
Mycoflora causing grain discolouration (Gd) of rice and its effect on some yield components

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Both healthy and discoloured grains (having different type of spotting and colour) of rice seeds were harvested from twenty one (21) different varieties cultivated at Rice Research Station, Chinsurah, West Bengal for analysis. Analysis revealed that eight fungi were responsible for grain discolouration (Gd). Among eight fungi *Curvularia* spp. and *Sarocladium oryzae* were predominant. Germination study revealed that viability was lost due to infection of grain discolouration pathogens. Germination percentage reduced by 3 to 40.4% over healthy grain. It was also observed that grain weight of discoloured seeds reduced from 3.8 – 23.8% over healthy grain that means infection of Gd pathogens caused deteriorations of grains. Both healthy and discoloured grains were also set for seedling vigour test. It was found that seedling vigour index (SVI) was 281 to 590 of discoloured grains whereas it was 657 to 765 of healthy seeds of same varieties. So it was also evident that pathogens causing grain discolouration had effect on shoot and root length of seedlings. So proper protection should be taken to avoid infection from Gd pathogens which had both quantitative and qualitative effect on grains.

Key words: Grain discolouration, Gd-pathogens, germination, grain weight, SVI

INTRODUCTION

Rice is an important crop and is infected by various fungi before and after harvest causing grain discolouration. Grain discolouration (Gd) is now common problem throughout the rice growing areas. Thus pathogens causing grain discolouration are gaining importance day by day as they have direct influence on both quantity and quality of seeds. Discoloured seeds are reported to cause loss of viability and germination (Sharma *et al.*, 1987; Zulkifi and Castano, 1991). Grain discolouration also have adverse effect on seedling vigour of rice (Zulkifi and Castano, 1991; Ou, 1985; Roy, 1983; Bora and Gogoi, 1992). Present study has been undertaken in Rice Research Station, Chinsurah, West Bengal to find out the mycoflora associated with freshly harvested discoloured seeds and their effect on viability, germination and seedling vigour over the healthy seeds of same variety.

MATERIALS AND METHODS

Both fresh and discoloured seeds were collected from 21 varieties cultivated as check in screening

nursery for disease resistance plot during the year 2002–03 and 2003–04. All the seeds were properly dried to maintain the optimum moisture percentage. Mycoflora were detected by standard blotter method and agar plate method as prescribed by Seed Testing Association (Anonymous, 1966). For discoloured seeds, seeds having $\geq 25\%$ discoloured areas or spots were taken for study. Germination of seeds of rice was determined by 'Top of paper' method. Separate set of healthy and discoloured seeds were taken for study. For grain weight 100-grain weight of each variety was taken separately for healthy and discoloured grains.

Seedling vigour was determined by measuring the shoot length, root length and dry weight of seedlings. For comparison separate set of healthy and discoloured grains were taken.

Observations were recorded in terms of per cent seed germination, grain weight of discoloured grains and shoot length, root length of seedling grown from discoloured seeds and reduction percentage was calculated over healthy seeds.

RESULTS AND DISCUSSION

Discoloured grains of 21 varieties were kept for blotter test and agar plate test separately for isolating fungi. Altogether eight fungi were isolated and identified from the discoloured grains. Out of the eight, *Curvularia* spp. was the predominant fungus. Besides *Curvularia*, *Sarocladium oryzae*, *Aspergillus niger* and *Helminthosporium oryzae* were commonly found in most of the varieties. *Drechslera oryzae*, *Fusarium* sp. and *Alternaria* sp. were also isolated from 2 to 3 varieties. *Magnaporthe salvinii* was isolated from only Sasyasree variety (Table 1).

All the 21 varieties were taken for comparing grain weight between healthy and discoloured grains. Maximum weight loss due to fungal infection was found in Annada (ca 23%). Seven varieties' grain weight was reduced by 16 – 19%,

viz., Govinda, IR 64, PR 106, Vikramarya, Purnendu, KRH 2 and Jalamagna. In case of Tulasi, Sasyasree, Swarnadhan and Heera grain weight was reduced by 11 – 13%. Whereas grain weight reduction was <10% and range between 3.8 – 8.3% in case of another 8 varieties over healthy grains (Table 2).

Out of 21 varieties 15 were taken for comparing germination percentage study between healthy and discoloured grains. In case of IR 64, it exhibited highest level of germination loss (40.4%) over healthy grains and next loss percentage was in Sasyasree. But in case of Sabita and Purnendu germination percentage was reduced by 20.2% and 22.5% respectively. In case of Tulasi, Jaya and Triguna germination percentage loss ranged between 11.1 to 15.5%. Rest four varieties, lost was very negligible due to fungal infection (Table 2).

Table 1 : Fungi isolated from discoloured grains of rice

Name of variety	Isolated fungi
Govinda	<i>Curvularia lunata</i> , <i>Alternaria</i> sp.
IR 64	<i>Helminthosporium oryzae</i> , <i>Drechslera oryzae</i>
PR 106	<i>Curvularia affinis</i> , <i>Sarocladium oryzae</i> , <i>Aspergillus niger</i>
Tulasi	<i>Sarocladium oryzae</i>
Jaya	<i>Helminthosporium</i> sp., <i>Curvularia affinis</i>
Dinesh	<i>Sarocladium oryzae</i> , <i>Fusarium</i> sp.
Annada	<i>Sarocladium oryzae</i> , <i>Helminthosporium oryzae</i>
Sasyasree	<i>Magnaporthe salvinii</i> , <i>Curvularia lunata</i>
Triguna	<i>Sarocladium oryzae</i> , <i>Fusarium</i> sp.
Vikramarya	<i>Curvularia lunata</i> , <i>Alternaria</i> sp.
Swarnadhan	<i>Helminthosporium oryzae</i> , <i>Sarocladium oryzae</i>
Sabita	<i>Aspergillus niger</i> , <i>Curvularia affinis</i>
Purnendu	<i>Drechslera oryzae</i> , <i>Curvularia lunata</i>
KRH 2	<i>Sarocladium oryzae</i> , <i>Curvularia lunata</i> , <i>Fusarium</i> sp.
Narendra	<i>Fusarium</i> sp., <i>Curvularia pallescens</i> .
NDR 359	<i>Curvularia affinis</i>
Heera	<i>Curvularia lunata</i> , <i>Helminthosporium oryzae</i>
Ajay	<i>Sarocladium oryzae</i>
RH 124	<i>Aspergillus niger</i>
HR 12	<i>Aspergillus niger</i> , <i>Curvularia pallescens</i>
Jalamagna	<i>Curvularia affinis</i>

In five varieties seedling vigour index (SVI) was observed. It was observed that the IR 64 was the worst affected. In healthy seeds of IR 64 SVI was 765 whereas in discoloured grains it was only 281. Next worst affected variety was PR 106 and Govinda (Table 3).

It was clearly observed that IR 64 was worst affected, as its germination loss was 40.4% over healthy seeds and grain weight was reduced by about 16.7% which had reflection in SVI. Thus seeds with fungal infection were observed to cause apparent seed discolouration on glume or may be on

Table 2 : Effect of grain discolouration on germination and grain weight of rice

Name of variety	Germination (%)			Grain weight (100 grains)		
	Healthy	Gd seed	Reduction (%)	Healthy	Gd seed	Reduction (%)
Govinda	97	90	7.2	2.2	1.8	18.2
IR 64	89	53	40.4	2.4	2.0	16.7
PR 106	98	94	4.1	2.6	2.1	19.2
Tulasi	97	82	15.5	1.8	1.6	11.1
Jaya	99	88	11.1	2.5	2.4	6.4
Dinesh	82	77	6.1	2.4	2.2	8.3
Annada	98	95	3.1	2.1	1.6	23.8
Sasyasree	94	64	31.9	2.5	2.2	12.0
Triguna	95	83	12.6	2.0	1.9	5.0
Vikramarya	93	87	6.5	3.2	2.6	18.8
Swarnadhan	99	90	9.1	2.3	2.0	13.0
Sabita	98	76	22.5	3.4	2.6	23.5
Purnendu	94	75	20.2	2.1	1.7	19.1
KRH 2	99	96	3.0	2.3	1.9	17.4
Narendra	97	92	5.2	2.6	2.4	7.7
NDR 359	-	-	-	3.1	2.8	9.7
Heera	-	-	-	2.3	2.0	12.0
Ajay	-	-	-	2.4	2.3	4.2
RH 124	-	-	-	2.5	2.3	8.0
HR 12	-	-	-	2.6	2.5	3.8
Jalamagna	-	-	-	2.5	2.1	16.0

Table 3 : Effect of grain discolouration on seedling vigour of rice

Variety	Type of seed	Germination (%)	Root length (mm)	Shoot length (mm)	Seedling height (mm)	Seedling vigour index	Dry weight (mg)	Seedling vigour index
Govinda	Healthy	97	121.5	51.0	172.5	1673.3	7.0	679
	Diseased	90	96.5	35.2	131.7	1185.3	4.8	432
IR 64	Healthy	89	110.0	42.1	152.1	1353.7	8.6	765
	Diseased	53	46.7	29.2	75.9	402.3	5.3	281
PR 106	Healthy	98	113.9	56.7	170.6	1671.9	6.7	657
	Diseased	94	62.9	47.9	110.8	1041.5	3.9	367
Tulasi	Healthy	97	90.0	43.9	133.9	1298.8	8.9	863
	Diseased	82	70.6	33.9	104.5	856.9	6.8	558
Jaya	Healthy	99	74.5	30.6	105.1	1040.5	8.0	792
	Diseased	88	44.5	20.3	64.8	570.2	6.7	590

kernel (to be examined), and reduced the commercial quality and agronomic potentiality for yield performance besides playing a key role as potential inoculum as source of causing severe diseases. Misra and Vir (1993) also reported such incidents. Present investigation proved that these mycoflora has role in reducing quality and quantity of seeds and which has effect on seed production as well as grain production. More emphasis has to be given on study of grain discolouration of rice seeds.

ACKNOWLEDGEMENTS

Grateful thanks are due to the Director of Agriculture & Ex-officio Secretary, West Bengal; Additional Director of Agriculture (Research) West Bengal and Joint Director of Agriculture (Rice Dev.), Rice Research Station, Chinsurah, West Bengal for their continuous support and encouragement for carrying out the job.

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(Accepted for publication September.04, 2009)