International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 186-188

Received: 04-05-2019
Accepted: 06-06-2019

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Screening of rice genotypes for resistance to the brown plant hopper (*Nilaparvata lugens* Stal)

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Abstract
Rice genotypes were evaluated for resistance to the Brown Plant Hopper (BPH), *Nilaparvata lugens* Stal in SVPUA & T Meerut, were evaluated for resistance in greenhouse screening tests. Over a period of two years (2017 and 2018), 17 rice cultivars were screened using the plant standard seed box screening technique. The results showed 6 rice varieties *viz*. REMRE-1, RPMRE-2, RPMRE-3, RPMRE-5, RIL-501 and PTB-33 were possessing high level of resistance to the BPH. 3 rice varieties viz., Vallabh Basmati-24, Pusa Sugandha-5, Taraori Basmati and Pusa Basmati-1 were moderately resistant. 4 rice varieties viz., Kasturi, Vallabh Basmati-23, Vallabh Basmati-22, Improved Pusa Basmati-1460 were moderately susceptible and 3 rice varieties viz., Pusa Basmati-6, Pusa Basmati-1121 and Pusa Basmati-1509 were susceptible, according to standard evaluation system (IRRI, 1992) Standard Seed Box Screening technique (SSST).

Keywords: Rice, germplasm, screening, *Nilaparvata lugens*, resistance

Introduction
Rice is one of the most important staple food crops of India for more than 2/3rd of its human population and it is the world's largest cereal crop providing the caloric need for millions of people. It is the predominant dietary energy source for 17 countries in Asia and the Pacific, 9 countries in North and South America and 8 countries in Africa. It provides 20% of the world's dietary energy supply. The nutrition value of rice depends on the strain of rice, nutrient quality of the soil grown in, its processing and preparation before cooking. The brown plant hopper, *Nilaparvata lugens* Stål (Homoptera: Delphaciedae), is a destructive and widespread insect pest throughout the rice growing areas in Asia. The BPH feeds specifically in rice, using stylet like mouthparts to penetrate the plant tissues and sucks assimilates from the phloem. Feeding by a large number of BPH may result in drying of the leaves and wilting of the tillers resulting in a condition called 'Hopper Burn'. It also serves as a vector that transmits rice grassy stunt virus and ragged stunt virus, which are serious diseases in the tropical region (Du, *et al.*, 2007) [2]. In recent years, BPH infestations have intensified across Asia, causing heavy rice yield losses (Normile, 2008) [8].

Materials and Methods
Insect rearing
We used the method described by IRRI (Pathak and Khush 1977) [9] to rear the BPH. The insects were collected from the rice field and continuously rearing in greenhouse. For screening purpose the rice genotypes were infested by Brown Plant Hopper insect in the field. The insects were reared on 35 to 45 day old rice plants (susceptible variety Pusa Basmati-1121) inside a 60 × 45 × 10 cm seed box. This plastic seed box covered with a fine net cover to screen rice plants. The box bottom was open and setting in water. The original BPH insect population per box was started by 10–15 BPH adults. Eggs of about the same day age were obtained by placing the plants in a cage with BPH male and female adults for two days.

Screening procedures
For evaluating the BPH resistance of each rice genotype, the standard seed box screening technique was followed with some modifications (IRRI 1988) [4]. The experiment was conducted at a temperature of 28 to 30°C and relative humidity of 70% to 80%. The seeds were pre-soaked and sown in rows in 60 × 45 × 10 cm seed boxes along with resistant and

susceptible checks. 10 to 15 seedlings per row were maintained per genotype. Twenty (20) day old seedlings were infested with first instar nymphs at the rate of eight to 10 per seedling. Approximately one week after infestation “Hopper Burn” symptom was observed. The genotypes were scored as scoring system developed by the International Rice Research Institute (Harini A. S. *et al.* 2013) [3]. All of the screening was conducted in SVPUA&T Meerut, during the period 2017 and 2018.

Table 1: Criterion for brown planthopper resistance scores

Scale	Description	Reaction
0	No damage	Highly resistant
1	Very slight damage	Resistant
3	One to two leaves were yellowing or slight stunning	Moderately resistant
5	More than half the leaves shrunk	Moderately susceptible
7	More than half of the plant dead and remaining alive	Susceptible
9	Whole plant dead	Highly susceptible

Fig 1: Rice crop under standard seed box screening technique

Result

A set of 17 rice genotype were screened for their reaction against BPH infestation. Screening was done as per the methodology according to standard evaluation system (IRRI, 2010) [5] Standard Seed Box Screening technique (SSST). The test and check varieties were pregerminated and transferred to plastic boxes containing well mixed standardized soil. Each seed box contains 4-5 rice seedlings. The boxes were covered by the net cover to enhance seedling growth. After sowing the seed boxes were placed under field condition and 3-4 inches water level to provide sufficient humidity for the insect. When the seedlings were 9-10 days old with 2 to 4 leaves in the screening trays so that each seedlings has reared with 8-10 nymphs. Observation was recorded 10-12 days after releasing insects. The observation was recorded on the basis of 0-9 scale.

Table 2: Reaction of 17 rice germplasm lines against BPH infestation.

S. No.	Rice varieties	Average damage score	Reaction	Result
1	Kasturi	5	Pronounced yellowing or some stuning	MS
2	Pusa Basmati-1	3	First and second leave partially yellowing	MR
3	Pusa Basmai-6	7	Mostly wilted plant but alive	S
4	Vallabh Basmati-23	5	Pronounced yellowing or some stuning	MS
5	Vallabh Basmati-24	3	First and second leave partially yellowing	MR
6	Pusa Basmati-1121	7	Mostly wilted plant but alive	S
7	Vallabh Basmati-22	5	Pronounced yellowing or some stuning	MS
8	Improved Pusa Basmati-1460	5	Pronounced yellowing or some stuning	MS
9	Pusa Sugandha-5	3	First and second leave partially yellowing	MR
10	Taraori Basmati	5	First and second leave partially yellowing	MR
11	Pusa Basmati-1509	7	Pronounced yellowing or some stuning	S
12	REMRE-1	1	Partially yellowing of first leave	R
13	RPMRE-2	1	Partially yellowing of first leave	R
14	RPMRE-3	1	Partially yellowing of first leave	R
15	RPMRE-5	1	Partially yellowing of first leave	R
16	RIL-501	1	No visible damage	R
17	Pitambi-33	1	Partially yellowing of first leave	R

Out of 17 rice varieties, 6 rice varieties viz., REMRE-1, RPMRE-2, RPMRE-3, RPMRE-5 and PTB-33 showed the plant damage score of (0-1) 1, 1, 1, 1, 1, 1 respectively i.e. resistant. 3 rice varieties viz., Vallabh Basmati-24, Pusa Sugandha-5, Taraori Basmati and Pusa Basmati-1, showed the plant damage score of (3-5) 3, 3, 5, 3 respectively i.e. moderately resistant. 4 rice varieties viz., Kasturi, Vallabh Basmati-23, Vallabh Basmati-22, Improved Pusa Basmati-1460 showed the average plant damage score of (5-6.9) 5, 5, 5, 5 respectively i.e. moderately susceptible. 3 rice varieties viz., Pusa Basmati-6, Pusa Basmati-1121 and Pusa Basmati-1509, showed the average plant damage score of (7-9) 6, 7, 7 respectively i.e. susceptible.

Table 3: Summery of BPH reaction of 17 rice germplasm lines

Average plant damage score (Range)	Rice varieties	Reaction
0-1	6 Rice varieties	Resistant
3-5	3 Rice varieties	Moderately Resistant
5-6	4 Rice varieties	Moderately Susceptible
7-9	3 Rice varieties	Susceptible

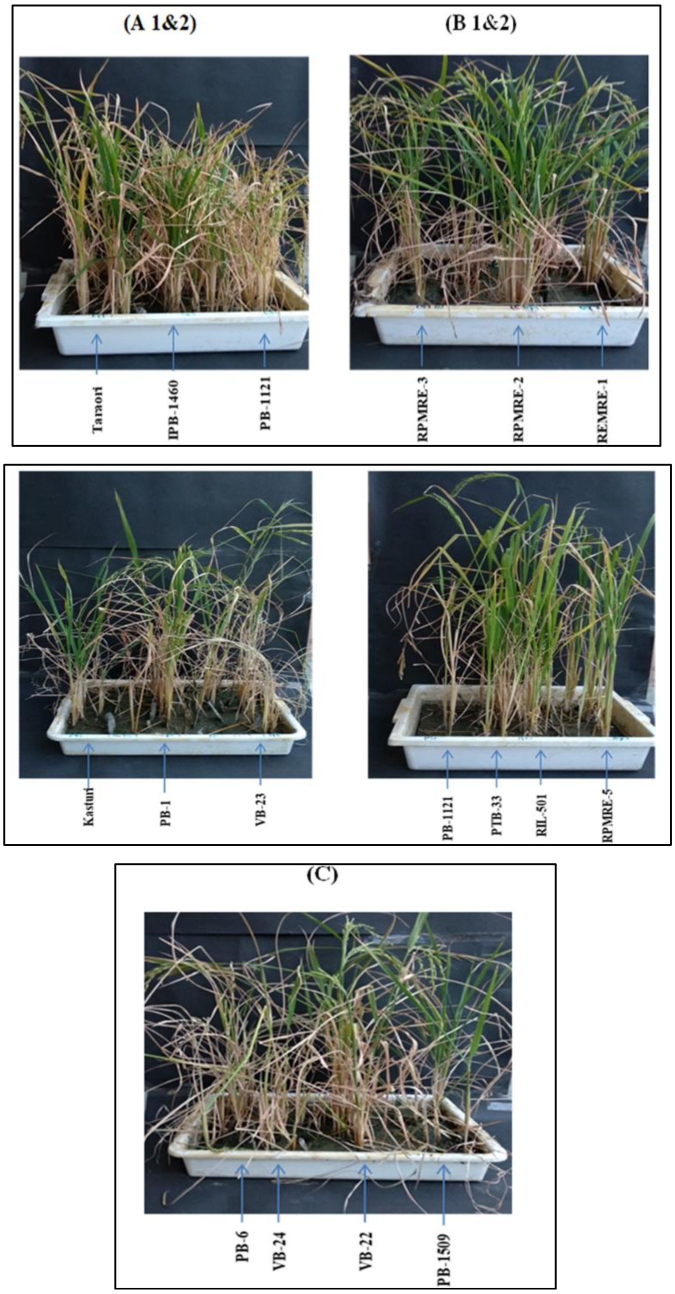

Fig 2: Evaluation of rice genotype according to standard seed box screening (SSST) technique. In figure A1: Taraori Basmati, IPB-1460, PB-1121, A2: Kasturi, PB-1, VB-23, B1: RPMRE-3, RPMRE-2, REMRE-1, B2: PB-1121, PTB-33, RIL-501,RPMRE-5, and C: PB-6, VB-24, VB-22, PB-1509.

Discussion

Out of 17 tested rice genotypes collected from different sources only 6 were found to be resistant to the BPH (Table 2). IRRI has a wide range of resistance sources for BPH. The incorporation of resistance gene to improve the rice varieties is essential because our data showed that the frequency of the different rice varieties resistant to BPH was quite low. Jena and Kim (2010) [6] reported that Mudgo, ASD7, Raghu Hematic, Babawee, ARC10550, Swarnalata, T12, Chin Saba, Balamawee are resistant donors. But the present study showed that some rice varieties had resistance to the BPH at the seedling stage in Seed box screening. Our study suggested that the resistant rice variety should cultivated by farmers to avoid the yield loss due to BPH insect.

References

1. Ali MP, Salem Alghamdi S, Begum MA, Uddin ABMA, Alam MZ, Dingcheng H. Screening of Rice Genotypes for Resistance to the Brown Plant hopper, *Nilaparvata lugens* Stål. Cereal Research Communications. 2012; 40(4):502-508.
2. Du PV, Cabunagan RC, Cabauatan PQ, Choi HS, Choi IR, Chien HV, Huan NH. Yellowing syndrome of rice: Etiology, current status, and future challenges. *Omonrice*. 2007; 15:94-101.
3. Harini AS, Sai KS, Padma B, Sharma R, Ayyappa DM, Shenoy V. Evaluation of rice genotypes for brown plant hopper (BPH) resistance using molecular markers and phenotypic methods. Afr. J Biotechnol. 2013; 12(19):2515-2525.
4. IRRI (International Rice Research Institute). Standard Evaluation System for Rice. International Rice Research Institute, Manila, Philippines, 1988.
5. IRRI (International Rice Research Institute). Standard evaluation system for rice. International Rice Research Institute, Manila, Philippines. Home page, 2010. http://beta.irri.org/index.php/Home/Welcome/Frontpage.
6. Jena KK, Kim SM. Current status of brown plant hopper (BPH) resistance and genetics. Rice. 2010; 3:161-171.
7. Khush GS. Breeding for resistance in rice. New York Acad. Sci. 1977; 287:296-308.
8. Normile D. Reinventing rice to feed the world. Science. 2008; 321:330-333, 7.
9. Pathak MD, Khush GS. Studies of varietal resistance in rice to the brown plant hopper at the International Rice Research Institute. In: Brown Plant hopper: Threat to Rice Production in Asia. IRRI, Los Baños, Philippines, 1977, 285-301.