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ASSESSMENT OF DEAD HEART DAMAGE BY *SCIRPOPHAGA INCERTULAS* (WALKER) ON DIFFERENT RICE ACCESSIONS UNDER FIELD CONDITION

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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* under field condition at nearby village "Shivapuri" Annamalainagar-Chidambaram. Among the 260 accessions screened, 52 accessions recorded as highly resistant (Grade 0) with nil incidence of stem borer and 15 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. The rice accessions like Sadhana and BPT-5204 (Local accessions-Annamalainagar) also showed no stem borer attack and have been 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.

Key words: Rice, Accessions, Resistance, Yellow Stem Borer.

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's population. Rice crop is affected by various factors like biotic and abiotic stresses. Among the biotic stresses, insect pests play a major role in limiting the production of rice. Approximately 52 per cent of the global rice produce is lost annually due to the damage caused by biotic factors. Out of which 21 per cent is attributed to the attack of insect pest fauna (Yarasi *et al*., 2008). Among all insect pests, the rice stem borers are the most destructive one and it is responsible for the economic yield loss under natural condition up to 5-10 per cent (Mahar and Hakro, 1979). Eight species of stem borers of rice are known to be significantly important in Asia. These stem borers' attacks the crop specifically during seedling stage and causes reduction in yield (Akinsola *et al*., 1984). Symptoms produced by this insect are drying of central shoot known as "Dead heart" at vegetative stage and "White ear head (or) Chaffy panicle" at reproductive stage which leads to no grain formation. Every year *Scirpophaga incertulas* causes 27-34 per cent of yield loss. Use of resistant varieties is the best method for pest control instead of using chemicals and thereby reducing the load of toxicity in the food stuff as well as in the environment. Field screening was conducted to identify the resistant genotypes of different rice accessions against yellow stem borer (*S. incertulas*) under field condition for the benefit of farming communities.

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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". 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

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 35 DAT.

S. No.	Accessions	Deadheart Damage (%)	Score	Status
1.	BA-1	3.66	1	R
2.	BA-2	11.66	3	MR
3.	BA-3	12.49	3	MR
4.	BA-4	6.50	1	R
5.	BA-5	6.00	1	R
6.	BA-6	6.66	1	R
7.	BA-8	19.16	3	MR
8.	BA-9	16.33	3	MR
9.	BA-11	14.50	3	MR
10.	BA-12	12.09	3	MR
11.	BA-13	0.00	0	HR
12.	BA-14	3.66	1	R
13.	BA-16	31.66	7	S
14.	BA-17	8.99	1	R
15.	BA-18	12.49	3	MR
16.	BA-20	23.83	5	MS
17.	BA-21	19.99	3	MR
18.	BA-23	5.83	1	R
19.	BA-24	8.33	1	R
20.	BA-25	6.50	1	R
21.	BA-26	11.66	3	MR
22.	BA-27	5.33	1	R
23.	BA-28	15.50	3	MR
24.	BA-29	29.83	5	MS
25.	BA-30	0.00	0	HR
26.	BA-31	26.66	5	MS
27.	BA-32	0.00	0	HR
28.	BA-33	0.00	0	HR
29.	BA-34	0.00	0	HR
30.	BA-35	0.00	0	HR
31.	BA-36	0.00	0	HR
32.	BA-37	0.00	0	HR
33.	BA-38	19.83	3	MR
34.	BA-39	5.00	1	R
35.	BA-40	31.83	7	S
36.	BA-41	19.00	3	MR
37.	BA-42	15.50	3	MR
38.	BA-43	7.00	1	R
39.	BA-44	9.99	1	R
40.	BA-45	7.00	1	R
41.	BA-46	12.50	3	MR
42.	BA-47	0.00	0	HR
43.	BA-48	0.00	0	HR
44.	BA-49	0.00	0	HR
45.	BA-50	0.00	0	HR
46.	BA-52	11.00	3	MR
47.	BA-53	5.830	1	R
48.	BA-54	18.00	3	MR
49.	BA-56	0.00	0	HR
50.	BA-57	0.00	0	HR
51.	BA-59	18.00	3	MR
52.	BA-60	5.00	1	R
53.	BA-63	11.60	3	MR
54.	BA-64	0.00	0	HR
55.	BA-65	0.00	0	HR
56.	BA-66	0.00	0	HR
57.	BA-67	0.00	0	HR
58.	BA-68	2.50	1	R
59.	BA-76	8.50	1	R
60.	BA-78	5.00	1	R
61.	BA-79	7.00	1	R
62.	BA-80	11.00	3	MR
63.	BA-81	10.00	1	R
64.	BA-82	21.16	5	MS
65.	BA-83	5.83	1	R
66.	BA-86	7.00	1	R
67.	BA-87	11.00	3	MR
68.	BA-88	9.50	1	R
69.	BA-89	6.90	1	R
70.	BA-90	8.33	1	R
71.	BA-91	10.00	1	R
72.	BA-92	6.66	1	R
73.	BA-93	12.50	3	MR
74.	BA-94	5.83	1	R
75.	BA-95	8.33	1	R
76.	BA-96	27.49	5	MS
77.	BA-98	9.16	1	R
78.	BA-100	0.00	0	HR
79.	BA-101	10.83	3	MR
80.	BA-103	5.83	1	R
81.	BA-104	15.00	3	MR
82.	BA-105	8.33	1	R
83.	BA-106	14.16	3	MR
84.	BA-107	0.00	0	HR
85.	BA-108	0.00	0	HR
86.	BA-109	19.99	3	MR
87.	BA-110	7.50	1	R

88.	BA-111	10.00	1	R
89.	BA-112	5.00	1	R
90.	BA-113	5.00	1	R
91.	BA-114	0.00	0	HR
92.	BA-115	0.00	0	HR
93.	BA-116	5.00	1	R
94.	BA-117	8.33	1	R
95.	BA-118	15.80	3	MR
96.	BA-119	5.00	1	R
97.	BA-120	9.99	1	R
98.	BA-121	10.83	3	MR
99.	BA-122	5.00	1	R
100.	BA-123	7.00	1	R
101.	BA-124	10.00	1	R
102.	BA-125	0.00	0	HR
103.	BA-126	11.66	3	MR
104.	BA-127	5.83	1	R
105.	BA-128	7.50	1	R
106.	BA-129	7.50	1	R
107.	BA-130	7.50	1	R
108.	BA-131	8.33	1	R
109.	BA-132	0.00	0	HR
110.	BA-133	0.00	0	HR
111.	BA-134	0.00	0	HR
112.	BA-135	10.00	1	R
113.	BA-136	5.83	1	R
114.	BA-137	8.66	1	R
115.	BA-138	10.00	1	R
116.	BA-139	2.50	1	R
117.	BA-140	13.33	3	MR
118.	BA-141	15.83	3	MR
119.	BA-142	35.83	7	S
120.	BA-143	24.99	5	MS
121.	BA-145	44.16	7	S
122.	BA-146	10.83	3	MR
123.	BA-147	0.00	0	HR
124.	BA-148	10.83	3	MR
125.	BA-149	7.50	1	R
126.	BA-150	5.00	1	R
127.	BA-151	26.60	5	MS
128.	BA-152	5.00	1	R
129.	BA-153	13.33	3	MR
130.	BA-154	0.00	0	HR
131.	BA-155	10.00	1	R
132.	BA-156	10.00	1	R
133.	BA-157	8.33	1	R
134.	BA-158	4.50	1	R
135.	BA-159	8.33	1	R
136.	BA-160	12.49	3	MR
137.	BA-161	8.33	1	R
138.	BA-162	14.99	3	MR
139.	BA-163	9.16	1	R
140.	BA-164	7.00	1	R
141.	BA-165	14.99	3	MR
142.	BA-166	14.99	3	MR
143.	BA-167	15.83	3	MR
144.	BA-168	17.50	3	MR
145.	BA-169	18.33	3	MR
146.	BA-170	33.33	7	S
147.	BA-171	15.83	3	MR
148.	BA-172	10.00	1	R
149.	BA-173	12.49	3	MR
150.	BA-174	11.66	3	MR
151.	BA-175	10.83	3	MR
152.	BA-176	19.99	3	MR
153.	BA-177	14.16	3	MR
154.	BA-178	16.66	3	MR
155.	BA-179	14.99	3	MR
156.	BA-180	17.49	3	MR
157.	BA-181	11.66	3	MR
158.	BA-182	17.49	3	MR
159.	BA-183	43.16	7	S
160.	BA-184	35.83	7	S
161.	BA-185	36.00	7	S
162.	BA-186	17.49	3	MR
163.	BA-187	15.83	3	MR
164.	BA-188	7.50	1	R
165.	BA-189	32.50	7	S
166.	BA-190	8.33	1	R
167.	BA-191	7.50	1	R
168.	BA-192	12.50	3	MR
169.	BA-193	10.33	3	MR
170.	BA-194	8.33	1	R
171.	BA-195	7.50	1	R
172.	BA-196	2.50	1	R
173.	BA-197	8.33	1	R
174.	BA-198	8.33	1	R
175.	BA-199	5.83	1	R
176.	BA-200	25.00	5	MS
177.	BA-201	10.00	1	R
178.	BA-202	2.50	1	R
179.	BA-203	13.33	3	MR
k180.	BA-204	0.00	0	HR
181.	BA-205	12.50	3	MR
182.	BA-206	0.00	0	HR
183.	BA-207	0.00	0	HR
184.	BA-208	0.00	0	HR
185.	BA-209	14.16	3	MR
186.	BA-210	32.50	7	S
187.	BA-211	7.50	1	R
188.	BA-212	40.00	7	S
189.	BA-213	8.33	1	R
190.	BA-214	15.83	3	MR
191.	BA-215	15.83	3	MR

192.	BA-216	0.00	0	HR
193.	BA-217	22.50	5	MS
194.	BA-218	12.50	3	MR
195.	BA-219	9.99	1	R
196.	BA-221	0.00	0	HR
197.	BA-223	13.33	3	MR
198.	BA-226	0.00	0	HR
199.	BA-227	10.00	1	R
200.	BA-228	0.00	0	HR
201.	BA-229	18.33	3	MR
202.	BA-230	27.50	5	MS
203.	BA-231	19.99	3	MR
204.	BA-233	25.83	5	MS
205.	BA-234	0.00	0	HR
206.	BA-235	17.49	3	MR
207.	BA-238	14.99	3	MR
208.	BA-240	0.00	0	HR
209.	BA-242	10.83	3	MR
210.	BA-243	0.00	0	HR
211.	BA-244	0.00	0	HR
212.	BA-245	8.33	1	R
213.	BA-247	8.33	1	R
214.	BA-248	7.50	1	R
215.	BA-249	23.33	5	MS
216.	BA-250	13.33	3	MR
217.	BA-251	5.00	1	R
218.	BA-252	10.33	3	MR
219.	BA-253	16.66	3	MR
220.	BA-254	0.00	0	HR
221.	BA-257	0.00	0	HR
222.	BA-258	10.00	1	R
223.	BA-260	16.66	3	MR
224.	BA-262	18.33	3	MR
225.	BA-264	0.00	0	HR
226.	BA-266	22.50	5	MS
227.	BA-267	0.00	0	HR
228.	BA-269	2.50	1	R
229.	BA-270	36.66	7	S
230.	BA-271	33.16	7	S
231.	BA-272	10.83	3	MR
232.	BA-274	0.00	0	HR
233.	BA-275	5.00	1	R
234.	BA-276	10.83	3	MR
235.	BA-277	5.00	1	R
236.	BA-278	46.66	7	S
237.	BA-282	0.00	0	HR
238.	BA-283	0.00	0	HR
239.	BA-284	22.49	5	MS
240.	BA-285	8.33	1	R
241.	BA-287	10.00	1	R
242.	BA-288	0.00	0	HR
243.	BA-293	7.50	1	R
244.	BA-294	11.66	3	MR
245.	BA-295	12.50	3	MR
246.	BA-296	13.33	3	MR
247.	BA-298	14.16	3	MR
248.	TN-1	22.50	5	MS
249.	Norungan	0.00	0	HR
250.	Nootripathu	5.83	1	R
251.	Kuliyadichan	12.50	3	MR
252.	Poongkar	14.16	3	MR
253.	Kuruvai Kalanchium	10.00	1	R
254.	Kattanur	0.00	0	HR
255.	Sivappu Chitirai Kar	18.33	3	MR
256.	Vellai Chitirai Kar	5.00	1	R
257.	Kalanamak	5.00	1	R
258.	Mattaikar	41.66	7	S
259.	Sadhana	0.00	0	HR
260.	BPT-5204	0.00	0	HR

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

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 (35 DAT) was calculated using the following formula (Heinrichs *et al.*, 1985) (Table 2).

Per cent deadheart =

$$\frac{Number\ of\ damaged\ tillers\ (deadheart)}{Total\ number\ of\ tillers} \quad 100$$

The damage rating and scale was given for the test accessions using IRRI Standard Evaluation System for rice (IRRI, 1998) (Table 1).

Results and Discussion

Out of 260 accessions screened, 52 accessions scored grade 0 (0% deadheart) and showed nil incidence of yellow stem borer, 96 accessions scored grade 1 (1-10% deadheart) were found to show minimal stem borer attack, 82 accessions recorded as grade 3 (11-20% deadheart), 15 accessions got grade 5 (21-30% deadheart) and 15 accessions scored grade 7 (31-60% deadheart). In this study no accessions were recorded under grade 9 (Above 60% deadheart). Similarly, Elanchezhyan and Arumugachamy (2015) 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. The resistance in rice accessions may be due to the presence of a strong repellent or antifeedant stimuli by the plants and either due to the presence of toxic chemical or nutritional deficiencies in the plant for insect. Chandler (1968) reported that yellow stem borer resistance is offered from several characteristics of rice plant. Rice accessions with closely arranged vascular bundles than the width of the larval head offered resistance to larval boring. 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 be involved in stem borer resistance.

Conclusion

Identification and evaluation of rice yellow stem borer resistance is a primary task for the development of resistant varieties. Among all the tested rice accessions only 52 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, local varieties *Viz.,* Sadhana and BPT-5204 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.

References

Akinsola, E.A. and M.A. Sampong (1984). The ecology, bionomics and control of rice stem borers in West Africa. *Insect Science Application*, **5:** 69-77.

Chandler, R.F. (1968). The contribution of insect control to high yields of rice. Paper presented in a Symposium on the Impact- Actual and Potential of Modern Economic Entomology on World Agriculture, at the Annual Meeting of the Entomological Society of America held on 29th November, 1967 at New York. Pp. 133-135.

Elanchezhyan, K. and K. Arumugachamy (2015). Evaluation of medium duration germplasm against yellow stem borer, *Scirpophaga incertulas* Walker in rice. *Biotic Environment*, **21(2 and 3):** 38 - 41.

Heinrichs, E.A., F.G. Medrano and H. Rapusas (1985). Genetic evaluation for insect resistance in Rice (eds.), IRRI, Los Banos, Philippines.

IRRI (1998). Standard Evaluation System for Rice. III Edition, June 1988; International Rice Testing Program, IRRI, Los Banos, Philippines.

Mahar, M.M. and M.R. Hakro (1979). The prospects and possibilities of yellow rice stem borer eradication under Sindh condition. Paper presented at the Rice Research and Production Seminar. Islamabad.

Yarasi, B., V. Sadumpati, C.P. Immanni, V. Reddy and R.K. Venkateshwara (2008). Transgenic rice *O. sativa* expressing *Allium sativum* leaf agglutinin (ASAL) exhibits high level resistance against major sap-sucking pests. *BMC Plant Biology*, **8:** 102.