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Fungal flora of the hair coat of stray cats in Iran

Die Pilzflora im Haarkleid von Straßenkatzen in Iran

A. R. Khosravi

Key words. *Microsporum canis*, fungal flora, cat, hair coat, carrier, Iran.
Schlüsselwörter. *Microsporum canis*, Pilzflora, Katze, Haarkleid, Träger, Iran.

Summary. The fungal flora of the hair coat of 100 stray cats in different districts of the city of Isfahan, Iran, were examined. Saprophytic fungi were isolated from all cats. *Penicillium*, *Aspergillus*, *Alternaria*, *Mucor* and *Cladosporium* spp. were the most frequently isolated saprophytes. *Microsporum canis* was isolated from all kittens with clinical signs of dermatophytosis. In other cases, *M. canis* was isolated only from 22 of the 96 cats. No significant differences in sex, hair length, and fungal flora of the hair coat were found between the *M. canis*-infected and *M. canis*-free cats.

Zusammenfassung. Insgesamt 100 Straßenkatzen aus verschiedene Stadtteilen von Isfahan, Iran, wurden auf Pilzbefall untersucht. Saprophytische Pilze wurden von den Haaren aller Katzen isoliert. *Penicillium*, *Aspergillus*, *Alternaria*, *Mucor* und *Cladosporium* spp. waren die am häufigsten gefundenen Saprophyten. Von allen Jungkatzen mit klinischen Dermatophytose-Symptomen wurde *Microsporum canis* isoliert, in anderen Fällen jedoch nur bei 22 von 96 Katzen. Es gab keine signifikanten Unterschiede in Bezug auf Geschlecht, Haarlänge und Pilzflora zwischen *M. canis*-infizierten und -nichtinfizierten Katzen.

Introduction

Microsporum canis is commonly isolated from the hair coat of cats with dermatophytosis [1–4]. Furthermore, *M. canis*, which is potentially pathogenic to humans, can be isolated from the hair and skin in up to 88% of clinically normal cats [5, 6]. The purpose of the present study was to identify the fungal flora of stray cats and to determine the prevalence of *M. canis* carrier status in the cat population under study.

Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran.

Correspondence: Prof. Dr A. R. Khosravi, Faculty of Veterinary Medicine, University of Tehran, PO Box 14155-6453, Tehran, Iran.

Materials and methods

Cats

Stray cats ($n = 100$) from different districts of Isfahan, Iran, were studied. For this purpose, the city was divided into five approximately equal districts, in each of which 20 places were chosen randomly. The cats were caught by setting special traps in these places. To calm the cats, they were anaesthesized with 25 mg kg^{-1} ketamine given intramuscularly. The age (adult or kitten), sex and hair length of the cats were determined and recorded. All cats were examined for clinical signs of dermatophytosis. Wood's lamp was also used in this examination.

Specimen collection

Specimens were obtained from the coat of each cat by using a sterile toothbrush. The entire body of the cat was brushed, beginning at the head and followed by the neck, dorsum, trunk, ventrum, limbs and tail. Each cat was brushed for at least 3 min or until the bristles of the toothbrush contained hairs. After specimen collection, the toothbrush was replaced in its original package and resealed. All toothbrush packages were transported to the Medical Mycology Laboratory of the Faculty of Veterinary Medicine, University of Tehran, Iran.

Fungal culture

Sabouraud glucose agar and dermatophyte test medium (DTM) were used for initial fungal isolations. The media were inoculated by repeatedly stabbing the bristles of toothbrushes onto the surface of medium. The cultures were incubated at 26 °C and examined daily for 30 days. Saprophytic fungi and fungi commonly regarded dermatophytic pathogens were identified to genus and species levels respectively. Microscopic examination of colonies was achieved by use of a wet mount in lactophenol cotton blue stain. Subcultures of unknown fungi were made onto rice grain medium and observed for an additional 21 days. Yeasts were identified to genus level by microscopic examination and growth characteristics on Sabouraud glucose agar and/or rice grain agar.

Statistical analysis

The chi-square test was used to assess statistical differences between the groups.

Table 1. Fungal isolates from stray cats in Isfahan, Iran

Organism	All cats ($n=100$)		
	n	%*	%†
Acremonium spp.	3	0.9	3.0
Alternaria spp.	45	12.9	45.0
Aspergillus spp.	81	23.3	81.0
Candida spp.	9	2.6	9.0
Cephalotrichum spp.	2	0.6	2.0
Chrysosporium spp.	2	0.6	2.0
Cladosporium spp.	26	7.5	26.0
Geotrichum spp.	5	1.4	5.0
Gliocladium spp.	1	0.3	1.0
Malassezia spp.	2	0.6	2.0
M. canis	26	7.5	26.0
M. gypseum	1	0.3	1.0
Mucor spp.	28	8.0	28.0
Paecilomyces spp.	3	0.9	3.0
Penicillium spp.	93	26.7	93.0
Rhinocladiella spp.	1	0.3	1.0
Rhizopus spp.	6	1.7	6.0
Scopolariopsis spp.	13	3.7	13.0
Trichoderma spp.	1	0.3	1.0
Total	348		

*Percentage of total fungal isolates.
†Percentage of all cats from which organisms were isolated.
n = no. of cats.

Results

Description of the cats

One hundred stray cats were included in this study. Forty-five (45%) cats had short hair, 39 (39%) had medium-length hair and 16 (16%) had long hair. Sixty-two (62%) cats were adults and 38 (38%) were kittens. Fifty-five (55%) cats were male and 45 (45%) were female.

All adult cats were free of dermatophyte skin infection and all asymptomatic carrier cats were adults. Clinical signs of dermatophytosis – alopecia, broken hair and crusting – were observed in only four kittens. Wood's lamp examination was positive only from lesions in these kittens.

Fungal isolates

The number of isolates and the results of their differentiation to the genus level are demonstrated in Table 1. *Microsporum canis* was successfully isolated from all the kittens with skin lesions. In other cases, *M. canis* was cultured only from the hair coat of 22/96 cats.

Typical gross and morphological features were observed in cultures of 17/26 *M. canis* isolated. Nine atypical isolates of *M. canis*, one from an infected kitten and eight from the adult cats, were obtained in this study. These isolates were extremely slow-growing and produced a brown pigment. The mycelial growth was less aerial and fluffy than in other isolates. On microscopic examination abnormal macroconidia were predominant.

Significant differences between fungal isolates were not observed when the fungal flora of cats with short, medium-length and long hair were compared. Both *M. canis* and *M. gypseum* were isolated from one of the infected kittens. There were no significant differences between *M. canis*-positive and *M. canis*-negative cats with respect to sex, hair length and fungal flora.

Saprophytic fungi were isolated from all cats. The number of fungal isolates per cat varied from 3 to 9 (mean 4). The most frequent saprophytyic fungal isolates were *Penicillium*, *Aspergillus*, *Alternaria*, *Mucor* and *Cladosporium* species.

Significant differences in fungal culture results were not observed between cats in different districts of Isfahan.

Discussion

Dermatophyte skin infection is a common cause of feline skin disease. The most common causative organism of feline dermatophytosis is *M. canis* [1–4]. Several studies indicate that *M. canis* can be isolated from the hair and skin of 6.5–88% of

clinically normal cats [5, 6]. It seems that *M. canis* is well adapted to survival on the skin and hair coat of cat [3, 7, 8].

In this study *M. canis* was isolated from 26/100 stray cats. Of these 26 cats, 22 were clinically normal and did not have any clinical signs of dermatophytosis. As the stray cats under study were able to move freely in outdoor areas and were in contact with other cats, *M. canis* was transmitted from infected cats to healthy ones. This suggests that occasional contact with *M. canis*, results in the development of natural immunity to the infection in these cats, which therefore do not show clinical signs and may be asymptomatic carriers. This explains the observation that all adult cats were clinically normal, whereas all of the *M. canis*-positive kittens showed lesions.

In our study, we observed nine isolates of *M. canis* which were slowly growing and produced a brown pigment, and fewer aerial and fluffy mycelia than the other isolates as well as having abnormal macroconidia. Later studies showed that these isolates are stable atypical strains of *M. canis*. This is the first documented record of atypical strains of *M. canis* occurring in Iran.

The normal fungal flora of the coat of stray cats is characterized by common saprophytic fungi such as *Penicillium*, *Aspergillus*, *Alternaria*, *Mucor* and *Cladosporium* species.

It has been suggested that long-haired cats are more commonly asymptomatic carriers [2, 5, 9]. In this study, we did not observe this difference to be significant.

The environment and living conditions of the cats sampled were not different, therefore the incidence of *M. canis* infection in cats in various districts of Isfahan was not significantly different.

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