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Evaluation of the efficacy of some insecticides against rice yellow stem borer, *Scirpophaga incertulas* (Walker)

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Abstract
The present investigation entitled Evaluation of the efficacy of some insecticides against rice yellow stem borer, *Scirpophaga incertulas* (Walker) was undertaken at MAE Farm, Regional Agriculture Research Station, Karjat (M.S.) during *Kharif* 2018. The overall mean yellow stem borer infestation (dead heart) varied from 1.23 – 7.50 per cent. The T5 (Flubendiamide 20 WG @ 0.005%) recorded minimum (1.23%) infestation of yellow stem borer and which was significantly superior over all remaining treatments. The next effective treatments were T7 (Chlorantraniliprole 18.5 SC @ 0.006%) and T3 (Emamectin benzoate 5 SG @ 0.0015%) which recorded 1.75 and 1.94 per cent infestation, respectively. The T4 (Thiodicarb 75 WP @ 0.113%) recorded 2.26 per cent infestation and was at par with T1 (Cartap hydrochloride 75 SG @ 0.090%) 2.32 per cent infestation. Other treatments with descending order of effectiveness were T6 (Fipronil 5 SC @ 0.01 5) 2.59 per cent infestation and T2 (Lambda cyhalothrin 5 EC @ 0.003%) 2.84 per cent infestation. The maximum infestation 7.50 per cent dead heart was recorded in T8 (untreated control).

Keywords: Yellow stem borer, efficacy, management, infestation, dead heart

Introduction
Rice (*Oryza sativa* L.) (2n = 24) belonging to the family Graminae is one of the most important staple food crop for more than two-third of the world population and it has become a synonym of food itself. India is one of the world's largest producers of white rice, accounting for 20 per cent of the world rice production. In India it is cultivated in all directions from north to south and east to west. It is grown under diverse cultural conditions and over wide geographical range. The India's rice production has reached to a record high of 165 million tonnes from an area of 44 million hectares in 2016-2017 crop year (Anonymous, 2016) [1]. Grist and Lever (1969) [4] reported that over 100 species of insect pests attack rice crop at various stages of its growth. The field losses in rice due to insect pests account at least 20 per cent in India (Pathak *et al*. 1982) [9]. Damage during vegetative phase (50%) contributed more to yield reduction than the reproductive (30%) or ripening phase (20%) (Gupta and Raghuraman, 2003) [5]. Thus, insect pests are one of the major constraints in rice production and it has been reported that protected rice crop yield 28.1 per cent more than the unprotected. Therefore, insect pests are to be managed effectively to achieve stable higher yields in rice (Kalode and John, 1982) [6].

Pests of rice have been grouped in various categories based on their nature of damage like sucking pests which include brown plant hopper (*Nilaparvata lugens* Stal.), white backed plant hopper (*Sogatella furcifera* Horvath), green leaf hopper (*Nephotettix nigropictus* Stal.) and gundhi bug (*Leptocorisa varicornis* Thunb.); the defoliater insects like grasshopper, army worm, leaf folder, case worm, two horned caterpillar and rice hispa etc. Rice stem borers are a key group of insect pest damaging rice crop. There are five species of stem borers distributed throughout India. Among these, yellow stem borer (YSB) (*Scirpophaga incertulas* Walker) is the widest spread, dominant and destructive. The other borers are, pink stem borer, *Sesamia inferens* (Walker) occurring mostly in rice-wheat cropping systems of north-west, white borer (*Scirpophaga innotata* walker) common in southern region particularly in Kerala, dark headed stem borer (Meyrick) and striped stem borer (*Chilo suppressalis* Meyrick) in states of West Bengal and Assam, respectively.

Stem borer *S. incertulas* usually comprise more than 90 per cent of the borer population in rice. The onset of flooding and stem elongation provided a more favorable environment for *S. incertulas*. The rice borer's activity increased steadily during the first 3 to 4 months of flooding, to average 23 per cent damaged stems by the flowering stage. Borer's activity continued at about the same level as the water receded; to reach maximum annual levels of 38 to 44 per cent damaged stems at the late-ripening stage. At harvest, 60 per cent of the fields were at outbreak level (> 40% damaged stems) (Catling *et al*. 1984) [3]. It is the serious pest species of rice throughout the orient, and abundant both on lowland rice and upland rice attacking young plant even in the nursery stage (Litsinger *et al*. 1987) [8].The effective management of this pest studies related to efficacy of newer insecticides against yellow stem borer need to be studied. Keeping these facts in view the present investigation was proposed.

Materials and Methods

A statistically designed field experiment with randomized block design was conducted during 2018-19 at MAE farm, Regional Agriculture Research Station, Karjat.

Table 1: Experimental Details

Location	**:**	**Regional Agriculture Research Station, Karjat**
Design	:	Randomized Block Design (RBD)
Replications	:	3
Season	:	*Kharif* 2018-19
Crop	:	Rice
Variety	:	Karjat 3
Spacing	:	20 cm x 15 cm
Total Experimental Area	:	1433.7m2 (59m x 24.3m)
Total treatments	:	8

Table 2: Treatment Details

		Insecticide	**Dose/liter water (ml/gm)**	**Conc. (%)**
T_1	:	Cartap hydrochlorid 75 SG	1.23	0.090
T_2	:	Lambda cyhalothrin 5 EC	0.8	0.003
T_3	:	Emamectin benzoate 5 SG	0.3	0.0015
T_4	:	Thiodicarb 75 WP	0.3	0.113
T_5	:	Flubendiamide 20 WG	0.25	0.005
T_6	:	Fipronil 5 SC	2.5	0.01
T_7	:	Chlorantraniliprole18.5 SC	0.3	0.006
T_8	:	Untreated control	-	-

Method of recording observations: The observations were recorded at 3rd, 7th and 14th days after spraying. The observation was recorded by counting damage done by yellow rice stem borer i.e. dead hearts (DH) during vegetative stage and white ear heads (WEH) during panicle initiation stage. The per cent damage was calculated by using following formula:-

$$\text{for Stem borer} = \frac{\text{Per cent damage No. of dead hearts/White ear heads}}{\text{Total no. of tillers/panicle per hill}} 100$$

Pre-treatment observation was recorded 24 hrs before first spray. Commencing pest incidence on rice spraying was undertaken. The data thus obtained was subjected to appropriate transformation and analyzed statistically.

Results and Discussion

Efficacy of insecticides against yellow stem borer

The efficacy of insecticides was studied to perceive their effectiveness against yellow stem borer during *kharif* 2018. Initial application of all insecticides was given at 20 DAT to access the efficacy of different treatments. The damage caused by stem borer was recorded one day before spraying, later 3rd, 7th and 14th days after spraying and it was observed that insecticides were quite effective against stem borer as compared to untreated control. Data on per cent infestation of yellow stem borer recorded at 3rd, 7th, and 14th days after spray are presented in Table 3. The pre-treatment observation of stem borer infestation for all the treatments differs non-significantly which ranged from 6.65 to 7.02 per cent.

The post treatment observation recorded at 3 days after spray revealed that the yellow stem borer infestation (dead hearts) varied from 3.12 – 7.15 per cent. The treatment T5 (Flubendiamide 20 WG @ 0.005%) recorded minimum infestation (3.12%) of yellow stem borer and was significant over all the other treatments. The next best treatment was T7 (Chlorantraniliprole 18.5 SC @ 0.006%) with 3.40 per cent yellow stem borer infestation which was significant over T3 (Emamectin benzoate 5 SG @ 0.0015%), T4 (Thiodicarb 75 WP @ 0.113%), T1 (Cartap hydrochloride 75 SG @ 0.090%), T6 (Fipronil 5 SC @ 0.01%) and T2 (Lambda cyhalothrin 5 EC @ 0.003%). The T3 (Emamectin benzoate 5 SG @ 0.0015%) with 3.79 per cent yellow stem borer infestation was found at par with T4 (Thiodicarb 75 WP @ 0.113%) 3.93 per cent infestation. The T1 (Cartap hydrochloride 75 SG @ 0.090%) recorded 4.03 per cent infestation and was at par with T6 (Fipronil 5 SC @ 0.01%) 4.16 per cent infestation followed by T2 (Lambda cyhalothrin 5 EC @ 0.003%) 4.25 per cent infestation. Maximum infestation, 7.15 per cent was recorded in T8 (untreated control). At 7th days after spray the stem borer infestation (dead heart) ranged from 0.00 to 7.58 per cent. The T5 (Flubendiamide 20 WG @ 0.005%) recorded minimum infestation (0.00%) of yellow stem borer and was significant over all other treatments. The next best treatment was T7 (Chlorantraniliprole 18.5 SC @ 0.006%) 0.67 per cent infestation. The next treatments in descending order of effectiveness were T3 (Emamectin benzoate 5 SG @ 0.0015%) 0.77 per cent infestation, T4 (Thiodicarb 75 WP @ 0.113%) 1.18 per cent infestation, T1 (Cartap hydrochloride 75 SG @ 0.090%) 1.22 per cent infestation, T6 (Fipronil 5 SC @ 0.01%) 1.56 per cent infestation and T2 (Lambda cyhalothrin 5 EC @ 0.003%) 1.88 per cent infestation. The maximum infestation 7.58 per cent was recorded in T8 (untreated control). At 14th days after spray the stem borer infestation ranged from 0.56 to 7.77 per cent. The T5 (Flubendiamide 20 WG @ 0.005%) recorded minimum infestation (0.56%) of yellow stem borer and was significant over all the other treatments. The next best treatment was T7 (Chlorantraniliprole18.5% SC @ 0.006%) with 1.17 per cent infestation. The next treatments in descending order of effectiveness were T3 (Emamectin benzoate 5 SG @ 0.0015%) 1.27 per cent infestation, T4 (Thiodicarb 75 WP @ 0.113%) 1.68 per cent infestation, T1 (Cartap hydrochloride 75 SG @ 0.090%) 1.72 per cent infestation, T6 (Fipronil 5 SC @ 0.01%) 2.06 per cent infestation and T2 (Lambda cyhalothrin 5 EC @ 0.003%) 2.38 per cent infestation. The maximum infestation, 7.77 per cent was recorded in T8 (untreated control).

The overall mean yellow stem borer infestation (dead heart) varied from 1.23 – 7.50 per cent. The T5 (Flubendiamide 20

WG @ 0.005%) recorded minimum (1.23%) infestation of yellow stem borer and which was significantly superior over all remaining treatments.

Table 3: Efficacy of insecticides against rice yellow stem borer

Per cent infestation of rice yellow stem borer							
		Conc. (%)	**1DBS****	**3DAS*****	**7DAS**	**14DAS**	**Mean infestation (%)**
Cartap hydrochloride 75% SG	T1	0.090	6.85 (15.17)*	4.03 (11.57)	1.22 (6.34)	1.72 (7.54)	2.32 (8.76)
Lambda cyhalothrin 5% EC	T2	0.003	7.19 (15.56)	4.25 (11.90)	1.88 (7.88)	2.38 (8.87)	2.84 (9.70)
Emamectin benzoate 5% SG	T3	0.0015	6.93 (15.26)	3.79 (11.22)	0.77 (5.03)	1.27 (6.47)	1.94 (8.01)
Thiodicarb 75% WP	T4	0.113	6.86 (15.18)	3.93 (11.43)	1.18 (6.24)	1.68 (7.45)	2.26 (8.65)
Flubendiamide 20% WG	T5	0.005	6.65 (14.94)	3.12 (10.17)	0.00 (0.00)	0.56 (4.29)	1.23 (6.37)
Fipronil 5% SC	T6	0.01	6.74 (15.05)	4.16 (11.77)	1.56 (7.17)	2.06 (8.25)	2.59 (9.26)
Chlorantraniliprole 18.5% SC	T7	0.006	6.96 (15.30)	3.40 (10.63)	0.67 (4.70)	1.17 (6.21)	1.75 (7.67)
Untreated Control	T8	-	7.02 (15.36)	7.15 (15.51)	7.58 (15.98)	7.77 (16.19)	7.50 (15.89)
	SE (m±)		0.158	0.08	0.03	0.02	0.04
	C.D. 5%		NS	0.24	0.09	0.05	0.13

*Figures in parenthesis are arc sine values, ***DAS= Days After Spray,
**DBS= Day Before Spray

The next effective treatments were T7 (Chlorantraniliprole 18.5 SC @ 0.006%) and T3 (Emamectin benzoate 5 SG @ 0.0015%) which recorded 1.75 and 1.94 per cent infestation, respectively. The T4 (Thiodicarb 75 WP @ 0.113%) recorded 2.26 per cent infestation and was at par with T1 (Cartap hydrochloride 75 SG @ 0.090%) 2.32 per cent infestation. Other treatments with descending order of effectiveness were T6 (Fipronil 5 SC @ 0.01 5) 2.59 per cent infestation and T2 (Lambda cyhalothrin 5 EC @ 0.003%) 2.84 per cent infestation. The maximum infestation 7.50 per cent dead heart was recorded in T8 (untreated control).

The present findings are more or less in conformity with Aulak *et al.* (2016) [2], revealed that the per cent dead hearts were significantly lower (1.33) in the plots treated with Regent/Fipronil and it was closely followed by Padan/Cartap hydrochloride (1.40) and significantly better than Furadan (2.36).The present findings are more or less in conformity with (Karthikeyan, 2018) [7], 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.

Conclusion

The above research on efficacy of some insecticides against rice yellow stem Borer, *Scirpophaga incertulas* (Walker) revealed that treatment T5 (Flubendiamide 20 WG @ 0.005%) recorded minimum (1.23%) infestation and which was significantly effective over all remaining treatments for controlling the yellow stem borer infestation in rice. The maximum infestation 7.50 per cent dead heart was recorded in Treatment T8 (untreated control). These findings could be helpful for proper management of the yellow stem borer in rice crop.

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