Varietal Screening of Rice Genotypes for Stem Rot (*Sclerotium oryzae*) under Artificial Inoculation Method

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Abstract— Rice (Oryza sativa L.) is a staple food in many countries and food security to millions of population in the world and is one of the major food crops of India. Stem rot is the one among major diseases of paddy infect the crop from moderate to severe form and also result in commercial yield losses. Looking to the disease severity, the present investigation was carried out to study the sources of resistance of pathogen in order to minimize the crop losses of rice. Screening of forty four genotypes along with two susceptible checks against stem rot pathogen under artificial inoculation condition during kharif 2019 revealed that, 18 genotypes were found moderately resistant viz., NVSR-317, NVSR-348, NVSR-355, NVSR-2147, NVSR-2566, NVSR-330, NVSR-360, NVSR-365, NVSR-370, NVSR-374, NVSR-405, NVSR-407, NVSR-2102, NVSR-2117, NVSR-2130, NVSR-2140, NVSR-2153 and IET-24336. Whereas, 12 genotypes viz., NVSR-2101, NVSR-328, NVSR-2528, NVSR-331, NVSR-335, NVSR-364, NVSR-384, NVSR-2435, NVSR-368, IET-25470, GR-11 and TN-1 were found susceptible to Sclerotium oryzae.

Keywords— Rice, Sclerotium oryzae, Genotypes, Pathogen.

I.   INTRODUCTION

Rice (*Oryza sativa* L.) is the most important cereal crop in the developing world and is a staple food of over half the world's population and food security to millions of population in the world. The total area of the world under harvested rice is 167.24 million hectares producing 500 million tonnes of grains in 2017 (Anonymous, 2020). In India, rice is cultivated on 43.19 million hectares with an annual production of 117.47 million tonnes and annual yield 2550 kg/ha (Anonymous, 2019). In Gujarat, Rice is cultivated on 0.84 million hectares with an annual production of 1.93 million tonnes and annual yield 2306 kg/ha in 2016-2017 (Anonymous, 2017). Stem rot is a fungal disease caused by *Sclerotium oryzae* was first described from Italy by Cattaneo in the sclerotial form in 1876 and he was given name *Sclerotium oryzae* Catt. Cavara in 1889 later reported *Helminthosporium sigmoideum* Cav. on rice (Gopika *et al*., 2016[b]). Stem rot (*Sclerotium oryzae* Catt.) perfect state *Magnaporthe salvinni* Catt., is a destructive disease under favourable weather conditions in rice growing areas of the world which eventually causes substantial spectrum of diseases (Venkateswarlu *et al*., 2013). Stem rot was considered as a minor disease in earlier, is now one of the major constraint in rice cultivation in East Godavari, Warangal and Khammam districts of Andhra Pradesh in recent years (Gopika *et al*., 2016[a]). The pathogen has been reported to cause substantial losses in grain yield ranging from 5-80 per cent (Kumar *et al*., 2003).

II.   MATERIALS AND METHODS

Use of high yielding and identification of resistant or tolerant genotypes or entries is the most viable, environmentally safe and economically sound technique for the management of the disease. Hence, the present investigation was undertaken to find out resistant sources against stem rot disease of rice under artificial condition. Forty four genotypes + two checks were screened under field with 15 cm x 20 cm spacing, fertilizer 150:30:00 (N: P: K) kg/hectare. The screening trial was conducted during *kharif* 2019 at Main Rice Research Centre, N.A.U., Navsari. Two rows of two meter length for each genotypes were taken and international susceptible check TN-1 and local susceptible check GR-11 were planted after 10th test entry. The local susceptible check GR-11 was planted around the screening nursery. The artificial inoculation of stem rot pathogen was done by standard sclerotium inoculation technique after 30 days of transplanting by placing the inoculum between the tillers just above the water line with the help of sterilized forceps and observations were recorded by using 0-9 SES scale as per SES of rice (IRRI, 2013).

Formula for calculating per cent disease intensity is

$$PDI = \frac{\text{Sum of score}}{\text{No.of observation} \times \text{Highest number of rating scale}} \times 100 \tag{1}$$

Ten hills from each genotype was randomly selected and considered for grading the severity of disease on standing plants. The severity of stem rot disease was recorded by following the standard evaluation system of rice.

Disease severity scale for stem rot of rice (IRRI, 2013).

0	No incidence (Immune)
1	Less than 1% (Resistant)
3	1-5% (Moderately Resistant)
5	6-25% (Moderately Susceptible)
7	26-50% (Susceptible)
9	51-100% (Highly Susceptible)

III.   RESULTS AND DISCUSSION

Forty four rice genotypes along with two susceptible check GR-11 and TN-1 were screened against the *S. oryzae* under field condition by artificial inoculation method. The results presented in [Table-1 and Table-2] revealed that among all the tested genotypes none were found immune, resistant as well as highly susceptible. Out of them, 18 genotypes were found moderately resistant *viz.,* NVSR-317, NVSR-348, NVSR-355, NVSR-2147, NVSR-2566, NVSR-330, NVSR-360, NVSR-365, NVSR-370, NVSR-374, NVSR-405, NVSR-407, NVSR-2102, NVSR-2117, NVSR-2130, NVSR-2140, NVSR-2153 and IET-24336. Whereas, 16 genotypes *viz.,* NVSR-350, NVSR-411, NVSR-2103, NVSR-401, NVSR-329, NVSR-2526, NVSR-2565, NVSR-338, NVSR-367, NVSR-389, NVSR-406, NVSR-2115, NVSR-2116, NVSR-2155, IET-25453 and IET-24783 were found moderately susceptible. 12 genotypes *viz.,* NVSR-2101, NVSR-328, NVSR-2528, NVSR-331, NVSR-335, NVSR-364, NVSR-384, NVSR-2435, NVSR-368, IET-25470, GR-11 and TN-1 were found susceptible to *S. oryzae*.

Among forty four screened genotypes, highest disease severity (45.6 %) was recorded in international susceptible check TN-1, which was followed by; genotype NVSR-331 (43.3 %) and susceptible state check GR-11 (42.2 %). Whereas, lowest disease severity (1.1 %) was recorded in genotype NVSR-370 and NVSR-2153.

From the study, it was revealed that out of 44 genotypes tested along with 2 susceptible checks, 18 genotypes were found moderately resistant. Whereas, 16 genotypes were showed moderately susceptible reaction and 12 genotypes were found susceptible to *S. oryzae* under artificial inoculation method [Table-2].

TABLE 1
SCREENING OF PADDY GENOTYPES FOR STEM ROT UNDER ARTIFICIAL INOCULATION METHOD

Sr. No.	Genotypes	Disease severity (%)	Disease Index scale (0-9 Scale)	Disease reaction	Sr. No.	Genotypes	Disease severity (%)	Disease Index scale (0-9 Scale)	Disease reaction
1	NVSR-317	4.4	3	MR	24	NVSR-370	1.1	3	MR
2	NVSR-348	3.3	3	MR	25	NVSR-374	3.3	3	MR
3	NVSR-350	15.6	5	MS	26	NVSR-384	34.4	7	S
4	NVSR-355	2.2	3	MR	27	NVSR-389	13.3	5	MS
5	NVSR-411	13.3	5	MS	28	NVSR-405	4.4	3	MR
6	NVSR-2101	28.9	7	S	29	NVSR-2435	40.0	7	S
7	NVSR-2103	16.7	5	MS	30	NVSR-406	21.1	5	MS
8	NVSR-401	6.7	5	MS	31	NVSR-407	3.3	3	MR
9	NVSR-2147	2.2	3	MR	32	NVSR-368	38.8	7	S
10	NVSR-328	27.3	7	S	33	NVSR-2102	4.4	3	MR
11	NVSR-329	11.1	5	MS	34	NVSR-2115	13.3	5	MS
12	NVSR-2526	20.0	5	MS	35	NVSR-2116	23.3	5	MS
13	NVSR-2528	35.6	7	S	36	NVSR-2117	3.3	3	MR
14	NVSR-2565	23.3	5	MS	37	NVSR-2130	4.4	3	MR
15	NVSR-2566	4.4	3	MR	38	NVSR-2140	3.3	3	MR
16	NVSR-330	3.3	3	MR	39	NVSR-2153	1.1	3	MR
17	NVSR-331	43.3	7	S	40	NVSR-2155	7.8	5	MS
18	NVSR-335	40.1	7	S	41	IET-25453	13.3	5	MS
19	NVSR-338	7.8	5	MS	42	IET-25470	27.8	7	S
20	NVSR-360	2.2	3	MR	43	IET-24783	14.4	5	MS
21	NVSR-364	35.6	7	S	44	IET-24336	2.2	3	MR
22	NVSR-365	3.3	3	MR	45	Check - GR-11	42.2	7	S
23	NVSR-367	22.2	5	MS	46	Check -TN-1	45.6	7	S

MR-Moderately Resistant, MS-Moderately Susceptible, S-Susceptible, HS- Highly Susceptible

TABLE 2
GROUPING OF PADDY GENOTYPES BASED ON THEIR REACTIONS AGAINST STEM ROT UNDER FIELD CONDITION

Scale	Disease Severity (%)	Disease Reaction	Genotypes	No. of genotypes perceived
0	0	Immune	Nil	0
1	< 1	Resistant	Nil	0
3	1 -5	Moderately Resistant	NVSR-317, NVSR-348, NVSR-355, NVSR-2147, NVSR-2566, NVSR-330, NVSR-360, NVSR-365, NVSR-370, NVSR-374, NVSR-405, NVSR-407, NVSR-2102, NVSR-2117, NVSR-2130, NVSR-2140, NVSR-2153, IET-24336	18
5	6 – 25	Moderately Susceptible	NVSR-350, NVSR-411, NVSR-2103, NVSR-401, NVSR-329, NVSR-2526, NVSR-2565, NVSR-338, NVSR-367, NVSR-389, NVSR-406, NVSR-2115, NVSR-2116, NVSR-2155, IET-25453, IET-24783	16
7	26 – 50	Susceptible	NVSR-2101, NVSR-328, NVSR-2528, NVSR-331, NVSR-335, NVSR-364, NVSR-384, NVSR-2435, NVSR-368, IET-25470, GR-11, TN-1	12
9	51 – 100	Highly Susceptible	Nil	0

Screening of paddy genotypes against stem rot was carried out on different varieties by earlier workers. Konthoujam and Chhetry (2007) screened 34 varieties among them, Chakhao amuba, Ching Chakhao and Huikap were found moderately resistant. While 17 varieties were found susceptible to the *S. oryzae* under field condition. Kumar *et al*. (2003) screened 234 varieties among them, 38 varieties were found moderately resistant. While 103 varieties were found moderately susceptible and 88 varieties were found highly susceptible reaction to the *S. oryzae*. Panwar *et al*. (1988) screened 61 genotypes. Among them, no genotype was found resistant and six genotypes *viz.,*PR 4141, HKR 120, HKR 122, IR 54, HAU 83-222 and RP 2151-21-1 were found moderately resistant against stem rot. The new genotypes screened in the present study, so no specific information was available related to screening with respect to stem rot of paddy.

IV.   CONCLUSION

Forty-four genotypes were screened against stem rot pathogen under artificial inoculation condition, highest per cent disease severity (45.6%) was recorded in international susceptible check TN-1 followed by genotype NVSR-331 (43.3%) and susceptible state check GR-11 (42.2%). Whereas, lowest per cent disease severity (1.1%) was recorded in genotype NVSR-370 and NVSR-2153. Out of 44 genotypes tested along with 2 susceptible check, 18 genotypes were found moderately resistant. Whereas, 16 genotypes were moderately susceptible and 12 genotypes were found susceptible reaction to *S. oryzae* under artificial inoculation condition.

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