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**RESEARCH ARTICLE**

# SCREENING FOR SHEATH BLIGHT (*RHIZOCTONIA SOLANI* KÜHN) RESISTANCE IN RICE (*ORYZA SATIVA* L.)

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**ABSTRACT**

Rice is one of the most important and widely cultivated food crops of the world and the majority of rice (90 per cent) is being produced in Asian countries with China and India being the major producers (IRRI, 2013). Rice varieties, parental lines of the hybrids and the hybrid in general are susceptible to several biotic stresses such as bacterial blight (BB), blast, brown plant hoppers (BPH) and Sheath blight (ShB), resulting into dramatic reduction in the yield as well as the quality of rice (Singh *et al*., 2011). ShB is the soil-borne fungal disease caused by Rhizoctonia solani Kuhn, which alone accounts to 25 per cent of yield losses (Kumar *et al*., 2009). Wide host range of the ShB pathogen makes the management of the disease a difficult task. Till date, no rice germplasm in the world has been found to be completely resistant to this fungus as the resistance is typically governed by polygenes (Sha and Zhu, 1989). Six parents viz., FL 478, IW Ponni, BPT 5204, IR 64, RNR 57979 and TETEP utilized in the present study were subjected to screening for Sheath Blight resistance along with susceptible check, T (N) 1. Screening was done both under field as well as in screen house with artificially inoculated condition. The screen house facility that was available at Department of Plant Breeding and Genetics, ADAC and RI, Trichy was utilized for artificial screening of diseases and the entries in the present study were evaluated for sheath blight disease.



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## INTRODUCTION

Rice is one of the most important and widely cultivated food crops of the world and the majority of rice (90 per cent) is being produced in Asian countries with China and India being the major producers (IRRI,2013).Rice varieties, parental lines of the hybrids and the hybrid in general are susceptible to several biotic stresses such as Bacterial blight(BB), blast, brown plant hoppers (BPH) and Sheath blight (ShB), resulting into dramatic reduction in the yield as well as the quality of rice (Singh *et al.,*2011). ShB is the soil-borne fungal disease caused by *Rhizoctonia solani* Kuhn, which alone accounts to 25 per cent of yield losses (Kumar *et. al.,* 2009). Wide host range of the ShB pathogen makes the management of the disease a difficult task.

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Till date, no rice germplasm in the world has been found to be completely resistant to this fungus as the resistance is typically governed by polygenes (Sha and Zhu, 1989).

## MATERIALS AND METHODS

### Mass multiplication of Sheath Blight (ShB) isolate

The Sheath Blight pathogen, *Rhizoctonia solani* Kühn was obtained from Tamil Nadu Rice Research Institute, Aduthurai and used for the present study. The fungal isolate was multiplied in rice straw bits for inoculation purpose. The rice straw was cut into small bits of 4-5 cm long, each with a node, washed thoroughly and soaked in water for 5 min. The pieces were drained for excess water and later these were filled loosely to one third volume of 250 ml conical flask and sterilized in autoclave at 1.1 kg/cm$^2$ for 30 min. for two consecutive days. The flask containing the sterilized bits of paddy straw was inoculated with 8 mm disc of actively

growing mycelium of *R. solani* and incubated at room temperature (28 ± 2°C) for 15 days.

## RESULTS AND DISCUSSION

### Screening of parental lines under field condition

The screening of parental lines under field conditions was done at the experimental farm of ADAC & RI., Trichy during *thaladi* season, 2012–13. Six parental lines *viz.,* FL 478, IW Ponni, BPT 5204, IR 64, RNR 57979 and TETEP were planted along with the susceptible check, T (N) 1 by adopting a recommended spacing of 20 x 15 cm. For each entry, single seedling was planted in five rows of 3m length and it was replicated thrice. The rice plants were inoculated at maximum tillering stage (45 DAT) with ShB isolate by placing the paddy straw pieces with the fungal mycelia in between tillers of each rice hill, just above the water level and tied for better contact with the sheath region (Bhaktavatchalam *et al*., 1978). The water level (5-10 cm) was maintained constantly for ensuring enough humidity (90-95%) to promote disease development. Standard agronomic practices were followed for upkeep of crop growth. When typical lesions appeared after 3 days from inoculation, the tied tillers were loosened. It was observed that greyish-green lesions enlarged and coalesced on lower leaf sheaths and on leaves.

The lesion length and plant height after 10 and 25 Days After Inoculation (DAI) were recorded. The Relative Lesion Height (RLH) was calculated by adopting the formula provided by Sharma *et al*. (1990).

$$\text{Relative Lesion Height (RLH) (\%)} = \frac{\text{Lesion length (cm)}}{\text{Plant height (cm)}} \times 100$$

The degree of vertical spread in terms of Relative Lesion Height (RLH) was used for evaluation of rice genotypes against Sheath Blight disease.

### Screening of parental lines against Sheath Blight disease under screen house condition

The screening of parental lines of rice accessions used for the study was carried out in screen house facility available at ADAC and RI, Trichy. The same set of parental lines along with susceptible check was evaluated for confirmation of results obtained from field condition. Each accession was raised in five pots and was replicated thrice. The plants from each replication were chosen for the artificial inoculation of Sheath Blight pathogen. The methodology followed in field screening was repeated under screen house condition to confirm the disease resistance. The spread of lesion height in the inoculated plants were measured on 10 and 25 DAI.

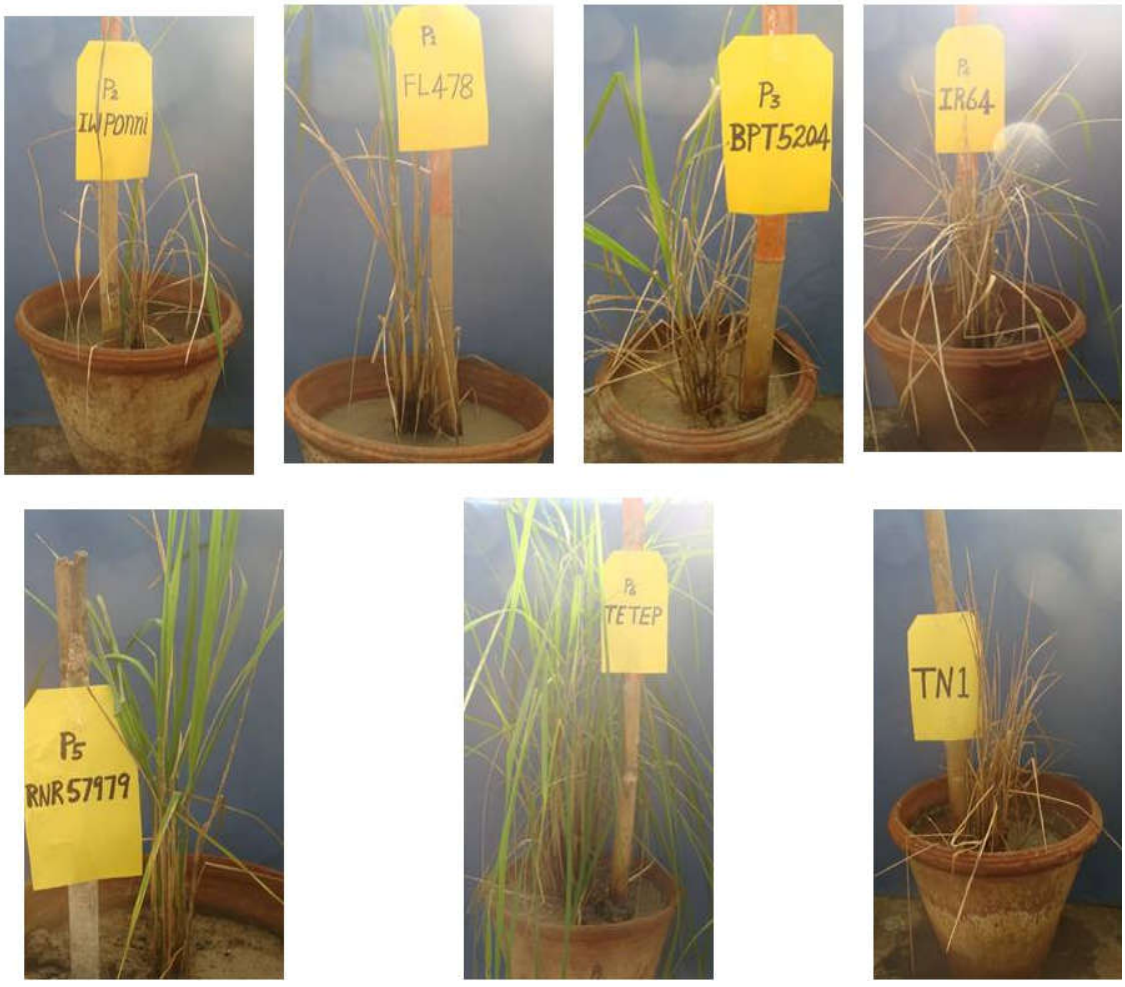


**Fig. 1. Sheath blight symptoms at 25 days after inoculation in the parental lines and Check T (N) 1**

**Field screening for ShB resistance**

Six parental genotypes of rice *viz.*, FL 478, IW Ponni, BPT 5204, IR 64, RNR 57979 and TETEP taken in the present study along with the susceptible check, T(N) 1 were screened against sheath blight resistance / tolerance under field condition at research farm of Anbil Dharmalingam Agricultural College and Research Institute, Trichy, Tamilnadu. Field screening was done after inoculation with *Rhizoctonia solani* at maximum tillering stage. The symptoms were observed among parents seven days after inoculation. Relative Lesion Height (RLH) was recorded at 10 and 25 days after inoculation (DAI). The data recorded on 25 DAI was used to classify the test entries. Among parental lines, TETEP exhibited resistant reaction to sheath blight with 5.75% mean RLH as against the highest mean RLH of 66.70% in T (N) 1 (susceptible check). The parental lines RNR 57979 and IR 64 exhibited moderately resistant and moderately susceptible reaction with a mean RLH of 21.35% and 31.80% respectively. The other parental lines *viz*., FL 478, IW Ponni and BPT 5204 showed susceptible reaction recording 47.60%, 49.55% and 46.70% mean RLH respectively (Table 1).

**Table 1. Reaction of parent lines to sheath blight resistance under field condition**

| Parent | Mean RLH (%) | | Disease reaction* |
|---|---|---|---|
| | 10 DAI | 25 DAI | |
| FL 478 | 6.20 | 47.60 | S |
| IW Ponni | 8.75 | 49.55 | S |
| BPT 5204 | 10.76 | 46.70 | S |
| IR 64 | 7.45 | 31.80 | MS |
| RNR 57979 | 4.32 | 21.35 | MR |
| TETEP | 1.80 | 5.75 | R |
| T(N) 1 (check) | 20.85 | 66.70 | HS |

**Table 2. Reaction of parent lines to sheath blight resistance under screen house condition**

| Parent | Mean RLH (%) | | Disease reaction* |
|---|---|---|---|
| | 10 DAI | 25 DAI | |
| FL 478 | 9.30 | 56.80 | S |
| IW Ponni | 12.85 | 54.55 | S |
| BPT 5204 | 16.88 | 49.65 | S |
| IR 64 | 13.52 | 36.35 | MS |
| RNR 57979 | 8.29 | 27.40 | MR |
| TETEP | 4.70 | 9.50 | R |
| T (N) 1 (check) | 33.96 | 72.40 | HS |

**Screening for ShB resistance under screen house condition**

Artificial inoculation was done with *Rhizoctonia solani* at maximum tillering stage under screen house condition. Relative Lesion Height (RLH) percentage was recorded at 10 and 25 days after inoculation (DAI).

The data recorded on 25 DAI revealed that among the parental lines, TETEP exhibited resistant reaction against Sheath Blight with 9.50% mean RLH as against the highest mean RLH of 72.40% in T(N) 1 (susceptible check). The parental lines RNR 57979 (27.40%) and IR 64 (36.35%) exhibited moderately resistant and moderately susceptible reaction respectively as in field screening. The genotypes *viz.,* FL 478, IW Ponni and BPT 5204 showed susceptible reaction with 56.80%, 54.55% and 49.65% of mean RLH respectively (Table 2). The symptoms of sheath blight (Parental lines and check) recorded on 25 DAI was depicted in Fig. 1.

**DAI: Days After Inoculation**

*Disease reaction based on the Mean Relative Lesion Height (RLH) at 25 DAI, where, RLH was the mean value over three replications, HR: Highly Resistant (0%); R: Resistant (1-20%); MR: Moderately Resistant (21-30%); MS: Moderately Susceptible (31-45%); S: Susceptible (46-65%); HS: Highly susceptible (> 65%).

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