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Short Communication

Screening and identification of resistant sources against sheath blight of rice

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Abstract

Sheath blight of rice, caused by *Rhizoctonia solani* Kuhn (Teleomorph: *Thanatephorus cucumeris* (Frank) Donk) is one of the important rice diseases after rice blast and is known to cause yield losses up to the extent of 1.2-69.0 per cent. For an effective management of sheath blight, different disease management approaches could be opted but the use of resistant varieties is considered as the most reliable one. Considering the importance of crop and extent of damage, a set of 50 rice germplasm lines was screened against sheath blight of rice, out of which 14 lines showed resistant reaction and 16 lines exhibited moderately resistant reaction, respectively. Rest 20 lines showed moderately susceptible and susceptible reaction. Rice germplasm lines identified in this study could be brought into rice breeding programmes after field validation.

Key words: Germplasm, resistance, management, sheath blight

Rice (*Oryza sativa* L.) is the world's second most economically important cereal crop after wheat in terms of total area and production. In world, rice is cultivated in an area of 161.1 million hectares with production of 751.9 million tonnes (Anonymous 2017). India ranks first in the world in terms of area under rice (43.19 million hectares) and second in terms of production (110.15 million tonnes) with the productivity of 2550 kilogram per hectare (Anonymous 2017). In Himachal Pradesh, the area under rice cultivation is 73.69 thousand hectares with production of 117.80 thousand metric tonnes (Anonymous 2017).

The production and productivity of rice is being adversely affected by several biotic and abiotic stress factors (Datta *et al*. 2017). Sheath blight of rice is known as the second most economically important disease after rice blast (Lee and Rush 1983). Earlier sheath blight was considered as the minor disease but recently it has attained the status of major disease not only in India but throughout the world (Biswas *et al*. 2011) causing yield losses to the extent of 1.2 to 69.0 per cent (Naidu 1992). In India, the disease was first reported from Gurdaspur, Punjab by Paracer and Chahal in 1963 (Kohli 1966). For an effective management of sheath blight, many strategies could be followed. Among all, the use of chemicals is considered as the best practice but the adverse effect of chemicals on ecosystem and high cost, makes it difficult to further rely on their usage for the management of diseases (Yellareddygari *et al*. 2014). Additionally, the undue application of fungicides imparts huge selection pressure on the pathogen and that further leads to fungicidal resistance (Dath 1990). Considering the awareness among consumers regarding intake of pesticide free food, scientists are making efforts for the identification of new resistance sources. So far, none of the germplasm lines is found completely resistant to sheath blight (Pavani *et al*. 2018) and the resistance in the cultivable varieties of rice ranges from very susceptible to moderately resistant (Kumar *et al*. 2009). Keeping in view the aforesaid limitations, a set of 50 rice germplasm lines was screened for resistance to sheath blight.

A set of fifty germplasm lines representing Japonica, Basmati and Indica groups was procured from the RWRC, Malan and were screened for the resistance against ShB of rice. The experiment was conducted in plastic pots in complete randomized design (CRD). The sterilized soil was inoculated with twelve days old grain culture of *R. solani* by thoroughly mixing at the rate of 50 g/ kg (1:20). After seven days of inoculation, the pots were filled with sick soil and after that, twenty five days old seedlings of different lines of rice were transplanted in pots containing sick soil. Proper moisture (> 95% RH) was maintained by regular watering of plants. On the appearance of disease symptoms, data on disease incidence and severity were recorded. Rating of disease was done by using 0-9 standard scale based on relative lesion height given by SES of Rice (IRRI, 2002):

$$\text{Relative lesion height (\%)} = \frac{\text{Lesion height (cm)}}{\text{Plant height (cm)}} \times 100$$

As per 0-9 scale, 0: no infection observed (immune); 1: lesions limited to lower 20% of the plant height (resistant); 3: 20-30% (moderately resistant); 5: 31-45% (moderately susceptible); 7: 46-65% (susceptible) and 9: more than 65% (highly susceptible), respectively. The germplasm was categorized under different categories on the basis of disease reaction.

Perusal of the data in Table 1 indicated that the lowest relative lesion height was recorded in HPR 2720 (12.37%) followed by Himalayan 1 (12.40%) and Himalayan 2 (12.67%). Whereas, highest relative lesion height (49.39%) was recorded in HPU 2216 followed by VL 221 (46.84%) and Palam Dhan (46.77%).

Among fifty genotypes evaluated for resistance, fourteen genotypes, *viz*., Himalayan 1, Himalayan 2, Kasturi, China 988, HPR 2720, NBPGR 45, NBPGR 468, NBPGR 501, NBPGR 565, NBPGR 619, NBPGR 646, NBPGR 659, NBPGR 668 and NBPGR 721 were resistant to sheath blight. While sixteen genotypes, *viz*., HPR 2612, HPU 741, HPW 2143, HPR 2656, Hasan Sarai, HPR 2421, HPR 2795, NBPGR 262, NBPGR 415, NBPGR 480, NBPGR 483, NBPGR 571, NBPGR 620, NBPGR 647, NBPGR 670 and NBPGR 671 were found to be moderately resistant. Seventeen genotypes, *viz*., HPU 799, HPR 1068, Nagar Dhan, Varun, Bhrigu Dhan, HPR 1156, HPR 2280, T-23, Him Dhan, NBPGR 58,

Table 1. Evaluation of rice germplasm against sheath blight of rice

Rice germplasm	Disease severity (%)	Disease Score	Reaction
Himalayan 1	12.40	1	R
Himalayan 2	12.67	1	R
HPU 2216	49.39	7	S
HPU 799	35.36	5	MS
HPR 2612	23.53	3	MR
HPR 1068	32.25	5	MS
Palam Dhan	46.77	7	S
HPU 741	26.58	3	MR
HPW 2143	23.32	3	MR
Kasturi	13.76	1	R
VL 221	46.84	7	S
HPR 2656	20.71	3	MR
Nagar Dhan	36.59	5	MS
Varun	31.09	5	MS
Bhrigu Dhan	40.21	5	MS
HPR 1156	40.69	5	MS
HPR 2280	35.87	5	MS
Hasan Sarai	22.94	3	MR
T 23	43.81	5	MS
HPR 2421	22.54	3	MR
China 988	18.55	1	R
HPR2795	23.26	3	MR
Him Dhan	32.95	5	MS
HPR 2720	12.37	1	R
NBPGR 45	14.61	1	R
NBPGR 58	36.57	5	MS
NBPGR 224	40.82	5	MS
NBPGR 262	21.65	3	MR
NBPGR 415	22.89	3	MR
NBPGR 436	37.24	5	MS
NBPGR 458	43.47	5	MS
NBPGR 468	16.26	1	R
NBPGR 478	34.22	5	MS
NBPGR 480	25.95	3	MR
NBPGR 483	25.72	3	MR
NBPGR 501	18.99	1	R
NBPGR 565	13.61	1	R
NBPGR 571	20.98	3	MR
NBPGR 572	38.25	5	MS
NBPGR 619	16.26	1	R
NBPGR 620	22.84	3	MR
NBPGR 642	31.02	5	MS
NBPGR 646	13.95	1	R
NBPGR 647	22.40	3	MR
NBPGR 658	31.76	5	MS
NBPGR 659	17.78	1	R
NBPGR 668	19.24	1	R
NBPGR 670	28.88	3	MR
NBPGR 671	24.19	3	MR
NBPGR 721	17.17	1	R
CD (P = 0.05)	4.82		

NBPGR 224, NBPGR 436, NBPGR 458, NBPGR 478, NBPGR 572, NBPGR 642 and NBPGR 658 were found moderately susceptible and three genotypes *viz*., HPU 2216, Palam dhan and VL221 were susceptible to *R. solani*. A large number of rice germplasm have earlier been screened for resistance to ShB under natural and artificial inoculation conditions by many workers (Dubey *et al*. 2014; Chandra *et al*. 2016; Kumar *et al*. 2017; Pavani *et al*. 2018) but none of the genotypes was found immune or resistant. However, many entries have been reported to be moderately resistant to ShB. As the genotypes screened in the present experiment were new so, no specific information was available related to their resistance status against ShB of rice in the literature and in future there is a need for continuous screening of large number of rice genotypes against *R. solani* to find out resistant genotypes.

Conflicts of interest: The authors declare that there is no conflict of interest in this research article.

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