias* spp, *Helicoverpa armigera* and *Pectinophora gossypiella* as compared to other standard check Ampligo 150 ZC (30 g a.i./ ha), chloranatriliprole 18.5 SC @ 30 g a.i./ ha, quinalphos 25 EC @ 500 g a.i./ ha, deltamethrin 2.8 EC @ 12.5 g a.i./ ha and lambdacyhalothrin 4.9 CS @ 25 g a.i./ ha. Similarly, Ampligo 150 ZC except 30 g a.i./ ha recorded significant reduction in per cent damage on squares, bolls and loculi as compared to untreated control and standard treatments during both the years. There was no significant difference in population of natural enemies (*Chrysoperla* and spider) among the combined insecticide (Ampligo 150 ZC), standard insecticides and untreated control. Ampligo 150 ZC @ 60 g a.i./ ha recorded the lowest per cent square and boll damage at 14 DAT during *kharif,* 2011 and 2012, respectively. The lowest locule damage at harvest was also recorded in Ampligo 150 ZC @ 60 g a.i./ ha during tested period. It was however, *at par* with its lower doses @ 37.5 and 45 g a.i./ ha. Ampligo 150 ZC @ 60 g a.i./ ha was recorded the best treatment with lowest square, boll and locule damage as well as high yield in both years.

Key words : Ampligo 150ZC, bollworm complex, chlorantraniliprole (9.3%) + lambda cyhalothrin (4.6%) ZC

India is the second largest producer of cotton in the world after China and area wise it ranks first. One of the major constraints in its cultivation is the bollworms and they cause 30 to 80 per cent yield loss. Among the insect pests of cotton, spotted bollworm (*Earias* species), American bollworm (*Helicoverpa armigera)* (Hubner), pink bollworm (*Pectinophora gossypiella)* cause severe yield reduction. The cotton growers in India depend heavily on synthetic pesticides to combat pests and the crop consumes about 20 per cent of the total insecticides used in the country. However, the indiscriminate use of organophosphates, carbamates and synthetic pyrethroids has created a number of problems such as resistance and pest resurgence (Bajya *et al.,* 2010). The existing chemicals are becoming obsolete in pest management so, newer molecules have to be evaluated for their efficacy. Ampligo (chlorantraniliprole 9.3% + lambda cyhalothrin 4.6% ZC) is a newer molecule, combination of anthralinic diamide and synthetic pyrethroid present field evaluation of new combination was undertaken for the management of bollworm complex in cotton.

MATERIALS AND METHODS

Field experiments were laid at IPFT Research Farm, Gurgaon during *kharif,* 2011-2012 and 2012-13 to evaluate the bioefficacy of new formulation Ampligo 150ZC (chlorantraniliprole 9.3% + lambda cyhalothrin 4.6% ZC) against bollworms complex in randomized block design (RBD) with 9 treatments including control and was replicated thrice. Five different insecticides namely; Ampligo 150ZC at 30, 37.5, 45 and 60 g a.i./ ha, chlorantraniliprole 18.5 SC at 30 g a.i./ ha, lambdacyhalothrin 4.9 CS @ 25 g a.i. / ha, quinalphos 25 EC @ 500 g a.i./ ha, deltamethrin 2.8 EC @ 12.5 g a.i./ha were applied on non *Bt* variety RCH 317. The crop was sprayed two times based on the bollworm occurrence, at 15 days interval commencing from 60 days after sowing. Ten plants were randomly selected from each replication for larval

population bollworm complex infestation (% square damage, % boll damage) in green fruiting bodies before spraying, 7 and 14 DAT after first and second spraying and mean number of natural enemies (*Chrysoperla* and spiders) were recorded. Observations on locule damage and cotton seed yield were recorded at harvest on whole plot basis after each picking and computed to ha basis. The corrected per cent variation of pest population over control in the field population was worked out and transformed into Arc Sine value before statistical analysis.

RESULTS AND DISCUSSION

Larval population of bollworms: The larval population of *Earias* sps, *H. armigera* and *P. gossypiella* are depicted in Table 1 and 3. The incidence of *Earias* spp and *H. armigera* was observed pre treatment, 7 and 14 DAT whereas, *P. gossypiella* was observed as pre treatment and at harvest. The population of *Earias* spp during 1st year ranged from 8 - 11.33 larvae/ 10 plants before spraying. Among the various doses, Ampligo 150 ZC @ 60 g a.i./ ha recorded the lowest (2.67 and 1.67 larvae/10 plants) population of *Earias* spp on 7 and 14 DAT, respectively which was *on par* with Ampligo 150 ZC @ 45 g a.i./ ha(3.43 and 3 larvae/ 10 plants) followed by Ampligo 150 ZC @ 37.5 g a.i./ ha (4 and 3.37 larvae/ 10 plants), Ampligo 150 ZC @ 30 g a.i./ ha(4 and 3.67 larvae/ 10 plants) and standard chlorantraniliprole 18.5 SC (4.67 and 4 larvae/ 10 plants). Further all the treatments were significantly superior to untreated control (10 larvae/ 10 plants). Ampligo 150 ZC @ 60, 45, 37.5 and 30 g a.i./ ha recorded 83.3, 70, 66.3, and 63.3 per cent reduction, respectively of *Earias* spp over untreated check. (Table 1). In the 2nd year, observation of *Earias* sps on 7 DAT, Ampligo 150 ZC @ 60 g a.i./ ha(2.33 larvae/ 10 plants) which was *on par* with with Ampligo 150ZC @ 45 and 37.5 g a.i./ ha(2.47 and 3.40 larvae/ 10 plants) . Similar trend of observation was recorded even on 14 DAT. Ampligo 150 ZC @ 60.0 g a.i./ ha recorded maximum (78.33 %) reduction over untreated check (Table 3). Similar findings were recorded by Murali Bhaskaran *et al.*, (2012) on cotton crop.

The larval population of *Helicoverpa armigera* prior to first spraying were recorded 2-5.67 and 3.10-4.33 larvae/ 10 plants during both the years (2011 and 2012). All the treatments were found significantly superior to untreated control. The lowest population *H. armigera* was recorded in Ampligo 150 ZC @ 60 g a.i./ ha(0.33 and1.30 larvae/ 10 plants) which was *on par* with Ampligo 150 ZC @ 45 g a.i./ ha (1.33 and 1.50 larvae/ 10 plants) followed by Ampligo 150 ZC 37.5 g a.i./ ha (1.67 and 1.93 larvae/ 10 plants) and 30 g a.i./ ha (2 and 2.23 larvae/ 10 plants). Further Ampligo 150 ZC @ 60 g a.i./ ha recorded maximum (96.03 and 75.14%) reduction of *H. armigera* over untreated check at 14 DAT during 2011 and 2012 (Tables 1 and 3).

No larval population of *P. gossypiella* was recorded prior to first spray during 2011 and 2012. At the time of harvest *P. gossypiella* larvae was recorded on 25 randomly picked open bolls / plot and observed that all the treatments was significantly superior from untreated check. Ampligo 150 ZC @ 30, 37.5, 45 and 60 g a.i./ ha registered 65.1, 74.9, 74.9 and 89.9 per cent reduction over control (Table 1). The same trends was also reported during 2nd season. The present findings confirm to earlier report of Murali Bhaskaran *et al.*, (2012).

Per cent infestation in green fruiting bodies : The square damage before imposing treatments ranged from 37.33 - 41.40 per cent and 21.23 - 29.33 per cent / plant during 2011 and 2012. The lowest square damage was recorded in Ampligo 150ZC @ 60 g a.i./ ha(14.33%) at 14 DAT and the same trend was observed in the 2nd season (Table 2 and 4). Ampligo 150 ZC @ 60 g a.i./ ha found to be the highest (70.9 and 95.7) per cent reduction over control in both years.

The per cent boll damage prior to spray was recorded from 32.30 – 34.50 and 14.42 – 17.08/plant during both seasons. All the treatments were found significantly superior to untreated control. The lowest boll damage was

Table 1. Effect of Ampligo 150ZC (Chlorantraniliprole 9.6 % + Lambda Cyhalothrin 4.6%ZC) on larval population of bollworm complex in cotton during 2011-2012

Treatments	Dose (g a.i./ha)	Larvae/ 10 plants* *Earias* species			Larvae/ 10 plants* *Helicoverp armigera*				Larvae/ 25 bolls* *Pectinophora gossypiella*			
		PTC	7 DAT	ROC (%)	14 DAT	ROC (%)	PTC	7 DAT	ROC (%)	14 DAT	ROC (%)	PTC	At harvest	ROC (%)
Ampligo 150ZC	30	8.00 (2.91)	4.00 (2.11)	65.72	3.67 (2.00)	68.55	2.00 (1.56)	1.67 (1.46)	74.96	2.00 (1.56)	75.99	0.00 (0.71)	2.33 (1.64)	65.06
Ampligo 150ZC	37.5	8.33 (2.97)	4.00 (2.11)	65.72	3.37 (1.96)	71.12	3.00 (1.86)	1.33 (1.34)	80.05	1.67 (1.46)	79.95	0.00 (0.71)	1.67 (1.44)	74.96
Ampligo 150ZC	45	7.67 (2.86)	3.43 (1.98)	70.60	3.00 (1.81)	74.29	3.33 (1.93)	1.33 (1.34)	80.05	1.33 (1.34)	84.33	0.00 (0.71)	1.67 (1.44)	74.96
Ampligo 150ZC	60	10.00 (3.24)	2.67 (1.77)	77.12	1.67 (1.35)	85.68	3.00 (1.86)	0.33 (0.88)	95.05	0.33 (0.88)	96.03	0.00 (0.71)	0.67 (1.05)	89.95
Chlorantraniliprole 18.5SC	30	9.00 (3.06)	4.67 (2.22)	59.98	4.00 (2.11)	65.72	4.33 (2.20)	1.67 (1.46)	74.96	1.00 (1.22)	87.99	0.00 (0.71)	2.00 (1.56)	70.00
Lambda Cyhalothrin 4.9 CS	25	10.67 (3.28)	4.00 (2.10)	65.72	5.67 (2.34)	51.41	4.33 (2.19)	4.00 (2.11)	40.02	4.67 (2.27)	43.93	0.00 (0.71)	1.67 (1.46)	74.96
Quinalphos 25 EC	500	9.00 (3.07)	4.33 (2.19)	62.89	6.00 (2.53)	48.48	5.00 (2.34)	3.00 (1.86)	55.02	3.00 (1.86)	63.98	0.00 (0.71)	3.33 (1.93)	50.00
Deltamethrin 2.8 EC.	12.5	11.00 (3.36)	4.33 (2.18)	62.89	5.67 (2.46)	51.41	5.67 (2.48)	5.67 (2.34)	14.99	6.33 (2.61)	24.00	0.00 (0.71)	2.33 (1.64)	65.06
Untreated check		11.33 (3.44)	9.00 (3.06)		10.00 (3.23)		4.33 (2.15)	6.67 (2.67)		8.33 (2.91)		0.00 (0.71)	6.67 (2.62)	
SEm+		0.27	0.26		0.40		0.33	0.28		0.23			0.30	
CD(p=0.05)		NS	0.78		1.19		NS	0.85		0.68			0.89	

PTC= Pre treatment count: DAT= Days after treatments; ROC= Reduction over control; * Mean of two sprays, Values in parentheses are "x+0.5 transformed values

Table 2. Bio efficacy of Ampligo 150ZC (Chlorantraniliprole 9.6 % + Lambda Cyhalothrin 4.6%ZC) on bollworm complex in cotton during *Kharif* 2011-2012.

Treatments	Dose (g a.i./ha)	Square damage** (%)			Boll damage** (%)			Locule damage at harvest** (%)	Population of natural enemies*		Yield (q/ha)
		PTC	7DAT	14DAT	PTC	7DAT	14DAT		*Chrysoperla*	Spiders	
Ampligo 150ZC	30	37.78 (37.94)	34.50 (35.97)	29.37 (32.83)	34.28 (35.85)	25.70 (30.46)	28.07 (32.01)	27.73 (31.76)	1.03 (1.23)	2.83 (1.82)	11.10
Ampligo 150ZC	37.5	39.16 (38.76)	19.53 (26.21)	16.37 (23.89)	34.50 (35.97)	19.13 (25.92)	19.80 (26.42)	20.53 (26.92)	0.80 (1.14)	2.63 (1.73)	14.45
Ampligo 150ZC	45	37.33 (37.64)	17.83 (24.95)	15.97 (23.58)	32.30 (34.63)	16.13 (23.66)	17.13 (24.43)	17.13 (24.43)	0.58 (1.03)	2.63 (1.71)	14.60
Ampligo 150ZC	60	40.00 (39.23)	17.50 (24.73)	14.33 (22.22)	33.93 (35.61)	14.30 (22.22)	15.97 (23.58)	16.63 (24.04)	0.75 (1.11)	2.72 (1.78)	15.17
Chlorantraniliprole 18.5 SC	30	38.27 (38.23)	35.37 (36.51)	32.77 (34.94)	33.60 (35.43)	26.43 (30.92)	29.37 (32.83)	30.33 (33.40)	0.62 (1.07)	2.82 (1.85)	11.07
Lambda Cyhalothrin 4.9 CS	25	40.20 (39.35)	34.47 (35.97)	30.37 (33.46)	34.27 (35.85)	28.13 (32.01)	32.03 (32.03)	32.40 (34.70)	0.72 (1.09)	2.52 (1.63)	12.13
Quinalphos 25 EC	500	38.37 (38.29)	25.30 (30.20)	22.03 (27.97)	32.43 (34.70)	20.13 (26.64)	22.23 (28.11)	23.37 (28.93)	0.80 (1.14)	2.91 (1.87)	12.17
Deltamethrin 2.8 EC.	12.5	41.40 (40.05)	34.70 (36.09)	28.33 (32.14)	33.93 (35.61)	23.80 (29.20)	27.33 (31.50)	27.33 (31.50)	0.85 (1.17)	2.60 (1.69)	9.63
Untreated check		39.20 (38.76)	46.97 (43.28)	49.20 (44.54)	37.27 (37.64)	46.83 (43.17)	48.50 (44.14)	49.70 (44.83)	1.21 (1.24)	2.85 (1.85)	7.20
SEm+		1.10	1.31	0.95	1.17	1.90	1.69	1.35	0.07	0.10	0.62
CD(p=0.05)		NS	3.93	2.84	NS	5.69	5.05	4.06	NS	NS	1.85

PTC= Pre treatment count: DAT= Days after treatments; Mean of two sprays, *Values in parentheses are "x+0.5 transformed value, ** Arc Sine "Percentage transformation

Table 3. Effect of Ampligo 150ZC (Chlorantraniliprole 9.6 % + Lambda Cyhalothrin 4.6%ZC) on larval population of bollworm complex in cotton during 2012-2013

Treatments	Dose (g a.i./ha)	Larvae/ 10 plants*											Larvae/ 25 bolls *Pectinophora gossypiella**	
		Earias species					*Helicoverpa armigera*							
		PTC	7 DAT	ROC (%)	14 DAT	ROC (%)	PTC	7 DAT	ROC (%)	14 DAT	ROC (%)	PTC	At harvest	ROC (%)
Ampligo 150ZC	30	9.00(3.08)	6.33 (2.61)	35.40	5.33(2.40)	42.25	3.10(1.88)	2.30 (1.66)	49.22	2.23 (1.64)	57.36	0.00(0.71)	1.77(1.49)	62.57
Ampligo 150ZC	37.5	8.00(2.87)	3.40 (1.97)	65.30	2.73(1.75)	70.42	3.77(2.06)	2.13 (1.62)	52.98	1.93 (1.56)	63.09	0.00(0.71)	1.63(1.46)	65.53
Ampligo 150ZC	45	8.67(3.01)	2.47 (1.72)	74.79	2.50(1.72)	72.91	3.57(2.01)	1.93 (1.54)	57.39	1.50 (1.41)	71.31	0.00(0.71)	1.57(1.43)	66.80
Ampligo 150ZC	60	10.20(3.24)	2.33 (1.66)	76.22	2.00(1.57)	78.33	3.13(1.90)	1.63 (1.46)	64.01	1.30 (1.34)	75.14	0.00(0.71)	1.10(1.26)	76.74
Chlorantraniliprole 18.5SC	30	10.37(3.29)	7.33 (2.77)	25.20	6.17(2.52)	33.15	3.20(1.92)	2.43 (1.71)	46.35	1.97 (1.56)	62.33	0.00(0.71)	2.30(1.66)	51.37
Lambda Cyhalothrin 4.9 CS	25	9.93(3.22)	4.50 (2.23)	54.08	3.37(1.93)	63.48	3.33(1.96)	2.70 (1.77)	40.39	2.50 (1.73)	52.19	0.00(0.71)	1.83(1.53)	61.31
Quinalphos 25 EC	500	8.70(3.01)	4.90 (2.30)	50.00	4.23(2.15)	54.17	4.00(2.11)	3.43 (1.97)	24.28	3.30 (1.91)	36.90	0.00(0.71)	2.77(1.74)	41.43
Deltamethrin 2.8 EC.	12.5	11.38(3.44)	4.27 (2.15)	56.42	3.83(2.03)	58.50	4.33(2.15)	4.17 (2.16)	7.94	3.77 (2.06)	27.91	0.00(0.71)	2.73(1.79)	42.28
Untreated check		9.47(3.14)	9.80 (3.20)		9.23(3.10)		4.00 (2.08)	4.53 (2.23)		5.23 (2.38)		0.00(0.71)	4.73(2.28)	
SEm+		0.28	0.24		0.32		0.21	0.17		0.18			0.20	
CD(p=0.05)		NS	0.71		0.96		NS	0.50		0.52			0.59	

PTC= Pre treatment count: DAT= Days after treatments; ROC= Reduction over control; Mean of two sprays
*Values in parentheses are "x+0.5 transformed values

Table 4. Bio efficacy of Ampligo 150 ZC (Chlorantraniliprole 9.6 % + Lambda Cyhalothrin 4.6%ZC) on bollworm complex in cotton during 2012-2013.

Treatments	Dose (g a.i./ha)	Per cent square damage**			Per cent boll damage**			Locule damage at harvest** (%)	Population of natural enemies*		Yield (q/ha)
		PTC	7DAT	14DAT	PTC	7DAT	14DAT		*Chrysoperla*	Spiders	
Ampligo 150ZC	30	25.97 (30.66)	10.74 (19.09)	7.74 (16.11)	15.38 (23.11)	6.20 (14.42)	6.90 (15.23)	15.75 (23.42)	0.93 (1.19)	1.27 (1.31)	12.69
Ampligo 150ZC	37.5	23.89 (29.27)	8.80 (17.26)	3.03 (9.98)	16.83 (24.20)	4.10 (11.68)	4.40 (12.11)	12.11 (20.36)	0.83 (1.15)	1.17 (1.29)	16.63
Ampligo 150ZC	45	22.87 (28.59)	8.73 (17.16)	2.53 (9.10)	14.42 (22.30)	3.85 (11.39)	4.18 (11.83)	10.13 (18.53)	0.70 (1.09)	1.00 (1.20)	17.10
Ampligo 150ZC	60	28.80 (32.46)	8.00 (16.43)	1.58 (7.27)	16.08 (23.66)	3.77 (11.24)	3.43 (10.63)	9.01 (17.46)	0.73 (1.11)	1.07 (1.25)	17.59
Chlorantraniliprole 18.5 SC	30	29.33 (32.77)	13.07 (21.22)	8.13 (16.54)	15.52 (23.19)	7.88 (16.32)	8.88 (17.36)	17.13 (24.43)	0.81 (1.14)	1.14 (1.27)	11.29
Lambda Cyhalothrin 4.9 CS	25	21.23 (27.42)	13.97 (21.97)	7.50 (15.89)	14.59 (22.46)	8.23 (16.64)	8.93 (14.42)	19.10 (25.92)	0.85 (1.16)	1.02 (1.23)	12.47
Quinalphos 25 EC	500	23.70 (29.13)	14.83 (22.63)	6.70 (15.00)	16.27 (23.81)	5.83 (13.94)	6.16 (14.42)	12.80 (20.96)	0.83 (1.15)	0.89 (1.18)	12.65
Deltamethrin 2.8 EC.	12.5	29.23 (32.71)	13.83 (21.81)	8.07 (16.54)	17.08 (24.43)	7.58 (16.00)	8.02 (16.42)	16.89 (24.27)	0.90 (1.16)	1.07 (1.25)	10.36
Untreated check		26.37 (30.92)	29.93 (33.15)	36.37 (37.11)	15.78 (23.42)	25.88 (30.59)	31.16 (33.96)	39.35 (38.88)	0.87 (1.17)	0.97 (1.21)	8.82
SEm+		4.81	1.64	1.40	3.54	1.23	1.48	1.51	0.09	0.12	1.26
CD(p=0.05)		NS	4.92	4.19	NS	3.69	4.45	4.52	NS	NS	3.78

PTC= Pre treatment count: DAT= Days after treatments; Mean of two sprays, *Values in parentheses are "x+0.5 transformed values, ** Arc Sine " Percentage transformation

recorded in Ampligo 150 ZC @ 60 g a.i./ ha (15.97 and 3.43 / plant) which was *on par* with Ampligo 150 ZC @ 45 g a.i./ ha (17.13 and 4.18 / plant) (Tables 2 and 4). Further, Ampligo 150 ZC @ 60 g a.i./ ha recorded maximum (67.1 and 89.0%) reduction over control in both the years. Similar, results were reported by Murli Bhaskaran *et al.*, (2012).

Per cent infestation of locule damage at harvest : In the first season, the lowest locule damage, was observed in plots sprayed with Ampligo 150ZC @ 60 g a.i./ ha (16.63%) followed by Ampligo 150ZC at 45 and 37.5g a.i./ ha (17.17 % and 20.53 %). The highest damage among the treatments was observed in lambda cyhalothrin 4.9 CS (32.40%). Per cent reduction in locule damage was maximum in plots treated with Ampligo 150ZC at 60g a.i./ ha (66.5%) followed by Ampligo 150ZC @ 45g a.i./ ha (65.5%) over untreated control. The same trend of locule damage and per cent reduction over control was observed in 2nd season.

Effect on natural enemies: A non significant difference was recorded on natural enemies *viz., Chrysoperla* and spiders as compared to untreated check during both the seasons.

Yield: Data presented in Table 2 and Table 4 revealed the significant differences among the treatments were observed. In both seasons, the highest yield of 15.17 and 17.59 q/ ha were obtained in plots treated with Ampligo 150ZC @ 60g a.i./ ha which was *on par* with Ampligo 150ZC @ 45 g a.i./ ha (14.60 and 17.10 q/ha) and 37.5 g a.i./ ha (14.45 and 16.63 q/ ha). A similar findings were recorded by Murali Bhaskaran *et al.*, (2012), (Patil *et al.*, 2004) and (Vadodaria *et al.,* 2001).

It may be concluded that Ampligo 150ZC at 37.5 g a.i./ ha or above doses showed good efficacy against bollworm complex and also recorded higher yield. Thus, Ampligo 150ZC could be deployed for effective pest management.

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