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Evaluation of rice germplasm against grain discoloration for sub-tropics of Jammu

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Abstract
The cultivation of the basmati which traditional and the staple crop of the people living the sub tropics of the Jammu not only socially important but also economically important in the livelihood of the people particular in the export value of the basmati rice, the grain discoloration has gained importance in all rice-growing areas in recent years and is emerging as a serious threat to the basmati cultivation of Jammu. It is a complex disease incited by various microorganisms, lead both qualitative and quantitative grain yield losses with low seeding vigour viability. It is also known as glume discoloration, dirty panicles, or pecky rice and is an early sign of poor seed quality fetches a low market value and render its consumption with mycotoxins association. Grain discoloration has been recorded throughout the world in the rice growing tracts of India and gained prominence in recent years because of the lack of resistant cultivars. The ecofriendly alternative strategies for the management of the disease is host plant resistance identification and promoting the cultivation of resistant cultivars. The present study reveals that that major basmati varieties in Jammu subtropics with dominate basmati cultivating one hundred eighteen genotypes were screened against grain discoloration under artificial (controlled) epiphytotic conditions. Out of these rice genotypes, none of the genotypes was free from infection. Whereas eighty-five cultivars/genotypes were found moderately resistant, thirty-three cultivars/genotypes were found susceptible. These moderately resistant genotypes can be used in the breeding program for developing resistant genotypes for grain discoloration.

Keywords: complex, economical, grain discoloration, genotypes, resistant

Introduction

Rice (*Oryza sativa* L.) belongs to the family Poaceae and is grown throughout the world (Ezuka and Kaku, 2000) [7]. India is the world's second-largest producer and consumer of rice (Shiva Lingaiah and Umesha, 2011[19]; Sharma *et al.*, 2013) [18]. Rice is grown on an area of 168 million hectares worldwide, with production and productivity of 500 million tonnes and 4.64 tonnes ha^{-1}, respectively. China, India, Indonesia, Bangladesh, and Japan are the world's major rice-producing countries (Shaheen *et al.*, 2022) [17]. Rice is grown on 45.07 million hectares in India, with a production and productivity of 122.27 million tonnes and 2.72 tonnes ha^{-1} respectively (Anonymous, 2022a) [1]. In the U. T. of Jammu and Kashmir, rice is grown on 267.58 thousand hectares, with production and productivity of 5186 thousand quintals and 21.74 quintals ha^{-1}, respectively (Anonymous, 2022b) [2].

The paddy is affected by many diseases caused by fungi, bacteria, viruses and nematodes. The major diseases of paddy are brown spot, bacterial blight, blast, false smut and sheath blight. Due to climatic change many minor diseases such as grain discoloration, bakanae and sheath rot have emerged as a major threat to rice cultivation (Raghu *et al.*, 2018) [14]. Grain discoloration has gained importance in all rice-growing areas in recent years and is emerging as a serious threat to the seed industry worldwide (Bhat *et al.*, 2009 [5], Kar *et al.*, 2018) [11]. It is a complex disease incited by various microorganisms. Mustafa and Mohsan (2017) [12] found six fungi, *viz.*, *Alternaria alternata, Dreschelera oryzae, Curvularia oryzae*, *Fusarium moniliforme*, *Cercospora oryzae* and *Helminthosporium oryzae*, associated with discolored panicles of various varieties of rice in the field. Persaud *et al.* (2019) reported *Curvularia* spp. as the most prevalent fungal pathogen, associated with more than 95 per cent of the discolored grain samples. Furthermore, *Bipolaris oryzae*, *Sarocladium oryzae*, *Alternaria* spp., *Aspergillus* spp. and *Fusarium* spp. were detected in less than 5 per cent of the samples. This disease causes both qualitative and quantitative grain yield losses, reduced germination, and seedling vigour (Rao *et al.*, 2018) [15]. This disease has become a major issue in early and medium-duration rice varieties grown in wet seasons with high relative humidity and warm environments during flowering and post-flowering stages (Rawte, 2007) [16]. It is also known as glume discoloration, dirty panicles, or pecky rice and is an early sign of poor seed quality. Because of nutritional value degradation, such grains have low market value and consumption quality (Arshad *et al.*, 2009) [3]. Symptoms varied depending on the microorganism and the degree of infection. Brown or black spots on the grains, hollow lightweight panicles, blackish-brown stripes on the grains and infected panicles with unfilled grains are symptoms of this disease. Grain discoloration influences grain morphology in terms of grain size and shape. Rusty, water-soaked lesions appear on the palea, brown immature lighter grains form on the panicles and grain discoloration, glume discoloration and grain rot are symptoms of this disease (Chhabra and Vij, 2020) [6].

Fungicides sprayed during the maturity stage to manage grain discoloration may have lingering effects on rice grains that are harmful to human health. Despite this, diseases could still become resistant to fungicides.

This disease has been posing a problem in the procurement of paddy. The minimal standard for grain discoloration for paddy procurement is 3 per cent and samples exceeded that are rejected. This disease appears in moderate to a severe

form in U. T. of Jammu and Kashmir depending upon the genotypes, pathogens prevalence and climatic conditions. Therefore, considering the significance of the crop and disease present study was undertaken with the following objective: to manage the disease through host resistance.

Materials and methods

Experiment of 118 genotypes *viz.*, R26741, 6585STAZ, 8433AZDT, MR8222, MR20101, MR8383, SR1, SR2, SR3, SR4, Basmati-118, Basmati-123, Basmati-138, Basmati-1121, CPR414, RALLIS-20101, RALLIS-20102, HRI-214, UPLRH-180842, VNR-228, US-321, UPLRH-181325, KAVERI-7227, TNRH-297, JKRH-1004, MEPH-162, IIRRH-153, US-314(NCH), CO-51 (NCV), PR-124/Luit/NDR-9, IRH-129, Indam 200-053, UPLRH-169054, UPLRH-189001, RNRH-15, SPH-43, PAN-2140, NPH-X49, US-346, ARRH-23316, US-355, RNC-0334, PHI-21104, MEPH-164, PHI-21105, RNC-0457, MEPH-165, US-312 (NCH), Gontra Bidhan-3 (NCV), PR-113/ Lalat/ Karjat-7, TMRH-2110, HRI-209, HRI-211, RNE-0337, Marshal-135 Pro, US-384, PHI-21106, CRHR-156, VNR-229, KRH-11, TMRH-5766, CRHR-153, SRH-5402, WGL-14 (NCV-1), BPT-5204 (NCV-2), Improved Samba Mahsuri, Rasi, TETEP, CO-39, CH-45, Benibhog, Ajaya, RP-Bio-226, Swarnadhan, IR-50, Vikramarya, Nidhi, Basmati 564, Sanwal Basmati, Basmati-370, PHB-71, Giza 14, JRH-133, UPLRH-162087, PAN-2150, NPH-X60, IIRRH-152, PHI-21101, PHI-21102, IIRRH-150, MEPH-163, IIRRH-151, Pusa Basmati-1509, MALI-348, JRH-134, CP R444, Indam 300-021, IRH-130, RRX-271, UPLRH-180839, PHI-21103, PRSH-2009, KPHDF8PX, JKRH-1038, IIRRH-149, RRX-338, PAN-2435, RNE-0337, VNR-230, PHI-21107, MEPH-166, CRHR-155, JKRH-3333 (NCH-1), 27P63 (NCH-2), IR-64, MT7, Basmati 129 and SJR5 were procured from the Division of Plant Breeding and Genetics, Mega Seed Project, SKUAST-Jammu, Chatha and Division of Genetics and Plant Breeding, SKUAST-Kashmir. During the *Kharif* 2021 and 2022, these genotypes were screened for resistance to grain discoloration in the artificial epiphytotic (controlled) conditions at the greenhouse of the Division of Plant Pathology, SKUAST-J, Chatha. 25 days old genotype seedlings were transplanted in polyethylene bags containing sterilized soil under greenhouse conditions. Panicles were sprayed with spore suspension of 4×10^7 spores ml^{-1} with a mixture of inoculums of four predominant fungi (*Bipolaris oryzae*, *Curvularia lunata*, *Alternaria alternate* and *Fusarium moniliforme*) causing grain discoloration at the heading stage. Checks were also maintained where no inoculum was sprayed. Three replications were maintained for each treatment. After inoculation, the panicles were covered with moist polythene bags for 72 hours at 18-20°C and high humidity was maintained by sprinkling water thrice daily in the glass house. Regular monitoring was done every day for symptom development. Observations on grain discoloration were taken after 7 days of inoculation. Data on grain discoloration were recorded by counting the number of discolored grains twice a week. Three replications were maintained for each genotype. Based on their response to the disease in the field, the genotypes were categorized into Highly Resistant (HR), Resistant (R), Moderately Resistant (MR), Susceptible (S) and Highly Susceptible (HS) groups. The area under the disease progression curve (AUDPC) was calculated by using the formula:

$$\text{AUDPC}=\sum_{i=1}^{n-1}\frac{(yi+yi+1)}{2}\text{ x }(t_{i+1}-t_i)$$

Where y_i is an assessment of disease (percentage) at the i^{th} observation, t_i is time (in days) at the i_{th} observation and n is the total number of observations.

Per cent grain discoloration was recorded using a 0-9 scale given by (IRRI, 2013) [10] (Table 1 & Plate 1). Per cent grain discoloration was calculated by using the following formula:

$$\text{Grain discoloration (\%)} = \frac{\text{No. of discoloured grain}}{\text{Total no.of grains observed}}\times 100$$

Table 1: Disease rating scale (0-9) for grain discoloration (IRRI, 2013)

Score	Grain discolored (%))	Host Response
0	No incidence	Immune
1	> 1	Highly Resistant (HR)
3	1-5	Resistant (R)
5	6-25	Moderately Resistant (MR)
7	26-50	Susceptible (S)
9	51-100	Highly Susceptible (HS)

Fig 1

Results and Discussion

One hundred eighteen rice cultivars/genotypes were screened during *Kharif* 2021 and 2022 under artificial epiphytotic (controlled) conditions (Table 2 & Table 3). Pooled data from both the years (*Kharif* 2020 and 2021) one hundred eighteen genotypes/cultivars were screened under artificial (controlled) epiphytotic conditions. Out of one hundred eighteen rice cultivars/genotypes, none was free from infection. Among these genotypes/cultivars, eighty-five cultivars/genotypes were found moderately resistant *viz.*, R26741, 6585STAZ, 8433AZDT, MR8222, MR20101, MR8383, SR1, SR2, SR3, Basmati K, Basmati 118, Basmati 123, Basmati 138, Basmati 1121, JRH-133, CP R414, RALLIS-20101, RALLIS-20102, HRI-214, UPLRH-180842, VNR-228, UPLRH-162087, US-321, UPLRH-

181325, KAVERI-7227, PAN-2150, TNRH-297, NPH-X60, IIRRH-152, JKRH-1004, MEPH-162, IIRRH-153, US-314(NCH), CO-51 (NCV), PR-124/Luit/NDR-9, MALI-348, IRH-129, Indam 200-053, UPLRH-169054, UPLRH-189001, RNRH-15, SPH-43, PAN-2140, NPH-X49, US-346, ARRH-23316, US-355, RNC-0334, PHI-21104, MEPH-164, PHI-21105, RNC-0457, MEPH-165, US-312 (NCH), Gontra Bidhan-3 (NCV), PR-113/ Lalat/ Karjat-7, TMRH-2110, HRI-209, HRI-211, RNE-0219, Marshal-135 Pro, US-384, PHI-21106, CRHR-156, VNR-229, KRH-11, TMRH-5766, CRHR-153, SRH-5402, WGL-14 (NCV-1), BPT-5204 (NCV-2), Improved Samba Mahsuri, Rasi, TETEP, CO-39, CH-45, Benibhog, Ajaya, RP-Bio-226, Swarnadhan, IR-50, Vikramarya, Nidhi, Basmati 564 and Sanwal Basmati with disease incidence ranging from 10.87-23.97 per cent and AUDPC value ranging from 157.12-337.09. Thirty-three cultivars/genotypes were found susceptible *viz.*, Giza 14, PHI-21101, PHI-21102,MEPH-163, IIRRH-151, Pusa Basmati-1509, JRH-134, CP R444, Indam 300-021, IRH-130, RRX-271, UPLRH-180839, PHI-21103, PRSH-2009, KPHDF8PX, JKRH-1038, IIRRH-149, RRX-338, PAN-2435, RNE-0337, CRHR-155, JKRH-3333 (NCH-1), 27P63 (NCH-2), IR-64, MT7, Basmati 129, SJR5, PHB-71 (Local Check), Basmati 370 (Local Check), IIRRH-150, VNR-230, PHI-21107 and MEPH-166 with disease incidence ranging from 26.09-30.49 per cent and AUDPC value ranging from 363.06-430.54 respectively. Our results conform with Bait *et al*. (2019) [4] Gouda *et al*. (2019) [9] and Gangwar *et al*. (2020) [8].

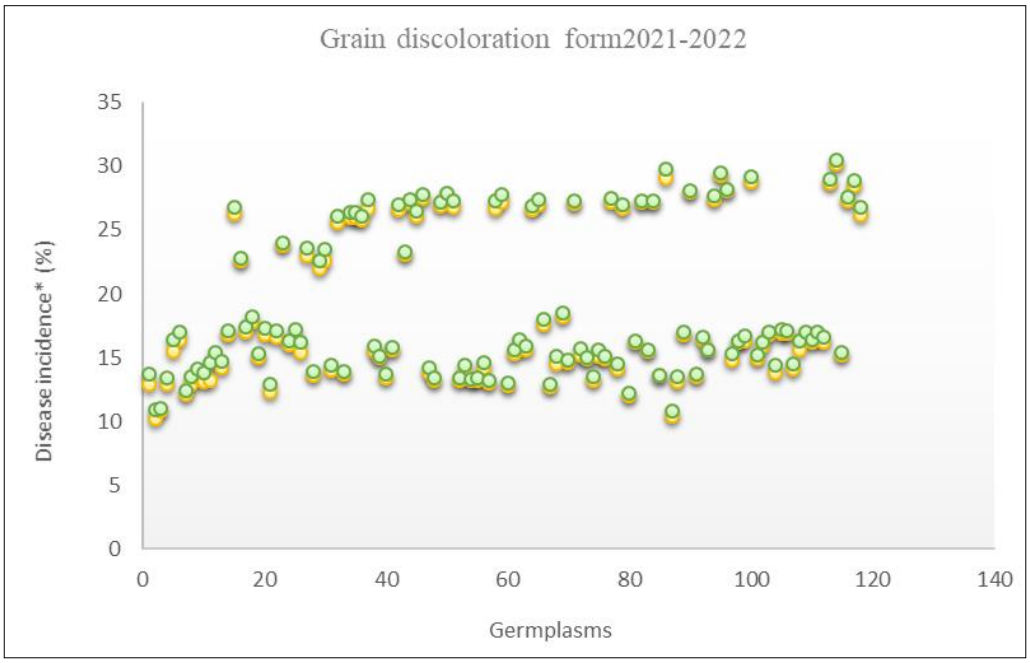

Fig 3: Graphical representation of the disease incidence of screened germplasm

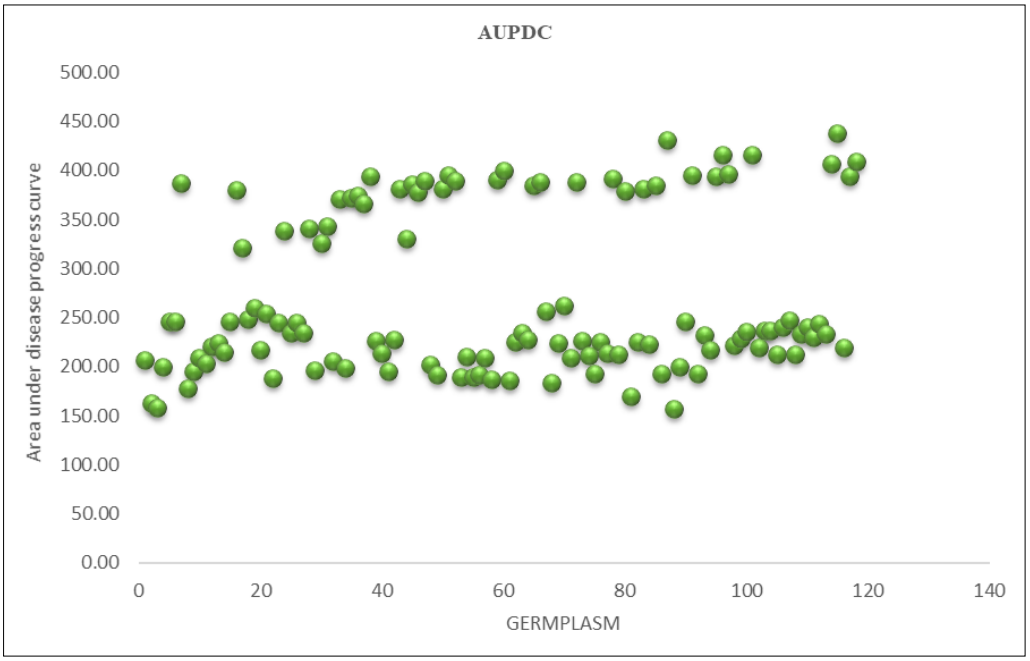

Fig 4: Graphical representation of the Area under disease progress curve of screened germplasm

Table 2: Evaluation of different riccultivars/genotypes against grain discoloration during Kharif 2021-2022 under artificial epiphytotic (controlled) conditions

S. No.	Cultivars/Genotypes	Disease incidence* (%)			AUDPC value			Host Response
		2021	2022	Pooled	2021	2022	Pooled	
1.	R26741	14.53	12.86	13.70	206.26	174.76	190.51	MR
2.	6585STAZ	11.54	10.20	10.87	162.37	151.87	157.12	MR
3.	8433AZDT	11.15	10.82	10.99	157.96	154.46	156.21	MR
4.	MR8222	13.89	12.89	13.39	199.96	182.46	191.21	MR
5.	MR20101	17.19	15.52	16.36	246.58	218.58	232.58	MR
6.	MR8383	17.71	16.38	17.05	245.56	224.56	235.06	MR
7.	SR1	12.75	12.08	12.42	177.80	170.80	174.30	MR
8.	SR2	1 4.06	12.86	13.46	195.06	181.76	188.41	MR
9.	SR3	14.75	13.41	14.08	208.53	187.53	198.03	MR
10.	SR4	14.45	13.11	13.78	203.04	182.04	192.54	MR
11.	Basmati 118	16.01	13.18	14.60	221.13	182.63	201.88	MR
12.	Basmati 123	15.93	14.93	15.43	223.76	209.76	216.76	MR
13.	Basmati 138	15.21	14.21	14.71	214.59	200.59	207.59	MR
14.	Basmati 1121	17.44	16.77	17.11	246.37	235.87	241.12	MR
15.	Giza 14	27.26	26.33	26.80	380.00	372.30	376.15	S
16.	JRH-133	23.06	22.56	22.81	321.09	314.79	317.94	MR
17.	CP R414	17.77	17.00	17.39	248.26	238.81	243.54	MR
18.	RALLIS-20101	18.56	17.77	18.17	260.23	250.57	255.40	MR
19.	RALLIS-20102	15.58	15.04	15.31	217.42	211.47	214.45	MR
20.	HRI-214	17.78	16.84	17.31	254.03	236.78	245.41	MR
21.	UPLRH-180842	13.48	12.30	12.89	188.23	172.20	180.22	MR
22.	VNR-228	17.48	16.65	17.07	245.39	235.94	240.67	MR
23.	UPLRH-162087	24.14	23.80	23.97	338.84	335.34	337.09	MR
24.	US-321	16.67	16.00	16.34	234.15	223.65	228.90	MR
25.	UPLRH-181325	17.71	16.64	17.18	244.65	231.35	238.00	MR
26.	KAVERI-7227	16.95	15.41	16.18	234.75	215.71	225.23	MR
27.	PAN-2150	24.13	23.00	23.57	340.52	321.62	331.07	MR
28.	TNRH-297	14.18	13.61	13.90	196.32	188.62	192.47	MR
29.	NPH-X60	23.15	22.00	22.58	325.89	308.74	317.32	MR
30.	IIRRH-152	24.40	22.58	23.49	342.51	315.84	329.18	MR
31.	JKRH-1004	14.78	14.02	14.40	205.42	196.67	201.05	MR
32.	PHI-21101	26.56	25.63	26.10	370.30	357.00	363.65	S
33.	MEPH-162	14.15	13.75	13.95	198.35	190.65	194.50	MR
34.	PHI-21102	26.74	26.03	26.39	372.19	366.10	369.15	S
35.	IIRRH-150	26.81	26.00	26.41	374.47	360.68	367.58	S
36.	MEPH-163	26.37	25.81	26.09	366.38	359.73	363.06	S
37.	IIRRH-151	28.02	26.72	27.37	393.93	375.03	384.48	S
38.	IIRRH-153	16.29	15.46	15.88	226.31	217.56	221.94	MR
39.	US-314(NCH)	15.26	15.02	15.14	213.82	211.37	212.60	MR
40.	CO-51 (NCV)	14.04	13.44	13.74	194.88	188.23	191.56	MR
41.	PR-124/Luit/NDR-9	16.09	15.58	15.84	226.94	217.91	222.43	MR
42.	Pusa Basmati-1509	27.45	26.58	27.02	381.54	370.34	375.94	S
43.	MALI-348	23.59	23.09	23.34	330.89	325.64	328.27	MR
44.	JRH-134	27.63	27.10	27.37	385.46	379.16	382.31	S
45.	CP R444	26.80	26.13	26.47	377.37	366.87	372.12	S
46.	Indam 300-021	28.03	27.47	27.75	389.66	383.01	386.34	S
47.	IRH-129	14.52	13.85	14.19	202.62	192.12	197.37	MR
48.	Indam 200-053	13.66	13.22	13.44	191.70	183.51	187.61	MR
49.	IRH-130	27.36	26.93	27.15	380.66	376.11	378.39	S
50.	RRX-271	28.11	27.71	27.91	395.15	390.25	392.70	S
51.	UPLRH-180839	27.76	26.82	27.29	388.96	372.86	380.91	S
52.	UPLRH-169054	13.58	13.24	13.41	189.04	185.54	187.29	MR
53.	UPLRH-189001	14.84	13.90	14.37	210.56	194.25	202.41	MR
54.	RNRH-15	13.52	13.16	13.34	189.77	184.38	187.08	MR
55.	SPH-43	13.69	13.19	13.44	191.17	184.52	187.85	MR
56.	PAN-2140	14.96	14.24	14.60	209.13	199.50	204.32	MR
57.	NPH-X49	13.36	13.00	13.18	187.32	183.47	185.40	MR
58.	PHI-21103	27.85	26.66	27.26	390.08	371.95	381.02	S
59.	PRSH-2009	28.43	27.23	27.83	399.14	383.04	391.09	S
60.	US-346	13.21	12.81	13.01	185.50	178.50	182.00	MR
61.	ARRH-23316	15.88	15.35	15.62	225.51	214.31	219.91	MR
62.	US-355	16.68	16.18	16.43	234.75	226.00	230.38	MR
63.	RNC-0334	16.26	15.62	15.94	227.43	216.58	222.01	MR

64.	KPHDF8PX	27.11	26.57	26.84	384.90	375.80	380.35	S
65.	JKRH-1038	27.70	27.03	27.37	388.47	380.77	384.62	S
66.	PHI-21104	18.29	17.63	17.96	256.66	246.16	251.41	MR
67.	MEPH-164	13.07	12.67	12.87	184.10	176.40	180.25	MR
68.	PHI-21105	15.72	14.52	15.12	223.76	202.76	213.26	MR
69.	RNC-0457	18.85	18.15	18.50	262.26	253.86	258.06	MR
70.	MEPH-165	14.96	14.61	14.79	209.13	202.41	205.77	MR
71.	IIRRH-149	27.44	27.11	27.28	388.40	381.40	384.90	S
72.	US-312 (NCH)	16.29	15.19	15.74	226.31	214.76	220.54	MR
73.	Gontra Bidhan-3 (NCV)	15.09	14.92	15.01	211.72	209.62	210.67	MR
74.	PR-113/ Lalat/ Karjat-7	13.87	13.21	13.54	193.13	186.13	189.63	MR
75.	TMRH-2110	16.16	15.06	15.61	224.91	212.31	218.61	MR
76.	HRI-209	15.26	14.92	15.09	213.82	210.32	212.07	MR
77.	RRX-338	27.73	27.20	27.47	391.44	380.24	385.84	S
78.	HRI-211	14.92	14.08	14.50	212.17	194.67	203.42	MR
79.	PAN-2435	27.26	26.66	26.96	379.47	372.82	376.15	S
80.	RNE-0219	12.34	12.00	12.17	169.23	165.73	167.48	MR
81.	Marshal-135 Pro	16.32	16.19	16.26	225.09	223.69	224.39	MR
82.	RNE-0337	27.48	27.15	27.32	381.15	377.65	379.40	S
83.	US-384	15.72	15.51	15.62	222.60	219.63	221.12	MR
84.	VNR-230	27.47	27.14	27.31	384.34	380.84	382.59	S
85.	PHI-21106	13.70	13.60	13.65	192.96	191.91	192.44	MR
86.	PHI-21107	30.52	29.06	29.79	430.57	411.67	421.12	S
87.	CRHR-156	11.09	10.42	10.76	157.26	146.76	152.01	MR
88.	VNR-229	13.89	13.06	13.48	199.96	184.21	192.09	MR
89.	KRH-11	17.19	16.85	17.02	246.58	239.58	243.08	MR
90.	MEPH-166	28.14	28.01	28.08	394.84	392.18	393.51	S
91.	TMRH-5766	13.87	13.54	13.71	193.13	189.63	191.38	MR
92.	CRHR-153	16.83	16.39	16.61	231.91	227.36	229.64	MR
93.	SRH-5402	15.59	15.59	15.59	217.32	217.32	217.32	MR
94.	CRHR-155	28.04	27.37	27.71	394.38	383.88	389.13	S
95.	JKRH-3333 (NCH-1)	29.62	29.29	29.46	415.98	412.48	414.23	S
96.	27P63 (NCH-2)	28.31	28.07	28.19	395.85	393.40	394.63	S
97.	WGL-14 (NCV-1)	15.83	14.76	15.30	221.41	209.51	215.46	MR
98.	BPT-5204 (NCV-2)	16.49	16.16	16.33	228.41	224.91	226.66	MR
99.	Improved Samba Mahsuri	17.16	16.33	16.75	235.41	226.66	231.04	MR
100.	IR-64	29.62	28.79	29.21	415.98	403.73	409.86	S
101.	Rasi	15.58	14.87	15.23	219.17	211.12	215.15	MR
102.	TETEP	16.58	15.92	16.25	236.67	222.67	229.67	MR
103.	CO-39	17.25	16.85	17.05	236.67	232.47	234.57	MR
104.	CH-45	14.92	13.85	14.39	212.17	193.27	202.72	MR
105.	Benibhog	17.54	16.87	17.21	239.72	232.72	236.22	MR
106.	Ajaya	17.25	16.92	17.09	247.17	240.17	243.67	MR
107.	RP-Bio-226	14.92	14.08	14.50	212.17	201.67	206.92	MR
108.	Swarnadhan	16.92	15.65	16.29	233.17	217.07	225.12	MR
109.	IR-50	17.25	16.85	17.05	240.17	235.27	237.72	MR
110.	Vikramarya	16.58	16.18	16.38	229.67	225.47	227.57	MR
111.	Nidhi	17.25	16.75	17.00	243.67	237.72	240.70	MR
112.	Basmati 564	16.92	16.20	16.56	233.17	225.12	229.15	MR
113.	MT7	29.23	28.73	28.98	406.84	400.54	403.69	S
114.	Basmati 129	30.82	30.15	30.49	437.54	423.54	430.54	S
115.	Sanwal Basmati	15.58	15.25	15.42	219.17	215.67	217.42	MR
116.	SJR5	27.92	27.25	27.59	394.17	380.17	387.17	S
117.	PHB-71 (Local Check)	29.29	28.46	28.88	408.98	396.73	402.86	S
118.	Basmati 370 (Local Check)	27.41	26.21	26.81	386.65	363.55	375.10	S
	CD (0.01)	1.89	1.75	1.82				

Conclusion

Because of growing concern about the health effects of pollution, the usage of fungicides is being reduced, which for some reason is impractical. Host plant resistance is the most promising method of combating this disease. Based on the above findings it is concluded that eighty-five genotypes *viz.*, R26741, 6585STAZ, 8433AZDT, MR8222, MR20101, MR8383, SR1, SR2, SR3, SR4, Basmati 118, Basmati 123, Basmati 138, Basmati 1121, JRH-133, CP R414, RALLIS-20101, RALLIS-20102, HRI-214, UPLRH-180842, VNR-228, UPLRH-162087, US-321, UPLRH-181325, KAVERI-7227, PAN-2150, TNRH-297, NPH-X60, IIRRH-152, JKRH-1004, MEPH-162, IIRRH-153, US-314(NCH), CO-51 (NCV), PR-124/Luit/NDR-9, MALI-348, IRH-129, Indam 200-053, UPLRH-169054, UPLRH-189001, RNRH-15, SPH-43, PAN-2140, NPH-X49, US-346, ARRH-23316, US-355, RNC-0334, PHI-21104, MEPH-164, PHI-21105, RNC-0457, MEPH-165, US-312 (NCH), Gontra Bidhan-3 (NCV), PR-113/ Lalat/ Karjat-7, TMRH-2110, HRI-209, HRI-211, RNE-0219, Marshal-135 Pro, US-384, PHI-

21106, CRHR-156, VNR-229, KRH-11, TMRH-5766, CRHR-153, SRH-5402, WGL-14 (NCV-1), BPT-5204 (NCV-2), Improved Samba Mahsuri, Rasi, TETEP, CO-39, CH-45, Benibhog, Ajaya, RP-Bio-226, Swarnadhan, IR-50, Vikramarya, Nidhi, Basmati 564 and Sanwal Basmati were found moderately resistant Whereas, thirty-three cultivars/genotypes *viz.*, Giza 14, PHI-21101, PHI-21102, MEPH-163, IIRRH-151, Pusa Basmati-1509, JRH-134, CP R444, Indam 300-021, IRH-130, RRX-271, UPLRH-180839, PHI-21103, PRSH-2009, KPHDF8PX, JKRH-1038, IIRRH-149, RRX-338, PAN-2435, RNE-0337, CRHR-155, JKRH-3333 (NCH-1), 27P63 (NCH-2), IR-64, MT7, Basmati 129, SJR5, PHB-71 (Local Check), Basmati 370 (Local Check), IIRRH-150, VNR-230, PHI-21107 and MEPH-166 were found susceptible to grain discoloration disease under artificial (controlled) epiphytotic conditions.

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