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Research article

SCREENING OF RICE GERMPLASM FOR RESISTANCE TO YELLOW STEM BORER *SCIRPOPHAGA INCERTULAS* WALKER.

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ABSTRACT: Twenty nine entries during kharif 2011 and 53 entries during kharif 2012 were screened under natural field conditions for resistance to stem borer. During kharif 2011, highest incidence of stem borer as percent white ears was recorded in TN-1 whereas six cultures were resistant with '1' scale, incidence ranged between 1.9-5.1% WE. During kharif 2012, highest incidence recorded in RpPatho-02 with 13.13% WE whereas five cultures are resistant with scale '1', incidence ranged between 2.01-5.13% WE. The culture CR 2711-76 and CR 3005-230-5 were resistant to stem borer at reproductive stage during both the years. The culture CR 3005-77-2 was moderately resistant in both the years where as CR 3006-8-2 was moderately resistant in one year and moderately susceptible in another year.

Key words: Rice germplasm, Screening, Yellow stem borer, Resistance

INTRODUCTION

Rice (Oryza sativa L.) is one of the most significant cereals and is the staple food for more than 2 billion people. Almost 90 percent of the rice is grown and consumed in Asia. India is the second largest rice producing country in the world. In India rice occupies about 44.6 million hectares with a production of 90 million tones [5] and it constitute 52 percent of total food grain production. One of the major yield limiting factors of paddy is the attack of insect pests that cause 20-30% losses every year [11]. Nearly 300 species of insect pests are attacking the paddy crop at various stages and among them only 23 species cause notable damage [9]. Yellow stem borer, *Scirpophaga incertulas* (Walker), (Lepidoptera: Pyralidae), a monophagous pest of paddy is considered as most important nuisance of rain fed, low land and flood prone rice ecosystems [4]. It is one of the major pests in all rice producing areas of the world. Globally, yellow stem borer alone causes yield losses of 10 million tones and accounts 50% of all insecticides used in the rice field [6]. The rice stem borer, which infest the rice from seedling to maturity, act as a major constraint for the rice production [10], their larvae bore in to stem, feed on the inner tissue and usually one larva occurs per tiller. The damage symptoms due to stem borer larvae on affected plants differ with the development period at which plant infestation is initiated. The feeding of larve cause 'dead heart' symptoms at the vegetative stage and the rice plants may be capable of recompense the damage during the stage of maximum tillering. During reproductive stage, feeding of larvae particularly in panicle initiation and earhead emergence, cause 'white ear' symptoms and with heavy infestation resulting profound loss in yield [12]. Farmers frequently use chemical pesticides for the control of this pest [8]. This reliance on use of insecticides leads to numerous undesirable consequences. The varietal resistance is mainly inexpensive, least problematical and ecological friendly approach and major tactic in integrated pest management. Hence, present study undertaken to identify the new sources of resistant genotypes for management of yellow stem borer.

MATERIALS AND METHODS

Twenty nine entries during kharif 2011 and 53 entries during kharif 2012 supplied by Directorate of Rice Research, Rajendranagar, Hyderabad were raised under natural field conditions at Agricultural Research Station, Ragolu, Srikakulam district of Andhra Pradesh, India. During both the years the nurseries were sown on well prepared raised beds and about a month old seedlings were transplanted in the field with spacing of 20×15cm, 2 seedlings per hill in a single row of 20 hills for each entry with two replications. No plant protection coverage was provided in the test material to create optimum condition for pest multiplication. All the recommended agronomic practices were adopted during the experimentation. Incidence of stem borer was recorded on all the 20 hills per culture. The total tillers and number of dead hearts at vegetative stage and number of white ears at pre harvest stage were noted and percent dead hearts and white ears were worked out. Observations were noted at peak incidence at vegetative stage and at preharvest stage.

$$\% \text{ dead hearts / white ears} = \frac{\text{Total no.of dead hearts/white ears}}{\text{Total tillers}} \times 100$$

Based on the damage rating and scale the status of rice culture was determined by following the IRRI Standard Evaluation System (SES) for rice.

RESULTS AND DISCUSSION

KHARIF 2011

During *kharif* 2011 under natural field conditions percent tiller damage was assessed during vegetative and reproductive stages. During vegetative stage the incidence as dead hearts was not in significant level but during reproductive stage the incidence was observed significantly. Among the 29 genotypes the lowest stem borer damage was observed in 6 cultures i.e CR 2711-76, CR 3005-226-5, CR 3006-8-2, CB 05022, CB 05031 and CB 06124 with '1' scale (incidence ranged between 1.9-5.1%WE) under resistant category (1-5%WE) (Table.1).

Eleven genotypes i.e CR 2711-114, CR 2711-139, CR 2711-149, CR 3005-11-3, CR 3005-77-2, CR 3005-226-7, TNRH 192, TNRH 244, RP Patho-08, BPT 5204 and Swarna were moderately resistant with '3' scale (6-10% WE) (Table.1). Seven cultures i.e CR 2712-12, TNRH 237, RP Patho-01, Suraksha, RP Patho-03, RP Patho-06 and RP Patho-07 were moderately susceptible with '5'scale (11-15% WE) (Table.1). Four cultures i.e TNRH 258, RP Patho-02, C 101 A 51 and C 101 LAC were susceptible with '7' scale (16-26%WE) and one entry TN1 was highly susceptible with 36.4%WE i.e scale '9'(Table.1).

KHARIF 2012

During *kharif* 2012 fifty three genotypes were tested for resistance. The incidence of stem borer was low during vegetative stage. During reproductive stage 5 genotypes viz., CR 2711-76, CR 3005-231-5, Rp Bio 4918-230S, W1203(DRR) and CB05-022 were resistant with scale'1'(Table.2). The genotypes CR 3005-77-2, JGL 17974, IRGA 318-11-6-9-2B, W1263(IRRI), (Table-3) RP Patho-03, RP Patho-04, RP Bio Patho-02, B 95-1, BPT 5204, C 101A 51, Suraksha, C 101 LAC, HR-DRR-01, HR-DRR-02, HR-DRR-03, HR-DRR-04, HR-DRR-05, HR-DRR-06, HR-DRR-07, BG 380-2, RP 4918-212(S), RP 4918-221(S), RP 4918-228(S), CB 05-031, CB 06-124, CB 07-540, RP 4680-1-2-23, CB 09-125, CB 09-512, CB 09-570, TNRH 206 and TNRH 237 (32 genotypes) were moderately resistant with scale'3'(Table.2). The genotypes CR 3006-8-2, RP Patho-01, RP Patho-02, RP Bio Patho-01, Tetep, RP 4918-215(S), CB 09-516, CB 09-526, CB 09-537, CB 09-538, CB 10-504, THRH 222, TNRH 241, TNRH 244, TNRH 258 and TN1 (16) genotypes were moderately susceptible with scale '5'(Table.2).

Table-1: Yellow stem borer damage (%) in different genotypes of Rice during Kharif 2011

S.No	Rice genotype	Stem borer damage (%) White ears	Damage rating	Status
1	CR 2711-76	3.5	1	R
2	CR 2711-114	7.8	3	MR
3	CR 2711-139	9.1	3	MR
4	CR 2711-149	6.2	3	MR
5	CR 2712-12	12.9	5	MS
6	CR 3005-11-3	9.3	3	MR
7	CR 3005-77-2	7.8	3	MR
8	CR 3005-226-7	7.4	3	MR
9	CR 3005-230-5	1.9	1	R
10	CR 3006-8-2	5.1	1	R
11	CB 05022	2.9	1	R
12	CB 05031	4.9	1	R
13	CB 06124	2.4	1	R
14	TNRH 192	8.5	3	MR
15	TNRH 237	13	5	MS
16	TNRH 244	7.8	3	MR
17	TNRH 258	15.6	7	S
18	RP Patho-01	12.8	5	MS
19	Suraksha	14.8	5	MS
20	RP Patho-02	15.9	7	S
21	RP Patho-03	11	5	MS
22	RP Patho-06	10.8	5	MS
23	RP Patho-07	13.3	5	MS
24	RP Patho-08	6.9	3	MR
25	C 101 A 51	22.3	7	S
26	C 101 LAC	24.9	7	S
27	BPT 5204	9.6	3	MR
28	Swarna	6.8	3	MR
29	TN1	36.4	9	HS

The genotype CR 2711-76 and CR 3005-230-5 were resistant to stem borer at reproductive stage during kharif 2011 and 2012. The genotype CR 3005-77-2 was moderately resistant during kharif 2011 and 2012 where as CR 3006-8-2 was moderately resistant in 2011 and moderately susceptible in 2012. The screening of 29 genotypes during 2011 and 53 genotypes during 2012 led to the identification of some genotypes with natural resistance to the stem borer. The resistance in genotypes CR2711-76, CR3005-230-5 and CR3005-77-2 may be due to the presence of a strong repellent or a lack of feeding stimulus in the plants, and either due to the presence of toxic material or nutritional deficiencies in the plant for the insect. Generally, the plant resistance to insects is distinguished as antibiosis, tolerance and antixenosis [1]. All the three categories of resistance are observed against borers in rice germplasm [13]. Differential behavior of rice cultures to borers infestation was observed [1,7,13]. A significant positive correlation was observed between different corrected damage ratings and leaf width and chlorophyll content in rice leaves [14].

Table-2: Yellow stem borer damage (%) in different genotypes of Rice during Kharif 2012

S.No.	Rice genotype	Stem borer damage (%) White ears	Damage rating	Status
1	CR 2711-76	3.4	1	R
2	CR 3005-77-2	5.66	3	MR
3	CR 3005-230-5	4.46	1	R
4	CR 3006-8-2	12.02	5	MS
5	JGL 17974	6.34	3	MR
6	RP Bio 4918-230S	2.01	1	R
7	IRGA 318-11-6-9-2B	9.84	3	MR
8	W 1263 (DRR)	4.76	1	R
9	W 1263 (ACC11057) IRRI	9.01	3	MR
10	TN 1	12.83	5	MS
11	RP Patho-01	12.39	5	MS
12	RP Patho-02	13.13	5	MS
13	RP Patho-03	5.62	3	MR
14	RP Patho-04	9	3	MR
15	RP Bio Patho-01	11.34	5	MS
16	RP Bio Patho-02	9.76	3	MR
17	B 95-1	6.12	3	MR
18	BPT 5204	8.11	3	MR
19	C 101A 51	6.25	3	MR
20	Suraksha	7.83	3	MR
21	C 101LAC	6.54	3	MR
22	Teteo	10.84	5	MS
23	HR-DRR-01	7.21	3	MR
24	HR-DRR-02	8.65	3	MR
25	HR-DRR-03	6.8	3	MR
26	HR-DRR-04	7.02	3	MR
27	HR-DRR-05	6.84	3	MR
28	HR-DRR-06	7.69	3	MR
29	HR-DRR-07	7.76	3	MR
30	BG 380-2	8.08	3	MR
31	RP 4918-212(S)	5.88	3	MR
32	RP 4918-215(S)	10.57	5	MR
33	RP 4918-221(S)	5.61	3	MR
34	RP 4918-228(S)	7.55	3	MR
35	CB 05-022	5.13	1	MR
36	CB 05-031	7.53	3	MR
37	CB 06-124	8.05	3	MR
38	CB 07-540	8.16	3	MR
39	RP 4680-1-2-23	8.18	3	MR
40	CB 09-125	9.89	3	MR
41	CB 09-512	6.67	3	MR
42	CB 09-516	11.43	5	MR
43	CB 09-526	10.99	5	MR
44	CB 09-537	12.75	5	MR
45	CB 09-538	10.53	5	MR
46	CB 09-570	5.71	3	MR
47	CB 10-504	11	5	MR
48	TNRH 206	9.52	3	MR
49	TNRH 222	11.3	5	MS
50	TNRH 237	6.42	3	MR
51	TNRH 241	10.83	5	MS
52	TNRH 244	11.11	5	MS
53	TNRH 258	11.97	5	MS

Table-3: IRRI Standard Evaluation System

Damage rating %	Scale	Status
0	0	Highly Resistant
1-5	1	Resistant
6-10	3	Moderately Resistant
11-15	5	Moderately Susceptible
16-25	7	Susceptible
26 and above	9	Highly Susceptible

CONCLUSION

The genotypes CR2711-76, CR3005-230-5 and CR3005-77-2 exhibited resistance in both the years; hence, they can be developed as varieties or can be used in breeding programme as a source of stem borer resistance.

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