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Tolerance Mechanism of Resistance to *Sogatella furcifera* (Horvath) On Selected Rice Genotypes

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ABSTRACT

The tolerance mechanisms of resistance to Sogatella furcifera was studied by the Functional Plant Loss Index (FPLI). The mean Functional Plant Loss Index was the lowest on PTB 41 (25.56 %) followed by CB 05 635 (26.83 %) and IR 64 (28.07 %). The Functional Plant Loss Index was high in Veeradangan (70.99 %) followed by BPT 5204 (70.97 %). The Functional Plant Loss Index of resistant and susceptible checks are PTB 33 (27.21 %) and (71.43 %)

Key words: *Rice, Genotypes, Sogatella furcifera, Tolerance, Functional Plant Loss Index.*

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[8]. Three billion people depend on it as a major source of their subsistence diet[3]. Over 800 species have been identified damaging either standing or stored rice[5]. Pawar[13] 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[2]. Among these rice pests, about 20 of them are of economic importance. Of the insect pests, rice yellow stem borer, rice leaffolder, leafhoppers, planthoppers, gallmidge and earhead bug occur every year in most of the rice growing areas of the world. In the management of *S. furcifera*, no single control component is a panacea. Use of insecticides to control *S. furcifera* was not always rewarding. Continuous and repeated application of certain insecticides has resulted in the development of resistance[10] and they caused resurgence of the insect after repeated application[6]. In the integrated management of *S. furcifera*, use of resistant varieties forms the basis with which other methods of management can be dovetailed.

MATERIALS AND METHODS

Insect culture

S. furcifera was mass cultured in the glass house on the susceptible rice variety Taichung Native 1 (TN1). Initial WBPH population was collected from unsprayed rice fields at Paddy Breeding Station, Tamil Nadu Agricultural University, Coimbatore.

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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 *S. furcifera* was maintained in the glasshouse during the period of study. The temperature and relative humidity in the glasshouse ranged from 29^o to 38^o 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 *S. furcifera* at seedling stage.

Reevaluation of selected genotypes

Rice genotypes selected after mass screening were retested for their resistance. The methodology adopted for retesting was the same as for mass screening. To avoid any grading errors and to prevent the possibility of escaping infestation, each selected genotype was reevaluated by replicating four times.

Tolerance

Functional Plant Loss Index (FPLI)

The tolerance response experiment of the genotypes to *S. furcifera* population levels was determined by using the method, developed by Panda and Heinrichs[12]. At 30 and 45 DAS, the plants in each pot were covered with a polyester film cage and infested with 25 and 50 freshly emerged nymphs. The genotypes were graded, when the susceptible check had a damage rating of 9. Later, the plants were uprooted, roots washed in water, air dried for two hours, dried in an oven at 70 ^{o}C for 72 h and then the dry weight was recorded. The FPLI was worked out using the following formula:

$$\text{FPLI} = 1 - \left(\frac{\text{Dry weight of infested plant}}{\text{Dry weight of uninfested plant}} \right) \text{X } 100$$

if the damage rating is three or lower,

$$\text{FPLI} = 1 - \left(\frac{\text{Dry weight of infested plant}}{\text{Dry weight of uninfested plant}} \right) \left(\frac{\text{1-damage rating on the test accession}}{\text{Damage rate on the susceptible check}} \right) \text{X } 100$$

if the damage rating is more than three

(Panda and Heinrichs)[12]

RESULTS AND DISCUSSION

On 30 day old plants, the FPLI was the lowest of 25.56 per cent in PTB 41 followed by CB 06 535 (26.83 per cent) and the highest of (70.99 per cent) in Veeradangan, whereas TN1 recorded maximum FPLI (71.43 per cent) (Table 1).

The phenomenon of tolerance is generally cumulative and is a result of interaction between insect feeding and plant growth responses. It includes general vigour, inter and intra plant compensatory growth, wound compensation, mechanical strength of tissues and nutrients and growth regulator partitioning.

FPLI was very low in PTB 41, CB 06 535, IR 64, CB 08 504 and CO 43 compared to susceptible check TN1 (Figure 14). It might be concluded that since the resistant genotypes are less preferred, the insects would have fed less on them which in turn resulted in lesser plant damage than in susceptible TN1. These findings are in accordance with the earlier reports made by Panda and Heinrichs[12], Jiang[7] and Emmanuel *et al*[4]. Samal and Misra[15] and Alagar[1] also observed minimum tolerance in resistant varieties compared to susceptible check, TN1 for *N. lugens*.

Rubia *et al*[14]., reported that *S. furcifera* showed a stronger effect on plant height of most cultivars. Reduction in plant height of vegetative field plants, caused by *S. furcifera*, was reported by Kiyota and Okuhara[9] and Naba[11]. This study showed that plant height decreased with increasing *S. furcifera* density per hill. Rubia *et al*[14]., reported that *N. lugens* also reduced plant height of some cultivars but the decrease was less than that caused by *S. furcifera*. WBPH interfered with the growth and elongation of the leaves and the stems and also reduce root dry weight of cultivars but did not affect root nitrogen content (Fig 1).

Rubia *et al*[14]., reported that *S. furcifera* significantly reduced the number of tillers of leaf area, leaf photosynthetic rates and plant dry weights. Hopper density was low in resistant varieties compared to susceptible variety TN1. These results showed the importance of population increase in reducing plant growth at vegetative stage.

Table1: Functional Plant Loss Index (FPLI) of rice genotypes against *S. furcifera*

Genotypes	FPLI (%)*
CB 06 535	26.83 (31.2)[a]
BPT 5204	70.97 (57.4)[f]
CB 08 504	29.92 (33.2)[bc]
CO 43	31.38 (34.1)[c]
ADT 47	66.02 (54.3)[e]
VEERADANGAN	70.99 (57.4)[f]
PTB 41	25.56 (30.4)[a]
IR 72	35.35 (36.5)[d]
IR 64	28.07 (32.0)[ab]
PTB 33	27.21 (31.4)[ab]
TN1	71.43 (57.7)[f]

*Mean of three replications

Figures in parentheses are arcsine transformed values; In a column, mean followed by a common letter are not significantly different by DMRT at 5 per cent level

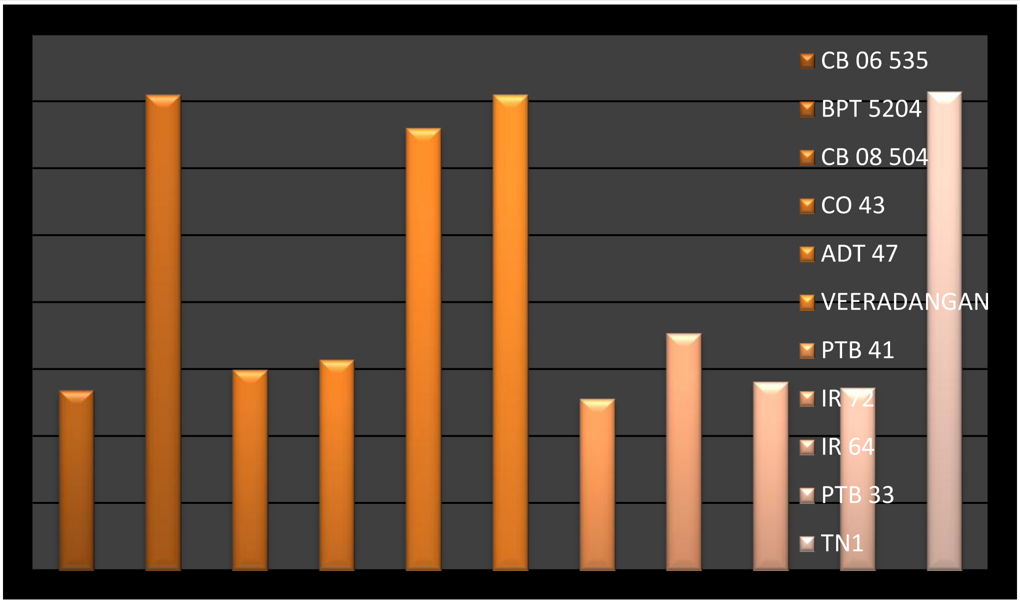

Fig. 1: Functional Plant Loss Index (FPLI) of rice genotypes exposed to *S. furcifera* nymphs

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