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Mycoflora associated with diseased rice grains in Bangladesh and their pathogenic potentiality

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ABSTRACT: Fifty six spotted rice grain samples of four commercially cultivated rice varieties namely BRRI 28, 29, Kalijira and Pajam were collected from 14 different districts of Bangladesh. Forty rice samples (Hybrid 2,3,4, BR7,11,12,14,16,22,23,25,26and BRRI28 to BRRI 55) were also collected from Bangladesh Rice Research Institute at Joydevpur. Twenty-fivespecies of fungi belonging to 15 genera were associated with these rice varieties. The isolated fungi were *Alternaria alternata*, *Aspergillus clavatus, A. flavus*, *A. fumigatus*, *A.niger, A. ochraceus, A.oryzae, A. terreus, Chaetomium globosum, Cladosporium cladosporioides, Colletotrichum gloeosporioides, Curvularia lunata, C. lunata* var. *aeria, Drechslera oryzae, Fusarium moniliforme, F. oxysporum, F. solani, Microdochium oryzae*, *Nigrospora oryzae, Penicillium* spp., *Pestalotiopsis guepinii, Sarocladium oryzae* and *Trichoderma viride.* Amongst these fungi nine i.e. *Alternaria alternata* (Fr.) Keissler*, Aspergillus flavus* Link, *Curvularia lunata* (Wakker) Boedijn*, Drechsler aoryzae* Breda de Haan (Subramanian and Jain), *Fusarium moniliforme* Sheldon, *F. solani* (Mart.) Sacc*., Microdochium oryzae* (Hashloka and Yokogi) Sam. and Hal., *Pestalotiopsis guepinii* (Desm.) Stay. and *Sarocladium oryzae* (Sawada) W. Gams and D. Hawks were found to be pathogenic to rice seeds. The most predominant fungus was *D. oryzae* which was followed by *A. flavus* and the least incidence was observed in case of *F. solani* and *P. guepinni.*

KEYWORDS: Mycoflora, Rice grains, Pathogenic potentiality, Bangladesh.

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Introduction

Rice is the major world's primary food crop mostly grown in tropical and sub-tropical climate. It covers 93% of the food grains production and 75% of the total crop land in Bangladesh[1]. Rice diseases are very common in many parts of South East Asia and cause considerable lossand also resulteda lot of breakage during milling and black clean rice which reduced the market prize. In Bangladesh, 43 diseases are known to occur in rice crop.Among these 36 are seed borne of which 14 are of major importance and 22 are caused by fungi[2].

Most of the major diseases of rice are seed borne, approximately 2.5 million tons of rice are lost annually due to diseases caused by seed borne pathogens[3].Under favorable conditions fungi in general are known to cause 42% yield loss. In Bangladesh the farmers do not maintain the seed health properly that resulted heavy infestation by the fungi particularly during hot and humid seasons and cause deterioration of quality and viability of seeds. These seeds results in reduced germination rate and transmit pathogens from seed to seed bed and ultimately cause field diseases[4].

Many researches have been done on rice grain spotting but information on pathogenic mycoflora of rice grain and its control is insufficient[5-8].Keeping all these facts in mind, the present study was undertaken to isolate, characterize and identify the fungi associated with Boro, Aus and Aman rice grains.Pathogenic potentiality of the isolated fungi was also performed.

Materials and Methods

Four commercially cultivated rice varieties*viz.*, BRRI 28,29, Pajam and Kalizira were collected from 14 districts under 7 divisions *viz.* Pabna and Sirajgonj (Rajshahi division), Tangail and Gazipur (Dhaka division), Comilla and Laksmipur (Chittagong division), Potuakhali and Barisal (Barisal division), Dinajpur and Gaibandha (Rangpur division), Satkhira and Chuadanga (Khulna division), Habiganj and Sunamganj (Sylhet division) during Boro, Aus and Aman seasons of 2012 and 2013. Samples were collected after harvesting and placed in clean brown paper bag, labeled properly and preserved at 4^0C in refrigerator for subsequent use.Forty rice samples *viz.* hybrid 2, 3, 4, BR 7, 11, 12, 14, 16, 22, 23, 25, 26, BRRI 28 to 55 were also collected from Bangladesh Rice Research Institute (BRRI).

The fungi were isolated from the collected samples following "Tissue planting method" on PDA medium[9] and "Blotter" method"[10]. Two hundred seeds of each sample were placed on three layers of moist blotting paper (Whatman No.1) in Petri plates. The seeds were washed with sterile water and then surface sterilized by dipping in 10% chlorox for 5 minutes. Seeds were placed in each plate and incubated for 5-7 days at 25º±2ºC. The isolated fungi were identified based on morphological characteristics observed under a compound microscope following standard literature[11-16].Prevalence (%) of fungi in different specimens was also recorded.

Pathogenicity test of isolated fungi in test tubes:
Pathogenicity of the selected fungi was done following seed inoculation technique[17]. Four hundred healthy and 400 Spotted rice grains of different varieties were selected, soaked in distilled water in a beaker for three hours and then surface sterilized with 10% chlorox for 5minutes. One hundred ml of spore suspension of the test fungi at 10^4 concentrations was prepared in a 250 ml sterilized beaker. Four hundred seeds from each variety were inoculated with spore suspension and then incubated for 30 minutes.
Two hundred of each healthy, spotted and inoculated seeds of different rice varieties were placed in sterilized 8 inch cotton plugged test tubes containing 5 ml 2% water agar medium. Healthy seeds served as control. Observation was made for 4 weeks at 3 days intervals. Germination percentage of seeds, development of disease symptoms and mortality of seedlings were recorded on healthy, diseased and inoculated seeds. After 10 days of inoculation, pathogenic fungi were re-isolated from diseased and inoculated seeds and the seedlings from healthy seeds remained fresh.

Results and Discussions

Per cent frequency of fungi with diseased boro ricegrains after collection from BRRI: Per cent frequency of fungi varied in different boro rice varieties. During boro season 23 species of fungi belonging to13 genera were found to be associated with 11 varieties of boro rice varieties after collection from BRRI in July 2012 (Table 1).
Highest per cent frequency (27.7) was observed in *Drechslera oryzae* and lowest (2.0) in *Pestalotiopsis guepinii*in BRRI 29 rice variety. Maximum per cent frequency of other fungi, i.e. *Alternaria alternata* (8.6), *Aspergillus clavatus* (8.0), *A. flavus* (24.6), *A. fumigatus* (22.0), *A, niger* (20.7), *A. terreus* (10.0), *A. ochraceus* (6.7), *Chaetomium globosum* (20), *Cladosporium cladosporioides* (9.7), *Curvularia lunata* (10.7),*C. lunata* var. *aeria* (6.0), *Fusarium moniliforme* (14), *F. oxysporum* (9.7), *F. solani* (9), *Microdochium oryzae* (9.0), *Nigrospora oryzae* (8.7), *Penicillium* sp_1. (15.7), *Penicillium* sp_2. (3.6), *Rhizopus stolonifer* (20.7), *Sarocladium oryzae* (3.3) and *Trichoderma viride* (6.7) were found in different rice varieties. *Pestalotiopsis guepinii* was isolated first time fromboro rice grains in Bangladesh (Table 1).

Table-1. Per cent frequency of fungi with diseased Boro ricegrains after collection from BRRI in July2012.

	Rice varieties and per cent frequency of fungi										
Fungi	Hybrid-2	Hybrid-3	BR-7	BR-14	BRRI-28	BRRI-29	BRRI-35	BRRI-36	BRRI-45	BRRI-47	BRRI-50
Alternaria alternata	-	2.7	-	5.3	6.7	5.0	-	8.6	-	-	-
Aspergillus clavatus	-	-	-	2.2	4.0	-	8.0	-	-	-	-
A. flavus	8.3	10.3	15.7	10.0	10.0	3.0	24.6	12.0	10.7	11.0	-
A. fumigatus	10.7	5.7	8.3	20.0	10.0	-	12.0	10.7	14.7	22.0	-
A.niger	20.3	10.0	20.7	10.0	20.0	8.0	20.7	18.3	20.3	16.7	15.7
A. terreus	-	-	-	-	8.7	-	-	-	-	-	10.0
A. ochraceus	-	-	-	-	2.3	6.7	-	-	-	-	3.3
Chaetomium globosum	-	-	-	-	-	8.0	-	20	-	-	-
Cladosporium cladosporioides	-	-	9.7	8.7	-	8.0	-	-	-	-	-
Curvularialunata	-	-	2.6	-	10.7	10.0	-	3.0	-	-	-
C. lunata var. *aeria*	-	-	-	3.3	2.3	6.0	-	-	-	-	-
Drechslera oryzae	2.0	-	7.7	20.3	-	27.7	12.0	14.3	-	-	-
Fusarium moniliforme	-	-	-	5.0	14.0	4.0	-	-	-	-	10.00
F. oxysporum	-	-	4.0	-	-	9.7	-	-	-	-	-
F. solani	-	-	5.0	-	-	9.0	-	-	-	-	-
Microdochium oryzae	-	-	-	5.7		9.0		-	6.7		-
Nigrospora oryzae	-	-	-	-	2.3	2.7	8.7	-	-	-	-
Penicillium sp_1.	9.7	15.7	4.7	-	-	-	3.7	-	5.7	3.3	10.7
Penicilliums p_2.	-	-	-	-	-	-	-	-	3.6	-	-
Pestalotiopsis guepinii	-	-	-	-	-	2.0	-	-	-	5.6	-
Rhizopus stolonifer	3.3	-	-	-	-	-	-	-	-	-	20.7
Sarocladium oryzae	-	-	-	-	2.3	3.3	-	-	-	-	-
Trichoderma viride	-	-	-	-	2.6	-	-	3.0	-	-	6.7

- represents absence of respective fungus.

Table-2. Per cent frequency of fungi with diseased Aus rice grains collected from BRRI in July 2012.

Fungi	Rice varieties and per cent frequency of fungi						
	BR 12	**BR 14**	**BR 16**	**BR 26**	**BRRI 42**	**BRRI 43**	**BRRI 48**
Alternaria alternata	12.0	6.0	10.6	4.0	4.7	-	-
Aspergillus flavus	18.7	10.6	10.0	12.0	-	6.3	10.7
A. fumigatus	12.6	10	-	12.0	10.0	-	10.3
A. niger	10.7	17.6	20.7	10.7	10.3	24.7	-
A. terreus	-	3.3	-	-	-	-	3.7
Curvularia lunata	6.0	3.3	7.7	-	6.6	-	2.7
Drechslera oryzae	16.6	17.6	20.6	10.3	14.6	12	13.6
Fusarium moniliforme	-	8.3	10.6	4.7	-	10.3	-
Penicillium sp.	10	-	-	9.3	-	5.0	10.7
Rhizopus stolonifer	12	14.3	10.7	20.7	25.7	-	20.3
Sarocladium oryzae	-	7.3	-	2.7	-	-	-

- represents absence of respective fungus

Per cent frequency of association of fungi with diseased grains of aus rice varieties collected from BRRI: In aus season 11 species of fungi belonging to 8 genera were obtained from spotted grains of seven rice varieties. Highest per cent frequency (25.7) was observed in case of *Rhizopus stolonifer* isolated from BRRI 42. Lowest per cent frequency (2.7) was observed in both *Sarocladium oryzae* and *Curvularia lunata* from BR 26 and BRRI 48 respectively. Maximum frequency per cent of other fungi, i.e. *Alternaria alternata* (12.0) *Aspergillus flavus* (18.7), *A. fumigatus* (12.6), *A. niger* (24.7), *A. terreus*(3.7), *Drechslera oryzae* (20.6) *Fusarium moniliforme* (10.6) and *Penicillium* sp.(10.7) were found in different rice varieties.

Per cent frequency of association of fungi with diseased grains of aman rice varieties collected from BRRI: During T. aman season15 species of fungi belonged to 12 genera were collected from 22 varieties of affected rice grains. Highest per cent frequency (20.7) was observed in case of *Aspergillus niger* from BRRI 41 and lowest (2.0) in *Pestalotiopsis guepinii* from BRRI 38. Maximum per cent frequency of other fungi, *i.e. Alternaria alternata* (7.7*), Aspergillus flavus* (18.3), *A. fumigates* (22.7), *A. terreus* (10.7), *Cladosporium cladosporioides* (9.3), *Colletotrichum gloeosporoides* (4.0), *Curvularia lunata* (8.7), *Drechslera oryzae* (14.7), *Fusarium moniliforme* (5.6), *Microdochium oryzae* (5.7), *Penicillium* sp.(10.7), *Rhizopus stolonifer* (12) and *Sarocladium oryzae* (8.3) were found in different rice varieties. *Pestalotiopsis guepinii* was isolated first time from aman rice grains in Bangladesh (Table 3).

After 6 months of storageat 25±2°C, frequency per cent of field fungi *i.e. Alternaria alternata*, *Curvularia lunata*, *Drechslera oryzae*, *Fusarium moniliforme*, *F. solani*, *Microdochium oryzae*, *Pestalotiopsis guepinii* and *Sarocladium oryzae* were decreased while frequency of storage funginamely *Aspergillus fumigatus*, *A. niger*, *Penicillium* sp. and *Rhizopus stolonifer* were increased in case of all varieties of rice.

Pathogenicity test of isolated fungi of different rice varieties

After 10 days of inoculation, among 25 species of isolated fungi, pathogenic fungi were re-isolated from diseased and inoculated seeds and the seedlings from those healthy seeds remained fresh. The isolated pathogenic fungi were *Alternaria alternata* (Fr.) Keissler, *Aspergillus flavus* Link *Curvularia lunata* (Wakker) Boedijn, *Drechslera oryzae* Breda de Haan (Subramanian and Jain), *Fusarium moniliforme* Sheldon, *Fusarium solani* (Mart.) Sacc. *Microdochium oryzae* (Hashloka and Yokogi) Sam. and Hal., *Pestalotiopsis guepinii* (Desm.) Stay. and *Sarocladium oryzae* (Sawada) W. Gams and D. Hawks.

Effects of pathogenic fungi on seed germination, seedling mortality and shoot-root length

Different varieties of rice seeds were inoculated with nine pathogenic fungi *viz. Alternaria alternata* (Fr.) Keissler, *Aspergillus flavus* Link *Curvularia lunata* (Wakker) Boedijn, *Drechslera oryzae* Breda de Haan (Subramanian and Jain), *Fusarium moniliforme* Sheldon, *Fusarium solani* (Mart.) Sacc. *Microdochium oryzae* (Hashloka and Yokogi) Sam. and Hal., *Pestalotiopsis guepinii* (Desm.) Stay. and *Sarocladium oryzae* (Sawada) W. Gams and D. Hawks. which showed germination 70, 75, 60, 80, 60, 50, 40, 70 and 60% respectively. But in control set, 100% seeds were germinated.The mortality percentages were 40, 35, 30, 30, 40, 16, 30, 50 and 40% respectively. The highest and the lowest shoot-root length range was 2.0 cm-1.2 cm and 0.3 cm-0.1 cm among all test pathogens. But in control set the highest and lowest shoot-root length was 9.5 cm - 8.5 cm to 8.0 cm - 7.7 cm (Table 4).

Table-3. Per cent frequency of fungi with diseased Aman ricegrains collected from BRRI in July 2013.

	Rice varieties and per cent frequency of fungi																					
Fungi	Hybrid-4	BR-11	BR-22	BR-23	BR-25	BRRI-30	BRRI-31	BRRI-32	BRRI-33	BRRI-34	BRRI-37	BRRI-38	BRRI-39	BRRI-40	BRRI-41	BRRI-46	BRRI-49	BRRI-51	BRRI-52	BRRI-53	BRRI-54	BRRI-55
Alternaria alternata	-	-	-	-	7.7	-	-	-	-	-	2.2	3.7	2.7	-	-	-	-	2.3	-	-	1.3	-
Aspergillus flavus	10.3	2.3	10.0	10.0	18.3	10.7	15.7	-	16.3	8.7	8.7	8.7	10	4.6	-	6.7	7.3	-	4.5	8.3	-	-
A. fumigatus	-	8.7	-	-	22.7	15.3	2.7	-	20.7	-	-	3.3	7.5	10.3	10.3	-	10.7	10.0	15.0	4.7	8.7	16.7
A. niger	10.6	10.7	5.6	10.0	12.3	13.0	14.0	9.7	12.7	15.7	-	10.3	16.0	14.7	**20.7**	10.7	-	-	-	-	12.3	8.3
A. terreus	-	-	-	-	2.3	-	-	5	-	-	-	10.7	-	-	-	-	10.6	5.7	8.7	4.3	8.3	8.3
Cladosporium cladosporioides	-	-	2.0	5.6	7.7	-	-	4.6	-	-	9.3	-	3.3	-	-	-	-	4.3	-	-	8.6	6.7
Colletotrichum gloeosporioides	-	-	-	-	-	-	-	-	-	4.0	1.3	2.0	-	-	-	-	-	-	-	-	4.0	-
Curvularia lunata	-	-	4.3	3.3	-	-	-	4.0	-	8.7	4.7	2.3	2.3	-	-	-	-	-	2.3	-	3.7	6.7
Drechslera oryzae	2.3	12.0	8.6	-	14	12	3.3	12.3	-	7.6	14.7	14.3	12.3	-	-	-	10.7	-	13.7	-	-	13.3
Fusarium moniliforme	-	-	-	-	2.7	-	-	-	4.3	-	5.6	4.0	2.3	-	-	5.6	-	-	2.7	-	-	-
Microdochium oryzae	-	-	-	-	-	-	-	-	-	4.3	-	-	-	-	4.7	-	-	5.6	3.0	-	5.7	-
Penicillium sp.	4.7	6.7	6.7	5.7	3.3	-	4.6	4.7	-	-	3.0	-	-	3.3	8.7	10.7	-	5.6	-	-	-	-
Pestalotiopsis guepinii	-	-	-	-	2.3		-	-	-	-	-	**2.0**	-	-	-	-		-	-	-	-	-
Rhizopus stolonifer	8.3	8.3	-	6.3	-	-	-	8.3	12.0	10.0	-	-	-	8.7	10.7	8.7	-	-	-	10.3	8.7	-
Sarocladium oryzae	-	-	-	-	2.3	-	-	-	-	**2.0**	-	-	-	-	-	-	-	2.6	8.3	2.3	-	-

- represents absence of respective fungus.

Table-4. Effects of pathogenic fungi on germination, seedling mortality and height of different rice varieties in test tubes.

Name of Fungi	Name of variety	Germination percentage			Mortality percentage			Shoot-Root length (cm)		
		Control	Diseased	Inoculated	Control	Diseased	Inoculated	Control	Diseased	Inoculated
Alternaria alternata	BRRI 29	100	80	70	12	40	70	9.0-8.1	2.0-1.4	1.6-1.1
Aspergillus flavus	BRRI 29	100	80	75	14	35	**72**	8.0-7.5	2.5-1.4	**2.0-1.2**
Curvularia lunata	BRRI 28	100	70	60	16	30	50	**8.0-7.7**	4.0-2.5	1-5-2.5
Drechslera oryzae	BRRI29	100	**90**	**80**	14	**50**	63	9.4-8.3	2.3-1.8	1.5-1.0
Fusarium moniliforme	BRRI 29	100	70	60	13	40	67	9.1-8.1	2.0-1.6	1.4-1.1
F. solani	BRRI29	100	60	50	15	**16**	**20**	9.2-8.1	2.0-1.5	**0.3-0.1**
Microdochium oryzae	BRRI41	100	**50**	**40**	**20**	30	60	9.0-8.0	2.2-1.7	1.3-1.1
Pestalotiopsis guepinii	BR25	100	60	70	**10**	**50**	40	**9.5-8.5**	2.0-1.5	1.5-1.0
Sarocladium oryzae	BRRI28	100	80	60	17	40	67	9.2-8.2	2.1-1.3	1.1-0.9

Table-5. Occurrence of fungi in rice seed samples collected from different districts of Bangladesh.

Fungi	Seed lot infected	Range of infection percentage of seed samples									
	(%)	01-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Alternaria alternata	18.75	17	1	-	-	-	-	-	-	-	-
Aspergillus clavatus	4.16	4	-	-	-	-	-	-	-	-	-
A. flavus	45.83	19	22	3	-	-	-	-	-	-	-
A. fumigatus	34.38	12	14	7	-	-	-	-	-	-	-
A. niger	39.58	5	20	11	1	-	-	-	-	-	1
A. ochraceus											
A. oryzae	3.13	3	-	-	-	-	-	-	-	-	-
A. terreus	13.54	9	4	-	-	-	-	-	-	-	-
Chaetomium globossum	3.13	2	1	-	-	-	-	-	-	-	-
Cladosporium cladosporioides	11.46	11	-	-	-	-	-	-	-	-	-
Colletotrichum gloeosporoides	5.2	5	-	-	-	-	-	-	-	-	-
Curvularia lunata	17.71	17	-	-	-	-	-	-	-	-	-
C. lunata var. *aeria*	3.13	3	-	-	-	-	-	-	-	-	-
Drechslera oryzae	62.5	26	17	7	4	-	2	1	2	-	1
Fusarium moniliforme	15.63	13	2	-	-	-	-	-	-	-	-
F. oxysporum	3.13	2	1	-	-	-	-	-	-	-	-
F. solani	2.08	2	-	-	-	-	-	-	-	-	-
Microdochiumoryzae	4.16	2	2	-	-	-	-	-	-	-	-
Nigrospora oryzae	3.13	2	1	-	-	-	-	-	-	-	-
Penicillium sp.$_1$	25	18	6	-	-	-	-	-	-	-	-
Penicillium sp.$_2$	4.16	2	2	-	-	-	-	-	-	-	-
Pestalotiopsis guepinii	2.08	2	-	-	-	-	-	-	-	-	-
Rhizopus stolonifer	21.88	9	8	4	-	-	-	-	-	-	-
Sarocladiumoryzae	8.33	8	-	-	-	-	-	-	-	-	-
Trichoderma viride	4.16	3	1	-	-	-	-	-	-	-	-

- represents absence of respective fungus.

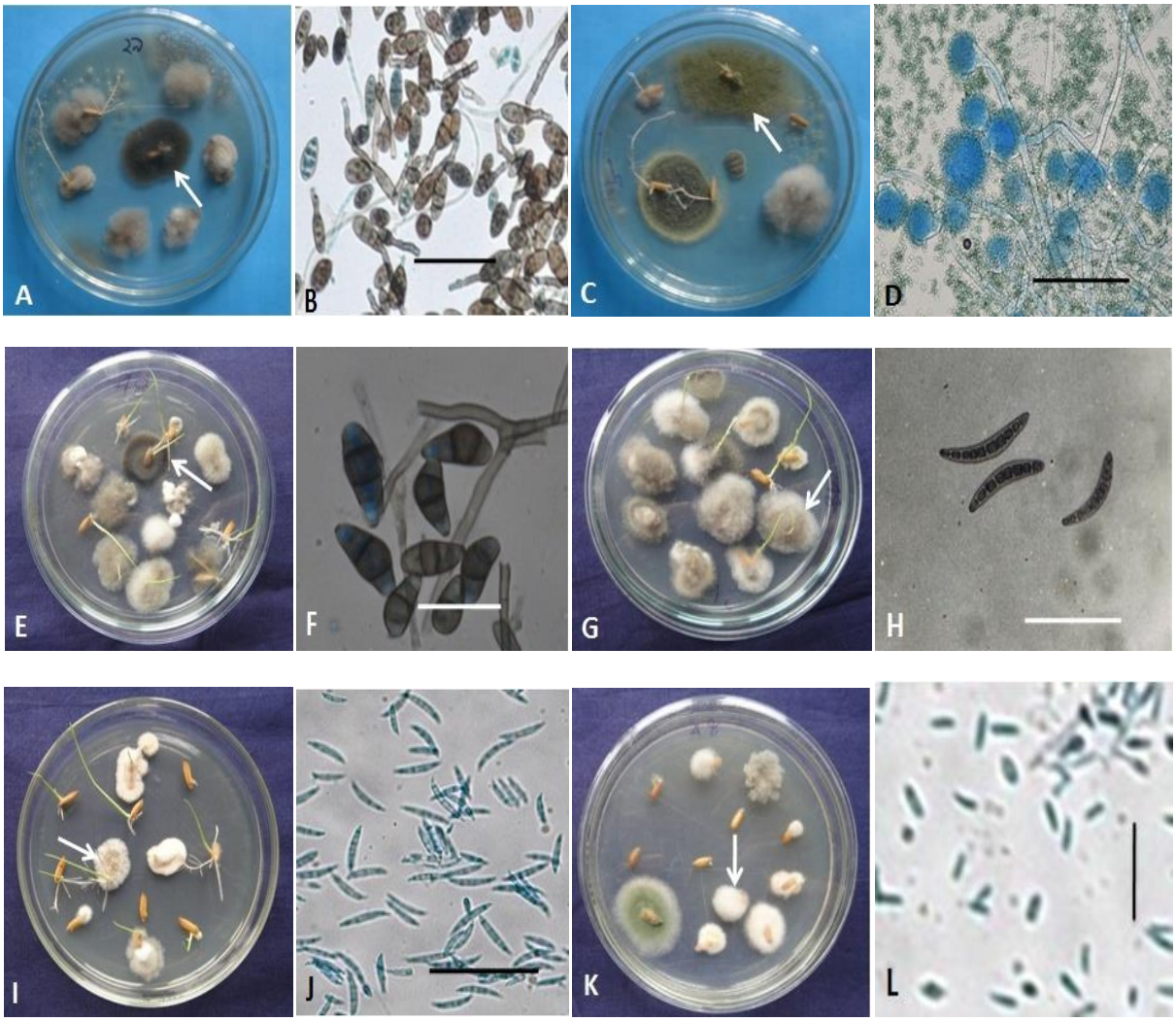

Plate-1. Fungal growth from rice grains and conidia of pathogenic fungi.

A-B: *Alternaria alternata*, C-D: *Aspergillus flavus*, E-F: *Curvularia lunata*,G-H: *Drechslera oryzae*, I-J:*Fusarium moniliform e*and K-L:*F. solani* (Bar = 50 µm).

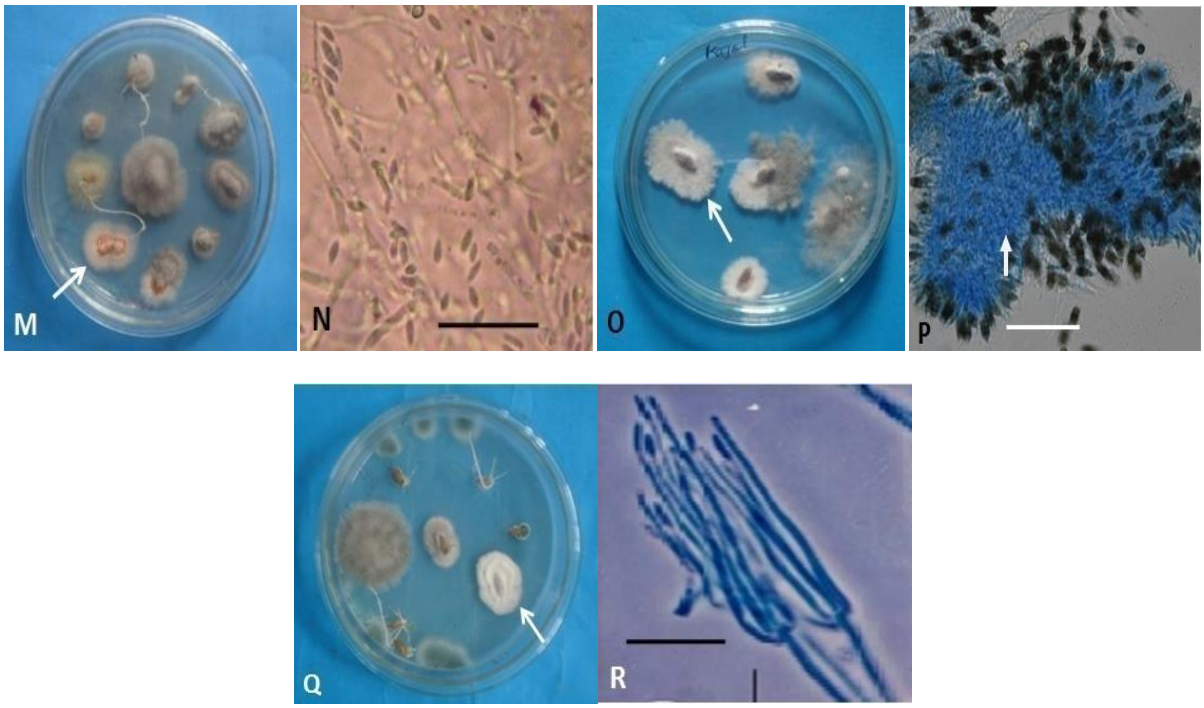

Plate-2. Fungal growth from rice grains and conidia of pathogenic fungi.

M-N: *Microdochium oryzae*, O-P: *Pestalotiopsis guepinii* and Q-R: *Sarocladium oryzae* (Bar = 50 µm).

Detection of fungi associated with rice seeds collected from different districts of Bangladesh:

A total of 96 seed samples consisting each of different varieties were obtained from different districts of Bangladesh. Seed samples were tested for their health status and the results are furnished in Table 5. In total, 15 genera of fungi comprising 25 species were found to be associated with the seed samples. Amongst these fungi nine i.e., *Alternaria alternata* (Fr.) Keissler, *Aspergillus flavus* Link, *Curvularia lunata* (Wakker) Boedijn, *Drechslera oryzae* Breda de Haan, (Subramanian and Jain), *Fusarium moniliforme* Sheldon, *Fusarium solani* (Mart.) Sacc., *Microdochium oryzae* (Hashloka and Yokogi) Sam. and Hal., *Pestalotiopsis guepinii* (Desm.) Stay. and *Sarocladium oryzae* (Sawada) W. Gams and D. Hawks (Plate 1-2) were found to be pathogenic to rice seeds. The most predominant fungus ,*Drechslera oryzae*, was associated with 62.5% seed samples followed by *A. flavus* (45.83%), *A. niger* (39.58%), *A. fumigatus* (34.38%), *Penicillium* sp. (25%), *Rhizopus stolonifer* (21.88%), *Alternaria alternata* (18.75%), *Curvularia lunata* (17.71%), *F. moniliforme* (15.63%), *A. terreus* (13.54%) and *Cladosporium cladosporioides* (11.46%).

Sarocladium oryzae and *Colletotrichum gloeosporioides* showed 8.33% and5.20% incidence respectively. *Aspergillus clavatus, Microdochium oryzae, Penicillium* $sp_2$and *T. viride* showed a common per cent incidence value of 4.16. Four of other fungi namely *A. oryzae, C. lunata* var. *aeria, F. oxysporum* and *Nigrospora oryzae* showed an incidence of 3.13%. Least incidence (2.08%) was observed in *F. solani* and *P. guepinii.*

In the present investigation, out of 96 seed samples tested, 61 samples carried *Drechslera oryzae*, among them 26 samples carried 1-10%, 17 carried 11-20%, 7 carried 21-30%, 4 carried 31-40%, 2 carried 51-60%, 1 carried 61-70%, 2 seed samples showed 71-80% and 1 sample showed 91-100% seed infection (Table 5).

Many researchers have reported *Alternaria padwickii, A. longissima, A.niger, Nigrospora oryzae, Curvularia oryzae, C. lunata, Bipolaris oryzae, Fusarium moniliforme, F. semitectum, F. solani* and species of *Phoma, Cercospora, Chaetomium, Sclerotium, Penicillium, Myrthecium* and *Colletotrichum* from seeds of different varieties of rice [18-20].

Rice seeds were reported to have been associated with 32 genera and 48 species of fungi[21]. Twenty different species of fungi were identified on the rice seeds which include 10 genera[22]. One hundred and fourspeciesof fungi were reported which include 39 genera[23]. Fifteen species of fungi were isolated from sheaths and sheath rot infected rice grains from Bangladesh[20]. Twelve seed borne pathogens were detected and identified from nine cultivated hybrid rice varieties in Bangladesh[24]. Ten seed borne fungi were isolated from 15 varieties of rice (8 coarse and 7 fine) from Rice Research Institute, Kala Shah Kaku, Paksitan[25]. Sixteen genera of fungi comprising 27 species were found to be associated with 69 rice seed samples obtained from different states of India and among these fungi the most predominant was *Bipolaris oryzae*[26].It was reported that seed borne fungi of rice were *Alternaria alternata, Aspergillus flavus, Bipolaris oryzae, Curvularia lunata, Drechslera oryzae, Fusarium moniliforme, F. oxysporum* and *Nigrospora oryzae*, where prevalence of *Bipolaris oryzae* was maximum[27-28].

The results of my investigation showed similarity with the findings of above-mentioned researchers.

The pathogenic fungi reported in the present study may cause huge economic losses by reducing rice yield. Seed health testing can also be a mean of quality control to improve seeding stocks for crop production by farmers.The present study revealed the presence of diverse mycoflora in rice grains from different districts of Bangladesh including BRRI. The present study suggested that the incidence of fungi with rice seed samples may cause serious damage to the crop. So, rice seed health management is a prerequisite for successful rice cultivation.

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