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Identification of rice donors resistant against yellow stem borer, *Scirpophaga incertulas* (Walker)

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Abstract: Altogether, 55 promising rice genotypes along with susceptible check variety TN-1 and resistant check variety Suraksha have been screened against yellow stem borer (YSB), *Scirpophaga incertulas* (Walker) during *kharif* seasons 2010-11, 2011-12 and 2012-13. The YSB infestation varied from 0.0 to 18.67, 0.67 to 22.83 and 0.0 to 20.58%, respectively, during the *kharif* seasons 2010-11, 2011-12 and 2012-13. The results clearly indicated that the rice genotypes RP-Bio-Patho-02, BPT-5204 and HR-DRR-02 were most promising and highly resistant with 0.67, 0.78 and 1.22% average YSB infestation in comparison to susceptible check variety TN-1 with 20.69% average YSB infestation. However, average YSB infestation in resistant check variety Suraksha was 5.22%. Also, the entries CB-06-535, RP-4867-52-2-1192, RTNRH-10, CR-2711-76, CR-3005-230-5, TNRH-244, RP-Patho-08, RP-Bio-Patho-01, C 101 LAC, HR-DRR-01, RP 4680-1-2-23, CB 09-538 and CB 10-504 were also promising with 5 to 6.37% average YSB infestation and may be rated as moderately resistant.
Keywords: Resistant rice donors, Yellow stem borer, *Scirpophaga incertulas*

INTRODUCTION

The yellow stem borer (YSB), *Scirpophaga incertulas* (Walker) is the most important and devastating insect pest of rice causing yield losses to the tune of 27-34% every year[1]. The economic threshold level for YSB have been determined to be in between 5 and 10% larval infestation levels[2]. The studies on evaluation of rice germplasm/ varieties against stem borer have been conducted by earlier research workers[3,4]. The use of modern synthetic insecticides in crop pest control programmes around the world has resulted in the disturbance of eco-bio-balance. However, in changing scenario of pest management programme, host plant resistance plays an important role. In view of above, in the present study, an attempt has been made to evaluate certain rice genotypes from All India Coordinated Rice Improvement Project against YSB under field conditions.

MATERIALS AND METHODS

The field experiments were conducted with 55 promising rice genotypes along with susceptible check variety TN-1 and resistant check variety Suraksha in augmented design during *kharif* seasons 2010-11, 2011-12 and 2012-13 at Crop Research Station, Ghaghraghat, Bahraich. The plot size was 3.0 x 0.2 m^2, i.e. one row of 3.0 m at a spacing of 20 cm. The seeds of different entries were sown at line to line spacing of 20 cm during last week of June. The crops were raised adopting a standard package of practices except plant protection measures. 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 sowing and top dressing of the rest 40 kg N ha^{-1} was made after hand weeding during last week of August before flooding of the field.

The infestation of yellow stem borer was very low during vegetative stage and not recorded. At pre harvest, the infestation of yellow stem borer was recorded by counting total tillers, ear bearing tillers and white ears in randomly selected 10 hills per entry and % white ears were worked out. Harvesting was done by the end of November. The scoring for yellow stem borer infestation have been conducted on the basis of Standard Evaluation System developed by IRRI, Philippines, i.e. 0-9 scale, where 0: no infestation, 1: 1to 5% infestation, 3: 6 to 10% infestation, 5: 11 to 15% infestation, 7: 16 to 25% infestation and 9: above 25% infestation.

RESULTS AND DISCUSSION

The results are summarized in table 1 and 2. The YSB infestation varied from 0.0 to 18.67, 0.67 to 22.83 and 0.0 to 20.58%, respectively, during the *kharif* seasons 2010-11, 2011-12 and 2012-13 and the entries were categorized according to infestation pattern (Table- 1).

Table 1. Screening of promising rice genotypes against yellow stem borer, *Scirpophaga incertulas* (Walker) during *kharif* seasons 2010-11, 2011-12 and 2012-13.

Sl. No.	YSB infestation (% WE)	No. of entries		
		2010-11	2011-12	1012-13
1	0	6	0	3
2	1(1-5% WE)	3	4	6
3	3(6-10% WE)	16	12	17
4	5(11-15% WE)	12	6	15
5	7(16-25% WE)	5	16	9
6	9(25% & above)	2	8	2
7	d	11	9	3
Total		**55**	**55**	**55**

-WE: white ears
-d: dead/ damaged

The results indicated that 6, 0 and 3 rice genotypes were most promising with nil YSB infestation during the *kharif* seasons2010-11, 2011-12 and 2012-13, respectively. It has also been noted that 3, 4 and 6 entries with up to 5% YSB infestation; and 12, 12 and 17 entries with up to 10% YSB infestation were also promising during the *kharif* seasons 2010-11, 2011-12 and 2012-13, respectively. On the basis of overall performance of all the genotypes against yellow stem borer during the three *kharif* seasons, the promising rice genotypes have been categorized along with susceptible check variety TN-1 and resistant check variety Suraksha (Table 2).

Table 2. The most promising rice genotypes against yellow stem borer during *kharif* 2009-10, 2010-11 and 2011-12.

Sl. No.	Rice Genotypes	% White Ears			
		2010-11	2011-12	2012-13	Average
1.	RP-Bio-Patho-02	0.00	1.33	0.67	0.67
2.	BPT-5204	1.67	0.67	0.0	0.78
3.	HR-DRR-02	1.67	0.67	1.33	1.22
4.	CB-06-535	5.33	6.67	5.37	5.79
5.	RP-4867-52-2-1192	2.77	5.57	6.67	5.00
6.	RTNRH-10	5.23	5.43	5.33	5.33
7.	CR-2711-76	7.07	5.57	5.67	6.10
8.	CR-3005-230-5	5.87	5.07	6.57	5.84
9.	TNRH-244	6.67	2.93	5.43	5.01
10.	RP-Patho-08	6.33	5.33	6.11	5.92
11.	RP-Bio-Patho-01	6.67	5.97	3.67	5.44
12.	C 101 LAC	6.33	6.03	5.33	5.90
13.	HR-DRR-01	5.67	7.97	2.77	5.47
14.	RP 4680-1-2-23	5.57	7.37	5.23	6.06
15.	CB 09-538	5.43	6.67	2.93	5.01
16.	CB 10-504	7.11	6.33	5.67	6.37
17.	TN-1 (susceptible check)	18.67	22.83	20.58	20.69
18.	Suraksha (resistant check)	4.33	5.51	5.82	5.22
	CD (0.05)	-	-	-	1.63
	CV (%)	-	-	-	14.23

It is clear from the data that the rice genotypes RP-Bio-Patho-02, BPT-5204 and HR-DRR-02 were most promising with 0.67, 0.78 and 1.22% average YSB infestation, respectively, in comparison to susceptible check variety TN-1 with 20.69% average YSB infestation. However, average YSB infestation in resistant check variety Suraksha was 5.22%. Earlier, Chaudhary et al.[3] and Padhi [4] have rated the cultivars with less than 5% YSB infestation as highly resistant. Thus, it is very likely that the rice genotypes RP-Bio-Patho-02, BPT-5204 and HR-DRR-02 may be rated as highly resistant against yellow stem borer. Also, the entries CB-06-535, RP-4867-52-2-1192, RTNRH-10, CR-2711-76, CR-3005-230-5, TNRH-244, RP-Patho-08, RP-Bio-Patho-01, C 101 LAC, HR-DRR-01, RP 4680-1-2-23, CB 09-538 and CB 10-504 were also promising with 5 to 6.37% average YSB infestation and may be rated as moderately resistant. Regarding the mechanism of resistance it has been noted earlier that yellow stem borer larvae feeding on

resistant varieties were smaller, had low survival, and caused lower percentages of dead hearts/ white ears than those feeding on susceptible varieties[5]. However, Rustamani et al. observed differential response of varieties is due oviposition preference by yellow stem borer[6]. Zhu et al. investigated that resistant varieties caused mortality or inhibited the growth of stem borers, and resistance was highly correlated with smaller interval vascular bundles and larger width of the leaf sheath ridge[7]. Recently, Sarwar opined that rice plant resistance to the stem borers may be attributed through two physical characteristics,[8] viz. (i) Tight oppression of the leaf sheath around the stalk to prevent larval movement (susceptible cultivars might have leaf sheaths that loosen rapidly as the plant grows) and (ii) premature hardness of the internodes to reduce penetration and feeding of larvae that caused direct mortality and other sub lethal effects to the borer young larvae. It is likely that resistance is a complex process and one or all the phenomenon are involved in stem borer resistant varieties.

On the basis of present study, it is concluded that the rice genotypes RP-Bio-Patho-02, BPT-5204 and HR-DRR-02 are highly resistant to yellow stem borer, *Scirpophaga incertulas* (Walker) and may be used as donors in breeding programme. Also, the entries CB-06-535, RP-4867-52-2-1192, RTNRH-10, CR-2711-76, CR-3005-230-5, TNRH-244, RP-Patho-08, RP-Bio-Patho-01, C 101 LAC, HR-DRR-01, RP 4680-1-2-23, CB 09-538 and CB 10-504 were moderately resistant and may be used in breeding programme based on the other characteristics required by the breeders.

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