FIELD EVALUATION FOR IDENTIFICATION YELLOW STEM BORER (*SCIRPOPHAGA INCERTULAS* WLK) RESISTANCE IN THIRTY LANDRACES OF RICE (*ORYZA SATIVA* L.)

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ABSTRACT

Rice (*Oryza sativa* L.) belongs to family Poaceae and Chromosome number $2n = 2x = 24$. Rice is a major staple food crop in the world and 90% of the rice is grown and consumed in south and southeast Asia. The thirty landraces which are subjected to study host plant resistance which were conserved at Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University. In the present study, the selected 30 landraces of rice were evaluated for identification of yellow stem borer (*Scripophaga incertulas*) resistance. Yellow Stem borers in the order Lepidoptera are widely prevalent and serious insect pests of rice. Host plant resistance is identified as the most effective way of stem borer management in various regions. 30 landraces of rice were screened for their reaction to stem borer. They are common and serious pests in Asian countries responsible for annual damages of 5-10 per cent of rice crops. Heavy infestation may cause yield loss up to 80 per cent. The symptoms of this pest is characterized by drying of central shoot known as 'dead heart' at vegetative stage. and 'white ear' at reproductive stage. Based on symptoms pest incidence and damage can be assessed. The study of host plant resistance resulted in identification resistant landraces that can be directly utilized for cultivation in stem borer prone areas or as a source of resistant parent in breeding programs or to identify the resistance genes in chromosomes of Landraces of rice for introgression into cultivated varieties.

Key words : Rice, yellow stem borer, resistance.

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important cereal crop cultivated widely in many parts of the world. Rice crop plays a vital role in our national food security and is a means of livelihood for millions of rural households. It is mainly grown in large areas of Asia, Latin America and Africa that are characterized by a

semitropical climate with alternating rainy and dry seasons (Rao *et al*. 2016). The chromosome number of rice is 2n = 24 which has a 12 pair of chromosomes and comes under the grass family Poaceae or Graminae. It is generally considered a semi-aquatic annual grass plant. In India rice is cultivated in a area of about 431.94 lakh hectares with with a production of about 110.15 million tonnes and productivity of 2550 kg per ha as of 2016-2017. Rice accessions are a rich reservoir of useful genes that rice breeder can harness for rice improvement programme (Rasmi *et al*. 2017). Since the previous few centuries, rice has experienced a loss in diversity as native types (landraces) have been replaced with high-yielding variants. Landraces are genetically heterogeneous varieties that has evolved in a certain ecogeographical area and is therefore adapted to the edaphic and climatic conditions and to its traditional management of rice and landraces are usually act resistant source for abiotic and biotic stresses. More than 100 species of insects attack and damage rice crop (Pathak, 1968, Pathak, 1977; Grist and Lever, 1969). Yellow Stem borers in the order Lepidoptera are widely prevalent and serious insect pests of rice. They are common and serious pests in Asian countries responsible for annual damages of 5-10 per cent of rice crops (Pathak and Khan, 1994). Heavy infestation may cause yield loss up to 80 per cent (Rubia-Sanchez *et al*.,1997). In India, 18 stem borer species in the family Pyralidae and three species in the family Noctuidae have been recorded (Banerjee, 1964; Kapur, 1967). The larvae of these borers cause dead hearts during vegetative stage resulting in loss of productive tillers and also results in white ear damage at crop reproductive stage resulting chaffy grain that reflects heavy economic loss in rice. Stem borer adults are moths and three or more generations occur in a season. Land races of rice such as TKM 6, CB1 and CB2 have been used as resistant donors since 1964 in India (Roy *et al*., 1971). The extent of damage caused by the yellow stem borer in rice ranged from 3 to 95 per cent (Ghose *et al*., 1960). So that it is important to identify the source for stemborer resistance from landraces, wild species of rice.

MATERIALS AND METHODS

The thirty Rice landraces are used as experimental material for host plant resistance analysis, which is shown in Table 1. An experiment was carried out during kharif season of 2017 at the Genetics and Plant Breeding Farm, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University. On end of april, the raised bed nursery is prepared for sowing of landraces and transplanted during may 25th using randomized block design with three replications was used to transplant 30-day-old seedlings onto the field. Each landrace was raised with a 25 X 25 cm gap between rows and plants for easy movement to take observations are made respectively. Standard agronomic procedures such as irrigation and weeding at proper intervals, application of recommended fertilizer doses at particular crop growth stages and planned plant protection measures were practiced.

Table 1- List of land races of rice used for screening of yellow stem borer resistance

Accession No.	Landraces	Accession No.	Landraces
G1	Aathur kitchali samba	G16	Sigapu kar
G2	Arupatham kuruvai	G17	Kulla kar
G3	Garuda samba	G18	Kandha sala
G4	Gomathi	G19	Thooya malli
G5	Sooran kuruvai	G20	Kattu yanam
G6	Kuzhali adichan	G21	Jeeraga samba
G7	Salem sannam	G22	Sivapu kavuni
G8	Sivan samba	G23	Madu muzhangi
G9	Illupam poo samba	G24	Kuruvai kar
G10	Mappilai samba	G25	Karupu kavuni
G11	Ottu kichali	G26	Kallurndi
G12	Chinnar	G27	Singini kar
G13	Kothamalli samba	G28	Kalli madiyan
G14	Rathasali	G29	Molam samba
G15	Poongar	G30	Manjal ponni

For screening the rice germplasms designed by IRRI (1980) for the yellow stem borer, *Scirpophaga incertulas*, a standard evaluation system was used. Based on damage symptoms for stem borer at two stages, such as the vegetative stage (30 - 35 DAT) and reproductive stage (70 - 75 DAT). an assessment has been made at 10 hills were chosen at random for each entry in each replication. The damage symptom such as "dead heart" is observed at 30 -35 DAT and "white ear" symptoms are observed at 70 - 75 DAT. The total number of tillers and injured tillers were counted in order to assess the percentage of stem borer damage (Heinrichs et al., 1985). The susceptible check used here for evaluation of stem borer resistance are TN1 and IR 29. The mean of the two susceptible checks are used for the dead heart index calculation.

$$\% \text{ dead hearts/ white ears} = \frac{\text{No. of damaged tillers (Dead hearts / White ears) X 100}}{\text{Total No. of tillers}}$$

Percentage of dead heart/white ears was converted to Dead heart Index (D),

$$\text{Dead heart Index (D)} = \frac{\% \text{ dead hearts / white ears in test entry X 100}}{\% \text{ dead hearts / white ears in the susceptible check}}$$

**Standard Evaluation system for scoring stem borer resistance in rice (IRRI, 1980)**

SCALE	D VALUE (DEAD HEART %)	D VALUE (WHITE EAR %)	STATUS
0	No Damage	No Damage	Highly Resistant (HR)
1	1-20%	1-10%	Resistant (R)
3	21-40%	11-25%	Moderately Resistant (MR)
5	41-60%	26-40%	Moderately Susceptible (MS)
7	61-80%	41-60%	Susceptible (S)
9	81-100%	61-100%	Highly Susceptible (HS)

RESULT AND DISCUSSION

The evaluation is done at both vegetative and reproductive stages of rice. The seedlings were evaluated during vegetative stage at 30 -35 DAT in Kharif 2017. As a result of screening for yellow stem borer *Scirpophaga incertulas* resistance and scoring in thirty land races of rice along with two susceptible checks (TN 1 & IR 29) at vegetative stage reveals that, Out of the 32 (30 + 2) landraces screened, no entry was found Highly resistant, 3 landraces were graded as resistant, 6 landraces were found moderately resistant, 8 landraces were rated as moderately susceptible, 7 landraces as susceptible and landraces were identified as 6 highly susceptible (Fig 1).

Landraces were also evaluated during reproductive stage (70-75 DAT), no entry was found to be highly resistance, 1 found to be resistant, 5 landraces were moderately resistant, 9 were found moderately susceptible, 7 were rated as susceptible and 8 landraces found as highly susceptible (Fig 1).

Fig 1. Incidence of Stem borer at Vegetative and Reproductive stages.
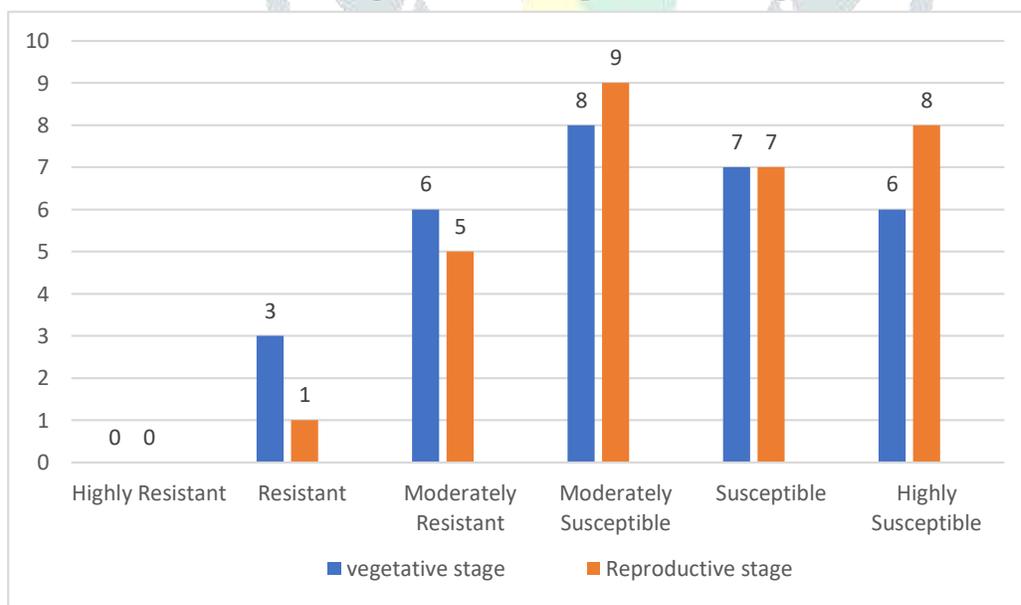
During Kharif 2017, dead heart by stem borers ranged from 12.3 – 89.4 per cent. Susceptible check IR 29 and TN 1 had 52.6 per cent and 45.9 per cent dead hearts respectively during vegetative stage, while the per cent white ears were 38.4 per cent and 29.3 per cent. The per cent white ears recorded from 30 Landraces ranged from 6.2 per cent to 78.5 per cent. The least incidence was observed in Kaatu Yaanam landrace with 12.3

per cent dead heart which also simultaneously shown low damage of 6.2 per cent white ears. The results obtained during the investigation showed that some of the entries exhibited low incidence with dead hearts did not prove themselves resistance with low infestation exhibiting minimum white ears.

Earlier research studies by different researchers claimed that the damage scale used to categorize the resistance of rice lines to stem borer damage was based on following categories: highly resistant, resistant, moderately resistant,moderately susceptible, susceptible, and highly susceptible (Gubbaiah and Revanna, 1993; Balasubramanian *et al*.,2000; Sarao *et al*.,2009; Padhi, 2009 and Rath *et al*.,2010).

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