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Varietal Screening of Rice against Pink Stem Borer, *Sesamia inferens* (Walker)

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Abstract: The pink stem borer (PSB), *Sesamia inferens* (Walker) (Lepidoptera: Noctuidae) is a serious pest of rice in Andhra Pradesh causing substantial yield loss. This study evaluated the tolerance of eight rice varieties to PSB under greenhouse conditions at ICAR-IIRR, Hyderabad. Test entries were infested with third instar larvae @ 15 larvae/m^2 and damage was recorded as dead hearts (%) and white ears (%). All the test entries exhibited varying levels of susceptibility (22.53-39.56%) at 35DAR in vegetative phase. Among tested varieties, PB1 recorded highest overall incidence of mean dead hearts (25.55 %) and white ears (26.05 %) indicating greater susceptibility to *S. inferens.* In contrast, MTU 1061 (14.73 &10.75%) and TKM 6 (16.44 & 10.41%) exhibited comparatively lower levels of damage. Significantly lower white ear damage due to continuous feeding by PSB larvae in BPT5204, MTU1121 and W1263 with high tillering ability reflects their tolerance. The study highlights the importance of reaction of entries to PSB damage and underscores the importance of detailed studies on identifying tolerant mechanisms which serve as a key component of sustainable pest management.

Keywords: Screening, Pink stem borer, *Sesamia inferens, Oryza sativa,* PB1

Rice (*Oryza sativa* L.) is a staple food for millions of people across South and Southeast Asia. India occupies the leading position worldwide in terms of rice cultivation area, spanning approximately 51.42 million hectares, and ranks second in global production, contributing around 149.07 million tonnes, which represents 27.82% of the world's total output, with an average productivity of 2899 kg/ha (Department of Agriculture and Farmers Welfare 2024). Among the numerous insect pests infesting rice, stem borers are recognized as the most destructive group, responsible for substantial yield reductions. Field surveys conducted across major rice-growing regions of India have revealed a diverse assemblage of insect fauna associated with the rice ecosystem, however, lepidopteran stem borers consistently dominate at various crop growth stages (Giri and Mohapatra 2024). In fact, more than six species of rice stem borers have been reported to infest rice, with their prevalence and intensity varying across ecological zones. Among these, in India the pink stem borer, *S. inferens* stands out as one of the most damaging species after the yellow stem borer (Katti et al., 2011).

In recent years, the incidence and severity of *S. inferens* have increased remarkably, particularly in coastal areas (Jena et al., 2018), where it has attained the status of a major pest. The prevalence of pink stem borer has increased significantly under rice-based cropping systems in coastal districts of Andhra Pradesh notably in West Godavari during the past two to three years, with damage levels often exceeding the economic threshold level (ETL5-10% DH PSB) (Dutta and Roy 2022, Swarupa et al., 2025). The PSB damage is often hidden and goes unnoticed in the field as the larvae engage in extensive tunnelling within the tillers and filling the bored holes with excreta, which makes early detection of this pest difficult (Swarupa et al., 2024). It has been conclusively demonstrated that the pest can successfully survive and complete its entire life cycle on rice, typically ranging from 41 to 73 days, thereby resulting in serious yield losses (Swarupa et al., 2025). Alarmingly, the most popular and widely cultivated rice varieties, which have dominated Andhra Pradesh for decades, have exhibited high levels of damage.

Host plant resistance (HPR) is a desirable approach for managing *S. inferens* as it is sustainable and environment friendly. Although chemical control using diamide insecticides such as chlorantraniliprole has been widely practiced by rice farmers of Andhra Pradesh, increasing dependence on these insecticides has raised concerns about susceptibility variation and the potential development of resistance in PSB populations. Research efforts focused on identifying resistant varieties against PSB in rice are still in the preliminary stage, highlighting the need for systematic screening of rice accessions to identify resistant sources against *S. inferens*. Understanding the nature and extent of pest damage across selected rice varieties provides valuable insights into varietal preference, crop loss patterns, and vulnerable stages of infestation, thereby contributing to the development of more effective pest management strategies. Hence, the present investigation was undertaken to screen rice varieties for their relative resistance or susceptibility to *S. inferens* and to examine preference mechanisms influencing pest incidence.

MATERIAL AND METHODS

The experiment was conducted under greenhouse conditions at ICAR-IIRR, Hyderabad (17.320921°N, 79.396614°E) at amean temperature of 28 ± 2 °C and relative humidity 60-80%. Eight rice varieties *viz*., BPT 5204, MTU 1121, MTU 1061 (mega varieties), Sasyasree, W1263, TKM 6, Pusa basmati 1 and TN1 were evaluated to assess the damage potential of *S. inferens*. Rice plants were raised in cement pots of 1m diameter with nine plants per pot. The rice plants were maintained in the greenhouse under natural light conditions up to 40 days and were used for artificial screening studies. The experiment was conducted in randomised block design with three replications. The larvae of *S. inferens* were collected from infested rice fields in the West Godavari district and reared on artificial diet under controlled laboratory conditions for one generation and the F_1 insects conditioned on rice plants were used in the present study. The 3rd instar PSB larvae were released once on to the rice plants at vegetative phase. A total of 15 larvae per meter (three larvae/hill) were released onto rice plants with the help of camel hair brush and infested plants were covered with mylar sheet to avoid the movement of larvae (Fig. 1).

Observations on dead hearts during the vegetative phase and white ears during the reproductive phase were recorded at ten-day intervals following the release, i.e., at 5, 15, 25, 35 days after release (DAR) in the vegetative stage and at 55, 65, 75 days after release during the reproductive stage. The per cent damage of dead hearts/ white ears was calculated (Heinrichs et al., 1985) to estimate the PSB damage. Data was subjected to angular transformation using OPSTAT (One factor analysis), version:14.139.232 and observations were subjected to analysis of variance (ANOVA) and Duncan's Multiple Range Test (DMRT) ($P \leq 0.05$) by using SPSS (Statistical Package for Social Sciences) statistics version 20.

RESULTS AND DISCUSSION

The results showed significant variation in PSB damage among the tested rice varieties Among the different rice varieties tested, PB1 recorded maximum infestation of PSB in terms of both percent DH and WE damage indicating high susceptibility to *S. inferens* (Table 1). The mean percentage of dead heart damage ranged from 14.73 (MTU 1061) to 25.55 (PB1) and the WE damage from 10.41 (TKM 6) to 26.05 (PB 1) per cent. The highest per cent of dead hearts were with PB1 (39.60) followed by Sasyasree< TN1< BPT 5204 respectively at 35 days after release where MTU 1061 and TKM6 exhibited relatively lower damage.

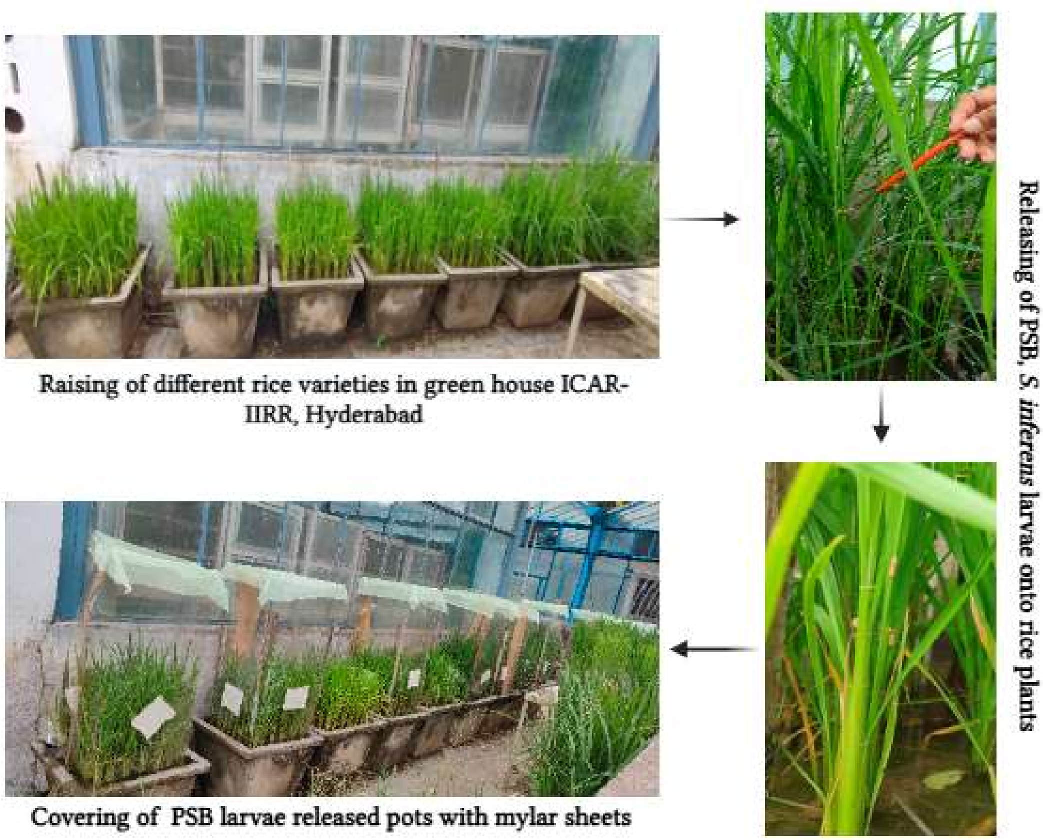

Fig. 1. Screening of rice varieties against pink stem borer, *S. inferens* under greenhouse conditions

The overall mean damage of dead hearts in MTU 1061 was statistically on par with BPT 5204, MTU 1121 and TKM 6 followed by W 1263, Sasyasree and TN 1 which showed intermediate susceptibility and were on par with each other while, PB1 recorded the highest incidence (25.55 %). Duringre productive phase, the overall mean white ear damage was highest in PB1 (26.05 %) followed by Sasyasree > TN1 > BPT 5204 > W1263 > MTU 1121 > MTU 1061 > TKM 6 , respectively. The maximum damage was from PB 1 variety whereas TKM 6 exhibited significantly lowest white ear damage where all the varieties were on par with each other (Fig. 2).

The infestation of rice varieties by PSB larvae continued from vegetative phase to booting stage which showed that insect was able to survive in all the test rice varieties and continue to damage in reproductive phase and resulted in white ear formation. It was also observed that the larvae were able to complete its life cycle and there was no negative effect on the life cycle of the PSB in tested rice varieties. All the varieties tested were susceptible to PSB infestation under artificial screening method in greenhouse but a variation in the level of infestation was observed. Apart from the dead hearts and white ears, the other symptoms of damage by pink stem borer were observed as bored holes and extensive tunnelling of rice stems filled with excreta inside the tunnels. Earlier workers reported that the dead heart damage can be compensated by producing new tillers or overcompensate by redirecting resources to produce larger and more rice grain (Horgan et al., 2016). In the current study, all tested varieties, despite exhibiting low white ear damage, produced panicles with poorly filled grains. Additionally, delay in the maturity of infested rice plants was observed. This study provides one of the first detailed accounts quantifying PSB damage at the critical stages of rice crop under artificial infested conditions demonstrating that none of the tested varieties escaped infestation entirely.

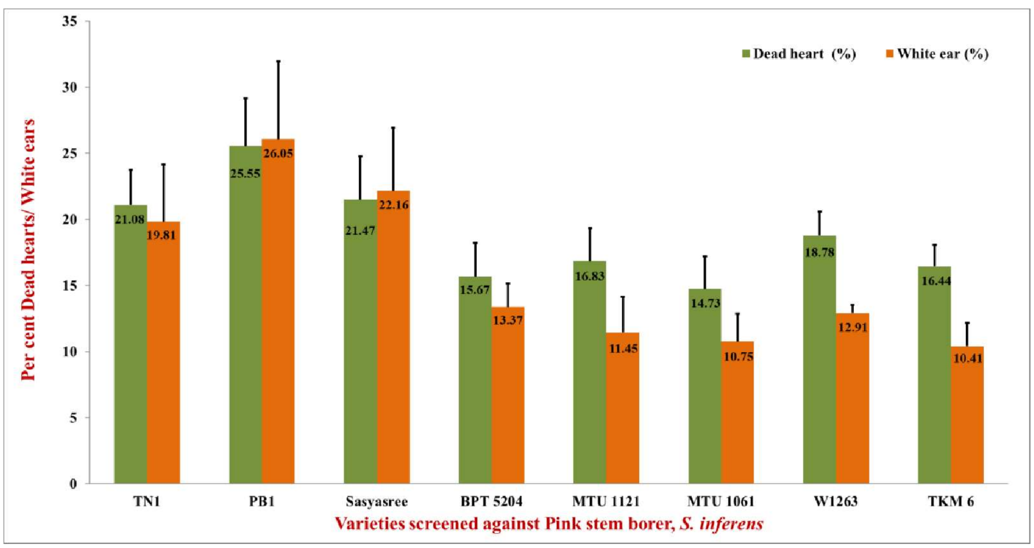

Fig. 2. Overall mean damage caused by *S. inferens* in different rice varieties under artificial infestation

Table 1. Damage by Pink stem borer, *S. inferens*, in selected rice varieties under artificial infestation in greenhouse conditions

Rice varieties	*Per cent dead hearts				*Per cent white ears		
	5 DAR**	15 DAR	25 DAR	35 DAR	55 DAR	65 DAR	75 DAR
Taichung Native 1	10.85[abc]	17.57[ab]	25.32[ab]	29.82[bc]	11.36[ab]	22.22[ab]	25.84[b]
Pusa Basmati1	13.19[a]	21.62[a]	30.08[a]	39.60[a]	15.63[a]	26.53[a]	36.00[a]
Sasyasree	9.09[abc]	18.63[ab]	24.58[b]	34.06[b]	14.71[a]	20.69[b]	31.08[a]
BPT 5204	7.00[c]	11.36[c]	17.20[c]	26.59[cd]	10.53[ab]	12.90[c]	16.67[c]
MTU 1121	7.21[bc]	14.18[bc]	19.87[bc]	25.54[cd]	7.32[b]	10.53[c]	16.49[c]
MTU 1061	5.71[c]	10.95[c]	18.34[c]	22.63[d]	8.00[b]	9.41[c]	14.85[c]
W1263	12.90[ab]	16.04[abc]	20.59[bc]	25.97[cd]	12.50[ab]	12.12[c]	14.10[c]
TKM 6	10.43[abc]	14.93[bc]	18.30[c]	22.53[d]	7.14[b]	10.96[c]	13.13[c]

*Mean of damaged tillers from nine hills; **DAR-Days after release; Means followed by same letters are not significantly different by DMRT

Geerthana et al. (2022) also reported TKM 6 as aresistant variety and TN1 as susceptible variety against PSB. Dutta and Roy (2022) reported TKM 6 asa resistant rice cultivar for PSB. Aggarwal and Singh (2003) tested 11 rice varieties against multiple stem borers *viz*., YSB, WSB and PSB damage and observed PR 114 and PB1 as highly susceptible to all stem borers.They further noted that 35.71(PR 114) and 80 (PB1) per cent of white ears in these varieties were caused by PSB alone and concluded that PSB prefers heading to dough stage than the tillering stage of rice which is in confirmation with present studies.

Singh and Tiwari (2019) assessed eight varieties under field conditions in Uttar Pradesh where they stated that YSB, PSB, DHSB, SSB and WB were causing dead hearts with YSB being dominant one. The extent of damage caused by YSB and PSB during the vegetative, reproductive and maturity stages in MTU 7029 (Swarna) was 5.14, 25.76, 15.18 and 3.39, 14.7, 15.81 per cent, respectively (Rahman et al., 2004). The susceptibility was attributed to the loosely wrapped leaf sheaths, which only partially covered the internodes. Variation in resistance was attributed to the accessibility of migrating larvae to the inner part of the leaf sheath before burrowing into the stem. The study observed that 95% of the larvae migrated between the sheath and the stem within 48 hours after hatching finding it easier to establish on varieties with loose leaf sheaths.

Ntanos and Koutroubas (2000) further emphasized that late maturing rice varieties with high tillering capacity and wider stems tend to support greater borer survival. Pusa basmati 1 has been consistently reported as highly susceptible to the yellow stem borer both under field conditions (Padmakumari and Pasalu 2003) and infested conditions (Athulya et al., 2022) which aligns with the present finding of high PSB damage in this variety. Devasena et al. (2018) evaluated 44 varieties in Tamil Nadu against YSB, of which TN 1 and PB 1 were highly susceptible whereas TKM 6 and W 1263 were found to be resistant cultivars to YSB, reflecting parallel trends in PSB infestation patterns. Although Several researchers screened the rice varieties for resistance against the rice yellow stem borer (Mohankumar et al., 2003, Khan et al., 2010, Elanchezhyan and Arumugachamy, 2015), research on the pink stem borer remains limited. The present findings contribute valuable insights into varietal response under standardized artificial infestation, forming a useful basis for future breeding programs aimed at developing PSB-resistant rice varieties.

CONCLUSION

There is a significant varietal differences in susceptibility to the pink stem borer in rice under artificial infestation. Among the tested rice varieties, PB1 exhibited the highest levels of dead heart and white ear damage, indicating high susceptibility, whereas TKM 6 has been found to portray low dead heart and white ear damage under infested conditions. W1263 and the test entries *viz*., BPT5204, MTU1121, MTU1061 which are long duration and high yielding could tolerate the damage throughout the crop growth phase because of high tillering capacity exhibiting notable tolerance to pink stem borer. Further research is needed to understand the mechanism of resistance and develop suitable pest management strategies.

AUTHOR'S CONTRIBUTION

Authors declare that this research is an original piece of work and has not been published or submitted elsewhere. Proper citations and acknowledgements have been provided for all referenced materials. No part of the work has been copied or reproduced without permission.

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