J. Mycopathol. Res. **40 (1)** : 5-7 (2002) *Printed in India*

Diversity of seed mycoflora of flood-prone low land rice genotypes

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Analysis of seed samples of five rice genotypes comprising four indigenous cultivars and one improved variety, predominantly cultivated in flood-prone low land ecosystem, yielded twenty one fungal species as were isolated by standard blotter and agar plate methods. There was qualitative and quantitative variation in the association of the seed mycoflora, as were influenced by the rice genotypes viz. Panisali, Bordhan, Panikekua, Rangagatha and Mahsuri. The predominant fungal species isolated were *Aspergillus niger, A.flavus, Fusarium moniliforme, Helminthosporium oryzae, Curvularia affinis, C.lunata, C. pallescens and Pyricularia oryzae*. Potential pathogenic risks of some of the isolated seed microfungi for reducing seed quality standards and seedling vigour have been discussed.

Key words : Seed mycoflora, rice cultivars

INTRDUCTION

Rice cultivation under flood-prone low land ecosystem is invariably subjected to water logging and flood submergence of varying depth and duration. Diverse seed mycoflora that harbour the seeds of flood-prone low land rice varieties are often responsible for quality degradation of seeds. Several fungal species have been reported to be associated with rice seeds causing seed infections that lead to grain discolouration, loss of germinability, seed rotting, seedling mortality and consequent yield loss (Roy, 1983 and Bora and Gagoi, 1992). It has also been observed by Sharma *et al* (1987) that the amount of fungal recovery, severity of infection and germinability of seeds were proportional to varying degrees of seed discolouration. The present investigation was, thus undertaken to assess the existing diversity of mycoflora associated with the seed samples of five rice cultivars, popularly cultivated in flood-prone low land rice ecosystem of Assam.

MATERIALS AND METHODS

Seed samples of five flood-prone low land rice cultivars viz. Panisali, Bordhan, Panikekua, Rangagatha and Mahsuri from different rice growing tracts of Sonitpur district were analysed for their seed-borne mycoflora during *Kharif* seasons of 1997-98 and 1998-99. The mycoflora were detected by standard blotter method and agar plate method, as prescribed by Seed Testing Association (Anonymous, 1966). In blotter method, two lots of seeds were used one lot was surface sterilized with 0.1 percent mercuric chloride and the other lot was used unsterilized. The seeds were then plated separately in petridishes containing three layers of moist sterilized blotting papers. The plated seed lots were incubated at room temperature (27 ± 2 ° C) for 8 days under natural light and darkness.

In agar plate method the seeds were plated in petridishes containing potato dextrose agar (PDA) and were incubated following the same procedure. Isolation of mycoflora was done by aseptically transferring the fungal organisms growing out of the seed surface on to the PDA slants.

The isolated mycoflora were examined under the microscope. Identification of the mycoflora was done by using relevant keys and monographs.

Evaluation of pathogenic potential was restricted to the dominant fungal species isolated. For conducting their pathogenecity tests, the seeds of rice cv. Mahsuri were surface sterilized with 0.1 percent mercuric chloride and the seeds were then rolled on actively sporulating cultures of each test

fungus. Inoculated seeds were sown at the rate of 10 seeds in a pot, filled up with steam sterilized soil and sand mixture. Observations were recorded for percent seed germination, seedling

RESULTS AND DISCUSSION

Quantitative and qualitative analyses revealed the presence of 21 fungal species contaminating the seeds of five rice cultivars (Table 1). The most frequently occurring fungal species were *Aspergillus niger, A flavus, Fusarium moniliforme, Helminthosporium oryzae, Curvularia affinis, C. lunata, C. pallescens and Pyricularia oryzae.*

Table 1. Percent occurrence of seed-borne mycoflora on unsterilized (US) and surface sterilized (SS) seed samples of rice cultivars

	Cultivars									
	Panisali		Bordhan		Panikekua		Rangagatha		Mashuri	
Mycoflora	US	SS	US	SS	US	SS	US	SS	US	SS
Curvularia lunata	5	7	6	7	4	5	3	6	12	18
C.affinis	2	1	5	2	3	4	2	2	14	17
C. pallescesns	1	3	4	6	3	3	1	4	11	13
Pyricularia oryzae	1	2	2	4	2	3	1	1	10	14
Helminthosporium oryzae	3	3	6	6	4	3	2	1	16	21
Fusarium moniliforme	0	5	0	11	1	5	0	4	1	25
F. pallidoroseum	2	6	2	7	1	8	1	5	1	10
Sarocladium oryzae	1	10	3	9	3	5	2	4	4	15
Aspergillus niger	6	2	9	3	6	4	3	3	26	1
A. flavus	7	4	8	1	7	2	4	2	21	2
A. terreus	3	0	5	5	5	4	2	0	10	2
A. candidus	8	6	9	5	10	3	3	1	11	1
Drechslera oryze	1	1	1	4	1	3	1	2	2	3
Penicillium sp.	2	0	6	5	2	2	3	1	9	2
Nigrospora oryzae	1	3	3	2	1	4	2	2	3	1
Phyllostica sp.	0	2	1	2	0	3	1	1	3	2
Alternaria oryzae	1	6	1	3	1	4	1	3	1	8
Epicoccum sp.	1	1	4	6	2	0	1	0	4	0
Trichoconis padwickii	2	3	1	3	1	4	1	2	4	7
Rhizopus sp.	1	4	5	4	3	2	1	3	6	3
Cladosporium sp.	3	2	4	3	2	1	1	2	9	1

Other prominent pathogenic fungi intercepted from seeds of the cultivars in varying percentage of occurrence were – *Sarocladium oryzae, Drechslera oryzae* and *Trichoconis padwickii.*

It was observed that pre-treatment of seeds with 0.1 percent mercuric chloride greatly lowered the seed inoculum of some of the mycoflora irrespective of the host cultivars. These fungal species include – *A. nigra, A. flavus, A, terrus, A candidus, Cladosporium sp.* and *Penicillium sp.* which contaminated the seeds as externally seed-borne fungi, while some of the fungal species viz. *Alternaria oryzae, F. monoliforme, F.pallidoroseum* and *S. oryzae* appeared to be internally seed-borne, being deeply seated inside the seed, as were earlier observed by Padmanabhan (1949) and Bora and Gogoi (1992). The results presented in Table 1. further revealed that the fungal types recovered from the cv. Rangagatha showed the lowest frequency of occurrence. It was worth noting that the cultivars differed greatly in their degree of susceptibility against the isolated fungi as was indicated by varying amount of fungal inoculum associated with different cultivars.

This may be due to the differences of genetic make up of the cultivars, chemical composition of the seeds or existence of diverse strains or pathotypes of the fungal species. The present findings are in partial conformity of the observations made by Ray (1993) who reported differential reactions of three rice cultivars to four pathogenic seed mycoflora.

Table 2. Pathogenecity of seed mycoflora on rice seeds

Mycoflora	Germination (%)	Abnormal seedlings (%)	Seedling vigour Index
Aspergillus niger	34	20	168
A. flavus	43	17	214
Fusarium moniliforme	27	22	175
Helminthosporium oryzae	23	25	152
Curvularia lunata	31	19	212
C. affinis	25	26	148
C. pallescens	52	16	206
Pyricularia oryzae	46	18	212
Sarocladium oryzae	29	21	178
Drechslera oryzae	35	19	214
Trichoconis padwickii	28	23	204
Control	87	6	436

Evaluation of pathogenic potential of eleven predominant seed-borne fungal species tested on cv. Mashuri showed varying degrees of pathogenecity on rice seeds and emerging seedlings. The data presented in Table 2. revealed a considerable reduction in seed germinability. Maximum inhibition of germination upto 77 percent was caused by *H.oryzae* followed by *C. affinis* (75%), *F. moniliforme* (73%), *T. padwickii* (72%), S.

oryzae (71%) and *C. lunata* (69%). Number of abnormal seedling ranged from 26% caused by *C. affinis* to 16 % when infected by *C. pallescens* as compared to 6% in control. Seedling vigour index (SVI) was lowest (148) due to *C. affinis*, followed by *H. oryzae* (152), *A. niger* (168), *F. moniliforme* (175) and *S.oryze* (178) as against 436 in control. The loss of germinability was proportional to the severity of seed infection in the host cultivar. This indicates the possible role of fungal toxins produced inside the seeds resulting inhibition of germination, increase in number of abnormal seedlings and reduction of seedling vigour index. Seeds with fungal infection were observed to cause apparent seed discolouration, reduction of commercial quality and agronomic potential of the seed lot for yield performance, besides playing a key role as potent inoculum source for transmission of the pathogenic fungi across the seasons and cultivating sites. Similar results have been reported by Misra and Vir (1988) and Ray (1993). The present investigation indicated a greater diversity of the seed borne mycoflora associated with the five rice cultivars popularly grown in flood-prone rice ecosystem. It was interesting to note that the rice cultivars viz. Rangagatha, Panikekua and Panisali yielded comparatively lower frequency of the isolated mycoflora.

ACKNOWLEDGEMENTS

The authors are grateful to the professor and Head, Dapartment of Botany, Guwahati University, Guwahati 14 for providing the necessary facilities for carrying out the investigation.

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(Accepted for publication November 06, 2001)