

THE PREVALENCE OF KERATINOPHILIC AND SAPROBIC FUNGI ON POULTRY FEATHERS IN EGYPT

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ABSTRACT

Two methods were used for the isolation of dermatophytes and other fungi from the feathers of ducks, geese and turkeys: baiting technique and the dilution plate method. 86 species and 3 varieties belonging to 35 genera were collected. Dermatophytes and related fungi were represented by 12 species: *Arthroderma curreyi*, *A. tuberculatum*, *Chrysosporium asperatum*, *C. carmichaelii*, *C. dermatitidis*, *C. georgii*, *C. indicum*, *C. keratinophilum*, *C. pannorum*, *C. pseudomerdarium*, *C. tropicum* and *Trichophyton terrestre*. Other moulds were collected such as *Acremonium* (2 species), *Alternaria* (2), *Aspergillus* (15+1 variety), *Cladosporium* (4), *Fusarium* (5+1 variety), *Paecilomyces* (3), *Penicillium* (14), *Rhizopus* (1), *Scopulariopsis* (3), *Sepedonium* (1), *Syncephalastrum* (1), *Thermoascus* (1) and others.

INTRODUCTION

Birds, especially poultry, can act as reservoir for keratinophilic, dermatophytes and other moulds, as well as may also play an important role in the transmission of these fungi to human in contact with birds. These fungi can also cause diseases to human and animals, and had been isolated from feathers and nests of birds in different parts of the world (Pugh 1965, 1966; Otcenasek *et al.* 1967; Rees 1967; Pugh and Evans 1970; Hubalek *et al.* 1973; Hubalek 1974; Moharram *et al.* 1988 and others).

In Egypt, our knowledge on the presence of these fungi on poultry is very limited. Hence the aim of the present investigation was to study intensively the composition, numbers and frequency of occurrence of keratinophilic fungi, dermatophytes and other moulds associated with feathers of ducks, geese and turkeys.

MATERIALS AND METHODS

Twenty feather samples, about 100 feathers each, from 20 healthy birds of each of ducks, geese and turkeys were collected from Kharga Oases, Assiut and Sohag Governorates (Egypt). The number of birds (samples) from each region was as follows: Kharga Oases, 10, 6, and 6; Assiut, 5, 7 and 7; and Sohag, 5, 7 and 7 birds of ducks, geese and turkeys, respectively. Each feathers sample was placed in clean plastic bags and transferred to the Mycological laboratory and stored at 3-5°C until fungal determination.

Isolation of keratinophilic fungi and other moulds

A. The feather-baiting technique was used for the estimation of keratinophilic fungi. Four feather fragments, about 3-4 cm length, of each samples placed on sterile clay soil (about 40 g soil based on dry weight in each sterile Petri-dish) moistened with sterilized distilled water (25-30% moisture content) and remoistened whenever necessary. Five dishes were used for each samples. The plates were incubated at 25°C for 14-16 weeks and the developing moulds on feather fragments were transferred onto Sabouraud's glucose agar medium (Moss and McQuown 1969) amended with penicillin, sodium salts (20 U/ml), chloramphenicol (0.04 mg/ml) and cycloheximide (0.5 mg/ml). The plates were incubated at 25°C for 3-4 weeks and the developing fungi were counted, identified and calculated per 400 feather fragments for each type of birds. The relative importance value (RIV) for each genera and species isolated were also calculated (Ali-Shtayeh and Asa'd 1988).

B. The dilution plate method was also used for the estimation of fungi. Sabouraud's glucose agar medium (Moss and McQuown 1969) supplemented with penicillin, sodium salts (20 U/ml), chloramphenicol (0.04 mg/ml) and cycloheximide (0.5 mg/ml); and Czapek's glucose agar emended with rose bengal (30 ppm) and chloramphenicol (0.04 mg/ml) were used as isolation media. Ten plates were used for each feather sample (5 plates for each type of medium). The dishes of Sabouraud's glucose and Czapek's glucose agar were incubated at 25°C, respectively, for 3-4 and 1 weeks during which the developing fungi were counted, identified (purely morphological, based on macro- and microscopic characteristics) and calculated per g feather.

The following references were used for the identification of fungal genera and species: Carmichael 1962; Morton and Smith 1963; Raper and Fennell 1965; Simmons 1967; Ames 1969; Moss and McQuown 1969; Ellis 1971; Booth 1971; Frey *et al.* 1979; Pitt 1979; Domsch *et al.* 1980; Van Oorschot 1980; Ramirez 1982 and others.

RESULTS AND DISCUSSION

Keratinophilic fungi

Forty two species and 1 species variety belonging to 18 genera of keratinophilic fungi were collected from the feathers of ducks (13 genera and 27 species + 1 variety), geese (7 and 19+1 variety) and turkeys (9 and 24+1 variety) using feather-baiting technique at 25°C (Table 1, 2).

Dermatophytes and related fungi were represented by *Arthroderma*, *Chrysosporium* and *Trichophyton*.

Chrysosporium was the most common genus on the feathers of ducks, geese and turkeys and was found in 80, 40 and 75% of the samples comprising 25.5, 3.9 and 17.6% of total fungi and had the RIV's of 105.1, 43.9 and 92.6, respectively. It was represented by 9 species on all feathers examined of which *C. keratinophilum* and *C. tropicum* were the most prevalent. They were recovered from 55 and 40%, 30 and 20%, and 50 and 35% of the samples constituting 10.4 and 8.9%, 1.5 and 1.03%, and 8.2 and 5.2% of total fungi and had the RIV's of 65.4 and 48.9, 31.5 and 21, and 58.2 and 40.2 in feathers of ducks, geese and turkeys, respectively. The remaining species were less frequent and were encountered, but with different numbers and frequencies, from one or more birds as follows: *C. asperatum* on ducks and geese; *C. carmichaelii* on turkeys; *C. dermatitidis* and *C. pseudomerdarium* on ducks; *C. pannorum* on geese; and *C. georgii* and *C. indicum* on ducks, geese and turkeys. In England, Pugh (1965, 1966) and Pugh and Evans (1970) isolated numerous keratinophilic fungi included *Chrysosporium* spp. from feathers and bird's nest. In Australia, Rees (1967b) showed that 40% of the feather samples of wild birds were common with *Chrysosporium*. In Czechoslovakia, Hubalek *et al.* (1973) isolated *C. keratinophilum*, *C. tropicum* and *C. pannorum* from bird's nests. Numerous species of *Chrysosporium* were collected from hairs of some mammals in Egypt and some Arab countries (Bagy and Abdel-Hafez 1985; Bagy 1986; Abdel-Hafez 1987; Ali-Shtayeh *et al.* 1988 a,b). Moharram *et al.* (1988) isolated *C. lobatum*, *C. keratinophilum*, *C. queenslandicum* and *C. tropicum* from human hair in Egypt.

Arthroderma was recovered from feathers of ducks and geese. It occurred in 25 and 5% of the samples contributing 1.06 and 0.34% of total fungi and possessed the RIV's of 26.6 and 5.3, respectively. Two species were collected: *A. curreyi* (RIV 5.3) on geese; and *A. tuberculatum* (RIV 26.6) on ducks. These two species were previously encountered from feathers and bird's nests (Pugh 1966; Rees 1967b,c; Hubalek *et al.* 1973). Abdel-Hafez (1987) found that 19.1% of the hair samples of goats and sheep contaminated with *A. tuberculatum*. This species was also isolated from cow hair from the West Bank of Jordan (Ali-Shtayeh *et al.* 1988 b).

Trichophyton terrestre was the only dermatophyte species found on the feathers of turkeys and was recovered from one sample (out of 20) and had the RIV of 5.2. This species reported from student's toe nails from Egypt (Abdel-Hafez and El-Sharouny 1989). Some members of *Trichophyton* as *T. mentagrophytes* and *T. verrucosum* had been frequently isolated from the hairs of some animals (Ali-Shtayeh 1988 a) and from human and animal lesions.

Aspergillus was recovered from all feather samples of ducks, geese and turkeys comprising 62.8, 81.1 and 73.2% of total fungi and had the highest RIV's of 162.8, 181.1 and 173.2, respectively. It was represented by 10 species and 1 variety of which *A. flavus*, *A. flavus* var. *columnaris*, *A. fumigatus*, *A. niger*, *A. sydowii* and *A. terreus* were the most prevalent in the feathers of all birds. They were found in 35-90%, 30-95% and 30-100% of the samples matching 5.8-35.3%, 2.3-35.5% and 4.1-40.2% of total *Aspergillus* and 3.6-22.1%, 1.9-28.8% and 3.0-29.4% of total fungi and had the RIV's of 39.3-112.1, 31.9-123.8 and 33-129.4, respectively. *A. ochraceus*, *A. tamarii*, *A. ustus*, *A. versicolor* and *A. zonatus* were less common in one or two types of feathers. Many of the above species had been encountered, but with different numbers and frequencies, from the hair of some animals (Bagy and Abdel-Hafez 1985; Bagy 1986; Abdel-Hafez 1987; Ali-Shtayeh *et al.* 1988 a,b), as well as from chicken and pigeon claws and hooves and horns of sheep and goat (Abdel-Hafez 1989; Abdel-Hafez *et al.* 1990). Many species of *Aspergillus* had been found in cases of onychomycosis (Velez and Diaz 1985).

Penicillium was recovered from 20, 60 and 50% of the feather samples of ducks, geese and turkeys comprising 2.1, 11.3, and 4.4% of total fungi and possessed the RIV's of 22.1, 71.3 and 54.4. From the genus four species were collected of which *P. chrysogenum* (RIV 22.1) on ducks; and *P. funiculosum* on geese (RIV 64.8) and turkeys (RIV 38) were the most frequent. *P. herquei* and *P. jensenii* were of rare frequency of occurrence and found only on the feather of turkeys. Pugh (1965) found that the genus *Penicillium* was widespread on the feathers removed from living birds. Several species of *Penicillium* were found to contaminate the hair of some animal as cats, camels, cows, dogs, donkeys, goats, sheep and rabbits (Bagy and Abdel-Hafez 1985; Bagy 1986; Abdel-Hafez 1987; Ali-Shtayeh *et al.* 1988 a,b). Moharram *et al.* (1988) isolated 5 species of *Penicillium* from Egyptian human hair; *P. chrysogenum*, *P. funiculosum*, *P. jensenii*, *P. martensii* and *P. waksmanii*. Abdel-Hafez and El-Sharouny (1989) isolated 10 species of *Penicillium* from student's nails in Egypt and the most prevalent species were *P. chrysogenum*, *P. citrinum* and *P. funiculosum*.

Fusarium were only encountered from the feathers of ducks and geese. It was recovered from 40 and 20% of the samples constituting 3.1 and 2.6% of total fungi and had the RIV's of 44.9 and 22.6. Three species were collected: *F. moniliforme* and *F. solani* on ducks and geese; and *F. oxysporum* on ducks. These species were

previously encountered from hair of animals by several researchers. Velez and Diaz (1985) found that *Fusarium* spp. in 40% of cases of onychomycosis examined. Many species of *Fusarium* had been frequently encountered from various keratinized substrates by several workers.

Other members of *Acremonium*, *Allescheria*, *Alternaria*, *Chaetomium*, *Cladosporium*, *Cylindrocarpon*, *Emericella*, *Mucor*, *Paecilomyces*, *Scopulariopsis*, *Trichothecium* and *Ulocladium* were frequently isolated from the feathers tested. The above fungi had been found on various substrata which included claws, hairs, hooves and horns of animals as reported by numerous researchers.

Other moulds:

Sabouraud's glucose agar. Forty eight species and 2 varieties representing 24 genera were collected from the feathers of ducks (19 genera and 40 species + 2 varieties), geese (15 and 29+2 varieties) and turkeys (12 and 20+1 variety) on Sabouraud's glucose agar at 25°C (Table 1, 3).

Dermatophytes and related fungi (*Arthroderma*, *Chrysosporium* and *Trichophyton*) were represented by 9 species. *Arthroderma tuberculatum* was found only on the feathers of turkeys (10% of the samples and 1.7% of total fungi); and *Trichophyton terrestre* (5 and 0.18%) on ducks. *Chrysosporium* was recovered from 50, 65 and 90% of the feathers samples of ducks, geese and turkeys comprising 11.4, 13.9 and 16.3% of total fungi, respectively. From *Chrysosporium* three species were frequently encountered from the three birds: *C. indicum*, *C. keratinophilum* and *C. tropicum*. They occurred in 10, 35 and 25%; 20, 50 and 30%; and 25, 75 and 20% of the feathers of ducks, geese and turkeys constituting 0.7, 6.2 and 2.8%; 1.7, 6.7 and 5%; and 5.7, 6.5 and 3.4% of total fungi, respectively. Other *Chrysosporium* species were encountered from one bird as follows: *C. asperatum* (10% of the samples and 1.18% of total fungi) and *C. georgii* (5 and 0.47%) on ducks; *C. pannorum* (5 and 0.55%) on geese; and *C. pseudomerdarium* (5 and 0.68%) on turkeys. The above dermatophyte and related fungi were found to contaminate small and large mammals (Rees 1967 a,b,c; Hoffmann *et al.* 1970; Kushida 1974; Gugnani *et al.* 1975; Garcia *et al.* 1980, 1981; Chittawar and Rao 1982; Thakur and Verma 1984; Abdel-Hafez 1987; Ali-Shtayeh *et al.* 1988 a,b and others).

Also several members of the following genera were recovered from the feathers of birds (Table III): *Acremonium* (2 species), *Allescheria* (1), *Alternaria* (1), *Aspergillus* (9+1 variety), *Candida* sp., *Chaetomium* (1), *Cladosporium* (4), *Emericella* (1+1 variety), *Fusarium* (2-1 variety), *Geotrichum* (1), *Gliocladium* (1), *Monocillium* (1), *Mucor* (1), *Paecilomyces* (2), *Penicillium* (6), *Scopulariopsis* (3), *Syncephalastrum* (1), *Thermoascus* (1), *Trichosporon* sp., *Trichothecium* (1) and *Torulopsis* sp. The above fungi were found on various substrata and several of

which contaminate keratinized substrates as reported by numerous workers.

Czapek's glucose agar. Sixty-six species and 2 varieties appertaining 26 genera were collected from the feathers of ducks (23 genera and 56 species + 2 varieties), geese (18 and 44+1 variety) and turkeys (13 and 24+1 variety) on Czapek's glucose agar at 25°C (Table I, III). The most common genera included: *Acremonium* (2 species), *Alternaria* (2), *Aspergillus* (15+1 variety), *Cladosporium* (3), *Emericella* (2+1 variety), *Fusarium* (5), *Penicillium* (13) and *Scopulariopsis* (3). The most prevalent species on the feather birds were: *Acremonium strictum*, *Alternaria alternata*, *Aspergillus flavus*, *A. flavus* var. *columnaris*, *A. fumigatus*, *A. niger*, *A. sydowii*, *A. versicolor*, *Cladosporium herbarum*, *Fusarium oxysporum*, *F. moniliforme*, *Penicillium chrysogenum*, *P. jensenii* and *Scopulariopsis brevicaulis*. These fungi are cosmopolitan and had been found on various substrata as reported by several researchers. Some of these species were found in cases of onychomycosis.

In conclusion the feathers of poultry were contaminated with dermatophytes and related fungi as well as with other moulds which call all workmen in poultry houses or pens and in contact birds must be careful to avoid infection and mycotoxin intoxications.

Table 1

Numbers of species (NS) and percentage incidence (% I) of various fungal genera recovered from the feathers of ducks, geese and turkeys.

Genera	Bating technique						Sabouraud's agar						Czapek's agar					
	Ducks		Geese		Turkeys		Ducks		Geese		Turkeys		Ducks		Geese		Turkeys	
	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I
<i>Acremonium</i> (2)	1	10	-	-	1	15	2	20	1	10	1	5	2	25	2	20	1	10
<i>Allescheria</i> (1)	1	5	-	-	-	-	1	20	-	-	1	10	-	-	-	-	-	-
<i>Alternaria</i> (2)	1	5	-	-	-	-	1	30	1	35	1	10	1	30	1	20	2	55
<i>Arthroderma</i> (2)	1	25	1	5	-	-	-	-	-	-	1	10	-	-	-	-	-	-
<i>Aspergillus</i> (15+1 variety)	7+1	100	6+1	100	8+1	100	9+1	80	8+1	95	5+1	90	15+1	100	12+1	100	8+1	100
<i>Botryotrichum</i> (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	5	1	5	1	5
<i>Candida</i> (-)	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-
<i>Chaetomium</i> (1)	1	5	-	-	-	-	-	-	1	20	1	25	-	-	-	-	1	20
<i>Chrysosporium</i> (9)	7	80	6	40	5	75	5	50	4	65	4	90	-	-	-	-	-	-
<i>Cladosporium</i> (4)	-	-	-	-	1	5	3	40	2	20	1	10	2	50	1	10	1	5
<i>Circinella</i> (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	-	-	-
<i>Cunninghamella</i> (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	-	-	-
<i>Cylindrocarpon</i> (1)	1	5	-	-	-	-	-	-	-	-	-	-	1	5	1	5	-	-
<i>Drechslera</i> (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	-	-	-
<i>Emericella</i> (3+1 variety)	-	-	1	5	2	20	1	10	1+1	20	1	10	2+1	35	1	25	1	20
<i>Fusarium</i> (5+1 variety)	3	40	2	20	-	-	2+1	25	2	15	-	-	5	30	2	15	1	10
<i>Geotrichum</i> (1)	-	-	-	-	-	-	1	5	-	-	-	-	-	-	1	5	1	10
<i>Gliocladium</i> (1)	-	-	-	-	-	-	-	-	1	5	-	-	1	5	1	25	-	-
<i>Humicola</i> (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	-	-	-
<i>Monocillium</i> (1)	-	-	-	-	-	-	-	-	1	5	-	-	1	20	-	-	-	-
<i>Mucor</i> (3)	-	-	-	-	1	5	-	-	1	5	-	-	2	15	3	30	1	20

Table 1 Contd.

Genera	Bating technique						Sabouraud's agar						Czapek's agar					
	Ducks		Geese		Turkeys		Ducks		Geese		Turkeys		Ducks		Geese		Turkeys	
	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I	NS	%I
<i>Myrothecium</i> (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	-	-	-
<i>Paecilomyces</i> (3)	-	-	-	-	1	5	2	35	1	30	-	-	1	25	1	5	1	20
<i>Penicillium</i> (14)	1	20	2	60	4	50	6	75	3	45	2	55	11	100	11	100	2	90
<i>Rhizopus</i> (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	5	1	5	-	-
<i>Scopulariopsis</i> (3)	1	5	1	5	-	-	3	70	2	100	2	100	2	80	2	85	3	70
<i>Sepedonium</i> (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	5	1	5	-	-
<i>Sterile hyphae</i>	-	-	-	-	-	-	-	20	-	-	-	25	-	-	-	15	-	10
<i>Syncephalastrum</i> (1)	-	-	-	-	-	-	1	5	+	-	-	-	-	-	-	-	-	-
<i>Thermoascus</i> (1)	-	-	-	-	-	-	1	5	-	-	-	-	-	-	-	-	-	-
<i>Trichoderma</i> (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	30	-	-	-	-
<i>Trichophyton</i> (1)	-	-	-	-	1	5	1	5	-	-	-	-	-	-	-	-	-	-
<i>Trichosporon</i> (-)	-	-	-	-	-	-	-	10	-	35	-	10	-	-	-	-	-	-
<i>Trichothecium</i> (1)	1	5	-	-	-	-	1	15	-	-	-	-	1	25	1	15	-	-
<i>Torulopsis</i> (-)	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-
<i>Ulocladium</i> (2)	1	5	-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	-
Total number of genera = 35	13		7		9		19		15		12		23		18		13	
Total number of species = 86+3 var.	27+1		19+1		24+1		40+2		29+2		20+1		56+2		44+1		24+1	

Figures between parenthesis refer to the number of species.

Table 2

Positive individuals (PI; calculated per 400 feather fragments), positive samples (PS; out of 20 samples) and the relative importance value (RIV) of fungal genera and species recovered from feathers of ducks, geese and turkeys at 28°C.

Genera and species	Ducks			Geese			Turkeys		
	PI	PS	RIV	PI	PS	RIV	PI	PS	RIV
I. Dermatophytes and related fungi:									
<i>Arthroderma</i> ^a	5	5	26.6	2	1	5.3	—	—	—
<i>A. cureyi</i> Berk.	—	—	—	2	1	5.3	—	—	—
<i>A. tuberculatum</i> Kuehn	5	5	26.6	—	—	—	—	—	—
<i>Chrysosporium</i> ^a	120	16	105.1	23	8	43.9	88	15	29.6
<i>C. asperatum</i> Carmichael	2	2	10.4	1	1	5.2	—	—	—
<i>C. carmichaelii</i> Van Oorschot	—	—	—	—	—	—	6	2	11.2
<i>C. dermatitidis</i> Gilchrist et Stokes	2	1	5.4	—	—	—	—	—	—
<i>C. georgii</i> (Vars. et Ajello) Van Oorschot	1	1	5.2	2	1	5.3	3	1	5.6
<i>C. indicum</i> (Rand. et Sand.) Garg.	22	5	29.7	4	2	10.7	12	4	22.4
<i>C. keratinophilum</i> Frey et Carmichael	49	11	65.4	9	6	31.5	41	10	58.2
<i>C. pannorum</i> (Link) Hughes	—	—	—	1	1	5.2	—	—	—
<i>C. pseudomerdarium</i> Van Oorschot	2	2	10.4	—	—	—	—	—	—
<i>C. tropicum</i> Carmichael	42	8	48.9	6	4	21.0	26	7	40.2
<i>Trichophyton terrestre</i> Durie et Frey	—	—	—	—	—	—	1	1	5.2
II. Other moulds:									
<i>Acremonium strictum</i> W. Gams	5	2	11.1	—	—	—	6	3	16.2
<i>Allescheria boydii</i> Shear	2	1	5.4	—	—	—	—	—	—
<i>Alternaria alternata</i> (Fr.) Keissler	2	1	5.4	—	—	—	—	—	—
<i>Aspergillus</i> ^a	295	20	162.8	473	20	181.1	366	20	173.2
<i>A. flavus</i> Link	49	14	80.4	168	19	123.8	117	20	123.4
<i>A. flavus</i> var. <i>columnaris</i> Raper et Fennell	20	7	39.3	88	17	100.1	15	6	33.0

Table 2 Contd.

Genera and species	Ducks			Geese			Turkeys		
	PI	PS	RIV	PI	PS	RIV	PI	PS	RIV
<i>A. fumigatus</i> Fresenius	30	9	51.4	40	10	56.9	35	12	67.0
<i>A. niger</i> Van Tieghem	104	18	112.1	112	19	114.2	147	20	129.4
<i>A. ochraceus</i> Wilhelm	—	—	—	—	—	—	3	2	10.6
<i>A. sydowii</i> (Bain. et Sart.) Thom et Church	57	10	62.1	39	9	51.7	15	7	38.0
<i>A. tamaris</i> Kita	—	—	—	15	6	32.6	1	1	5.2
<i>A. terreus</i> Thom	17	8	43.6	11	6	31.9	21	7	39.2
<i>A. ustus</i> (Bain.) Thom et Church	1	1	5.2	—	—	—	—	—	—
<i>A. versicolor</i> (Vuill.) Tirab.	—	—	—	—	—	—	12	4	22.4
<i>A. zonatus</i> Kwon et Fennell	17	5	28.6	—	—	—	—	—	—
<i>Chaetomium globosum</i> Kunze	3	1	5.6	—	—	—	—	—	—
<i>Cladosporium herbarum</i> (Pers.) Link	—	—	—	—	—	—	1	1	5.2
<i>Cylindrocarpon lichenicola</i> (G. Mass.) Hawksw.	1	1	5.2	—	—	—	—	—	—
<i>Emericella</i> _a	—	—	—	2	1	5.3	11	4	22.2
<i>E. nidulans</i> (Eidam) Vuill.	—	—	—	2	1	5.3	9	3	16.8
<i>E. quadrilineata</i> (Thom et Raper) Benjamin	—	—	—	—	—	—	2	1	5.4
<i>Fusarium</i> _a	23	8	44.9	15	4	22.6	—	—	—
<i>F. moniliforme</i> Sheldon	12	4	22.6	9	2	11.5	—	—	—
<i>F. oxysporum</i> Schlecht	6	3	16.3	—	—	—	—	—	—
<i>F. solani</i> (Mart.) Sacc.	5	2	11.1	6	2	11.0	—	—	—
<i>Mucor hiemalis</i> Wehmer	—	—	—	—	—	—	4	1	5.8
<i>Paecilomyces lilacinus</i> (Thom) Samson	—	—	—	—	—	—	1	1	5.2
<i>Penicillium</i> _a	10	4	22.1	66	12	71.3	22	10	54.4
<i>P. chrysogenum</i> Thom	10	4	22.1	9	2	11.5	5	2	11.0
<i>P. funiculosum</i> Thom	—	—	—	57	11	64.8	15	7	38.0
<i>P. herquei</i> Bainier et Sartory	—	—	—	—	—	—	1	1	5.2

The prevalence of keratinophilic and saprobic fungi

Table 2 Contd.

Genera and species	Ducks			Geese			Turkeys		
	PI	PS	RIV	PI	PS	RIV	PI	PS	RIV
<i>P. jensenii</i> Zaleski	—	—	—	—	—	—	1	1	5.2
<i>Scopulariopsis brevicaulis</i> (Sacc.) Bainier	2	1	5.4	2	1	5.3	—	—	—
<i>Trichothecium roseum</i> (Pers.) Link	1	1	5.2	—	—	—	—	—	—
<i>Ulocladium botrytis</i> Preuss	1	1	5.2	—	—	—	—	—	—
Gross total count	470			583			500		
Number of genera	13			7			9		
Number of species	27+1 variety			19+1 variety			24+1 variety		
Total number of genera = 18									
Total number of species = 42+1 variety									

* total counts

Occurrence remarks: High occurrence (between 11-20 cases; out of 20); Moderate occurrence (between 6-10 cases); Low occurrence (between 3-5 cases); Rare occurrence (1 or 2 cases).

Table 3

Table counts (TC; calculated per g feathers in every sample) and number of cases of isolation (NCI; out of 20 samples) of fungal genera and species recovered from feathers of ducks, geese and turkeys on Sabouraud's glucose and Czapek's glucose agar at 25°C.

Genera and species	Sabouraud's agar						Czapek's agar					
	Ducks		Geese		Turkeys		Ducks		Geese		Turkeys	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI
I. Dermatophytes and related fungi:												
<i>Arthroderma tuberculatum</i> Kuehn	—	—	—	—	300	2	—	—	—	—	—	—
<i>Chrysosporium</i> ^a	1902	10	3000	13	2900	18	—	—	—	—	—	—
<i>C. asperatum</i> Carmichael	200	2	—	—	—	—	—	—	—	—	—	—
<i>C. georgii</i> (Vars. et Ajello) Van Oorschot	80	1	—	—	—	—	—	—	—	—	—	—
<i>C. indicum</i> (Rand. et Sand.) Garg.	120	2	360	4	1020	5	—	—	—	—	—	—
<i>C. keratinophilum</i> Frey et Carmichael	1040	7	1440	10	1160	15	—	—	—	—	—	—
<i>C. pannorum</i> (Link) Hughes	—	—	120	1	—	—	—	—	—	—	—	—
<i>C. pseudomerdarium</i> Van Oorschot	—	—	—	—	120	1	—	—	—	—	—	—
<i>C. tropicum</i> Carmichael	480	5	1080	6	600	4	—	—	—	—	—	—
<i>Trichophyton terrestre</i> Durie et Frey	40	1	—	—	—	—	—	—	—	—	—	—
II. Other moulds:												
<i>Acremonium</i> ^a	720	4	120	2	60	1	480	5	720	4	360	2
<i>A. strictum</i> W. Gams	480	3	120	2	60	1	320	4	420	3	360	2
<i>A. kiliens</i> Gruetz	240	2	—	—	—	—	160	2	300	2	—	—

Table 3 Contd.

Genera and species	Sabouraud's agar						Czapek's agar					
	Ducks		Geese		Turkeys		Ducks		Geese		Turkeys	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI
<i>Allescheria boydii</i> Shear	280	4	—	—	240	2	—	—	—	—	—	—
<i>Alternaria</i> ^a	520	6	1240	7	240	2	720	6	420	4	2760	11
<i>A. alternata</i> (Fr.) Keissler	520	6	1240	7	240	2	720	6	420	4	1800	10
<i>A. raphani</i> Groves et Skolko	—	—	—	—	—	—	—	—	—	—	960	4
<i>Aspergillus</i> ^a	3760	16	5580	19	6220	18	46320	20	63300	20	47400	20
<i>A. candidus</i> Link	—	—	—	—	—	—	80	2	—	—	—	—
<i>A. carneus</i> (V. Tiegh.) Blochwitz	—	—	—	—	—	—	80	1	2460	2	—	—
<i>A. flavipes</i> (Bain. et Sart.) Thom et Church	—	—	—	—	—	—	360	4	1620	2	—	—
<i>A. flavus</i> Link	240	3	1560	10	960	5	8880	19	9180	20	8400	16
<i>A. flavus</i> var. <i>columnaris</i> Link	40	1	300	3	900	4	2080	12	5040	13	4440	18
<i>A. fumigatus</i> Fresenius	800	4	1140	5	2880	15	3720	13	12900	16	10260	20
<i>A. niger</i> Van Tieghem	120	2	1320	6	960	4	18000	20	13740	20	12060	20
<i>A. ochraceus</i> Wilhelm	320	3	120	1	—	—	4400	17	1800	8	—	—
<i>A. parasiticus</i> Speare	—	—	—	—	—	—	40	1	—	—	—	—
<i>A. sydowii</i> (Bain. et Sart.) Thom et Church	640	6	120	2	360	3	3600	15	8100	16	7560	8
<i>A. tamarii</i> Kita	360	2	—	—	—	—	480	5	660	5	360	2
<i>A. terreus</i> Thom	560	3	780	2	—	—	3520	15	6240	14	1200	6
<i>A. ustus</i> (Bain.) Thom et Church	—	—	—	—	—	—	480	5	120	1	720	2
<i>A. versicolor</i> (Vuill.) Tirab.	280	4	60	1	160	2	1800	12	540	5	2400	10
<i>A. wentii</i> Wehmer	—	—	—	—	—	—	760	9	900	2	—	—
<i>A. zonatus</i> Kwon et Fennell	400	3	180	2	—	—	40	1	—	—	—	—
<i>Botryotrichum atrogriseum</i> Van Beyma	—	—	—	—	—	—	200	1	120	1	60	1
<i>Candida</i> sp.	200	2	—	—	—	—	—	—	—	—	—	—
<i>Chaetomium globosum</i> Kunze ex Fr.	—	—	480	4	1080	5	—	—	—	—	600	4

Table 3 Contd.

Genera and species	Sabouraud's agar						Czapek's agar					
	Ducks		Geese		Turkeys		Ducks		Geese		Turkeys	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI
<i>Cladosporium</i> ^a	760	8	420	4	360	2	2160	10	300	2	60	1
<i>C. herbarum</i> (Pers.) Link	480	6	300	3	—	—	1960	9	300	2	—	—
<i>C. oxysporum</i> Perk. et M.A. Curt.	120	2	—	—	360	2	—	—	—	—	60	1
<i>C. resinae</i> Parbery	—	—	120	1	—	—	—	—	—	—	—	—
<i>C. tenuissimum</i> Cooke	160	3	—	—	—	—	200	2	—	—	—	—
<i>Circinella simplex</i> Van Tieghem	—	—	—	—	—	—	40	1	—	—	—	—
<i>Cunninghamella elegans</i> Lndner	—	—	—	—	—	—	40	1	—	—	—	—
<i>Cylindrocarpon lichenicola</i> (G. Mass.) Hawksw.	—	—	—	—	—	—	40	1	120	1	—	—
<i>Drechslera halodes</i> (Drech) Subram et Jain	—	—	—	—	—	—	80	1	—	—	—	—
<i>Emericella</i> ^a	120	2	600	4	240	1	840	7	1080	5	780	4
<i>E. nidulans</i> (Eidam) Vuill.	120	2	360	4	240	1	720	6	1080	5	780	4
<i>E. nidulans</i> var. <i>latus</i> Thom et Raper	—	—	240	2	—	—	40	1	—	—	—	—
<i>E. rugulosa</i> (Thom et Raper) Benjamin	—	—	—	—	—	—	80	1	—	—	—	—
<i>Fusarium</i> ^a	520	5	240	3	—	—	360	6	300	3	240	2
<i>F. equiseti</i> (Corda) Sacc.	—	—	—	—	—	—	80	1	—	—	—	—
<i>F. moniliforme</i> Sheldon	280	3	120	2	—	—	40	1	180	2	—	—
<i>F. moniliforme</i> var. <i>anthophilum</i> (A. Braun) Wollenw.	120	1	—	—	—	—	—	—	—	—	—	—
<i>F. oxysporum</i> Schlecht.	120	2	120	2	—	—	120	2	—	—	240	2
<i>F. sambucinum</i> Fuckel	—	—	—	—	—	—	40	1	—	—	—	—
<i>F. solani</i> (Mart.) Sacc.	—	—	—	—	—	—	80	2	120	1	—	—
<i>Geotrichum candidum</i> Link	40	1	—	—	—	—	—	—	300	1	240	2
<i>Gliocladium catenulatum</i> Gilman et Abbott	—	—	120	1	—	—	40	1	660	5	—	—
<i>Humicola grisea</i> Traaen	—	—	—	—	—	—	40	1	—	—	—	—
<i>Monocillium indicum</i> Saksena	—	—	120	1	—	—	160	4	—	—	—	—

The prevalence of keratinophilic and saprobic fungi

Table 3 Contd.

Genera and species	Sabouraud's agar						Czapek's agar					
	Ducks		Geese		Turkeys		Ducks		Geese		Turkeys	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI
<i>Mucor</i> ^a	—	—	180	1	—	—	320	3	2460	6	840	4
<i>M. circinelloides</i> Van Tieghem	—	—	—	—	—	—	—	—	1560	5	—	—
<i>M. hiemalis</i> Wehmer	—	—	—	—	—	—	280	2	720	4	—	—
<i>M. racemosus</i> Fresenius	—	—	180	1	—	—	40	1	180	1	840	4
<i>Myrothecium verrucaria</i> Ditmar ex Fr.	—	—	—	—	—	—	40	1	—	—	—	—
<i>Paecilomyces</i> ^a	560	7	1260	6	—	—	400	5	40	1	480	4
<i>P. lilacinus</i> (Thom) Samson	320	4	1260	6	—	—	—	—	—	—	—	—
<i>P. variotii</i> Bainier	240	3	—	—	—	—	400	5	—	—	480	4
<i>P. roseolus</i> G. Smith	—	—	—	—	—	—	—	—	40	1	—	—
<i>Penicillium</i> ^a	2920	15	1740	9	1800	11	18940	20	24260	20	3180	18
<i>P. chrysogenum</i> Thom	1800	13	1440	8	1680	11	7500	20	12120	20	2460	18
<i>P. citrinum</i> Thom	—	—	—	—	—	—	560	5	900	2	—	—
<i>P. corylophilum</i> Dierckx	80	1	—	—	—	—	600	4	—	—	—	—
<i>P. cyclopium</i> Westling	120	2	—	—	—	—	600	4	—	—	—	—
<i>P. frequentans</i> Westling	—	—	—	—	—	—	1800	7	2120	8	—	—
<i>P. funiculosum</i> Thom	720	6	120	2	—	—	1080	5	420	2	—	—
<i>P. jensenii</i> Zaleski	120	3	180	2	120	2	3000	10	2160	7	720	6
<i>P. lanosum</i> Westling	—	—	—	—	—	—	—	—	120	2	—	—
<i>P. martensii</i> Biourge	—	—	—	—	—	—	40	1	60	1	—	—
<i>P. nigricans</i> (Bain.) Thom	80	1	—	—	—	—	3240	12	4500	9	—	—
<i>P. oxalicum</i> Currie et Thom	—	—	—	—	—	—	480	2	1500	3	—	—
<i>P. purpurogenum</i> Stoll	—	—	—	—	—	—	—	—	300	2	—	—
<i>P. rugulosum</i> Thom	—	—	—	—	—	—	40	1	60	1	—	—
<i>Rhizopus stolonifer</i> Ehrenb. ex Lindt	—	—	—	—	—	—	120	1	60	1	—	—

Table 3 Contd.

Genera and species	Sabouraud's agar						Czapek's agar					
	Ducks		Geese		Turkeys		Ducks		Geese		Turkeys	
	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI	TC	NCI
<i>Scopulariopsis</i> ^a	3520	14	4620	20	3660	20	5320	16	4080	17	4020	14
<i>S. brevicaulis</i> (Sacc.) Bainier	2680	11	3660	20	3060	19	4360	16	3960	10	3000	12
<i>S. brumptii</i> Salvanet-Duval	40	1	—	—	600	9	—	—	—	—	540	5
<i>S. candida</i> (Gueguen) Vuillemin	800	4	960	3	—	—	960	7	120	12	480	2
<i>Sepedonium chrysospermum</i> (Bull.) Link	—	—	—	—	—	—	40	1	60	1	—	—
Sterile hyphae	240	4	—	—	360	5	—	—	480	3	240	2
<i>Syncephalastrum racemosum</i> (Cohn) Schroeter	40	1	—	—	—	—	—	—	—	—	—	—
<i>Thermoascus aurantiacus</i> Miehe	160	1	—	—	—	—	—	—	—	—	—	—
<i>Trichoderma viride</i> Pers.	—	—	—	—	—	—	720	6	—	—	—	—
<i>Trichosporon</i> sp.	200	2	1920	7	300	2	—	—	—	—	—	—
<i>Trichothecium roseum</i> (Pers.) Link	320	3	—	—	—	—	400	5	420	3	—	—
<i>Torulopsis</i> sp.	40	1	—	—	—	—	—	—	—	—	—	—
<i>Ulocladium tuberculatum</i> E. Simmons	—	—	—	—	—	—	—	—	120	1	—	—
Gross total count	16880		21640		17760		77820		99300		61260	
Number of genera	19		15		12		23		18		13	
Number of species	40+2 var.		29+2 var.		20+1 var.		56+2 var.		44+1 var.		24+1 var.	
Total number of genera = 35												
Total number of species = 80 + 3 varieties												

^a total count

Occurrence remarks: High occurrence (between 11-20 cases; out of 20); Moderate occurrence (between 6-10 cases); Low occurrence (3-5 cases); Rare occurrence (1 or 2 cases).

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انتشار الفطريات الكيراتينوفيليه والرمية على ريش الطيور الداجنة في مصر

عباس ابراهيم اسماعيل عبدالحافظ

يهدف هذا البحث إلى التعرف على الفطريات الكيراتينوفيليه والرمية العالقة بريش الطيور الداجنة (البط ، الأوز والرومي) وذلك باستخدام طريقتين للعزل هما طريقة الأثراء بالريش وطريقة التخفيف . وقد تم عزل وتعريف ٨٦ نوعاً فطرياً بالإضافة إلى ثلاثة أصناف تنتمي إلى ٣٥ جنساً من ريش الطيور الداجنة . ولقد مثلت فطريات الديرماتوفيت والقريبة منها بأثنى عشر نوعاً فطرياً هي : تريكوفيتون تيراستري ، أرثوديرما كوراي ، أرثوديرما تيوبركيولاتم ، كريزوسبوريم أسبراتم ، كريزوسبوريم كارميشيلياي ، كريزوسبوريم ديرماتيتيديز ، كريزوسبوريم جورجياي ، كريزوسبوريم انديكم ، كريزوسبوريم كيراتينوفيلم ، كريزوسبوريم بانورام ، كريزوسبوريم بسيدومبرداريم ، كريزوسبوريم تروبيكم . كما تم عزل العديد من الفطريات الرمية الأخرى مثل : اكريمونيم (نوعين) الترناريا (نوعين) ، اسبرجيلس (١٥ نوعاً + صنف واحد) ، كلادوسبوريم (٤ أنواع) ، فيوزاريوم (٥ أنواع + صنف واحد) ، باسيلوميس (٣ أنواع) ، بنسيليوم (١٤ نوعاً) ، ريزوبس (نوع واحد) ، سكوبيولاريوبس (٣ أنواع) ، سيبيدونيم (نوع واحد) وثيرمو أسكس (نوع واحد) . والعديد من هذه الفطريات المعزولة قد تسبب أمراضاً للعاملين في مجال تربية الطيور الداجنة مما يستوجب اتخاذ الاحتياطات اللازمة للوقاية منها .