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NOTES

Saprophytic fungi on hair and feathers from apparently healthy animals

M.ª Lourdes Abarca*, M.ª Rosa Bragulat, M.ª Teresa Bruguera and Francisco Javier Cabañes

Departamento de Patología y Producciones Animales (Microbiología). Facultad de Veterinaria. Universidad Autónoma de Barcelona. Bellaterra, Barcelona. Spain

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Summary

The occurrence of saprophytic fungi on hair and feathers samples taken from apparently healthy domestic animals (cows, pigs, rabbits, and chickens) has been studied. A total of 221 strains classified in 24 genera were isolated. The most frequent genera were *Aspergillus, Penicillium, Mucor, Absidia* and *Alternaria,* and some statistically significant differences of contamination were detected among the animal species.

Key words: Mycoflora, hair, feathers, healthy animals.

Resumen

Se ha realizado un estudio de los hongos presentes en muestras de pelos y plumas de animales aparentemente sanos (vacas, cerdos, conejos y gallinas). Se han aislado 221 cepas pertenecientes a 24 géneros. Los géneros aislados más frecuentemente fueron *Aspergillus, Penicillium, Mucor, Absidia* y *Alternaria,* y se obsevaron diferencias significativas al comparar la frecuencia de aparición de los distintos géneros y especies fúngicas en las especies animales estudiadas.

The hair and feathers of animals represent a suitable substrate for the colonization of keratinophilic fungi, some of which are pathogens, opportunistic pathogens or allergens. Studies focused on the knowledge of mycoflora of this substrate have gradually revealed that the findings of fungi in this kind of samples may reflect specific relationships between the fungi and their hosts.

It is not known whether most of the saprophytic fungi can produce infections in healthy animals. However, some of them become invasive in conditions of decreased resistance, thus being opportunistic in their pathogenicity. Cases of suspected fungal infections caused by normally saprophytic fungi have been described in animals during the last two decades (1). However, only a few surveys about the fungal flora of asymptomatic skin of animals have come out (1, 2, 6, 8, 11, 14). In this work we study the occurrence of saprophytic fungi on hair and feather samples taken from apparently healthy domestic animals.

Seventy breeding places in Cataluña, Spain, have been sampled (20 of cows, 20 of pigs, 15 of

(*) Corresponding author.

rabbits and 15 of chickens). It was taken hair or feather samples of one selected animal from each breeding place. Samples were placed on the surface of Sabouraud's dextrose agar with chloramphenicol (DIFCO) and incubated at 28° C. Three plates per animal were used. Cycloheximide was not used because its selective influence on the growth of contaminant moulds and yeasts. The taxonomic identification was performed according to the macro- and microscopic morphology of the suspected colonies. All the strains were cultivated on the appropriate culture medium to achieve typical growth and sporulation and identified according to the criteria established by the mycological handbooks published for each genera. The yeast colonies were identified using the API 20 C AUX system. The χ^2 test was used when possible to determine if there were significant differences of contamination among the animal species.

A total of 221 strains classified in 24 genera were isolated during the study. Figure 1 shows the percentage occurrence of the 10 most frequent genera arranged in accord with the descending frequency of occurrence. All the dematiaceous strains which did not sporulate under laboratory conditions within 30 days, are grouped together as «dematiaceous sterile mycelia».

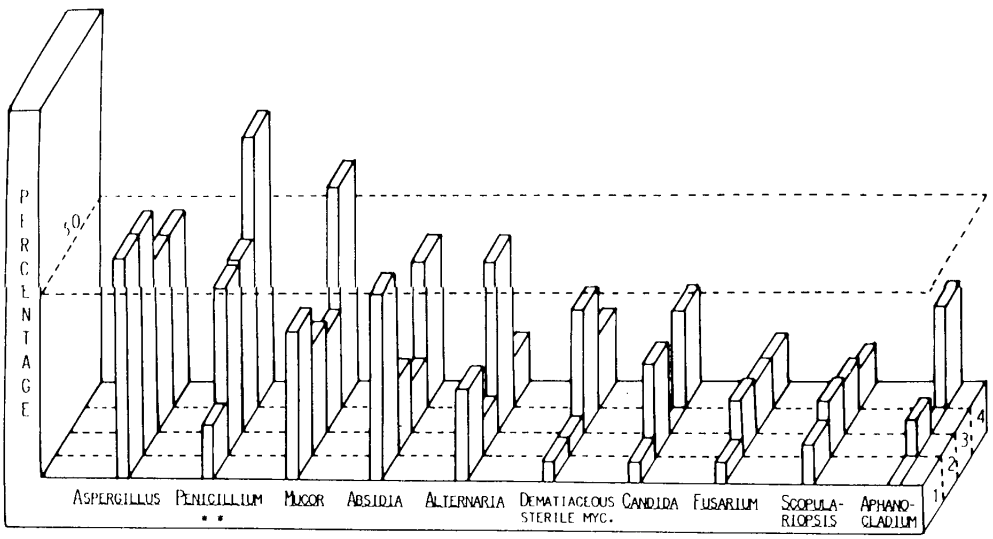

Fig. 1. Percentage occurrence of the 10 most frequent genera (including dematiaceous sterile mycelia) isolated from cow's hair (1), pig's hair (2), rabbit's hair (3) and chicken's feather (4).
**: Statistically significant differences (χ^2 test) $p < 0.01$.

Table 1 shows the various species of fungi isolated and the frequency of their occurrence among the animal species studied. In both cases, the significant differences among the animal species (χ^2 test) are pointed out.

The most frequent genera were *Aspergillus, Penicillium, Mucor, Absidia* and *Alternaria.* All these genera are ubiquous in nature and nearly all the isolated genera have been reported in similar studies made on asymptomatic animals. In a survey of the normal fungal flora of dogs (14), the authors reported that *Cladosporium* and *Alternaria* were the commonest genera isolated. Other studies made in asymptomatic dogs (2, 8) showed the isolation of some dermatophyte species and strains of genera *Scopulariopsis, Penicillium, Aspergillus* and *Alternaria* among others. Marsella *et al.* (11) studying the occurrence of fungi in animals of the Zoological Park of Rome reported among the ac-

TABLE 1
FREQUENCY OF FUNGAL SPECIES OCCURRENCE AMONG THE ANIMALS EXAMINED

Fungal species	Cows n = 20	Pigs n = 20	Rabbits n = 15	Chickens n = 15
Absidia corymbifera	10	4	2	6
Acremonium strictum	2	—	1	—
Acremonium terricola	—	—	1	—
Alternaria alternata **	5	1	7	1
Alternaria longipes	—	—	—	1
Alternaria tenuissima	—	1	—	—
Aphanocladium album	—	2	—	4
Artrinium phaeospermum	—	2	—	—
Arthroderma sp.	—	—	2	—
Aspergillus amstelodami	2	2	2	—
Aspergillus awamori	1	—	1	—
Aspergillus candidus	—	6	2	3
Aspergillus chevalieri	1	1	—	—
Aspergillus flavus	3	1	1	1
Aspergillus fumigatus	3	3	2	3
Aspergillus nidulans	—	—	1	—
Aspergillus terreus	1	—	—	—
Aspergillus terricola	1	—	—	1
Aspergillus tubingensis *	6	2	—	—
Aspergillus versicolor	2	—	—	—
Candida famata	1	4	—	3
Candida lusitaniae	—	1	—	1
Circinella umbellata	—	—	—	1
Cladosporium cladosporioides	1	—	—	—
Cladosporium herbarum	1	—	1	1
Cladosporium macrocarpum	—	—	1	—
Epicoccum purpurascens	—	—	1	—
Fusarium oxysporum	1	3	1	2
Fusarium equiseti	—	—	1	—
Geotrichum candidum	2	—	1	1
Gliocladium catenulatum	—	—	1	—
Gliocladium virens	—	—	1	—
Mucor circinelloides	1	—	—	—
Mucor hiemalis	1	—	1	—
Mucor plumbeus	2	1	2	2
Mucor racemosus	4	5	1	7
Paecilomyces variotii	—	—	—	2
Penicillium carneo-lutescens	—	—	—	1
Penicillium chrysogenum	1	2	3	4
Penicillium frequentans	—	2	1	—
Penicillium fellutanum	—	—	—	1
Penicillium jenseni	—	—	—	1
Penicillium martensii	—	—	1	3
Penicillium olivino-viride	—	1	—	—
Penicillium palitans	—	1	—	2
Penicillium variabile	2	2	—	1
Penicillium viridicatum	1	2	2	3

TABLE 1 (CONTINUED)

Fungal species	Cows n = 20	Pigs n = 20	Rabbits n = 15	Chickens n = 15
Phoma glomerata	1	—	—	—
Rhizopus oryzae	—	—	—	1
Rhizopus oligosporus	1	—	—	—
Rhizopus stolonifer	—	1	—	—
Scopulariopsis brevicaulis	—	—	1	1
Scopulariopsis candida	2	3	2	—
Scytalidium lignicola	1	—	—	—
Trichoderma viride	1	—	—	1
Trichothecium roseum	—	—	2	—
Ulocladium consortiale	1	1	—	—

* Statistically significant differences (χ^2 test) $p < 0.05$.
** Statistically significant differentes (χ^2 test) $p < 0.01$.

companying fungal flora, strains of the genera *Alternaria, Aspergillus, Acremonium, Cladosporium, Geotrichum, Penicillium* and *Scopulariopsis.* Hubalek *et al.* (6), in a survey of the fungi isolated on the hair of small wild mammals reported a high incidence of different species belonging to the genera *Penicillium, Aspergillus* and *Alternaria.* Aho (1) examined hair samples of dogs, cats, horses, cows, rats and other animals for the presence of saprophytic fungi. The commonest in order of frequency were members of the genera *Penicillium, Cladosporium, Aspergillus, Mucor, Aureobasidium, Alternaria, Scopulariopsis, Trichoderma* and *Trichothecium.* Statistically significant differences in contamination of animal skin were noted in some cases.

In our study, the genus *Penicillium* was isolated significantly more often (χ^2 test $p < 0.01$) from chicken samples than those of rabbits, pigs or cows. *P. chrysogenum* and *P. viridicatum* were the most frequent species of *Penicillium* isolated.

The commonest species of *Aspergillus* isolated were *A. fumigatus, A. candidus,* and *A. tubingensis.* Statistically significant differences (χ^2 test $p < 0.05$) were noted in *A. tubingensis,* more frequent in cow's hair.

Alternaria alternata, one of the most frequent species in the study was isolated significantly more often (χ^2 test $p < 0.01$) from rabbit samples than those of cows, pigs or chickens.

We have to point out the isolation of *Arthroderma* sp., perfect state of *Trichophyton mentagrophytes* in two rabbit's hair samples without apparent injury. The dermatophyte *T. mentagrophytes* is one of the most common causes of tinea in rabbits, and it has been isolated from healthy animals as wild rodents (10, 12, 13), laboratory animals (3, 4, 5, 9), bird feathers (7) and dogs (2), suggesting that in some cases, animals can act as healthy carriers. They do represent a potential risk of infection both for other animals living in the same animal house and for the people working with them.

The hair of animals serves as a collector of environmental fungi and thus it acquires a transient fungal flora. In this study the fungal flora isolated from the skin of the animals reflected in general the abundance of fungi in their environments because the samples were taken inside the farmhouses.

It is unknown how long the fungi can survive on the skin of animals and how some fungi can multiply on the coats of animals contaminated by soil and foodstuffs. The presence of opportunitic fungi on the coats of animals creates an opportunity for them under special circumstances to become invasive and thus to cause primary or secondary infections. Because of that, further studies are obviously required.

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