

Evaluation of rice accessions against yellow stem borer, *Scirpophaga incertulas* (Walker)

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Abstract

Two hundred and sixty rice accessions were screened for their reaction to deadheart damage by yellow stem borer *Scirpophaga incertulas* at 55 DAT under field condition. Among the 260 accessions screened, 22 accessions recorded as highly resistant (Grade 0) with nil incidence of stem borer and 19 accessions were recorded as susceptible (Grade 7) with 31-60 per cent deadheart damage at vegetative phase. Two traditional rice accessions like Norungan and Kattanur were rated as highly resistant. Accessions which are rated as resistant (or) highly resistant have to be screened in artificial conditions with high insect pressure and may be used as resistant donors in breeding programs against yellow stem borer.

Keywords: resistance, yellow stem borer, deadheart

Introduction

Rice (*Oryza sativa* L.) belongs to the family Gramineae or Poaceae. It is the most important staple food for more than 60 per cent of the world population. In India, approximately 100 insect species feed on rice and 20 of these are considered to be as major pests that causing 30% yield loss. Among these, Yellow Stem Borer, *Scirpophaga incertulas* is the most predominant and destructive one causing yield loss of about 10-60% [7]. *S. incertulas* is a monophagous pest which attacks rice plant from seedling phase and up to maturity phase [6]. In vegetative stage the symptom produced by the attack of yellow stem borer is called "Deadheart" and in the reproductive stage "White ear head" appears at the time of panicle or ear development [1] (Fig-1). Use of chemical insecticides for the protection of rice crop causes health hazards to humans. Host Plant Resistance is one of the eco-friendly and cost effective methods of pest management. Hence the present study was conducted to identify the resistant accessions by screening under field condition against yellow stem borer for the benefit of farming communities.

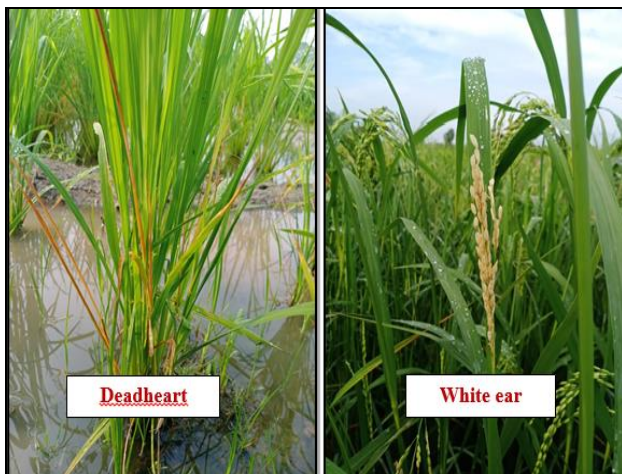


Fig 1: Symptoms of Yellow stem Borer *Scirpophaga incertulas*

Materials and methods

The field experiment was conducted to evaluate rice accessions against yellow stem borer to identify the resistant sources. A total of 260 accessions used in this study, out of these 248 accessions/ genotypes procured from NRRI, Cuttack, 10 traditional rice accessions were collected from ARS, Paramakudi and 2 local accessions collected from Department of Agronomy, Annamalai University. All the genotypes were screened under field condition at nearby village "Shivapuri" (11.3921°N, 79.7141°E). Nursery of these genotypes was prepared properly as per the common agronomic practices. Each accession was sown in raised nursery bed and transplanting of seedlings was done on 22 days after sowing. The seedlings were planted in two rows with spacing of 20 cm between rows and 15 cm between plants. The crop was left insecticides free throughout the entire study period. Ten plants were selected at random per accession for recording the deadheart damage at vegetative state (55 DAT) was calculated using the following formula [4] (Table 2).

$$\text{Per cent deadheart} = \frac{\text{Number of damaged tillers (deadheart)}}{\text{Total number of tillers}} \times 100$$

The damage rating and scale was given for the test accessions using IRRI Standard Evaluation System for rice [5] (Table 1).

Table 1: Standard Evaluation System for damage rating and scale of rice accessions for resistance against yellow stem borer on per cent damage basis.

Deadheart (DH)		
Damage (%)	Scale	Status
0	0	Highly Resistant (HR)
1-10	1	Resistant (R)
11-20	3	Moderately Resistant (MR)
21-30	5	Moderately Susceptible (MS)
31-60	7	Susceptible (S)
61 & above	9	Highly Susceptible (HS)

Table 2: Assessment of deadheart damage by *Scirpophaga incertulas* on different rice accessions under field conditions at 55 DAT

S. No.	Accessions	Deadheart Damage (%)	Score	Category
1.	BA-1	6.00	1	R
2.	BA-2	9.16	1	R
3.	BA-3	10.33	1	R
4.	BA-4	8.33	1	R
5.	BA-5	8.00	1	R
6.	BA-6	11.99	3	MR
7.	BA-8	17.16	3	MR
8.	BA-9	17.52	3	MR
9.	BA-11	17.50	3	MR
10.	BA-12	12.37	3	MR
11.	BA-13	3.33	1	R
12.	BA-14	4.00	1	R
13.	BA-16	28.99	5	MS
14.	BA-17	7.61	1	R
15.	BA-18	12.50	3	MR
16.	BA-20	21.83	5	MS
17.	BA-21	14.99	3	MR
18.	BA-23	11.66	3	MR
19.	BA-24	17.00	3	MR
20.	BA-25	17.83	3	MR
21.	BA-26	20.83	5	MS
22.	BA-27	8.66	1	R
23.	BA-28	20.50	5	MS
24.	BA-29	30.66	7	S
25.	BA-30	2.00	1	R
26.	BA-31	30.33	5	MS
27.	BA-32	2.00	1	R
28.	BA-33	0.00	0	HR
29.	BA-34	3.33	1	R
30.	BA-35	4.00	1	R
31.	BA-36	4.00	1	R
32.	BA-37	4.99	1	R
33.	BA-38	18.00	3	MR
34.	BA-39	5.66	1	R
35.	BA-40	35.83	7	S
36.	BA-41	25.50	5	MS
37.	BA-42	26.00	5	MS
38.	BA-43	14.00	3	MR
39.	BA-44	17.33	3	MR
40.	BA-45	17.50	3	MR
41.	BA-46	7.33	1	R
42.	BA-47	4.00	1	R
43.	BA-48	2.00	1	R
44.	BA-49	0.00	0	HR
45.	BA-50	0.00	0	HR
46.	BA-52	12.66	3	MR
47.	BA-53	10.66	3	MR
48.	BA-54	16.50	3	MR
49.	BA-56	1.66	1	R
50.	BA-57	1.66	1	R
51.	BA-59	9.00	1	R
52.	BA-60	3.66	1	R
53.	BA-63	10.50	3	MR
54.	BA-64	1.66	1	R
55.	BA-65	3.66	1	R
56.	BA-66	4.00	1	R
57.	BA-67	1.66	1	R
58.	BA-68	6.00	1	R
59.	BA-76	9.00	1	R
60.	BA-78	3.66	1	R
61.	BA-79	6.00	1	R
62.	BA-80	19.00	3	MR
63.	BA-81	9.00	1	R
64.	BA-82	24.00	5	MS
65.	BA-83	12.00	3	MR

66.	BA-86	6.00	1	R
67.	BA-87	10.00	1	R
68.	BA-88	5.33	1	R
69.	BA-89	8.85	1	R
70.	BA-90	7.33	1	R
71.	BA-91	8.00	1	R
72.	BA-92	4.00	1	R
73.	BA-93	10.33	1	R
74.	BA-94	6.99	1	R
75.	BA-95	10.50	3	MR
76.	BA-96	42.00	7	S
77.	BA-98	5.33	1	R
78.	BA-100	6.00	1	R
79.	BA-101	14.00	3	MR
80.	BA-103	12.00	3	MR
81.	BA-104	21.50	5	MS
82.	BA-105	12.00	3	MR
83.	BA-106	23.50	5	MS
84.	BA-107	4.00	1	R
85.	BA-108	0.00	0	HR
86.	BA-109	18.50	3	MR
87.	BA-110	6.00	1	R
88.	BA-111	3.66	1	R
89.	BA-112	8.00	1	R
90.	BA-113	6.99	1	R
91.	BA-114	5.33	1	R
92.	BA-115	4.00	1	R
93.	BA-116	8.50	1	R
94.	BA-117	11.50	3	MR
95.	BA-118	16.00	3	MR
96.	BA-119	8.00	1	R
97.	BA-120	11.50	3	MR
98.	BA-121	16.50	3	MR
99.	BA-122	6.00	1	R
100.	BA-123	6.50	1	R
101.	BA-124	12.00	3	MR
102.	BA-125	0.00	0	HR
103.	BA-126	15.50	3	MR
104.	BA-127	10.50	3	MR
105.	BA-128	12.33	3	MR
106.	BA-129	11.00	3	MR
107.	BA-130	8.00	1	R
108.	BA-131	17.49	3	MR
109.	BA-132	0.00	0	HR
110.	BA-133	0.00	0	HR
111.	BA-134	0.00	0	HR
112.	BA-135	6.50	1	R
113.	BA-136	14.16	3	MR
114.	BA-137	15.66	3	MR
115.	BA-138	6.00	1	R
116.	BA-139	7.00	1	R
117.	BA-140	18.33	3	MR
118.	BA-141	9.83	1	R
119.	BA-142	38.83	7	S
120.	BA-143	22.00	5	MS
121.	BA-145	39.16	7	S
122.	BA-146	12.50	3	MR
123.	BA-147	0.00	0	HR
124.	BA-148	9.00	1	R
125.	BA-149	10.00	1	R
126.	BA-150	6.00	1	R
127.	BA-151	23.33	5	MS
128.	BA-152	13.50	3	MR
129.	BA-153	16.50	3	MR
130.	BA-154	4.00	1	R
131.	BA-155	10.00	1	R
132.	BA-156	10.00	1	R
133.	BA-157	15.50	3	MR

134.	BA-158	6.00	1	R
135.	BA-159	10.00	1	R
136.	BA-160	15.00	3	MR
137.	BA-161	18.00	3	MR
138.	BA-162	23.99	5	MS
139.	BA-163	14.99	3	MR
140.	BA-164	16.00	3	MR
141.	BA-165	20.00	3	MR
142.	BA-166	16.50	3	MR
143.	BA-167	28.66	5	MS
144.	BA-168	11.50	3	MR
145.	BA-169	17.33	3	MR
146.	BA-170	40.00	7	S
147.	BA-171	15.83	3	MR
148.	BA-172	17.50	3	MR
149.	BA-173	25.50	5	MS
150.	BA-174	19.50	3	MR
151.	BA-175	13.33	3	MR
152.	BA-176	21.83	5	MS
153.	BA-177	15.83	3	MR
154.	BA-178	17.83	3	MR
155.	BA-179	18.99	3	MR
156.	BA-180	22.66	5	MS
157.	BA-181	18.49	3	MR
158.	BA-182	21.66	5	MS
159.	BA-183	34.83	7	S
160.	BA-184	32.49	7	S
161.	BA-185	36.00	7	S
162.	BA-186	16.50	3	MR
163.	BA-187	27.00	5	MS
164.	BA-188	9.00	1	R
165.	BA-189	50.83	7	S
166.	BA-190	27.50	5	MS
167.	BA-191	24.16	5	MS
168.	BA-192	19.99	3	MR
169.	BA-193	28.33	5	MS
170.	BA-194	5.00	1	R
171.	BA-195	7.50	1	R
172.	BA-196	15.83	3	MR
173.	BA-197	13.33	3	MR
174.	BA-198	14.16	3	MR
175.	BA-199	16.99	3	MR
176.	BA-200	29.49	5	MS
177.	BA-201	15.50	3	MR
178.	BA-202	4.00	1	R
179.	BA-203	22.33	5	MS
k180.	BA-204	0.00	0	HR
181.	BA-205	25.50	5	MS
182.	BA-206	0.00	0	HR
183.	BA-207	2.00	1	R
184.	BA-208	2.50	1	R
185.	BA-209	30.83	7	S
186.	BA-210	42.83	7	S
187.	BA-211	11.00	3	MR
188.	BA-212	33.00	7	S
189.	BA-213	7.50	1	R
190.	BA-214	15.66	3	MR
191.	BA-215	27.49	5	MS
192.	BA-216	4.00	1	R
193.	BA-217	30.00	5	MS
194.	BA-218	10.00	1	R
195.	BA-219	10.00	1	R
196.	BA-221	0.00	0	HR
197.	BA-223	25.83	5	MS
198.	BA-226	5.33	1	R
199.	BA-227	6.00	1	R
200.	BA-228	2.00	1	R
201.	BA-229	20.83	5	MS

202.	BA-230	29.16	5	MS
203.	BA-231	27.50	5	MS
204.	BA-233	31.66	7	S
205.	BA-234	4.50	1	R
206.	BA-235	24.49	5	MS
207.	BA-238	14.16	3	MR
208.	BA-240	4.00	1	R
209.	BA-242	18.33	3	MR
210.	BA-243	0.00	0	HR
211.	BA-244	0.00	0	HR
212.	BA-245	8.50	1	R
213.	BA-247	10.00	1	R
214.	BA-248	14.00	3	MR
215.	BA-249	22.00	5	MS
216.	BA-250	17.00	3	MR
217.	BA-251	8.00	1	R
218.	BA-252	16.50	3	MR
219.	BA-253	19.33	3	MR
220.	BA-254	0.00	0	HR
221.	BA-257	0.00	0	HR
222.	BA-258	11.83	3	MR
223.	BA-260	22.83	5	MS
224.	BA-262	20.49	5	MS
225.	BA-264	4.50	1	R
226.	BA-266	33.66	7	S
227.	BA-267	4.50	1	R
228.	BA-269	3.33	1	R
229.	BA-270	39.16	7	S
230.	BA-271	45.83	7	S
231.	BA-272	12.50	3	MR
232.	BA-274	0.00	0	HR
233.	BA-275	6.00	1	R
234.	BA-276	15.66	3	MR
235.	BA-277	10.00	1	R
236.	BA-278	34.16	7	S
237.	BA-282	0.00	0	HR
238.	BA-283	3.66	1	R
239.	BA-284	24.16	5	MS
240.	BA-285	5.33	1	R
241.	BA-287	6.00	1	R
242.	BA-288	0.00	0	HR
243.	BA-293	11.00	3	MR
244.	BA-294	22.99	5	MS
245.	BA-295	18.00	3	MR
246.	BA-296	18.00	3	MR
247.	BA-298	18.50	3	MR
248.	TN-1	23.00	5	MS
249.	Norungan	0.00	0	HR
250.	Nootripathu	7.00	1	R
251.	Kuliyadichan	10.50	3	MR
252.	Poongkar	14.83	3	MR
253.	Kuruvai Kalanchium	10.50	3	MR
254.	Kattanur	0.00	0	HR
255.	Sivappu Chitirai Kar	17.83	3	MR
256.	Vellai Chitirai Kar	8.00	1	R
257.	Kalanamak	2.00	1	R
258.	Mattaikar	49.66	7	S
259.	Sadhana	0.00	0	HR
260.	BPT-5204	4.00	1	R

DAT- Days After Transplanting, HR- Highly Resistant, R- Resistant, MR- Moderately Resistant, MS-Moderately Susceptible, S-Susceptible

Results and Discussion

Out of 260 accessions screened, 22 accessions scored grade 0 (0% dead heart) and showed nil incidence of yellow stem borer, 97 accessions scored grade 1 (1-10% dead heart) were found to show minimal stem borer attack, 84

accessions recorded as grade 3 (11-20% dead heart), 38 accessions got grade 5 (21-30% dead heart) and 19 accessions scored grade 7 (31-60% dead heart). In this study no accessions were recorded under grade 9 (Above 60% deadheart). Similarly ^[3] evaluated 15 medium duration rice

cultures during *Pishanam* season, 2013-2014 and reported that the entries AS 12035 and AS 12051 recorded grade 1. The cultures AS 12005, AS 12050, AS 12104 and AS 12001 recorded grade 3. Resistance in rice accessions may be due to the presence of secondary metabolites, repellent or antifeedant stimuli by the plants. Moreover, varieties with thin layers of sclerenchyma tissue were usually escaped from yellow stem borer attack than those with thick layers. Similarly, the internal factors such as silica content and other chemical properties may offered resistance to stem borer [2].

Conclusion

Identification and evaluation of rice yellow stem borer resistance is a difficult task for the development of resistant varieties. Out of 260 rice accessions screened, only 22 accessions showed highly resistance against *S. incertulas* in the vegetative phase. Traditional rice accessions like Norungan and Kattanur having no incidence of stem borer attack. Similarly, the local variety Sadhana used in and around Annamalainagar- Chidambaram showed highly resistance against yellow stem borer. Hence, they can be utilized in breeding programs as a source of resistance against yellow stem borer.

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