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On the Fungal Flora of Saudi Arabian Soils*

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Abstract: Sixteen different localities in Southern area of Saudi Arabia were examined for their fungal mycoflora. A modified soil-dilution plate method was used for isolating the fungi. Sixty four species in twenty two genera were reported. Of these species five were *Phycomycetes*, ten were *Ascomycetes* and forty nine were *Deuteromycetes*. Of the reported species 55 are new records to the Flora of Saudi Arabia and one of these is a new species.

Key words: Fungi, soil, Saudi Arabia

INTRODUCTION

Few investigations have been made of soil fungi in Saudi Arabia. Fathi *et al.* (1975) studied the activities of the soil fungi in Riyadh region. Ali (1977) conducted a general survey of the fungal flora in Wadi Hanifa. Subsequently, Ali *et al.* (1977) recorded the seasonal fluctuations of different fungi in the rhizosphere of some plants. Abdel-Hafez (1982) in a preliminary survey of the mycoflora of desert soils in Saudi Arabia isolated thirty four different fungal genera and 80 species from different places. He also recorded more than forty tow new fungal species. Some of the important reviews dealing with fungal flora were those of Chaudhuri and Sachar (1934), Bisby *et al.* (1935), Taber (1951), Miller *et al.* (1957), Doory *et al.* (1959), Borut (1960), Kendrick (1962), Jensen (1963), Waheeb and Yusef (1968), Christensen (1969), Bhatt (1970), Moubasher and Moustafa (1970) and Samuels (1996). The present study was undertaken to characterize the soil mycoflora of different localities in Southern area of Saudi Arabia as being recorded for the first time.

MATERIALS AND METHODS

Soil samples were collected from sixteen localities in Southern area in December and April 2000, 2001 (Fig. 1), according to the method described by Johnson *et al.* (1960). The Southern region, laying to the east of South Hijaz, to the South of Najd to and the north of Yemen. It includes, Abha, Bisha, Gizan and Najran areas (Migahid, 1978). The surveyed localities include the coastal area of the Red sea from Al Gunfudah to Najran and from Al Baha to Khamis Mushayt. The methods applied for soil analysis were based on those referred to in Piper (1947). The dilution plate method was used, for the estimation of soil fungi, as described by Johnson *et al.* (1960), but with some modifications. The primary suspension was prepared from 25 g of the soil in a pint Mason jar containing 250 mL of sterile 0.15% water agar. This primary suspension was blended for 15 min. A dilution series was prepared from this primary suspension. Samples from 1:100 and 1:1000 dilutions of the primary suspension were plated out in triplicate using modified Czapek's Dox medium in which glucose (10 g L^{-1}) replaces sucrose and supplemented with 0.5 g yeast extract, rose bengal and streptomycin. The plates were incubated at 22-23°C and examined periodically. Dilution plates were kept for at least 3 weeks before being discarded to allow slow-growing colonies to develop. The fungal colonies growing on the dilution plates were transferred to fresh Czapeck's Dox agar and pure cultures of isolated fungi were obtained by making spored- or single-hyphal tip isolations. Prepared slides of lactophenol-cotton blue were

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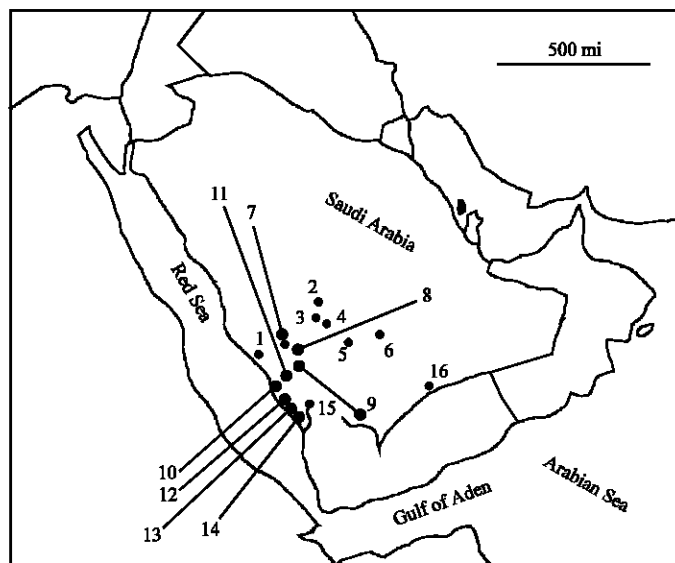


Fig. 1: Map locating sites where the different soil samples were collected *1 = Al Gunfudah; 2 = Al Baha; 3 = AL Majardah; 4 = Annamas; 5 = Abha; 6 = Khamis Mushayt; 7 = Al Gawz; 8 = Kayad; 9 = As Saidah; 10 = Amaq; 11 = Dabsa; 12 = Al Birk; 13 = Al Tirq; 14 = Gizan; 15 = Ash Shugaig; 16 = Najran

Table 1: Characteristics of soils of the different localities in Southern region of Saudi Arabia

Locality	Water content of air-dry soil	Total soluble salts	Organic carbon content	pH
Al Gunfudah	1.81	0.60	0.11	7.1
Al Baha	1.06	0.09	0.08	7.5
AL Majardah	1.19	0.32	0.31	7.2
Annamas	2.03	0.40	0.36	7.2
Abha	0.90	0.10	0.14	7.5
Khamis Mushayt	1.53	0.39	0.51	7.3
Al Gawz	0.92	0.09	0.08	7.9
Kayad	0.81	0.22	0.07	8.0
As Saidah	0.72	0.18	0.05	8.1
Amaq	0.61	0.08	0.05	7.8
Dabsa	0.96	0.12	0.09	7.6
Al Birk	0.80	0.13	0.08	7.7
Al Tirq	0.84	0.23	0.07	7.9
Gizan	1.03	0.21	0.09	7.1
Ash Shugaig	1.23	0.35	0.21	7.2
Najran	0.61	0.14	0.06	7.5

examined and identification of the isolated fungal species was done using stereoscopic binocular (40x) and compound research binocular microscopes (1000x).

RESULTS AND DISCUSSION

The results given in Table 1 show that the Southern area soils are generally poor in inorganic content. The total soluble salt content varies from a low value (0.08) to relatively high value (0.6). The pH values of the soil samples reveal no appreciable differences; all are alkaline and the pH ranges from 7.2-8.1. The soil samples are of characteristic desert type. They are light and sandy.

Records of Fungal Genera

In the isolation studies of the fungi from southern region soils a total of 64 species in 22 genera were recovered. Most of the fungal genera isolated belonged to the class *Deuteromycetes*. Four species were *Phycomycetes*, ten were *Ascomycetes* and forty nine were *Deuteromycetes*. The various fungal species are listed according to their occurrence in the following localities:

Al Gunfudah

Pleospora herbarum, *Alternaria alternata*, *Aspergillus niger*, *Cladosporium cladosporioides*, *Penicillium crustosum*, *Penicillium chrysogenum*, *Penicillium decumbens*, *Trichoderma aureoviride*, *Trichoderma harzianum*, *Trimmatostroma* sp.

Al Baha

Alternaria alternata, *Cladosporium cladosporioides*, *Fusarium acuminatum*, *Fusarium semitectum*, *Penicillium chrysogenum*.

AL Majardah

Rhizopus stolonifer, *Pleospora infectoria*, *Alternaria alternata*, *Alternaria* sp., *Cladosporium cladosporioides*, *Fusarium oxysporum*, *Fusarium semitectum*, *Penicillium decumbens*, *Trimmatostroma* sp.

Annamas

Mucor hiemalis, *Chaetomium bostrychodes*, *Chaetomium irregulare*, *Chaetomium cf. mollicellum*, *Chaetomium* sp. (new species), *Pleospora infectoria*, *Alternaria alternata*, *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus ustus*, *Cladosporium cladosporioides*, *Cladosporium macrocarpum*, *Chaetomidium subfimetii*, *Coniothyrium* sp., *Penicillium canescens*, *Penicillium chrysogenum*, *Penicillium frequentans*.

Abha

Chaetomium spirale, *Neurospora crassa*, *Aspergillus ochraceus*, *Aspergillus versicolor*, *Cladosporium cladosporioides*, *Penicillium canescens*, *Penicillium cyclopium*, *Penicillium crustosum*.

Khamis Mushayt

Rhizopus arrhizus, *Chaetomium fusisporum*, *Chaetomium cf. mollicellum*, *Pleospora infectoria*, *Aspergillus glaucus*, *Cladosporium cladosporioides*, *Coniothyrium fuckelii*, *Fusarium concolor*, *Gliocladium roseum*, *Penicillium canescens*, *Penicillium cyclopium*, *Penicillium frequentans*, *Penicillium funiculosum*, *Penicillium janthinellum*, *Phoma* sp., *Scolecobasidium variabile*, *Stachybotrys sacchari*, *Ulocladium atrum*.

Al Gawz

Pleospora infectoria, *Aspergillus ustus*, *Cladosporium tenuissimum*, *Penicillium canescens*, *Phoma exigua*.

Kayad

Chaetomium jodhpurensis, *Aspergillus nidulans*, *Aspergillus tamarisii*, *Fusarium acuminatum*, *Penicillium canescens*, *Penicillium cyclopium*.

As Saidah

Cladosporium cladosporioides, *Fusarium concolor*, *Penicillium canescens*.

Amaq

Cladosporium sphaerospermum, *Penicillium decumbens*, *Trimmatostroma* sp.

Dabsa

Aspergillus fumigatus, *Aspergillus niger*, *Cladosporium sphaerospermum*, *Penicillium chrysogenum*.

Al Birk

Fusarium semitectum, *Penicillium canescens*, *Trichoderma viride*.

Al Tirq

Rhizopus stolonifer, *Fusarium equiseti*, *Penicillium chrysogenum*.

Gizan

Myrothecium roridum, *Penicillium lilacinum*, *Cladosporium aureoviride*, *Stachybotrys atra corda*.

Ash Shugaig

Mortierella sp., *Aspergillus flavipes*, *Cladosporium cladosporioides*, *Cladosporium sphaerospermum*, *Penicillium canescens*, *Penicillium cyclopium*, *Penicillium chrysogenum*, *Penicillium decumbens*, *Penicillium frequentans*, *Penicillium thomii*, *Phoma exigua*, *Trimmatostroma* sp., *Ulocladium atrum*.

Najran

Cladosporium macrocarpum, *Fusarium solani*, *Penicillium cyclopium*, *Penicillium frequentans*, *Phoma* sp.

All these fungal species were new records from Southern area soils except *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus glaucus*, *Aspergillus niger*, *Fusarium equiseti*, *Fusarium oxysporum*, *Fusarium solani* and *Penicillium chrysogenum*.

According to their occurrence in the soil samples, *Penicillium* and *Cladosporium* are of high occurrence in Southern area soils. The former was present in all the soil samples and the other was absent from four samples only.

Aspergillus and *Fusarium* were of moderate occurrence. Five genera were of low occurrence, namely *Alternaria*, *Pleospora*, *Rhizopus*, *Chaetomium* and *Phoma*. Twelve genera i.e., *Trichoderma*, *Trimmatostroma*, *Chaetomidium*, *Coniothyrium*, *Mucor*, *Neurospora*, *Scolecobasidium*, *Stachybotrys*, *Ulocladium*, *Gliocladium*, *Myrothecium* and *Mortierella* were rare.

Aspergillus and *Penicillium* were the fungal genera having the highest number of isolated species. Ten species from each genus were recorded. Seven species were recovered from both *Fusarium* and *Chaetomium*, four species from *Cladosporium* and *Trichoderma*, two species from *Alternaria*, *Pleospora*, *Rhizopus*, *Stachybotrys*, *Coniothyrium* and *Phoma*. Only one species was recorded from the rest of fungal genera namely, *Trimmatostroma*, *Scolecobasidium*, *Chaetomidium*, *Mucor*, *Ulocladium*, *Gliocladium*, *Neurospora*, *Mortierella* and *Myrothecium*. The broadest range of genera and species isolated from the different soil samples were from Annamas, Khamis Mushayt and Ash Shugaig. These results are in close agreement with those reported early in Saudi Arabia (Ali, 1977; Ali *et al.*, 1977; Abdul-Hafez, 1982; Arif and Hashem, 1998) and elsewhere in the neighboring regions (Doory *et al.*, 1959; Waheeb and Yusef, 1968).

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