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Original Research Paper

# Fungal Biodiversity in Seeds of Some Cereals of Nashik District, and Its Pathogenicity and Control Measures

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## ABSTRACT

Twenty seven fungal species were found associated with seeds of six cereals. Maximum fungi were reported from seeds of *Pennisetum typhoides* and *Sorghum vulgare*. *Aspergillus flavus, Fusarium moniliformae* and *Fusarium oxysporum* were found pathogenic causing seed rot, seed discoloration and germination inhibition. Captan and Dithane M-45 proved best for seed dressing.

## INTRODUCTION

The seed-borne fungi of cereals were earlier studied by Sharma & Basu Chaudhary (1975), Gupta (1976), Konde et al. (1880), Randhwa & Aulakh (1980), Prasad & Narayan (1981), Girisham & Redddy (1985, 1986) and Khairnar & Mukadam (1989).

The present investigations were carried out to detect the seed-borne fungi of some major cereals viz., *Pennisetum typhoides*, *Sorghum vulgare*, *Triticum aestivum, Zea mays*, *Oryza sativa* and *Elsusine coracana* by different seed health testing methods and to study their pathogenic behaviour and control by seed dressing fungicides.

## MATERIALS AND METHODS

Seed samples of bajra (pearl millet), jowar, wheat, maize, rice and elsusine were collected in three random samples (half kg each) from fields, various storehouses and markets. A composite sample of this was prepared by mixing the individual samples, and preserved in cloth bags at laboratory temperature during the study.

Standard blotter and agar plate method with Wakman's acid agar and Rose bengal agar medium was used as recommended by ISTA (1960) for the isolation of seed-borne fungi of six cereals. Four hundred seeds were used in each case. Seeds used for experiments were untreated and pretreated with 0.1% $HgCl_2$ solution; in agar plate method ten seeds were plated in each plate. The plates were incubated at 20 ± 2°C under alternate light and darkness condition for seven days.

The pathogenicity tests of each fungus on seeds during germination were carried out by soaking the surface sterilized seeds in spore suspensions of seed-borne fungi for 24 h. The seeds were used for germination studies on moist blotter. Seeds treated similarly but without spore suspension served as control. This type of work was done by Panchal (1984) on jowar seeds.

The fungicides namely Captan, Dithane M-45, Dithane Z-78, Brassicol, Blitox-50 W, Bavistin, Thiram, Zinkop, Ceresan, Zineb-75, Wettable sulphur each (2 g/kg seed) were evaluated for their efficacy in reducing the seed-borne fungi of pearl millet. The treated seeds were tested by standard blotter method after 24 hours of the treatment. Untreated seeds served as control.

## RESULTS AND DISCUSSION

It is clear from the results summarized in Table 1 that 27 fungal species appeared on the seeds of six cereals tested. In present investigation three fungi viz., *Mortirella exigua*, *Pythium* sp. and *Torula herbarum* are newly recorded on *Pennisetum typhoides*. On untreated seeds, maximum incidence was of *Drechslera tetramera* followed by *Aspergillus niger, A. flavus, Fusarium oxysporum, F. moniliformae* and *Rhizopus nigricans*, while *Absidia ramosa, A. flavipes, A. fumigatus, Drechslera rostrata, Penicillium oxalicum, Pithium* sp., *Torula herbarum* and *Rhizoctonia solani* were reported poorly.

Seeds treated with surface sterilizer showed complete absence of certain fungi like *Absidia ramosa, Aspergillus nidulans* and *Penicillium oxalicum*. It was interesting to note that one phycomycetous non-sporulating fungus appeared on untreated seeds. Fungal species like *Aspergillus flavus, A. niger* and *Fusarium oxysporum* were found on all cereals.

It is evident from the results given in Table 2 that

Table: 1. Fungal biodiversity in seeds of some cereals of Nashik district.

| Sr. No. | Fungal species | % incidence on the seeds | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Pennisetum typhoides* | | *Sorghum vulgare* | | *Triticum aestivum* | | *Zea mays* | | *Oryza sativa* | | *Elsusine coracana* | |
| | | UT | PT | UT | PT | UT | PT | UT | PT | UT | PT | UT | PT |
| 1. | *Absidia ramosa* | 10 | - | 10 | - | - | - | - | - | - | - | - | - |
| 2. | *Alternaria alternata* | - | 10 | 20 | 10 | - | - | - | - | - | - | - | - |
| 3. | *Aspergillus carbonarius* | 20 | 10 | 30 | 20 | 20 | 20 | - | - | 10 | - | - | - |
| 4. | *A. flavipes* | 10 | - | 10 | 10 | 10 | - | - | | - | - | - | - |
| 5. | *A. flavus* | 30 | 20 | 30 | 10 | 30 | 10 | 40 | 10 | 30 | 20 | 40 | 10 |
| 6. | *A. fumigatus* | 10 | - | - | - | - | - | - | - | - | - | - | - |
| 7. | *A. nidulans* | 10 | - | 10 | - | 20 | - | 10 | - | 10 | - | - | - |
| 8. | *A. niger* | 40 | 30 | 20 | 20 | 20 | 10 | 10 | 10 | 20 | 20 | 30 | - |
| 9. | *A. terreus* | 10 | 10 | - | - | | | - | - | - | - | - | - |
| 10. | *A. ustus* | 20 | 10 | 10 | 10 | 20 | 10 | 20 | - | - | - | 10 | - |
| 11. | *Cladosporium herbarum* | 20 | 10 | 20 | 10 | 10 | - | - | - | - | - | - | - |
| 12. | *Curvularia lunata* | 10 | 10 | 20 | 20 | - | - | - | - | - | - | - | - |
| 13. | *C. Pallescens* | - | 20 | 10 | - | - | 10 | - | - | - | - | - | - |
| 14. | *Drechslera longirostrata* | 20 | 30 | 20 | 20 | - | - | - | - | - | 20 | - | - |
| 15. | *D. rostrata* | 10 | 10 | 10 | 10 | - | - | - | 10 | - | - | - | - |
| 16. | *D. tetramera* | 60 | 10 | 10 | 10 | - | - | - | - | - | - | - | - |
| 17. | *Fusarium moniliformae* | 30 | 10 | 20 | 20 | - | 10 | - | - | - | - | - | - |
| 18. | *F. oxysporum* | 30 | 20 | 10 | 20 | 40 | - | 30 | 20 | - | 10 | - | 10 |
| 19. | *Mortierella exigua* | 20 | 10 | 10 | - | - | - | - | - | - | - | - | - |
| 20. | *Mucor globosum* | 20 | 20 | 20 | 10 | 30 | - | 40 | 10 | 20 | - | - | - |
| 21. | *Penicillium oxalicum* | 10 | - | 10 | - | - | - | - | - | - | - | - | - |
| 22. | *Pythium* sp. | - | 10 | - | - | - | - | - | - | - | - | - | - |
| 23. | *Rhizoctonia solani* | - | 10 | 10 | 10 | - | - | - | - | - | - | - | - |
| 24. | *Rhizopus nigricans* | 30 | 30 | 30 | - | 30 | - | - | - | - | - | - | - |
| 25. | *Syncephalastrum racemosum* | 20 | - | 20 | 10 | - | - | - | - | - | - | - | - |
| 26. | *Torula herbarum* | 10 | 10 | - | - | - | - | - | - | - | - | - | - |
| 27. | *Non-sporulating mycelium* | 10 | - | - | - | - | 10 | - | - | - | - | - | - |
| | Total fungial species = 27 | 23 | 20 | 21 | 16 | 10 | 07 | 06 | 05 | 05 | 04 | 03 | 02 |

UT = Untreated seeds; PT = Pretreated seeds; + Present; - Absent

Table 2: Effect of artificial infestation on seeds and seedlings of *Pennisetum typhoides*.

| Fungal species | Abnormalities in seeds and seedlings | | | | | | |
|---|---|---|---|---|---|---|---|
| | % Seed Germination | Seed Rot | Seed Discolourations | Seedling | | Seedling | |
| | | | | Shoot | Length | Root | Length |
| *Alternaria alternata* | 40 | - | Black brown | Blight | 5.0 | - | 9.8 |
| *A. tenuis* | 40 | - | Brown | Yellow | 5.2 | Shortening | 4.1 |
| *Aspergillus flavus* | 10 | + | Green | Tip rot | 2.6 | Root rot | 1.9 |
| *Aspergillus niger* | 100 | - | black | Yellow | 5.4 | Healthy | 9.0 |
| *Cladosporium herbarum* | 40 | - | Dull green | Stunted | 1.6 | Shortening | 3.0 |
| *Curvularia lunata* | 30 | - | Black cloudy | Chlorosis | 4.9 | Root rot | 10.7 |
| *Curvularia pallescens* | 50 | - | Black cloudy | Stunted | 2.5 | Root rot | 9.2 |
| *Dreshslera longirostrata* | 40 | - | Black cloudy | Blight | 5.0 | Root rot | 10.0 |
| *Dreshslera rostrata* | 50 | - | Black cloudy | Blight | 5.2 | Root rot | 9.2 |
| *Dreshslera tetramera* | 20 | - | Black cloudy | Blight | 5.0 | Root rot | 8.8 |
| *Fusarium moniliformae* | 00 | + | White pink | - | - | - | - |
| *Fusarium oxysporum* | 00 | + | White | - | - | - | - |
| *Penicillium oxalicum* | 10 | - | Faint blue | Pale green | 2.8 | Curling root | 4.5 |
| *Rhizopus nigricans* | 20 | - | Ash | Tip rot | 4.5 | Shortening | 1.5 |
| *Rhizoctoni solani* | 50 | - | Black brown | Chlorossis | 4.9 | Root rot | 9.7 |
| Control | 100 | - | Normal | Normal | 5.2 | Normal | 10.0 |

complete inhibition of seed germination was achieved due to *Fusarium moniliformae* and *Fusarium oxysporum*, while seed rotting was effectively found due to *Aspergillus flavus*, *Fusarium moniliformae*, *F. oxysporum*, and partial seed rot by *Penicillium oxalicum*. In five days old seedlings, blight and retardation of root length and shoot elongation were the common symptoms caused by the most of the seed-borne fungi.

Captan, Dithane-45, Bavistin and Blitox-50W (each 2g/kg seeds) showed broad spectrum effect and eliminated all the fungi from seed and improved germination to the extent of 90-98 percent as compared to 50-60 percent obtained in untreated seeds. The remaining fungicides were less effective in controlling the seed-borne fungi of cereals.

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