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BIOEFFICACY OF LAMBDA CYHALOTHRIN 4.9 C AGAINST CHILLI THRIPS & FRUIT BORERS

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ABSTRACT
Lambda cyhalothrin 4.9 CS was tested in the field of Sagar Island of Sundarban, West Bengal at four dose levels (12.5, 15, 20 and 25 g a.i/ha) against the chilli thrips and chilli fruit borer in pre-*kharif* season of two consecutive years, 2010 and 2011. Two standard check fipronil 5% SC @ 50g a.i/ha and spinosad 48 SC @ 80 g a.i/ha along with an untreated check were also taken for comparison. Lowest average score of thrips (0.75 and 1.19 in two years) were recorded in lambda cyhalothrin 4.9 CS @ 25 g a.i./ha treated plots. Average no. of *Spodoptera* larvae per plant were also lowest (1.94 & 2.01) in this treatment. The highest yield was recorded from lambda cyhalothrin 4.9 CS @ 25 g a.i./ha treated plots (62.33 and 61.06 q/ha). Lambda cyhalothrin 4.9 CS @ 25 g a.i./ha reduces the population of *Menochilus* sp. to the tune of 20.82% and 0.84 % while population of *Chrysoperla* sp. was reduced to 9.03% and 1.89% only in the respective year of studies.

INTRODUCTION

Chilli, *Capsicum annum* L. is an important spice and vegetable crop of India. The productivity of chilli is very low due to several factors among which insect and mite pests are most destructive (Tatagar *et al.,* 2009). Thrips, *Scirtothrips dorsalis* Hood is an important sucking pest of chilli (Dey *et al.,* 2001, Meena *et al.*, 2013) that inflicts yield loss of over 50 per cent in the event of serious infestation. On the other hand, damage caused by fruit borers *viz., Spodoptera litura* (Fb.) and *Helicoverpa armigera* (Hubner) during flowering and fruit formation may leads to 90 per cent flower and fruit drop in chilli (Reddy and Reddy, 1999). But in West Bengal incidence of *Helicoverpa armigera* (Hubner) on chilli is relatively less. Due to continuous use most of the recommended chemicals are now failing to reduce the incidence of these pests (Tatagar *et al.*, 2014). Many insecticides used to control these pests also have adverse effects on natural enemies and pollinators. Therefore, it is necessary to evaluate these insecticides for their safety to natural enemies before incorporating in the IPM programme.

Lambda cyhalothrin belonging to the synthetic pyrethroid group reported to control a wide spectrum of insect pests, *viz.,* aphids, colorado beetles, thrips, lepidopteran larvae, coleopteran larvae and adults etc. in cereals, ornamentals, potatoes, vegetables, cotton and other crops (Gough and Wilkinson 1984, Jutsum *et al.,* 1984 and O'Connor, 1996). Lambda cyhalothrin with a new formulation, Capsule Suspension (CS) has recently been introduced in Indian market. The product is based on microencapsulation technology which encloses the liquid active ingredient in a polymer shell to provide protection against hostile environmental conditions and to eliminate the EC formulation considering human and environmental toxicity profile.

Considering all these facts, the present study was undertaken with the objective to evaluate the lambda cyhalothrin 4.9 CS for the management of thrips and fruit borer of chilli and its effect on some important natural enemies in chilli ecosystem.

MATERIALS AND METHODS

Field experiments were conducted at Sagar Island of Sundarban, West Bengal in two consecutive years during pre-*kharif* (February - May), 2010 and 2011. Experiments were laid out following randomized block design with seven treatments and three replications. Bullet, a high yielding variety of chilli, was selected for the experiments and was raised in 25 sq m. plots with 45×45 cm spacing. All recommended agronomic practices were followed to maintain a good crop. Lambda cyhalothrin 4.9 CS at different dosages along with Fipronil 5 % SC and Spinosad 48 SC were applied thrice at an interval of ten days against the pests commencing at ETL (5-7 thrips/leaf and 3-4 *Spodoptera* larvae/plant). The population of *Helicoperva* was almost negligible. Therefore, no attempt was made to study its effect on damage.

Observations were recorded by counting the number of motile stages of thrips / 10 random leaves from apical portion (Seal *et al.*, 2006) of five random plants / plot before application as

well as on 1st, 3rd, 7th & 10th day after each application. Then the number was put in 0-4 scale scoring following (0) Nil; (1) 1-5; (2) 6-20; (3) 21-100 & (4) >100 no. motile stages of thrips. To estimate the population of numbers of *Spodoptera* larvae per plant "Direct visual counting method" was used (Jat and Ameta, 2013). For natural enemies, percent reduction or increase (+) of important predators i.e. *Menochilus* sp. & *Chrysoperla* sp. was worked out based on their number on ten random leaves selected out of five random plants. Observations on the incidence of natural enemies were taken on 10th day after each application. Yield of different plot were also recorded. Statistical analysis of all the recorded data were subjected to analysis of variance after necessary transformation in randomized block design with the procedure followed by Panse and Sukhatme (1984).

RESULTS AND DISCUSSION

Effect of different treatment schedule on the incidence of thrips and fruit borer and the yield of the crop during February - May, 2010 has been presented in the Table 1 and 2. The results indicated that lambda cyhalothrin 4.9 CS @ 25 g a.i/ ha has given superior control over motile stages of thrips followed by fipronil 5% SC @ 50g a.i/ ha, lambda cyhalothrin 4.9 CS @ 20 g a.i/ha and spinosad 48 SC @ 80 g a.i/ha. The incidence of *Spodoptera* recorded at different days after spraying revealed that lambda cyhalothrin 4.9 CS @ 25 g a.i/ ha has given superior control of *Spodoptera* followed by spinosad 48 SC @ 80 g a.i/ ha, lambda cyhalothrin 4.9 CS @ 20 g a.i/ha and lambda cyhalothrin 4.9 CS @ 15 g a.i/ha. Fipronil 5% SC @ 50g a.i./ ha was found to be least effective in reducing the incidence of fruit borer. Significantly superior yield was also recorded in case of lambda cyhalothrin 4.9 CS @ 25 g a.i/ ha treatment. The result of the second year study presented in the Table-3 & 4 which also revealed the same trend of efficacy as in the case of first year. Among all the treatments lambda cyhalothrin 4.9 CS @ 25 g a.i/ha recorded least number of thrips and *Spodoptera* consistently throughout the study period. Yield was also highest in this treatment.

It was also observed in both the seasons that lambda cyhalothrin 4.9% CS was relatively soft on the two important predators, *Menochilus* sp. and *Chrysoperla* sp. in comparison to fipronil 5% SC. But even at the highest dose of lambda cyhalothrin (25 g a.i./ha) reduction of the natural enemies was lower than fipronil 5% SC. Spinosad was equally safe or in some cases safer than lambda cyhalothrin 4.9% CS against the natural enemies.

It is evident from the present experiment that the incidence of thrips and *Spodoptera* on chilli were significantly lower in the treated plots than that of control plots. Among the different doses, lambda cyhalothrin 4.9 CS @ 25 g a.i/ ha treated plots recorded the lowest infestation of both the thrips and *Spodoptera* in chilli and thereby recorded highest yield. The superior control of thrips and *Spodoptera* shown by lambda cyhalothrin 4.9 CS @ 25 g a.i/ ha over other doses may be attributed to the presence of more of the active ingredient. Our findings are in line with the findings of Badii *et al.*(2013) who reported that lambda cyhalothrin can be used for effective pest control including flower thrips in cowpea. Our findings are also supported by Duraimurugan *et al.* (2004) who

Table 1: Effect of Lambda cyhalothrin 4.9 CS on incidence of *Thrips* on chilli during Feb – May, 2010 at Sagar, Sundarban, West Bengal (Mean of three replications)

Sl.	Treatment	Dose(g a. i. ha)	Scoring of chilli thrips (0-4 scale) on different days														Mean of three sprays
			Before application	Days after 1st spray				Days after 2nd spray				Days after 3rd spray					
				1st	3rd	7th	10th	1st	3rd	7th	10th	1st	3rd	7th	10th		
1.	Lambdacyhalothrin 4.9% CS	12.5	1.66	1.33(1.15)*	1.59(1.27)	1.89(1.37)	2.46(1.57)	1.86(1.36)	2.10(1.45)	2.49(1.58)	2.79(1.67)	2.15(1.47)	2.49(1.58)	2.73(1.65)	2.94(1.71)		2.99(2.32)
2.	Lambdacyhalothrin 4.9% CS	15	1.33	1.08(1.04)	1.44(1.21)	1.69(1.30)	1.92(1.39)	1.56(1.25)	1.83(1.35)	2.40(1.55)	2.64(1.62)	1.32(1.15)	1.53(0.96)	1.83(1.35)	2.46(1.57)		1.81(2.16)
3.	Lambdacyhalothrin 4.9% CS	20	1.06	0.84(0.92)	1.05(1.01)	1.33(1.15)	1.59(1.26)	0.99(0.99)	1.29(1.14)	1.50(1.22)	1.65(1.28)	0.72(0.85)	0.96(0.98)	1.23(1.11)	1.47(1.21)		1.12(1.09)
4.	Lambdacyhalothrin 4.9% CS	25	1.66	0.66(0.81)	0.84(0.92)	0.99(0.99)	1.20(1.09)	0.72(0.87)	0.82(0.91)	1.08(1.03)	1.29(1.14)	0.54(0.73)	0.66(0.81)	0.75(0.87)	0.99(0.99)		0.75(0.93)
5.	Fipronil 5 % SC	50	1.06	0.69(0.83)	0.99(0.99)	1.29(1.14)	1.59(1.26)	0.93(0.96)	1.05(1.02)	1.29(1.08)	1.47(1.21)	0.78(0.88)	0.87(0.93)	1.03(1.01)	1.14(1.07)		1.09(1.03)
6	Spinosad 48 SC	80	1.33	0.99(0.99)	1.59(1.26)	1.75(1.32)	1.92(1.39)	1.29(1.14)	1.50(1.22)	1.59(1.26)	1.80(1.34)	1.05(1.02)	1.27(1.13)	1.56(1.25)	1.65(1.28)		1.49(1.22)
7.	Untreated control (water spray)	-	1.66	1.89(1.35)	2.13(1.46)	2.46(1.57)	2.64(1.63)	2.73(1.65)	2.82(1.68)	2.94(1.71)	3.03(1.75)	3.14(1.77)	3.33(1.82)	3.42(1.85)	3.30(1.82)		2.82(1.67)
	CD at 5 %		N.S.	0.12	0.06	0.09	1.14	0.05	0.07	0.11	0.09	0.12	0.11	0.12	0.08		0.18

N.B.:- N.S. - Not significant; *Figures in parentheses are square root transformed values.

Table 2: Effect of Lambda cyhalothrin 4.9 CS on incidence of *Spodoptera* on chili during Feb–May, 2010 at Sagar Island, Sundarban, West Bengal (Mean of three replications)

Sl. No.	Treatments	Dose (g a.i. /ha)	Before application	No. of Spodopteran larvae/ Plant on various days Days after 1st spray 1st	3rd	7th	10th	Days after 2nd spray 1st	3rd	7th	10th	Days after 3rd spray 1st	3rd	7th	10th	Mean of three sprays	Yield/ ha (q)
1.	Lambdacyhalothrin 4.9% CS	12.5	4.33	2.88(1.86)	3.18(1.80)	3.54(1.87)	3.78(1.94)	2.70(1.64)	2.94(1.71)	3.33(1.82)	3.66(1.90)	2.62 (1.61)	2.82 (1.69)	3.03 (1.74)	3.15 (1.79)	3.13(1.84)	57.06
2.	Lambdacyhalothrin 4.9% CS	15	4.66	2.76(1.66)	2.97(1.67)	3.27(1.81)	3.66(1.92)	2.52(1.59)	2.73(1.65)	2.94(1.71)	3.15(1.78)	2.48 (1.58)	2.64 (1.62)	2.73 (1.65)	2.88 (1.70)	2.59(1.69)	58.66
3.	Lambdacyhalothrin 4.9% CS	20	5.06	2.19(1.48)	2.49(1.58)	2.76(1.67)	3.03(1.75)	1.92(1.39)	2.16(1.47)	2.49(1.58)	2.88(1.70)	1.68 (1.30)	1.77 (1.32)	1.89 (1.35)	2.02 (1.41)	2.27(1.50)	60.06
4.	Lambdacyhalothrin 4.9% CS	25	4.66	1.80(1.34)	2.04(1.44)	2.52(1.50)	2.70(1.66)	1.50(1.23)	1.74(1.32)	2.19(1.48)	2.64(1.63)	1.29 (1.12)	1.38 (1.15)	1.68 (1.27)	1.89 (1.35)	1.94(1.37)	62.33
5.	Fipronil 5 % SC	50	5.06	2.94(1.70)	3.27(1.79)	3.66(1.91)	3.99(1.98)	2.79(1.66)	3.03(1.73)	3.33(1.81)	3.84(1.95)	2.64 (1.64)	2.79 (1.69)	3.12 (1.78)	3.33 (1.84)	3.22(1.79)	55.66
6	Spinosad 48 SC	80	4.66	1.92(1.39)	2.16(1.47)	2.46(1.56)	2.85(1.69)	1.62(1.28)	1.89(1.37)	2.22(1.49)	2.70(1.65)	1.38 (1.16)	1.47 (1.20)	1.83 (1.34)	1.98 (1.39)	2.04(1.41)	60.33
7.	Untreated control (water spray)	-	4.33	5.79(2.39)	5.97(2.44)	6.66(2.57)	7.29(2.68)	7.42(2.72)	7.84(2.82)	8.04(2.83)	8.43(2.88)	9.03 (3.02)	9.33 (3.06)	9.63 (3.12)	9.99 (3.18)	7.95(2.81)	43.66
	CD at 5 %		N.S.	0.13	0.12	0.05	0.09	0.08	0.12	0.09	0.06	0.09	0.04	0.06	0.04	0.08	1.65

N.B.:- N.S. - Not significant; Figures in parentheses are square root transformed values.

Table 3: Effect of Lambda cyhalothrin 4.9 CS on incidence of *Thrips* on chilli during Feb – May, 2011 at Sagar, Sundarban, West Bengal (Mean of three replications)

Sl. No.	Treatments	Dose (g a.i./ ha)	Before application	Scoring of chilli thrips (0-4 scale) on different days Days after 1st spray 1st	3rd	7th	10th	Days after 2nd spray 1st	3rd	7th	10th	Days after 3rd spray 1st	3rd	7th	10th	Mean of three sprays
1.	Lambdacyhalothrin 4.9% CS	12.5	2.06	1.53(1.24)	1.83(1.35)	2.04(1.43)	2.16(1.47)	1.74(1.32)	1.89(1.37)	2.13(1.46)	2.34(1.53)	2.22(1.49)	2.34(1.53)	2.82(1.68)	3.99(2.00)	2.25(1.40)
2.	Lambdacyhalothrin 4.9% CS	15	1.66	1.44(1.20)	1.62(1.27)	1.74(1.32)	2.04(1.43)	1.53(1.24)	1.65(1.28)	1.83(1.35)	2.13(1.46)	1.44(1.20)	1.50(1.22)	1.86(1.36)	2.49(1.58)	1.77(1.32)
3.	Lambdacyhalothrin 4.9% CS	20	2.06	0.99(0.99)	1.20(1.10)	1.47(1.21)	1.62(1.27)	0.84(0.92)	1.02(1.01)	1.32(1.15)	1.53(1.24)	0.78(0.88)	0.99(0.99)	1.29(1.14)	1.53(1.24)	1.42(1.12)
4.	Lambdacyhalothrin 4.9% CS	25	1.66	0.84(0.92)	1.20(1.10)	1.38(1.17)	1.74(1.32)	0.72(0.85)	1.14(1.07)	1.23(1.11)	1.68(1.30)	0.87(0.93)	0.99(0.99)	1.23(1.1)	1.32(1.15)	1.19(1.11)
5.	Fipronil 5 % SC	50	1.33	0.72(0.85)	0.96(0.98)	1.05(1.02)	1.44(1.20)	0.63(0.79)	0.84(0.92)	0.96(0.98)	1.29(1.14)	0.63(0.79)	0.69(0.83)	0.78(0.88)	1.07(1.03)	1.21(0.95)
6	Spinosad 48 SC	80	1.06	1.32(1.15)	1.83(1.35)	2.07(1.44)	2.40(1.55)	1.29(1.14)	1.74(1.32)	1.89(1.37)	2.19(1.48)	1.29(1.14)	1.38(1.17)	1.74(1.32)	1.80(1.34)	1.74(1.69)
7.	Untreated control (water spray)	-	2.06	2.34(1.53)	2.46(1.57)	2.64(1.57)	2.79(1.67)	2.94(1.71)	3.15(1.77)	3.27(1.81)	3.39(1.84)	3.42(1.85)	3.63(1.91)	3.69(1.92)	3.72(1.93)	3.12(1.69)
	CD at 5 %		N.S	0.03	0.08	0.12	0.04	0.08	0.06	0.06	0.07	0.05	0.03	0.05	0.04	0.05

N.B.:- N.S. - Not significant; Figures in parentheses are square root transformed values.

Table 4: Effect of Lambda cyhalothrin 4.9 CS on incidence of *Spodoptera* on chili during Feb – May, 2011 at Sagar Island, Sundarban, West Bengal (Mean of three replications)

Sl. No.	Treatments	Dose (g a.i./ ha) application	No. of *Spodoptera* larvae/ Plant on various days after application Before 1st	Days after 1st spray 3rd	7th	10th	Days after 2nd spray 1st	3rd	7th	10th	Days after 3rd spray 1st	3rd	7th	10th	Mean of three sprays	Yield/ ha (q)
1.	Lambdacyhalothrin 4.9% CS	12.5	4.06	2.09(1.45)	2.43(1.56)	3.72(1.93)	4.20(2.05)	2.94(1.71)	3.15(1.77)	3.42(1.85)	3.99(2.00)	2.79(1.67)	2.94(1.71)	3.27(1.81)	3.63(1.91)	3.21(1.78)	58.06
2.	Lambdacyhalothrin 4.9% CS	15	4.33	2.85(1.69)	3.06(1.75)	3.33(1.82)	3.69(1.92)	2.64(1.62)	2.82(1.68)	3.18(1.78)	3.33(1.82)	2.58(1.61)	2.73(1.65)	2.85(1.69)	2.94(1.71)	3.00(1.72)	59.33
3.	Lambdacyhalothrin 4.9% CS	20	4.66	2.22(1.49)	2.52(1.59)	2.83(1.68)	3.21(1.79)	2.04(1.43)	2.22(1.49)	2.58(1.61)	2.99(1.73)	1.74(1.32)	1.80(1.34)	1.92(1.39)	2.04(1.43)	2.34(1.52)	60.33
4.	Lambdacyhalothrin 4.9% CS	25	4.33	1.89(1.37)	2.13(1.46)	2.64(1.62)	2.82(1.68)	1.59(1.26)	1.80(1.34)	2.19(1.48)	2.73(1.65)	1.32(1.15)	1.44(1.20)	1.65(1.28)	1.92(1.39)	2.01(1.40)	61.06
5.	Fipronil 5 % SC	50	5.06	2.94(1.71)	3.27(1.81)	3.63(1.91)	3.84(1.96)	2.79(1.67)	3.06(1.75)	3.39(1.84)	3.84(1.96)	2.70(1.64)	2.94(1.71)	3.21(1.79)	3.33(1.82)	3.24(1.7)	54.06
6	Spinosad 48 SC	80	4.06	2.13(1.46)	2.19(1.48)	2.58(1.61)	2.94(1.71)	1.74(1.32)	1.98(1.41)	2.34(1.53)	2.89(1.70)	1.47(1.21)	1.62(1.27)	1.95(1.40)	2.19(1.48)	2.16(1.46)	60.66
7.	Untreated control (water spray)	-	4.33	5.88(2.42)	6.18(2.49)	6.84(2.62)	7.59(2.75)	7.59(2.75)	7.92(2.81)	8.19(2.86)	8.64(2.94)	9.09(3.01)	9.18(3.03)	9.39(3.06)	9.69(3.11)	8.01(2.82)	43.06
	CD at 5 %		N.S	0.04	0.07	0.06	0.02	0.07	0.03	0.04	0.03	0.04	0.03	0.03	0.03	0.04	0.33

N.B.:- N.S. - Not significant; Figures in parentheses are square root transformed values

Table 5: Effect of Lambda cyhalothrin 4.9 CS vis-à-vis standard chemicals against some important natural enemies associated with chilli ecosystem during Feb-May, 2010 and Feb-May, 2011 at Sagar, Sundarban, West Bengal (Mean three applications and three replications).

Sl. No.	Treatment	Dose(g a.i./ha)	% reduction / increase (+) of natural enemies on 10th day after application. First season (Feb-May, 2010)		Second season (Feb-May, 2011)	
			Menochilus sp.	*Chrysoperla* sp.	*Menochilus* sp.	*Chrysoperla* sp.
1.	Lambdacyhalothrin 4.9% CS	12.5	14.40(22.32)	1.02(5.68)	3.09(10.25)	3.21(10.32)
2.	Lambdacyhalothrin 4.9% CS	15	15.93(23.54)	4.83(12.72)	1.89(7.90)	2.62(9.32)
3.	Lambdacyhalothrin 4.9% CS	20	17.79(24.92)	6.00(14.22)	1.23(6.37)	2.34(8.80)
4.	Lambdacyhalothrin 4.9% CS	25	20.82(27.18)	9.03(17.52)	0.84(5.26)	1.89(7.90)
5.	Fipronil 5 % SC	50	31.29(34.04)	12.63(20.82)	1.24(6.39)	3.99(11.52)
6.	Spinosad 48 SC	80	18.00(25.15)	7.20(15.62)	1.89(7.90)	2.79(9.61)
7.	Untreated control (water spray)	-	+127.23(0.00)	+93.33(0.00)	2.94(9.87)	8.79(17.25)
	CD at 5 %		1.88	1.98	0.19	0.13

N.B.:- Figures in parentheses are angular transformed values; No. of *Menochilus* & *Chrysoperla* varied between 7 to 16 & 2 to 4/plant (10 leaves), respectively during the period under observation.

reported lambda cyhalothrin as the effective insecticide against *S. dorsalis* in rose. The present findings are also in agreement with Saner *et al.* (2014) who conducted an experiment on impact of newer insecticides on *Menochilus sexmaculatus* in hybrid cotton and reported that lambda cyhalothrin 5 SC was ecofriendly. In the present experiment it was found that in some cases Spinosad 48 SC was safer than lambda cyhalothrin 4.9 CS against natural enemies. Similar findings were also reported by Sabry *et al.* (2011) who found that lambda cyhalothrin was moderately harmful and spinosad was slightly harmful against *Chrysoperla carnea*.

It may be concluded that lambda cyhalothrin 4.9 CS @ 25 g a.i/ ha provides satisfactory control of chilli thrips and *Spodoptera* along with maximum fruit yield and less adverse effect on natural enemies. Fipronil 5% SC @ 50g a.i/ ha stands second in order of efficacy in control of chilli thrips but spinosad 48 SC @ 80 g a.i/ha was found 2nd best chemical in reducing the incidence of fruit borer. The persistent efficacy of lambda cyhalothrin may be attributed to the slow release mechanism of CS formulation. Though there is paucity of earlier works on lambda cyhalothrin 4.9 CS against chilli thrips and fruit borers the present findings show that lambda cyhalothrin 4.9 CS @ 25 g a.i/ ha may favourably be considered in the integrated pest management schedule of chilli.

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