

Original Research Article

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Evaluation of resistance in some rice genotypes against Brown Planthopper, *Nilaparvata lugens* (Stal)

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ABSTRACT

Keywords

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Studies were carried out under glass house conditions to study the evaluation of resistance in some rice genotypes against Brown plant hopper, *Nilaparvata lugens*. Among the rice genotypes tested against *N. lugens* (Stal), Ptb 33 (the resistant check) lowest mean damage rating (1.00), while genotypes, PTB 41 exhibited a damage score ranging from (1.00-1.67), when compared to T(N)1 (9.00). The genotypes viz., Co 43, ADT 36, Columbia, Swarna, SR 26B were moderately resistant with damage rating of (3.00-3.67) and the remaining genotypes were moderately susceptible or highly susceptible.

Introduction

Rice (*Oryza sativa* L.) is a staple food crop and more than 90% of the world's production was consumed in Asia. More rice production is demanded due to the rapid population growth in this part of the world (Khush, 2005). Three billion people depend on it as a major source of their subsistence diet (Cantrell and Reeves, 2002). It is planted on about 154 m ha or on about 11% of the world's cultivated land with an annual production of 700.7 million tons (FAO, 2011). China and India, which account for more than one-third of global population, supply over half of the world's rice. In India, area under rice is estimated to be 43 million ha with a production of 102 million tons (Anonymous, 2011).

Rice is cultivated in all the districts of Tamil Nadu (Anonymous, 2011). About 94 per cent of total area under rice in the State is concentrated in high productivity group, which accounts for about 98 per cent of total production of the State. In Tamil Nadu, there has been a large fluctuation of rice production in the last decade. The area under rice has decreased from 2.08 million hectares in 2000 to 1.89 million hectares in 2011. The production levels have come down from 7.53 million tons in 2000 to 5.47 million tons in 2011 (Anonymous, 2011).

Over 800 species have been identified damaging either standing or stored rice (Grist and Lever, 1969). Pawar (1974) listed 650 species of insect pests of rice from Philippines. In India, 221 species of insects

feeding on rice were reported by Arora and Dhaliwal (1996). Among these rice pests, about 20 of them are of economic importance. Among these rice pests, rice yellow stemborer, rice leaffolder, leafhoppers, planthoppers, gallmidge and earhead bug occur every year in most of the rice growing areas of the world. These insects are considered to be the major pests causing economic damage. Of the rice pests, the sucking pests such as brown planthopper, white backed planthopper, and green leafhopper has assumed greater importance in recent times. Besides causing the direct damage by feeding, the hoppers also act as vectors of many virus diseases. Severe outbreaks have been reported in different in different countries (IRRI 1975) and also in different states of India. Rice hoppers, brown planthopper (BPH) *Nilaparvata lugens* (Stal), whitebacked planthopper (WBPH), *Sogatella furcifera* (Horvath) and green leaf hopper (GLH), *Nephotettix virescens* (Distant) are considered as green revolution induced pests (Gunathilagaraj and Ganesh Kumar, 1997).

The estimated yield loss caused by these pests of rice in India is more than 20 million US\$ (Rangasamy *et al.*, 1997). Use of insecticides to control sucking pests of rice was not always rewarding. Continuous and repeated application of certain insecticides has resulted in the development of resistance (Lin *et al.*, 1979); as well they caused resurgence of the insect after repeated application (Chelliah, 1979). In the integrated management of sucking pests, use of resistant varieties forms the basis with other methods of control can be integrated. We therefore examined the reaction of new rice genotype against brown planthopper.

Materials and Methods

Insect culture

Nilaparvata lugens was mass cultured in the glass house on the susceptible rice variety

Taichung Native 1 (TN1). Initial BPH population was collected from unsprayed rice fields at Paddy Breeding Station, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. The adults were confined on 30 day old potted plants of TN1 placed in oviposition cages (45x45x60 cm) having wooden frames, glass top and door and wire-mesh side walls. The ovipositing insects were removed three days later and plants with eggs were taken out of cages, placed in separate cages for the nymphs to emerge. The emerged nymphs were then transferred to 10 to 15 day old TN1 seedlings raised in 10 cm diameter clay pots placed in galvanized iron trays (64x47x15cm) containing 10 cm depth of water and permitted to feed for 3-4 days and the resulting second and third instar nymphs were used either for seedling screening or for varietal resistance studies. The remaining second and third instar nymphs were used for further multiplication on grown up TN1 plants.

Using this technique, a continuous pure culture of the *N. lugens* was maintained in the glasshouse during the period of study. The temperature and relative humidity in the glasshouse ranged from 29 °C to 38 °C and 42-80 per cent, respectively. The plants were observed periodically and the natural enemies if any were removed regularly along with the dried leaves.

Plant materials

A set of 30 rice accessions including both cultivated varieties and local landraces collected from Paddy Breeding Station, Coimbatore, Tamil Nadu Rice Research Institute, Aduthurai, Agricultural College and Research Institute, Killikulam, Agricultural Research Station, Ramnad and Hybrid Rice Evaluation Centre, Gudalore were used to assess the level of resistance to *N. lugens* at seedling stage

Identification of resistant sources

Standard Seedbox Screening Technique (SSST)

The main objective of mass screening was to rapidly eliminate the bulk of the susceptible lines. Seeds of the test genotypes were soaked in water for 24 h and then the water was drained off and the seeds were allowed to sprout for a day by keeping in darkness. The seeds were sown on the third day of sowing. Pre-germinated seeds of test genotypes were sown 3 cm apart in a plastic seed box filled with 3-5 cm depth of clay soil. Each genotype was sown in a row across the width of the seed box in such a way so as to have at least 20 plants per row. One row of the susceptible check, TN1 and one row of resistant check, PTB 33 were sown at random in each seed box. The rice genotypes were replicated thrice.

The seed box was then transferred to a galvanized iron tray filled with water on seventh day of sowing. The *N. lugens* populations cultured on TN1 plants were used to infest the seedlings. Ten days after sowing, the seedlings were infested with second and third instar nymphs. The plants with nymphs were gently tapped over the seedlings in such a way that approximately 5 to 8 nymphs settle on each seedling. After infestation, each seed box was covered with a fibreglass wire-mesh cage to prevent any escape of nymphs and to prevent entry of natural enemies. The test genotypes were observed daily for the damage by the *N. lugens*. Damage rating of the test genotypes was observed when 90 per cent of the seedlings in the susceptible check, TN1 were killed using the Standard Evaluation System (SES) for rice on 0-9 scale (IRRI, 2002) as given below.

Results and Discussion

30 rice cultures were evaluated for their resistance against BPH by the Standard Seedbox Screening Technique (SSST) including the resistant and susceptible checks, PTB 33 and TN1 respectively.

Table.1 Reaction of rice genotypes to *N. lugens* in SSST

S. No	Genotypes	Rating*	Category
1	IR 72	5.67	MS
2	PTB 41	1.67	R
3	ADT 45	7.67	S
4	CO 43	3.67	MR
5	IR 64	5.67	MS
6	CB 06 535	7.67	S
7	CB O6 651	8.33	S
8	CB 08 504	5.67	MS
9	ADT 36	3.67	MR
10	CO 49	7.67	S
11	ADT 47	5.00	MS
12	COLUMBIA	3.67	MR
13	MANIPUR LOCAL	7.67	S
14	WHITE PONNI	7.67	S
15	TNRH 180	8.33	S
16	TNRH 243	7.67	S
17	SWARNA	3.67	MR
18	GEB 24	5.67	MS
19	IR 36	6.33	MS
20	VEERADANGAN	5.00	MS
21	PURPLE PUTTU	5.67	MS
22	CB 05 219	7.67	S
23	NJAVARA	5.67	MS
24	KARANELLU	7.00	S
25	SR 26B	3.67	MR
26	TNRH 174	5.67	MS
27	CORH 3	7.67	S
28	BPT 5204	8.33	S
29	TN1	9.00	HS
30	PTB 33	1.00	R

Of the genotypes tested, PTB 33, the resistant check recorded the lowest mean damaging rating (1.00), while genotypes, PTB 41 was found to be resistant while CO 43, ADT 36, Columbia, Swarna and SR 26 B were moderately resistant and remaining genotypes were either moderately susceptible or susceptible (Table 1).

Resistance rating was done only in the seedling stage, as varieties resistant at seedling stage are reported to be resistant at later stages of the plant growth. This finding is in accordance with the findings of Velusamy and Ganesh Kumar (1999; 2000), Rath and Marndi. 2010 and Boopathi *et al.*, (2011).

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