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Bioefficacy of Endosulfan 330 CS Against Yellow stem borer, *Scirpophaga incertulas* (Walker) and Leaf folder, *Cnaphalocrocis medinalis* (Guenee) in Rice

Key words : Chlorpyriphos, *Cnaphalocrocis medinalis*, Efficacy, Endosulfan, Monocrotophos, Rice, *Scirpophaga incertulas*

Rice is mainly a tropical and subtropical crop grown in almost all states in India. More than 70 insect pests infest rice in India and 20 are of regular occurrence (Pathak, 1975). Of the pest complex, the yellow stem borer, *Scirpophaga incertulas* (Walker) has assumed the number one pest status, attacks the crop at all stages of growth and causes considerable yield losses. Changes in cropping pattern, changes in varieties grown, etc are resulting in changes in host crop-pest interactions thus leading to a shift in pest scenario in different crops. Rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) is one such pest which once considered as a minor pest has now increased in abundance since last two decades and attained major pest status. Khan *et al*. (1985) has reported the outbreak of this pest from various parts of the world. The present study was conducted to evaluate the efficacy of endosulfan 330 CS (Thiodan) against stem borer and leaf folder in deep black soils of Agricultural Research Station, Warangal during *kharif*, 2005.

The experiment was laid out in a randomized block design with seven treatments, including untreated control (check), each replicated three times, with an individual plot size of 25 m^2. The test variety, Kavya was sown on 26th July, 2005 and was transplanted on 24th August, 2005 at a spacing of 20 x 15 cm. All recommended agronomic practices were followed except plant protection measures. Three doses of endosulfan 330 CS @ 330, 412.5, 495 g a.i.ha^{-1},endosulfan 35 EC @ 437.5 g a.i.ha^{-1}, chlorpyriphos 20 EC @ 300 g a.i.ha^{-1} monocrotophos 36 SL @ 450 g a.i.ha^{-1} were included as insecticide treatments along with an untreated control (check). Treatments were imposed when sufficient pest infestation was noticed in the experimental plot. First spray was applied during last week of October. The spray mixture of each treatment was prepared by mixing required quantity of the insecticide formulation in water to make it equivalent to 375 l ha^{-1}. Spraying was done with a high volume knapsack sprayer.

Observations on total number of dead hearts and leaf folder damaged leaves on ten randomly selected hills per plot were recorded before spraying, 10 days after first spray, 9 days after second spray and 7 days after third spray.

The crop was harvested on 7th December, 2005. Grain yield from each plot was recorded by excluding border rows. Grain yield of each plot was converted into grain yield in kg ha^{-1}. The data obtained were subjected to analysis of variance.

Data recorded on stem borer damage (Table-1) revealed that there were no significant differences among different treatments before spraying. Ten days after first spray, it was found that the plots sprayed with monocrotophos 36 SL @ 450 g a.i.ha^{-1}and chlorpyriphos 20 EC @ 300 g a.i.ha^{-1}were effective against stem borer, and recorded lower dead hearts of 27.00 to 27.67 dead hearts per 10 hills. Endosulfan 330 CS @ 330 and 412.5 g a.i.ha^{-1} were equally effective as monocrotophos 36 SL @ 450 g a.i.ha^{-1}and chlorpyriphos 20 EC @ 300 g a.i.ha^{-1}. Same trend was observed even after 9 days after second spray. However, there was not much difference in dead hearts recorded among the treatments after third spray. The mean performance indicated similar trend as that of first and second sprays. The results are in agreement with Prasad *et al*. (2010) who reported that monocrotophos 36 SL @ 500 g a.i.ha^{-1} was more effective than endosulfan 330 CS @ 500 g a.i.ha^{-1} against stem borer. Sontakke and Dash (2000) also reported that application of chlorpyriphos at 50 days after transplanting was effective against stem borer.

Pre spraying counts of number of leaf folder damaged leaves (25.33 to 30.00 per 10 hills) revealed that there were no significant differences among different treatments and check (Table 1). Ten days after first spray, number of damaged leaves by leaf folder ranged from 53.67 to 70.00 per 10 hills, with significant differences of leaf folder damage among treatments and check. Untreated control showed significantly higher damage than all other treatments. Among the treatments, monocrotophos

Table1. Efficacy of Endosulfan 330 CS on yellow stem borer and leaf folder in rice.

Treatment	Dose (g a.i. ha^{-1})	Yellow stem borer					Leaf folder					Yield (kg ha^{-1})
		No. of dead hearts/10 hills					No. of leaf folder damaged leaves/10 hills					
		Pre treat-ment	10 days after I spray	9 days after II spray	7 days after III spray	Pooled mean of sprays	Pre treat-ment	10 days after I spray	9 days after II spray	7 days after III spray	Pooled mean of sprays	
Endosulfan 330 CS	330.0	14.67	30.67	12.33	3.67	15.56	25.67	67.00	17.67	6.67	30.44	5907
Endosulfan 330 CS	412.5	16.00	29.33	11.67	3.00	14.67	25.33	63.33	18.33	5.33	29.00	5669
Endosulfan 330 CS	495.0	17.67	32.00	14.00	3.33	16.44	27.67	67.33	20.00	5.00	30.78	5900
Endosulfan 330 CS	437.5	18.00	32.33	15.67	5.00	17.67	30.00	65.00	17.67	6.00	29.55	6022
Chlorpyriphos 20 EC	450.0	15.00	27.67	10.67	3.33	13.89	26.00	59.00	20.00	5.67	28.22	6663
Monocrotophos36 SL	300.0	16.33	27.00	10.33	4.67	14.00	26.33	53.67	17.33	7.00	26.00	6638
Control (check)	-	18.00	34.67	18.67	3.67	19.00	29.67	70.00	21.33	7.33	32.89	5528
F – test		NS	*	*	NS	*	NS	*	NS	NS	*	*
SEm±		1.31	1.37	0.87	0.54	0.63	2.11	2.21	1.55	1.06	0.90	320
CD (P = 0.05)		-	4.22	2.68	-	1.96	-	6.79	-	-	2.77	987

* Significant at P = 0.05

36 SL @ 450 g a.i.ha^{-1} (53.67 damaged leaves/10 hills) showed significantly lower damage by leaf folder. Chlorpyriphos 20 EC @ 300 g a.i.ha^{-1} with 59.00 damaged leaves/10 hills was the next best treatment. Similar results were reported by Sontakke *et al.,* (1999) who found that application of monocrotophos at tillering stage at 50 days after planting was effective against leaf folder. Sarao and Mahal (2008) also reported that monocrotophos 36 SL at 0.5 kg a.i.ha^{-1}and chlorpyriphos 20 EC at 0.50 kg a.i.ha^{-1} proved effective against leaf folder. There was no significant variation among various treatments and control with respect to dead hearts after subsequent sprays. Absorption and persistence of monocrotophos was highest at tillering than at later stages (Sontakke and Senapati, 1998). Probably, this could be the reason for less effectiveness of monocrotophos at later stages and hence non significant variation after second and third sprays. Mean over sprays indicated better performance of monocrotophos 36 SL @ 450 g a.i.ha^{-1} followed by chlorpyriphos 20 EC 300 g a.i.ha^{-1} against leaf folder. Endosulfan 330 CS @ 330, 412.5, 495 g a.i.ha^{-1} and endosulfan 35 EC @ 437.5 g a.i.ha^{-1} were equally effective as chlorpyriphos against leaf folder.

Grain yield in the experimental block ranged from 5528 kgha^{-1} to 6663 kgha^{-1} with control plot recording lowest yield. Significantly highest yield of 6663 kgha^{-1} was recorded from the plot treated with chlorpyriphos followed by monocrotophos (6638 kgha^{-1}). Marginal differences in yield could be due to low to moderate incidence of insect pests during the crop season. Pandi *et al*., (1998) reported that the yield loss due to *C. medinalis* was greater when the infestation occurred at 40 days after planting than at 30,60 or 80 days after planting. This is in agreement with the present study where leaf folder incidence was observed at 60 days after planting. All the endosulfan treatments except endosulfan 330 CS @ 412.5 g a.i.ha^{-1} were at par with monocrotophos, chlorpyriphos.

From the above results it can be concluded that monocrotophos 36 SL @ 450 g a.i.ha^{-1} chlorpyriphos 20 EC @ 300 g a.i.ha^{-1} were effective against stem borer and leaf folder in rice. Endosulfan 330 CS @ 330 g a.i.ha^{-1} and 412.5 g a.i.ha^{-1} were equally effective as monocrotophos 36 SL and chlorpyriphos 20 EC against stem borer.

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S Malathi

Regional Agricultural Research Station,
Acharya N G Ranga Agricultural University,
Warangal 506 007
Andhra Pradesh.

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