

KERATINOPHILIC FUNGI IN SOILS OF YEMEN ARAB REPUBLIC

A.H.M. EL-SAID*

SUMMARY: Thirty-six species belonging to 15 genera of keratinophilic fungi were collected from 50 soil samples gathered from different places of Yemen by using hair fragments as baits at 28°C. Six species of true dermatophytes were collected: *Arthroderma Lenticulare* (= *Trichophyton terrestre*), *Trichophyton mentagrophytes*, *T. equinum*, *T. rubrum*, *T. soudanense* and *Microsporum gypseum*. Numerous Keratinophilic fungi were isolated namely: *Aphanoascus terreus* (= *Chrysosporium indicum*), *Aphanoascus species* (= *C. tropicum*), *A. fulvescens* (= *C. Keratinophilum*), *Chrysosporium pannicola*, *C. pruinosum*, *C. carmichaelii*, *C. lucknowense*, *C. xerophilum*, *C. asperatum*, *Arthroderma cuniculi*, (= *C. anamorph of Arthroderma cuniculi*), *A. curreyi* (= *C. anamorph of Arthroderma curreyi*) and *Plectinotrichum llanense* (= *C. anamorph of Plectinotrichum llanense*). The commonest saprophytes in order of frequency were member of the genera *Aspergillus*, *Alternaria*, *Penicillium*, *Rhizopus*, *Cunninghamella*, *Fusarium*, *Ulocladium* and *Macrohomina*.

Key Words: *T. equinum*, *T. rubrum*, *T. soudanense*, *Trichophyton terrestre*.

INTRODUCTION

Several investigations have been made on the contribution of Keratinophilic fungi in soil of many countries all over the world (6,12-16,19,23,24,30-33).

In Arab countries, few surveys were carried out on Keratinophilic fungi from soil (1,2,4,5,8,20, 22,37). The objective of this investigation was to determine the Keratinophilic and saprophytic fungi in soil samples of Yemen.

MATERIALS AND METHODS

50 soil samples were collected from different localities of Yemen, according to the method described by Johnson *et. al.* (21). The hair baiting technique was used as reported by Vanbreuseghem (35) and employed Abdel-Fattah *et. al.* (1). Two plates were used for each sample, five goat hair fragments taken at random from each plate were transferred to the surface

of Sabouraud's dextrose (26) agar medium supplemented with chloramphenicol (0.5 mg/ml medium) and cycloheximide (0.5 mg/ml medium). The developing fungi were counted and identified and the numbers were calculated per 10 hair fragments for each sample or per 500 goat hair fragments in all soil samples. The relative importance value (RIV) for each fungal genera and species recovered was calculated (7).

RESULTS AND DISCUSSION

36 species belonging to 15 genera of Keratinophilic and saprophytic fungi were collected from soil samples gathered from Yemen baited with goat hair fragments at 28°C (Table 1).

Aphanoascus was the most common genus and encountered from 52% of the samples matching 25.3% of total fungi and had RIV 77.3. Of the genus 3 species were collected of which *A. terreus* (= *Chrysosporium indicum*), *Aphanoascus species* (= *C. tropicum*) and *A.*

*From Department of Botany, Faculty of Science, Qena, Egypt.

Table 1: Total isolates (TI, calculated per 500 hair fragments), number of cases of isolation (NCI, out of 50 cases), occurrence remarks (OR) and relative importance values (RIV) of fungal genera and species recovered from soil samples baited with goat hair fragments at 28°C.

Genera and species	TI	NCI	OR	RIV
Aphanoascus	121	26	H	77.3
<i>A. terreus</i> (Randhawa and Sandhu) Apinis	51	13	M	36.6
Aphanoascus sp.	44	12	L	33.2
<i>A. fulvescens</i> (Cooke) Apinis	26	7	L	19.4
Chrysosporium	87	25	H	68.2
<i>C. pannicola</i> (Corda) Van Oorschot and Stalpers	14	6	L	14.9
<i>C. pruinatum</i> Gilman and Abbott	21	6	L	16.4
<i>C. carmichaelii</i> Van Oorschot	20	5	R	14.2
<i>C. lucknowense</i> Garg	11	5	R	12.3
<i>C. xerophilum</i> Pitt	13	5	R	12.7
<i>C. asperatum</i> J. W. Carmichael	8	2	R	5.7
Arthroderma	72	17	M	49
<i>A. lenticulare</i> Pore, Tsao and Plunkett	36	9	L	25.5
<i>A. cuniculi</i> Dawson	20	6	L	16.2
<i>A. curreyi</i> Berk	16	4	R	11.3
Aspergillus	57	14	M	39.9
<i>A. flavus</i> Link	15	6	L	15.1
<i>A. fumigatus</i> Fresenius	15	4	R	11.1
<i>A. ustus</i> (Bainier) Thom and Church	11	3	R	8.3
<i>A. wentii</i> Wehmer	7	3	R	7.5
<i>A. niger</i> Van Tieghem	7	2	R	5.5
<i>A. terreus</i> Thom	2	1	R	2.4
Trichophyton	39	10	L	28.1
<i>T. mentagrophytes</i> (Robin) Blanchard	15	6	L	15.1
<i>T. equinum</i> (Matruchoth and Dassonville) Goedelst	7	3	R	7.5
<i>T. rubrum</i> (Castellani) Sabouraud	11	3	R	8.3
<i>T. soudanense</i> Joyeux	6	2	R	5.3
Alternaria	36	9	L	25.5
<i>A. alternata</i> (Fries) Keissler	12	4	R	10.5
<i>A. raphani</i> Groves and Skolko	15	4	R	11.1
<i>A. tenuissima</i> (Kunze: Pers.) Wiltshire	9	2	R	5.9
Penicillium	19	5	R	14
<i>P. funiculosum</i> Thom	9	3	R	7.9
<i>P. puberulum</i> Bainier	3	2	R	4.6
<i>P. citrinum</i> Thom	4	2	R	4.8
<i>P. chrysogenum</i> Thom	3	1	R	2.6
<i>Pectinotrichum ilanense</i> Varsavsk and Orr	13	4	R	10.7
<i>Rhizopus stolonifer</i> (Enrenb.) Lind.	10	3	R	8.1
<i>Apinisia queenslandica</i> Apinis and Rees	5	2	R	5
<i>Cunninghamella elegans</i> Lendner	3	2	R	4.6
<i>Fusarium oxysporum</i> Shelecht	5	2	R	5
<i>Ulocladium chartarum</i> (Preuss) Simmons	5	2	R	5
<i>Macrophomina phaseoline</i> (Tassi) Goid	2	1	R	2.4
<i>Microsporium gypseum</i> (Bodin Guiart and Grigorakis)	5	1	R	2.4

Occurrence remarks: H=high occurrence; isolated from 25-50 cases (out of 50); M=moderate occurrence, from 13-24 cases; L=low occurrence, from 6-12 cases; R=rare occurrence, from 1-5 cases.

Fulvencens (= *C. Keratinophilum*) were isolated in low or moderate incidence. They occurred in 26%, 24% and 14% of the samples and possessed RIVs of 36.6, 33.2 and 19.4. These species were encountered, but with different frequency of occurrence, from Egyptian soils (1,4,22,27,37), as well as from soil samples in Marrakesh and Casablanca (20). These species had been previously isolated, but with different frequencies from soils of many parts of the world (11,12,14,25,29, 33,34).

Chrysosporium was the second common genus and was encountered in about 50% of the samples comprising 18.2% of total fungi and had RIV of 68.2. From the genus 6 species were collected of which *C. pannicola* and *C. pruinatum* were the most common ones. They were emerged from nearly 12% and 12% of the samples matching 2.9% and 4.4% of total fungi and possessed RIVs of 14.9 and 16.4. The rest *Chrysosporium* species were recorded with rare frequencies; *C. carmichaelii*, *C. lucknowense*, *C. xerophilum* and *C. asperatum*. Abdel-Hafez *et. al.* (2,4) isolated *C. asperatum* and *C. pannicola* from Egyptian soils. Several of these species were infrequently isolated from various types of soil from many parts of the world (12,15,23, 24,30).

Arthroderma was the third common fungus and occurred in approximately 34% of the samples constituting 15% of total fungi and had RIV of 49. Three species of *Arthroderma* were isolated, *A. lenticulare* (= *Trichophyton terrestre*), *A. cuniculi* (= *chrysosporium* anamorph of *Arthroderma cuniculi*) and *A. curreyi* (= *Chrysosporium* anamorph of *Arthroderma curreyi*). They were emerged from 18%, 12% and 8% of the samples comprising 7.5%, 4.2% and 3.3% of total fungi and possessed RIVs of 25.5, 16.2 and 11.3. The above species had been recovered previously, but with different occurrence, from Egyptian soils and mud by Abdel-Hafez *et. al.* (2-4), Youssef *et. al.* (37), Karam El-Din *et. al.* (22) and others. *Arthroderma lenticulare* (= *Trichophyton terrestre*) has a world-wide distribution in soil and found as saprophytes on man and animals (18).

Aspergillus occupied the fourth place with regard to the number of cases of isolation. It occurred in 28% of the samples contributing 11.9% of total fungi and had RIV of 39.9. Six species were identified of which *A. flavus* (12% of the samples) was the most encountered. The rest *Aspergillus* species were recorded with rare frequencies; *A. fumigatus*, *A. ustus*, *A. wentii*, *A. niger* and *A. terreus*. Most of the above species had been previously encountered, but with different incidences from various types of soil from many parts of the world (1-3,32). *A. flavus*, *A. fumigatus* and *A. nidulans* were presented in cases of onychomycosis in Colombia (36). Aspergillosis due to *A. fumigatus* and *A. flavus* has a world-wide distribution (18).

Trichophyton ranked the fifth common genus and encountered from 20% of the samples tested and 8.1% of total fungi and RIV of 23.1. From the genus 4 species were collected of which *T. mentagrophytes* was common and recovered from 12% of the samples (RIV 15.1). It is a human and animal dermatophyte (17,18,28). It emerged from 1% of sand samples from children's playgrounds in Germany (11), from 68% of soil samples in Kuwait (8), from 3% in England (10) and from 6% in Egypt (2). The remaining *Trichophyton* species were isolated with rare frequency of occurrence and these were *T. equinum*, *T. rubrum* and *T. soudanense*.

Alternaria occupied the sixth place in order to frequency of occurrence and encountered in 18% of the sample giving rise to 7.5% of total fungi and had RIV of 25.5. From the genus 3 species were collected, they were *A. alternata*, *A. raphani* and *A. tenuissima*. The above species were isolated in rare frequency of occurrence. Bagy and Abdel-Hafez (9) isolated *A. alternata* from camel and goat hairs. Also, several workers in different places of the world reported *Alternaria alternata* as one of the most common saprophyte found on many kinds of plants and other substrata including foodstuffs, seeds, grains, soil and air; is cosmopolitan.

The remaining isolated 9 genera and 12 species were recovered in rare frequencies as in presented Table1.

REFERENCES

1. Abdel-Fattah HM, Moubasher AH and Maghazy SM : Keratinophilic fungi in Egyptian soils. *Mycopathologia* 79:49-53, 1982.
2. Abdel-Hafez All, Mazen MB and Galal AA : Keratinophilic and cycloheximide resistant fungi in soils of Sinai Governorate, Egypt, *Cryptogamie, Mycol*, 10:265-273, 1989.
3. Abdel-Hafez All, Bagy MMK and Shoreit AAM : Keratinophilic fungi in mud of Ibrahimia Canal Egypt, *Cryptogamie, Mycol*, 10:275-282, 1989.
4. Abdel-Hafez All, Abdel-Hafez SII, Mohawad SM and El-Said AHM : Composition, occurrence and cellulose activities of fungi inhabiting soils along Idfu-Marsa Alam Road at Eastern Desert. Egypt, *Bull Fac Sci, Assiut Univ*, 20:21-48, 1991.
5. Abdel-Mallek AY, Bagy MMK and Moharram AMA : Keratinophilic fungi of Wadi Qena in Egypt, *Folia Microbiol*, 34:37-41, 1989.
6. Ajello L and Padhye A : Keratinophilic fungi of the Galapagos Islands, *Mykosen*, 17:239-243, 1974.
7. Ali-Shtayeh MS and Asa'd Al-Sheikh BS : Isolation of Keratinophilic fungi from the floor dust of Arab Kindergarten schools in the West Bank of Jordan. *Mycopathologia*, 103:69-73, 1988.
8. Amer M, Hussein K, El-Shazly M and Refai M : Epidermatology of dermatophytes in Kuwait. I. Incidence of dermatophytes in soil of school yards in Kuwait. *J Kuwait Med Assoc*, 127-133, 1975.
9. Bagy MMK and Abdel-Hafez All : Mycoflora of camel and goat hairs from Al-Arish, Egypt. *Mycopathologia*, 93:73-75, 1985.
10. Baxter M : Keratinophilic fungi isolated from humans and from soil in the City of Birmingham, England. *Mycopath Mycol, Appl*, 39:389-397, 1969.
11. Bojanovsky A, Muller U and Freigang K : Occurrence of dermatophytes and other Keratinophilic fungi in children's playgrounds *Mykosen*, 22:149-159, 1979.
12. Calvo A, Vidal M and Guarro J : Keratinophilic fungi from urban soils of Barcelona, Spain. *Mycopathologia*, 85:145-147, 1984.
13. Caretta G and Piontelli E : Isolation of Keratinophilic fungi from soil in Pavia, Italy. *Sabouraudia*, 3:33-37, 1975.
14. Caretta G, Frat G, Piontelli E and Todaro F : Distribution of Keratinophilic fungi in the soil of Volcano Etna (Sicily). *Rivista Parassitol*, 38:115-127, 1977.
15. Chabasse D : Taxonomic study of keratinophilic fungi isolated from soil and some mammals in France. *Mycopathologia*, 101:133-140, 1988.
16. Crozier WJ : The prevalence of geophilic dermatophytes in soils of Illawarra area of new south Wales. *Austral J Dermatol*, 21:89-95, 1980.
17. Fleming WA : Dermatophytes isolation in North Ireland 1967-1973, *Ulster Med J*, 44:44-47, 1975.
18. Frey D, Oldfield RJ and Bridger RC : A colour Atlas of pathogenic fungi, London, Wolfe Medical publ, 1979.
19. Guarro J, Punsola L and Calvo MA : Keratinophilic fungi from soil of Tarragona, Catalunya. *Mycopathologia*, 76:69-71, 1981.
20. Jana M, Kures L, Guessous N, Biava MF and Percebois G : Keratinophilic micromycetes isolated from various sites in Marrakesh and Casablanca (Morocco). *Bull Soc Franc Mycol Med*, 8:225-257, 1979.
21. Johson LF, Curl EA, Bond JH and Fribourg HA : Method for studying soil microflora-plant disease relationships Minneapolis, Burgess Publ Co, 1959.
22. Karam El-Din AA, Hassanein SM and Youssef YA : Occurrence of keratinophilic fungi and related dermatophytes in soil in Cairo, Egypt *J Veterin Med Assoc*, 50:93-104, 1990.
23. Marsella R and Mercantini R : Keratinophilic fungi isolated from soil of the Abruzzo National Park, Italy. *Mycopathologia*, 94:97-107, 1986.
24. McAleer R : Investigation of Keratinophilic fungi from soils in Western Australia: A preliminary survey. *Mycopathologia*, 72:155-166, 1980.
25. Meissner A and Qadripur SA : Occurrence of Keratinophilic fungi in soil from Gottingen. *Mykosen*, 26:61-64, 1983.
26. Moss ES and Mc Quown AL : Atlas of medical mycology, 3rd ed. Baltimore, Willians and Wilkins Co, 1969.
27. Mostafa SA : Studies of certain keratinophilic fungi in ARE soils M sc Thesis, Bot Dept, Fac Sci, Alexandria Univ, 1977.
28. Nawok A : Keratinolytic and Keratinophilic fungi isolated from the soil on which dogs, foxes minks were bred in the Szczecin region. *Zesz Nauk Wyzsz Szkoig Roln Czezec*, 32:217-222, 1970.
29. Piontelli T and Caretta G : Ecological consideration in some geomycetes isolated in Keratin substrates in mountainous localities in the Chilean Andes. *Rivista Patol Veg*, 10:261-314, 1974.
30. Randhawa HS and Sandhu RS : A survey of soil inhabiting dermatophytes and related keratinophilic fungi of India. *Sabouraudia*, 4:71-79, 1965.
31. Saxena RP and Barnam P : Keratinophilic fungi in soil. *Journal of the India Botanical Society*, 61:80-84, 1982.
32. Sundaram BM : Incidence of keratinophilic fungi in rice-field soils. *Mycopathologia* 97:43-44, 1987.
33. Sur B and Ghosh GR : Keratinophilic fungi from Orissa India. I. Isolation from soils. *Sabouraudia*, 18:275-280, 1980.
34. Todaro F : Polluting agent of beaches. Note II. Results of screening in 10 localities on the shore north of Messina (Italy). *Nuovi Ann Ig Microbiol*, 29:491-498, 1978.
35. Vanbreuseghem R : Biological technique for the isolation of dermatophytes from soil. *Ann Soc Belge Med Trop*, 32:173, 1952.
36. Velez H and Diaz F : Onychomycosis due to saprophytic fungi *Mycopathologia* 91:87-92, 1985.
37. Youssef YA, Karam El-Din AA and Mohamed A : Survey of soil for human pathogenic fungi from Ismailia Governorate. Egypt. I. Isolation of keratinophilic fungi *Mans Sci Bull*, 16:153-163, 1989.

Correspondence:
A.H.M. El-Said
Botany Department,
Faculty of Science,
Qena, EGYPT.