

SCREENING OF SOME RESTORER AND MAINTAINER HYBRID RICE LINES AGAINST SHEATH BLIGHT (*Rhizoctonia solani*)

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ABSTRACT

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An experiment was conducted at the field laboratory of Genetics and Plant Breeding Department, BAU, Mymensingh during July to December, 2000. Forty-four test entries of parental lines of rice with one susceptible (BR 11) and one resistant check (BRRI dhan 29) were screened against sheath blight (*Rhizoctonia solani*) at maximum tillering and flowering stage in the field. The pathogenicity test was studied in the laboratory. Ten lines were resistant, 31 were moderately resistant and 3 showed moderately susceptible reaction at maximum tillering stage. At flowering stage only 2 lines were resistant, 24 were moderately resistant and 18 lines were moderately susceptible.

Key word: Screening, sheath blight, restorer line, maintainer line, hybrid rice

INTRODUCTION

Rice (*Oryza sativa* L.) is the major source of calories for a large portion of the world's population, particularly in Asia, where more than 90% of all rice is grown and consumed by about 60% of the world's population. The average world yield of rice is 3.75 metric tons per hectare, but the average yield in Bangladesh is lamentably poor; only 2.425 metric tons per hectare (Anonymous, 2005). Rice occupies about 75 % of the total cropped area covering 25.621 million acres and is the only source of cash income for many farmers. In Bangladesh 90% of the total cereal production comes from rice (Anonymous, 2005). To increase the production of rice, developing of hybrid varieties is the prime requisite at present. Sheath blight (*Rhizoctonia solani* Kuhn) is one of the major diseases of rice in Bangladesh. The disease occurs throughout rice production areas of the world, in both tropical and temperate climates, where it is most damaging in intense production systems. Sheath blight (*Rhizoctonia solani*) is systemic and may cause 20-30% yield loss (Ou, 1972) depending on the severity of infection. Dilla *et. al* (1993) reported that yield losses ranges from 0.27 to 1.29 ton/ha in the dry season and 0.23 to 1.37 ton/ha in the wet season. Hence, the new hybrid rice variety to be developed is either resistant or tolerant to sheath blight. Therefore, the present experiment was conducted to screen the some restorer and maintainer lines against sheath blight.

MATERIALS AND METHODS

The experiment was carried out at the field laboratory of Genetics and Plant Breeding Department, BAU, Mymensingh during the period from July to December of the year, 2000.

Thirty restorer and 14 maintainer lines were screened against sheath blight. One susceptible (BR 11) and one resistant check variety (BRRI dhan 29) were used.

Design and layout

The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 replications. In each block (replication), the susceptible check variety was transplanted in a line, which contained 12 hills. Then 2 lines of test materials were transplanted which contained 24 hills again one line of the susceptible check was transplanted and the resistant check was transplanted in the border of the block. This transplanting system was followed for all the test materials.

Recording of disease severity in the field

The disease sheath blight (*Rhizoctonia solani*) was recorded under natural epiphytotic conditions and the % Leaf Area Diseased (% LAD) of the symptoms was recorded at maximum tillering stage and flowering stage. The block was divided into 3 stripes. For each stripe, 2 hills from susceptible check, 2 hills from resistant check and 3 hills from the test material were selected randomly in each replication. Three tillers / hill and three leaves/ tiller of that hill were selected randomly for recording the data. For recording % LAD, IRRI developed grading scale (Standard Evaluation System for Rice, 1980) was followed. Plant height and tiller/hill were also recorded at the same corresponding stages.

The IRRI grading scale (Standard Evaluation System for Rice, 1980) for the sheath blight (*Rhizoctonia solani*) disease

Sheath blight (*Rhizoctonia solani*) (0-9 scale)

0	(HR)	No incidence
1	(R)	Lesions limited to lower ¼ of leaf.
3	(MR)	Lesions present on lower ½ of leaf.
5	(MS)	Lesions present on more than ½ of leaf.
7	(S)	Lesions present on more than ¾ of leaf sheath. Severe infection on upper leaves (flag and 2 nd leaf).
9	(HS)	Lesions reaching top of tillers. Severe infection on all leaves and some plants killed.

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

Data analysis

The data of plant height and tillers per hill of different lines within healthy and infected plants as well as the yield performance (no. of grains/panicle, no. of filled grains, no. of unfilled grains, no. of spotted grains, no. of non-spotted grains and yield per plant) were analyzed by MSTAT-C computer program. DMRT and paired t-test were used for mean separation.

Pathogenicity test

Growing of seedling (Growing on test)

Seedlings were grown in the pot

Isolation and preparation of inocula

Infected sheaths of the rice plants were washed with tap water to remove external material. The sheaths were cut into small pieces and sterilized by MgCl₂ (0.001%) solution for 30 seconds. After surface sterilization, the small pieces were washed 3 times in sterile water and placed on the PDA plates for incubation at room temperature for 7 days to grow the pathogen. The culture was observed under microscope and transferred them to other petridishes containing PDA by hyphal tip method. In this way 8 plates were made and preserved in the refrigerator. All these operations were done in the Laminar air flow chamber. Inoculum was prepared by cutting small mycelial blocks with 5 mm block cutter. Before this, the plates were brought out from the refrigerator and kept them into natural condition for 2 days.

Inoculation of *Rhizoctonia solani*

The prepared mycelial blocks were placed into the small rubbed hole of the leaf sheaths made before by a sterilized niddle. The inoculum blocks were wrapped with moist cotton and kept moist by watering for next 3 days. After 12 days symptoms were developed.

List of Restorer (R) and maintainer (B) lines along with their sources used in this experiment

GPB accession Number	Designation	Origin	Source
001R	Ajaya R	India	
002R	IR13155-60-3-1-3R	IRRI	GPB, BAU, Mymensingh
003R	IR29723-142-3-2-1R	IRRI	
004R	IR43342-10-1-1-3-3R	IRRI	
005R	IR56381-139-2-2R	IRRI	
006R	IR53082-126-1-2R	IRRI	
007R	IR58110-144-2-2-2R	IRRI	
008R	IR59624-34-2-2R	IRRI	
009R	IR5969-93-1-3R	IRRI	
010R	IR59682-132-1-1-2R	IRRI	
011R	IR60913-42-3-3-2-2R	IRRI	
012R	IR60997-16-2-3-2-2R	IRRI	
013R	IR2037-12-1-2-2-2R	IRRI	
014R	IR62037-129-2-3-3-3R	IRRI	
015R	IR62171-122-3-2-3-3R	IRRI	
016R	IR3870-123-2-2-2-2R	IRRI	
017R	IR63870-3-2-3-3R	IRRI	
018R	IR63877-43-2-1-3-1R	IRRI	
019R	IR63883-41-3-2-2-2R	IRRI	
020R	IR64683-87-2-2-3-3R	IRRI	
021R	IR65489H-A62-2R	IRRI	
022R	IR68926-61-1R	IRRI	
023R	IR68926-61-1R	IRRI	
024R	BR-736-20-3-1R	BIRRI	
025R	IR50404R	IRRI	
026R	IR21567R	IRRI	
027R	IR44675R	IRRI	
028R	BR-168-2B-283R	BIRRI	
029R	BR-827R	BIRRI	
030R	IR65515-19R	IRRI	
02B	IR68902B	IRRI	
08B	IR64608B	IRRI	
22B	IR69622B	IRRI	
25B	IR58025B	IRRI	
26B	IR69629B	IRRI	
29B	IR62829B	IRRI	
84B	IR67684B	IRRI	
85B	IR68885B	IRRI	
86B	IR68886B	IRRI	
88B	IR68888B	IRRI	
97B	IR68897B	IRRI	
99B	IR68899B	IRRI	
247B	MSP247B	IRRI	
248B	MSP248B	IRRI	

RESULTS AND DISCUSSION

Disease severity varied from 0.5 to 4.15 at maximum tillering stage. At this stage, 10 lines showed resistant (04R, 05R, 06R, 08R, 10R, 11R, 14R, 15R, 16R, 19R), 3 lines (02R, 247B, 248B) were moderately susceptible

and the rest 31 lines were moderately resistant reaction to the sheath blight disease (Table 1). The highest severity (4.15) was found in the susceptible variety (BR 11) and the lowest (0.5) was in the line 06R. The severity varied from 1.01 to 4.72 at flowering stage. At this stage, two accessions (06R, 08R) were resistant and 24 accessions were moderately resistant and 18 were moderately susceptible to sheath blight disease. (Table 1)

Performance of various entries against Sheath blight in terms of yield

Grains per panicle

The lines showed statistically significant effect on grains/panicle. The highest (208 & 201) grains/panicle were found in the accession number 16R and 29R, respectively while the lowest (100) was found in the accession number 26B.

Spotted grains

The highest spotted grains (60) were found in the accession number 08B while the lowest (5) was found in the 06R.

Non- Spotted grains

The highest (187) number of non-spotted grains was found in the accession number 16R and the lowest (65) was found in the accession number 86B.

Filled grains

The highest (175,178) number of filled grains was found in the accession number 08R & 16R and the lowest (59) number of filled grains was found in the accession number 26B.

Unfilled grains

The highest number (71) was found in the accession number 29R and the lowest (13) was in the accession numbers 06R and 09R.

Yield per plant

The highest yield (52.86g) was found in the accession number 08R and the lowest (24.15g) was found in the accession number 25B.

Singha and Borah (2000) found that only one cultivar (Chingdar) was resistant to sheath blight, 7 were moderately resistant and the rest were susceptible reaction to sheath blight out of 60 local upland test rice cultivars. Li *et al.* (2000) reported that only 6 accessions were resistant reaction, while 150 accessions were susceptible or moderately susceptible to sheath blight under field condition out of 190 test accessions. Meena *et al.* (2000) found that only 7 lines were moderately resistant while remaining accessions were found to be moderately susceptible to sheath blight out of 120 test accessions. The severity of the sheath blight increases with the high temperature (26-31.73^oc) and with high humidity (>65%). The relative humidity was also high (86.37%) which contributed the incidence of Sheath blight (Ashrafuzzaman, 1992)

Table 1. Reaction of different entries of rice against sheath blight at maximum tillering stage and flowering stage

Line No.	Maximum tillering stage		Flowering stage	
	Severity	Reaction group	Severity	Reaction group
001R	1.01	MR	1.23	MR
002R	3.02	MS	3.50	MS
003R	2.25	MR	3.08	MS
004R	1.0	R	1.12	MR
005R	0.89	R	1.15	MR
006R	0.50	R	1.0	R
007R	2.0	MR	2.46	MR
008R	0.72	R	1.0	R
009R	1.50	MR	1.82	MR
010R	1.00	R	1.30	MR
011R	0.69	R	1.15	MR
012R	2.25	MR	3.0	MR
013R	1.30	MR	1.69	MR
014R	1.0	R	1.53	MR
015R	0.85	R	1.65	MR
016R	0.75	R	1.57	MR
017R	2.50	MR	3.32	MS
018R	1.12	MR	1.82	MR
019R	0.85	R	2.26	MR
020R	2.69	MR	3.0	MR
021R	1.09	MR	1.39	MR
022R	1.20	MR	2.01	MR
023R	2.85	MR	3.50	MS
024R	1.11	MR	1.99	MR
025R	2.15	MR	2.92	MR
026R	1.20	MR	2.0	MR
027R	2.0	MR	2.75	MR
028R	1.10	MR	1.63	MR
029R	2.99	MR	3.50	MS
030R	1.17	MR	2.20	MR
02B	2.85	MR	3.59	MS
08B	2.50	MR	3.51	MS
22B	2.80	MR	3.40	MS
25B	2.72	MR	3.10	MS
26B	2.50	MR	3.19	MS
29B	2.88	MR	3.21	MS
84B	2.85	MR	3.30	MS
85B	2.70	MR	3.20	MS
86B	1.55	MR	2.10	MR
88B	3.09	MR	3.50	MS
97B	2.69	MR	3.52	MS
99B	2.89	MR	3.15	MS
247B	3.05	MS	3.55	MS
248B	3.10	MS	3.50	MS
Susceptible check (Nizersail)	4.15	MS	4.72	MS
Resistant check (BRR1 dhan 29)	1.0	R	1.39	MR

HR -Highly Resistant, HS- Highly Susceptible, R-Resistant-Susceptible, MR-Moderately Resistant, MS-Moderately Susceptible

Table 2. Performance of various entries against Sheath blight in terms of yield

Line No.	No. of grain/ panicle	No. of spotted grain	No. of non spotted grain	No. of filled grain	No of unfilled grain	Yield / plant (g)
001R	133I-N	21K-Q	112F-M	81M-O	52BC	33.25NO
002R	138H-M	48A-D	90K-M	122C-J	15L-N	35.13M
003R	148F-K	38B-I	110F-M	131C-G	17K-N	32.22PQ
004R	157D-I	38B-I	118F-J	138CD	19J-N	49.87BC
005R	152E-J	33E-L	119F-J	138CD	14MN	32.39OP
006R	112N-P	5S	107F-M	92L-O	13N	50.17B
007R	122M-P	27G-P	95I-M	102I-M	20JN	38.91J-K
008R	197AB	25I-Q	168AB	175A	22I-N	52.86A
009R	146F-M	20L-R	126D-G	133CF	13N	39.18I-K
010R	161D-H	41B-G	120E-I	140CD	28F-N	39.94IJ
011R	178B-D	29F-N	149B-D	163AB	15MN	49.19CD
012R	150E-J	20I-R	130C-F	122C-J	28F-N	45.24EF
013R	122M-P	19I-H	103F-M	97K-O	25H-N	31.16R
014R	150E-J	23J-Q	127C-G	123C-J	27G-N	38.42K
015R	163D-H	20K-R	145B-E	143B-D	19J-N	45.42EF
016R	208A	21K-R	187A	178A	30F-L	45.26EF
017R	170C-F	51A-C	119E-J	143B-D	23H-N	46.21E
018R	152EJ	51A-C	101G-M	125C-I	27G-N	37.36L
019R	148F-K	17M-S	128C-G	130C-H	15L-N	42.02H
020R	160D-H	13P-S	147B-D	134C-E	26H-N	39.15I-K
021R	141G-M	12Q-S	129C-G	119D-K	22I-N	30.09S
022R	175B-E	14Q-S	160B	137CD	38C-H	36.04M
023R	123L-P	15M-S	108F-M	78N-P	45B-E	25.95U
024R	170C-F	23J-Q	163A-B	46BC	24H-N	40.04I
025R	130J-O	14O-S	116F-L	105I-M	25H-N	25.19U
026R	124K-O	31E-M	93I-M	106H-L	18J-N	32.97OP
027R	165C-G	7R-S	158B	134C-E	31E-K	48.87D
028R	170C-F	23J-Q	147B-D	143B-D	27G-N	41.96H
029R	201A	45B-E	152BC	130C-H	71A	31.06P-R
030R	147F-L	45D-E	103F-M	119D-K	29F-M	39.01IK
02B	145F-M	26H-Q	119F-J	110E-L	35D-I	31.95P-R
08B	168C-F	60A	108F-M	123C-L	45B-E	40.17G
22B	150E-J	40B-H	110F-M	108C-I	42B-F	29.12S
25B	140G-M	23J-Q	117F-K	88L-O	51B-C	24.15V
26B	100P	35DPK	65N	59P	41B-G	31.96P-R
29B	106O-P	17M-S	88L-N	81M-O	25H-N	38.95JK
84B	132I-N	40B-H	92J-M	100J-N	32E-K	27.29T
85B	138H-M	27G-O	110F-M	106H-L	32E-K	50.19B
86B	108O-P	42B-F	65N	75OP	32E-J	25.24U
88B	148F-K	50A-C	98H-M	99J-N	48B-D	31.24QR
97B	160D-H	51A-B	108F-M	109F-L	51BC	25.19U
99B	175B-E	51A-C	124G-H	126C-I	48B-D	30.06S
247B	155D-J	45B-E	110F-M	106H-L	49B-D	36.13M
248B	159D-H	29F-N	129C-F	106G-L	50BC	21.10V
Susceptible check (Nizersail)	150E-J	36C-J	86MN	97K-O	52B	42.12FG
Resistant check (BRRI dhan 29)	189A-C	28G-O	160B	164AB	25H-N	49.89BC
LSD (P=0.01)	20.97	12.15	22.89	20.60	12.35	0.9561

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