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Vinoda
Department of Agricultural Entomology, Agricultural Research Station, Gangavathi, Karnataka, India

Sujay Hurali
Department of Agricultural Entomology, Agricultural Research Station, Gangavathi, Karnataka, India

AG Sreenivas
Department of Agricultural Entomology, college of agriculture, Raichur, Karnataka, India

SG Hanchinal
Department of Agricultural Entomology, college of agriculture, Raichur, Karnataka, India

BG Masthana-Reddy
Department of Agricultural Entomology, Agricultural Research Station, Gangavathi, Karnataka, India

RV Beladhadi
Department soil science and agricultural chemistry, University of Agricultural Sciences, Raichur, Karnataka, India

Corresponding Author:
Vinoda
Department of Agricultural Entomology, Agricultural Research Station, Gangavathi, Karnataka, India

Evaluation of paddy genotypes against brown planthopper, *Nilaparvata lugens* (Stal.) and whitebacked planthopper, *Sogotella furcifera* (Horvath) under field condition

Vinoda, Sujay Hurali, AG Sreenivas, SG Hanchinal, BG Masthana-Reddy and RV Beladhadi

Abstract
Screening of paddy genotypes against Brown planthopper (BPH) and Whitebacked planthopper (WBPH) under field condition was undertaken at ARS. About hundred genotypes were screened under field condition, in which 26 genotypes showed resistance reaction to planthoppers with a damage score of 3 and 5 and remaining found to be susceptible and highly susceptible to the planthoppers with a damage score 7 and 9. It was visualized that the planthoppers were settled at the base of the crop genotypes. In general the population of planthopper was recorded on the resistant and moderately resistant varieties less compared to susceptible varieties.

Keywords: Brown plant hopper (BPH), *Kharif*, paddy genotypes, screening, planthoppers, white backed plant hopper (WBPH)

Introduction
Planthopper, *viz.*, brown planthopper (BPH) *Nilaparvata lugens*, (Stal.) and white backed planthopper (WBPH) *Sogatella furcifera* (Horvath) has long been known as pest of rice in South Asia and South-East Asia [1]. In Karnataka this had not been reported previously as a pest but during May 1975 its outbreak caused hopper burn on rice in the field near Mandya. Later the pest was reported from many widely scattered parts of the state. Based on this incidence, it was predicted that infestation would become severe in all rice growing areas of Karnataka [2].

The planthoppers are sucking insects, under heavy infestations, can cause the wilting and complete drying of rice plants, a condition known as 'hopperburn' [3]. Excessive use of nitrogenous fertilizers and insecticides can lead to outbreaks by increasing the fecundity of the brown planthopper and by reducing populations of natural enemies. Also repeated sprayings upset the natural balance between the insect and its natural enemies. Thus, there is a growing awareness for a need to develop resistant/ tolerant varieties. The logical approach to BPH control would be to use host-plant resistance as part of an integrated pest management programme.

So for these studies screening of rice germplasm at global level and breeding BPH resistant rice varieties were initiated during 1970s and several resistant varieties have been released for cultivation [4, 5, 6, 7, 8, 9]. However, resistance in many of these varieties has been overcome by virulent biotypes. Also, many of the 29 BPH resistance genes identified so far are not effective in India.

Materials and Methods
Screening of paddy genotypes were undertaken at ARS, Gangavathi. The experimental material consisted of 100 genotypes of rice mentioned in Table 1 provided by IIRR, Hyderabad. Nursery of these varieties/genotypes was prepared as per the package of practices [10]. Thirty days old healthy seedlings were transplanted in experimental field to evaluate them against planthopper complex.

Experimental layout

The selected rice genotypes were planted in the field in two rows of ten hills each in one replication. Single seedling was transplanted per hill. All the recommended agronomical practices were adopted during crop cultivation. Transplanting was done at a spacing of 10×10 cm to enhance the infestation. All around the test entries, ten rows of tall, susceptible, long duration Jaya variety was planted. To maintain adequate BPH infestation, humid conditions were sustained by providing water level of 5 cm above the ground. Polythene sheet barrier of 2.5 feet height all around the planting area were erected as a barrier within 15 days after transplanting. Adult and nymphs of BPH and WBPH were released uniformly in polythene sheet in confined area on 30, 40, 50 and 60 days after transplanting only when infestation was less.

a. Observation

Observations were recorded on per cent hopper burn symptom from 30 days after transplanting until harvest at 10 days interval. The damage level of each variety was scored by using the rating scale provided by International Rice Research Institute [11] during the cropping period as given in Table 2.

Table 1: List of rice germplasm lines screened against paddy planthoppers under field condition

Sl. No.	Designation	Sl. No.	Designation
1	BPT 2601	51	JGL 34560
2	BPT 2795	52	JGL 34564
3	BPT 2776	53	JGL 34569
4	BPT 2593	54	JGL 34594
5	IC 216735	55	JGL 33430
6	BPT 2595	56	WGL 1269
7	BPT 2411	57	WGL 1268
8	BPT 2787	58	WGL 1246
9	CB 15714	59	WGL1248
10	TN1 (C)	60	PTB 33 (C)
11	IC 76013	61	WGL 1249
12	CB 15569	62	WGL 1250
13	CB 14528	63	WGL 1252
14	CB 14132	64	WGL 1319
15	CB 16146	65	WGL 1320
16	CB 14178	66	WGL 1279
17	CB 161650	67	WGL 1275
18	CB 15133	68	WGL 1272
19	CB 15541	69	WGL 1260
20	PTB 33 (C)	70	MO1 (C)
21	CB 15144	71	WGL 1021
22	IC 75975	72	RNR 15541
23	CB 12132	73	RNR 19416
24	CB 16157	74	RNR 19420
25	CB 15805	75	RNR 21225
26	CB 15509	76	RNR 23605
27	IC 216750	77	RNR 25988
28	MTU 1300	78	RNR 25993
29	MTU1301	79	RNR 26009
30	MO1 (C)	80	RP2068-18-3-5 (C)
31	MTU 1302	81	RNR 26111
32	MTU 1303	82	RNR 26113
33	MTU 1304	83	RNR 26130
34	MTU 1305	84	RNR 28379
35	IC 76057	85	RNR 28395
36	MTU 1306	86	RNR 28398
37	MTU 1307	87	RP 5995 Bphk 17-5
38	MTU 1308	88	IR 73382-80-9-3-13-2-2-1-3-B (HWR-16)
39	MTU 1309	89	RP 5690-20-6-3-2-1
40	RP 2068-18-3-5 (C)	90	TN1 (C)
41	JGL 33430	91	IL 1
42	JGL 32485	92	IL 2
43	JGL 33440	93	IL 3
44	JGL 33508	94	IL 4
45	JGL 33510	95	IL 5
46	JGL 34450	96	IL 6
47	JGL 34505	97	IL 7
48	JGL 34508	98	PTB 33 (C)
49	JGL 34540	99	MO1 (C)
50	TN1 (C)	100	RP 2068-18-3-5 (C)

C = Check

Table 2: Scale (For field test) for scoring damage level

	No damage
1	Slight yellowing of a few plants
3	Leaves partially yellow but with no hopperburn
5	Leaves with pronounced yellowing and some stunting or wilting and 10-25% of plants with hopperburn, remaining plants severely stunted
7	More than half the plants show wilting or with hopperburn, remaining plants severely Stunted
9	All plants dead

Results and Discussion

Of the 100 genotypes screened for their resistance against planthopper complex at ARS, Gangavathi during *Kharif* 2018, varied level of resistance to BPH and WBPH was recorded on the basis of 0-9 scale as per protocol recommended by International Rice Research Institute (IRRI). Among 100 genotypes screened no variety was found immune (0 to 1). While, 13 varieties were categorized as resistant germplasm *viz.*, BPT 2601, PTB 33, CB 15144, IC 75975, CB 12132, MO1, PTB 33, RP2068-18-3-5, PTB 33, MO1, RP 2068-18-3-5, MO1 and RP 2068-18-3-5 with damage score of 3. While 13 other genotypes *viz.*, IC 216735, MTU 1300, MTU1301, MTU 1303, MTU 1308, MTU 1309, WGL 1249, WGL 1250, WGL 1319, WGL 1320, WGL 1275, RP 5690-20-6-3-2-1 and MTU 1307 were found to be moderately resistant with damage score of 5 a remaining genotypes were found moderately susceptible (17) and highly susceptible (57) to planthoppers with damage score of 7 and 9 respectively. Detail score of all genotypes screened presented in Table 3.

The findings of present experiment were similar to the results obtained by Akshaya *et al.* (2011) [12] who screened 57 accession of rice, among them only seven genotypes were showed resistant reaction, with a damage score of 1. Rest of the entries was susceptible with a damage score of 7 to 9. Other studies which support present findings are Sidde Gowda [13] and Sidde Gowda and Gubbaiah [14] screened 14,190 accessions and identified 386 donors processing varied degree of resistance to BPH and WBPH. Seven accessions were identified as brown planthopper resistant cultivar [15, 16].

Table 3: Summary of reaction of rice germplasms against BPH and WBPH under planthopper screening (PHS) trial

Scale	No. of genotypes	Reaction	Genotypes
1	13	R	BPT 2601, PTB 33, CB 15144, IC 75975, CB 12132, MO1, PTB 33, RP2068-18-3-5, PTB 33, MO1, RP 2068-18-3-5, MO1, RP 2068-18-3-5.
2	13	MR	IC 216735, MTU 1300, MTU1301, MTU 1303, MTU 1308, MTU 1309, WGL 1249, WGL 1250, WGL 1319, WGL 1320, WGL 1275, RP 5690-20-6-3-2-1, MTU 1307.
3	17	S	BPT 2411, CB 15569, CB 14528, MTU 1302, MTU 1305, IC 76057, MTU 1306, JGL 34450, JGL 34560, WGL 1260, WGL 1021, RNR 19416, RNR 26111, RNR 28379, RP 5995 Bphk 17-5, IL 2, IL 5.
4	57	HS	BPT 2795, BPT 2776, BPT 2593, BPT 2595, BPT 2787, TN1, CB 15714, IC 76013, CB 14132, CB 16146, CB 14178, CB 16165, CB 15133, CB 15541, CB 16157, CB 15805, CB 15509, IC 216750, MTU 1304, JGL 33430, JGL 32485, JGL 33440, JGL 33508, JGL 33510, JGL 34505, JGL 34508, JGL 34540, TN1, JGL 34564, JGL 34569, JGL 34594, JGL 33430, WGL 1269, WGL 1268, WGL 1246, WGL 1248, WGL 1252, WGL 1279, WGL 1272, RNR 15541, RNR 19420, RNR 21225, RNR 23605, RNR 25988, RNR 25993, RNR 26009, RNR 26113, RNR 26130, RNR 28395, RNR 28398, IR 73382-80-9-3-13-2-2-1-3-B (HWR-16), TN1, IL 1, IL 3, IL 4, IL 6, IL 7.

R= Resistant, MR= Moderately resistant, S= Susceptible and HS= Highly susceptible

Conclusion

The present study concludes that the few genotypes showed the resistant reaction to the planthopper population with low level of hopperburn symptoms and also these resistant genotypes offered low level planthopper population compared to the susceptible ones. The genotypes which found to be resistant under field condition can be utilized for further breeding programmes for development of varieties which are resistant to planthoppers.

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