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Grain discoloration in popular rice varieties (*Oryza sativa*) released from Indira Gandhi Krishi Vishwavidyalaya, Raipur of Chhattisgarh in Chhuikhadan, and associated mycoflora

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Abstract

Production and productivity of rice is reduced greatly due to the emerging disease-causing grain discoloration. The disease is a complex symptom due to the association of a number of pathogenic and saprophytic fungi that infect the rice grains both in field and storage conditions. These pathogens not only reduce yield and quality, but also produce harmful mycotoxins which are detrimental to human and animal life. Looking into the incidence and severity of the disease, present investigation was undertaken to assess the disease incidence among the popular 34 rice varieties release from, Raipur, Chhattisgarh in RABLCARS, Chhuikhadan and associated mycoflora causing grain discoloration. The results indicated that, maximum Percent Disease Incidence (PDI) was recorded in Chhattisgarh Bhavya Dhan followed by Indira Barani Dhan-1 whereas least disease incidence by mycoflora was recorded from variety, Trombey C.G Vishnubhog Mutant. This study clearly indicated that the disease incidence and yield losses due to grain discoloration varies with the different varieties of Chhattisgarh. Moderate to severe disease incidence among thirty-four rice varieties was noticed. Further, it was observed that, the disease affects seed growth and quality parameters which may leads to reduced grain yield.

Keywords: Chhattisgarh Bhavya Dhan, Indira Barari Dhan-1, Indira Gandhi Krishi Vishwavidyalaya, Mycoflora, Saprophyte, Trombey C.G. Vishnubhog Mutant

Introduction

Rice (*Oryza sativa*) is the most important staple food of more than 60 percent of population in India. It provides livelihood and food security to more than two third population of the country (Adam *et al.*, 2018) [1]. The global population is increasing every year and has been predicted to exceed 8 billion by 2025. It has also been estimated that the production of rice needs to be increased by 40% in order to meet the increasing food demands by 2030 (Khush, 2005; Yadav *et al.*, 2018; Jena *et al.*, 2018) [5, 6, 4]. Rice is susceptible to a wide range of pests and diseases which affects the crop in all its growth stages. Some of the major diseases of rice in India are rice blast, brown spot, sheath blight, bacterial blight and tungro. sheath rot, stem rot, bakane, narrow brown spot, bacterial leaf streak, false smut and rice grain discoloration have emerged as major problem in the recent years (Raghu *et al.*, 2018; Jena *et al.*, 2018) [6, 4]. Amongst all these emerging diseases, the Rice Grain Discoloration (RGD) has become a serious problem for rice cultivators in recent times causing significant loss to the quality and quantity of rice (Raghu, 2020) [7].

Hence, the present study was undertaken where some of the popular rice varieties release3d from Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh were screened against RGD disease complex.

Materials and Methods

The present study was undertaken during the year 2021 at RABLCARS (Rani Avanti Bai Lodhi College of Agriculture and Research Station Chhuikhadan), IGKV, Chhattisgarh, India which is situated at latitude and longitude of 21.516821° and 80.995124°, respectively. A total of 34 of popular rice varieties of Chhattisgarh namely Indira Barani Dhan-1, Danteshwari, Durgeshwari, C.G Javaful Trumbay, Jaldubbi, Zinc Rice M.S, C.G Zinc Dhan-1, C.G Madhuraj 55, Syamala, R-2404-343-164-1, R-2464-1-R-1-10, R-1853-105-1-821, Trombay Chhattisgarh Dubraj Mutant -1, C.G Dhan 1919, Indira Barani Dhan-2, Indira Aerobic Dhan, Mahamaya, Vishnubhog, Purnima, Maheshwari, Vikram TCR, C.G Tejaswi Dhan, Trombay

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C.G Sangathi Mutant, R 2370-486-1-278-1, C.G Dev Bhog, Protegin, Rajeshwari, Karma Masuri, Bastar Dhan, Bamleshwari, Chandrasahini, Vishnu Bhog Selection-1, Tarun Bhog Selection -1. were considered under the study. For *in vitro* experiments, 500g of each of the 34 varieties were collected from freshly harvested grains in a properly labelled zip lock bag and brought to the Plant Pathology Laboratory of RABLCARS, Chhuikhadan. All the samples were stored at room temperature for further trials.

Estimation of disease incidence: For estimation of disease incidence, a total of 100 rice grains were randomly picked from the collected rice samples and the grains that were discoloured were counted based on visual observation. The experiment was conducted in five replicates and in Kharif Season, 2024 and the average was calculated out. The disease incidence was then calculated using the following formula:

Disease incidence % = (Number of infected grains/ Total number of grains) × 100.

Estimation of percent discoloration: As RGD disease is known to be caused by multiple pathogens showing different degrees of discoloration, hence, the percent discoloration was estimated in order to understand the severity of the disease of a particular rice variety. Hundred discoloured grains from each variety were carefully picked and categorized as point, partial or complete discoloration. The experiment was conducted in three replicates in Kharif Season, 2024. The percent discoloration was then calculated using the following formula.

Discoloration (point/partial/complete) (%) = {No. of discoloured grains (point/partial/complete) / Total no. of grains counted for each sample} × 100.

Results and Discussion

Details of rice varieties taken under study The Rice Grain Discoloration (RGD) disease complex is one of the emerging diseases of rice in the changing climatic scenario. A total of 34 popular rice varieties released from IGKV, Raipur, Chhattisgarh were evaluated against RGD in the present study, the details of which are shown in Table 1 and Fig. 1. Amongst these varieties, maximum percent disease incidence (PDI) was recorded in Chhattisgarh Bhavya Dhan followed by Indira Barani Dhan-1 whereas least disease incidence by mycoflora was recorded from variety, Trombey C.G Vishnubhog Mutant.

The different mycoflora found while studying the seed samples are *Curvularia* spp, *Fusarium* spp, *Sarocladium oryzae*, *Ustilaginoidea virens*, *Alternaria* sp., and *Helminthosporium* sp.

Similar studies were conducted by Butt *et al.* (2011)^[2], where they studied five Basmati rice varieties against seed borne microflora where they observed 27%, 19%, 17%, 16% and 14% found associated with the seeds of Basmati kernel, Basmati-385, Basmati-370, Basmati-198 and KS-282, respectively. They also reported four fungal species namely *Fusarium moniliforme*, *Alternaria* sp., *Helminthosporium* sp. and *Curvularia* sp., which were associated with the disease. Habib *et al.* (2012)^[3] on the other hand tested 8 coarse and 7 fine grained varieties of rice against seed borne microflora. They reported that the predominant pathogen infecting the rice grains was *Helminthosporium oryzae* and in the coarsed grain rice varieties, the percent infection caused by *H. oryzae* was 28.11% in case of agar plate method and 17.014% in case of blotter paper method.

Table 1: Percent of Grain Discolouration in 34 Rice Varieties Released from IGKV

S. No.	Name of variety	Grain discolouration %
1.	Indira Barani Dhan-1	52
2.	Danteshwari	46
3.	Durgeshwari	32
4.	C.G Javaful Trumbay	20
5.	Jaldubbi	26
6.	Zinc Rice M.S.	28
7.	C.G Zinc Dhan-1	32
8.	C.G Madhuraj 55	18
9.	Syamala	22
10.	R-2404-343-164-1	21
11.	R-2464-1-R-1-10	20
12.	R-1853-105-1-821	25
13.	R 2370-486-1-278-1	28
14.	Trombay Chhattisgarh Dubraj Mutant -1	15
15.	C.G Dhan 1919	29
16.	Indira Barani Dhan-2	35
17.	Indira Aerobic Dhan	27
18.	Mahamaya	46
19.	Vishnubhog	45
20.	Purnima	40
21.	Maheshwari	42
22.	Vikram TCR	40
23.	C.G Tejaswi Dhan	36
24.	Trombay C.G Sangathi Mutant	24
25.	C.G Dev Bhog	20
26.	Protegin	24
27.	Rajeshwari	28
28.	Karma Masuri	25

29.	Bastar Dhan	30
30.	Bamleshwari	28
31.	Chandrasahini	32
32.	C.G Bhavya Dhan	55
33.	Vishnu Bhog Selection-1	41
34.	Tarun Bhog Selection -1	35
	S.Ed (\pm)	1.720701
	CV	3.128849
	C.D($P=0.05$)	3.84

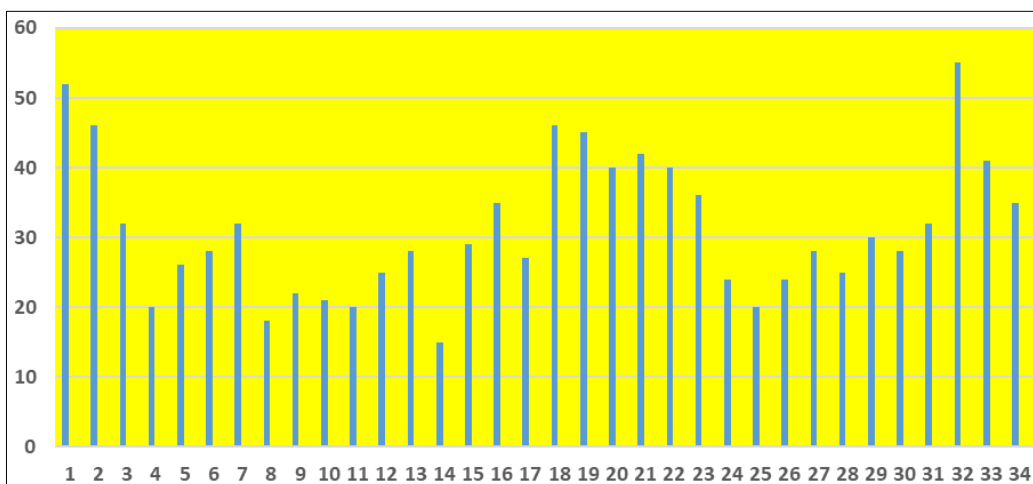


Fig 1: Percent of Grain Discolouration in 34 Rice Varieties Released from IGKV

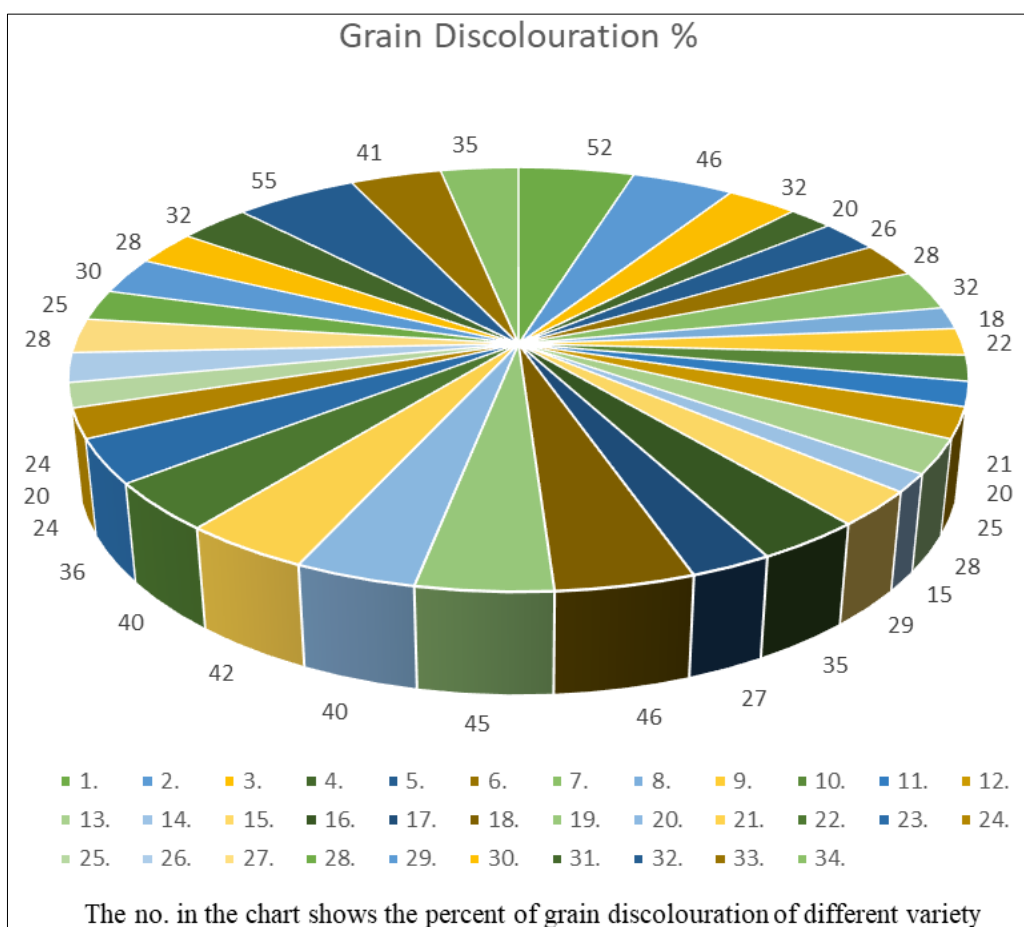


Fig 2: Grain discolouration %

Conclusion

The rice grain discoloration (RGD) disease complex has become an emerging problem of Chhattisgarh causing yield

losses every year. Chhattisgarh is considered as Rice Bowl of India and it is the need of the hour to understand the susceptibility status of the most popular rice varieties of the

state against the disease in order to meet the ever growing demand of rice to feed the population. Hence, in the present study, a total of 34 rice varieties were screened against the disease wherein both the disease severity and the disease incidence were determined. However, in the future it is important to determine the major biotic and abiotic factors responsible for the disease and establish the most suitable sustainable management practices that shall be effective in managing the disease in the state.

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