Journal of Environmental Sciences, 2010; Vol. 39, No. 3 : 345-356

DISTRIBUTION PATTERN OF DERMATOPHYTES AND OTHER KERATINOPHILIC FUNGI ON GOATS HAIR AND SHEEP WOOL, TAIZ CITY, YEMEN

A. M. H. Sallam and A. M. ALKolaibe

Applied Microbiology Department, Faculty of Science, Taiz University, Taiz, Yemen.

ABSTRACT

The mycoflora of 80 samples of goats hair and sheep wool (40 each) from Taiz city at Yemen were examined and the frequency of occurrence and the relative importance value for different fungal species found were calculated. Using two methods of isolation at 28°C. Thirty eight species belonging to 21 genera were isolated during this investigation. The results revealed that goats hair were highly contaminated than sheep wool. The most common genera from the two substrates were: Chrysosporium, Aspergillus and Scopulariopsis. The dermatophytes represented by Microsporum canis, M. gypseum and Trichophyton verrucosum were rarely recorded . Goats hair and sheep wool seem to represent an adequate reservoir for several pathogenic fungi.

Key words: *Keratinophilic fungi, dermatophytes, goats hair, sheep wool, Yemen.*

INTRODUCTION

The epidermal surface and the hair coat of mammals are biotropes for a variety of bacteria and fungi (Meyer *et al.,* 2001). The composition of hair microflora in different genera and species may vary according to external seasonal climatic changes. With wet times of year generally increasing microbial density was seen (Merritt and Watts, 1978; Hay and Mills, 1982 and Yeruham *et al.,* 1995).

The presence and frequency of occurrence of dermatophtes and other keratinophilic fungi mainly forming hair mycobiota of domestic animals have been investigated by many workers (Guzman- Chavez *et al.* 2000; Muhsin and Salih, 2000, Efuntoye and Fashanu, 2001 a & b, Bentubo *et al.* 2006, Borman *et al.,* 2007 and Chermette *et al.,* 2008).

Studies on dermatophytes and other keratinophilic fungi on healthy hair or wool of domestic animals are of considerable significance. This present study aimed at the analysis of distribution pattern of keratinophilic fungi on goats hair and sheep wool in animals markets at Taiz city. Special emphasis was laid upon the role played by gents and sheep as possible reservoirs for these fungi.

MATERIALS AND METHODS

Forty samples of each of healthy goats hair and sheep wool were collected from different localities in Taiz city, Yemen during the period from September 2008 to April 2009. The samples were placed in sterile polyethelene bags and transferred immediatly to Microbiological laboratory and stored in a refrigerator (3-5^{o}C) until examination. For isolation of mycobiota associated with wool or hair samples, two techniques were used.

1- Soil-plating technique: Soil-plating technique as described by Rees (1967) with some modifications was employed. Wool or hair samples (3 fragments from each sample) were placed on dry sterile clay soil (50 g) in each sterile Petri-dish (3 plates for each sample) moistened with sterilized distilled water (25-30% moisture content) and remoistened whenever necessary. The soil used was autoclaved four times (every 24h for 4 days) at 12^{o}C for 30 min to insure a good sterilization. Plates were incubated at 28^{o}C for 8-10 weeks. The fungi appeared on the hair or wool fragments were transferred to the surface of Sabouraud's dextrose agar medium (Moss and McQuown, 1969), supplemented with chloramphenicol (0.5 mg/ml) and cycloheximide (0.5 mg/ml). The plates were incubated at 28^{o}C for 2-3 weeks and the developing fungi were counted, identified (based on morphological and microscopic characters) and calculated per 360 segments for all of goats hair and sheep wool.

2- Hair-plating direct technique: Three segments from each wool or hair sample were scattered on the surface of Sabouraud's dextrose agar medium. Three plates were used for each sample. The plates were incubated at 28^{o}C for 3-4 weeks and the growing fungi were counted, identified and calculated per 360 hair fragments for all samples.

RESULTS AND DISCUSSION

A 38 species related to 21 genera from goats hair and sheep wool were identified (Table1). The highest count of fungal colonies (303 and 220 colonies /360 segments) was recorded on goats hair, while low counts (185 and 140/360 segments) were noticed on sheep wool. These results were more or less similar to those obtained by Abdel- Gawad (1998a). She isolated 27 species and one variety belonging to 15 genera from 50 hair samples from goats. Efuntoye and Fashanu (2001a) studied the mycoflora associated with 220 samples from different animals (including sheep and goats) and could isolate 28 fungal species represented 10 genera. Meyer *et al.* (2001) reported that pathogenic (keratinophilic) fungi comprise about 75% of all fungi recorded from the hair of sheep.

In the present study, the most prevalent genera on the two substrates were Aspergillus, *Chrysosporium* and *Scopulariopsis* (Table1). These genera were usually prevalent on hairs of different domestic animals including goats. However, dermatophytes represented by *Microsporum canis, M. gypseum* and *Trichophyton verrucosum* were rarely recorded in our work. This species were also isolated with different frequencies on the hair of different animals as reported by (Guzman- Chavez *et al.* 2000; Mancianti *et al.* 2002 and Copetti *et al.* 2006). In this respect, Abdel- Gawad (1998a) reported that *Candida, Chrysosporium, Trichophyton, Microsporum, Scopulariopsis* and *Chaetomium* were the most common genera on the hair of goats, ewes and bovines udder. In addition, Efuntoye and Fashanu (2001b) reported that the mycofolora recovered from examined samples included true keratinophilic species like *Chrysosporium, Microsporum, Trichophyton* species and non-keratinophilic fungi such as Aspergillus, *Penicillium, Mucor, Geotrichum* and *Alternaria* species. Also, the above genera were isolated in high frequency of occurrence as indicated by

numerous reseachers (Ali- Shtayeh *et al.* 1989; Mbuthia *et al.* 1993; El- Said and Abdel-Sater 1994; Nasser and Abdel-Sater 1997; Mitra *et al.*1998 and Gradisar *et al.* 2000).

a) Fungi recovered from goats hair

A total count of 303 and 220 colonies/ 360 segments were isolated from goats hair on Sabouraud, agar at 28^{o}C. Thirty species appertaining to 20 genera were identified from goats hair. The broadest species were recovered on soil-plating technique (20 genera and 30 species) and the lowest on direct-hair plating methods (14 genera and 26 species).

Chrysosporium appreared to be the most predominate genus. It was recorded in 73% and 53% of the samples constituting 57.1% and 52.3% of total fungi, obtained by the two isolation methods, respectively. This genus was also isolated from goats hair in high frequency. In Egypt Abdel- Hafez (1987) found that *Chrysosporium* was presented by 97.3% in goats hair samples matching around 92% of total isolates in Gaza Strip. Also, in Bagy and Abdel- Hafez (1985) observed that Chrysosporium was the most frequent (91.7%) genus on goats hair in Al-Arish. In El- Bahrin, El- Said and Abdel-Sater (1994) indicated that *Chrysosporium* was the most prevalent fungi on hair of goats and sheep, emerging in 92% and 96% of the examined samples, respectively. Furthermore Abdel-Gawad (1998a) showed that *Chrysosporium* occupied the second prevalent genus on three animals, occurred in 36% of the goat samples tested. Efuntoye and Fashanu (2001b) examined hairs of different animals (including goats and sheep) and noticed that *Chrysosporium* was the genus most commonly recovered.

Among the chrysosporium species identified in the present study, *C.tropicum* was found to be the most common. Ince, it was isolated from 48% and 35% of the studied samples. Matching 86.1% 85.2% of total *Chrysosporium* and 49.2% and 44.6% of total fungi using the two isolation methods, respectively. The remaining two identified species, *C.indicum* and *C.keratinophilum* were less encountered and isolated in rare frequency of occurance (Table 1). This result is in agreement with the results obtained on goats hair from Japan, as reported by Takatori *et al.* (1980) who isolated, *C. keratinophilum* and *C. tropicum* from healthy hairs of domestic animals in high occurrence. In Egypt, Bagy and Abdel-Hafez (1985) found that *C. keratinophilum* and *C.tropicum* represented 55% and 45% of goats hair, respectively. Abdel-Gawad (1998a) observed that *C.keratinophilum* (26%), *C.tropicum* (30%) and *C.sulfureum* (24%) appeared to be quite common on the hair of goats. On the other hand, Ali-Shtayeh *et al.* (1988 a) reported that *C.keratinophilum* and *C.tropicum* were found respectively in 7.9% and 6.7% of goats hair from West Bank of Jordan. In addition, Efuntoye and Fashanu (2001a) noticed that among the 4 Chrysosporium spp. Isolated, *C. keratinophilum* occurred more frequently (18.2%) followed by *C. tropicum* (9.5%) in Nigeria. These species were also isolated from mammals in many parts of the world as reported by Gugnani *et al.* (1975); Otcenasek *et al.* (1980) and Terragni *et al.* (1995).

The second prevalent genus was represented by *Aspergillus*. This genus contributed the broadest number of species (9 species) colonized with about 28% and 33% of the sam-

ples comprising 6.6% and 11.4% of total fungi on the two isolation techniques, respectively (Table1).

In the current study *Aspergillus* was isolated in high frequency of occurrence. This result was in accordance with the results obtained by Aho (1983). He examined 394 specimens of hair samples from domestic and laboratory animals (include goats) and noticed that *Aspergillus* species were the most common isolates in the whole material. On the other side,

Mitra et al. (1998) identifyied some dermatophytes from different animals in India (including goats and sheep) and noticed that *Aspergillus* species were the most common among fungi other than dermatophytes isolated from the ruminants. Also, most of *Aspergillus* species were previously isolated in Egypt from the hairs of camel and goats (Bagy and Abdel- Hafez 1985 and Bagy 1986) and from hair of goats and sheep in Gaza (Abdel- Hafez 1987) as well as hairs of animals in many parts of the world (Ali- Shtayeh *et al.* 1988 a.b.; Gradisar *et al.* 2000; Deshmukh 2004; Gupta and Ramnani 2006 and Blyskal 2009).

*Scopulariops*is (represented by 2 species) occupied the third place in the number of cases of isolation. The genus was isolated from 23% and 20% of the samples comprising 10.6% and 8.2% of total fungi by the two isolation methods, respectively. In this respect, Abdel- Gawad (1998a) recoded that *Scopulariopsis* was obtained in 36% of goats hair. Also, this genus was isolated in different orders of frequencies from numerous animals as reported by (Kaul and Sumbali 1999; Filipello Marchisio et al. 2000; Filipello Marchisio and Fusconi 2001 and Yoder *et al.* 2003, 2007).

Of the two species identified *S. brevicaulis* was the most dominant. It was recovered each from 20% of the samples sharing with 96.9% and 100% of total *Scopulariopsis* and 10.2% and 8.2% of total fungi. *S. candida* was recovered in rare occurrence using only the soil plating technique isolated from one sample. In Italy, Pointelli et al. (1981) isolated *S. brevicaulis* and *S. candida* from 23 and 13 out of 60 samples of horse dung, respectively. S. brevicaulis also isolated from starlings by Camin *et al.* (1998). Also, members of the genus *Scopulariopsis* were isolated from various domestic and large animals all over the world (Bagy and Abdel- Mallek 1991 and Romano *et al.* 2005). Anbu et al. (2007) reported that this genus is a prolific keratinase producer and keratinase production by *S. breviculis* has a good model fit. This will also be useful for keratinases from other *Scopulariopsis* strains as they are common saprophytic fungi with a view to industrial applications.

The remaining genera and species were isolated in rare frequency matching collectively about 24.1% and 13.2% of total fungi on soil and direct hair- plating techniques, respectively (Table1). Abdel- Gawad (1998a) noticed that several cycloheximide resistant fungi were encountered on three animals (including goats). Members of Scopulariopsis, *Chaetomium* and *Penicillium* were the most common. The recovery of non-keratinophilic fungi was consistent with the findings of Aho (1983), Bagy and Abdel- Hafez (1985), and Marsella *et al.* (1985), who reported the isolation of mem-

bers of the genera *Aspergillus, Penicillium, Cladosporium, Geotrichum* and *Alternaria*. All of these fungi were previously isolated from the hairs of some animals as reported by Bagy (1986), Bagy and Abdel- Hafez (1985), El- Said and Abdel- Sater (1994).

b) Fungi recovered from sheep wool:

The number of fungi recovered from sheep wool when using soil plating technique (185 colony/360 segments) was higher than that recorded using other method (only 140 colony). Also, the broadest spectrum of genera (18) and species (29) was observed on the first isolation method than the second one (14 genera and 22 species).

The results obtained from sheep wool were nearly similar with those obtained from goats hair of which *Chrysosporium. Aspergillus* and *Scopulariopsis* were the most prevalent genera. They were recorded in case of using the two types of isolation methods in 68%, 45% and 33% and 55%, 25% and 15% of the samples shared with 47.1%, 20.6% and 11.4% and 57.2%, 12.9% and 5.7% of total fungi, respectively. In this respect, Abdel-Gawad (1998b) examined 75 samples of healthy sheep from Assiut Governorate. She isolate total of 27 keratinophilic and other fungi belonging to 8 genera from which 22 keratinophilic species whith one variety related to 4 genera were encountered. She noticed that the fungal isolates were represented by : Chrysosporium, *Trichophyton, Microsporum, Histoplasma, Alternaria, Fusarium, Penicillium* and *Aspergillus*.

Kushwaha and Gupta (2008) reported that there were true fungi that vigorously degrade keratin and include important human and animal pathogens. Degradation of hairs, nails, feathers, horns and hooves is carried out by enzymatic action of keratinophilic fungi. The most commonly occurring fungi are *Chrysosporium, Microsporum, Geomyces, Malbranchea* and *Trichophyton*.

From the preceding genera *C. tropicum, A. flavus, A. niger,* and *S.brevicaulis* were the most common species. The remaining species of the above three genera were isolated in rare frequency of occurrence. The resting genrea and species recovered from sheep wool were identified in rare frequency of occurrence (Table 1). Ogawa *et al.* (2008) isolated several fungal species including *Penicillium* sp., *Aspergillus flavus, Paecilomyces lilacinus* and *Candida globrata* from sites other than the skin, but were considered to be environmental contaminants because of their absence in the histological section. These result are in harmony with that previously recorded by Hay and Mills (1982); Cabasse *et al.* (1989); Ali-Shatayeh *et al.* (1989); El-Said and Abdel-Sater (1994); Yeruhum *et al.* (1995); Abdel-Gawad (1997); Nasser and Abdel- Sater (1997); Kaul and Suimbali (2000); Kushwaha (2000) and Meyer *et al.*(2001).

In conclussion the present result revealed that goats hair and sheep wool were highly contaminated with some saprophytic and keratinophilic fungi. These fungi may play a vital role in the breakdown of keratinaious substrates into simpler organic compounds. Some of them, due to their ability to grow on keratin residues, may also prove to be pathogens or potential pathogens for man and animals.

Table (1): Total counts (TC, calculated per 360 segments in all samples), numbers of cases of isolation (NCI, out of 40 samples) and occurrence remarks (OR) of various genera and species recovered from goats hair and sheep wool .

Genera & Species	Goats hair				Sheep wool			
	SPT		HPT		SPT		HPT	
	TC	NCI & OR	TC	NCI & OR	TC	NCI & OR	TC	NCI & OR
Acremonium strictum W. Gams	7	6R	6	4R	3	2R	1	1R
Alternaria spp.	5	3R	3	3R	1	1R	3	2R
A. alternata (Fries.) Keissler	4	2R	1	1R	1	1R	2	1R
A. tenuissima (Kunze) Wiltshire	1	1R	2	2R	-	-	1	1R
Aspergillus spp.	20	11L	25	13L	38	18M	18	10L
A. flavus Link	7	4R	5	2R	9	4R	6	3R
A. fumigatus Fresenius	2	1R	1	1R	6	2R	1	1R
A. niger Van Tieghem	5	2R	5	2R	11	4R	2	2R
A.ochraceus Wilhelm	-	-	1	1R	-	-	7	2R
A. oryzae (Ahlburg) Cohn	2	1R	8	3R	5	2R	-	-
A. sydowii (Bain. & Sart.) Thom & Church	-	-	2	2R	3	3R	2	2R
A. terreus Thom	-	-	2	1R	1	1R	-	-
A. ustus (Bain.) Thom & Church	4	3R	-	-	3	2R	-	-
A. versicolor (Vuill.) Tiraboschi	-	-	1	1R	-	-	-	-
Candida spp.	6	4R	10	5R	3	3R	2	2R
C. albicans Robin & Berkhout	4	2R	7	3R	1	1R	-	-
Candida. sp.	2	2R	3	2R	2	2R	2	2R
Chaetomium spp.	3	3R	2	2R	1	1R	-	-
C. bostrychodes Zoph	1	1R	-	-	-	-	-	-
C.globosum Kunze	2	2R	2	2R	1	1R	-	-
Chrysosporium spp.	173	29H	115	21M	87	27H	80	22M
C. indicum (Randhawa and Sandhau) Garg	10	4R	9	3R	8	5R	2	2R
C.Keratinophilum D.Frey ex. Carmichael	9	3R	5	2R	2	2R	7	4R
C.tropicum Carmichael	149	19M	98	14L	75	18M	68	13L
Chrysosporium. sp.	5	3R	3	2R	2	2R	3	3R

Table (1): Continued

Cladosporium herbarum (Persoon) Link	5	2R	7	4R	1	1R	3	3R
Emericella nidulans (Eidam) Vuillemin	9	4R	4	3R	7	5R	3	2R
Eurotium amstelodami Mangin	4	4R	-	-	2	2R	-	-
Fusarium spp.	10	8L	5	3R	3	3R	5	4R
F.oxysporium Schlecht	6	5R	4	2R	2	2R	2	2R
F.solani (Mart.) Sacc.	4	3R	1	1R	1	1R	3	2R
Goetrichum candidum Link	2	2R	4	3R	4	4R	1	1R
Microsporum spp.	2	2R	-	-	-	-	1	1R
M. canis Bodin	-	-	-	-	-	-	1	1R
M.gypsum (Bodin) Guiart & Grigorakis	2	2R	-	-	-	-	-	-
Mucor hiemalis Wehmer	3	3R	4	4R	-	-	5	4R
Paecilomyces lilacinus (Thom) Samson	2	2R	-	-	-	-	-	-
Penicillium spp.	4	3R	7	4R	2	2R	5	3R
P.aurantiogriseum Dierckx	-	-	1	1R	-	-	-	-
P.chrysogenum Thom	3	2R	6	3R	1	1R	5	3R
P. funiculosum Thom	-	-	-	-	1	1R	-	-
Penicillium.sp.	1	1R	-	-	-	-	-	-
Rhizopus stolonifer (Ehrenb. ex.Fries) Lind.	-	-	-	-	1	1R	-	-
Scopulariopsis spp.	32	9L	18	8L	21	13L	8	6R
S.brevicaulis (Sacc.) Bain.	31	8L	18	8L	17	10L	6	4R
S.candida (Gueguen) Vuillemin	1	1R	-	-	4	3R	2	2R
Thermoascus aurantiacus Miehe	3	3R	-	-	1	1R	-	-
Thermomyces lanuginosus Tsiklinsky	2	2R	2	1R	3	2R	2	2R
Tritirachium oryzae Van Beyma	3	2R	-	-	1	1R	-	-
Trichophyton verrucosum Bodin	3	3R	-	-	1	1R	-	-
Sterile mycelia	5	3R	8	6R	5	4R	3	3R
Gross total count	303		220		185		140	
No.of genera =21	20		14		18		14	
No.of species =38	30		26		29		22	

H= High occurrence, 26 – 40 (out of 40 cases) ; M= Moderate occurrence, 15-25 cases;
L= Low occurrence,7-14 cases; R= Rare occurrence,1-6 cases.

REFERENCES

Abdel-Gawad, K. M. (1997) : Mycological and some physiological studies of keratinophilic and other moulds associated with sheep wool. Microbiol. Res., 152:181-188.

Abdel-Gawad, K. M. (1998a) : Keratinophilic and saprobic fungi on the hair of goats, Ewes and Bovines udder in Egypt. Assiut Vet. Med. J. , 8 (15-17): 255-268.

Abdel-Gawad, K. M. (1998b) : Further observations on the keratinolytic activity of some fungal isolates from sheep wool in Assiut Vet. Med. J. , 8 (15-17): 269-282.

Abdel-Hafez, A. I. I. (1987) : Survey on the mycoflora of goat and sheep hairs from Gaza a Strip. Bull. Fac. Sci. Assiut Univ., 16:15-21.

Aho, R. (1983) : Saprophytic fungi isolated from the hair of domestic and laboratory animals with suspected dermatophytosis. Mycopathologia, 83: 65-73.

Ali-Shtayeh, M. S.; Arda, H. M.; Hassouna, M. and Shaheen, S. F. (1988a) : Keratinophilic fungi on the hair of goats from the West Bank of Jordan. Mycopathologia, 104 : 103-108.

Ali-Shtayeh, M. S.; Arda, H. M.; Hassouna, M. and Shaheen, S. F. (1988b) : Keratinophilic fungi on the hair of cows, donkey, rabbits, cats and dogs from the West Bank of Jordan. Mycopathologia, 104:109-121.

Ali-Shtayeh, M. S.; Arda, H. M.; Hassouna, M. and Shaheen, S. F. (1989) : Keratinophilic fungi on sheep hairs from the West Bank of Jordan. Mycopathologia, 106:95-101.

Anbu, P.; Gopinath, S. C. B.; Hilda, A.; Iakshmipriya, T. and Annadurai, G. (2007) : Optimization of extracellular keratinase production by poultry farm isolate *Scopulariopsis brevicaulis*. Bioresource Technology, 98: 1298-1303.

Bagy, M. M. K. and Abdel- Hafez, A. I. I. (1985) : Mycoflora of camel and goat hairs from AL-Arish, Egypt. Mycopathologia, 92 : 125-128.

Bagy, M. M. K. (1986) : Fungi on the hair of large mammals in Egypt. Mycopathologia, 93:73- 75.

Bagy, M. M. K. and Abdel- Mallek, A. Y. (1991) : Saprophytic and keratinolytic fungi associated with animals hair from Riyadh, Saudi Arabia. Zentralbl Mikrobiol., 146 (4): 305-310.

Bentubo, H. D. L.; Fedullo, J. D. L.; Correa, S. H. R.; Teixeira, R. H. F. and Coutinho, S. D. A. (2006) : Isolation of *Microsporum gypseum* from the haircoat of health wild felids kept in captivity in Brazil. Brazilian J. Microbiol., 37: 148-152.

Blyskal, B. (2009) : Fungi utilizing Keratinous substrates. International Biodeterioration and Biodegradation, 30: 1-23.

Borman, A. M.; Campbell, C. K.; Fraser, M. and Johnson, E. M. (2007) : Analysis of dermatophyte species isolated in the British Isles between 1980 and 2005 and review of

worldwide dermatophyte trends over the last three decades Med. Mycol., 45:131-141.

Cabasse, D.; De Gentile, L. and Bouchara, J. P. (1989) : Pathogenicity of some *Chrysosporium* species isolated in France. Mycopathologia, 106:171-177.

Camin, A. M.; Chabasse, D. and Guiguen, C. (1998) : Keratinophilic fungi associated with starlings *(Sturnus vulgaris)* in Brittany, France. Mycopathologia, 143:9-12.

Chermette, R. ; Ferreiro, L. and Guillot, J. (2008): Dermatophytoses in Animals. Mycopathologia, 166: 385-405.

Copetti M. V.; Santurio, J. M.; Carvalheiro, A. S.; Boeck, A. A.; Argenta, J. S.; Aguiar, L. C. and Alves, S. H. (2006) : Dermatophtes isolated from dogs and cats suspected of dermatophytosis in southern Brazil. Acta Scientiae Venerinariae., 34: 119- 124.

Deshmukh, S. K. (2004) : Keratinophilic fungi on feathers of pigeon in Maharashtra, India. Mycoses, 47:213-215.

.

Efuntoye, M. O. and Fashanu, S. O. (2001a) : Fungi isolated from skins and pens of healthy animals in Nigeria. Mycopathologia, 153:21-23.

Efuntoye, M. O. and Fashanu, S. O. (2001b) : Occurrence of keratinophilic fungi and dermatophtes on domestic birds in Nigeria. Mycopathologia, 153:87-89.

El-Said, A. H. M. and Abdel-Sater, M. A. (1994) : Fungi associated with the hairs of goat and sheep from El-Bahrin. Sohag pure and Applied Science Bulletin, Fac. Sci., Sohag, Egypt, 10:91-104.

Filipello Marchisio, V.; Fusconi, A. and Querio, F. L. (2000) : *Scopulariopsis brevicaulis:* a keratinophilic or a keratinolytic fungus. Mycoses, 43:281-292.

Filipello Marchisio, V. and Fusconi, A. (2001) : Morphological evidence for keratinolytic activity of *Scopulariopsis* spp. Isolated from nail and hair. Med. Mycol., 39:287-291

Gradisar, H.; Kern, S. and Friedrich, J. (2000) : Keratinase of *Doratomyces microsporus.* Appl. Microbiol., 53:196-200.

Gugnani, H. C.; Wattal, B. L. and Sandhu, R. S. (1975) : Dermatophytes and other keratinophilic fungi recovered from small mammals in India, Mykosen, 18 : 529-538.

Gupta, R. and Ramnani, P. (2006) : Microbial keratinases and their prospective applications. Appl. Micobiol. Biotechnol., 70 : 21:33.

Guzman- Chavez, R. E.; Segundo- Zaragoza, C.; Cervantes- Olivares, R. A. and Tapia- Perez, G. (2000) : Presence of keratinophilic fungi with special reference to dermatophytes on the haircoat of dogs and cats in Mexico and Nezahualcoyotl cities. Rev. latinoam. Microbiol., 42:41- 44.

Hay, J. B. and Mills, S. C. (1982) : Chemical changes in the wool wax of adult Merino sheep during prolonged wetting and prior to

development of fleece rot. Aust. J. Agric. Res., 33: 335-346.

Kaul, S. and Sumbali, G. (1999) : Production of extracellular keratinases by keratinophilic fungal species inhabiting feathers of living poultry birds *(Gallus domesticus)*: a comparison. Mycopathologia, 146:19-24.

Kaul, S. and Sumbali, G. (2000) : Keratinophilic fungi from poultry farm soils of Jammu, India. Mycologist, 14: 89-91.

Kushwaha, R. K. S. (2000) : In Biology of Dermatophytes and other keratinophilic fungi (eds kushwaha. R.K.S. and Guarro, J.), Bilbao, Revista Iberoamericana de Micol., 86-92.

Kushwaha, R. K. S. and Gupta, P. (2008) : Relevance of keratinophilic fungi. Current Science, 94: 706- 707.

Mancianti, F.; Nardoni, S.; Cecchi, S; Corazza, M. and Taccini, F. (2002) : Dermatophytes isolated from symptomatic dogs and cats in Tuscany, Italy during a 15- year- period. Mycopathologia, 156:13-18.

Marsella, R.; Mercantini, R.; Spinelli, P. and Volterra, L. (1985) : Occurrence of keratinophilic fungi in animals of the zoological park of Rome. Mykosen, 28:507-512.

Mbuthia, P. G.; Ngatia, I. A. and Wamukoya, J. P. O. (1993) : Occurrence of bovine skin diseases in Kenya. Bulletin of Animal Health and production in Africa, 41(4): 311-316.

Merritt, G. C. and Watts, J. E. (1978) : The changes in protein concentration and bacteria of fleece and skin during the development of fleece- rot and body strike in sheep. Aust. Vet. J., 54:517-520.

Meyer, W.; Neurand, K. and Tanyolac, A. (2001) : General anti- microbial properties of the integument in fleece producing sheep and goats Small Ruminant Research, 41: 181-190.

Mitra, S. K.; Sikdar, A. and Das, P. (1998) : Dermatophytes isolated from selected ruminants in India. Mycopathologia, 142:13-16.

Moss, E. S. and McQuown, A. I. (1969) : Atlas of medical mycology 3rd.ed. The Williams and Wilkins company Baltimore U.S.A.

Muhsin, T. M. and Salih, T. H. (2000) : Exocellular enzyme activity of dermatophytes and other fungi isolated from ruminants in southern Iraq. Mycopathologia, 150 : 49-52.

Nasser, Laila, A. and Abdel- Sater (1997) : Fungi associated with sheep hairs in Saudi Arabia. Czech. Mycol., 50(2).

Ogawa, S.; Shibahara, T.; Sano, A.; kadota, K. and Kubo, M. (2008): Generalized hyperkeratosis caused by *Scopulariopsis brevicaulis* in a Japanese black calf. J. Comp. Path., 138:145-150.

Otcenasek, M.; Hubalek, Z. and Sixl, W. (1980): Survey of dermatophytes in the hair of small mammals from Austria. Folia Parasitol (Praha), 27:83- 84.

Pointelli, E.; Alicia, T. S. M. and Caretta, G. (1981): Coprophilous fungi of the horse. Mycopathologia, 74:89-105.

Ress, R. G. (1967) : Keratinophilic fungi from Queensland. II. Isolation from animal hairs and scales. Sabouraudia, 5 : 165-172.

Romano, C.; Gianni, C. and Difonzo, E. M. (2005) : Retrospective study of onychomycosis in Italy: 1985- 2000. Mycoses, 48 (1): 42-44.

Takatori, I. K.; Sakamoto, K. and Ichijo, S. (1980) : The isolation and pential occurrence of keratinophilic fungi from hairs of healthy domesticated animals. 1. Saprophytic fungi of cattle and equine hairs. Trans. Mycol. Soc. Japan, 21: 113-120.

Terragni, L.; lasagni, A. and Oriani, A. (1995) : Superficial mycoses in the Milan area. Giornale Italiano di Dermatologia evenerologia, 130:(4) 249- 252.

Yoder, J. A.; Hanson, P. E.; Zettler, L. W.; Benoit, J. B.; Ghisays, F. and Piskin, K. A. (2003) : Internal and external mycoflora of the American dog tick, *Dermacentor variabilis* (Acari: lxodidae), and ecological implications. Appl. Environ. Microbiol., 69 (8): 4994-4996.

Yoder J. A.; Benoit, J. B.; Benlinger, D. l.; Tank, J. L. and Zettler, L. W. (2007) : An endosymbiotic conidial fungus, *Scopulariopsis brevicaulis,* protects the American dog tick, *Dermacentor variabilis,* from desiccation imposed by an entomopathogenic fungus. J.Invertebr. Pathol (in press) .

Yeruham, I.; Elad, D. and Nyska, A. (1995) : Skin diseases in a Merino sheep herd related to excessively rain winter in a Mediterranean climatic zone. Zbl.Vet.Med.,42:35-40.

Received on 9 / 2 / 2010

الملخص العربى

إنتشار بعض الفطريات الجلدية والفطريات المحبة للكراتين على شعر الماعز وصـوف الأغنـام بمدينـة تعز، اليمن

على محمد حسن سلام عبده محمد غالب الكليب

قسم الميكروبيولوچيا التطبيقية - كلية العلوم - جامعة تعز - اليمن

يهدف هذا البحث حصر وتعريف الفلورا الفطرية الملوث بثمانين عينة من شعر الماعز وصوف الغنم (٤٠ عينة لكل) جمعت من أماكن مختلفة فى مدينة تعز باليمن. باستخدام طريقتين للعزل، العزل المباشر من التربة وطريقة العزل والزراعة على الوسط الغذائى سبارود أجار والتحضين عند درجة ٢٨°م، وقد أظهرت النتائج أن شعر الماعز كان أكثر تلوثاً بالفطريات من صوف الأغنام، وقد تم عزل وتعريف ٢١ جنساً و٣٨ نوعاً من العينات المختبرة، وكانت أكثر الأجناس شيوعاً هى اسبرجيلس *Aspergillus* ، وكريزوسبوريم *Chrysosporium* ، وتريكوفايتون *Trichophyton* ، وسكوبيولاريوس *Scopulariopsis* ، وقد تم أيضاً عزل بعض أجناس الديرماتوفيتس مثل *Microsporum* ، ولوحظ أن العينات المختبرة يمكن أن تكون ممرضة للإنسان.

JOESE 5

DISTRIBUTION PATTERN OF DERMATOPHYTES AND OTHER KERATINOPHILIC FUNGI ON GOATS HAIR AND SHEEP WOOL, TAIZ CITY, YEMEN

A. M. H. Sallam and A. M. ALKolaibe

Applied Microbiology Department, Faculty of Science, Taiz University, Taiz, Yemen.

Reprint

from

Journal of Environmental Sciences, 2010; Vol. 39, No. 3

http://www.mans.edu.eg/facscim/english/MJI **ISSN 1110-192X**