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Screening of rice germplasm resistance against major insect pests under eastern Uttar Pradesh conditions

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Abstract
The present study was conducted for screening of rice germplasm against major insect pests under Eastern Uttar Pradesh conditions for two consecutive years, 2014 and 2015 at farmer field of district Deoria. There were 27 rice germplasm screened against major insect pests of rice comprised of 3 local checks and 24 new entries under augmented block design (ABD). The screening of rice germplasm resistance against major insect pests of rice was evaluated as per methodology of IRRI-Standard Evaluation System for Rice (SES) (IRRI, 2013) modified as accessibility. The germplasm resistance was varied in highly resistance, moderately resistance**,** moderately susceptible, and highly susceptible scale of germplasm screening. The infestations of major insect pests of rice were observed for most serious insect pests, *i.e.,* 1. Yellow stemborer (*Scirpophaga incertulus* Walker), 2. Common rice leaffolder (*Cnaphalocrosis medinalis* Guenee), 3. Brown planthopper (*Nilaparvata lugens* Stal), 4. Rice hispa (*Dicladispa armigera* Oliver), and 5. Rice earhead bug (*Leptocorisa acuta* Thunberg) specially. The highly resistance, moderately resistance**,** and moderately susceptible rice germplasm were observed for all major insect pests of rice except Rice earhead bug (*Leptocorisa acuta* Thunberg) not confined moderately resistance germplasm. The highly susceptible germplasm were not observed for any major insect pests of rice. Whereas, the mean infestation of major insect pests of rice was observed only highly resistance and moderately resistance germplasm. There were 19 rice germplasm (TCA 80-4, NDR 8002, PSBRC 70, RR 347-166, NDR 3112-1, NDR 2064, SARJU-52, GOVIND, NDGR 268, LALMATI, NDGR 296, NDR 392, MADAK, CR 1002, RR 272-89, RR 366-4, NDR 97, MOTI, and NDR 2026) confined highly resistance and 8 rice germplasm (BHANTAPHOOL 2, KALANAMAK 2, NAGINA 22, SWARN SUB 1, SHUSK SAMRAT, NDR 118, MADHUKAR, and SWARN) confined moderately resistance respectively.

Keywords: Germplasm screening, major insect pests of rice, Eastern Uttar Pradesh, India

Introduction

Rice is one of the most important staple foods of the world (70% of the population) and India (65% of the population). About 90% of the world's rice is produced and consumed in the Asian region and most staple food of South East Asia. It is grown in almost all the states of India and shares 21% of the world rice production. Uttar Pradesh shares 15% of the India rice production and occupies second position after West Bengal (17%) and first position in rice crop area. Despite this above proud credential, Uttar Pradesh is not appearing leading position. The main cause of low productivity of rice is ill cultivation practices and crop losses. The crop losses share about 32.1% losses by plant ailments (pests, diseases & weeds) and among them, about 10.8% losses caused by pests globally and India have been reported about 17.5% losses caused by insect pests. About 800 insect pest species associated with rice crop over world. Among them 250 insect pest species associated with rice crop in India and 20 of them are pests of major economic significance. The insect pests of rice infest all parts of the plant at all growth stages and transmit few viral diseases of rice. Historically, insect pest outbreaks have been causing extensive losses in rice crop production ranging from 60 to 95% over world. India have been estimated rice crop losses by insect pests ranging from 21 to 51%. (Pathak and Khan, 1994; Oerke, 2006; Dhaliwal *et al*., 2015; Sharma *et al*., 2017; Heinrichs and Muniappan, 2017; Pathak *et al*., 2018; DAC&FW, 2018; FAOSTAT, 2019) [15, 13, 7, 18, 10, 14, 3, 9].
There are numbers of research institutes, centers and projects and also extension machineries are running in India for insect pest management in rice.

Undoubtedly, these all are performing his possible responsibilities. But it is sorry to say, the Uttar Pradesh is under lag phase of adaptation of modern technologies of rice crop production, especially to insect pest management. Which contributes valuable share in India rice production. Though, Farmers are practicing all possible available methods and techniques for rice insect pest management as cultural, physical, biological, chemical and host resistance methods based on traditional knowledge, layman and salesman advice. While, all the management practices are concentrated to the farmers' perception about finishing approach of insect pests ignoring the significant role of ecofriendly approach of pest management. Of course, these management practices may be prevented 5.8% crop losses among of 21% crop losses caused by insect pests. (Pathak and Khan, 1994; Oerke, 2006; Dhaliwal *et al*., 2015; Sharma *et al*., 2017; Heinrichs and Muniappan, 2017) [15, 13, 7, 18, 10].

The productivity gap is directly concerned to the various constraints. There are three major constraints prevailing in rice production *i.e.*, biotic stress, abiotic stress, and infrastructure constraints respectively. The infrastructure constraint requires strengthen of implementation and dissemination of resources. The genetic resources have not been collected systematically regarding traditional rice and land races to conserve the rice genetic wealth. About 400,000 rice germplasm accessions are available over world and among them about 94,000 rice germplasm accessions are available in India. Merely 2320 germplasm accessions have working in Uttar Pradesh. Generally, high yielding varieties have been developed mostly specific to the ecosystems and their ailments. In the complex variations of nature, the resistant varieties could not be stand after few years with regular pest problems, and often offer the minor insect pests and their outbreaks. So, to maintaining the genetic potential of high yielding varieties, the regular multilocational trial has been benefited for potential crop production. Therefore, this research work selected those rice germplasm to evaluate their resistance against insect pest infestation regarding the biorational approach, which has been commonly trending among the scientific community among Eastern Uttar Pradesh conditions. The objective was aimed to screening of rice germplasm resistance against major insect pests under Eastern Uttar Pradesh conditions, that could become the effective information for rice insect pest management strategies.

Siddiq *et al.* (1998) [19] have been collectively identified rice germplasm resistance against the key insect pests include 1200 for green leafhopper, 570 for brown planthopper, 370 for whitebacked planthopper, 250 for gall midge, 44 for leaf folder and 32 for yellow stemborer. Prasad *et al.* (2013) [16] have been reported that, the entries Madak 13, WAB878-4-2-2-3-P1-HP and NDGR 268 were highly resistant to yellow stemborer. The entries IR 52561-UBN-1-1-2, PR 36949-B-B-16, TCA 80-4, NDGR 296, NDR 392, PSBRC 70, Bhantaful 2 and Kalanamak 2 were also promising with less than 5% average yellow stemborer infestation. Mishra and Singh (2019) [12] have been observed that, the rice germplasm entries RR 366-4 and NDR 97 were highly resistance and Shusk Samrat was found moderately resistance respectively.

Materials and Methods

The Screening was conducted on some new identified rice germplasm against major insect pests of rice under Eastern Uttar Pradesh conditions for the two consecutive years (2014 and 2015) on farmer field of district Deoria, U.P., India. This confined spot of study represents the conductive environment, for survival and proliferation of insect pests in rice ecosystem under Eastern Uttar Pradesh conditions. There were 27 rice germplasm accessions (24 new entries and 03 local checks) screened under augmented block design (ABD) by transplanting method of rice cultivation for transplanting stage and flowering stage. Germplasm were comprised of two groups, *i.e.* local checks and new entries. The local checks were comprised 3 local cultivars (SARJU-52, MOTI, and GOVIND) and new entries were comprised 24 accessions (SWARN, LALMATI, CR 1002, NDR 392, MADAK, MADHUKAR, TCA 80-4, NAGINA 22, PSBRC 70, NDR 2026, NDR 2064, NDR 8002, RR 272-89, NDGR 268, NDGR 296, NDR 118, BHANTAPHOOL 2, RR 347-166, NDR 3112-1, KALANAMAK 2, RR 366-4, NDR 97, SWARN SUB 1, and SHUSK SAMRAT). The infestation of major insect pests on rice germplasm was inference with adjusted infestation (%) value for new entries except local checks. The screening of mean infestation of rice germplasm for most serious insect pests as major insect pests of rice was inference under randomized block design (RBD) simultaneously. Samples were taken 03 times at interval of 30 and 60 days after transplanting (30 and 60 DAT) for transplanting stage and 60 DAT for flowering stage respectively. The duration of rice crops started from pre week of August to mid-week of November for about 110 days. There were 5 samples collected per plot at the size of 15 m^2. Each plot was selected 5 spots (4 in the corner and one in the center) at 01 hill/spot for transplanting and flowering stage to observe infestation of major insect pests. The timing of sampling was 9.30 A.M. to 12.30 P.M. respectively. Each observation was recorded percentage damage of plants by major insect pests concerned to screen major resistant germplasm of rice below 10% infestation by symptoms of damage respective to the healthy plants surface area. The screening of rice germplasm resistance against major insect pests of rice was evaluated under 4 scale of, 1. Highly resistance (Grade 1; <5% infestation), 2. Moderately resistance (Grade 2; 5.1-10% infestation), 3. Moderately susceptible (Grade 3; 10.1-15% infestation), and 4. Highly susceptible (Grade 4; >15% infestation) respectively.

Screening of rice germplasm resistance against major insect pests of rice was evaluated as per methodology of IRRI-Standard Evaluation System for Rice (SES) (IRRI, 2013) [11] modified as accessibility. Taxonomic identification was verified with texts of reference, *i.e*., Dale (1994) [4], Barrion and Litsinger (1994) [1], Pathak and Khan (1994) [15], David and Ananthakrishnan (2004) [5]; Rice knowledge management portal (RKMP); and Subject experts respectively. The statistical inferences were verified with texts of reference, *i.e*., Dhamu & Ramamoorthy (2007) [8], and Rangaswamy (2010) [17].

Results and Discussion

The screening of rice germplasm was observed against major insect pests for two consecutive years 2014 and 2015 respectively. The infestations of major insect pests of rice were observed for most serious insect pests, which were 1. Yellow stemborer (*Scirpophaga incertulus* Walker), 2. Common rice leaffolder (*Cnaphalocrosis medinalis* Guenee), 3. Brown planthopper (*Nilaparvata lugens* Stal), 4.Rice hispa (*Dicladispa armigera* Oliver), and 5. Rice earhead bug (*Leptocorisa acuta* Thunberg) specially. Of the total observed mean infestations of major insect pests of rice, there were 19 rice germplasm (TCA 80-4, NDR 8002, PSBRC 70, RR 347-166, NDR 3112-1, NDR 2064, SARJU-52, GOVIND, NDGR 268, LALMATI, NDGR 296, NDR 392, MADAK, CR 1002, RR 272-89, RR 366-4, NDR 97, MOTI, and NDR 2026) confined highly resistance and 8 rice germplasm (BHANTAPHOOL 2, KALANAMAK 2, NAGINA 22, SWARN SUB 1, SHUSK SAMRAT, NDR 118, MADHUKAR, and SWARN) confined moderately resistance respectively. The germplasm resistance was varied in highly resistance, moderately resistance**,** moderately susceptible, and highly susceptible scale of germplasm screening. The highly resistance, moderately resistance**,** and moderately susceptible rice germplasm were observed for all major insect pests of rice except Rice earhead bug (*Leptocorisa acuta* Thunberg) not confined moderately resistance germplasm. The highly susceptible germplasm were not observed for any major insect pests of rice. None of the germplasm were inference significant for highly resistance against mean infestation of major insect pests of rice. These findings have been varied itself. It has been scanty information regarding observed rice germplasm against mean infestation of major insect pests of rice to verify this finding. (Table 1, 2 & 3; Figure 1 & 2)

Of the total observed infestation of yellow stemborer (*Scirpophaga incertulus* Walker), there were 23 germplasm (RR 347-166, NDR 118, NDR 2064, NDR 392, LALMATI, NDGR 268, SWARN, MADAK, BHANTAPHOOL 2, KALANAMAK 2, SARJU-52, NDR 3112-1, TCA 80-4, GOVIND, CR 1002, PSBRC 70, NDR 8002, NDR 97, RR 272-89, NDR 2026, RR 366-4, MOTI, and NDGR 296) confined highly resistance; 2 germplasm (SHUSK SAMRAT, and NAGINA 22) confined moderately resistance; and rest 2 germplasm (SWARN SUB 1, and MADHUKAR) confined moderately susceptible. More or less similar trend had also been reported by Prasad *et al.* (2013) [16], Devsena *et al.* (2018) [6], and Mishra and Singh (2019) [12] with different genotypes of rice. (Table 3). Of the total observed infestation of common rice leaffolder (*Cnaphalocrosis medinalis* Guenee), there were 23 germplasm (NDR 2064, NDR 8002, CR 1002, SARJU-52, SWARN, MADAK, PSBRC 70, RR 272-89, TCA 80-4, NDR 392, LALMATI, NDR 118, RR 347-166, NDGR 268, MOTI, GOVIND, NDR 97, BHANTAPHOOL 2, NDGR 296, NDR 3112-1, KALANAMAK 2, RR 366-4, and NDR 2026) confined highly resistance; 2 germplasm (SHUSK SAMRAT, and NAGINA 22) confined moderately resistance; and rest 2 germplasm (SWARN SUB 1, and MADHUKAR) confined moderately susceptible. Similar findings have been reported by Tripathi and Saxena (2013) [21]. (Table 3). Of the total observed infestation of brown planthopper (*Nilaparvata lugens* Stal), there were 7 germplasm (RR 347-166, NDR 3112-1, BHANTAPHOOL 2, TCA 80-4, NDR 8002, KALANAMAK 2, and SARJU-52) confined highly resistance; 17 germplasm (RR 366-4, NDR 2064, RR 272-89, NDGR 296, GOVIND, NDGR 268, PSBRC 70, SWARN SUB 1, MADAK, NDR 392, LALMATI, NDR 2026, MOTI, CR 1002, NDR 97, MADHUKAR, and NAGINA 22) confined moderately resistance; and rest 3 germplasm (SHUSK SAMRAT, NDR 118, and SWARN) confined moderately susceptible. Similar findings have been reported by Siddique *et al.* (1998) [19], who found several promising genotypes of rice in their studies. (Table 3).

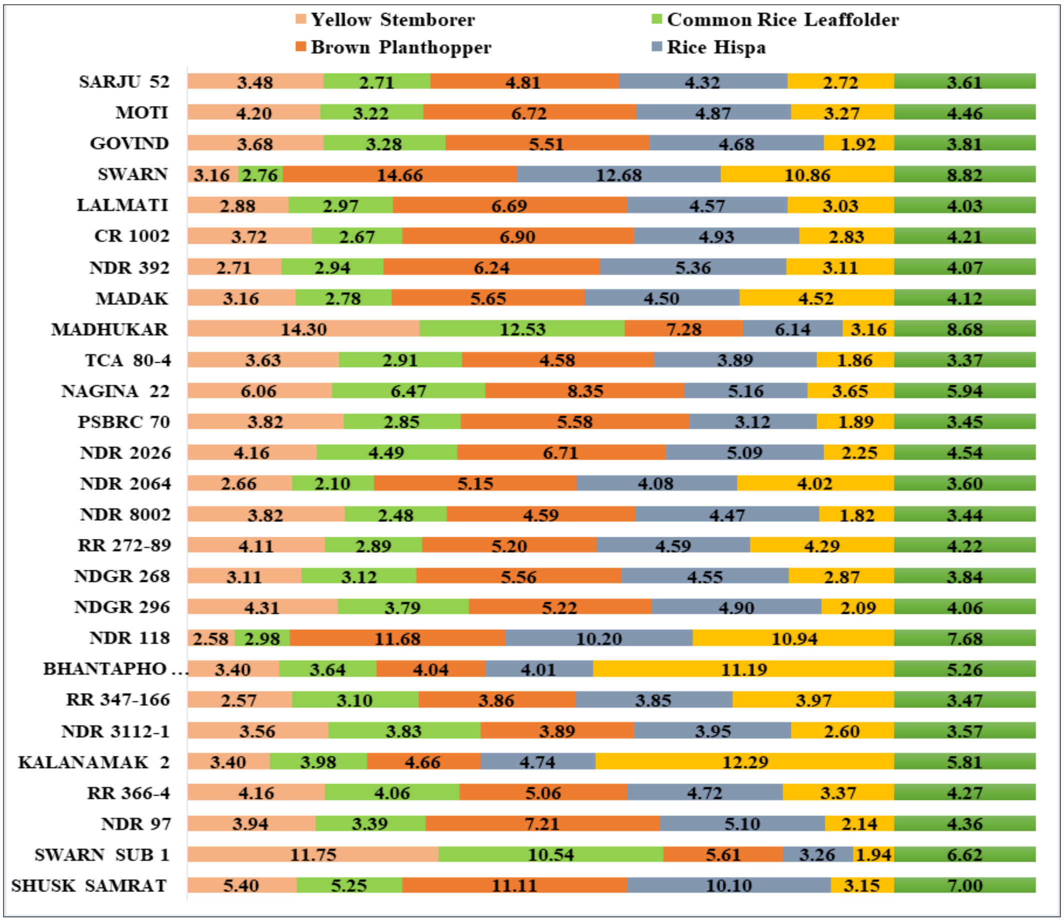
Of the total observed infestation of rice hispa (*Dicladispa armigera* Oliver), there were 19 germplasm (PSBRC 70, SWARN SUB 1, RR 347-166, TCA 80-4, NDR 3112-1, BHANTAPHOOL 2, NDR 2064, SARJU-52, NDR 8002, MADAK, NDGR 268, LALMATI, RR 272-89, GOVIND, RR 366-4, KALANAMAK 2, MOTI, NDGR 296, and CR 1002) confined highly resistance; 5 germplasm (NDR 2026, NDR 97, NAGINA 22, NDR 392, and MADHUKAR) confined moderately resistance; and rest 3 germplasm (SHUSK SAMRAT, NDR 118, and SWARN) confined moderately susceptible. It has been scanty information regarding observed rice germplasm against rice hispa to verify this finding. (Table 3). Of the total observed infestation of rice earhead bug (*Leptocorisa acuta* Thunberg, there were 23 germplasm (NDR 8002, TCA 80-4, PSBRC 70, GOVIND, SWARN SUB 1, NDGR 296, NDR 97, NDR 2026, NDR 3112-1, SARJU-52, CR 1002, NDGR 268, LALMATI, NDR 392, SHUSK SAMRAT, MADHUKAR, MOTI, RR 366-4, NAGINA 22, RR 347-166, NDR 2064, RR 272-89, and MADAK) confined highly resistance and 4 germplasm (SWARN, NDR 118, BHANTAPHOOL 2, and KALANAMAK 2) confined moderately susceptible. Similar findings have been reported by Tripathi and Saxena (2013) [21] and CRRI (2014) who found several promising genotypes of rice in their studies. (Table 3).

Table 1: Mean of Rice Germplasm Resistance for Major Insect Pests (Pooled of 2014 & 15).*

S.N.	Germplasm Accessions	Major Insect Pests					
		Yellow Stemborer	Common Rice Leaffolder	Brown Planthopper	Rice Hispa	Rice Earhead bug	Total # Mean
1.	SARJU 52 (Check)	3.48 (1.99)	2.71 (1.79)	4.81 (2.30)	4.32 (2.20)	2.72 (1.79)	3.61 (2.01)
2.	MOTI (Check)	4.20 (2.17)	3.22 (1.93)	6.72 (2.68)	4.87 (2.32)	3.27 (1.94)	4.46 (2.21)
3.	GOVIND (Check)	3.68 (2.04)	3.28 (1.95)	5.51 (2.45)	4.68 (2.28)	1.92 (1.56)	3.81 (2.04)
4.	SWARN	3.16 (1.91)	2.76 (1.81)	14.66 (3.89)	12.68 (3.63)	10.86 (3.37)	8.82 (2.92)
5.	LALMATI	2.88 (1.84)	2.97 (1.86)	6.69 (2.68)	4.57 (2.25)	3.03 (1.88)	4.03 (2.16)
6.	CR 1002	3.72 (2.05)	2.67 (1.78)	6.90 (2.72)	4.93 (2.33)	2.83 (1.82)	4.21 (2.14)
7.	NDR 392	2.71 (1.79)	2.94 (1.85)	6.24 (2.60)	5.36 (2.42)	3.11 (1.90)	4.07 (2.11)
8.	MADAK	3.16 (1.91)	2.78 (1.81)	5.65 (2.48)	4.50 (2.24)	4.52 (2.24)	4.12 (2.14)
9.	MADHUKAR	14.30 (3.84)	12.53 (3.61)	7.28 (2.79)	6.14 (2.58)	3.16 (1.91)	8.68 (2.95)
10.	TCA 80-4	3.63 (2.03)	2.91 (1.85)	4.58 (2.25)	3.89 (2.09)	1.86 (1.54)	3.37 (1.95)
11.	NAGINA 22	6.06 (2.56)	6.47 (2.64)	8.35 (2.97)	5.16 (2.38)	3.65 (2.04)	5.94 (2.52)
12.	PSBRC 70	3.82 (2.08)	2.85 (1.83)	5.58 (2.47)	3.12 (1.90)	1.89 (1.55)	3.45 (1.97)
13.	NDR 2026	4.16 (2.16)	4.49 (2.23)	6.71 (2.69)	5.09 (2.36)	2.25 (1.66)	4.54 (2.22)
14.	NDR 2064	2.66 (1.78)	2.10 (1.61)	5.15 (2.38)	4.08 (2.14)	4.02 (2.13)	3.60 (2.01)
15.	NDR 8002	3.82 (2.08)	2.48 (1.73)	4.59 (2.26)	4.47 (2.23)	1.82 (1.52)	3.44 (1.96)
16.	RR 272-89	4.11 (2.15)	2.89 (1.84)	5.20 (2.39)	4.59 (2.26)	4.29 (2.19)	4.22 (2.17)
17.	NDGR 268	3.11 (1.90)	3.12 (1.90)	5.56 (2.46)	4.55 (2.25)	2.87 (1.84)	3.84 (2.07)

18.	NDGR 296	4.31 (2.19)	3.79 (2.07)	5.22 (2.39)	4.90 (2.32)	2.09 (1.61)	4.06 (2.12)
19.	NDR 118	2.58 (1.75)	2.98 (1.86)	11.68 (3.49)	10.20 (3.27)	10.94 (3.38)	7.68 (2.75)
20.	BHANTAPHOOL 2	3.40 (1.97)	3.64 (2.03)	4.04 (2.13)	4.01 (2.12)	11.19 (3.42)	5.26 (2.33)
21.	RR 347-166	2.57 (1.75)	3.10 (1.90)	3.86 (2.09)	3.85 (2.09)	3.97 (2.11)	3.47 (1.99)
22.	NDR 3112-1	3.56 (2.01)	3.83 (2.08)	3.89 (2.09)	3.95 (2.11)	2.60 (1.76)	3.57 (2.01)
23.	KALANAMAK 2	3.40 (1.97)	3.98 (2.12)	4.66 (2.27)	4.74 (2.29)	12.29 (3.58)	5.81 (2.45)
24.	RR 366-4	4.16 (2.16)	4.06 (2.13)	5.06 (2.36)	4.72 (2.28)	3.37 (1.97)	4.27 (2.18)
25.	NDR 97	3.94 (2.11)	3.39 (1.97)	7.21 (2.78)	5.10 (2.37)	2.14 (1.62)	4.36 (2.17)
26.	SWARN SUB 1	11.75 (3.50)	10.54 (3.32)	5.61 (2.47)	3.26 (1.94)	1.94 (1.56)	6.62 (2.56)
27.	SHUSK SAMRAT	5.40 (2.43)	5.25 (2.40)	11.11 (3.41)	10.10 (3.26)	3.15 (1.91)	7.00 (2.68)
SE $_{(m)}$		0.03	0.03	0.01	0.02	0.01	0.21
CD $_{(5\%)}$		0.22	0.19	0.09	0.12	0.09	0.57
CV $_{(\%)}$		3.81	3.58	1.22	1.82	1.83	20.54

* Values in parentheses are square root transformation ($\sqrt{(x + 0.5)}$) for uniform sample size (Steel and Torrie, 1960; Dhamu and Ramamoorthy, 2007) [8]; Adjusted infestation (%) value for new entries in augmented block design. # Mean infestation (%) value for major insect pests in randomized block design.



***** Numeric values are mean infestation (%) for major insect pests of rice.

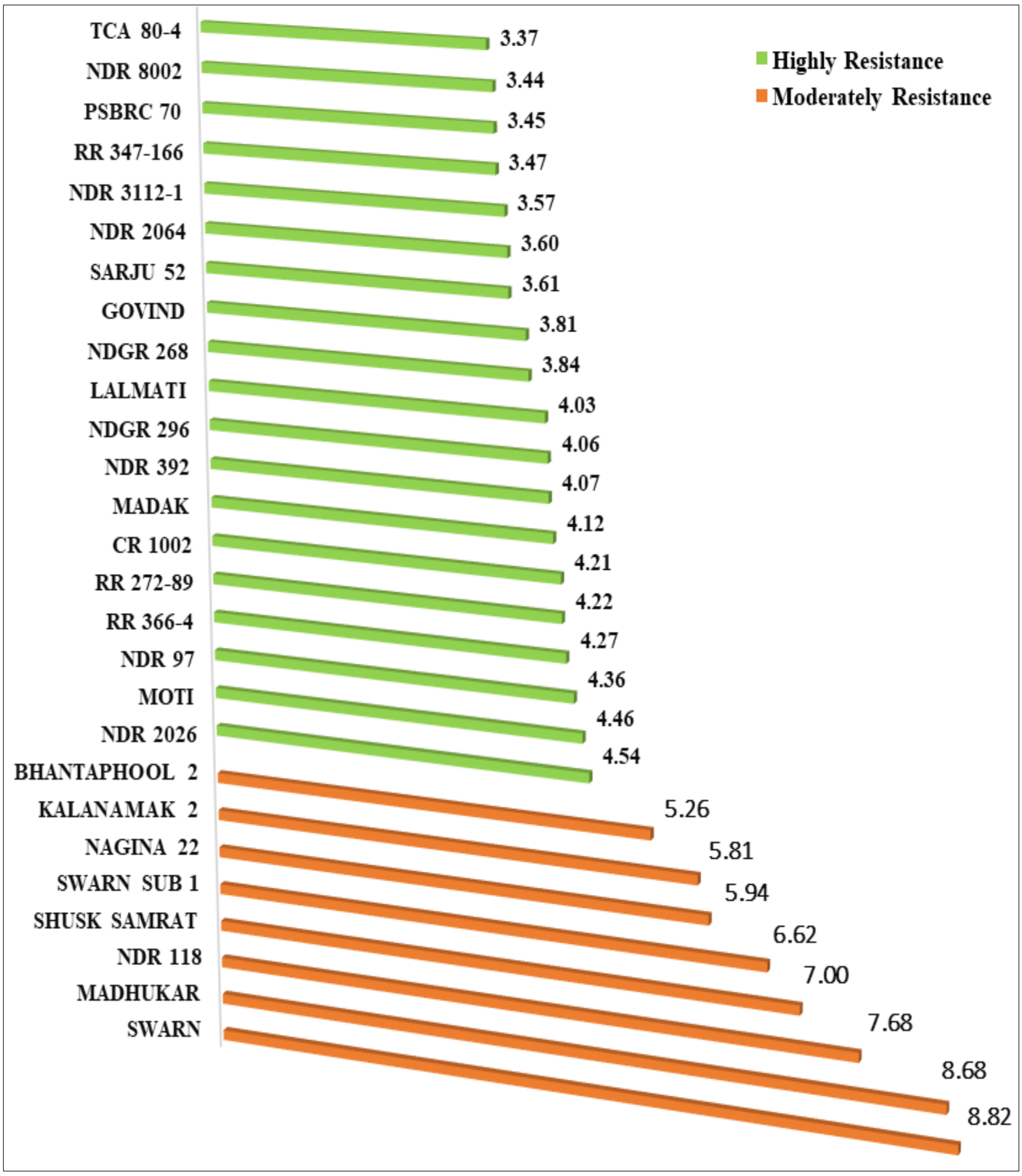
Fig 1: Mean of Rice Germplasm Resistance for Major Insect Pests (Pooled of 2014 & 15).*

Table 2: Mean Ranking of Rice Germplasm Resistance for Major Insect Pests (Pooled of 2014 & 15).*

S. N.	Germplasm Accessions	Infestation	Ranking		Screening of Resistance (Above/Below 10% Infestation) #
			Germplasm Accessions	Infestation	
1.	SARJU 52 (Check)	3.61 (2.01)	TCA 80-4	3.37 (1.95)	Highly Resistance
2.	MOTI (Check)	4.46 (2.21)	NDR 8002	3.44 (1.96)	Highly Resistance
3.	GOVIND (Check)	3.81 (2.04)	PSBRC 70	3.45 (1.97)	Highly Resistance
4.	SWARN	8.82 (2.92)	RR 347-166	3.47 (1.99)	Highly Resistance
5.	LALMATI	4.03 (2.16)	NDR 3112-1	3.57 (2.01)	Highly Resistance
6.	CR 1002	4.21 (2.14)	NDR 2064	3.60 (2.01)	Highly Resistance
7.	NDR 392	4.07 (2.11)	SARJU 52	3.61 (2.01)	Highly Resistance
8.	MADAK	4.12 (2.14)	GOVIND	3.81 (2.04)	Highly Resistance
9.	MADHUKAR	8.68 (2.95)	NDGR 268	3.84 (2.07)	Highly Resistance
10.	TCA 80-4	3.37 (1.95)	LALMATI	4.03 (2.16)	Highly Resistance
11.	NAGINA 22	5.94 (2.52)	NDGR 296	4.06 (2.12)	Highly Resistance
12.	PSBRC 70	3.45 (1.97)	NDR 392	4.07 (2.11)	Highly Resistance

13.	NDR 2026	4.54 (2.22)	MADAK	4.12 (2.14)	Highly Resistance
14.	NDR 2064	3.60 (2.01)	CR 1002	4.21 (2.14)	Highly Resistance
15.	NDR 8002	3.44 (1.96)	RR 272-89	4.22 (2.17)	Highly Resistance
16.	RR 272-89	4.22 (2.17)	RR 366-4	4.27 (2.18)	Highly Resistance
17.	NDGR 268	3.84 (2.07)	NDR 97	4.36 (2.17)	Highly Resistance
18.	NDGR 296	4.06 (2.12)	MOTI	4.46 (2.21)	Highly Resistance
19.	NDR 118	7.68 (2.75)	NDR 2026	4.54 (2.22)	Highly Resistance
20.	BHANTAPHOOL 2	5.26 (2.33)	BHANTAPHOOL 2	5.26 (2.33)	Moderately Resistance
21.	RR 347-166	3.47 (1.99)	KALANAMAK 2	5.81 (2.45)	Moderately Resistance
22.	NDR 3112-1	3.57 (2.01)	NAGINA 22	5.94 (2.52)	Moderately Resistance
23.	KALANAMAK 2	5.81 (2.45)	SWARN SUB 1	6.62 (2.56)	Moderately Resistance
24.	RR 366-4	4.27 (2.18)	SHUSK SAMRAT	7.00 (2.68)	Moderately Resistance
25.	NDR 97	4.36 (2.17)	NDR 118	7.68 (2.75)	Moderately Resistance
26.	SWARN SUB 1	6.62 (2.56)	MADHUKAR	8.68 (2.95)	Moderately Resistance
27.	SHUSK SAMRAT	7.00 (2.68)	SWARN	8.82 (2.92)	Moderately Resistance
SE (m)		0.21			
CD (5%)		0.57			
CV (%)		20.54			

***** Values in parentheses are square root transformation (√ (x + 0.5)) for uniform sample size (Steel and Torrie, 1960; Dhamu and Ramamoorthy, 2007) [8]; Adjusted infestation (%) value for new entries in augmented block design. # Highly Resistance (Below 5% infestation), Moderately Resistance (5-10% infestation), Moderately Susceptible (10-15% infestation), Highly Susceptible (Above 15% infestation).



***** Numeric values are mean infestation (%) of major insect pests of rice.

Fig 2: Mean Ranking of Rice Germplasm Resistance for Major Insect Pests (Pooled of 2014 & 15).*

Table 3: Mean Screening of Rice Germplasm Resistance for Major Insect Pests (Pooled of 2014 & 15).

S. No.	Major Insect Pests	Rice Germplasm Resistance			
		Highly Resistance (Grade 1; <5% infestation) (No.)	Moderately Resistance (Grade 2; 5.1 -10% infestation) (No.)	Moderately Susceptible (Grade 3; 10.1-15% infestation) (No.)	Highly Susceptible (Grade 4; >15% infestation) (No.)
1.	Yellow Stemborer	RR 347-166, NDR 118, NDR 2064, NDR 392, LALMATI, NDGR 268, SWARN, MADAK, KALANAMAK 2, SARJU 52, NDR 3112-1, TCA 80-4, GOVIND, CR 1002, PSBRC 70, NDR 8002, NDR 97, RR 272-89, NDR 2026, RR 366-4, MOTI, NDGR 296, BHANTAPHOOL 2 (23)	SHUSK SAMRAT, NAGINA 22 (2)	MADHUKAR, SWARN SUB1 (2)	(0)
2.	Common Rice Leaffolder	NDR 2064, NDR 8002, CR 1002, SARJU 52, SWARN, MADAK, PSBRC 70, RR 272-89, TCA 80-4, NDR 392, LALMATI, NDR 118, RR 347-166, NDGR 268, MOTI, GOVIND, NDR 97, BHANTAPHOOL 2, NDGR 296, NDR 3112-1, KALANAMAK 2, RR 366-4, NDR 2026 (23)	SHUSK SAMRAT, NAGINA 22 (2)	MADHUKAR, SWARN SUB1 (2)	(0)
3.	Brown Planthopper	RR 347-166, NDR 3112-1, BHANTAPHOOL 2, TCA 80-4, NDR 8002, KALANAMAK 2, SARJU 52, RR 366-4, NDR 2064, RR 272-89, NDGR 296, GOVIND, NDGR 268, PSBRC 70, SWARN SUB1 (15)	MADAK, NDR 392, LALMATI, NDR 2026, MOTI, CR 1002, NDR 97, MADHUKAR, NAGINA 22 (9)	SHUSK SAMRAT, NDR 118, SWARN (3)	(0)
4.	Rice Hispa	PSBRC 70, SWARN SUB1, RR 347-166, TCA 80-4, NDR 3112-1, BHANTAPHOOL 2, NDR 2064, SARJU 52, NDR 8002, MADAK, NDGR 268, LALMATI, RR 272-89, GOVIND, RR 366-4, KALANAMAK 2, MOTI, NDGR 296, CR 1002 (19)	NDR 2026, NDR 97, NAGINA 22, NDR 118, SWARN (5)	MADHUKAR, NDR 392, SHUSK SAMRAT (3)	(0)
5.	Rice Earheadbug	NDR 8002, TCA 80-4, PSBRC 70, GOVIND, SWARN SUB1, NDGR 296, NDR 97, NDR 2026, NDR 3112-1, SARJU 52, CR 1002, NDGR 268, LALMATI, NDR 392, SHUSK SAMRAT, MADHUKAR, MOTI, RR 366-4, NAGINA 22, RR 347-166, NDR 2064, RR 272-89, MADAK (23)	(0)	SWARN, NDR 118, BHANTAPHOOL 2, KALANAMAK 2 (4)	(0)
6.	Mean of Major Insect Pests	TCA 80-4, NDR 8002, PSBRC 70, RR 347-166, NDR 3112-1, NDR 2064, SARJU 52, GOVIND, NDGR 268, LALMATI, NDGR 296, NDR 392, MADAK, CR 1002, RR 272-89, RR 366-4, NDR 97, MOTI, NDR 2026 (19)	SWARN SUB1, SWARN, NDR 118, MADHUKAR, BHANTAPHOOL 2, KALANAMAK 2, SHUSK SAMRAT, NAGINA 22 (8)	(0)	(0)

Conclusion

The screening of rice germplasm was observed against major insect pests for two consecutive years 2014 and 2015 respectively. Of the total observed mean infestations of major insect pests of rice, there were 19 rice germplasm (TCA 80-4, NDR 8002, PSBRC 70, RR 347-166, NDR 3112-1, NDR 2064, SARJU-52, GOVIND, NDGR 268, LALMATI, NDGR 296, NDR 392, MADAK, CR 1002, RR 272-89, RR 366-4, NDR 97, MOTI, and NDR 2026) confined highly resistance and 8 rice germplasm (BHANTAPHOOL 2, KALANAMAK 2, NAGINA 22, SWARN SUB 1, SHUSK SAMRAT, NDR 118, MADHUKAR, and SWARN) confined moderately resistance respectively. The germplasm resistance was varied in highly resistance, moderately resistance**,** moderately susceptible, and highly susceptible scale of germplasm screening. The highly resistance, moderately resistance**,** and moderately susceptible rice germplasm were observed for all major insect pests of rice except Rice earhead bug (*Leptocorisa acuta* Thunberg) not confined moderately resistance germplasm. The highly susceptible germplasm were not observed for any major insect pests of rice. None of the germplasm were inference significant for highly resistance against mean infestation of major insect pests of rice.

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