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SCREENING OF RICE LINES/VARIETIES AGAINST RICE BLAST (*PYRICULARIA ORYZAE*) DISEASE UNDER NORMAL CONDITION OF DISTRICT BAHAWALNAGAR

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ABSTRACT

Development of resistant crop varieties is one of the significant tools of integrated pest management (IPM) practices. Screening of rice genotypes is the most effective physical tool for provision of resistant genotypes. In the present experiment, 9 coarse rice lines/varieties and 31 fine rice lines/varieties were sown for assessing their resistance and yield against rice blast disease for two consecutive years (2015 and 2016). During 2015, rice lines KSK 456 and KSK-464 found to be moderately resistant and yielded higher (5.8 t/ha and 5.6 t/ha respectively) as compared to other lines/varieties. During 2016, rice lines KSK 456 and KSK-464 showed good results in terms of resistance to blast and also yield was higher i.e. 5.9 t/ha and 5.7 t/ha respectively.

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INTRODUCTION

Rice is the important staple food for a large part of the human population in the world today. In Pakistan rice was sown on 2724 thousand hectares with an average yield of 2514 kg ha^{-1} (GOP, 2016). It is the most important food source in areas with high population and low dietary levels (Kinoshitai and Mori, 2001). Rice blast disease destroyed food more than adequate to eat for 60 million people and 50% paddy yield every year (Roy-Barman and Chattoo, 2005). Rice blast is most important disease that attack on rice crop. There are two major rice growing regions in Pakistan. One of districts of Sindh and adjoint district of Baluchistan province. The other is located in North Eastern Punjab (PARC, 2006). Rice blast is one of the most dangerous and broad spread diseases (Jia *et al.*, 2000). Rice yield in Pakistan is very low as compared to other countries of the world and this low yield is accredited to numerous biotic and abiotic factors. Crop diseases can be managed by the use of fungicides, development of resistant varieties, agronomic practices and biotechnological methods (Ribot *et al.*, 2008).The use of resistant varieties is the mainly economical and environment friendly tools for the management strategies to minimize incidence of rice blast (Haq *et al.*, 2002). It is observed that at farmers' fields, neck blast is consider more dangerous than leaf blast, because it is directly related to paddy yield losses (Zhu *et al.*, 2005). Many basmati varieties cultivated in the country are susceptible to Rice blast disease. Rice blast is proficient of causing severe losses to rice crop (Khan *et al.*, 2001). One of the safe measures to evade such a situation is to grow resistant crop genotypes (Ahmad *et al.*, 2011).

The objective of this study was to examine the rice varieties/lines that are resistant against Rice blast disease which can be used for further breeding Programme.

MATERIALS AND METHODS

The present research studies were conducted at the experimental farm of Rice Research Station Bahawalnagar during two consecutive years (2015 and 2016). Forty different rice varieties/lines were selected for assessing their resistance or susceptibility response and yield against Rice Blast disease. Seeds of all the rice varieties/lines were grown in nursery. Thirty day-old nursery of these lines were transplanted in well prepared soil. The plot sowing was done by keeping plant to plant and row to row distance of 20 cm. The experiment was designed in a Randomized Complete Block. Soil of the plots was kept moist with standing water at the time of transplanting and succeeding growth stages. All the normal agronomic practices were followed for growth of crop and no spray fungicides for the control of rice blast. To control weeds, the first weeding was done at 15 days after transplanting followed by second and third weeding done at 15 days interval after first and second weeding. A basal dose of nitrogen (N) and phosphorus (P) at the rate of 30 kg as urea and 50 kg ha^{-1} as triple super phosphate respectively were uniformly incorporated in the soil at the time of sowing, and then 30 kg N as urea added at tillering stage. Stem borers damage was recorded as dead hearts percentage at vegetative growth and whiteheads percentage at maturity stage by counting number of dead hearts and whiteheads per 1 m^2 area of rice plants in each replication. After harvesting, paddy yield data was taken per 3 m^2 and subjected to proper statistical analysis for testing the significance of results.

Isolation of *Pyricularia oryzae*: Rice blast Infected leaves and nodes of rice plant were cut into small pieces (0.5-1.0 cm) and surface disinfested with 2% sodium hypochlorite for two minutes. infected cut pieces were then washed with sterilized water and placed on Potato Dextrose Agar (PDA) (Difco) plates. These PDA plates were incubated at 25 ºC for 4 days for the isolation of *P. oryzae*. The identification of the pathogen was made by the colony characteristics of the isolates on the PDA plates (Agrawal *et al*., 1989).

Screening of rice germplasm against rice blast: The uniform blast nursery method approved by International Rice Research Institute (IRRI) was used for screening of rice varieties/lines against Rice blast. Disease severity was calculated by using 0-9 disease rating scale reported by Khan *et al.* (2001) (Table 1).

Table 1. 0-9 grade disease rating scale for rice blast screening.

Grade	Disease severity	Host response
0	No lesion observed	Highly Resistant
1	Small brown specks of pin point size	Resistant
3	Lesion type same as in 2, but significant number of lesions on the upper leaves	Moderately Resistant
5	Typical blast lesions of 3mm or longer infecting 4-10% of the leaf area	Moderately Susceptible
7	Typical blast lesions of 3 mm or longer infecting 26-50% of the leaf area	Susceptible
9	Typical blast lesions of 3 mm or longer infecting more than 75% leaf area affected	Highly Susceptible

RESULTS AND DISCUSSION

Kharif 2015: Screening of 9 coarse and 31 fine lines/varieties of rice against rice blast disease exposed that, none of the variety was highly resistant. Fifteen lines/varieties i.e. KSK-463, KSK-457, KSK-452, KSK-456, KSK-464, KSK-459, KSK-466, PK-8749-2-4-5-1, PK-8662-12-2-1, PK-8536-15-1, PK-8647-11-1-1, PK-9586-8-2, PK-8677-18-1-7-14, PK-3317-12 and SR-12 were moderately resistant with '3' scale (Table 1). Twenty-four lines/varieties i.e. KSK-468, KSK-469, PK-7688, PK-8649, PK-8660-13-3-1, PK-8685-1-1-1-1, PK-8649-5-1-1-2, PK-3810-30-1, PK-8535-15-2, PK-8662-2-15-4, PK-8662-12-2, PK-8644-1-3-1, PK-7837-11-1-1-3-1, PK-7899-9-2-1-1-1, PK-10052-1, PK-9843-15-1, PK-7899-9-2-1-1-1, PK-9653-9-3, PK-177, PK-178-2, PK-6292, PK-3327-2, PK3732-15-1 and PK-3303-7-2 were shown moderately susceptible response with '5'scale (Table 2). One line i.e. PK13-79-9-1-1 were shown susceptible response with '7'scale (Table 2). Dar *et al.* (2015) revealed that none of the test line was immune or highly resistant. Four crosses namely K-08-60 x IR-68888A, K-08-61 x SKAU-11A, K08-61 x IR-68888A, PS-5 x SKAU-11A and one parent PS-5 were found to be resistant. These resistance sources recognized from rice lines/varieties can be used in breeding programs for the development of rice blast resistant varieties. In field conditions increased seed yield (5.8 t/ha and 5.6 t/ha) were obtained by lines KSK 456 and KSK-464 respectively.

Table 2. Screening of rice germplasm against rice blast disease in Kharif 2015.

Germplasm	Disease incidence %	Host Response	Status	Paddy yield t/ha
KSK-463	4.5	3	MR	5.4
KSK-457	4	3	MR	4.8
KSK-452	4.2	3	MR	5.5
KSK-456	4.3	3	MR	5.8
KSK-464	4.7	3	MR	5.6
KSK-459	5	3	MR	4.9
KSK-466	7.5	5	MS	4.5
KSK-468	15	5	MS	4.2
KSK-469	10	5	MS	4.8
PK-7688	12	5	MS	4
PK-8649	20	5	MS	4.2
PK-8660-13-3-1	14	5	MS	4.3
PK-8685-1-1-1-1	22	5	MS	4.25
PK-8749-2-4-5-1	5	3	MR	4.6
PK-8662-12-2-1	4.9	3	MR	3.95
PK-8649-5-1-1-2	22	5	MS	4.1
PK-3810-30-1	20	5	MS	4.4
PK-8535-15-2	24	5	MS	4.2
PK-8662-2-15-4	21	5	MS	4.1
PK-8662-12-2	18	5	MS	4
PK-8644-1-3-1	19	5	MS	3.95
PK-8536-15-1	4.5	3	MR	4.1
PK-7837-11-1-1-3-1	20	5	MS	4.3
PK-8647-11-1-1	3.5	3	MR	4.4
PK-7899-9-2-1-1-1	8.5	5	MS	4.1
PK-10052-1	12	5	MS	3.95
PK-9843-15-1	16	5	MS	4.2
PK-7899-9-2-1-1-1	18	5	MS	4.3
PK-9653-9-3	20	5	MS	4.4
PK-9586-8-2	4.5	3	MR	4.2
PK-8677-18-1-7-14	3.5	3	MR	4.5
PK-177	8.5	5	MS	4.2
PK-178-2	7.5	5	MS	4
PK-6292	18	5	MS	3.98
PK13-79-9-1-1	28	7	S	3.8
PK-3317-12	3.5	3	MR	3.95
PK-3327-2	7.5	5	MS	4
PK3732-15-1	20	5	MS	4.4
PK-3303-7-2	14	5	MS	4.2
SR-12	3.8	3	MR	4.3

Kharif 2016: Screening of 9 coarse and 31 fine lines/varieties of rice against rice blast disease exposed that, none of the variety was highly resistant. Fifteen lines/varieties i.e. KSK-463, KSK-457, KSK-452, KSK-456, KSK-464, KSK-459, KSK-466, PK-8749-2-4-5-1, PK-8662-12-2-1, PK-8536-15-1, PK-8647-11-1-1, PK-9586-8-2, PK-8677-18-1-7-14, PK-3317-12 and SR-12 were moderately resistant with '3' scale. Twenty-four lines/varieties i.e. KSK-468, KSK-469, PK-7688, PK-8649, PK-8660-13-3-1, PK-8685-1-1-1-1, PK-8649-5-1-1-2, PK-

3810-30-1, PK-8535-15-2, PK-8662-2-15-4, PK-8662-12-2, PK-8644-1-3-1, PK-7837-11-1-1-3-1, PK-7899-9-2-1-1-1, PK-10052-1, PK-9843-15-1, PK-7899-9-2-1-1-1, PK-9653-9-3, PK-177, PK-178-2, PK-6292, PK-3327-2, PK3732-15-1 and PK-3303-7-2 were shown moderately susceptible response with '5'scale (Table 3).

Table 3. Screening of rice germplasm against rice blast disease in Kharif 2016.

Germplasm	Rice Blast incidence %	Host Response	Status	Paddy yield t/ha
KSK-463	4.2	3	MR	5.5
KSK-457	3.8	3	MR	4.7
KSK-452	4.5	3	MR	5.6
KSK-456	3.5	3	MR	5.9
KSK-464	4.8	3	MR	5.7
KSK-459	4.4	3	MR	5
KSK-466	4.2	3	MR	4.6
KSK-468	17	5	MS	4.4
KSK-469	8.2	5	MS	4.9
PK-7688	14	5	MS	4.1
PK-8649	18	5	MS	4.2
PK-8660-13-3-1	12	5	MS	4.3
PK-8685-1-1-1-1	19	5	MS	4.2
PK-8749-2-4-5-1	4.8	3	MR	4.4
PK-8662-12-2-1	4.6	3	MR	4.5
PK-8649-5-1-1-2	20	5	MS	3.95
PK-3810-30-1	18	5	MS	4.2
PK-8535-15-2	17	5	MS	4.25
PK-8662-2-15-4	21	5	MS	4.1
PK-8662-12-2	16	5	MS	3.95
PK-8644-1-3-1	18	5	MS	4.1
PK-8536-15-1	4.8	3	MR	4.2
PK-7837-11-1-1-3-1	22	5	MS	4.1
PK-8647-11-1-1	3.6	3	MR	4.5
PK-7899-9-2-1-1-1	9	5	MS	4.2
PK-10052-1	14	5	MS	4
PK-9843-15-1	19	5	MS	4.1
PK-7899-9-2-1-1-1	22	5	MS	3.85
PK-9653-9-3	23	5	MS	4.1
PK-9586-8-2	3.5	3	MR	4.4
PK-8677-18-1-7-14	4	3	MR	4.2
PK-177	9	5	MS	4.5
PK-178-2	6.8	5	MS	4.2
PK-6292	16	5	MS	4.1
PK13-79-9-1-1	27	7	S	4.1
PK-3317-12	3.8	3	MR	4
PK-3327-2	8	5	MS	4.1
PK3732-15-1	22	5	MS	4
PK-3303-7-2	16	5	MS	4.8
SR-12	3.2	3	MR	4.3

One line i.e. PK13-79-9-1-1 were shown susceptible response with '7'scale (Table.1). Sabin *et al.* (2016)

reported that Sankharika, Taichung-176, pusa basmati, NR 11111-B-B-23 and NR10490-89-3-2-1 were found most susceptible and sabitri and Radha-4 were found to be resistant. As Taichung-176, Sankharika was found to be most susceptible to blast on both field and lab condition as NARC described Taichung-176 susceptible variety to mild hills and sabitri was found to be most resistant among all genotypes. These resistance sources recognized from rice lines/varieties can be used in breeding programs for the development of rice blast resistant varieties. In field conditions increased seed yield (5.9 t/ha and 5.7 t/ha) were obtained by lines KSK-456 and KSK-464respectively.

CONCLUSION

The rice lines/varieties (KSK-463, KSK-457, KSK-452, KSK-456, KSK-464, KSK-459, PK-8749-2-4-5-1, PK-8662-12-2-1, PK-8536-15-1, PK-8647-11-1-1, PK-9586-8-2, PK-8677-18-1-7-14, PK-3317-12 and SR-12) shown moderately resistant response in both the years and hence, they can be used as varieties or can be used in future breeding programme as a source of rice blast resistance.

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