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OCCURRENCE AND SIGNIFICANCE OF MOULDS
AND YEASTS ISOLATED FROM WILD RATS IN
EGYPT.

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M.H.R. KOTB; M.K. REFAL, and F. EL-FAR.

* Pyramid Research Institute, Giza, ** Faculty of
Veterinary Medicine, Cairo University, and
*** Animal Health Research Institute, Dokki.

SUMMARY: Many species of moulds and yeasts could be isolated from hair and lungs of wild rats. Moulds isolated were belonging to the genera of *Aspergillus* (40.20%), *Penicillium* (21.90%), *Mucor* (13.70%), *Scopulariopsis* (11.60%), *Cladosporium* (0.30%), *Cephalosporium* (2.10%), *Alternaria* (1.70%), *Rhizopus* (1.40%), *Verticillium* (1.40%), and *Chrysosporium* (0.30%). Yeasts isolated were *Candida* (68.40%), *Rhodotorula* (21.10%) and *Geotrichum* (10.50%). The most predominant species of *Candida* was *Candida albicans* (53.80%) which showed a higher incidence in lungs than on hair samples.

INTRODUCTION

Numerous dermatophytes and other keratinolytic fungi have been isolated from hair of wild animals, including mice and rats, by many workers in several countries (Badillet, 1977; Mantovani, 1979 and Aho, 1980). The dermatophytes recorded either in diseased or apparently healthy rodents were belonging mainly to the genera *Trichophyton* and *Microsporum* as well as the perfect forms of these dermatophytes mainly *Arthroderma* and *Nannizzia* (Gentles, 1970 and Baker *et al.*, 1979).

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Many species of moulds have been isolated by several workers from rats and mice such as species of *Aspergillus*, *Mucor*, *Chrysosporium*, *Penicillium*, *Scopulariopsis*, *Verticillium*, *Alternaria*, *Chaetomium*, *Cephalosporium*, *Helminthosporium*, *Cladosporium* and others. Species of *Aspergillus fumigatus*, *A. flavus*, *A. ochraceus*, *A. nidulans*, *A. niger*, *A. clavus* and *A. amstelodami* have been shown to be pathogenic for experimental animals (Ford and Friedman, 1967 and Fore and Larsh, 1968). In addition, Rees (1960) isolated *Aspergillus* species from rodents. Grimmer and Rieth (1965) isolated *A. candidus* and *A. niger* from mice and rats. Experimental aspergillosis could be induced by Smith (1972) and Rippon (1982); while natural infection with *Mucor* species was recorded to be widespread among wild animals (Rippon, 1982) and in mice and rats (Elder and Baker, 1956 and Ainsworth and Austwick, 1973). *Rhizopus* was isolated by Rees (1960). *Chrysosporium* species have been isolated from hair and skin of rodents by Rees (1960), Knudtson and Robertstad (1970), Orr and Kuehn (1972), Gugnami and Shrivastav (1972) and Josephine *et al.* (1981). Other moulds were recovered from rats and mice by Rees (1960), Grimmer and Rieth (1960), Gugnami *et al.* (1971), Wright (1973) and Lloyd and Noble (1982). Yeasts were also investigated in rats and mice (Gugnami *et al.*, 1971 and Balsari *et al.*, 1981).

In the present work, wild rats were examined mycologically both for the fungal flora of skin as for fungi in their lungs.

MATERIAL AND METHODS

One hundred and fifty four wild rats were trapped from houses, poultry farms, pigeon nests, fields, gardens and from the sides of water runs from different localities of Egypt. The animals were either caught alive or dead; the alive rats were anaesthetized by either ether or chloroform. Each animal was brushed all over the body with sterilized hair brush and pressed over Sabouraud's dextrose agar plates with chloramphenicol

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(0.05 mg / ml) and cycloheximide (0.5 mg / ml) incubated at 28°C and observed for 2-3 weeks. Rats were opened with sterilized scissors, lungs were removed and directly cultured onto brain-heart infusion agar with chloramphenicol (0.05 mg/ml). All plates were incubated at 37°C for 1-4 weeks. Identification of moulds was based on the macro and micromorphology of the isolates in a direct culture mount and in microculture. Yeasts were identified by using direct microscopic slide mount technique, culturing on rice agar media and assimilation and fermentation of sugars.

RESULTS

Surprisingly, none of the dermatophytes could be recovered from the hair or skin of any of the examined rats. On the other hand, moulds and yeasts could be isolated from the hair and skin of 123 out of 154 examined wild rats (79.80%) while those isolated from lungs were from 110 rats in an incidence of 71.40%. On the other hand, 84 rats (54,50%) yielded isolates from their hair and lung samples.

As shown in Table 1, several moulds could be recognized in solely or as concurrently mixed infections and revealed the isolation of 10 types namely; *Aspergillus* (40.20%), *Penicillium* (91.90%), *Mucor* (13,70%), *Scopulariopsis* (11.60%), *Cladosporium* (5.30%), *Cephalosporium* (2,10%), *Alternaria* (1.70%), *Rhizopus* and *Verticillium* (1.4% each) and *Chrysosporium* species (0.30%). Among *Aspergilli*, the most dominant species isolated were *A. flavus* (56.10%) followed by *A. niger* (21.90%), *A. fumigatus* (10.50%). On the other hand, species of *A. ochraceus* and *A. terreus* represented the less frequent types (6.10% and 5.20% respectively). *Chrysosporium candidum* isolated only once. The isolation of such moulds from hair or lungs was in order of their frequency. The incidence of *A. niger* was increased in the lung samples in comparison to that of hair ones, on the reverse, the most common seat of the isolation of *A. fumigatus* was the hairs as the lungs were rarely infected.

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Table (1): Moulds isolated from hair and the lungs of wild rats.

Species	Hair	Lung	Both	Total	%
1. <i>Aspergillus</i> spp.				114	40.2
<u><i>A. flavus</i></u>	33	24	7	64	22.6
<u><i>A. fumigatus</i></u>	10	2	0	12	4.2
<u><i>A. ochraceus</i></u>	4	3	0	7	2.4
<u><i>A. niger</i></u>	11	13	1	25	8.8
<u><i>A. terreus</i></u>	4	2	0	6	2.1
2. <i>Penicillium</i> spp.	29	23	10	62	21.9
3. <i>Scopulariopsis</i> spp.	16	14	3	33	11.6
4. <i>Cephalosporium</i> spp.	5	1	0	6	2.1
5. <i>Verticillium</i> spp.	4	0	0	4	1.4
6. <i>Mucor</i> spp.	19	15	5	39	13.7
7. <i>Rhizopus</i> spp.	3	1	0	4	1.4
8. <i>Alternaria</i> spp.	5	0	0	5	1.7
9. <i>Cladosporium</i> spp.	9	5	1	15	5.3
10. <i>Chrysosporium</i> spp.	1	0	0	1	0.3
Total	153	103	27	283	

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(hair and lungs).

Species	Positive cases from		Total	%
	Hairs	Lungs		
1. <i>Candida</i> spp.			13	68.4
<u><i>C. albicans</i></u>	2	5	7	
<u><i>C. guilliermondii</i></u>	1	4	5	
<u><i>C. reukaufii</i></u>	1	0	1	
2. <i>Rhodotorula</i> spp.			4	21.1
<u><i>Rh. pilimane</i></u>	0	1	1	
<u><i>Rh. rubra</i></u>	0	3	3	
3. <i>Geotrichum</i> spp.	2	0	2	10.5
Total	6	13	19	

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As shown in **Table 2**, yeast isolates from rats were differentiated into the following three genera: *Candida*; which was the most predominant species (68.40%), *Rhodotorula* (21,10%) and the less frequent species was *Geotrichum* in an incidence of 10.50%. The most predominant species of *Candida* was *C. albicans* (53.80%), also its recovery from lung samples was considerably higher than hair samples. *C. guilliermondii* (43.30%) was also isolated 5 times from lungs in comparison to one isolate only obtained from hair, while *C. reukaufii* (7.60) was isolated only once from hair samples. It is interesting to note that the lung samples gave high isolates of *Rhodotorula* species. Also, it was noted that strains of *Geotrichum* were absent in the lung samples while they were present in the hair ones.

Generally, the recovery rates of moulds, either from hair or lung samples were more than those of yeasts.

DISCUSSION

It is of interest that several mould species were recovered from skin coats and lungs or from both in wild rats collected from different localities. These findings gave credence to the view that rats may act as a host for fungi which under certain conditions might play a role in spreading such fungi in the environment of man and animals.

Aspergillosis is frequently associated with birds and sporadic cases occur among mammals. However, various *Aspergillus* species were isolated and shown to be pathogenic for experimental animals by several authors (Grimmer and Rieth, 1965; Ford and Friedman, 1967; Pore and Larsh, 1968; Smith, 1972 and Rippon, 1982). *Aspergillus* species were isolated from rodents (including rats and mice) by Rees (1960) as well as Grimmer and Rieth (1965) are in agreement with those species recorded in the present work; namely *A. flavus*, *A. fumigatus*, *A. niger*, *A. ochraceus* and *A. terreus*. Rats carrying a huge number of spores of such

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potentially pathogenic *Aspergillus* species may constitute a hazard for both man and animals through contamination of foods and feeds. Such fungi are known to cause lung infections particularly in birds and their toxic metabolites are known to cause mycotoxicosis in man and animals.

Species of *Penicillium* isolated from rats during this work and recovered by Rees (1960) and Grimmer and Rieth (1965) are considered as common contaminants of foods and sources of various toxic metabolites. The most important mycotoxic conditions in animals caused by *Penicillium* toxins include a disease in cattle related to consumption of patulin, haemorrhagic syndrome in chicks, ducklings and turkey poults caused by rubratoxin (Refai, 1969).

Mucor and *Rhizopus* species isolated in this work were in coincidence with those isolated from rats and mice either experimentally (Elder and Baker, 1956 and Josefiah and Smith - Foushee, 1958) or naturally (Ainsworth and Austwick, 1973). *Rhizopus* species may cause human infection (Al-Doory, 1980 and Rippen, 1982). *Scopulariopsis* species isolated from rats recorded by Grimmer and Rieth (1965) is of significance as this fungus is known to cause nail infection in man (Seeliger and Heymer, 1981).

Species of *Cephalosporium* recovered from rats during this work and recorded by Grimmer and Grieth (1965) have been reported as causative agents of onychomycosis and mycotic keratitis; also isolated from a case of meningitis (Laron, 1976).

Cladosporium species have been recorded to be one of the common causes of chromoblastomycosis and on rare occasions spread to the central nervous system (CNS), lungs or muscular tissue (Laron, 1976). It is worthy to mention that yeasts isolated belonging to species of the genera *Candida*, *Rhodotorula* and *Geotrichum* were recovered in 12.90% of the total examined samples, however, postmortem examinations revealed no

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noticeable alterations in the internal organs, thus such rats may play a role as one of the vehicles of these yeasts. *Candida albicans* and other *Candida* species have been isolated from men and animals in Egypt (Refai, 1969; Refai and Amer, 1974 and El - Batrawi, 1976) and also recorded in rats and mice by Gugnani *et al* . (1971) and Balsari *et al* . (1981) Also *Rhodotorula* species were recovered from a blood culture (Rippon, 1982) and from food sources, cheese and milk products, air soil and water (Volz and Jerger, 1974). *Rh rubra* was recovered from several fatal infections of the lungs, kidneys and central nervous system (Pore and Chen, 1976). It was recently recorded by Faisal *et al*. (1986) as the cause of red eye syndrome in fish in Egypt.

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