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Efficacy of New Insecticide Molecules against Major Pests of Rice

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Abstract

The experiments were conducted during the year 2013- 2014 in two cropping seasons viz., *Kharif* 2013 and *Rabi*' 2013-14 at Regional Agricultural Research Station, Pattambi and farmers field at kondurkara, Ongallur using the rice variety Jyothi. The insecticide molecules tested during the periods were fipronil 5% EC @ 1.50l/ha, chlorantraniliprole 0.4G @10kg/ha, chlorantraniliprole 18.5EC @ 150ml/ha, fipronil 0.3G @ 10kg/ha, thiodicarb75%WP @750g/ha, novaluron 10% EC @ 450ml/ha, lufenuron 5.4EC @ 600ml/ha and flubendiamide 20%WDG (125g/ha) as check insecticide with an untreated control. The pooled results of two crop seasons and farmers field trials revealed that new insecticides, chlorantraniliprole @ 150ml/ha, lufenuron5.4EC @ 600ml/ha and fipronil 5% EC @ 1.50l/ha were the most effective treatment against rice yellow stem borer, while insecticides lufenuron 5.4EC @ 600ml/ha and chlorantraniliprole @ 150ml/ha found effective against leaf folder and whorlmaggot. The grain yield per plot was also higher in chlorantraniliprole 0.4G @10kg/ha, lufenuron 5.4EC @ 600ml/ha and chlorantraniliprole @ 150ml/ha treated plots.

Key words: Insecticides, rice, efficacy

Introduction

Rice is a staple crop of India cultivated in diverse ecologies leading the world in area with 41.85 mha with a production of 104 m tones but the productivity is only 75% of world production of 4.02 t/ha (Anonymous, 2012). Insect pests are major constraints limiting rice productivity besides diseases and weeds (Behura, *et al*., 2011). Chlorantraniliprole 25 SC a new insecticide found effective against major lepidopteran pests (Sidde Gowda, 2009). Mahal *et al*., (2008) reported that fipronil application significantly reduced the incidence of leaf folder in rice and similarly Dhawan *et al*., (2010) reported the efficacy of thiocylam hydro oxalate against leaf folder. Satapathy and Mukhurjee (2012) reported the efficacy of lufenuron against rice gallmidge. To find the efficacy of new insecticide molecule against major rice pests, trials were conducted at the station and farmers field.

Materials and Methods

Field experiments were conducted at Regional Agricultural Research Station, Pattambi, Kerala Agricultural University during two cropping seasons *viz., Kharif* 2013 and *Rabi*'2013-14. Twenty five days old seedlings of Jyothi were transplanted in a plot size of 7 x 4m with a spacing of 20 x 15 cms at the rate of two seedlings per hill. The experiment included nine treatments with seven insecticides using flubendiamide as check insecticide and an untreated control, with four replications. The sprays were made at 25, 45 and 60 days after transplanting with a hand sprayer of 9 litre capacity. The observations were made a day before spraying and a week after spraying on per cent tiller damage (dead heart) at vegetative stage and white ear at reproductive stage for yellow stem borer (*Scirpophaga incertulas* Walker), per cent damaged leaves in case of whorlmaggot (*Hydrellia philippina* Ferino) and leaffolder (*Cnaphalocrocis medinalis* Guenee). The grain yield was recorded in kg's per ha and the experiments were laid out using completely randomized block design. The means were compared for significance using CD at 0.05% level.

Results and discussion

Effect on stem borer

The results of the first crop season (*Kharif* 13) showed that per cent incidence of yellow stem borer (dead heart) was lowest with 3.1 percent in lufenuron 5.4 EC @ 600 ml/ ha followed by chlorantraniliprole 18.5 SC, fipronil 5% SC and chlorantraniliprole 4% G treated plot with 3.6, 4.0 and 5.0 per cent respectively at 50 days after transplanting and was on superior over flubendiamide (Check) sprayed plots which recorded 5.2 per cent dead hearts. In case of white ear damage produced by stem borer during the reproductive

phase at 80 DAT showed that chlorantraniliprole 18.5% SC recorded lowest white ear with 2.0 per cent followed by chlorantraniliprole 0.4G, lufenuron 5.4 EC and fipronil 0.3G treated plots with 2.2, 4.4 and 4.6 and was superior over flubendiamide sprayed plots which recorded a white ear incidence of 5.5 per cent as in Table 1.

Table 1: Per cent incidence of rice pests during Kharif 2013 season

Trt. No	Treatments g /ml / ha	SB % Dh 50 DAT	SB % WE 80 DAT	LF (% DL) 50 DAT	LF (% DL) 65DAT	WM (%DL) 30DAT	Grain Yield (Kg/ha)
T1	Fipronil5% SC@ 1.5 1	*4.0 (0.2)	6.9 (0.2)	1.6 (0.1)	10.4 (0.3)	14.7 (0.4)	2210
T2	Chlorantranilprole 0.4 G@ 10 kg	5.0 (0.2)	2.5 (0.2)	1.2 (0.1)	4.3 (0.2)	14.2 (0.7)	3420*
T3	Chlorantranilprole 18.5% SC @ 150 ml	*3.6 (0.2)	2.0 (0.1)	1.1* (0.1)	3.7 (0.2)	13.0* (0.3)	2972
T4	Fipronil 0.3 G @ 10kg	5.6 (0.2)	4.6 (0.2)	1.6 (0.2)	11.6 (0.3)	13.7 (0.4)	2613
T5	Thiodicarb 75%WP @ 750 ml	6.3 (0.2)	6.7 (0.2)	2.6 (0.2)	7.8 (0.3)	13.6 (0.4)	2061
T6	Novaluran 10% EC @ 450ml/ha	5.7 (0.2)	6.8 (0.3)	1.3 (0.1)	5.00 (0.2)	14.2 (0.4)	2038
T7	Lufenuron 5.4 EC @600 ml/ ha	*3.1 (0.2)	4.4 (0.2)	1.0* (0.1)	3.6* (0.2)	8.5* (0.2)	2658*
T8	Flubendiamide 20%WDG@ 125g	5.2 (0.3)	5.5 (0.3)	1.1* (0.1)	3.8 (0.2)	14.3 (0.5)	2390
T9	Control	6.3 (0.3)	7.4 (0.3)	3.1 (0.2)	20.8 (0.5)	15.8 (0.5)	1598
	CD (0.05%)	0.26	0.09	0.05	0.15	0.06	483

SB: stem borer, WE: white ear, LF: leaffolder, WM: Whorlmaggot

* Figures in parentheses are arcsine transformed values

During the second crop season *(Rabi*'2012-13), chlorantraniliprole 18.5 SC recorded lowest dead heart incidence of 1.6 per cent and superior over check insecticide which recorded 3.0% of dead heart while other treatments had higher incidence over the check insecticides. In case of white ear incidence, chlorantraniliprole 18.5 SC recorded lowest incidence of white ear with 1.6 per cent followed by lufenuron 5.4 EC, fipronil 5% EC, thiodicarb 75% WP, chlorantraniliprole 0.4G and fipronil 0.3G with 3.5, 3.5, 5.6, 7.1 and 7.7 per cent respectively as in Table 2.

Table 2: Per cent incidence of rice pests in Rabi 2013-2014 season

Trt. No	Treatments g /ml / ha	SB % Dh 50 DAT	SB %WE 80 DAT	LF (% DL) 65 DAT	WM (%DL) 30DAT	Grain Yield (Kg/ha)
T1	Fipronil5% SC@ 1.5 1	4.5 (0.1)	3.5* (0.2)	2.0 (0.1)	4.9* (0.2)	2261
T2	Chlorantranilprole 0.4 G@ 10 kg	4.3 (0.2)	7.1* (0.3)	2.7 (0.1)	5.2* (0.2)	2297
T3	Chlorantranilprole 18.5% SC @ 150 ml	1.6* (0.1)	1.6* (0.1)	3.4 (0.2)	4.0* (0.2)	2389
T4	Fipronil 0.3 G @ 10kg	6.6 (0.2)	7.7* (0.3)	2.5 (0.2)	6.4* (0.3)	2352
T5	Thiodicarb 75%WP @ 750 ml	8.3 (0.04)	5.6* (0.2)	2.0 (0.1)	6.8* (0.3)	2209
T6	Novaluran 10% EC @ 450ml/ha	8.7 (0.1)	9.9 (0.3)	1.9 (0.1)	7.7* (0.4)	1910

Trt. No	Treatments g /ml / ha	SB % Dh 50 DAT	SB %WE 80 DAT	LF (% DL) 65 DAT	WM (%DL) 30DAT	Grain Yield (Kg/ha)
T7	Lufenuron 5.4 EC @600 ml/ ha	4.1 (0.04)	3.5* (0.2)	2.0 (0.2)	5.1* (0.2)	2404
T8	Flubendiamide 20%WDG@ 125g	3.00 (0.1)	8.6 (0.3)	2.8 (0.2)	9.1 (0.3)	2105
T9	Control	11.5 (0.2)	9.4 (0.3)	4.8 (0.2)	13.9 (0.4)	2040
	CD (0.05%)	NS	0.13	NS	0.12	NS

SB: stem borer, WE: white ear, LF: leaffolder, WM: Whorl maggot

* Figures in parentheses are arcsine transformed values

Farmers field trials during the same period with same set of treatments showed that for dead heart incidence all the treatments were par in efficacy and superior over check insecticides and for white ear incidence chlorantraniliprole 18.5 SC recorded lowest incidence of white ear with 4.0 per cent followed by fipronil 5% EC, chlorantraniliprole 0.4%G, lufenuron 5.4% EC and fipronil 0.3%G with 7.5, 7.9, 8.6 and 9.0 per cent respectively as in Table 3 The pooled analysis of three crop seasons showed that dead heart was low with 3.1 per cent in chlorantraniliprole 18.5 SC followed by lufenuron 5.4% EC and fipronil 5% SC with 4.0 and 4.1 per cent respectively and white ear incidence was low with 3.2 per cent in chlorantraniliprole 18.5 SC sprayed plots followed by lufenuron 5.4% EC, chlorantraniliprole 0.4%G, fipronil 5% SC, fipronil 0.3G and thiodicarb 75%WP with 5.5, 5.8, 6.0, 7.1 and 7.6% against stem borer which is statistically superior over check insecticide, treated plots as in table 4. The results were in confirmation with the earlier study of Srinivasan *et al*., (2012) and Karthikeyan and Christy (2014) who reported that spray with chlorantraniliprole 18.5 EC @ 30g a.i./ha reduced stem borer (dead heart and white ear) incidence. Kulagod *et al*., (2011) reported that the incidence of white ear was low in fipronil 5% SC and thiocarb 75%WP treated plots. The newly tested molecule adds to the list of new generation insecticides like thiacloprid, cartap hydrochloride, acephate 95% SG, phosphamidon granules, spinosad, buprofezin 20% + acephate 50% and flubendiamide (4%) + buprofezin (20%) (Gupta *et al*., 2006 Karthikeyan *et al.,* 2007, 2008; Krishnamoorthy *et al.,* 2012a ; 2012b, Karthikeyan *et al*., 2012).

Table 3: Pooled analysis of pest incidence in farmers field (3 plots) in *Rabi* 2013-14

Trt. No	Treatments g /ml / ha	SB % Dh 50 DAT	SB %WE 80 DAT	LF (% DL) 65 DAT	WM (%DL) 30DAT	Grain Yield (Kg/ha)
T1	Fipronil5% SC@ 1.5 1	3.7 (0.1)	7.5* (0.3)	9.3 (0.2)	10.4 (0.3)	2060
T2	Chlorantranilprole 0.4 G@ 10 kg	4.2 (0.2)	7.9* (0.2)	4.6* (0.1)	10.6 (0.3)	2859*
T3	Chlorantranilprole 18.5% SC @ 150 ml	4.1 (0.2)	4.0* (0.1)	9.8 (0.2)	10.8 (0.3)	2656
T4	Fipronil 0.3 G @ 10kg	4.7 (0.2)	9.0 (0.3)	10.6 (0.2)	11.1 (0.3)	2482
T5	Thiodicarb 75%WP @ 750 ml	3.7 (0.1)	10.6 (0.3)	8.6 (0.1)	11.2 (0.3)	2635
T6	Novaluran 10% EC @ 450ml/ha	3.9 (0.2)	10.0 (0.3)	9.2 (0.2)	10.7 (0.3)	2310
T7	Lufenuron 5.4 EC @600 ml/ ha	3.5 (0.1)	8.6* (0.2)	4.2* (0.1)	10.1 (0.3)	3247*
T8	Flubendiamide 20%WDG@ 125g	5.2 (0.2)	9.0 (0.3)	6.2 (0.2)	11.7 (0.4)	2531
T9	Control	6.6 (0.3)	10.4 (0.3)	12.6 (0.4)	12.1 (0.4)	1930
	CD (0.05%)	NS	0.08	0.13	NS	893

SB: stem borer, WE: white ear, LF: leaffolder, WM: Whorl maggot

* Figures in parentheses are arcsine transformed values

Effect on Leaffolder

The incidence of leaf folder was lowest in lufenuron 5.4 EC treated plots with 1.0 and 3.6 per cent followed by chlorantraniliprole 18.5 EC with 1.1 and 3.7 per cent during 50 days and 65 days after transplanting followed by and were superior in efficacy to all other new insecticides including that of flubendiamide (check) sprayed plots in *Kharif'*2013 as in Table 1. During the second crop season (*Rabi*' 2013-14) there was no significant difference between treatments was observed as in Table 2. Farmers field trials during *Rabi*'2013-14 similar results observed where leaf folder incidence was low in lufenuron 5.4 EC followed by chlorantraniliprole 18.5 EC treated plots with 4.2 and 4.6 per cent respectively as in Table 3. The pooled analysis of three crop seasons results showed that lufenuron 5.4 EC followed by chlorantraniliprole 18.5 EC showed the lowest leaf folder damage as in Table 3 and the results was in confirmation with the earlier study of Karthikeyan and Christy (2014) and Srinivasan *et al*., (2012) who reported the efficacy of chlorantraniliprole 18.5 EC against rice leaf folder. The efficacy of the new molecule lufenuron to leaf folder adds to the reports of new generation insecticides like thiacloprid, cartap hydrochloride 4 G, phosphamidon granules, spinosad, Flubendiamide + Fipronil, Flubendiamide (4%) + Buprofezin (20%) (Gupta *et al.,* 2006; Karthikeyan *et al.,* 2007, 2008; Sharma and Srivatsava, 2009; Karthikeyan *et al*., 2012)

Effect on Whorl maggot

Whorlmaggot incidence was low in lufenuron 5.4 EC and chlorantraniliprole sprayed plots with 8.5 and 13.0 per leaf damage similarly other treatments like thiodicarb 75% WP, fipronil 0.3G, chlorantraniliprole 0.4%G and Novaluran 10%EC recorded low incidence of leaf folder incidence in comaparison to check insecticide during *Kharif'*13 as in Table 1. During the second crop season (*Rabi*'2013-14) the incidence of whorlmaggot was lowest in chlorantraniliprole and lufenuron 5.4 EC with 4.0 and 5.1 per cent and all the tested insecticides were superior in efficacy over the check insecticides flubendiamide which recorded 9.1 per cent of leaf damage as in table 2. There was no significant difference among treatments in the trials conducted in farmer's field as shown in Table 3. The pooled analysis of all the crop season studies showed that lufenuron 5.4 EC and chlorantraniliprole sprayed plots recorded the lowest whorlmaggot incidence with 7.9 and 9.4 per cent and all tested insecticides was superior in efficacy to check insecticide as shown in Table 4. The earlier reported effective molecules against whorlmaggot were cartap and triazophos (Mishra and Sahithi, 2005), carbofuran, chlorpyriphos and monocrotophos (Sharma *et al*., 2006) thiacloprid (Gupta *et al*., 2006), bifenthrin, Imidacloprid + Ethiprole and Flubendiamide + Fipronil combination (Sharma and Srivatsava, 2009) phosphamidon granules (Karthikeyan *et al*., 2008), Flubendiamide (4%) + Buprofezin (20%) (Karthikeyan *et al*., 2012) present study on the efficacy of lufenuron and chlorantraniliprole against this pest adds to the earlier list.

Table 4. Pooled analysis of all the tested locations

Trt. No	Treatments g /ml / ha	SB % Dh 50 DAT	SB %WE 80 DAT	LF (% DL) 65 DAT	WM (%DL) 30DAT	Grain Yield (Kg/ha)
T1	Fipronil5% SC@ 1.5 1	4.1* (0.1)	6.0* (0.2)	7.2 (0.2)	9.9* (0.3)	2177
T2	Chlorantranilprole 0.4 G@ 10 kg	4.7 (0.2)	5.8* (0.2)	5.6 (0.2)	10.0* (0.4)	2859*
T3	Chlorantranilprole 18.5% SC @ 150 ml	3.1* (0.2)	3.2* (0.1)	3.7* (0.2)	9.4* (0.3)	2672
T4	Fipronil 0.3 G @ 10kg	5.6 (0.2)	7.1 (0.3)	8.2 (0.2)	10.4* (0.3)	2482
T5	Thiodicarb 75%WP @ 750 ml	6.1 (0.1)	7.6 (0.2)	6.1 (0.2)	10.3* (0.3)	2301
T6	Novaluran 10% EC @ 450ml/ha	6.1 (0.2)	8.9 (0.3)	5.3 (0.2)	10.9* (0.4)	2086
T7	Lufenuron 5.4 EC @600 ml/ ha	4.0* (0.1)	5.5* (0.2)	3.6* (0.2)	7.9* (0.2)	2770*

Trt. No	Treatments g /ml / ha	SB % Dh 50 DAT	SB %WE 80 DAT	LF (% DL) 65 DAT	WM (%DL) 30DAT	Grain Yield (Kg/ha)
T8	Flubendiamide 20%WDG@ 125g	4.4 (0.2)	7.7 (0.3)	4.3 (0.2)	11.7 (0.4)	2342
T9	Control	12.2 (0.2)	9.1 (0.3)	12.7 (0.4)	13.9 (0.4)	1856
	CD (0.05%)	0.05	0.05	0.09	0.13	483

SB: stem borer, WE: white ear, LF: leaffolder, WM: Whorl maggot

*Figures in parentheses are arcsine transformed values

Grain Yield

During the first crop season (*Kharif* 2013), chlorantraniliprole 18.5 SC sprayed plots recorded high yield of 3420 kg /ha followed by lufenuron 5.4 EC sprayed plots with 2658 kg/ha and lowest yield was recorded in control plots with 1598 kg/ha as in table 1. During the second season, *Rabi* 2013-14 there was no significance difference in grain yield among the treatments as in table 2. Farmers trails results showed higher grain yield in lufenuron 5.4EC sprayed plots with 3247 kg /ha followed by chlorantraniliprole 0.4G treated plots with 2859 kg/ ha as in table 3. The pooled analysis of all the crop seasons also showed that chlorantraniliprole 0.4G treated plots recorded high grain yield of 2859 kg /ha followed by lufenuron 5.4 EC sprayed plots with 2770 kg/ha and lowest yield recorded in control plots with 1856 kg /ha as in table 4.

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