PATHOGENIC POTENTIALITY OF THE FUNGI ASSOCIATED WITH SELECTED SEEDS OF BRRI RICE VARIETIES

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ABSTRACT

A total of 19 fungal species were isolated from the seeds of selected rice varieties (BRRI dhan 90 to BRRI dhan 99) following Tissue planting method and Blotter method. The isolated fungi were *Aspergillus niger*, *A. ochraceus*, *A. oryzae*, *A. tamarii*, *A. terreus*, *Chaetomium globosum*, *Cladosporium oxysporum*, *Colletotrichum gloeosporioides*, *Corynespora cassiicola, Curvularia lunata, Curvularia soli, Daldinia eschscholtzii, Fusarium solani, Penicillium oxalicum*, *Penicillium sclerotiorum*, *Pestalotiopsis guepinii*, *Pyricularia oryzae*, *Rhizopus stolonifera* and *Trichoderma viride*. Out of 19 species of fungi *Aspergillus niger, Curvularia lunata*, and *Fusarium solani* were found to be pathogenic to the selected rice varieties.

KEYWORDS: Fungi, Selected BRRI rice seeds, Pathogenic potentiality, Bangladesh

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Introduction

Rice is the most important food for over two billion people in Asia and for hundreds of million in Africa and Latin America. In Asia about 90% rice is produced and consumed [1]. Rice ranked first position by production during the year 2015-2016 among all the cereals [2] majority of the rice produced comes from China, India, Indonesia, Bangladesh, Pakistan, Vietnam, Thailand, Myanmar, Philippines and Japan (Table-1). In Bangladesh, rice production is increased more than three and a half during 1972 to 2019. Hence, the per hectare production of rice in Bangladesh is minimum in comparison to other countries.[3].

Table 1. Rice production leading producers (Countries listed according to their position production in global)

Name of country	Million tons milled equivalent			
	2020	2021	2022	Change: 2022 over 2021
China (mainland)	145.1	145.8	146.1	0.2%
India	124.4	126.2	127.4	0.9%
Bangladesh	37.4	37.8	38.4	1.4%
Indonesia	35.0	34.8	35.2	0.9%
Vietnam	27.8	28.5	28.4	-0.5%
Thailand	21.0	22.0	21.7	-1.1%
Myanmar	15.2	15.0	14.5	-3.3%
Philippines	12.9	13.1	13.2	0.7%
Pakistan	8.4	8.8	8.8	-0.9%

Brazil	7.6	8.0	7.3	-9.1%
Japan	7.4	7.4	7.2	-2.4%
Cambodia	6.7	7.0	6.9	-2.0%
United States of America	7.2	6.1	5.8	-4.7%
Nigeria	4.9	5.0	5.3	5.5%
Egypt	4.4	4.3	4.0	-6.5%
World	517.0	520.8	519.5	-0.3%

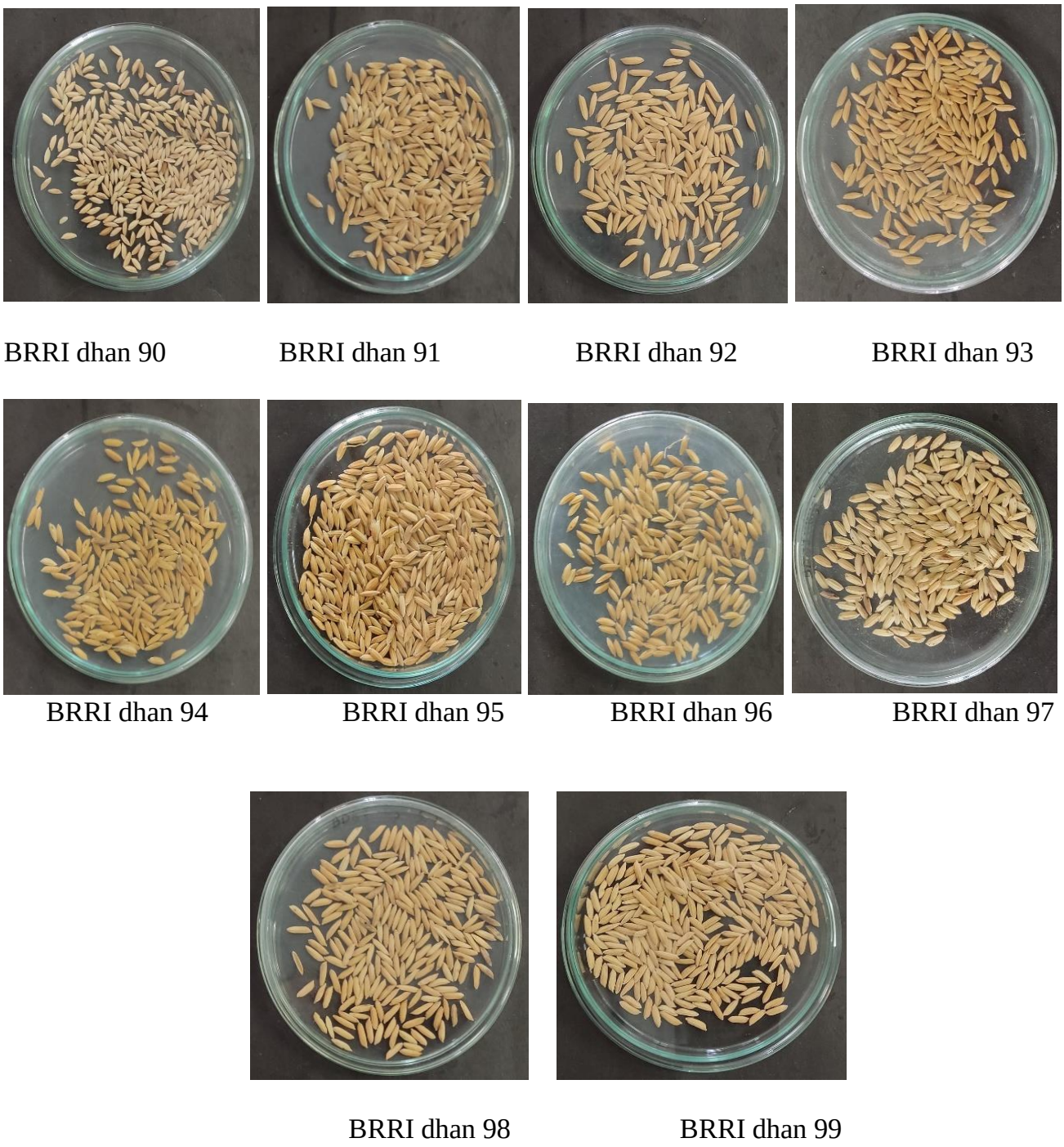

Figure 1. Different varieties of BRRI rice seeds collected from BRRI, Joydebpur, Gazipur.

Material and Methods

Ten varieties of BRRI rice seeds i.e., BRRI dhan 90 to BRRI dhan 99 were collected from Bangladesh Rice Research Institute (BRRI), Joydebpur, Gazipur. Samples were collected during August 2021 (Figure 1). Isolation and morphological identification of fungi Fung associated with selected BRRI rice varieties were carried out e following "Tissue planting method" on PDA medium[4] the mycelia and spore observation were made at 40× magnification. The microphotographs of the fungi along with the measurement of spore size were taken by a high-resolution microscope facilitated with camera (Nikon optiphot-2 trinocular microscope, Japan). Identification of the isolates was were determined following standard literatures[5-14]. The specimens were preserved in the Herbarium, Mycology and Plant Pathology Laboratory, Department of Botany, University of Dhaka, Bangladesh.

Seed health testing was done following ISTA (1996)[15]

Pathogenicity test of isolated fungi

Pathogenicity test of isolated fungi were done following seed inoculation technique.[16] Three hundred seeds were selected from each variety of rice seeds and soaked in distilled water in a beaker for 30 minutes and then surface sterilized separately with 10% Clorox for five minutes. Hundred ml of spore suspension of each test fungus at 10^4 concentrations was prep) ared in a 250 ml sterilized beaker. Three hundred seeds from each rice variety were placed in beakers with spore suspension and left undisturbed for 2 hours. Three hundred of each healthy and inoculated seeds of ten rice varieties were selected and single seed was placed in sterilized 6-inch cotton plugged test tubes containing 10 ml (2% agar) water agar medium. Healthy seeds served as control. Observation was made for 2 weeks at 3 days interval. Germination percentage of seeds, development of disease symptoms, seed mortality and root shoot length of seedlings were recorded on healthy and inoculated seeds of ten BRRI rice varieties.

Results and Discussion

A total of 19 species of fungi were isolated from seeds of ten BRRI rice seeds varieties. They were *Aspergillus niger* Van Tieghem, *A. ochraceus* K. Wilh., *A. oryzae* (Ahlb.) Cohn, *A. tamari* Kita G., *A. terreu s*Thom, *Chaetomim globosum* Kunze ex Fr., *Cladosporium oxysporum* Berk. & Curt.,*Colletotrichum gloeosporioides* Penz. & Sacc., *Corynespora cassiicola* Berk. & Curt.,*Curvularia lunata* (Wakker) Boedjin, *Curvularia soli* Y. Marín & Crous, *Daldinia eschscholtzii* (Ehrenb.: Fr.) Rehm., *Fusarium solani* (Mart.) Sacc., *Penicillium oxalicum* Currie & Thom, *Penicillium sclerotiorum* J.F.H. Beyma, *Pestalotiopsis guepinii* (Desm.) Stey., *Pyricularia oryzae* Cavara, Rhizopus *stolonifer* (Ehrenb.) Vuill. and *Trichoderma viride* Pers.

Seeds of BRRI rice varieties were inoculated by all of the 19 isolated fungi. Healthy seeds did not show any fungal growth, but inoculated seeds showed fungal growth on seeds. Out of 19 species of fungi *Aspergillus niger, Curvularia lunata*, and *Fusarium solani* were re-isolated from artificially inoculated seeds. which suggested that they were pathogenic for seeds of selected BRRI rice varieties Rest of the fungi did not grow and or re- isolated on culture plates that means they were not pathogenic to seeds of BRRI rice varieties (Figure 2).

Effect of pathogenic fungi on the seed germination, mortality, root and shoot length of rice seedlings are presented in Table 2.

Table 2. Effect of pathogenic fungi on the seed germination, mortality, root and shoot length of rice seedlings

Fungi	Average shoot length (mm)		Average root length (mm)		Germination (%)		Seedling mortality (%)	
	SH	IS	SH	IS	SH	IS	SH	IS
Aspergillus niger	83.2	30.7	41.6	25.7	97.0	73.6	26.7	36.4
Curvularia lunata	81.2	31.9	41.6	23.0	97.0	61.0	26.7	47.6
Fusarium solani	83.2	39.0	41.6	25.0	97.0	63.7	26.7	27.5

HS = Healthy seed, IS = Inoculated seed.

Aspergillus niger inoculated seeds showed shoot length 30.7 mm, root length 25.7 mm, 73.6 percent germinated seeds and 36.4 percent seedling mortality after 2 weeks of inoculation. Whereas control seeds showed shoot length 83.2 mm, root length 241.6 mm, 97.0 germinated seeds and 26.7 percent seedling mortality.

Curvularia lunata inoculated seedlings showed 31.9 mm shoot length, 23.0 mm root length, 61.0 percent seed germination and 47.6. percent seedling mortality. Control seedlings showed 81.2 mm shoot length, 41.6 mm root length, 97.0 percent seed germination and 26.7 percent seedling mortality.

Seeds inoculated with *Fusarium solani* showed 39 mm shoot length, 25.0 mm root length, 63.7 percent germinated seeds and 27.5 percent seedling mortality. Control seedlings showed 83.2 mm shoot length, 41.6 mm root length 97.0 percent germinated seeds and 27.5 percent seedling mortality.

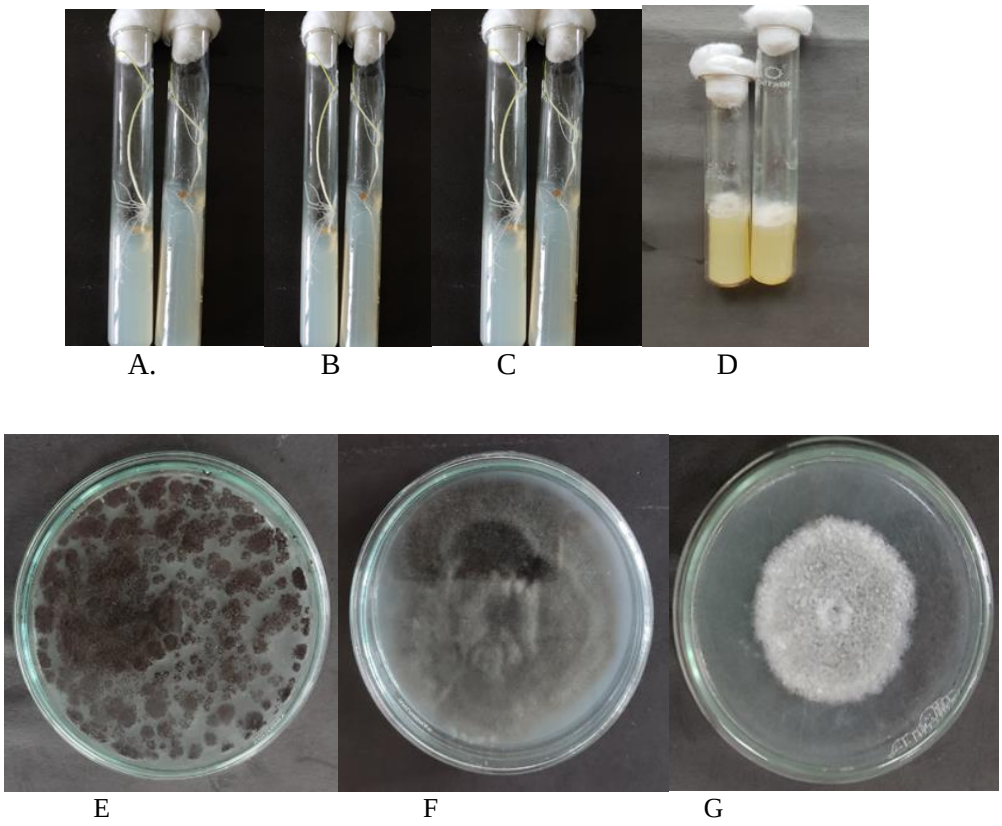

Figure 2. Pathogenicity test of, *Aspergillus niger, Curvularia lunata Fusarium solani*
A. Control healthy seedlings,
B-D Seedings inculated with *Aspergillus niger, Curvularia* and *Fusarium solani*.
E-G . Re-isolated fungal colonies of *Aspergillus niger, Curvularia* and *Fusarium solani*

Shamsi et al (2003)[17] examined where 794 sheath rot affected rice samples from 317 varieties collected from all over Bangladesh. They reported that *Sarocladium oryzae*, *Curvularia lunata*, *Drechslera oryzae* and *Nirospora oryzae* causes sheath rot symtoms on various rice varieties.

Ora et al. (2011)[18] conducted seed health testing of 83 samples of rice collected from 15 districts of Bangladesh. The study revealed the association of seven fungal pathogens with rice grains. Incidences of these pathogens was found to vary with respect to location and source of collection. In general, infection was higher in farmer seed than those from government farms. Average incidence of *Drechslera oryzae* and *Alternaria padwickii* was much higher in northern districts of the country compared to south. Chawdhuri et al. (2021)[16] isolated twenty-five species of fungi from the seeds of different rice varieties (BRRI dhan 56 to BRRI dhan 75) collected from Bangladesh Rice Research Institute (BRRI). The fungi were isolated from the samples following "Tissue Planting" method and "Blotter" methods. The isolated fungi were *Alternaria alternata*, *A. tenuissima*, *A. flavus*, *A. fumigatus*, *A. niger A.ochraceus*., *A. terreus*., *Bipolaris multiformis*, *B. oryzae*, *B. sorokiniana*, *Chaetomium globosum*., *Curvularia lunata*, *Fusarium equiseti*,., *F. fujikuroi*, *F. oxysporum*, *F. proliferatum*, *Microdochium fisheri*., *Nigrospora oryzae*, *Penicillium*., *Pestalotiopsis oxyanthi* , *Phanerochaete chrysosporium*., *Rhizopus stolonifer Sarocladium oryzae* (*Syncephalastrum racemosum*. and *Trichoderma viride* were isolated from the BRRI rice varieties. Among the isolated fungi, *Bipolaris oryzae*, *Curvularia lunata*, *Fusarium equiseti*, *F. fujikurori*, *Microdochium fisheri* and *Nigrospora oryzae* showed pathogenic potentiality following seed inoculation technique.

Sultana et al..(2020)[19] reported twenty-five species of fungi were isolated from the seeds of twenty rice varieties (BRRI dhan 56 to BRRI dhan 75) collected from Bangladesh Rice Research Institute (BRRI). The fungi were isolated from the samples following "Tissue Planting" method and "Blotter" methods. The isolated fungi were *Alternaria alternata*, *A. tenuissima*, *Aspergillus flavus*, *A. fumigatus*., *A. niger*., *A. ochraceus*, *A. terreus*., *Bipolaris multiformis*, *B. oryzae*, *B. sorokiniana*,,*Chaetomium globosum*., *Curvularia lunata*, *Fusarium equiseti*,, *F. fujikuroi*, *F. oxysporum*., *F. proliferatum*, *Microdochium fisheri*, *Nigrospora oryzae*, *Penicillium* sp., *Pestalotiopsis oxyanthi* Thum., *Phanerochaete chrysosporium*., *Rhizopus stolonife,r Sarocladium oryzae*, *Syncephalastrum racemosum* and *Trichoderma viride* were isolated from the BRRI rice varieties. Among the isolated fungi, *Bipolaris oryzae*, *Curvularia lunata*, *Fusarium equiseti*, *F. fujikuroi*, *Microdochium fisheri* and *Nigrospora oryzae* showed pathogenic potentiality following seed inoculation technique. These pathogenic fungi had remarkable effect on seed germination, root shoot length and mortality of rice seedlings.

Shamsi et al. (2023)[20] selected rice varieties such as BR-78, 80, 81, 82, 83, 84, 86, 87, 88 and 89 were used in this experiment to investigate the prevalence of seed-borne fungi. A total of twelve fungi belonging to six genera seed samples of ten (500 g each) newly released varieties (BRRI dhan 78-BRRI dhan 89, except BRRI dhan 79 and BRRI dhan 85) were collected from Bangladesh Rice Research Institute, Joydebpur,Gazipur in May 2019.

Among the isolated fungi, *Curvularia lunata* and *Drechsle*ra oryzae associated with newly released

BRRI rice varieties were found to be pathogenic to the selected rice varieties. These pathogenic fungi had remarkable effect on seed germination, root shoot length and mortality of rice seedlings.

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References

1. Salim, M., Akhter, M.H. and Ashraf, M. (2003). Rice Production Hankbook. Pak. Agric. Res. Council, Islamabad.pp. 70.
2. BBS. (2012). Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of People's Republic of Bangladesh. pp. 33-36.
3. BBS. (2016). Statistical Pocket Book of Bangladesh. Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of People's Republic of Bangladesh. pp. 207.
4. CAB (Commonwealth Agricultural Bureau (1968). *Plant Pathologist's Pocket Book.*1st edn. The Commonwealth Mycological Institute, England. pp. 267.
5. Thom, C and Raper, K.B. (1945. *A manual of the Aspergilli.* Williams and Wilkins, Baltimore, M.D. USA.
6. Raper, K.B. and Thom, C. (1949). *Manual of the Penicillia, Williams and Wilkins, Baltimore, M.D. USA.*
7. Benoit, M.A. and Mathur, S.B. (1970*). Identification of species Curvularia* on rice seed. Proc. Int. Seed Test. Ass. **35**(1): 1-23.
8. Booth, C. (1971). *The Genus Fusarium*. Commonwealth Mycological Institute, Kew, Surrey, England, pp. 237.
9. Barnett, H.L. and Hanter, B.B. (1972). *Illustrated genera of imperfect fungi*. Burgess Pub. Co. U.S. A. pp. III + 241
10. Ellis, M.B. (1971). *Dematiaceous Hyphomycetes*. The Commonwealth Mycological Institute, England. pp. 608.
11. Ellis, M.. B.. (1976). *More Dematiaceous Hyphomycetes*. The Commonwealth Mycological Institute, England, pp. 507.
12. Ellis, M. B. (1976). *More Dematiaceous Hyphomycetes*. The Commonwealth Mycological Institute, England, pp. 507.
13. Ellis, M. B. and Ellis, J…P. (1997. *Micro Fungi on Land Plants.An Identification Handbook*. pp. 868.
14. Sutton, B.C. (1980). *The Coelomycetes. Fungi Imperfecti with Pycnidia, Acervuli andStromata*. Commonwealth Mycological Institute, England. pp. 696.
15. ISTA (International Seed Testing Association) (1996). International Rules for seed testing: rules 1996. Seed Science and Technology **4**(1): 3-177.
16. Chowdhury, P., S. Shamsi, H. H. Begum and and M. A. Bashar. 2021. Mycoflora associated with diseased rice grains in Bangladesh and their pathogenic potentiality. *Biores. Commu*. **7**(1): 932-940.
17. Shamsi, S., A. Z. M. Nowsher A. Khan, A.K.M. Shahjahan and Siddique Ali Miah. 2003. Fungal species associated with sheaths and grains of sheath rot affected rice varieties from *Bangladesh J. Bot*. **32**(1): 17-22.
18. Ora, N., Faru, A.N.., Islam, M.T., Akhtar, N. and Rahman, M.M. (2011). Detection and identification of seed borne pathogens from some cultivated hybrid rice varieties in *Bangladesh. Middle-East Journal of Scientific Research*. 10(4): 482-488.
19. Sultana, S., Bashar, M. A. and Shamsi, S. (2020). Pathogenic Potentiality of fungi isolated from seeds of twenty BRRI released rice varieties (*Oryza Sativa* L.). *Biores. Commu*. **6**(1): 817-821.
20. Shamsi, S., Chakravorty, S. and. Hosen. S. (2023). Prevalence of seed-borne fungi associated with selected rice varieties of BRRI. *J. biodivers. conserv. bioresour. manag*. **9**(1): 202.