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NEW RECORDS OF FUNGI ASSOCIATED WITH SOME STORED CEREAL GRAINS

Sher Muhammad* Waseem Ahmad** and Masood Ahmad Nasir***

Seed samples of wheat, rice, maize and sorghum collected from different seed stores of Pakistan yielded 92 species belonging to 42 different genera of fungi. Out of these, 75 per cent of the genera belonged to Deuteromycetes, 23 per cent to Phycomycetes and only 2 per cent to Ascomycetes. Detailed description of only sixteen new records of fungi associated with these cereal grains is given.

INTRODUCTION

A variety of microorganisms are harboured by the cereal grains and among these fungi are of significant importance. It is interesting to know that among the fungi associated with the grains, some of these produce certain toxic metabolites, commonly known as mycotoxins. Sometimes the production of such toxic substances by these fungi produce health hazards in livestock and poultry.

Although some information is available about the fungi associated with wheat grain of Karachi area (Hasany *et al.*, 1968; and Ahmad and Husain, 1971) and some cereal grains of Punjab area (Bajwa and Kausar, 1986; Nasir and Kausar, 1965; Hassan, 1967; Ahmad, 1961, Mohyuddin *et al.* 1971; Khan, 1973; and Anwar, 1973), but the present paper aims at providing detailed description of only new records of fungi associated with some common stored cereal grains.

MATERIALS AND METHODS

Isolations from the seeds samples were made with usual isolation technique (Duggar, 1909). The isolates were purified and later identified upto specific level with the help of available literature (Gilman, 1956; Ames, 1961; Raper and Fennel, 1965; Zycha and Seipman, 1965; Raper and Thom, 1968; Ellis, 1971; Booth, 1971; and Barron, 1972). The isolates were preserved in

*Deptt. of Biology, Govt. Islamia College, Faisalabad.
**Rice Research Institute, Kala Shah Kaku.
***Deptt. of plant Pathology, University of Agriculture, Faisalabad.
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sterilized mineral oil and stored at room temperature of 20-25°C in the lab. for further reference.

RESULTS

Isolations from about 450 naturally infested and surface disinfested samples of wheat, rice, maize and sorghum yielded the following 92 species belonging to 42 different genera of fungi.

Acremoniella atra; Alternaria tenuis and *A. tenuissima; Arthrinium phaeospermum; Aspergillus niger, A. sydowi, A. fumigatus, A. ochraceus, A. versicolor, A. petrakii, A. auricomas, A. funiculosus, A. candidus, A. nidulans, A. flavus, A. sulphureus, A. glaucus, A. oryzae, A. parasiticus* and *A. ustus; Candida* sp., *Cephalosporium curtipes: Cladosporium herbarum* and *C. Cladosporioides; Curvularia lunata, C. inaequalis, C. clavata, C. crepnii* and *C. tuberculata; Cladobotryum thumenii; Diplodia* sp; *Drechslera tridis, D. holmii, D. specifierum, D. papendorfii, D. setariae, D. semeniperda, D. hawaiiensis; Epicoccum nigrum; Fusarium heterosporum; F. moniliforme, F. stilboides* and *F. semitectum; Fusidium* sp.; *Graphium penicillioides; Helminthosporium oryzae, H. stivum* and *H. turcicum; Hormodendrum viridre; Memnoniella echinata; Monilia sitophila; Monodictys levis; Nigrospora oryzae; Paecilomyces elegans* and *P. bacillisporus: penicillium purpurogenum, P. funiculosum, P. italicum, P. corylophilum, P. oxalicum, P. variabile, P. turbatum, p. pustilum, P. lapidosum, P. chrysogenum* and *P notatum; phoma lingam; Sclerotium complanatum; Septonema* sp.; *Sporotrichum carnis; Stachybtrys atra; Stemphyllum botryosum; Trichothecium roseum. Trichoderma viride; Ulocladium botrytis; Verticillium glaucum; Zygodesmus* sp.; *Mucor racemosus; Absidia corymbifera; Circinella simplex; Rhizopus oryzae, R. colnii* and *R. arrhizus; Syncephalis cornu; Syncephalastrum racemosum; Actinomucor elegans; Chaetomium globosum, C. erraticum, C. minutum, C. olivaceum, C. indicum* and *C. breviptilum.* Out of these, only the new records on these cereal grains are described.

DESCRIPTION OF SPECIES

1. *Aspergillus funiculosus* Smith

Colonies on malt salt agar light grey, scattered. Heads hyaline, to sub-hyaline, small, globose to sub-globose. Conidiophores hyaline, simple, erect, sparingly septate, smooth, 5.6–7.5 μ wide and upto 250 μ in length

Vesicles typically globose, fertile all over, a few slightly cylindric, 10–15 μ in diameter. Phialids uniserriate, radiate, flask shaped to cylindrical, 6–9 × 3–4 μ. Conidia thick walled, light green, smooth to rough, globose to sub-globose, 2.8–4.0 μ in diameter.

2. *A. glaucus* var. *mangini* Thom and Raper

Vesicles globose, short, light olivaceous, 5.6–9.4 μ in diameter. Conidiophores short to long, wavy, non-septate, light olivaceous brown, erect, simple, smooth, 52–134 μ. Phialids uniserriate, a few biserriate, radiate to loosely columnar. Conidia globose, light to deep green in mass finely echinulate. Asci 8-spored, globose to sub-globose 6.6–7.5 μ in diameter. Ascospores reddish brown, ovoid to ellipsoid, with furrow in the centre. Hulle cells globose, greenish to golden yellow, 9.4–14.0 μ in diameter.

3 *A. parasiticus* Speare

Colonies on malt extract agar yellowish green, spreading. Conidiophores long, mostly rough, erect, simple, sparingly septate, apex broader, 140–205 × 8–10 μ. Conidial heads loosely radiate. Vasicle sub-globose, 20–30 μ in diameter. Sterigmata uniserriate, 8-9 × 3-4 μ, light olivaceous to yellow green shade. Conidia light yellow green, deep greenish yellow in mass, in small chain, 1-celled, globose to sub-globose, conspicuously verrucose, 3.8-6.0 μ in diameter. Cleistothecia not found.

4. *Cladosporium herbarum* (Pers.) Link ex Gray

Colonies effuse, olive green to olivaceous brown, velvety, reverse on malt extract agar greenish black. Conidiophores straight to flexuous, sometines geniculate, smooth, mostly 50 μ in length, upto 200 μ long and 3–5 μ thick. Conidia in chain, ellipsoid to ovoid mostly scar at one and rounded at ends, rather thick walled, pale to light brown, verrucose, mostly 0-septate, a few indistinctly uniseptate, 7.5-21.0 × 3.0-5.5 μ (mostly 5-12 × 4-5 μ).

5. *Drechslera iridis* (Oud.) Ellis Comb. nov.

Colonies dark brown to black, velvety, with septate hyphae. Conidiophores in groups, deep olivaceous to brown, erect, short to long septate, geniculate, 37-150 × 7-8 μ. Conidia cylindrical to fusiform,

dark brown, with non-protuberant scar, gradually tapered at both ends, mostly 4–7 pseudo-septate. 31-65 × 14-18 μ. Hilum 3.5-5.6 μ wide.

6. ***D. setriae*** (Sawada) Subram. and Jain

Colonies grey brown to rather black. Conidiophores septate, straight to flexuous, broad to slightly flattened at the apex, light-olivaceous to deep-olivaceous, short to long, mostly 60 μ in length and 6–7 μ wide. Conidia smooth, mostly straight, a few slightly curved, cylindrical to slightly ellipsoid, light to deep brown, 70-90 × 19-24 μ. Hilum not protuberant, 2.0-3.5 μ wide.

7. ***Fusarium moniliforme*** Sheldon

Microconidia mostly inchain when young, later spread out over the mycelium, 1 or 2-celled, spindle to ovate, 5-10 × 1.5-2.5 μ. Macroconidia slightly crescent shaped to almost straight in the middle, tapering and pointed at both ends, often constricted at the tip, with a small foot cell, in mass salmon coloured, mostly, 3-5 septate, 20-30 × 2.5-4.5 μ. Chlamydospores and sporodochia not found.

8. ***F. semitectum*** Berk and Rav.

Colonies at first white, later becoming avellaneous. Sporodochia and chlamydospores absent. Macroconidia spindle shaped, tapering at both ends, 3-5 septate, with no basal pedicel, short, straight to mildly bulged in the centre, 20-36 × 2.9-3.8 μ. Microconidia hyaline, 1-celled, ovate, 5-7 × 1.5-2.0 μ.

9. ***Fusidium*** sp.

Mycelium at first creamy white, later becoming shelter brown, indistinctly septate. Conidiophores not differentiated from the mycelium, arising at right angles as short lateral branches, simple, non-septate, short light brown,. Conidia in chain, produced in a-cropetal succession, ellipsoid to fusiform, sub-hyaline, later creamy to light brown, straight, pointed to rather truncate at both ends, 4.0-4.5 × 3-3.5 μ.

10. ***Hormodendrum virdi*** (Frees) Saccardo

Colonies olive-green on malt extract agar. Conidio-phores erect, septate, deep-brown, arising from prostrate mycelium. Conidia mostly egg shaped, a few-long, 1-celled, smooth, frequently with two oil drops, light olivaceous to light green, 5.0-10.5 × 3-3.8 μ.

11. *Penicillium purpurogenum* Stoll

Colonies on Czapek's agar growing rather restrictedly, with reverse, blood red. Conidiophores thin, light green, 80-131 × 2.5-3.9 μ. Penicilli typically biverticillate and symmetrical, compact, usually with a single verticle of 4-6 metulae, mostly 4 in number. Each terminating in a compact to rather loose cluster of parallel sterigmata. Sterigmata mostly 9.0-9.5 × 2.0-2.5 μ, lenceolate, characteristically tapered. Conidia 1-celled, green, sub-globose, 2.8-3.5 × 2.8-3.3 μ.

12. *P. corylophilum* Dierckx

Colonies on malt extract agar dull green, velvety. Conidiophores simple, septate, smooth walled, mostly 70-110 × 2.0-2.5 μ, upto 200 μ long. Penicilli biverticillate, asymmetrical, with typically 2-3 metulae (mostly two) verible in size, 11-17 × 2.0-2.8 μ. Sterigmata slightly narrower at the apex and broader below, non-septate, 2-4 in number, 7.5-9.5 × 2.0-2.6 μ. Conidia 1-celled, smooth, sub-globose to ovoid to broadly elliptical, 3.7-4.7 × 2.0-3.8 μ.

13. *P. chrysogenum* Thom

Colonies on Czapek's agar spreading, dull grey green, pistachio green to American green, velvety with exudates as yellow droplets, odour lacking, reverse light yellow to rather brown yellow. Conidiophores long, smooth, hyaline, mostly 150-200 μ upto 300 μ in length, 3.0-3.5 μ in diameter. Penicilli biverticillate, asymmetrical, a few with one or more branches, in verticils of 2-3, metulae, 10-11 x 2.0-2.8 μ. Sterigmata 8-10 x 2.0-2.5 μ. Conidia smooth, elliptical to sub-globose, 3.0-4.0 x 2.8-3.5 μ.

14. *Absidia blakesleeana* Lender

Turf white, turning grey near maturity. Sporangiospores hyaline to light brown, mostly smooth, upto 1.5 mm. in height. Lateral sporangia often bent or circinate, sporangia pyriform, columellate, hyaline when young to light grey at maturity, 55-68 x 55-113 μ. Columellae globose, mostly with collar, sub-globose, ovoid, hyaline to

greyish brown, 48-60 x 5.5-5.7 μ. Sporangiospores ovoid, cylindrical, with smooth wall, byaline to light grey, 7.9-10 x 2.4-3.6 μ.

15. *Chaetomium olivaceum* Cooke and Ellis

Perithecia ostiolate, globose, 325-400 μ in diameter, with loose mass of grey to brown hairs, terminal hairs rough, with rigged appearance long, septate, 3.5-4.5 μ in thickness. Lateral hairs similar but short and blunt. Asci irregularly club-shaped, ascospores dark olivaceous brown, broadly ovoid, more likely umbonate at both ends, 9.5-12.00 x 7.8-9.4 μ.

16. *C. indicum* Corda

Mycelium greenish yellow, scanty. Perithecia ostiolate, small, globose to sub-globose, deep-olivaceous to dark brown to black, 130-210 x 123-190 μ. Terminal hairs mostly 5-6μ, septate, slender slightly broader at the base, blunt 5-6 μ wide, dichotomously branched at the apex, with rough and reflexed branches, inter-mixed with a few straight hairs, lateral hairs mostly unbranched, olive-brown, straight, rough, 2.5-3.5 μ thick. Asci club shaped, 8-spored, 26-30 x 9.0-9.5 μ. Ascospores smooth, ovate to lemon shaped, olive brown, filled with globules, sub-apiculate at one or both ends, 5-7 x 4-5 μ.

DISCUSSION

It appears from the results that good number of species get associated with the grains in the field and in storage. Among different isolates, most of the fungi belonged to Deuteromycetes and Phycomycetes. Whereas, the number of ascomycetous fungi was comparatively very low. A low occurrence of this group of fungi may be due to rare occurrence on seeds and over gorwth of other fast growing fungi, mostly belonging to the order Mucorales.

As reported in the literature, a good number of species produce certain toxic substances and even their small quantities are harmful to health, when present in foods and feeds. It is interesting to note the kind and distribution of different species, particularly toxin producing, in different seed samples, so as to assess the magnitude of the problem.

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