International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 3 Number 9 (2014) pp. 736-740**
http://www.ijcmas.com

Original Research Article

Evaluation of certain new insecticides against yellow stem borer, *Scirpophaga incertulas* on semi deep water rice

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A B S T R A C T

Field experiments have been conducted on a semi deep water rice variety, *Jalpriya* during *kharif* seasons 2009-10, 2010-11 and 2011-12 to evaluate the efficacy of certain new insecticides against stem borer. Altogether, 9 treatments including 5 insecticides, viz. buprofezin 25 SC @ 700 ml ha^{-1}, acephate 95 SG @ 592 g ha^{-1}, acephate 75 SP @ 667 g ha^{-1}, dinetofuran 20 SG @ 200 g ha^{-1}, flubendiamide 20 WDG @ 175 g ha^{-1}; 2 combination of insecticides, viz. flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1}, buprofezin (20%) + acephate (50%) 70 WP @ 900 g ha^{-1} besides insecticidal check monocrotophos 36 SL @ 1390 ml ha^{-1} and untreated control. The stem borer infestation, i.e. white ears varied from 2.24 to 10.90% over the *kharif* seasons. The results on stem borer infestation and yield indicated that all the insecticidal treatments were significantly superior to untreated control. The results clearly indicated that acephate 75 SP @ 667 g ha^{-1} followed by the combination of flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1} and flubendiamide 20 WDG @ 175 g ha^{-1} with 3.50, 4.15 and 4.40 average YSB infestation; and 18.00, 16.37 and 16.27 q ha^{-1} average grain yields, respectively, were effective against YSB on semi deep water rice. The insecticidal check monocrotophos 36 SL @ 1390 g ha^{-1} was superior with 5.54% average stem borer infestation and 13.42 q ha^{-1} average grain yield to untreated control with 9.69% average stem borer infestation and 10.87 q ha^{-1} average grain yield.

Keywords

Insecticide, Yellow stem borer, *Scirpophaga incertulas*, Semi deep water rice

Introduction

The low production in deep water rice ecosystem is a recurring feature, which is adapted to *chaurs* and *tals* etc. in rainfed lowland ecosystem in different parts of eastern India. One of the major reasons for low production of deep water rice in Asia is insect pests and diseases. Among the insect pests, the yellow stem borer (YSB), *Scirpophaga incertulas* (Walker) is the most important and devastating insect pest of deep water rice causing yield losses to the tune of 27-34% every year (Catling *et al.*, 1987; Prasad *et al.*, 1988). The economic threshold level for YSB have been determined to be in between 5 and 10% larval infestation levels (Prasad *et al.*, 1992). As there is no full proof method to get rid of YSB either through a resistant variety or through certain biological agents, the use of insecticides becomes unavoidable. For quick knock down effect, the application of judicious dose of insecticides is desired to save the crop from toll of insects. By the change in the resistance level of pest and discovery of new chemicals with insecticidal activities always provide room to conduct field trials to evaluate their efficacy. Keeping in view of the above, in the present study, an attempt has been made to evaluate the efficacy of certain new promising insecticides against YSB in semi deep water rice.

Materials and Methods

The field experiments have been conducted in randomized block design with four replications during *kharif* seasons 2009-10, 2010-11 and 2011-12. The plot size was (5x4) m^2 with 1.0 m replication border and 0.5 m treatment border between the plots. The experimental plots have been separated by raising bunds of about 0.6 m height all around each plot. The semi deep water rice variety used in the present study was *jalpriya* of 150 days duration. Thirty five days old seedlings were transplanted at a spacing of 20x15 cm during last week of July. The crops were raised adopting a standard package of practices. The fertilizers were applied @ 80 :40 :40 kg N:P:K ha^{-1}. The basal application of N:P:K @ 40:40:40 kg ha^{-1} was done just before transplanting and top dressing of the rest 40 kg N ha^{-1} was made after hand weeding during 2nd week of August before flooding of the field.

Semi deep water rice is grown in a water depth of 50-100 cm at least for one month. The experimental field remains flooded with accumulated rain water from 3rd week of August to 3rd week of November with maximum water depth of 70 cm in last week of October during the year 2009; from 4th week of August to 1st week of November with maximum water depth of 72 cm in 4th week of September during the year 2010; and 2nd week of August to 1st week of November with maximum water depth of 78 cm in 2nd week of September during the year 2011.

The treatments included 5 new insecticide formulations, viz. buprofezin 25 SC @ 700 ml ha^{-1}, acephate 95 SG @ 592 g ha^{-1}, acephate 75 SP @ 667 g ha^{-1}, dinetofuran 20 SG @ 200 g ha^{-1}, flubendiamide 20 WDG @ 175 g ha^{-1}; 2 combinations of insecticides, viz. flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1}, buprofezin (20%) + acephate (50%) 70 WP @ 900 g ha^{-1} besides check monocrotophos 36 SL @ 1390 ml ha^{-1} and untreated control. To record the infestation of YSB, each plot was divided into 3 equal units for observation before harvesting. An area of 0.25 m^2 was selected from each unit and total panicle bearing tillers and YSB infested tillers, i.e. white ears (WE) were counted. Thus, a total of 20-27 hills (56-112 tillers) were sampled in each plot and infestation of YSB as %WE have been worked out. Harvesting was done by the end of November. The yield data was recorded by excluding 2 border rows from all sides for each plot separately. The data have been statistically analyzed. The YSB infestation data were transformed by the formula, $a = \sqrt{p + 0.5}$ where a is transformed value and p is %WE, before analysis.

Results and Discussion

The results regarding YSB infestation and yield are summarized in table 1. The YSB infestation varied from 2.24 to 8.76, 3.94 to 9.41 and 4.31 to 10.90% during *kharif* seasons 2009-10, 2010-11 and 2011-12, respectively. The results on YSB infestation revealed that all the insecticidal treatments were significantly superior to untreated control during the three *kharif* seasons. During the year 2009-10, acephate 75 SP @ 667 g ha^{-1} was most promising with 2.24% YSB infestation. It was followed by the combination of flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1} and flubendiamide 20 WDG @ 175 g ha^{-1} with 3.26 and 3.41% YSB infestation, respectively. These were comparable to check insecticide monocrotophos 36 SL @ 1390 ml ha^{-1} with 3.75% YSB infestation and significantly superior to untreated control with 8.76% YSB infestation.

However during the year 2010-11, acephate 75 SP @ 667 g ha^{-1} followed by the combination of flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1} and acephate 95 SG @ 592 g ha^{-1} with 3.94, 4.6 and 4.62% YSB infestation, respectively, were most promising and significantly superior over untreated control with 9.41% YSB infestation. Also during the year 2011-12, acephate 75 SP @ 667 g ha^{-1} followed by the combination of flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1} and flubendiamide 20 WDG @ 175 g ha^{-1} with 4.31, 4.58 and 5.17% YSB infestation, respectively, were most promising and significantly superior over untreated control with 10.90% YSB infestation. The check insecticide monocrotophos 36 WSC @ 500 g.a.i. ha^{-1} was also effective with 5.19 and 7.67% YSB infestation, respectively, during the year 2010-11 and 2011-12. Thus on an average the pooled data indicated that acephate 75 SP @ 667 g ha^{-1}, the combination of flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1} and flubendiamide 20 WDG @ 175 g ha^{-1} with 3.50,4.15 and 4.40% YSB infestation, respectively, were most promising insecticides. Earlier, Nayak *et al*. (2000) have reported that endosulfan was most effective against YSB. Cypermethrin, a pyrethriod have also been found effective against rice stem borer (Purohit *et al*., 1987 and Kumar *et al*., 1988). However in the present study, the newer insecticides such as acephate (phosphoramidothioate group), flubendiamide (diamide group) and the combination of flubendiamide and buprofezin (chitin synthesis inhibitor), respectively, were most effective against YSB on semi deep water rice. We have also reported earlier that flubendiamide 480 SC @ 24 g.a.i. ha^{-1}, indoxacarb 15 EC @ 30 g.a.i. ha^{-1}, lambda cyhalothrin 5 CS @ 12.5 g.a.i. ha^{-1} and the combination of acetamiprid 0.4% and chlorpyriphos 20% (20.4 EC) @ 510 g.a.i. ha^{-1} were effective against YSB on deep water rice variety (Prasad *et al*., 2010).

The grain yield data also revealed that all the insecticidal treatments were significantly superior to untreated control and comparable to check insecticide monocrotophos 36 SL @ 1390 ml ha^{-1}. The yield data indicated that acephate 75 SP @ 667 g ha^{-1} followed by acephate 95 SG @ 592 g ha^{-1} and the combination of flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1} with 22.53, 20.09 and 20.02 q ha^{-1} grain yields, respectively, were significantly superior to untreated control with 14.77 q ha^{-1} yields during 2009-10. However during the year 2010-11 & 2011-12, acephate 75 SP @ 667 g ha^{-1} followed by the combination of flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1} and flubendiamide 20 WDG @ 175 g ha^{-1} with 18.71, 17.27 and 17.23 q ha^{-1} & 12.76, 11.81 and 11.63 q ha^{-1} grain yields, respectively, were significantly superior to untreated control with 11.35 & 6.48 q ha^{-1} grain yields. In general, grain yields were very less during the year 2011-12 in comparison to yields obtained during the year 2009-10 and 2010-11. It may be attributed to early flooding of the experimental field with enhanced water level, i.e. starting from 2nd of August to 2nd of November with maximum water depth of 78 cm during 2nd week of September and also to more YSB infestation during the year 2011-12. The average grain yield of three seasons indicated that acephate 75 SP @ 667 g ha^{-1}, the combination of flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1} and flubendiamide 20 WDG @ 175 g ha^{-1} were most promising with 18.00, 16.37 and 16.27 q ha^{-1} average grain yields, respectively, in comparison to check insecticide monocrotophos 36 SL @ 1390 g ha^{-1} and untreated control with 13.42 and 10.87 q ha^{-1} average grain yields, respectively.

Thus on the basis of present findings, it may be concluded that acephate 75 SP @ 667 g ha^{-1}, the combination of flubendiamide (4%) + buprofezin (20%) 24 SC @ 875 ml ha^{-1} and flubendiamide 20 WDG @ 175 g ha^{-1} with 3.50, 4.15 and 4.40 average YSB infestation; and 18.00, 16.37 and 16.27 q ha^{-1} average grain yields were effective in controlling YSB on semi deep water rice variety and may be recommended for field use.

Table.1 Comparative efficacy of certain new insecticides on YSB infestation in semi deep water rice variety, *jalpriya* during *kharif* 2009-10, 2010-11 and 2011-12

Treatments			**Yellow stem borer (% WE)**				**Yield (q/ ha)**			
Insecticides	**Formulation**	**Dose (g or ml/ha)**	**2009-10**	**2010-11**	**2011-12**	**Pooled**	**2009-10**	**2010-11**	**2011-12**	**Pooled**
1. Buprofezin	25 SC	700	3.62 (2.03)	5.08 (2.36)	6.87 (2.71)	5.19	19.36	16.48	9.89	15.24
2. Acephate	95 SG	592	3.46 (1.99)	4.70 (2.28)	6.54 (2.65)	4.90	20.09	17.08	11.27	16.15
3. Acephate	75 SP	667	2.24 (1.66)	3.94 (2.11)	4.31 (2.19)	3.50	22.53	18.71	12.76	18.00
4. Dinotefuran	20 SG	200	3.56 (2.01)	5.08 (2.36)	6.75 (2.69)	5.13	19.87	16.81	10.36	15.68
5. Flubendiamide	20 WG	175	3.41 (1.98)	4.62 (2.26)	5.17 (2.38)	4.40	19.95	17.23	11.63	16.27
6. Flubendiamide + buprofezin	24 SC	875	3.26 (1.94)	4.60 (2.26)	4.58 (2.25)	4.15	20.02	17.27	11.81	16.37
7. Buprofezin + acephate	70 WP	900	3.48 (1.99)	5.02 (2.35)	6.63 (2.67)	5.04	19.89	16.81	10.47	15.72
8. Monocrotophos	36 SL	1390	3.75 (2.06)	5.19 (2.39)	7.67 (2.86)	5.54	17.14	14.33	8.79	13.42
9. Untreated control	Water	Nil	8.76 (3.04)	9.41 (3.15)	10.90 (3.38)	9.69	14.77	11.35	6.48	10.87
CD (5%)			1.18	1.29	1.15		2.05	2.02	1.81	
CV (%)			10.56	12.88	7.29		10.15	11.39	11.53	

- Figures in parentheses are transformed values

Acknowledgements

Thanks are due to Directorate of Rice Research, Hyderabad for supplying insecticides and financial assistance.

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