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Field screening of rice germplasm for resistance against brown plant hopper, *Nilaparvata lugens* (STAL)

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ABSTRACT

A total of 178 rice genotypes from various station and national trials were evaluated for resistance against brown planthopper (BPH) under natural infestation condition during *kharif* 2011 at CCS HAU, Rice Research Station, Kaul, Kaithal. The results revealed that only 5 genotypes *viz*., CN 1724-9-4-5, MAUB-181, ACC-451 and IR 79584-38-2-1-9 were resistant, 28 were moderately resistant, 102 moderately susceptible and the rest were susceptible (43) to brown planthopper.

Key words: Brown planthopper, germplasm, screening, resistance, susceptible, genotypes.

Rice (*Oryza sativa* L.) has been ranked high among the most important food crops in the world. It is a staple food for over half of the world's population, particularly in south-east Asia with rapidly growing populations (Grist, 1988). Worldwide, rice is grown on 161 million hectares, with an annual production of 678.7 million tonnes of paddy. About 90% of the world's rice is grown and produced (143 million hectares of area with a production of 612 million tonnes of paddy) in Asia (FAO, 2009). The total rice-wheat production in South Asian countries comprising India, Pakistan, Bangladesh and Nepal with 3.26% (437.5 million ha) of world geographical area is 314.5 million tonnes, about 25% of the world food production (FAO, 2010). It is grown on an area of 43.97 million hectare in the country with total production of 104.32 million tonnes and productivity of 2372 kg ha^{-1} whereas; Haryana occupied an area of 1.24 million hectare with total production of 3.76 million tonnes during 2011-2012 (Annonymous, 2012). Among several planthopper species found in India, the brown BHP, Nilaparvata lugens (Stal.) and the whitebacked planthopper (WBPH), Sogatella furcifera (Howarth) are the most important ones infesting rice (Das and Mukherjee, 2009). At high population densities of these pests, hopper burn is observed, which may cause up to 60% yield loss. Rapid multiplication and widespread outbreak of brown planthopper during September-October 2008 in northern India resulted in heavy yield losses. Brown planthopper removes plant sap resulting in "hopper burn". Though application of insecticides can control these pests, but there is every likely hood of residue problem in the grains. To meet the demand of increasing population and maintain this self sufficiency the present production level need to be increased up to 140 million tonnes by 2025 which can be achieved only by increasing the rice production by over 2 million tonnes per year in coming decade (Anonymous, 2005). This has to be done against the backdrop of declining natural resource base such as land, water, labour and other inputs and without adversely affecting the quality of environment. Moreover in the present WTO era where a lot of stress is given on quality parameters, the search for alternate methods of control becomes important. Thus, the present studies were conducted to identify the new sources of resistance against brown planthopper in rice.

Materials and Methods

A total of 178 genotypes including various station and national trials were evaluated for resistance against BPH in field. Each genotype was transplanted at 10×10 cm spacing in two rows of one meter length. All around test entries, two meters of susceptible variety PR 106 were transplanted.

Number of planthoppers on 10 plants/ entry at 10 days interval from 60 DAT to a week before harvest were observed and recorded. Number of dead and surviving plants per variety was recorded first at the time of hopper burn in any of the variety followed by another observation prior to harvest. Each entry was rated on 0-9 scale as per Standard Evaluation System for Rice (Anonymous, 2002) developed by International Rice Research Institute (IRRI) used to categorize the germplasm in different categories of resistance in response to BPH (Table 1).

Results and Discussion

A total of 178 rice genotypes maintained from various screening trials in entomology section at CCS HAU, Rice Research Station, Kaul were screened under field condition during *Kharif*, 2011. The results of screening trials showed that the genotype *viz*. PTB 33 (7.4 BPH/ hill), CN 1724-9-4-5 (8.4 BPH/ hill), MAUB-181 (8.8 BPH/ hill), ACC-451 (9.2 BPH/ hill) and IR 79584-38-2-1-9 (9.4 BPH/ hill) were resistant against BPH, ACC-2295, BNKR-102, CB 07103, CB 07702, CB 08524, HKR 05-22, HKR 06-47, HKR 07-191, HKR 06-59, HKR 08-67, HKR 06-95, IR 79643-39-2-2-3, IR 64, KAUM 164-1, KAUM 168-1, KAUM 172-1, KAUM 174-5, KAUM 174-6, MSN 97, OM 6377, OM 4668, Pusa 1121, RNR 2833-1, RP 4643-1020, RP 4616-8-1-333, RP 4680-1-1-17, RIC 06-0404 and SKL 2-2-3-24-35-40 genotypes were rated moderately resistant (MR) with a damage score of 5. All other genotypes (102) were rated as moderately susceptible and susceptible (43) with damage score 7 and 9, respectively (Table 2). The results are inconformity with other workers (Anonymous, 2010). The genotype CB 07-103 was moderately resistant during the present study while this genotype was rated as susceptible from other parts of the country. The response of genotypes CR 2711-76, CR 2711-114, CR 2711-139, CR 2711-149 and CR 2712-12 to BPH was found different from earlier workers who rated these genotypes as resistant. Kumar and Tiwari, (2010) also evaluated ninety six entries of plant hopper screening trial (PHS-05 and PHS-06) were evaluated under glass house conditions for their resistance to brown plant hopper, *N. lugens*. PHS-05 entries KAUM MO 8 20 KR and PTB 33 were found highly resistant, while ARC 6650 and CB 21006 were rated as resistant and moderately resistant, respectively. PHS-06 entries CRAc 34997, 9412-13 and PTB 33 were identified as highly resistant, resistant and moderately resistant. Sources of resistance to this pest have been reported earlier also (Madurangi *et al*., 2011; Yongfu *et al*., 2011; Alagar *et al*., 2010; Alagar and Suresh, 2007; Maheshwari *et al*., 2006; Misra *et al*., 1988 and Mishra and Misra, 1992).

Table 1. Standard evaluation system for resistance against brown planthopper

Scale/damage score	No. of BPH/ hill	Level of resistance
0	0	Immune (I)
1	1-5	Highly resistance (HR)
3	5.1-10	Resistance (R)
5	10.1-20	Moderately resistance (MR)
7	20.1-40	Moderately susceptible (MS)
9	>40	Susceptible (S)

Table 2. Reaction of different genotypes to brown planthopper under field conditions during *kharif* 2011

S. No.	Name of genotypes	Mean population of BPH/hill	Damage score	Field reaction
1	ACC-451	9.2	3	R
2	CN 1724-9-4-5	8.4	3	R
3	IR 79584-38-2-1-9	9.4	3	R
4	MAUB-181	8.8	3	R
5	PTB 33	7.4	3	R
6	ACC-2295	10.6	5	MR
7	BNKR-102	12.8	5	MR
8	CB 07-103	14	5	MR
9	CB 07-702	17.4	5	MR
10	CB 08-524	18.2	5	MR
11	HKR 05-22	16.5	5	MR
12	HKR 06-47	13.8	5	MR
13	HKR 07-191	14.2	5	MR
14	HKR 06-59	18.6	5	MR
15	HKR 08-67	18.1	5	MR
16	HKR 06-95	19.2	5	MR
17	IR 79643-39-2-2-3	17.4	5	MR
18	IR 64	16.2	5	MR
19	KAUM 164-1	16.8	5	MR
20	KAUM 168-1	18	5	MR
21	KAUM 172-1	14.8	5	MR
22	KAUM 174-5	19.4	5	MR
23	KAUM 174-6	19	5	MR
24	MSN 97	18.8	5	MR
25	OM 6377	16.6	5	MR
26	OM 4668	15	5	MR
27	Pusa 1121	19.2	5	MR
28	RNR 2833-1	18.6	5	MR
29	RP 4643-1020	18	5	MR
30	RP 4616-8-1-333	15.4	5	MR
31	RP 4680-1-1-17	15.8	5	MR
32	RIC 06-0404	19.4	5	MR
33	SKL 2-2-3-24-35-40	11.6	5	MR
34	ARC-10550	22.4	7	MS
35	BNKR-101	28.4	7	MS
36	CSR 30	26.8	7	MS
37	CB 07-537	33.6	7	MS
38	CB 07-608	26	7	MS
39	CB 08-504	20.4	7	MS
40	CB-06-550	24.6	7	MS
41	CB-06-563	36.8	7	MS
42	CB 00-15-24	23.2	7	MS

43	CB 08-534	23.8	7	MS
44	CB 08-721	20.2	7	MS
45	CB 09-123	28.2	7	MS
46	CB 09-138	29.4	7	MS
47	CB 09-142	37.2	7	MS
48	CB 09-507	29.2	7	MS
49	CB 09-516	20.6	7	MS
50	CB 05-031	25.4	7	MS
51	CB 05-754	30.2	7	MS
52	CN 1442-4-2-9	23.2	7	MS
53	CR 2711-76	25.2	7	MS
54	CR 2711-114	23	7	MS
55	CR 2711-139	27.6	7	MS
56	CR 2711-149	32	7	MS
57	CR 2712-12	27	7	MS
58	CR 2706	36.6	7	MS
59	CRR 624-207-B-1-B	39.6	7	MS
60	CR 2641-26-1-2-2	27.8	7	MS
61	CO 06-124	38.8	7	MS
62	DM-306	33.4	7	MS
63	DRRH-44	23	7	MS
64	DRRH-50	39.4	7	MS
65	DRRH-58	32.4	7	MS
66	Govind	30.4	7	MS
67	HKR 127	15.8	5	MS
68	HKR 06-8	26.8	7	MS
69	HKR 06-13	26.4	7	MS
70	HKR 06-16	25	7	MS
71	HKR 06-2	37.4	7	MS
72	HKR 06-4	24.8	7	MS
73	HKR 08-107	25.4	7	MS
74	HKR 08-51	33.8	7	MS
75	HKR 08-53	33.6	7	MS
76	HKR 08-58	33.6	7	MS
77	HKR 08-61	33.2	7	MS
78	HKR 08-62	28.4	7	MS
79	HKR 08-1	38.8	7	MS
80	HKR 08-12	32.2	7	MS
81	HKR 08-33	35.2	7	MS
82	HKR 08-36	37.2	7	MS
83	HKR 08-110	37.4	7	MS
84	HKR 07-147	23.2	7	MS
85	HKR 07-20	30.2	7	MS
86	HKR 99-60	22.8	7	MS
87	HKR 06-45	23.4	7	MS

88	HKR 06-103	31.4	7	MS
89	HKR 06-44	21.2	7	MS
90	HKR 07-18	21	7	MS
91	HKR 47	26.8	7	MS
92	HKR 08-417	30.4	7	MS
93	HKR 08-415	23.8	7	MS
94	IR 78089-149-2-3-3-3	35.8	7	MS
95	IR 79193-8-1-1-1	35.2	7	MS
96	IR 78091-6-2-3-1-1	36	7	MS
97	IR 82355-5-2-3	20.4	7	MS
98	IR 83326-39-1-2	20.2	7	MS
99	IT 21582 (OR 2172-7)	20.2	7	MS
100	KAUM 103-104-6	26	7	MS
101	KAUM 166-2	20.4	7	MS
102	KAUM 95-1	21.2	7	MS
103	KAUM 173-1	20.4	7	MS
104	KAUM 173-3	28.8	7	MS
105	KAUM 173-4	33.8	7	MS
106	KAUM 174-4	25.2	7	MS
107	KAUM 174-7	21.2	7	MS
108	KMP 194	20.6	7	MS
109	MO 1	36.4	7	MS
110	OR 2109-2	21	7	MS
111	OR 2162-5	20.8	7	MS
112	OM 2502	30.2	7	MS
113	OM 5240	30.2	7	MS
114	Pusa 1301	34.2	7	MS
115	Pusa Basmati 1	21	7	MS
116	RI 4656-IR 73678-6-9-13	36.6	7	MS
117	RP 4334-TSH-41-8-1-1-2-6	32.6	7	MS
118	RP Bio 4918	22.8	7	MS
119	RP Bio 4919	25.8	7	MS
120	RP Bio 4919	26.6	7	MS
121	RP Bio 4919	27	7	MS
122	RNR-2413	26	7	MS
123	RNR-2458	24.2	7	MS
124	RNR-2788	31.2	7	MS
125	RP 2068-18-3-5	23.6	7	MS
126	SG-331	28	7	MS
127	Taraori Basmati	29.4	5	MS
128	TNAU-180	34.6	7	MS
129	TNRH-173	37.6	7	MS
130	TNRH-174	30.6	7	MS
131	TRC 2008-4	26.6	7	MS
132	TN 1	39.6	7	MS

133	WR 15-6-1	27.4	7	MS
134	WR 26-4-1	23.2	7	MS
135	230 (S)	37.8	7	MS
136	CB 09-153	45.4	9	S
137	CB 05-022	51.2	9	S
138	HKR 06-57	51.8	9	S
139	HKR 05-47	44.2	9	S
140	HKR 08-63	71.2	9	S
142	HKR 08-83	42.8	9	S
142	HKR 08-118	73.2	9	S
144	HKR 08-119	43	9	S
145	HKR 08-121	46.8	9	S
146	HKR 08-9	41.4	9	S
147	HKR 08-14	44.2	9	S
148	HKR 08-29	40.4	9	S
149	HKR 09-13	74	9	S
150	HKR 09-14	59.4	9	S
151	HKR 09-19	55.4	9	S
152	HKR 09-26	86.8	9	S
153	HKR 09-27	64	9	S
154	HKR 09-28	115.4	9	S
155	HKR 08-6	51	9	S
156	HKR 08-41	50.2	9	S
157	HKR 05-10	41.2	9	S
158	HSD 1	44.8	9	S
159	HKR 02-37	51.2	9	S
160	HKR 06-443	42.4	9	S
161	HKR 03-408	78.8	9	S
162	HKR 06-434	92.2	9	S
163	HKR 06-487	45.2	9	S
164	HKR 07-406	48	9	S
165	HKR 08-425	43.4	9	S
166	IR 79584-38-2-1-4	41	9	S
167	IR 79525-20-2-2-2	51.6	9	S
168	IR 79524-65-1-3-2	56.2	9	S
169	IR 79253-19-3-3-5	66.8	9	S
170	Indam 200-017 (Hybrid)	56.2	9	S
171	KAUM 176-4	100.8	9	S
172	KAUM 177-1	42.8	9	S
173	KAUM 178-1-1-1	123.8	9	S
174	PNR 898	42	9	S
175	PA 6444 (Hybd.)	87.6	9	S
176	PAC 835	59	9	S
177	TNAU-185	42.6	9	S
178	212 (S)	102.4	9	S

R= resistant (3), MR= moderately resistant (5), MS= moderately susceptible (7) and S= susceptible (9)

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