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Fungi associated with discoloured rice grains and their effect on germination

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Incidence of seed discoloration was highest (38.5%) in China-1039 and least (18.1%) in K.D. 2-6-3 cultivars. Discoloration reduces the germination rate of seeds. The loss in germination was proportional to the severity of seed discoloration. Eight fungal species viz., *Aspergillus sp., Curvularia geniculata, C. lunata, Fusarium avanaceum, F. graminearum, F. moniliforme, Helminthosporium oryzae and Nigrospora oryzae* were isolated from discoloured seeds. *C. lunata* and *F. moniliforme* were more common fungi.

Key words : Discoloured rice grains, seed germination

INTRODUCTION

Rice is most widely grown food crop of the world. Rice grains may be infected by various organisms before or after harvest, causing seed damage in the form of discoloration and the extent of damage varies according to season, locality, seed mycoflora and host cultivar (Caster and Frederikson, 1980). Invasion of seeds by storage fungi may result discoloration and loss in viability (Oren and Bass, 1982). Several factors may be responsible for the discoloration of rice seeds - premature harvesting and subsequent storage without proper drying, stocking of freshly harvested seeds in heaps and attack by insect pests and microbes during grain formation can caused seed discoloration (Kimura, 1938, Baldacci and Picco, 1948, Douglus and Tullis, 1950). This paper reports on the mycoflora associated with the discoloured seeds, incidence of seed discoloration of four rice cultivars and its effect on seed germination.

MATERIALS AND METHODS

Seed samples of rice cultivars Huikap-phou, China-1039, K.D. 2-6-3 and Norin-18 were collected from the seed production field, during 1995-96 and stored for 6 months in paper bags under laboratory condition. The seed lot was grouped into 3 categories, on the basis of severity of seed discoloration. For studying the mycoflora associated with the discoloured seeds, 200 seeds were tested by Agar plate method (ISTA 1966). The seeds were surface sterilized with 0.1 % NaClO for 3 mins. and washed in sterilized distilled H_2O. Ten seeds were plated in each petridishes containing PDA medium. The plates were incubated at 28±1°C and the fungal colonies developed on the seeds were examined after 5 days. Each colony arising on seeds were transferred to PDA slants and their % occurrence of each fungal species was calculated from the total isolates. The per cent germination of seeds was recorded as per procedure laid down by International Seed Testing association.

RESULTS AND DISCUSSION

Mycoflora associated with discoloured seeds

Table-1 showed that eight fungal species were found to be associated with normal & different categories of discoloured seeds, out of which *C. lunata, F. graminearum, F. moniliforme, H. oryzae* occurred more commonly than other fungi. Although *F. moniliforme* was found even in healthy seeds, its occurrence was more in discoloured seeds. It is expected that high incidence of *F. moniliforme* might have enhanced the seed discoloration though at times this fungus was carried by rice seed showing no visual discoloration at all. Agarwal and Singh (1973) reported that *F. moniliforme* cause seed discoloration in rice. Kheroda (2000) while studying

the discoloration of rice grain caused by field fungi reported that *H. oryzae* caused maximum discoloration in rice.

Seed discoloration and its effect on germination

The seed discoloration appeared as light brown, small pinhead size spots which were light brown in colour. These spots increased in size gradually and the colour intensified to chocolate brown with time. Subsequently the entire seed became discoloured. On the basis of severity of discoloration, the seeds were divided into 3 categories and the percentage of discoloured seeds was calculated from each category. Table - 2 showed that the no. of partially and fully discoloured seeds was highest (37.6 %) in cultivar K.D-2-6-3 and (38.5 %) in China-1039.

Table 1 : Per cent of fungi associated with different categories of discoloured seeds in four rice cultivars

Fungi	Huikap-phou			China-1039			K.D.2-6-3			Norin-18		
	C_I	C_{II}	C_{III}	C_I	C_{II}	C_{III}	C_I	C_{II}	C_{III}	C_I	C_{II}	C_{III}
Aspergillus sp.	0	0	0	0	10	0	0	5	10	0	10	0
Curvularia lunata	0	20	25	10	20	40	0	15	10	10	23	40
C.geniculata	0	10	10	0	10	0	0	0	0	0	6	0
F.avenaceum	0	20	0	0	0	0	5	10	20	0	10	15
F.graminearum	10	24	20	0	10	0	10	15	25	10	20	40
F.moniliforme	13	26	20	10	30	50	0	20	30	12	50	40
H.oryzae	10	25	20	10	20	10	10	30	55	0	10	20
N.oryzae	0	20	10	0	10	10	0	0	0	0	0	10

Table 2 : Incidence of discoloured seeds of rice cultivars *Huikap-phou, China*-1039, K.D.2-6-3 and *Norin*-18 and the germinability of discoloured seeds

Cultivars	Percent seeds			Germination (%)		
	C_I	C_{II}	C_{III}	C_I	C_{II}	C_{III}
Huikap-phou	43.9	31.7	24.4	90	70	60
China-1039	42.3	19.2	38.5	80	60	40
K.D.2-6-3	44.8	37.6	18.1	89	76	70
Norin-18	31.3	37.5	31.8	90	70	65

C_I = Normal seeds. C_{II} = Partially discoloured seeds
C_{III} = Fully discoloured seeds

Discoloration of seeds lowered the germinability of cultivars Huikap-phou, China-1039, K.D. 2-6-3 and Norin-18. The loss in germinability was directly proportional to the severity of discoloration. This suggests that either the discoloration imparting compound itself was inhibitory to the seed germination or the factors inducing the discoloration had damaged the embryo of the seed resulting in reduced the rate of germination. The microbial agents inducing discoloration can also inhibit the germination of seeds (Neergard, 1966). Similar trends or findings were also reported by Sharma *et al.*, (1987).

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