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Screening of rice germplasm against yellow stem borer (*Scripophaga incertulas* walker) under shallow water rice ecosystem

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Abstract

Eighteen rice germplasm were evaluated against yellow stem borer (*Scripophaga incertulas* Walker) infestation, to estimate the reaction under field condition during *Kharif*, 2007 and 2008. Based on pooled mean data, among the tested germplasm; check variety, Savita had shown higher YSB infestation in farm of 17.79 and 11.45 per cent Dead hearts (DH) and White Ears (WEs), respectively. Based on per cent DH infestations at late tillering stage, two germplasm viz., Purrendu (4.97) and IET 20042 (4.59) were found resistant and identified as the promising, ten germplasm including Swarna Sub 1(7.39) was moderately resistant, two viz., IET 20048 (14.61) and IET 19185 (12.16) moderately susceptible and remaining four were found to be susceptible. However, at maturity only on the bases of per cent WEs IET 19171(2.49) was identified as promising one being relatively low infestation, while six germplasm viz., IET 20093 (3.17), IET 20042 (3.27), IET 19186 (3.66), Purrendu (4.16), IET 20039 (4.70) and Swarna Sub 1 (4.82) were moderately resistant, seven moderately susceptible and the remaining four were found to be susceptible. None of the germplasm was highly resistant or highly susceptible against yellow stem borer infestation at both the crop stages.

Keywords: Yellow stem borers, rice germplasm, screening, resistance

Introduction

The rice plant is subjected to attack by more than 100 species of insect; 20 of them having economic importance. Among them stem borer species attacking the rice crop, yellow stem borer, *Scirpophaga incertulas* Walker is considered as the serious and specific pest of irrigated and lowland rice that caused heavy yield loss (Singh *et al.*, 2005) [2]. It is a major constraint responsible for low production of rice yield in all most the rice ecosystems, which causing 3-95% yield losses in India (Senapati and Panda, 1999). Due to limitation in the use of pesticides such as adverse effect on non-target organism, degradation of environment, development of new biotypes and breaking of the plant resistance, the identification and use of resistance/ tolerant varieties is best alternative for the management of the pest.

Materials and Methods

To study the varietal response of eighteen rice germplasm against yellow stem borer, *S. incertulas* under natural field infestation, an experiment was conducted at Crop Research Station Masodha, Faizabad during the two consecutive wet seasons of 2007 and 2008 under shallow water rice ecosystem. Thirty days old seedlings of rice germplasm having susceptible check (Savita) were transplanted in 2nd fortnight of July in 1m x 3m plots size with 15cm x 20cm plant spacing under Randomized Block Design (RBD) and replicated thrice. All the agronomical practices were adopted in raising the crop of good stand. The observation on the total number of tillers coupled with infested tillers (dead hearts; DH) was counted on 10 randomly selected hills from each plot at late tillering stage, however, at the maturity stage of the crop (15 days before harvest), the total number ear bearing tillers as well as white ears (WE) were counted. The mean per cent dead heart and white ears were calculated by using appropriate formulas. Finally the mean significance differences between germplasm were also

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calculated and compared to each other's.

Formulas for calculating per cent dead hearts & white ears

$$\text{Dead heart (\%)} = \frac{\text{No. of damaged tillers (DH) / 10 hills}}{\text{Total no. of tillers (healthy + damage) / 10 hills}} \times 100$$

$$\text{White ears (\%)} = \frac{\text{No. of damaged panicles (WE) / 10 hills}}{\text{Total no. of panicles (healthy + damage) / 10 hills}} \times 100$$

Table 1: Scale for germplasm evaluation against rice stem borer.

Scale	late tillering stage (DH)	maturity stage (WE)	Degree of resistance
0	No damage	No damage	HR (Highly resistance)
1	0.5 – 5.0 per cent	0.5-2.5 per cent	R (Resistant)
3	5.0-10.0 per cent	2.5-5.0 per cent	MR (Moderately resistant)
5	10.0-15.0 per cent	5.0-7.5 per cent	MS (Moderately susceptible)
7	15.0-30.0 per cent	7.5-12.5 per cent	S (Susceptible)
9	30.0 per cent and above	12.5 per cent and above	HS (Highly Susceptible)

Result and Discussion

Based on data presented in table 2, At late tillering stage, the dead hearts caused by yellow stem borer were ranged between 4.76 to 18.16 and 4.43 to 18.84 per cent among all the germplasm during *kharif*, 2007 and 2008, respectively. In 2007, the maximum dead hearts (18.16%) was recorded in IET 18782 as compared to susceptible check Savita (16.74%), which was at par with IET 19185, IET 20078 and IET 20069 that showed 14.90, 15.71 and 16.04 per cent DH, respectively. However, the minimum% DH (4.76) was observed in IET 20077 that was significantly lowest damage than the other germplasm except the IET 20042 (4.78), Purrendu (5.31), IET 19186 (5.31), IET 19189 (5.87), IET 20039 (6.50), IET 20093 (6.96), Sambha (6.57), Swarna Sub 1 (6.71) and IET 20082 (5.57). In *kharif* 2008, out of eighteen tested germplasms, the

maximum per cent DH (18.84) was noticed in susceptible check (Savita) which was significantly higher among all except IET 18782 (16.83%), IET 20069 (17.74%) and IET 20078 (15.58%). The lowest DH was recorded in germplasm IET 20042 (4.43%), which was at par with IET 19186 (5.93%), Purrendu (4.63%), IET 20082 (6.07%), IET 19189 (5.71%) and IET 20093 (5.27%), while rest of the germplasm showed significantly higher DH infestations than IET 20042. Remaining six germplasm viz., IET 19171, IET 20039, Sambha, IET 20048, IET 20077, Jal lahari, Swarna Sub 1 and IET 19185 had 8.64, 7.22, 7.24, 14.79, 6.77, 9.48, 8.08 and 9.42 per cent dead hearts, respectively and were at par to each other except IET 20048 and Jal lahari.

Table 2: Evaluation of rice germplasm against yellow stem borer in shallow water rice ecosystem during *Kharif* seasons.

Sl. No	Germplasm	Per cent dead hearts				Per cent white ears			
		2007	2008	Mean	Rating	2007	2008	Mean	Rating
1	IET 19171	8.24 (16.62)	8.64 (17.06)	8.44	3	2.11 (8.11)	2.71 (9.36)	2.41	1
2	IET 19186	6.13 (14.30)	5.93 (14.06)	6.03	3	3.91 (11.27)	3.41 (10.46)	3.66	3
3	IET 18782	18.16 (25.20)	16.83 (24.20)	17.49	7	10.17 (18.54)	9.77 (18.18)	9.97	7
4	IET 20039	6.50 (14.67)	7.22 (15.51)	6.86	3	4.12 (11.66)	5.28 (13.19)	4.70	3
5	Purrendu	5.31 (13.09)	4.63 (13.35)	4.97	1	3.91 (11.31)	4.42 (11.99)	4.16	3
6	Sambha	6.57 (14.81)	7.24 (15.60)	6.90	3	5.71 (13.80)	5.75 (13.85)	5.73	5
7	IET 20042	4.78 (12.60)	4.43 (12.10)	4.59	1	3.41 (10.62)	3.12 (10.14)	3.27	3
8	IET 20048	14.43 (22.26)	14.79 (22.61)	14.61	5	6.12 (14.20)	9.91 (18.31)	8.01	7
9	IET 20069	16.04 (23.53)	16.74 (24.12)	16.40	7	5.44 (13.45)	5.30 (13.30)	5.37	5
10	IET 20077	4.76 (12.52)	6.77 (15.24)	5.76	3	7.54 (15.92)	8.55 (16.96)	8.04	7
11	IET 20078	15.71 (23.32)	15.58 (23.23)	15.64	7	4.98 (12.83)	6.53 (14.44)	5.76	5
12	IET 20082	5.57 (13.64)	6.07 (14.24)	5.82	3	5.58 (13.54)	6.74 (14.99)	6.16	5
13	IET 19189	5.87 (13.96)	5.71 (13.79)	5.79	3	6.00 (14.15)	4.97 (13.85)	5.48	5
14	IET 20093	6.96 (15.17)	5.27 (13.23)	6.12	3	3.38 (10.43)	2.97 (9.93)	3.17	3
15	Jal lahari	8.76 (17.19)	9.48 (17.82)	9.12	3	6.25 (14.44)	5.70 (13.78)	5.98	5
16	Swarna Sub-1	6.71 (14.98)	8.08 (16.50)	7.39	3	4.08 (11.58)	5.56 (13.63)	4.82	3
17	IET- 19185	14.90 (22.69)	9.42 (17.60)	12.16	5	7.53 (15.90)	6.37 (14.56)	6.95	5
18	Savita (Susceptible check)	16.74 (24.13)	18.84 (25.71)	17.79	7	10.67 (18.79)	12.53 (20.69)	11.45	7
	Sem±	0.99	0.90	-	-	1.01	0.80	-	-
	CD at 5%	2.77	2.49	-	-	2.87	2.23	-	-

Values with in parentheses are arc sin transformation $\text{Sin}^{-1} \sqrt{x/100}$

At maturity stage (2007), the maximum white ears (10.67%) were observed in susceptible check (Savita) that was significantly higher than all the germplasm except the IET 20077 (7.54%) and IET 18782 (10.17%). However, significantly lowest damage (2.11% WE) was recorded in IET

19171 except IET 20042 (3.41%) and IET 20093 (3.38%). In 2008, the susceptible check variety Saavita (12.53%) has showed significantly highest white ear than all screened germplasm, while the lowest WEs was recorded in IET 19171 (2.71%), which differed significantly than others except IET

19186 (3.41%), IET 20042 (3.12%) and IET 20093 (2.97%). Based on pooled mean, at late tillering indicated that varieties IET 20048 (4.59%) and Savita (17.79%) exhibited a minimum and maximum infestation levels, respectively whereas at maturity the minimum incidence (2.41% WE) was observed in IET 19171 and maximum (11.45% WE) in Savita variety. Out of 18 germplasm evaluated IET 20042 and Purrendu were found resistant, ten germplasm i.e., IET 19171,

IET 19186, IET 20039, Sambha, IET 20048, IET 20077, IET 20082, IET 19189, IET 20093, Jal lahari and Swarna Sub 1 moderately resistant, two germplasm viz., IET 20048 and IET 19185 moderately susceptible and the remaining four, namely; IET 20078, IET 18782, IET 20069 and Savita were found susceptible against YSB infestation at late tillering (table: 3).

Table3: Categorization of rice germplasm under shallow water rice ecosystem

Sl. No.	Category (Score)	Late tillering Stage		Maturity Stage	
		Dead hearts (%)	Name of germplasm	White Ear (%)	Name of germplasm
1	HR (0)	No damage	Nil	No damage	Nil
2	R (1)	0.01 -5.00	Purrendu and IET 20042 (2)	0.01-2.5	IET 19171 (1)
3	MR (3)	5.0-10.0	IET 19171, IET 19186, IET 20039, Sambha, IET 20048, IET 20077, IET 20082, IET 19189, IET 20093, Jal lahari and Swarna Sub 1 (10)	2.5-5.0	IET 19186, IET 20039, Purrendu, IET 20042, IET 20093 and Swarna Sub 1 (6)
4	MS (5)	10.0-15.0	IET 19185 and IET 20048 (2)	5.0 -7.5	Sambha, IET 20069, IET 20078, IET 20082, IET 19189, Jal lahari and IET 19185 (7)
5	S (7)	15.0-30	IET 18782, IET 20069, IET 20078 and Savita (4)	7.5-12.5	IET 20048, IET 20077, IET 18782 and Savita (4)
6	HS (9)	30.0 and above	Nil	12.5 and above	Nil

The present findings are corroborated with Singh and Pandey (1997) ^[5], who reported that variety Savita was susceptible at late tillering stage. However, at maturity stage only IET 19171 germplasm was found resistant. Besides, six germplasm viz., Purrendu (resistant at late tillering), IET 19186, IET 20039, IET 20042, IET 20093 and Swarna Sub 1 were found moderately resistant, seven viz., Sambha, IET 19185, IET 19189, IET 20069, IET 20078, IET 20082 and Jal lahri and the remaining four germplasm viz., IET 20048 and IET 20077, IET 18782 and Savita were found moderately susceptible. The germplasm IET 20048 and IET 20077 were found moderately resistant while IET 20069 and IET 20078 susceptible at late tillering stage against yellow stem borer. The findings of present studies corroborate the findings of Singh and Pandey (1997) ^[5], Singh *et. al* (2005) ^[6], Gupta *et al.* (2002) ^[1], Padhi (2002 and 2007) ^[3, 4] and Gupta *et al.* (2003) ^[2]. None of the germplasm showed immune or highly susceptible reactions at both the growth stages in the crop in shallow water ecosystem.

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