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RICE RESILIENCE: FIELD SCREENING OF LOCAL LANDRACES FOR YELLOW STEM BORER, *Scirpophaga incertulas* (WALKER) RESISTANCE

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ABSTRACT

Field evaluations of 50 local landraces against the paddy yellow stem borer (YSB), *Scirpophaga incertulas* **(Walker), were conducted at the College of Agriculture, Vishweshwaraiah Canal Farm, Mandya, during the** *kharif* **season of 2022 and the summer season of 2023. The extent of damage caused by YSB across different genotypes was assessed at 30, 60, and 90 days post-transplanting in both seasons. Using the Standard Evaluation System for Rice (SES) developed by the International Rice Research Institute (IRRI), genotypes were classified into various resistance categories based on their mean percentage of incidence. In both** *kharif* **2022 and summer 2023 evaluations, nine genotypes displayed a resistant reaction (score 1), while 27 genotypes were classified as moderately resistant (score 3). Additionally, ten genotypes were categorized as moderately susceptible (score 5), and four genotypes were deemed susceptible (score 7). Importantly, no genotypes was classified as either highly resistant or highly susceptible in either season. The identification of these resistant and moderately resistant genotypes offers significant potential for incorporation into future breeding programs aimed at enhancing resistance to yellow stem borer..**

Keywords: Host plant resistance, Screening, resistance breeding, local landraces

Rice (*Oryza sativa* Linn.) serves as the staple food for over half of the world population (Kulagod *et al.*, 2011). Remarkably, more than 92% of rice production and consumption occurs in Asia. In India, rice occupies approximately one-fourth of the total cropped area and sustains over half of the population. India ranks as the second-largest producer and consumer of rice worldwide, following China, with a cultivation area of 463.79 lakh hectares, an annual production of 130.29 million tonnes, and an average productivity of 2809 kg per hectare (Anonymous, 2023). Paddy cultivation is a crucial element of global food production; however, it faces significant challenges from various pests that threaten crop yield and quality. In contemporary agricultural practices, high-yielding rice varieties are widely cultivated, often alongside the application of fertilizers and organic manures. This cultivation strategy can inadvertently lead to infestations by numerous insect pests, resulting in substantial crop yield losses (Neeta *et al.*, 2013). Among these pests, the yellow stem borer (*Scirpophaga incertulas*) poses a particularly severe threat to paddy fields, leading to considerable economic losses and undermining food security.

The rice yellow stem borer (YSB), *Scirpophaga incertulas* (Walker), is one of the most destructive pests affecting paddy crops, responsible for a yield reduction of approximately 25-30%, translating to annual losses of 27-34% of production (Pasalu *et al*., 2002). During the vegetative stage of rice, newly emerged caterpillars bore into the stem and consume internal tissues, resulting in the drying of the central shoot and the formation of "dead heart." In the reproductive stage, mature larvae penetrate the peduncle, leading to "white ears," which further exacerbates yield losses (Karthikeyan and Purushothaman, 2000). Given the significant impact of YSB infestation on rice production, there is an urgent need for effective and sustainable pest management strategies. Screening, as a comprehensive and systematic approach, plays a crucial role in identifying and developing resistant rice varieties that can withstand YSB attacks. This process involves the careful evaluation of diverse rice germplasm to uncover genetic traits that confer resistance to the yellow stem borer (Fig. 1).

Several studies have highlighted the critical role of screening initiatives in the development of YSB-resistant paddy varieties. Pathak and Khan (1994) emphasized the need for ongoing screening efforts to effectively address the challenges posed by evolving pest populations. Cultivating resistant varieties is an excellent alternative to other management strategies, as it integrates well with various pest management methods. Therefore, identifying sources of resistance against the yellow stem borer is an essential step. The current study aims to systematically screen genotypes

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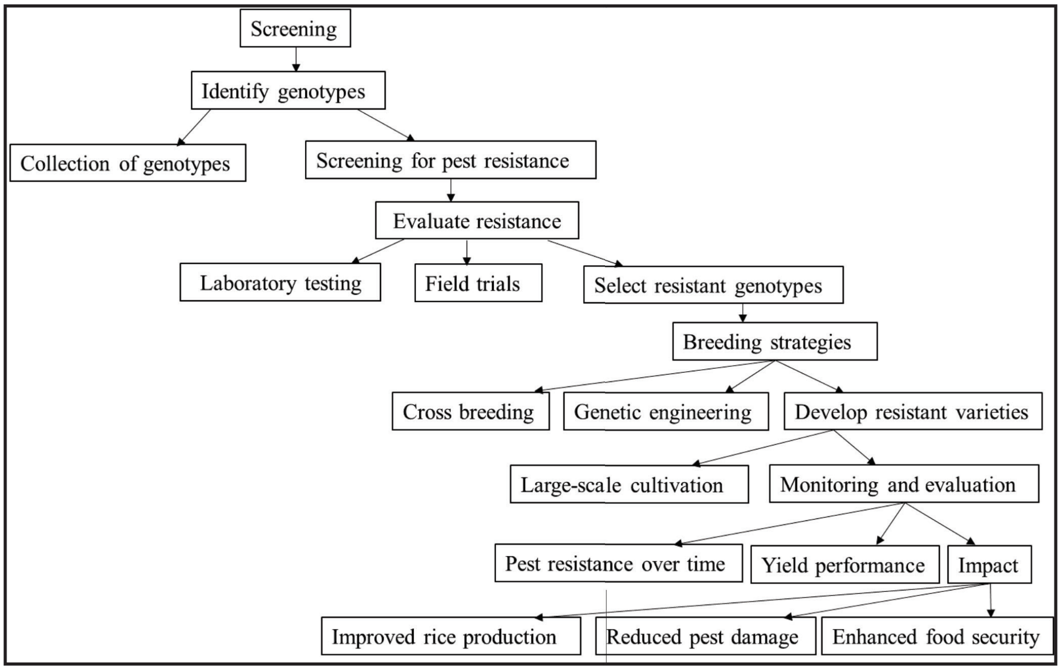

Fig. 1. Screening of genotypes and their applications in pest resistance

for resistance to YSB under field conditions across two growing seasons.

MATERIALS AND METHODS

Field evaluations of local rice landraces for resistance to the yellow stem borer (YSB) were conducted at A-Block, College of Agriculture, Vishweshwaraiah Canal Farm, Mandya, UAS (B), Karnataka, during the *kharif* and summer seasons of 2022-23.

Screening material: A total of 50 local rice landraces (Tables 2 and 3) were collected from the Zonal Agricultural Research Station, V.C. Farm, Mandya, and sown separately for evaluation. These landraces were planted in nursery beds on June 20, 2022, in *kharif* 2022 season and on February 15, 2023, in summer 2023 season. Twenty-five-day-old seedlings of each landrace were transplanted in three rows, with a spacing of 20 cm between rows and 15 cm between plants. Each entry was managed according to standard agronomic practices, with the exception of plant protection measures, implemented in both seasons (Anonymous, 2016).

In each genotype, the infestation of the yellow stem borer (YSB) was assessed during the vegetative stage (prior to panicle emergence) by counting the number of dead hearts relative to the total number of tillers in 10 randomly selected hills for each test entry at 30 and 60 days after transplanting (DAT). Similarly, at the pre-harvest stage, YSB infestation was recorded by counting the total number of ear-bearing tillers and the occurrence of white ears in 10 randomly chosen hills. The percentage of white ears was then calculated at 90 DAT.

$$\text{Dead heart (\%)} = \frac{\text{Number of dead hearts}}{\text{Total number of tillers}} \text{X } 100$$

$$\text{White ear (\%)} = \frac{\text{Number of white ears}}{\text{Total number of productive tillers}} \text{X } 100$$

Mean and standard deviation were calculated, and rice genotypes were categorized into different resistance groups based on the level of infestation for data interpretation. Additionally, the assessment of rice yellow stem borer infestation was conducted using the scoring system outlined in the Standard Evaluation System for Rice (SES) developed by the International Rice Research Institute (IRRI, 2013) (Table 1).

RESULTS AND DISCUSSION

Kharif 2022

The results indicated that among the 50 local landraces studied, the percentage incidence of yellow stem borer (YSB) resulting in dead hearts ranged from 6.01 ± 3.16% in Muttina sanna to 35.36 ± 10.71% in Basumathi. Similarly, the incidence due to white ears varied from 3.2 ± 3.89% in KMP-220 to 20.14 ± 3.39% in Chinne Ponni – 2 (Table 2). Overall, in the *kharif* 2022 season, nine genotypes were classified as resistant (score 1), while 27 genotypes were deemed moderately resistant (score 3). Additionally, ten genotypes were categorized as moderately susceptible (score 5), and

Table 1. Standard evaluation system for rice

For dead heart			For white ear		
Scale	Per cent	Category	Scale	Per cent	Category
0	No damage	Highly resistant	0	No damage	Highly resistant
1	1- 10	Resistant	1	1-5	Resistant
3	11- 20	Moderately resistant	3	6- 10	Moderately resistant
5	21-30	Moderately susceptible	5	11-15	Moderately susceptible
7	31-60	Susceptible	7	16-25	Susceptible
9	61 and above	Highly susceptible	9	26 and above	Highly susceptible

four genotypes were classified as susceptible (score 7). Notably, no genotypes were found to be highly resistant or highly susceptible, corresponding to scores of 0 and 9, respectively (Fig. 2).

At 30 days after transplanting (DAT), the percentage incidence of dead heart varied among the local landraces, ranging from 6.01 ± 3.16% in Muttina sanna to 8.71 ± 2.62% in Naland paddy, both categorized as resistant genotypes (score 1). In the moderately resistant category (score 3), the incidence of dead heart ranged from 11.14 ± 3.1% in Bigan munji to 17.39 ± 2.57% in Onamardini nellu. On the other hand, genotypes classified as moderately susceptible (score 5) exhibited infestation rates varying from 21.43 ± 5.7% in Dappa valige to 28.09 ± 4.23% in Manjula sona. Additionally, the percentage of dead heart was observed to be between 31.6 ± 6.55% and 35.36 ± 10.71% in Punkutt kodi-1 and Basumathi, which were categorized as susceptible (score 7). Notably, none of the local landraces screened were classified as highly resistant (HR) or highly susceptible, corresponding to scores of 0 and 9, respectively (Table 2).

At 60 days after transplanting (DAT), none of the genotypes were classified as highly resistant. The percentage incidence of dead heart ranged from 7.5 ± 2.54% in Mise batta to 8.63 ± 3.86% in Akkalu jaddi, both categorized as resistant genotypes (score 1). In the moderately resistant category (score 3), the incidence of dead heart varied between 13.67 ± 2.98% in Honasu and 18.17 ± 7.83% in Sanbag. For moderately susceptible genotypes (score 5), the infestation ranged from 22.24 ± 4.99% in Bangara gundu to 27.2 ± 4.16% in Manjula sona. In contrast, the percentage of dead heart was observed to be between 32.51 ± 6.22% and 34.9 ± 5.19% in Punkutt kodi-1 and Basumathi, which were classified as susceptible (score 7). Notably, no genotypes were found to be highly susceptible (score 9) (Table 2).

At 90 days after transplanting (DAT), the percentage of white ears ranged from 3.2 ± 3.89% in KMP-220 to 4.62 ± 3.16% in Tai jasmine, both classified as resistant varieties. In the moderately resistant category, the percentage of white ears was observed to be between 6.31 ± 2.72% in Honasu and 9.24 ± 2.7% in Muththina sanna. Moderately susceptible genotypes, such as Jawahar and Dappa valige, exhibited infestation rates ranging from 11.66 ± 2.65% to 14.37 ± 6.52%. Meanwhile, Punkutt kodi-1 and Chinne ponni-2 were classified as susceptible, with percentages of white ears ranging from 16.65 ± 3.25% to 20.14 ± 3.39%. Notably, none of the genotypes were found to be highly resistant or highly susceptible (Table 2).

Summer 2023

The results from the Summer 2023 season indicated that among the 50 local landraces studied, the percentage incidence of yellow stem borer (YSB) resulting in dead hearts ranged from 6.87 ± 3.9% in Muttina sanna to 38.11 ± 8.18% in Basumathi. Similarly, the incidence of white ears varied from 2.87 ± 3.3% in Maplilai samba-1 to 19.14 ± 3.68% in Selam sanna (Table 3). In this summer screening, nine genotypes were classified as resistant (score 1), while 27 genotypes were categorized as moderately resistant (score 3). Additionally, ten genotypes were found to be moderately susceptible (score 5), and four genotypes were classified as susceptible (score 7). Notably, none of the genotypes were observed to be highly resistant or highly susceptible, corresponding to scores of 0 and 9, respectively (Fig. 2).

At 30 days after transplanting (DAT), the percentage of dead heart incidence varied among the local landraces, with Muttina sanna and Naland paddy exhibiting ranges of 6.87 ± 3.9% to 9.04 ± 2.54%, categorizing them as resistant genotypes (score 1). In the moderately resistant category (score 3), Muththina sanna and Raksha showed dead heart percentages ranging from 11.98 ± 2.81% to 17.02 ± 5.02%. For the moderately susceptible category (score 5), Kottayam and Manjula sona had infestation rates between 21.33 ± 7.07% and 26.2 ± 4.71%. In contrast, genotypes Selam sanna and Basumathi were classified as susceptible (score 7), with dead heart percentages ranging from 31.1 ± 7.28% to 37.13 ± 9.16% at 30 DAT. Importantly,

Table 2. Reaction of local landraces of rice to yellow stem borer, *Scirpophaga incertulas during kharif* 2022

Sr. No.	Genotypes	Dead heart (%)		White ears (%)	Score	Category
		30 DAT	60 DAT	90 DAT		
1	Anandi – 2	14.29 ± 5.73	16.32 ± 5.9	8.51 ± 2.76	3	MR
2	Akkalu jaddi	8.02 ± 4.27	8.63 ± 3.86	3.75 ± 1.84	1	R
3	Boo Jaddu	22.73 ± 2.38	23.17 ± 4.33	12.72 ± 2.10	5	MS
4	Bangara gundu	21.96 ± 6.64	22.24 ± 4.99	12.18 ± 2.00	5	MS
5	Bigan munji	11.14 ± 3.1	13.83 ± 3.04	7.41 ± 2.79	3	MR
6	Bidagi kannappa	12.24 ± 3.76	15.04 ± 3.42	8.77 ± 5.88	3	MR
7	Basumathi	35.36 ± 10.71	34.90 ± 5.19	17.03 ± 4.80	7	S
8	Chinne ponni – 2	32.11 ± 4.24	34.21 ± 5.20	20.14 ± 3.39	7	S
9	Degundi	13.15 ± 3.15	15.29 ± 3.56	6.80 ± 2.54	3	MR
10	Dappa valige	21.43 ± 5.70	22.86 ± 4.90	14.37 ± 6.52	5	MS
11	G K – 9 Light brown	12.12 ± 2.47	13.87 ± 2.91	8.22 ± 3.67	3	MR
12	Honasu	12.11 ± 3.03	13.67 ± 2.98	6.31 ± 2.72	3	MR
13	Jawahar	25.51 ± 4.91	26.43 ± 3.73	11.66 ± 2.65	5	MS
14	Joopvadly	12.51 ± 2.59	13.96 ± 2.04	7.26 ± 4.77	3	MR
15	Kempunellu	22.00 ± 5.28	23.95 ± 4.18	12.32 ± 3.63	5	MS
16	Kaggali kecrona	21.47 ± 5.37	23.87 ± 4.69	17.11 ± 3.00	5	MS
17	Kamadari	7.38 ± 2.06	8.60 ± 2.21	4.15 ± 2.80	1	R
18	Kottayam	22.05 ± 6.75	23.94 ± 4.64	12.17 ± 4.17	5	MS
19	Muththina sanna	12.49 ± 2.92	14.28 ± 2.10	9.24 ± 2.70	3	MR
20	Mise batta	6.63 ± 2.09	7.50 ± 2.54	3.54 ± 2.64	1	R
21	Muttina sanna	6.01 ± 3.16	8.17 ± 3.50	4.22 ± 0.99	1	R
22	Maplilai samba – 1	6.74 ± 5.34	7.51 ± 5.37	3.70 ± 3.40	1	R
23	Mahasuri	16.64 ± 5.69	17.81 ± 5.14	6.89 ± 3.46	3	MR
24	Naland paddy	8.71 ± 2.62	7.35 ± 2.54	4.07 ± 3.92	1	R
25	Nirga samba	15.72 ± 5.51	16.94 ± 4.86	8.21 ± 2.40	3	MR
26	Neergula batta	23.72 ± 4.83	25.00 ± 4.56	12.45 ± 1.75	5	MS
27	Nail batta	15.33 ± 5.45	17.02 ± 5.42	8.64 ± 3.17	3	MR
28	Onamardini nellu	17.39 ± 2.57	16.73 ± 2.69	6.44 ± 3.88	3	MR
29	Padma rekha – 2	12.90 ± 3.38	14.24 ± 3.59	8.47 ± 1.94	3	MR
30	Raichur sanna	6.59 ± 2.76	7.60 ± 2.94	4.31 ± 2.64	1	R
31	Rasakadam	16.86 ± 4.85	17.94 ± 4.39	7.16 ± 1.32	3	MR
32	Manjula sona	28.09 ± 4.23	27.20 ± 4.16	12.43 ± 2.51	5	MS
33	Nawali	17.30 ± 2.07	15.97 ± 2.95	7.46 ± 2.44	3	MR
34	Nazar bat	14.88 ± 2.35	15.85 ± 1.69	8.99 ± 3.62	3	MR
35	Nellur sanna	12.57 ± 3.48	14.72 ± 4.19	9.01 ± 2.02	3	MR
36	Punkutt kodi – 1	31.60 ± 6.55	32.51 ± 6.22	16.65 ± 3.25	7	S
37	Rajamudi kempu	13.93 ± 4.38	15.05 ± 3.58	7.93 ± 4.35	3	MR
38	Sada halga	16.70 ± 3.18	17.57 ± 3.21	7.14 ± 1.44	3	MR
39	Selam sanna	32.42 ± 4.76	34.55 ± 3.92	18.32 ± 4.21	7	S
40	Sanbag	17.33 ± 8.14	18.17 ± 7.83	7.47 ± 6.08	3	MR
41	Sona masuri	13.91 ± 3.27	15.85 ± 4.09	8.46 ± 1.07	3	MR
42	Tai jasmine	6.69 ± 2.34	7.59 ± 2.85	4.62 ± 3.16	1	R
43	TRV s Biladadi martiga	25.16 ± 5.34	25.51 ± 5.12	12.12 ± 5.33	5	MS
44	TRV s that jasmine	11.94 ± 3.13	14.29 ± 4.06	6.96 ± 2.66	3	MR
45	Togarsi	12.06 ± 7.09	14.13 ± 5.74	7.36 ± 3.99	3	MR
46	Tonnaru	14.36 ± 3.30	16.48 ± 2.86	9.13 ± 4.50	3	MR
47	Raksha	15.44 ± 5.46	17.35 ± 3.94	7.91 ± 5.55	3	MR
48	KMP - 220	6.26 ± 3.95	7.64 ± 3.56	3.20 ± 3.89	1	R
49	KMP – 225	16.14 ± 5.75	15.07 ± 5.33	7.43 ± 6.15	3	MR
50	MSN 99	12.00 ± 3.22	13.89 ± 2.89	7.75 ± 1.44	3	MR
51	TN-1 (SC)	48.94 ± 15.25	50.74 ± 5.52	23.17 ± 7.94	7	S
52	RP2068-18-3-5 (RC)	4.69 ± 6.23	6.51 ± 6.12	2.49 ± 4.42	1	R
Mean ±		16.64	17.87	9.12	-	
SD		4.73	4.06	3.39		

DAT: Days after transplanting, R: Resistant, MR: Moderately resistant, MS: Moderately susceptible; S: Susceptible; Resistance categories based on Standard Evaluation System of rice, IRRI, Philippines (IRRI, 2013); DH: Dead heart; WE: White ears; RC: Resistant check, SC: Susceptible check; Values are presented as mean ± SD.

none of the local landraces screened demonstrated high resistance (HR) or high susceptibility, corresponding to scores of 0 and 9, respectively (Table 3).

At 60 days after transplanting (DAT), no genotypes exhibited high resistance. Among the genotypes, KMP-220 and Raichur sanna demonstrated dead heart incidences ranging from 6.22 ± 3.4% to 8.36 ± 2.89%, classifying them as resistant (score 1). In the moderately resistant category (score 3), Muththina sanna and Mahasuri displayed dead heart percentages between 11.47 ± 3.11% and 15.91 ± 4.65%. Within the moderately susceptible category (score 5), Kempunellu and Boo Jaddu showed infestation rates ranging from 22.01 ± 3.44% to 25.32 ± 3.12%. In contrast, Selam sanna and Basumathi exhibited dead heart percentages between 32.63 ± 5.4% and 38.11 ± 8.18%, categorizing them as susceptible (score 7). Notably, none of the genotypes were classified as highly susceptible, scoring 9 (Table 3).

At 90 days after transplanting (DAT), the percentage of white ear incidence ranged from 2.87 ± 3.3% in Maplilai samba-1 to 4.25 ± 3.05% in Mise batta, categorizing them as resistant varieties. Similarly, Raksha and Rajamudi kempu exhibited white ear percentages ranging from 6.41 ± 4.08% to 8.55 ± 3.44%, designating them as moderately resistant. Genotypes Jawahar and Kaggali kecrona demonstrated infestation rates between 12.46 ± 1.89% and 14.54 ± 4.52%, classifying them as moderately susceptible. In contrast, Basumathi and Selam sanna exhibited white ear incidences ranging from 16.43 ± 3.4% to 19.14 ± 3.68%, marking them as susceptible. Notably, none of the genotypes were identified as highly resistant or highly susceptible (Table 3).

The results of the present study align with the findings of Balaji *et al.* (2023), who reported that out of 50 local landraces, five genotypes exhibited a resistance reaction with a damage score of 1. Additionally, 23 genotypes were categorized as moderately resistant (score 3), 17 as moderately susceptible (score 5), and five as susceptible (score 7). Among the screened popular cultivars, four genotypes were identified as resistant, four showed moderately resistant reactions, one was categorized as moderately susceptible, and one was classified as susceptible. Notably, none of the local landraces or popular cultivars demonstrated high resistance or high susceptibility to the yellow stem borer (YSB). Similar results were also reported by Balaji *et al.* (2024).

Yadav *et al.* (2023) reported that among the 20 rice accessions screened against *Scirpophaga incertulus* during the Summer 2022 season, the rice variety Radha-13 exhibited the lowest infestation, with approximately 0.547% dead heart incidence compared to other accessions. Additionally, the accessions Subarna Sub-1 and NR2188-13-5-2-5-1 were classified as moderately resistant to YSB, with a dead heart incidence of 9.95%. Overall, most rice accessions evaluated demonstrated improved plant resistance against YSB. Furthermore, Rajadurai and Kumar (2017) screened 193 genotypes and found that 56 were resistant, 95 were moderately resistant, 28 were moderately susceptible, 8 were susceptible, and 6 were highly susceptible. The observed resistance in these genotypes was attributed to strong antibiosis and the presence of phenolic compounds, which contribute to mortality in rice stems (Zhu *et al.*, 2002). Similarly, screening of 50 local rice landraces by Megha (2019) identified high resistance in five genotypes, while eight genotypes were classified as resistant, including Kari munduga, Malgudi sanna-2, Jenugudu, Murkanna sanna, GK-1, and Adari batta. Additionally, 14 genotypes were found to be moderately resistant, seven were classified as moderately susceptible, and ten were categorized as susceptible.

Similarly, the results of rice germplasm screening for resistance to stem borer, assessed by the incidence of white ear at 75 and 95 days after transplanting (DAT), revealed that out of 46 rice cultures screened, TP 10003, TP 10004, TP 10039, and TP 08095 exhibited minimal incidence and were classified as resistant. Additionally, TP 10002, TP 10005, TP 10016, TP 10038, TP 10051, TP 10052, TP 09048, and TP 09052 were rated as moderately resistant (Preetha, 2017). Moreover, five accessions—AD 16124, AD 15101, AD 16189, AD 12182, and AD 12272—showed no dead heart or white ear damage, categorizing them as highly resistant. In contrast, three accessions—AD 16157, AD 12132, and AD 16157—were classified as highly susceptible (Sharmitha *et al.*, 2019).

Similarly, Justin and Preetha (2013) reported that among 77 genotypes screened during *kharif* 2011, five genotypes were classified as highly resistant, receiving a score of '0'. In *Kharif* 2012, seven genotypes also exhibited high resistance, again scoring '0'. During *Rabi* 2011, the genotype TP 10007 was identified as highly resistant, showing no dead heart or white ear damage. In *Rabi* 2012, a total of 57 genotypes were screened for resistance to the rice stem borer, with 15 genotypes recording zero incidence of stem borer. In contrast, the highest incidence of stem borer-related white ear damage was observed in TN-1 and RpPatho-02, which recorded 13.13% white ears (Visalakshmi *et al.*, 2014).

Among the 231 paddy genotypes screened against the yellow stem borer, the percentage of white ears at 80 days after transplanting (DAT) varied from 0.84% (classified as resistant) to 25.96% (classified as susceptible). A total of 74 genotypes were identified as resistant, exhibiting less than 5% white ear incidence. Additionally, 87 genotypes were

Table 3. Reaction of local landraces of rice to yellow stem borer, *Scirpophaga incertulas* during *summer* 2023

Sr. No.	Genotypes	Dead heart (%)		White ears (%)	Score	Category
		30 DAT	60 DAT	90 DAT		
	Anandi – 2	12.70 ± 4.54	14.72 ± 5.12	7.72 ± 2.87	3	MR
	Akkalu jaddi	7.46 ± 4.60	8.13 ± 4.41	4.17 ± 2.35	1	R
	Boo Jaddu	24.28 ± 3.42	25.32 ± 3.12	13.14 ± 2.44	5	MS
	Bangara gundu	23.17 ± 7.87	24.49 ± 7.45	13.01 ± 1.79	5	MS
	Bigan munji	12.92 ± 3.87	14.32 ± 3.57	6.67 ± 2.82	3	MR
	Bidagi kannappa	13.73 ± 3.71	12.63 ± 3.42	7.80 ± 5.11	3	MR
	Basumathi	37.13 ± 9.16	38.11 ± 8.18	16.43 ± 3.40	7	S
	Chinne ponni – 2	33.61 ± 2.47	34.81 ± 2.06	21.61 ± 3.33	7	S
	Degundi	14.21 ± 3.80	15.26 ± 3.28	7.30 ± 3.54	3	MR
	Dappa valige	23.50 ± 4.48	22.74 ± 4.51	13.70 ± 7.06	5	MS
	G K – 9 Light brown	12.69 ± 2.91	13.74 ± 2.36	8.51 ± 3.56	3	MR
	Honasu	12.84 ± 3.07	14.14 ± 3.46	6.87 ± 2.81	3	MR
	Jawahar	23.40 ± 4.93	24.34 ± 3.69	12.46 ± 1.89	5	MS
	Joopvadly	12.31 ± 3.26	13.50 ± 2.33	8.09 ± 4.03	3	MR
	Kempunellu	23.30 ± 4.70	22.01 ± 3.44	13.25 ± 3.07	5	MS
	Kaggali kecrona	21.95 ± 5.80	24.24 ± 3.73	14.54 ± 4.52	5	MS
	Kamadari	7.09 ± 2.07	7.43 ± 2.61	3.89 ± 2.81	1	R
	Kottayam	21.33 ± 7.07	22.61 ± 4.76	13.18 ± 3.78	5	MS
	Muththina sanna	11.98 ± 2.81	11.47 ± 3.11	8.48 ± 2.41	3	MR
	Mise batta	7.66 ± 2.35	6.95 ± 1.72	4.25 ± 3.05	1	R
	Muttina sanna	6.87 ± 3.90	7.92 ± 5.91	3.22 ± 1.91	1	R
	Maplilai samba – 1	7.02 ± 5.32	7.85 ± 5.39	2.87 ± 3.30	1	R
	Mahasuri	14.81 ± 5.37	15.91 ± 4.65	7.45 ± 3.66	3	MR
	Naland paddy	9.04 ± 2.54	7.80 ± 3.56	3.65 ± 4.13	1	R
	Nirga samba	14.96 ± 4.72	15.83 ± 4.25	7.45 ± 2.96	3	MR
	Neergula batta	24.15 ± 4.37	22.62 ± 4.73	13.54 ± 2.09	5	MS
	Nail batta	14.82 ± 5.93	14.13 ± 4.6	7.85 ± 4.53	3	MR
	Onamardini nellu	15.72 ± 3.79	14.12 ± 4.75	7.31 ± 3.19	3	MR
	Padma rekha – 2	13.94 ± 3.32	12.20 ± 3.68	6.97 ± 3.26	3	MR
	Raichur sanna	7.37 ± 3.55	8.36 ± 2.89	3.91 ± 2.97	1	R
	Rasakadam	15.57 ± 3.87	13.78 ± 4.8	6.82 ± 1.79	3	MR
	Manjula sona	26.20 ± 4.71	23.86 ± 6.97	13.05 ± 3.37	5	MS
	Nawali	16.26 ± 3.51	14.85 ± 4.48	7.14 ± 2.78	3	MR
	Nazar bat	15.98 ± 2.31	15.17 ± 2.62	7.82 ± 4.09	3	MR
	Nellur sanna	13.25 ± 3.39	14.38 ± 3.84	8.18 ± 2.99	3	MR
	Punkutt kodi – 1	33.25 ± 6.04	35.38 ± 5.00	17.76 ± 3.04	7	S
	Rajamudi kempu	12.68 ± 4.63	14.70 ± 3.80	8.55 ± 3.44	3	MR
	Sada halga	15.54 ± 2.75	13.74 ± 4.45	7.81 ± 1.86	3	MR
	Selam sanna	31.10 ± 7.28	32.63 ± 5.40	19.14 ± 3.68	7	S
	Sanbag	16.48 ± 8.81	15.26 ± 10.02	6.98 ± 5.85	3	MR
	Sona masuri	14.24 ± 3.32	13.09 ± 3.88	7.87 ± 1.46	3	MR
	Tai jasmine	7.01 ± 2.52	7.55 ± 2.39	3.97 ± 3.48	1	R
	TRV s Biladadi martiga	26.08 ± 4.32	23.92 ± 5.89	13.12 ± 4.75	5	MS
	TRV s that jasmine	12.25 ± 2.96	13.47 ± 3.88	7.59 ± 2.38	3	MR
	Togarsi	14.49 ± 6.02	13.49 ± 6.63	8.05 ± 3.07	3	MR
	Tonnaru	15.57 ± 2.6	13.23 ± 3.51	8.19 ± 4.76	3	MR
	Raksha	17.02 ± 5.02	13.35 ± 6.54	6.41 ± 4.08	3	MR
	KMP - 220	7.09 ± 3.94	6.22 ± 3.40	3.68 ± 3.75	1	R
	KMP - 225	14.20 ± 5.86	12.45 ± 7.11	6.72 ± 5.65	3	MR
	MSN 99	13.16 ± 2.40	11.99 ± 4.49	6.95 ± 2.08	3	MR
	TN-1 (SC)	48.94± 15.25	50.74 ± 5.52	23.17 ± 7.94	7	S
	RP2068-18-3-5 (RC)	4.69 ± 6.23	6.51 ± 6.12	2.49 ± 4.42	1	R
Mean ± SD		16.81 4.26	16.75 4.38	9.00 3.32		-

DAT: Days after transplanting, R: Resistant, MR: Moderately resistant, MS: Moderately susceptible; S: Susceptible; Resistance categories based on Standard Evaluation System of rice, IRRI, Philippines (IRRI, 2013); DH: dead heart; WE: white ears; RC: Resistant check, SC: Susceptible check; values are presented as mean ± SD.

categorized as moderately resistant, with 6-10% white ear incidence, while 45 genotypes were deemed moderately susceptible, recording less than 15% white ears. Furthermore, 25 genotypes showed susceptible reactions, with white ear incidence ranging from 16% to 25%. The susceptible check, TN1, recorded a white ear incidence of 25.96%. Importantly, none of the genotypes were classified as highly resistant (0% white ear), and none reacted as highly susceptible (26-100% white ear) (Girish *et al.*, 2013).

Screening rice genotypes for resistance against insect pests is essential in resistance breeding, as it facilitates the identification and development of rice varieties with natural pest resistance. This approach reduces reliance on chemical pesticides and minimizes environmental impact (Smith and Clement, 2012). Moreover, it enhances our understanding of the genetic basis of resistance, enabling breeders to combine multiple resistance genes, which ultimately increases the durability of pest resistance in rice cultivars (Kogan, 1994). Such genetic diversity is crucial for managing pest populations and delaying the evolution of pest resistance (Fujita *et al.*, 2013). Additionally, screening for resistance plays a significant role in ensuring food security by stabilizing rice production and reducing crop losses due to pest infestations (Jena and Kim, 2010). This is particularly vital in regions where rice serves as a staple food and a primary source of income for farmers (Khush and Brar, 1991). Overall, the importance of screening rice genotypes in resistance breeding lies in its potential to produce resilient, environmentally sustainable, and economically beneficial rice varieties, ultimately contributing to food security (Fig. 1).

Pest screening is essential for evaluating the damage inflicted by different rice genotypes and investigating host plant resistance as a pest mitigation strategy. In our current study, we have aimed to identify rice varieties that exhibit resistance to the yellow stem borer across various parameters. These resilient

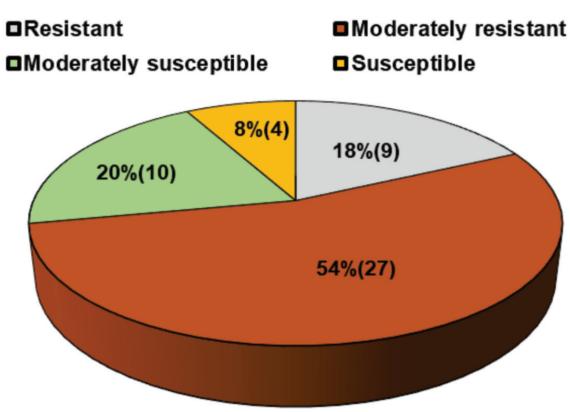

Fig. 2. Per cent genotypes under different resistance categories during *Kharif* and *Summer* 2022-23

varieties hold promise for integration into breeding programs. Employing host plant resistance mechanisms represents a promising, eco-friendly, and cost-effective approach to pest control, potentially reducing the reliance on chemical pesticides. Cultivating these resistant varieties is crucial for effective insect pest management. Our research indicates that a significant majority of the tested genotypes demonstrate either resistance or moderate resistance. Consequently, it is vital to explore the underlying mechanisms of this resistance, which will facilitate their application in future breeding programs aimed at combating the yellow stem borer in paddy cultivation.

This study is limited by the relatively small sample size of only 50 local landraces, which may not capture the full genetic diversity present in the broader population. Additionally, the research was conducted in a specific geographical region (Mandya, Karnataka) and over only two seasons (*Kharif* 2022 and *Summer* 2023), which may restrict the generalizability of the findings to other regions and climatic conditions. Furthermore, there is a need to investigate the underlying genetic and biochemical mechanisms responsible for the observed resistance, as this could yield valuable insights for developing more effective breeding programs.

Future research should aim to expand the sample size and geographical scope to encompass a more diverse range of rice landraces and environments. Conducting longitudinal studies across multiple seasons and varying climatic conditions would enhance our understanding of the stability of resistance traits over time. Additionally, incorporating molecular and genetic analyses could help identify specific genes or biochemical pathways associated with resistance to *S. incertulas*. Such insights would significantly improve the development of rice varieties with durable resistance, thereby contributing to sustainable pest management and enhanced rice yields.

CONCLUSION

In conclusion, the screening of local rice landraces for resistance to the yellow stem borer (*Scirpophaga incertulas*) has revealed promising findings, with many genotypes exhibiting either resistance or moderate resistance. This research highlights the importance of integrating resistant varieties into breeding programs, as they represent a sustainable and eco-friendly approach to pest management that can reduce reliance on chemical pesticides. However, the study is limited by its small sample size and specific geographical focus, which may affect the generalizability of the results. Future research should expand the sample size and geographical scope, conduct longitudinal studies across diverse climatic conditions, and employ molecular and genetic analyses to uncover the underlying mechanisms of resistance. Such efforts will enhance our understanding of resistance traits and facilitate the development of rice varieties with durable resistance, ultimately contributing to improved pest management and increased rice yields, thereby supporting food security in regions dependent on rice cultivation.

Authors' contribution

Conceptualization of research work and designing of experiments (LVK); Execution of field experiments, data collection, analysis of data, interpretation and preparation of manuscript (BBN).

Conflicts of interest: Authors declare that they have no conflicts of interest.

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