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Efficacy of chlorpyriphos 75wdg against rice stem borer, *Scirpophaga incertulas* walker. (Lepidoptera: Pyralidae)

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Abstract
The experiment was conducted to study the efficacy of Chlorpyriphos 75 WDG against rice stem borer, *Scirpophaga incertulas* Walker. The research work was carried out during Rabi 2014 - 15 on the rice field of Mr. Kamal Murarkar, village Morabe, Tal. Karjat, Dist. Raigad (M.S.). Experiment consisted of eight treatments and three replications. Two rounds of sprays were done. Observations on per cent dead hearts were recorded at 7 and 14 days after each application. It was observed that per cent dead hearts decreased with increase in concentration of each insecticide. The results revealed that 7 days after first and second spraying, treatment T3, Chlorpyriphos 75 WDG @533g/ha was found effective and at par with the treatment T2, Chlorpyriphos 75 WDG @500g/ha and were significantly superior over all other treatments. Maximum yield was also obtained from the treatment T3, Chlorpyriphos 75 WDG @533g/ha (51.90 q/ha) and at par with the treatment T2, Chlorpyriphos 75 WDG @500g/ha (50.70 q/ha).

Keywords: Chlorpyriphos 75 WDG, rice stem borer, *Scirpophaga incertulas*, per cent dead hearts

1. Introduction
Rice (*Oryza sativa* L.) is the staple food of more than 50% of the global population [FAO, 2011, Garris, *et al*, 2005] [4, 5]. Rice is the main source of food for about 2.5 billion people in Asia [FAO, 1995] [3]. In Asia, about 90% of land is under rice crop cultivation [Khush and Brar, 2002] [8]. Among the cereals production all over the world, rice shares one fifth of the world crop land [Pathak and Khan, 1994] [13].

Rice is attacked by number of insect pests, about 128 insect species are recorded to infest the rice fields. Out of these, 15 to 20 insect species are economically important [Kalode, 2005] [7]. Among these economically important insect pests, stem borers (SBs) are major insect pests of rice which causes considerable damage of the crop [Dhaliwal and Arora, 1996] [2]. Rice is attacked by six species of stem borer, *viz.* yellow stem borer (*Scirpophaga incertulas* Walker), white stem borer (*Scirpophaga innotata* Walker), striped stem borer (*Chilo suppressalis* Walker), gold-fringed stem borer (*C. auricilius* Dudgeon), dark-headed striped stem borer (*C. polychrysus*), and the pink stem borer (*Sesamia inferens* Walker). Yellow stem borer (YSB is observed all over India and is considered as the most dominating and destructive pest species out of the all species of stem borers [Mahar, *et al*., 1985] [10]. Karjat tehsil in Raigad district of Maharashtra state was considered as hot spot for YSB. In Karjat tehsil, Khrif and Rabi rice is grown, hence food is available throughout the year to YSB.

Yellow stem borer is a monophagous pest of rice and larva is the damaging stage. Larva enter in the stem by boring it, feeds there, matures and subsequently pupates [Sarwar, 2012] [18]. If stem borer infestation occurs during vegetative growth stage, then it results in formation of dead hearts. And if the infestation occurs in reproductive stage of the crop, then it causes the damage of the growing panicle resulting in 'white ear head'' symptoms. If YSB infestation is severe, then it may results in complete crop failure [Kushwaha KS, 1995] [9]. Yellow stem borer, *Scirpophaga incertulas* (Walker) can cause 25-30 per cent damage to the crop as "dead hearts" in vegetative stage and white ears with chaffy grains during heading stage (Rath, 2001 and Sachan *et al*., 2006) [15, 16].

In Karjat tehsil, farmers use granular insecticides *viz.* Phorate 10 G for control of YSB, as it is comparatively cheap and easy to apply. But Phorate 10 G is harmful to the environment and is now banned to use in rice fields as it is hazardous to nature. Hence, it is necessary to give some options to farmers which may be economic and effective in managing the pest.

Hence, the present work is carried out to determine the efficacy of coded formulation Chlorpyriphos 75 WDG against rice stem borer, *Scirpophaga incertulas* Walker. (Lepidoptera: Pyralidae).

2. Materials and Methods

The field experiment was laid out on the rice field of Mr. Kamal Murarkar, village Morabe, Tal. Karjat, Dist. Raigad (M.S.) during Rabi 2014-15. The experiment comprised of total eight treatments including different insecticides *viz.* Chlorpyriphos 75 WDG, Chlorpyriphos 50 EC and Acephate 75 SP with different concentrations and water spray as control. The experiment was replicated thrice. The treatment details are as follows.

Table 1: Treatment details

Treatments	Product	Dosage (per ha)	Dosage (per ha)
T0	Control (Water Spray)	-	
T1	Chlorpyriphos 75 WDG	350 g ai/ha	467 g/ha
T2	Chlorpyriphos 75 WDG	375 g ai/ha	500 g/ha
T3	Chlorpyriphos 75 WDG	400 g ai/ha	533 g/ha
T4	Chlorpyriphos 50 EC	375 g ai/ha	750 ml/ha
T5	Chlorpyriphos 50 EC	400 g ai/ha	800 ml/ha
T6	Acephate 75 SP	500 g ai/ha	666 g/ha
T7	Acephate 75 SP	750 g ai/ha	1000 g/ha

2.1 Method of assessment

Pre- treatment observations were recorded on 20 randomly selected hills per plot by counting total tillers and dead hearts per hill one day before spray. The per cent infestation was thus calculated. First spraying was done 34 days after transplanting, when incidence was above ETL. Post treatment observations were recorded on total tillers and dead hearts at 7 and 14 days after application of insecticides. The applications of insecticides were done twice. At each time of recording observations, 20 hills were randomly selected to record the total tillers and dead hearts.

$$\text{Per cent Dead hearts} = \frac{\text{Total dead hearts per hill}}{\text{Total tillers per hill}} \text{ X } 100$$

The average per cent dead heart infestation was worked out, transformed in to arcsin and analysed statistically. The yield from each treatment was calculated and converted in to q/ha.

3. Experimental Results

3.1 Effect of chlorpyriphos 75 WDG against rice stem Borer (*Scirpophaga incertulas*)

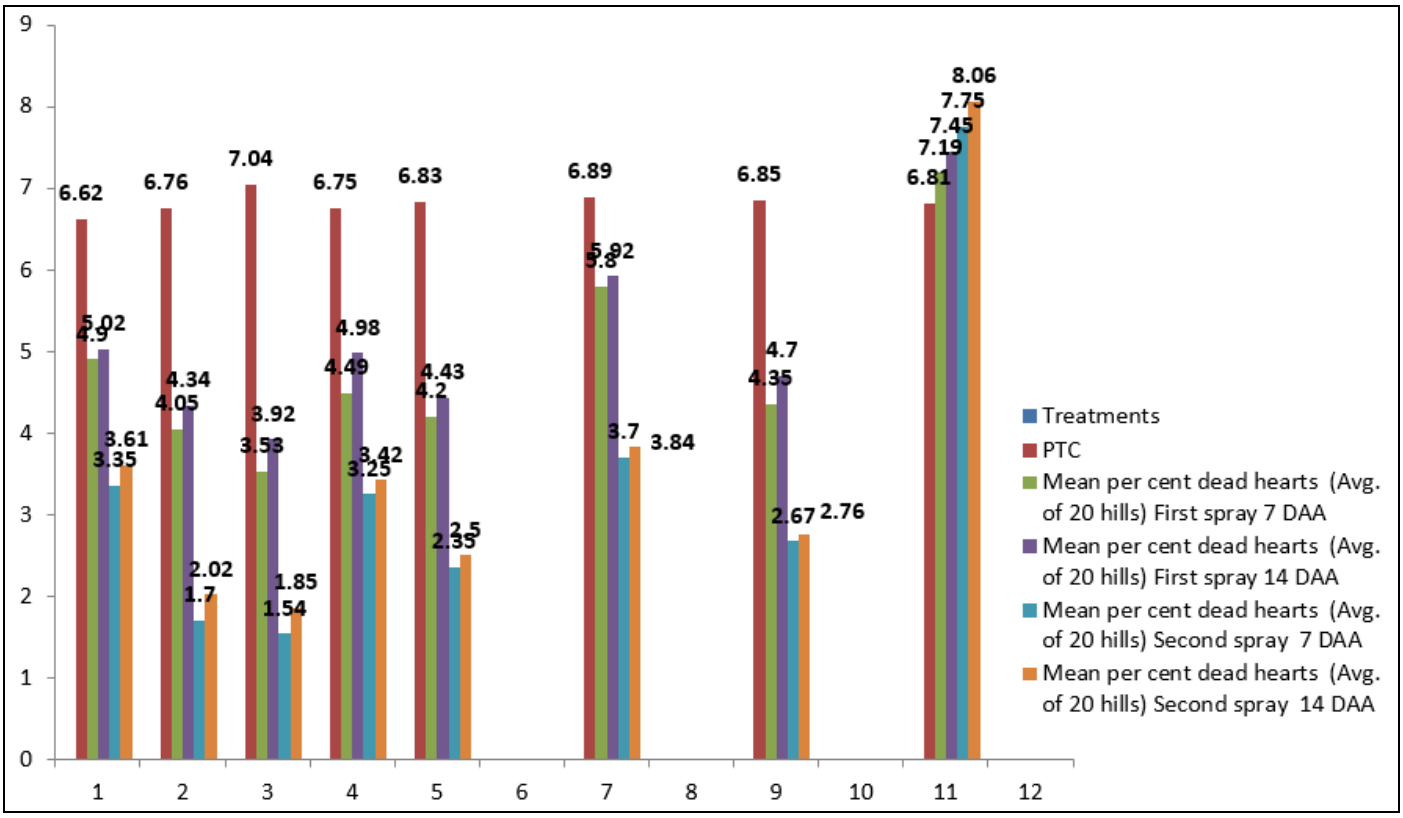
The per cent stem borer infestation ranged from 6.62 to 7.04 before treatment (Table 1). Seven Days after insecticide application (DAA), there was significant difference in incidence among the treatments. Treatment (T3), Chlorpyriphos 75 WDG @533 g/ha (3.53 per cent) was found at par with the treatment (T2), Chlorpyriphos 75 WDG @500 g/ha (4.05 per cent) and were significantly superior over all other treatments. The next best treatments in order of efficacy were the treatment (T5), Chlorpyriphos 50 EC @800 ml/ha (4.20 per cent) (T7), Acephate 75 SP @ 1000 gm/ha (4.35 per cent) and the treatment (T4) Chlorpyriphos 50 EC@ 750 ml/ha (4.49 per cent) which were at par with each other.

The observations recorded at 14 DAA, indicated that the treatment (T3), Chlorpyriphos 75 WDG @533 g/ha (3.92 per cent) was found at par with the treatment (T2), Chlorpyriphos 75 WDG @500 g/ha (4.34 per cent) and were significantly superior over all other treatments. The next best treatments in order of efficacy were the treatment (T5), Chlorpyriphos 50 EC @800 ml/ha (4.43 per cent) and (T7), Acephate 75 SP @ 1000 gm/ha (4.70 per cent). Maximum incidence was observed in untreated control (11.13 per cent) which were at par with each other. The same trend was observed 7 and 14 Days after second Spray. New insecticide molecules show higher efficacy in controlling yellow stem borer damage in rice due to their new broad spectrum and high insecticidal activity with novel mode of action [Prasad, *et al.*, 2014] [14].

Table 2: bio-efficacy of novel insecticides against stem borer in rice.

Treatments	Dose Per ha	PTC	Mean per cent dead hearts (Avg. of 20 hills)				Yield (q/ha)
			First spray		Second spray		
			7 DAA	14 DAA	7 DAA	14 DAA	
T1 - Chlorpyriphos 75 WDG	467 g/ha	6.62 (14.91)	4.90 (12.78)	5.02 (12.93)	3.35 (10.55)	3.61 (10.95)	46.77
T2 - Chlorpyriphos 75 WDG	500 g/ha	6.76 (15.07)	4.05 (11.60)	4.34 (12.02)	1.70 (7.48)	2.02 (8.17)	50.37
T3 - Chlorpyriphos 75 WDG	533 g/ha	7.04 (15.37)	3.53 (10.83)	3.92 (11.42)	1.54 (7.12)	1.85 (7.82)	51.90
T4 - Chlorpyriphos 50 EC	750 ml/ha	6.75 (15.06)	4.49 (12.22)	4.98 (12.90)	3.25 (10.38)	3.42 (10.64)	47.10
T5 - Chlorpyriphos 50 EC	800 ml/ha	6.83 (15.14)	4.20 (11.81)	4.43 (12.14)	2.35 (8.82)	2.50 (9.08)	49.60
T6 - Acephate 75 SP	666 g/ha	6.89 (15.22)	5.80 (13.94)	5.92 (14.07)	3.70 (11.09)	3.84 (11.29)	47.90
T7 - Acephate 75 SP	1000 g/ha	6.85 (15.17)	4.35 (12.03)	4.70 (12.53)	2.67 (9.38)	2.76 (9.54)	49.00
T8 - Untreated control	---	6.81 (15.12)	7.19 (15.54)	7.45 (15.84)	7.75 (16.15)	8.06 (16.49)	44.13
SE +		0.29	0.28	0.21	0.22	0.24	0.66
C.D. at 5%		N.S.	0.93	0.69	0.74	0.81	2.21

*Figures in parantheses are arc sin transformed values. PTC- Pre-Treatment Count DAA – Days after Application



Graph 1: Bio-efficacy of novel insecticides against Stem Borer in rice

3.2 Yield parameters

The yield data revealed that the maximum yield was obtained from the treatment (T3), Chlorpyriphos 75 WDG @533 g/ha (51.90 q/ha) which was at par with the treatment (T2) Chlorpyriphos 75 WDG @500 g/ha (50.7 q/ha) and both the treatments were found significantly superior over all other treatments in terms of yield. The next best treatments in order of yield were the treatment (T5), Chlorpyriphos 50 EC @800 ml/ha (49.60 q/ha), (T7), Acephate 75 SP @ 1000 gm/ha (49.00 q/ha) which were at par with each other. Minimum yield (44.13 q/ha) was observed in untreated control (T0).

4. Discussion

The results obtained from this experiment are in accordance with the results of Neena Bharti, *et al*., 2018 [11] who applied carbofuran 3G and fipronil 5% SC in rice fields and observed that the lowest incidence of rice stem borer 3.3 and 3.6 per cent were recorded in fields treated with Carbofuran 3G @ 30 kg/ha at 5 DBT in nursery with application of 2 spray of Fipronil 5%SC at 30 & 50 DAT. The highest grain yield (30.3 q/ha) was recorded and found best with application of Carbofuran 3G @ 30 kg/ha along with 2 spray of Fipronil 5% at 30 and 50 DAT followed by application of Carbofuran 3G @ 30 kg/ha in nursery + *T. chilonis* @ 5 cards/ha. The results are also in the same line with the results of Chatterjee, S and Mondal, P. 2014 [1]. They observed that Spinosad 45% SC proved most effective in managing yellow stem borer population as lowest DH% and WE% were observed in all the crop growing seasons. Result also revealed that 80.27% and 67.10% reduction of dead heart and white ear head were achieved over the control by two sprayings of Spinosad 45%SC which resulted in 69.96% increase of yield over the control. The results from this experiment also showed similarity with the results obtained by Sachan, S.K., *et al.*, 2018 [17]. They observed that application of chlorantraniliprole 18.5 SC @ 150 ml/ha was the most effective treatment in reducing the stem borer infestation at all observational interval resulting higher grain yield (44.10 g/ha) and it was followed by chlorantraniliprole 0.4% GR @ 10 kg/ha. The present findings are also in conformity with the finding of earlier studies conducted by Harikesh Singh and Wajid Hasan, 2017 who observed that per cent stem borer infestation was less in the treatment Chlorpyriphos 50 EC. The results obtained from Omprakash, S. *et al*, 2017 [12] revealed that Acephate 75 SP is effective in controlling rice stem borer as compared to untreated control, which are in accordance with our findings.

5. Conclusion

The treatment, (T3) Chlorpyriphos 75 WDG @533 g/ha and treatment, (T2) Chlorpyriphos 75 WDG @500 g/ha were found superior in minimizing the stem borer (*Scirpophaga incertulas*) incidence over rest of the treatments.

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