Int.J.Curr.Microbiol.App.Sci (2017) *6*(9): 1187-1192

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 9 (2017) pp. 1187-1192**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.609.143

Glasshouse Evaluation of New Source of Resistance against Brown Plant Hopper *Nilaparvata lugens* (Stal) in Rice

Vijay Kumar Soni[1*] and S.N. Tiwari[2]

[1]Department of Entomology, S. K. College of Agriculture and Research Station, IGKV, Kawardha (Kabirdham) 491 995, Chhattisgarh, India
[2]Department of Entomology, G.B. Pant University of Agriculture and Technology, Pantnagar (U.S. Nagar) 263 145, Uttarakhand, India
**Corresponding author*

Keywords

Brown plant hopper, Evaluation, Glasshouse, Resistance, Rice.

Article Info

Accepted:
17 July 2017
Available Online:
10 September 2017

A B S T R A C T

Brown plant hopper (BPH), *Nilaparvata lugens* Stal is one of the most serious rice pest in India. Growing of resistance varieties is the most effective and environment-friendly strategy for protecting the crop from BPH. In the present study we evaluated the forty entries of plant hopper screening trial against BPH under glass house condition. The trial material was received from All India Coordinated Rice Improvement Programme (AICRIP) DRR, Hyderabad during *kharif* 2011. Two screening tests were conducted in plastic tray (42cmx32cmx7cm) under glasshouse condition. Ptb 33 and Tainching Native 1 (TN1) were used as resistant and susceptible check. BPH culture maintained in the glass house was used for the screening test. In the above rating scale particulars in scale and level of resistance were taken from standard evaluation system for rice but the ranges for percent dead seedlings were constructed to facilitate the rating based on percent seedling mortality due to BPH damage. According to the results entry MSN97 showed only 4.5 per cent seedling mortality, therefore, classified as highly resistant. The entry KAUM 172-1 was rated as resistant in which mean seedling mortality was 7.7 per cent. Moderate level of resistant was observed in KAUM 166-2 and CB 05-022 with 18.2 and 20.0 per cent mean seedling mortality, respectively. The rest of the entries were either moderately susceptible (27.1 to 59.7 per cent mortality) or susceptible (64.2 to 100 per cent mortality) against BPH.

Introduction

Rice (*Oryza sativa* L.) is an ancient and the most genetically diversified cereal crop. Approximately half of the people on earth obtain the majority of their caloric intake from rice. Rice harbour more than 100 insect pest species. Among these, brown planthopper (BPH), *Nilaparvata lugens* (Stål) belongs to the Family Delphacidae and Order Hemiptera, is probably the most important pest of rice in Asia and India.

Plant responses with direct or indirect deleterious effects from the attack of BPH including reduction in the plant growth (root development, plant height and reproduction), wilting and leaf chlorosis. Collectively these symptoms are acknowledged as 'hopper burn'. BPH losses in grain yield ranges from 10% in moderately affected fields to 70% in those severely affected and the damage to the standing crop sometimes reached 100%

(Krishnaiah *et al.*, 2008). Insecticide proves to be the only option where we can rely for emergency management of insect pest reaching on or beyond ETL. But the indiscriminate use of broad spectrum chemicals reduces the biodiversity of natural enemies, lift the natural control, induce outbreak of secondary pests, residue problem in the grains and contaminate eco-system (Singh, 2000) resulted in resurgence of brown planthopper (Heinrichs and Mochida, 1984; Kenmore *et al.*, 1984).

Moreover in the present WTO era where a lot of stress is given on quality parameters, the search for alternate methods of control BPH becomes important. Exploitation of Host Plant Resistance (HPR) is a major component to manage this pest. The development of rice varieties (*Oryza sativa* L.) that are resistant to the BPH is an important objective in current breeding programmes (Park *et al.*, 2007). Growing resistant varieties is the most effective and environment-friendly strategy for protecting the crop from BPH.

Thus, the present studies were conducted to identify the new sources of resistance against BPH in rice under glass house condition.

Materials and Methods

The screening of rice genotypes at seedling stage against BPH were conducted in the glasshouse of Department of Entomology, G.B. Pant University of Agriculture and Technology, Pantnagar during *Kharif* 2011. Two screening trials conducted during *Kharif* 2011. Seed bed screening method was used for screening of entries. The purpose of bulk screening was to reject the susceptible ones and to find out entries showing moderate to high level of resistance against BPH. Both the screening tests were done in plastic tray size of 42cmx32cmx7cm in glasshouse. Following screening procedure was used:

Sources of PHS entries

Plant hopper screening (PHS) entries (Table 1) received from All India Co-ordinated Rice Improvement Programme (AICRIP) during *kharif* 2011 were evaluated against brown plant hopper in both the screening trials.

Seed germination

Plastic petridishes were marked with respective entry number of PHS and fifty seeds of each entry were kept on double layered moist filter papers. Water was added to each petridish for seed soaking which was removed after 24 hours. Thereafter, petridishes were placed in incubator maintained at 30°C temperature for efficient germination. Sufficient moisture was maintained in each petridish till germinated seeds were sown into tray.

Preparation of seed bed for sowing

The plastic tray (42cmx32cmx7cm) was filled with well manured soil up to the sufficient height so that 5 cm water level could be maintained above the soil surface. Soil was puddled properly and upper layer was leveled uniformly with the help of a smooth object to facilitate sowing.

Seed sowing and maintenance of test seedlings

The germinated seeds of each test entry were sown in the tray with the help of forceps. Single row of each entry with 20 pre-germinated seeds was sown and labeled with ice-cream sticks containing entry numbers. The distance between the rows was maintained at 4 cm apart, while distance between seeds was kept at 1 cm. After completing the sowing sufficient water was added daily to ensure the healthy growth of seedlings.

Mass rearing of brown plant hoppers

A laboratory population of *N. lugens* were maintained on the plants of *Oryza sativa* L. (cv: TN1) in pots in glasshouse. The temperature of glasshouse was maintained from 25 to 30°C during the study period. The 2nd and 3rd instar nymphs of BPH from this culture were used for the infestation.

Infestation of seedlings with BPH

At 12 days after sowing (DAS) tray was filled with 5 cm water level and each row was thinned to about 20 seedlings / row after which the 2nd and 3rd instar nymphs of BPH from the culture were distributed uniformly on the test entries at the rate of approximately 10 nymphs per seedling.

Gradation of the test entries

The final score was taken when the seedlings of susceptible check variety TN-1 became 100 percent dead. The rating was based on the following scoring system:

In the above rating scale particulars in 'scale' 'and level of resistance' were taken from Heinrichs *et al.,* (1985) but the ranges for percent dead seedlings were constructed to facilitate the rating based on percent seedling mortality due to BPH damage.

Results and Discussion

The mean seedling mortality ranged from 4.5 to 100 per cent in the different entries screened against BPH (Table 1). The mean of two screening tests indicated that MSN97 (33) showed only 4.5 per cent seedling mortality, so, classified as highly resistant (HR). The entry KAUM 172-1(19) was rated as resistant (R) in which mean seedling mortality was 7.7 per cent. Moderate level of resistant (MR) was observed in KAUM 166-2 (17) and CB 05-022(36) with 18.2 and 20.0 per cent mean seedling mortality, respectively. The rest of the entries were either moderately susceptible (MS) (27.1 to 59.7 per cent mortality) or susceptible (S) against BPH due to the 64.2 to 100 per cent mortality of seedlings.

Rating scale

Scale	Percent dead seedlings	Level of resistance
0	0	Immune (I)
1	1-5	Highly resistant (HR)
3	6-9	Resistant (R)
5	10-25	Moderately resistant (MR)
7	26-60	Moderately susceptible (MS)
9	61-100	Susceptible (S)

Table.1 Evaluation of PHS entries against *N. lugens* under glasshouse condition

Ent. No	Designation	Cross	Per cent seedling mortality		Mean mortality (%)	Final score	Resistance grade**
			I screening*	II screening*			
1	CB 07103	Swarna/CO 43	-	33.3(7)	33.3	7	MS
2	CB 07537	CO47/JGL 1798	25.0(5)	36.4(7)	30.7	7	MS
3	CB 07608	ADT 43/WGL 32100	63.6(9)	72.7(9)	68.2	9	S
4	CB 07702	I.W.PONNI/Rasi	46.2(7)	23.1(5)	34.6	7	MS
5	CB 08504	Rasacdam/IR 50	66.7(9)	23.1(5)	44.9	7	MS
6	CB 08254	BPT 5204 /IR 64	100.0(9)	90.0(9)	95.0	9	S
7	CB 08534	JGL 384/ Rasi	100.0(9)	66.7(9)	83.3	9	S
8	CB 08721	ADT 43 /IR 20	100.0(9)	75.0(9)	87.5	9	S
9	CB 09123	BPT 5204 / CO(R)50	100.0(9)	-	100.0	9	S
10	CHECK	TN1	100.0(9)	100.0(9)	100.0	9	S
11	CB 09138	BPT 5204 / Tadukan	45.5(7)	60.0(7)	52.7	7	MS
12	CB 09142	WGL 14 /Rasi	44.4(7)	30.0(7)	37.2	7	MS
13	CB 09153	BPT 1788/GEB 24	-	-	-	-	-
14	CB 09507	PMK (R)3 /RR1025	69.2(9)	66.7(9)	67.9	9	S
15	CB 09516	RR 4065-381-245/UPR 2893-93	61.5(9)	56.3(7)	58.9	7	MS
16	KAUM 164-1	Remanika / Gouri	64.3(9)	15.4(5)	39.8	7	MS
17	KAUM 166-2	Makom /PTB 9	18.2(5)	18.2(5)	18.2	5	MR
18	KAUM 168-1	Pavizham /Arikkilari					
19	KAUM 172-1	Aiswarya/Karthika	7.1(3)	8.3(3)	7.7	3	R
20	CHECK	PTB 33	-	-	-	-	-

21	KAUM 173-1	Kanakom /Gouri	-	-	-	-	-
22	KAUM 173-3	Kanakom /Gouri	33.3(7)	62.5(9)	47.9	7	MS
23	KAUM 173-4	Kanakom /Gouri	-	76.9(9)	76.9	9	S
24	KAUM 174-4	Uma / Gouri	40.0(7)	72.7(9)	56.4	7	MS
25	KAUM 174-5	Uma / Gouri	41.7(7)	77.8(9)	59.7	7	MS
26	KAUM 174-6	Uma / Gouri	20.0(5)	75.0(9)	47.5	7	MS
27	KAUM 174-7	Uma / Gouri	85.7(9)	62.5(9)	74.1	9	S
28	KAUM 176-4	Gouri / Uma	-	-	-	-	-
29	KAUM 177-1	Uma /Aruna	57.1(7)	0.0	28.6	7	MS
30	CHECK	MO 1	-	-	-	-	-
31	KAUM 178-1-1-1	Gouri /Aruna	100.0(9)	-	100.0	9	S
32	KMP 194	IR 64 / O. Rufipogan	41.7(7)	80.0(9)	60.8	7	MS
33	MSN 97	-	0.0(0)	9.1(3)	4.5	1	HR
34	230 (S)	RP Bio 4918	-	-	-	-	-
35	212 (S)	-	40.0(7)	14.3(5)	27.1	7	MS
36	CB 05-022	CO 43 /ADT 39	40.0(7)	0.0(0)	20.0	5	MR
37	CB 05-031	CO 43/TNAU 91043	100.0(9)	0.0(0)	50.0	7	MS
38	CB 05-754	MTU 1066 /RR 272-662/PMK3/IR 64	58.3(7)	70.0(9)	64.2	9	S
39	CO 06-124	BPT 5204/ Jeeraga Samba	57.1(7)	38.5(7)	47.8	7	MS
40	CHECK	RP 2068-18-3-5	66.7(9)	-	66.7	9	S

— = Seed did not germinate

* Values in parentheses are score given at each screening test

** I= Immune, HR= Highly Resistant, R=Resistant, MR=Moderately Resistant, MS=Moderately Susceptible, S=Susceptible

The results indicated that reaction of entries against BPH varied in different screening tests. However, entries such as MSN97 and KAUM 172-1 performed better against BPH in both the tests under glasshouse condition. Entry KAUM 172-1 which was resistant in our study also gave promising reaction against BPH attack at other locations of India under greenhouse test (Anonymous, 2011). Other entry *viz.* KAUM 166-2 also showed resistance reaction at different locations (Anonymous, 2011) was considered as moderately resistant against BPH in our investigation.

References

Anonymous, 2011. Progress Report Entomology and Pathology. All India Co-ordinated Rice Improvement Pogramme. Directorate of Rice Research, Hyderabad, India. Vol. 2.

Heinrichs, E.A., and Mochida O 1984. From secondary to major pest status. The case of insecticide-induced rice brown plant hopper, *Nilaparvata lugens* resurgence. Protection Ecology 7:201-218.

Heinrichs, E.A., Medrano F G and Rapusas H R 1985. Genetic evaluation for insect resistance in rice. IRRI, Los Banos, Philippines 356.

Kenmore, P.E., Carino F D, Perez C A, Dyck V A and Gutierrez A P 1984. Population regulation of the rice brown planthopper (*Nilaparvata lugens* Stal) within rice fields in the Philippines. *Journal of Plant Protection Tropical*, 1:19-37.

Krishnaiah, N.V., Jhansi Lakshmi V, Pasalu I C, Katti G R and Padmavathi C 2008. Insecticides in rice IPM past, present and future. Technical Bulletin No.30. Directorate of Rice Research, Hyderabad, A.P. India 146.

Park, D.S., Lee S K, Lee J H, Song S Y, Kwak D Y, Yeo U S, Jeon N S, Park S K, Song Y C, Nam M H, Ku Y C and Jeon J S 2007. The identification of candidate rice genes that confer resistance to the brown plant hopper (*Nilaparvata lugens*) through representational difference analysis. *Theortical Applied Genetics*, 115: 357-547.

Singh, S.P., 2000. Bio-intensive approach helpful. *The Hindu Survey of Indian Agriculture*, 2: 159-163.

How to cite this article:

Vijay Kumar Soni and Tiwari, S.N. 2017. Glasshouse Evaluation of New Source of Resistance against Brown Plant Hopper *Nilaparvata lugens* (Stal) in Rice. *Int.J.Curr.Microbiol.App.Sci.* 6(9): 1187-1192. doi: https://doi.org/10.20546/ijcmas.2017.609.143