

Original Research Article

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## Screening of Rice (*Oryza sativa* L.) Genotypes against Grain Discoloration Disease

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### ABSTRACT

#### Keywords

Genotype, Screen, Resistance, Susceptibility

#### Article Info

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Two years, *kharif* 2017 and 2018, screening of rice genotypes against grain discoloration under field conditions in Yalandur taluk, Chamarajanagara district revealed that five genotypes viz., viz., BR-2655, Jaya, KCP-1, Rajamudi and Ratnachudi were found moderately resistant. Out of thirty-eight rice genotypes screened, none of the them were found immune or resistant but twenty-one genotypes showed moderate susceptibility and twelve genotypes were susceptibility, The identified moderately resistant genotypes could be used in the disease resistant breeding programme as grain discoloration is considered one of the most important threats to paddy cultivation in Kabini, Kaveri, Thunga, Bhadra, Hilly upland and Coastal areas.

### Introduction

Rice (*Oryza sativa* L.) is the most important crop of the world both in terms of area (433.38 m ha) and production (481.54 m t) (Anon., 2016). One out of every three people depends on rice for more than half of their daily diet. Rice is most important staple food in Asia, where 60 per cent world population lives and accounts between 35 -60 per cent of the caloric intake of three billion Asians. In India rice is grown in 43.86 m ha, the production level was 104.80 mt and the productivity of 2404 kg/ ha (Anon., 2016). In Karnataka, rice is also extensively cultivated both in *kharif* and rabi seasons. Total area

under rice in Karnataka is 1.42 mha with a production of 3.6 mt accounting for a productivity of 2.62 t per ha (Anon., 2016). This low productivity is attributed due to abiotic and biotic stresses leading to heavy crop losses. Rice crop is prone to attack by several diseases to a much larger extent than any other cereal crops. Rice crop suffers from many diseases like blast, sheath blight, sheath rot, bacterial blight, false smut, grain discoloration, udabatta and tungro. Throughout the world these diseases have drawn much attention and consequently, these diseases have been intensively studied. However, other diseases on which sufficient stress in not yet devoted are generally

considered as “minor disease”. But for the past 5-10 years such diseases problems have come in to light due to heavy crop losses mainly in costal tracts of India, consisting the states namely Andhra Pradesh, Tamil Nadu, Karnataka, West Bengal, Odisha and parts of Bihar.

Grain discoloration was considered to be a minor disease and is now receiving more attention in tropical rice growing areas. The disease is distributed throughout Asia, Africa and America. It is a complex disease due to infection by pathogens on the glume, kernals or both. In Karnataka, it is considered as one of the most important threats to paddy cultivation in Kabini, Kaveri, Thunga, Bhadra, Tungabhadra Hilly upland and Coastal areas. Its intensity varies according to seasons and localities factors such as lodging, frequent rain, high relative humidity and cloudy weather, prevailing particularly from booting to maturity influence the development of grain discoloration.

The main cause of grain discoloration is due to various pathogens, especially species of fungi viz., *Curvularia*, *Drechslera*, *Sarocladium*, *Fusarium* etc. (Bag, 2007; Sachin and Agarwal, 1995). Grain discoloration results in seedling mortality and reduction in germination and seedling vigour (Bag, 2007), causing significant yield loss. Thus, the pathogens causing grain discoloration have direct influence on both quantity and quality of seeds. Discoloration

$$\% \text{ Discoloured grains (number based)} = \frac{\text{Number of discoloured grains}}{\text{Total number of grains}} \times 100$$

Later, based on 0 to 9 disease rating scale, the rice genotypes were grouped in to immune, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible (Anon., 2013) (Table 1).

results in poor quality of grain or seed and an important degrading factor. In such seeds disorders may indicate the presence of seed borne pathogen (Padmanabhan, 1974). In the present context, the development variety looks like an apt choice in the crop improvement programme and is an integral part of Integrated Disease Management (IDM) programmes. Further, it will go a long way in avoiding fungicidal toxicity likely to occur due to chemical spray.

## Materials and Methods

Thirty-eight rice genotypes were collected from Zonal Agricultural Research Station, V.C. Farm, Mandya for screening rice genotypes against grain discoloration. The experiments were conducted in the farmer’s field of Yalandur taluk, Chamarajanagara district during *kharif* 2017 and 2018. The experiment was laid out in Randomized Block Design with two replications in a plot size of 3 m<sup>2</sup> and spacing of 20 x 10 cm. Fertilizers applied at the rate of 100:50:50 kg N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O /ha. N and P<sub>2</sub>O<sub>5</sub> were applied in the form of urea and single super phosphate and potash in the form of muriate of potash. At maturity five ear-heads from each entry were collected and threshed grains were assessed for percentage discoloration by counting the number of healthy and discoloured grains with in the sample. The per cent discoloration was calculated by using the following formulae:

## Results and Discussion

A total of thirty-eight rice genotypes of short, medium and long duration varieties/ hybrid were screened against grain discoloration during *Kharif* 2017 and 2018 in the farmer’s

field of Yalandur taluk, Chamarajanagara district. The data is presented in the (Table 2 and Fig. 1a - 1c) revealed that, during the *Kharif* season of 2017, the lowest of 4.80 per cent discoloration was noticed in Ratnachudi and the highest of 48 per cent in Jyoti (Table 2 and Fig. 1a). Similarly, in *Kharif* 2018, the lowest of 4.85 per cent discoloration was noticed in KCP-1 and the highest of 49 per cent in Mandya Vijaya (Table 2 and Fig. 1b). The average of two seasons indicated that discoloration varied from 4.75 (Jaya) to 47.75 (Mandya Vijaya) per cent (Table 2 and Fig. 1c). The present results are in agreement with Negiand Das (2003).

Out of thirty eight genotypes evaluated, none was found to be immune and resistant against grain discoloration. However, five genotypes *viz.*, BR-2655, Jaya, KCP-1, Rajamudi, and Ratnachudi were found moderately resistant and twenty one genotypes *viz.*, Rasi, KMP-153, IR-64, Mandya sona-2, Raksha, KMP-128, Jaya X ASD, MTU-1010, IR-38064, CTH-1, MSN-100, KMP-200,, GVT-7,

GVT-4, KRH-4, MTU-1001, Tellahamsa, MSN-99, KMP-149, Jyoti X BR-2655 and HR-12, twelve genotypes were susceptible *viz.*, KMP-201, KMP-175, BPT-5204, Jyoti, Basumati-270, JGL-1798, MS-1, Gangavatisona-VCF, Mandya Vijaya, Thanu, RNR-58048, CTH-3 showed moderate susceptibility reaction and none of the genotypes showed highly susceptible reaction and which are represented in (Table 3). The present results are in agreement with findings of Saifulla (1993), Bhimanagouda (2012) Divya (2015) and Varshashikhara (2018).

These conditions also increased the duration of flower opening which predisposed the crop to grain discoloration. The identified moderate resistant genotypes be recommended for cultivation in endemic areas and may be used as source of resistant in the breeding programme in crop improvement. This helps to solve the problem of loss due to this disease and also to avoid the chemical protection/ pollution.

**Table.1** Scale description for scoring grain discoloration disease of rice

Disease Score (0 –9)	Description	Response
0	No symptom of discoloration	Immune
1	Less than 1% discoloration	Resistant
3	1 to 5 % discoloration	Moderately Resistant
5	6 to 25 % discoloration	Moderately Susceptible
7	26 to 50 % discoloration	Susceptible
9	51 % to 100% discoloration	Highly Susceptible

**Table.2** Screening of short, medium and long duration varieties and hybrid against rice grain discoloration during *Kharif* 2017-8 and 2018-19 at Chamarajanagara

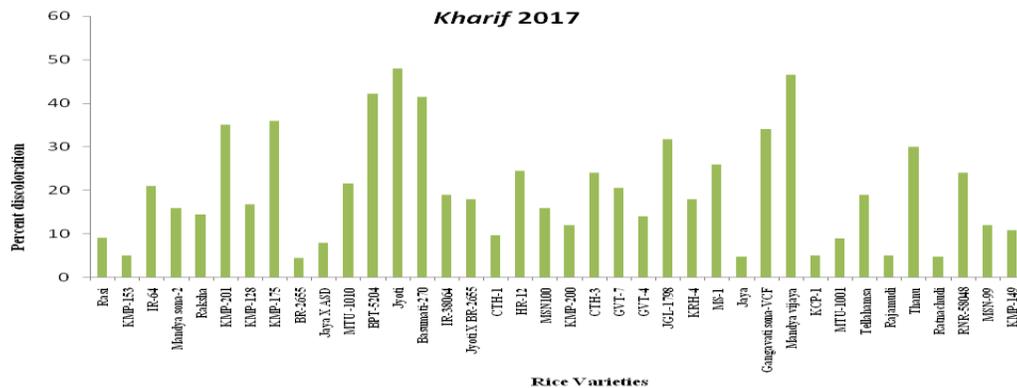
Treatments Variety	Per cent discoloration		
	<i>Kharif</i> 2017	<i>Kharif</i> 2018	Pooled
T <sub>1</sub> .Rasi	9.08 (17.50)	5.08 (12.94)	<b>7.08 (15.39)*</b>
T <sub>2</sub> .KMP-153	5.00 (12.92)	8.00 (16.31)	<b>6.5 (14.72)</b>
T <sub>3</sub> .IR-64	21.00 (27.25)	19.50 (26.19)	<b>20.25 (26.74)</b>
T <sub>4</sub> .Mandya sona-2	16.00 (23.56)	18.00 (25.07)	<b>17.00 (24.32)</b>
T <sub>5</sub> .Raksha	14.50 (22.25)	11.50 (19.77)	<b>13.00 (21.09)</b>
T <sub>6</sub> .KMP-201	35.00 (36.26)	29.00 (32.57)	<b>32.00 (34.44)</b>
T <sub>7</sub> .KMP-128	16.80 (24.16)	12.60 (20.74)	<b>14.70 (22.50)</b>
T <sub>8</sub> .KMP-175	36.00 (36.87)	31.60 (34.18)	<b>33.80 (35.55)</b>
T <sub>9</sub> .BR-2655	4.50 (12.18)	5.00 (12.86)	<b>4.75 (12.52)</b>
T <sub>10</sub> .Jaya X ASD	8.00 (16.31)	7.00 (15.26)	<b>7.50 (15.84)</b>
T <sub>11</sub> .MTU -1010	21.66 (27.73)	18.00 (25.07)	<b>19.83 (26.44)</b>
T <sub>12</sub> .BPT-5204	42.14 (40.47)	39.40 (38.88)	<b>40.77 (39.67)</b>
T <sub>13</sub> .Jyoti	48.00 (43.85)	45.00 (42.18)	<b>46.50 (42.99)</b>
T <sub>14</sub> .Basumati-270	41.50 (40.10)	39.00 (38.64)	<b>40.25 (39.37)</b>
T <sub>15</sub> .IR-38064	19.00 (25.81)	23.00 (28.64)	<b>21.00 (27.25)</b>
T <sub>16</sub> .Jyoti X BR-2655	18.00 (25.10)	24.00 (29.31)	<b>21.00 (20.51)</b>
T <sub>17</sub> .CTH-1	9.75 (18.16)	14.80 (22.58)	<b>12.27 (28.82)</b>
T <sub>18</sub> .HR-12	24.53 (29.67)	22.00 (27.95)	<b>23.26 (24.71)</b>
T <sub>19</sub> .MSN100	16.00 (23.57)	19.00 (25.81)	<b>17.50 (21.08)</b>
T <sub>20</sub> .KMP-200	12.00 (20.20)	14.00 (21.92)	<b>13.00 (30.63)</b>
T <sub>21</sub> .CTH-3	24.00 (29.33)	28.00 (31.93)	<b>26.00 (29.36)</b>
T <sub>22</sub> .GVT-7	20.55 (26.93)	27.58 (31.66)	<b>24.06 (23.54)</b>
T <sub>23</sub> .GVT-4	14.00 (21.92)	18.00 (25.07)	<b>16.00 (36.33)</b>
T <sub>24</sub> .JGL-1798	31.80 (34.32)	38.4 (38.29)	<b>35.10 (27.22)</b>
T <sub>25</sub> .KRH-4	18.00 (25.07)	24.00 (29.31)	<b>21.00 (31.07)</b>
T <sub>26</sub> .MS-1	25.88 (30.56)	27.50 (31.61)	<b>26.69 (12.65)</b>
T <sub>27</sub> .Jaya	4.80 (12.60)	4.88 (12.70)	<b>4.84 (33.82)</b>
T <sub>28</sub> .Gangavatisona-VCF	34.00 (35.66)	27.00 (31.29)	<b>31.00 (43.71)</b>
T <sub>29</sub> .Mandyavijaya	46.50 (42.99)	49.00 (44.43)	<b>47.75 (12.75)</b>
T <sub>30</sub> .KCP-1	5.00 (12.86)	4.85 (12.67)	<b>4.92 (20.90)</b>
T <sub>31</sub> .MTU-1001	9.00 (17.36)	17.50 (24.68)	<b>12.75 (28.98)</b>
T <sub>32</sub> .Tellahamsa	19.00 (25.81)	28.00 (31.93)	<b>23.50 (12.89)</b>
T <sub>33</sub> .Rajamudi	5.08 (13.01)	4.88 (12.70)	<b>4.98 (12.89)</b>
T <sub>34</sub> .Thanu	30.00 (33.20)	35.50 (36.56)	<b>32.75 (34.90)</b>
T <sub>35</sub> .Ratnachudi	4.80 (12.59)	4.90 (12.71)	<b>4.85 (12.65)</b>
T <sub>36</sub> .RNR-58048	24.00 (29.31)	29.00 (32.57)	<b>26.50 (30.95)</b>
T <sub>37</sub> .MSN-99	12.00 (20.20)	10.00 (18.35)	<b>11.00 (19.30)</b>
T <sub>38</sub> .KMP-149	10.80 (19.15)	9.90 (18.25)	<b>10.35 (18.71)</b>
S.Em +_	1.30	1.40	<b>1.32</b>
C.V.	7.32	7.61	<b>7.22</b>
C.D. @5%	<b>3.77</b>	<b>4.02</b>	<b>3.78</b>

\*(Figures in parenthesis are arc sine transformed values)

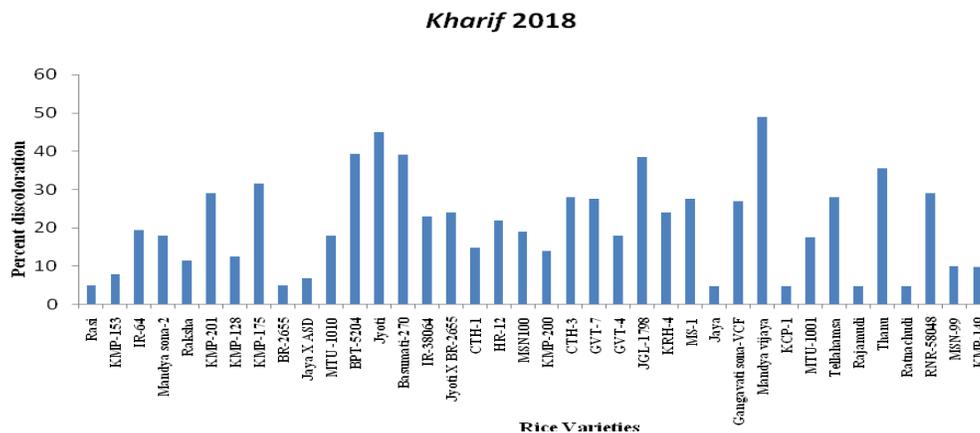
**Table.3** Reaction of rice genotypes against rice grain discoloration

Disease rating scale	Response	No. of entries	Name of varieties / Hybrid varieties/ Germplasm
0	Immune	Nil	Nil
1	Resistant	Nil	Nil
3	Moderately Resistant	5	BR-2655, Jaya, KCP-1, Rajamudi, and Ratnachudi
5	Moderately susceptible	21	Rasi, KMP-153, IR-64, Mandya sona-2, Raksha, KMP-128, Jaya X ASD, MTU-1010, IR-38064, CTH-1, MSN-100, KMP-200,, GVT-7, GVT-4, KRH-4, MTU-1001, Tellahamsa, MSN-99, KMP-149, Jyoti X BR-2655, HR-12
7	Susceptible	12	KMP-201, KMP-175, BPT-5204, Jyoti, Basumati-270, JGL-1798, MS-1, Gangavatisona-VCF, Mandyavijaya, Thanu, RNR-58048, CTH-3
9	Highly susceptible	Nil	Nil

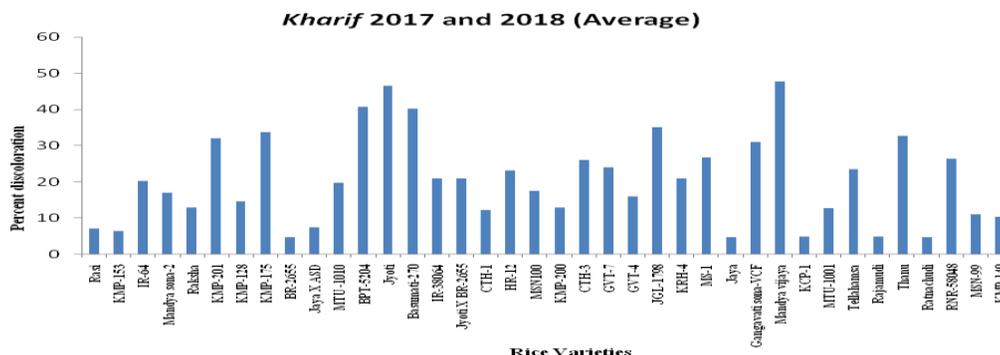
**Fig.1a** Screening of rice varieties/ hybrids against grain discoloration during *Kharif* 2017



**Fig.1b** Screening of rice varieties / hybrids against grain discoloration during *Kharif* 2018



**Fig.1c** Screening of rice varieties / hybrids against grain discoloration during *Kharif* 2017 and *kharif* 2018 (Average)



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