



Screening of Rice (*Oryza sativa* L.) Genotypes for Sheath Blight (*Rhizoctonia solani*) in changing Climate Scenario

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ABSTRACT

Out of 108 germplasm, screened under natural as well as under artificial inoculated condition, none of the entries were found immune or resistant. However, forty five entries *viz.*, Ramkajra, Baigani black, Beni, Prasada, Narendra-118, Narendra-97, Aswani, madhuri, Sawani, IET-14807, Pant Dhan-11, Gajgour, IET-16711, Karahni, Dalkachari, Bagri, Rambli-AS, Motiforam, Ram bhog, Kaland, Aktahwa -R, Lalkawa, Tulsi, IR-36, Suggapankhi, IET-16706, basti cul-9, Aktahwa- FIO, CR-1446, Sonachoor, Aktahwa, Bansfool, Saket-4, IR-24, NDR-359, NDR-637, Pant Dhan-4, NDR-330, Gajgour, T-182, IET-16705, Pusa-33, Akasi, IR-8, Saryukushmaha were found moderately resistant, 37 moderately susceptible and fourteen were observed susceptible. Rest of the entries showed highly susceptible reaction. Under artificial inoculated condition, out of 82 entries, none of the entry was found resistant. Only two entries *viz.*, Baigani black and Prasada showed moderately resistant reaction, seventeen moderately susceptible and twenty seven entries susceptible. Rest of the entries was found highly susceptible.

Keywords: Resistant, *Rhizoctonia solani* Kuhn., Screening, Sheath blight, Susceptible

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INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important cereal crops of the world (Singh *et al.*, 2009). It is called ad miracle crop as it can be grown successfully in any environment under sufficient moisture conditions (Singh and Singh, 2007). In India it occupies an area of 42.86 million hectares with production of 95.97 million tonnes, and productivity of 2.239 tonnes ha⁻¹ (DAC, 2011). It contributes 20.25 per cent of agricultural G.D.P. Rice being such a potential crop, which is feeding the world half population. Importantly In case of South Asia, about 90% calories has been derived from rice only. It has been attacked by several insets pests and disease, if rice is fitted in the cropping system the new pests also attack especially which is having broad range of host (Singh *et al.*, 2014). This crop is attack by many diseases caused by fungi, bacteria, viruses, nematodes and several physiological disorders (Gupta *et al.*, 2014) which caused annual loss of 12 to 25 per cent of the total production, while fungal diseases alone caused annual damage of 12 to 20 per cent of its production.

Rice is a host of several diseases causing agent approximately 100 pests attack on the rice crop depending upon favorable agro-climatic condition for the specific pests. Under change climate conditions the host paste relation has also changed dramatically, Balance nutrition can manage the several bio agent below the economic injury level (Singh *et al.*, 2012). Among diseases, the sheath blight caused by *Rhizoctonia solani* Kuhn., earlier it was considered as minor disease, now it is regarded as an internationally important. In India, the disease was first reported by Paracer and Chahal in the year 1963 from

Gurdaspur (Punjab). It is also designated as a sclerotial banded blight disease of rice in North India. The pathogen mainly infect leaf sheath but symptoms may be produced on any aerial part of the rice plant. Thus, sheath blight caused by *Rhizoctonia solani* Kuhn. is one of the most economically important disease and have possessed challenge to the farmers for successful cultivation of rice and ultimately to the plant pathologists. Keeping this fact in view, to find out resistant/tolerant germplasm against the causal pathogen, screening was under taken in field as well as laboratory conditions.

A total of 108 germplasm were evaluated under field conditions and in laboratory. The experiments were carried out for two successive years *i.e.*, Kharif- 2001 and 2002 to test rice germplasm for resistance against sheath blight disease caused by *Rhizoctonia solani* under field conditions and those found resistant (45) and moderately resistant (37) were further tested under artificial inoculation conditions in the next year (Kharif- 2002). Each entry was sown in well prepared fertilized soil separately in the earthen pots and maintained under glasshouse. Transplanting was done with 25 days old seedlings in the field in normal condition during both the crop years. All recommended agronomical and cultural practices were followed for raising a good crop. Under field conditions crop was regularly watched for appearance of disease after transplanting. Final observations on the affected plants were recorded at pre-ripening phase and graded as per 0-9 SES scale (IRRI- 1979).

Stems of 35-40 days old rice plants were cut in to pieces of about 2 cm size and filled in to 500 ml Erlenmeyer flasks upto one third. Ten ml (1 %) peptone + Sucrose (1:1) solution was

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added in each flask. Flasks were autoclaved at 15 pound per square inch for 30 minutes. Mycelial discs of 5 mm diameter cut from the margin of 48 hrs old culture of the pathogen were inoculated into the flask and incubated at $28^{\circ} \pm 2^{\circ}\text{C}$ up to fifteen days for full growth of fungus and formation sclerotia. For artificial inoculation, rice plants at maximum tillering stage were taken for inoculation. The inoculation was done by placing above mass culture with the help of sterilized forceps in the centre of each hill. After inoculation, crop was regularly watched for appearance of disease. Observations were recorded 30 days after inoculation and graded as per 0-9 SES

scale.

Studies on screening of available germplasm of rice were carried out under natural as well as under artificial inoculated conditions, to find out the source of resistance against *R. solani* by evaluating 108 entries. Out of these entries tested under natural conditions, none were found to be immune or resistant. However, forty five entries were moderately resistant, thirty seven moderately susceptible and fourteen were susceptible, and rest twelve entries expressed highly susceptible reactions (Table 1).

Table 1: Screening of rice varieties/germplasm for resistance against sheath blight caused by (*Rhizoctonia solani*) under natural conditions.

Disease rating scale	Response	No. of entries	Name of varieties/ germplasm Kharif-2001
0	Immune	Nil	Nil
1	Resistant	Nil	Nil
3	Moderately resistant	45	Ramkajra (Basti), Baigani black, Beni (Deoriya), Prasada, Narendra-118, Narendra-97, Aswani, madhuri, Sawani (Bhadoi), IET-14807, Pant Dhan-11, Gajgour, IET-16711, Karahni, Dalkachari, Bagri (Gorkhapur), Rambli-AS, Motiforam, Ram bhog, Kaland, Aktahwa -R, Lalkawa, Tulsi, IR-36, Suggapankhi, IET-16706, basti cul-9, Aktahwa- FIO, CR-1446, Sonachoor, Aktahwa, Bansfool, Saket-4, IR-24, NDR-359, NDR-637, Pant Dhan-4, NDR-330, Gajgour (Gonda), T-182, IET-16705, Pusa-33, Akasi, IR-8, Saryukushmaha.
5	Moderately susceptible	37	SAR-41, Champa course, IET-16709, Duddy, Sapana, Lalki (Bhadoi), CR-1548, NS-30, Koadaya, NDV-50, Chatani, Bhadoi -A, Dehula, IR -64, Sonkharcha, Narendra-2, Narendra-1, Govinda, NDR-5012, Manhar, Narendra-80, Vijeta, Indrasan, IET-16704, Pahariya, Heera, Aktahwa B.B.K., Tinpakhiya, Sita, Barani Deep, Basticul-5, cul-4, NDR-97, Koaya improved, Parsoon, Sarju-52, Karangi
7	Susceptible	14	NDR-1087-2, NDR-4179, NDR-2017, Narendra 5005, Salibahanu, Monday vijya, Salharalk, Turahwa, Gajraj, Jalsurya, Syamjeera, M-23, T-144, Usar-2
9	Highly susceptible	12	NDR-3011, NDR-1025-2, Narendra-6014, DNR-2018, NDR-1014-3, Narendra-6011, NDR-6045, NDR-6015, NDR-4147, Matura, Manan, T.K.M-6

Finally, entries which were found to be moderately resistant (45) and moderately susceptible (37) were retested under artificial inoculated conditions, by applying mass culture on cut leaves manually and rest of the environmental factors etc. were natural. In this experiment again none of the entries showed resistant reaction. However, out of 45 entries scored as moderately resistant under natural condition only two entries were found to be moderately resistant under artificial inoculated condition while rest eighty entries including 37 moderately susceptible were rated either moderately susceptible or highly susceptible. The difference in the

reaction under natural and artificial condition may be because of applying high inoculum density under artificial conditions and the inoculum were well placed at the site of infection (Table 2).

Topo and Dubey (1997) also screened 23 entries under artificial conditions and reported that none of the varieties were resistant. However, Reddy *et al.* (1997) also tested 457 breeding lines for sheath blight resistance and found two lines (RNR 15336 and RNR 82096) as resistant. Lee and Rush (1983) also reported that short and medium grain type Japonica rice showed highest degree of resistance. Singh and Borah (2000)

Table 2: Screening of rice varieties/ germplasm for resistance against sheath blight caused by *R. solani* under artificially inoculated conditions

Disease rating scale	Response	No. of entries	Name of varieties/germplasm Kharif-2002
0	Immune	Nil	Nil
1	Resistant	Nil	Nil
3	Moderately resistant	2	Baigani black, and Prasada
5	Moderately susceptible	17	Narendra-118, Narendra-97, Tulsi, IR-36, Madhuri, Sugga pankhi, IET-14807, IET-16706, IET-16711, Karahanni, Dalkachari, Basti cul-9, Ramkajra (Basti), Aktahwa -FIO, CR-1446, Sona choor, Aktahwa -R
7	Susceptible	27	Pusa-33, Bansfool, Saket -4, Pant dhan -4, IR -8, NDR -330, Sawani (Bhadai), Gajgour (Gonda), Saryu kushamaha, Bagri (Gorkhpur), SAR-41, Champa course, Rambali -AS, Motiforam, Sapana, NS-30, Kodaya, NDV -50, Rambhog, Kaland, Bhodi (A), Dehula, IR -64, Lalkawa, Beni (Deoriya), Pant dhan-11, Gajgour
9	Highly susceptible	36	Narendra-1, Govinda, narendra -2, NDR -5012, Aswani, Manhar, Narendra-80, IR -24, NDR -359, Vijeta, Indrasan, Sarju-52, Sita, T -182, IET -16704, IET -16705, Sawani, Pahariya, Heera, IET -16709, NDR-97, Aktahwa B.B.K., Tinpakhiya, Duddhy, Aktahwa, Baroni Deep, Lalki bhada, Basti cul -5, Chatni, cul -4, Koaya improved, Parson, Sonkharcha, NDR-637, Akasi, Karangi.

also screened sixty local upland rice cultivars in Assam and reported that only one variety i.e. Chingdar was found to be resistant, seven moderately resistant and rest 52 were susceptible. Variation in the observations at various locations

including present investigations may be due to variation in host genotypes, varying environmental conditions and variation in the inoculum load.

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