

# SCREENING OF RICE CULTIVARS AGAINST BROWN PLANT HOPPER, *Nilparvata lugens* STAL. (HEMIPTERA: DELPHACIDAE)

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## KEYWORDS

Brown plant hopper  
Resistant  
Susceptible etc

Received on :  
05.04.2018

Accepted on :  
14.07.2018

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## ABSTRACT

The results among 18 varieties on per cent hill damage due to brown plant hopper showed that GR-101, GR-102, GR-103, GR-104 considered as resistant (R) with 1 to 10 per cent hill damage, varieties GNR-3, GNR-2, GR-7, GAR-1 and Narmada considered as moderately resistant (MR) showed 11 to 25 per cent hill infestation. The varieties that recorded hill damage between 26 to 50 per cent were NAUR-1, GAR-2, GR-12 and IR-22 considered as moderately susceptible (MS). while varieties viz., IR-28, GR-11 and Masuri categorized as susceptible (S) with 51 to 75 per cent hill damage and the two varieties with more than 76 per cent hill damage viz., Jaya and Gurjari considered as highly susceptible (HS).

## INTRODUCTION

Asia is considered to be 'rice bowl' of world. It is the world's second most important cereal crop. At global level, rice is a staple food crop of paramount importance to more than half of the population with regard to food value and is consumed by more than 60 per cent of the world population. South Gujarat is an important rice growing tract of the state belonging to Dang, Valsad, Navsari and Surat districts of State. In rice among the biotic factors insect pests cause about 10-15 per cent yield losses. The average yield losses in rice have been estimated to vary between 21-51 per cent (Krishnaiah and Varma, 2010).

Attempts are being made in the Gujarat state to increase the rice production by the high yielding varieties with high rice yields. Lack of pest resistant varieties, poor water management and lack of suitable pest and disease management strategies are the major constraints in rice production (Waddington et al., 2010).

Rice hoppers complex infest all stages of the rice crop and both nymphs and adults suck the sap from the base of the tillers, resulting in yellowing and drying of the plants. The symptoms spread as patches of infestation from a point outwards within the field. This condition is known as 'hopper burn'. Outbreaks of plant hoppers recently have caused serious concern and in the last decade plant hoppers have rapidly spread to newer non-traditional areas (Korat and Pathak, 1997).

Of all insect control methods, the planting of pest resistant varieties is the most effective because it leaves no insecticide residue in food or the environment and is constantly effective

and generally compatible with other insect control measures. In absence of natural heritable resistance in rice varieties, resistance could be induced by alternate strategies to suppress certain pests. Besides these farmers are always worried about cost of production due to rise in inputs prices year by year. Host plant resistance is one of the reliable and sustainable components of Integrated Pest Management (IPM). There has been substantial progress in this area and number of paddy varieties/ lines have been developed and required to be screened out for their major insect pest susceptibility. Hence the present investigation is carried out on screening of rice cultivars against brown plant hopper, *Nilparvata lugens* Stal.

## MATERIALS AND METHODS

### Experimental details

1. Location	:	Wheat Research Station Farm, N.A.U., Bardoli
2. Season and year	:	Kharif 2012 and 2013
3. Design	:	Randomized Block Design (RBD)
4. Area of experiment	:	1000 m <sup>2</sup>
5. Spacing	:	20 cm x 15 cm
6. Method of sowing	:	Transplanting

The seedlings were transplanted when they were 25 days old. All the post sowing recommended agronomic practices were followed and the experimental area was kept free from insecticidal spray throughout the crop season in order to record the observations on Brown plant hopper incidence.

To assess the infestation of brown plant hopper, the observations were recorded by counting total number of nymph and adults on twenty randomly selected spots each

comprising five hills at weekly interval. Similarly, to assess the damage intensity the observations were recorded by counting the total number of damaged and healthy hills from randomly selected twenty spots of one m<sup>2</sup> area each. The spots were selected by walking "M" or "W" fashion in the field.

The damage done by BPH to the leaves was recorded by visual examination of selected hills. These observations were made at weekly interval from 10 randomly selected hills till harvest of paddy crop.

Sr. No.	% damage hills	Scale	Reaction
1.	0	0	HR (Highly Resistant)
2.	1 – 10	1	R (Resistant)
3.	11 – 25	3	MR (Moderately Resistant)
4.	26 – 50	5	MS (Moderately Susceptible)
5.	51 – 75	7	S (Susceptible)
6.	76 – 100	9	HS (Highly Susceptible)

The scale and reaction for resistance/susceptibility score was judged by using Standard Evaluation System for Rice (SES) for the insect pest (Anonymous, 1996) which is as under.

## RESULTS AND DISCUSSION

The data on per cent hill damage due to brown plant hopper indicated that none of the variety was free from the attack of *N. lugens* and all varieties showed more or less per cent damaged hills of rice brown plant hopper (Table 01-02 and Fig. 01).

### I year (Kharif 2012)

The findings of first year varietal screening revealed significant

the results on hill damage in eighteen varieties (Table 01 and Fig. 01). Out of the eighteen varieties, GR-104 (0.08%) and GR-103 (0.13%) was found less susceptible due to the low hill damage and at par each other. While, the variety GR-102 and GR-101 also reported less susceptibility with 0.18 and 0.21% hill damage, respectively and were at par with other. The varieties viz., GNR-3 and GNR-2 showed 0.35 and 0.49% hill damage and at par with each other, followed by Narmada (0.52%), GAR-1 (0.54%) and GR-7 (0.58%). The varieties NAUR-1 (0.79%), GAR-2 (0.80%), IR-22 (1.07%) and GR-12 (1.13%) exhibited moderate resistant to hill damage, in which earlier two and later two found at par with each other. The higher hill damage of *N. lugens* was registered in variety IR-28 (1.62%) than all the evaluated varieties of paddy and showed at par results with GR-11 (1.67%) and Masuri (1.79%). The significantly highest hill damage was found in variety Gurjari and Jaya with 2.17 and 2.64% hill infestation, respectively.

### II year (Kharif 2013)

During *Kharif* 2013, same 18 varieties were evaluated against brown plant hopper (Table 01 and Fig. 01) and the results of hill damage were found significant. The findings revealed that variety GR-104 was recorded less susceptibility to hill damage (0.10%), but showed at par results with GR-103 (0.15%), GR-102 (0.21%), while GR-101 recorded significantly less susceptible infestation due to low hill damage of 0.24%. The variety GNR-3 reported 0.47% hill damage and at par with GNR-2 (0.51%), GAR-1 (0.57%), Narmada (0.58%) and GR-7 (0.64%).

The next less susceptible varieties were NAUR-1, GAR-2, IR-22 and GR-12 exhibited 0.90, 0.93, 1.23, and 1.24% hill

**Table 01: Varietal screening of rice against Brown plant hopper during *Kharif* 2012 and 2013**

Sr. No.	Varieties	<i>Kharif</i> 2012 Hill damage (%)	Corr. % damage	Scale	Reaction	<i>Kharif</i> 2013 Hill damage (%)	Corr. % damage	Scale	Reaction
A.	Early Varieties								
1.	GR-7	4.36(0.58)	21.97	3	MR	4.58(0.64)	21.69	3	MR
2.	GR-12	6.10(1.13)	42.93	5	MS	6.38(1.24)	41.92	5	MS
3.	Gurjari	8.47(2.17)	82.32	9	HS	8.91(2.40)	81.47	9	HS
4.	GNR-3	3.35(0.35)	13.13	3	MR	3.84(0.47)	15.82	3	MR
5.	NAUR-1	5.08(0.79)	29.80	5	MS	5.42(0.90)	30.40	5	MS
6.	GAR-1	4.20(0.54)	20.45	3	MR	4.29(0.57)	19.21	3	MR
7.	GAR-2	5.13(0.80)	30.30	5	MS	5.51(0.93)	31.41	5	MS
8.	IR-28	7.30(1.62)	61.24	7	S	7.71(1.81)	61.24	7	S
B.	Mid-late varieties								
9.	GR-11	7.42(1.67)	63.26	7	S	7.78(1.84)	62.37	7	S
10.	GNR-2	3.99(0.49)	18.43	3	MR	4.03(0.51)	17.18	3	MR
11.	IR-22	5.92(1.07)	40.53	5	MS	6.35(1.23)	41.69	5	MS
12.	Jaya (Sus. check)	9.35(2.64)	—	9	HS	9.89(2.95)	—	9	HS
C.	Late varieties								
13.	Masuri	7.68(1.79)	67.80	7	S	7.79(1.85)	62.60	7	S
14.	GR-101	2.59(0.21)	7.83	1	R	2.78(0.24)	8.02	1	R
15.	GR-102	2.44(0.18)	6.94	1	R	2.60(0.21)	7.01	1	R
16.	GR-103	2.08(0.13)	5.05	1	R	2.22(0.15)	5.08	1	R
17.	GR-104	1.60(0.08)	3.03	1	R	1.81(0.10)	3.39	1	R
18.	Narmada	4.08(0.52)	19.70	3	MR	4.30(0.58)	19.55	3	MR
S. E. (m)		0.24				0.29			
C. D. at 5%		0.69				0.84			
C. V.		8.17				9.42			

\* Values in outside the parentheses are arc sine transformed values and inside are original values.

**Table 02: Varietal screening of rice against Brown plant hopper (Two years pooled)**

Sr. No.	Varieties	Hill damage (%)	Corrected % damage	Scale	Reaction
A.	Early Varieties				
1.	GR-7	4.47(0.61)	21.82	3	MR
2.	GR-12	6.24(1.19)	42.40	5	MS
3.	Gurjari	8.69(2.29)	81.87	9	HS
4.	GNR-3	3.60(0.41)	14.55	3	MR
5.	NAUR-1	5.25(0.84)	30.11	5	MS
6.	GAR-1	4.25(0.55)	19.80	3	MR
7.	GAR-2	5.32(0.86)	30.89	5	MS
8.	IR-28	7.51(1.71)	61.24	7	S
B.	Mid-late varieties				
9.	GR-11	7.60(1.76)	62.79	7	S
10.	GNR-2	4.01(0.50)	17.77	3	MR
11.	IR-22	6.14(1.15)	41.14	5	MS
12.	Jaya (Sus. check)	9.62(2.80)	—	9	HS
C.	Late varieties				
13.	Masuri	7.74(1.82)	65.06	7	S
14.	GR-101	2.68(0.22)	7.93	1	R
15.	GR-102	2.52(0.20)	6.98	1	R
16.	GR-103	2.15(0.14)	5.07	1	R
17.	GR-104	1.71(0.09)	3.22	1	R
18.	Narmada	4.19(0.58)	19.62	3	MR
S. E. (m) + (T)		0.17			
S. E. (m) + (TxY)		0.27			
C. D. at 5% (T)		0.48			
C. D. at 5% (TxY)		NS			
C. V. %		8.86			

\* Values in outside the parentheses are arc sine transformed values and inside are original values.

damage, in which former two and later two found at par with each other. The higher hill infestation of *N. lugens* was registered in variety IR-28 (1.81%) and at par with GR-11 and Masuri, which showed 1.84 and 1.85% hill infestation, respectively. The significantly highest hill damage was found in variety Gurjari and Jaya with 2.40 and 2.95% hill damage, respectively.

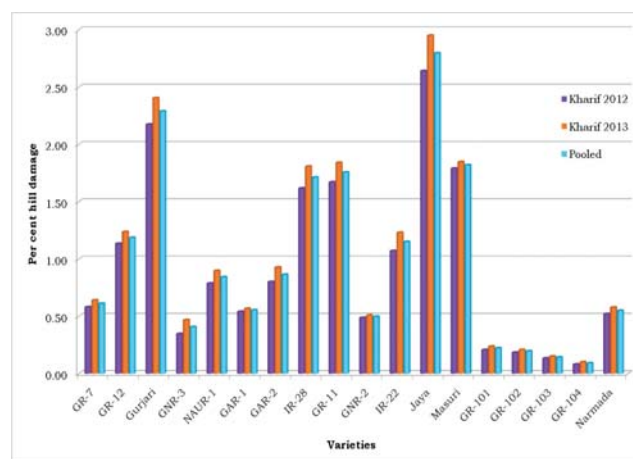
### iii. Pooled

The pooled data (Table 02 and Fig. 01) revealed that the minimum per cent damaged hills was found in variety GR-104 (0.09%) and GR-103 (0.14%), which were at par with each other. This was followed by GR-102, GR-101, GNR-3 and GNR-2 with 0.20, 0.22, 0.41 and 0.50 per cent damaged hills, respectively in which former two and later two found at par with each other. The other varieties like Narmada, GAR-1 and GR-7 having 0.55, 0.55 and 0.61 per cent damaged hills, respectively and were at par with other. NAUR-1 (0.84%) and GAR-2 (0.86%) showed moderate susceptibility and were at par with other, followed by IR-22 and GR-12 varieties were found moderately susceptible having 1.15 and 1.19 per cent damaged hills. Varieties IR-28, GR-11 and Masuri were found susceptible with 1.71, 1.76 and 1.82 per cent damaged hills, respectively and at par with other. The maximum per cent damaged hills were found in variety Gurjari (2.29), followed by Jaya (2.80). The interaction results between varieties and year were found non-significant showing consistent performance of different varieties.

Based on corrected per cent damage and scale (Table 02), the varieties having scale 1 viz., GR-101, GR-102, GR-103, GR-104 considered as resistant with 1 to 10% hill damage, while varieties having scale 3 viz., GNR-3, GNR-2, GR-7, GAR-1 and

Narmada showed hill infestation ranged between 11 to 25% considered as moderately resistant. The varieties recorded hill damage between 26 to 50% having scale 5 were NAUR-1, GAR-2, GR-12 and IR-22 considered as moderately susceptible. However, varieties having scale 7 viz., IR-28, GR-11 and Masuri considered as susceptible with hill damage between 51 to 75% and the varieties having scale 9 viz., Jaya and Gurjari considered as highly susceptible with more than 76% hill damage.

The similar type of trend was reported by Desai (2008) who showed that the minimum per cent damaged hills was found in variety GR-104 and highest in Jaya and Gurjari. Based on corrected per cent damage and scale, the varieties having



**Figure 1: Varietal screening of rice against brown plant hopper.**

scale 1 viz., IR-66, GR-101, GR-102, GR-103, GR-104 considered as resistant, varieties having scale 3 viz., GR-3, GR-6, GR-7, Narmada considered as moderately resistant, varieties having scale 5 viz., GR-10, Ratna, GR-12, IR-22 considered as moderately susceptible, varieties having scale 7 viz., IR-28, GR-11, Masuri considered as susceptible and varieties having scale 9 viz., Jaya and Gurjari considered as highly susceptible. However, in the findings of Cohen *et al.* (1997) showed slight to moderate levels of antibiosis, antixenosis in IR-64 and tolerance relative to the cultivars IR-22 Azucena, which contain no major genes for *N. lugens* resistance.

#### ACKNOWLEDGEMENT

The authors are thankful to Professor and Head, Department of Entomology, N.M. College of Agriculture, Navsari, Principal and Dean, N.M. College of Agriculture, Navsari as well as Director of Research and Dean Post Graduate Studies, Navsari Agricultural University, Navsari for providing all the necessary facilities during the course of the study.

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