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Research Article

Screening of Rice Genotypes Against Leaf Blast

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Abstract: Rice production and productivity is affected due to several biotic and abiotic stresses. Among the major biotic stresses blast disease of rice caused by *Pyricularia oryzae* has the potential to causes annually yield loss as high as 70–80% when pre-disposing factors favour epidemic development. The use of resistant cultivars is the most cost-effective and ecofriendly method for managing the disease. The present study was carried out for the screening of rice genotypes against *P. oryzae*. A total number of 48 genotypes showed multiple disease resistance during previous years experiments were selected and evaluated against the leaf blast of rice. The screening was carried out under artificial inoculation conditions in the field by adopting uniform nursery pattern. The result showed that out of 48 rice genotypes, none of the genotype found immune towards the disease. Whereas six genotypes were showed resistant reaction, nineteen genotypes were showed moderately resistant reaction and seventeen genotypes showed moderately susceptible reaction and six genotypes including susceptible check P-203 and TN-1 were showed susceptible reaction. The consistent resistant reactions found in six genotypes *viz.,* NWGR-12016, 13055, 13087, 14005, 14035 and 14059 against blast disease. These genotypes can be used in breeding programme for developing the blast resistant varieties.

Key word: Leaf blast, Rice genotypes, Screening

Introduction

Rice (*Oryza sativa* L.) is the major source of food for more than 2.7 billion peoples and by the year of 2025, this number will grow to 3.9 billion people. Human consumption accounts for 85% of total production for rice. More than 90% of the world's rice is produced and consumed in the Asia-Pacific region (Kulmitra *et al.*, 2017). India is the largest rice producing country accounting for about one third of the world acreage under the crop. The crop occupies an area of 44 million hectares with the production of 117.94 million tonnes and productivity of 2600 kg per ha in India (Anonymous, 2019). Rice production and productivity is affected due to several biotic and abiotic stresses. Among the biotic stresses, diseases are the major constraints. Among the major diseases blast of rice caused by *Pyricularia oryzae* Cavara [Synonym – *Pyricularia grisea* Sacc., the anamorph of *Magnaporthe grisea* (Hebert Yaegashi and Udagawa)] causes annually yield loss as high as 70–80% when pre-disposing factors favour epidemic development (Piotti *et al.*, 2005). Chandrasekhara *et al.* (2008) reported that rice blast caused by *P. oryzae* is causes yield losses up to 65% in susceptible rice cultivars. Padmanabhan (1965) investigated the relationship between yield and blast. He observed a 4% loss as a result of a 4% disease incidence. Bhat *et al.* (2013) conducted experiment in Kashmir and they recorded about 5-70% grain yield losses due to the disease depending upon the stage of the crop infected and severity of the disease. Pasha *et al.* (2013) reported yield reduction of 10- 20% of susceptible rice varieties from Iran, whereas in severe cases the yield loss caused by rice blast may reach up to 80%. Mustafa *et al.* (2018) evaluated 9 coarse rice varieties and 31 fine rice varieties were sown for two years to determine their resistance to rice blast disease and yield (2015 and 2016). In 2015, rice lines KSK 456 and KSK-464 were found to be moderately resistant and yielded higher than other varieties (5.8 t/ha and 5.6 t/ha, respectively). In 2016, rice lines KSK 456 and KSK-464 performed well in terms of blast resistance and yield, yielding 5.9 t/ha and 5.7 t/ha, respectively. Ghimire *et al.* (2019) were screened different genotypes for rice blast disease and tested in one factor RCBD with three replications and nine genotypes. The experiment was carried out to learn more about how different genotypes respond to rice blast disease. The seriousness of the disease, was found to be elevated in the Shankharika genotype and low in the Sabitri genotype. Thus, the Sabitri genotype provides adequate resistance to rice blast disease in rice grown in the Baitadi district's hill region under Direct Seeded Rice (DSR) conditions. The use of resistant cultivars is the most cost-effective and environmentally benign method for controlling rice blast (Khan *et al.,* 2001; Haq *et al.,* 2002), However, resistance to the disease can be break as new virulent races of the pathogen evolve. The purpose of this study was to assess the inbuilt resistance of different rice genotypes against leaf blast disease.

Materials And Methods

The experiment was carried out with 48 rice genotypes, showed multiple disease resistance during previous years trials. The screening trial was carried out with 48 rice genotypes including 2 susceptible checks 1 NC (TN-1) + 1 LC (P-203) and 2 resistant checks 1 NC (Tetep)

+ 1 LC (Mahisagar) were again screened against leaf blast to find out the source of stable resistance at Main Rice Research Station, Anand Agricultural University, Nawagam, Kheda, (Latitude: 22.79685`N, Longitude: 72.57486`E, Elevation: 37 m above mean sea level), Gujarat, India during *kharif* 2020.

List of evaluated genotypes: NWGR-8001, NWGR-9078, NWGR-9147, NWGR-10046, NWGR-11002, NWGR-11048, NWGR-12002, NWGR-12009, NWGR-12015, NWGR-12016, NWGR-12041, NWGR-12047, NWGR-12056, NWGR-12080, NWGR-12089, NWGR-13008, NWGR-13010, NWGR-13031, NWGR-13052, NWGR-13055, NWGR-13087, NWGR-13131, NWGR-14005, NWGR-14021, NWGR-14026, NWGR-14027, NWGR-14030, NWGR-14031, NWGR-14035, NWGR-14036, NWGR-14048, NWGR-14059, NWGR-14060, NWGR-14056, NWGR-14057, NWGR-14071, NWGR-14072, NWGR-14084, NWGR-15019, NWGR-15038, NWGR-15047, NWGR-15050, NWGR-15054, NWGR-15064, TN-1, P-203, Tetep and Mahisagar.

Layout: The nursery was grown on raised beds. All the recommended agronomical practices were adopted for raising the nursery of all genotypes. The experiment was established under transplanting conditions with the spacing of 20x15 cm. The row length of each genotype was 1.5 m along with two replications. The one row of each susceptible variety *i.e.* P-203 and TN- 1 was transplanted after every 5 genotypes. In addition to this the experimental plot were surrounded by border rows of highly susceptible variety P-203. All the recommended agronomical practices were adopted. The need based irrigation was applied.

Artificial inoculation: Conidial suspension was prepared from 7 days old culture of *P. oryzae* grown on Oat meal agar. Artificial inoculation was done by spraying conidial suspension (1×10^5) after 25 days of transplanting.

Observations recorded: observations on disease score were recorded two times by adopting 0-9 SES scale after 15 and 30 days of disease establishment as given in the table (1).

Table 1: SES scale for Leaf Blast

Scale	Description
0	No lesions.
1	Small brown specks of pinhead size without sporulating centre.
2	Small roundish to slightly elongated, necrotic grey spots, about 1-2 mm in diameter with a distinct brown margin and lesions are mostly found on the lower leaves.
3	Lesion type is the same as in scale 2, but significant numbers of lesion are on the upper leaves.
4	Typical sporulating blast lesions, 3 mm or longer, infecting less than 2% of the leaf area.
5	Typical blast lesions infecting 2-10% of the leaf area.
6	Blast lesions infecting 11-25% leaf area.
7	Blast lesions infecting 26-50% leaf area.
8	Blast lesions infecting 51-75% leaf area.
9	More than 75% leaf area affected.

Results and Discussion

Among the fourty-eight genotypes screened, six genotypes (NWGR-12016, NWGR-13055, NWGR-13087, NWGR-14005, NWGR-14035, NWGR-14059) were found resistant against leaf blast disease. However, nineteen genotypes (NWGR-8001, NWGR-9147, NWGR-10046, NWGR-11002, NWGR-11048, NWGR-12002, NWGR-12009, NWGR-12041, NWGR- 12047, NWGR-13008, NWGR-13052, NWGR-14031, NWGR-14057, NWGR-14071, NWGR-14072, NWGR-14084, NWGR-15038, Mahisagar, Tetap) showed a moderately resistant reaction to leaf spot. Seventeen genotypes

(NWGR-9078, NWGR-12015, NWGR- 12080, NWGR-12089, NWGR-13010, NWGR-13031, NWGR-13131, NWGR-14021, NWGR-14026, NWGR-14027, NWGR-14030, NWGR-14056, NWGR-15019, NWGR-15047, NWGR-15050, NWGR-15054, NWGR-15064) was found moderately susceptible to leaf blast disease. Six genotypes (NWGR-12056, NWGR-14036, NWGR-14048, NWGR-14060, P-203, TN-1) were found susceptible to leaf blast disease. Not a single genotype found highly susceptible to leaf blast disease. The result of the present study revealed considerable variation towards disease reaction among rice genotypes represented in the Table (2). Similar researches were also carried out by earlier workers viz., Mustafa et al. (2018), Ghimire et al. (2019), who also screened the genotypes of rice against blast disease of rice.

Table 2: Responses of rice germplasm to rice blast disease caused by *Pyricularia oryzae*

Sr No.	Genotypes	Leaf blast SES Scale	Disease reaction
1	NWGR-8001	3	MR
2	NWGR-9078	5	MS
3	NWGR-9147	4	MR
4	NWGR-10046	3	MR
5	NWGR-11002	3	MR
6	NWGR-11048	3	MR
7	NWGR-12002	3	MR
8	NWGR-12009	4	MR
9	NWGR-12015	5	MS
10	NWGR12016	2	R
11	NWGR-12041	4	MR
12	NWGR-12047	4	MR
13	NWGR-12056	7	S
14	NWGR-12080	5	MS
15	NWGR-12089	6	MS
16	NWGR-13008	3	MR
17	NWGR-13010	5	MS
18	NWGR-13031	4	MS
19	NWGR-13052	3	MR
20	NWGR-13055	2	R
21	NWGR-13087	2	R
22	NWGR-13131	5	MS
23	NWGR-14005	3	R
24	NWGR-14021	5	MS
25	NWGR-14026	6	MS
26	NWGR-14027	5	MS
27	NWGR-14030	5	MS
28	NWGR-14031	4	MR
29	NWGR-14035	2	R
30	NWGR-14036	7	S
31	NWGR-14048	7	S
32	NWGR-14059	2	R
33	NWGR-14060	7	S
34	NWGR-14056	5	MS
35	NWGR-14057	4	MR
36	NWGR-14071	3	MR
37	NWGR-14072	3	MR
38	NWGR-14084	3	MR
39	NWGR-15019	6	MS
40	NWGR-15038	4	MR
41	NWGR-15047	5	MS
42	NWGR-15050	5	MS
43	NWGR-15054	6	MS
44	NWGR-15064	5	MS
45	TN-1	7	S
46	P-203	7	S
47	Mahisagar	3	MR
48	Tetap	3	MR

Conclusion

The use of fungicides is being challenged as a result of rising concerns about air pollution and health issues, yet it is not feasible for some reason. The most promising strategy to combat the disease is to develop resistance in the host plant. Based on the above findings, the consistent resistance reactions found in six genotypes are concluded *viz.* NWGR-12016, NWGR-13055, NWGR-13087, NWGR-14005, NWGR-14035, NWGR-14059 against leaf blast. These genotypes can be used in breeding programme for developing leaf blast resistant varieties. Further the study and time to time field evaluation of rice genotypes against leaf blast is entertained.

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