E-ISSN: 2788-9297
P-ISSN: 2788-9289
SAJAS 2021; 1(2): 80-83
Received: 09-05-2021
Accepted: 12-06-2021

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Evaluation of rice accessions for mechanism of resistance to brow planthopper (*Nilaparvata lugens* Stal.)

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Abstract
In all 121 promising rice genotypes of IGAU were evaluated against brown plant hopper (BPH) in glasshouse by adopting internationally accepted screening technique out of these genetic stock, three genotypes were found to be resistant and 20 were moderately resistant whereas, 98 genotypes were susceptible to brown planthopper infestation. In depth studies of different rice category revealed that resistant rice genotypes had the least feeding values 24.75 to 39.00 mm^2 with the highest numbers of probes 25 to 40 per seedling in 24 hours feeding duration with vice versa in susceptible rice genotypes.

Keywords: Brown plant hopper, plant derivatives, mortality and phagodeterrant

Introduction
The use of insecticides in the wake to control the brown planthopper *Nilaparvata lugens* (Stal.) (Hemiptera: Delphacidae) in Asian countries has upset the ecological balance. The BPH, a minor pest before green revaluation has now become a major biotic constraint to rice production. Regular occurrence and severe outbreak of this pest not only hampered the rice production but also caused the insecticidal induced problems thereby polluting the rice ecosystem; further evaluation of BPH virulent biotypes is a constant threat to the stability of resistant varieties. However, to ahead of this problem constant new source of resistance with wide genetic bases are needed.
Different agronomic factors that contribute to high yield levels in modern rice varieties also favours a high population of brown plant hopper (BPH), *Nilaparvata lugens* (Stal.) in rice ecosystem (Heinrichs, 1986) [16]. Chemical control of BPH by using insecticides has remained futile approach (Balaji *et al.*, 1987) [2], which has forced the plant protectionists to opt for exploitation of host plant resistance for management of BPH as a valid alternative measure. Therefore, 121 rice accessions from I.G.A.U., were screened and feeding tests were carried out on selected promising rice genotypes against brown plant hopper.

Materials and Methods
Nilaparvata lugens was mass reared in an air-cooled glass house at 30°C ± 5°C on potted rice plants. Rice accessions were screened as per methodology described by Kalode (1976). Promising accessions were again revaluated to confirm the resistant reaction. Out of 121 rice accessions screened, three genotypes *i.e*. resistant (R), moderately resistant (MR) and susceptible (S) were further evaluated for their effect on BPH feeding activity. Feeding test was assessed as per methodology suggested by Pathak and Heinrichs (1982) [9]. Feeding probe test were carried out as per methodology suggested by Natio (1964).

Results and Discussion
The three resistant genotypes exhibited plant damage score, which ranged between 0.6 to 2.90 (Table 1). As per the norms of International scale for plant damage score, all these three genotypes were ranked as resistant. The rice genotypes RGL-5613 and R 1217-538-1-260-1 shown extremely good phenotypic plant stand, as the plant damage score in these cultivars was 0.60 and 2.44. Both these cultivars exhibited least feeding response to BPH and other three moderately resistant genotypes R 1033-103-1-1, R 979-78-2-62-1 and R 979-66-1-41-1 having the plant damage score ranged from 3.19 to 4.36, the lowest plant damage score was observed in rice genotype R 1033-103-1-1 (3.19). Whereas the damage score of susceptible genotypes IET 17920, Vijeta and R 1218-598-1-281-1 was 5.26, 6.20 and 8.05 respectively.

Looking to the data of honeydew excretion (Table 1) clearly depicted that in resistant rice genotypes average honeydew excretion rate was ranging from 24.75 to 39.00 mm^2 by per two females of BPH in 24 hours feeding. The genotypes R 1217-538-1-
260-1 (24.75 mm^2), RGL-5613 (30 mm^2) and IR 64 (39 mm^2) had the minimum feeding rate by BPH female with significantly higher probe marks (25 to 40 mm^2) on per seedling per female as compared to susceptible checks in which the honeydew excretion rate and probing marks 203 mm^2 and 16 respectively. The least honeydew excretion area by per two females in 24 hours feeding was recorded in resistant rice genotypes with the highest number of probe marks with vice versa in susceptible genotypes. The genotypes IET 17920 (119.50 mm^2), R 1218-598-1-281-1 (121.50 mm^2) and Vijeta (150 mm^2) had the maximum feeding rate by BPH female with significantly lower probe marks (11.25 to 17.00) as compared to resistant check Ptb 33 which had the feeding rate (50.25 mm^2) and probing marks (29.25) per seedling by per female. The moderate resistant rice genotypes to BPH had the intermediatory phenomenon, had the average feeding rate ranging from 54-80 mm^2 and probing marks 17.50 to 24 per female per seedling. Out of the three moderately resistant genotypes the genotype R 979-78-2-62-1 had the lowest feeding rate (54 mm^2) and highest number of probing marks (24).

The work reported by DRR Hyderabad (Anonymous, 2002) [1] in which 32 rice entries were showing average plant damage score less than three out of the 814 entries tested against BPH. Shen *et al.*, (2002) [10] screened 38 elite rice lines out of them five elite lines were found to be resistant to BPH. Soudarajan *et al.* (2001) reported feeding rate on DH rice line and two parent lines (IR 64 and Azucena) among DH lines, excretion of honeydew was less in DH 210 (212 mm^2 area) and was maximum in DH 1505 (542.65 mm^2) and among parent lines, feeding rate was lower in IR 64 than in Azucena, similarly Lu *et al.*, (1999) reported probing frequency of biotype 1 on TN1 decreased significantly and that of biotype 3 on ASD 7 increased significantly.

The association between plant biochemicals and host plant resistance was well documented by several authors. Stevension *et al*., (1996) [12] pointed out higher content of schaftoside and isoschaftoside and total apigenin-C-glycosides in resistant cultivar donars. Also schaftoside impeded BPH survival in a dose dependent manner, similar findings was observed by Grayer *et al*., (1994) [4] who suggested that apigenin-C-glycoside are responsible for BPH restricted feeding. Lack of sustained feeding by BPH insect on these resistant cultivars might be due to antifeeding activity of apigenin-C-glycoside. Yoshihara *et al*., (1980) [14] studied the role of soluble salicylic and oxalic acid in the plant sap, which acted as a sucking inhibitor. Presence of potassium and sodium oxylate in sap was responsible for completely inhibition of sucking by BPH (Cook *et al*., 1987) [3].

It seems that several biophysical parameters like surface waxes, anatomical adaptations of organs, thickness of epidermis which was related to morphological structural plant features that impair feeding by insect as Woodhead and Padgham (1988) [13] reported that increased activity of *N. lugens* on IR 46 over IR 22 and IR 62 was shown due to chemical composition of surface wax.

Table 1: Damage and feeding rate of brown planthopper, *Nilaparvata lugens* (Stal.) on different resistant, moderately resistant and susceptible rice genotypes

Sr. No.	Name of culture	Average plant damage score	Average feeding by per two females in 24 hours duration	Average probing marks per seedling	Category
1	**R 1217- 538-1-260-1**	2.44	24.75	40.00	R
2	RGL-5613	0.60	30.00	30.50	R
3	IR-64	2.90	39.00	25.00	R
4	R 979-78-2-62-1	3.20	54.00	24.00	MR
5	R 1033-103-1-1	3.19	62.50	20.00	MR
6	R 979-66-66-1-41-1	4.36	80.00	17.50	MR
7	IET 17920	5.26	119.50	17.00	S
8	R 1218-598-1-281-1	8.05	121.50	14.25	S
9	Vijeta	6.20	150.00	11.25	S
	(R. Check) Ptb 33	1.76	50.25	29.25	
	(S. Check) TN1	9.00	203.00	16.00	
	SEm±		6.83	1.55	
	CD (5%)		19.68	4.48	

* Mean of four replications

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