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## Dermatophytes isolated from dogs and cats suspected of dermatophytosis in Southern Brazil

Dermatófitos isolados de cães e gatos com suspeita de dermatofitose no sul do Brasil

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### ABSTRACT

Dermatophytosis which is characterized by a superficial infection confined to keratinised tissues, is the most common fungal disease in small animal veterinary medicine. It is unreliable to diagnose dermatophytosis on the basis of clinical signs alone, not only for the variable nature of the dermatological findings but also because there are several other skin diseases which mimic the typical fungal lesion (circular lesions with alopecia). The present study reports laboratory results of an extensive survey evaluating fungal and parasitic aetiology of skin diseases through the analysis of 1,240 fur, nails and skin scraping specimens from dogs and cats with clinical suspicion of dermatophytosis. Samples collected in several veterinary clinics of the Santa Catarina, Paraná and Rio Grande do Sul states, mainly of the Santa Maria city in Rio Grande do Sul, were processed at the Mycology Research Laboratory of the Federal University of Santa Maria, Southern Brazil, between 1998 and 2003. Among canine and feline samples, the percentages of positive dermatophyte specimens were 10.2% and 27.8%, respectively. The most prevalent fungal specie in both cats and dogs was *Microsporum canis*, which was isolated in 68.5% of the positive cultures for dermatophytes in dogs' samples, being the only species recovered from cats' cultures. *Malassezia pachydermatis* was the most commonly isolated yeast from the skin of dogs. Acari, mainly *Demodex canis*, were found in 5.0% of all samples with suspected diagnosis of dermatophytosis.

**Key words:** dermatophytosis, cat, dog, *Microsporum*, *Trichophyton*.

### RESUMO

Dermatofitose que é caracterizada por uma infecção superficial confinada aos tecidos queratinizados, é a doença fúngica mais comum na medicina veterinária de pequenos animais. O diagnóstico de dermatofitose com base apenas nos sinais clínicos é incerto, não somente pela natureza variável dos achados dermatológicos, mas também porque há várias outras doenças de pele que mimetizam a lesão fúngica típica (lesões circulares com alopecia). O presente estudo reporta resultados laboratoriais de uma extensiva pesquisa avaliando etiologia fúngica e parasitária de doenças de pele através da análise de 1240 amostras de crostas provenientes de unhas e pele de cães e gatos com suspeita clínica de dermatofitose. As amostras coletadas em várias clínicas veterinárias dos estados de Santa Catarina, Paraná e Rio Grande do Sul, principalmente da cidade de Santa Maria no Rio Grande do Sul, foram processadas no Laboratório de Pesquisas Micológicas da Universidade Federal de Santa Maria, Sul do Brasil, entre 1998 e 2003. Entre as amostras de caninos e felinos, a percentagem de espécimes positivas para dermatófitos foram 10,2% e 27,8%, respectivamente. A espécie fúngica mais prevalente tanto nos cães como nos gatos foi *Microsporum canis*, a qual foi isolada em 68,5% das amostras de cães, sendo a única espécie recuperada de culturas de gatos. *Malassezia pachydermatis* foi a levedura mais comumente isolada da pele de cães. Ácaros, principalmente *Demodex canis*, foram encontrados em 5,0% das amostras totais com diagnóstico suspeito de dermatofitose.

**Descritores:** Dermatofitose, cão, gato, *Microsporum*, *Trichophyton*.

## INTRODUCTION

Dermatophytosis which is characterized by a superficial skin infection confined to keratinised epithelium, is the most common fungal disease in clinical veterinary medicine in small animals. The dermatophyte agents mainly belonged to the genera *Microsporum* and *Trichophyton*. These fungi produce keratinases and others enzymes capable to digest the keratin protein complex, allowing the dermatophyte to burrow deeper into the *stratum corneum* in the host and therefore to elicit an inflammatory reaction [7,11]. The degree of inflammation, dependent of host-fungus interaction, determines the degree and significance of the clinical signs.

The diagnosis of dermatophytosis is unreliable on the basis of clinical signs exclusively, not only due to the variable nature of the dermatological findings, but also because there are several other skin diseases that mimic the typical dermatophytic lesion (circular lesions with alopecia). Demodicosis and dermatophytosis can be clinically indistinguishable, but can be reliably distinguished by skin scraping. Moreover, superficial folliculitis, especially when the spreading rings of erythema and exfoliation are also present, is often mistaken for dermatophytosis [10].

This study reports laboratory results of an extensive survey evaluating fungal and parasitic aetiology of skin diseases in dogs and cats with clinical suspicion of dermatophytosis through the analysis of specimens addressed to the Mycology Research Laboratory, southern Brazil, between 1998 and 2003.

## MATERIALS & METHODS

A total of 1,240 samples composed of fur, nail and skin scraping specimens were collected from 1,089 (87.8%) dogs and 151 (12.2%) cats with clinical suspicion of dermatophytosis in several veterinary clinics, and submitted by veterinarians to the Mycology Research Laboratory of the Federal University of Santa Maria, in Southern Brazil. Each sample corresponds to an animal, and can be composed by sub samples collected from different lesions. All samples were examined by direct microscopy and were cultured.

Specimens were both examined for fungal elements and acari by direct microscopy in 20% potassium hydroxide and inoculated on Micobiotic Agar and/or Sabouraud Chloramphenicol Agar slants. Cultures were incubated at 28°C and examined daily for 15 days. Each developing colony, morphologically com-

patible with dermatophytes, was subcultured on Lactrimel agar, under the same incubation conditions described above, for the induction of conidiation.

The laboratory identification of etiologic agents was based on micro and macroscopic characteristics. In addition, the urease and the *in vitro* hair perforation tests, the evaluation of nutritional requirements in culture, sugars assimilation, capability to growth at 37°C and the ability to produce germ tubes were also carried out to differentiate fungal species.

## RESULTS

Table 1 displays the list of fungal agents identified in specimens collected from cats and dogs with clinical diagnosis of dermatophytosis and their relative occurrence according to the animal species. A total of 220 (17.7%) out of 1,240 samples were positive to mycotic agents; among those, dermatophytes were identified in 153 (12.3%) samples. Misdiagnoses with acariosis were found in 58 (4.7%) of all examined samples.

Direct microscopy of samples was positive in 76 (68.47%) of 111 culture positive from dogs, and in 24 (57.14%) of 42 culture positive from cats. The percentages of samples positive for dermatophytes from canine and feline specimens were 9.8% and 27.2%, respectively. *Microsporum canis* was the most prevalent fungal species observed in those specimens. It was recovered from 68.5% of the positive cultures for dermatophytes from dogs, and was the only fungus to be recovered from cat specimens. In addition, *M. gypseum* and *T. mentagrophytes* were also isolated in specimens from dogs.

Among yeasts, *Malassezia pachydermatis* in dogs, and *Cryptococcus neoformans* and *Candida albicans* in cats, were the most prevalent agents isolated from animals with skin diseases. Most *Candida albicans* isolated from pets in this survey were related to a history of interdigital dermatitis.

Acari were found in 4.7% of the samples with clinical suspicion of dermatophytosis, mixed infections with *Demodex canis* and *M. canis* were observed in 4 (0.4%) specimens collected from dogs. Likewise, *Notoedres cati* was associated with *M. canis* in 1 (0.7%) cat specimen.

## DISCUSSION

Fungal skin disease is considered to be clinically overdiagnosed in veterinary medicine, especially in dogs [15]. Studies evaluating the aetiology of skin

**Table 1.** Laboratory results of cutaneous scrapings from dogs and cats with dermatophytosis suspicion.

	Animal Species					
	Canine samples (1089)	(%)	Feline samples (151)	(%)	Total number (1240)	(%)
<b>DERMATOPHYTES</b>	<b>107</b>	<b>(9.8)</b>	<b>41</b>	<b>(27.2)</b>	<b>148</b>	<b>(12)</b>
<i>Microsporum canis</i>	72	(6.6)	38	(25.2)	110	(8.9)
<i>M. canis</i> var. <i>distortum</i>	1	(0.1)	3	(2.0)	4	(0.3)
<i>M. gypseum</i>	33	(3.0)	0	-	33	(2.7)
<i>Trichophyton mentagrophytes</i>	1	(0.1)	0	-	1	(0.1)
<b>YEASTS</b>	<b>63</b>	<b>(5.8)</b>	<b>4</b>	<b>(2.6)</b>	<b>67</b>	<b>(5.4)</b>
<i>Candida albicans</i>	6	(0.6)	2	(1.3)	8	(0.6)
<i>Cryptococcus neoformans</i>	0	-	2	(1.3)	2	(0.2)
<i>Malassezia pachydermatis</i>	41	(3.7)	0	-	41	(3.3)
Not identified	10	(0.9)	0	-	10	(0.8)
<b>OTHERS FUNGI</b>	<b>6</b>	<b>(0.6)</b>	<b>0</b>	<b>-</b>	<b>6</b>	<b>(0.5)</b>
<i>Sporothrix schenckii</i>	6	(0.6)	0	-	6	(0.5)
<b>ACARI</b>	<b>51</b>	<b>(4.7)</b>	<b>7</b>	<b>(4.7)</b>	<b>58</b>	<b>(4.7)</b>
<i>Demodex canis</i>	34	(3.1)	0	-	34	(2.7)
<i>Notoedres cati</i>	0	-	6	(4.0)	6	(0.5)
<i>Otodectes cynotis</i>	1	(0.1)	0	-	1	(0.1)
<i>Sarcoptes scabiei</i>	16	(1.5)	1	(0.7)	17	(1.4)
<b>MIXED (ACARI &amp; DERMATOPHYTES)</b>	<b>4</b>	<b>(0.4)</b>	<b>1</b>	<b>(0.7)</b>	<b>5</b>	<b>(0.4)</b>
<i>D. canis</i> + <i>M. canis</i>	4	(0.4)	0	-	4	(0.3)
<i>N. cati</i> + <i>M. canis</i>	0	-	1	(0.7)	1	(0.1)
<b>NEGATIVE</b>	<b>864</b>	<b>(79.3)</b>	<b>98</b>	<b>(64.9)</b>	<b>962</b>	<b>(77.6)</b>

diseases in dogs and cats by fungal cultures indicated that the prevalence of dermatophytes might be as low as 2% of all dermatologic cases [10]. However, the ratio of positive cultures in relation to the samples examined present a great variation when the specimens under evaluation are originated from animals clinically suspected of dermatophytosis, which can be easily recognized by assessing reports of surveys carried out in a number of countries (Table 2). This variation allegedly occurs due to differences in temperature, climate, relative humidity and precipitation among the geographical regions where the surveys were executed [13], along with the degree of experience of clinicians collecting the samples.

The prevalence of dermatophytes in dogs with suspected lesions of dermatophytosis is relatively low,

usually ranging between 4% and 15% [2-5,9,12,13,16,17, 19,20,21]. These data are in accordance with the results obtained in our laboratory, but considerably higher values have been reported elsewhere [6,8,14]. In cats, the prevalence of dermatophytosis is usually higher than in dogs, with values higher than 20% being reported in most cases [3-6,12,14,17,20].

Most studies indicated that *Microsporum canis* is the most prevalent dermatophyte isolated from the skin of suspected animals, which is in agreement with this survey. *Microsporum canis*, along with *M. gypseum* and *Trichophyton mentagrophytes*, are the fungal species responsible for more than 95% of all dermatophytosis cases in pets. Geophilic dermatophytes were just isolated from dogs. This selective predominance can be explained considering the most frequent associa-

**Table 2.** Occurrence of dermatophytes in dogs and cats with suspicion of dermatophytosis in different countries according to literature.

Country	Period	Authors	Dogs		Cats	
			Samples (n)	Positive (%)	Samples (n)	Positive (%)
United Kingdom	1955-56	Pepin <i>et al.</i> [10]	628	7.0	324	9.6
Finland	1977-79	Aho [11]	206	3.9	61	21.3
Brazil	1979-82	Ferreiro <i>et al.</i> [12]	235	14.5	27	29.6
Norway	1981-84	Stenwing [13]	780	5.5	279	30.8
Italy	1985-87	Faggi <i>et al.</i> [14]	195	33.3	369	43.6
USA	1981-90	Lewis <i>et al.</i> [9]	1824	3.8	408	14.9
United Kingdom	1956-91	Sparkes <i>et al.</i> [15]	4942	9.6	3407	26.2
Austria	1988-91	Breuer-Strosberg [16]	636	12.4	384	50.3
Spain	1986-95	Cabañes <i>et al.</i> [17]	105	14.3	56	33.9
Italy	1987	Caretta <i>et al.</i> [18]	168	29.7	93	63.4
Italy	1990's	Marchisio <i>et al.</i> [6]	98	35.4	105	64.6
Croatia	1990-98	Pinter <i>et al.</i> [19]	3353	15.3	838	40.7
Germany	1993-95	Schmidt [20]	95	4.21	78	11.53
Iran	1994-98	Khosravi <i>et al.</i> [21]	97	8	186	55
Brazil	2000-01	Brilhante <i>et al.</i> [22]	189	14,3	38	36,8

tion of dogs with soil during traditional walks, in the houses' patio or living in rural areas. Cats are usually kept inside the houses, restricting contact with the agents' reservoir.

In contrast to others reports, especially from Europe, no isolation of *M. persicolor* from dogs was observed in this study. There are no reports of the occurrence of *M. persicolor* in animals in Brazil; however, in 1975, reported the first human case caused by this agent in this country [18]. It is inferred that this fungus, has little epidemiological importance in this country. On the other hand, the prevalence of *M. gypseum* in dogs in southern Brazil is considerably higher than values reported from Europe and United Kingdom (29.7% vs. 15.0% or less, respectively) [2,3,5, 6,8,14,16,17,19-21].

Comparing the relatively high occurrence of *M. gypseum* in this study with other two reports documented in Brazil, we found contrasting results depending on the geographic area. In a study [9], also carried out in Southern Brazil, but concentrated in a more metropolitan area, the prevalence of *M. gypseum* in dogs was relatively similar to our data (20.6%). Alternatively, [4] described a prevalence of 3.7% of *M. gypseum* re-

covered from dogs in Northeast Brazil. These distinctions may be mainly explained by climatic and geographic differences. However, the dermatophyte species (*M. canis*, *M. gypseum* and *T. mentagrophytes*) recovered from dogs and cats were similar among those studies, including this current. The rate of prevalence of dermatophytosis obtained in our survey was slightly lower than in other reports from Brazil. Regarding this issue, [13] indicated that when the number of submitted samples increases, the percentage of positive cultures tends to decrease. In our case, as the sample collection was at no cost for the pet owners, a fairly high number of material samples were retrieved for this study, which may have contributed to the relatively lower rate of dermatophytosis [13].

The positive values observed by direct examination of allegedly positive samples were similar to results obtained yet [4], but higher than the results from others authors [5,20] (61.4%, 61.0%, 58.8%, and 55.0%, respectively). Twenty-five samples from animals under therapy turned positive on direct microscopy, but remained negative in culture.

Generally, clinical signs of dermatophytosis are highly variable and depend on the host-fungus inte-

reaction and the degree of the subsequent inflammation. Consequently, clinical symptoms may vary from asymptomatic, to patchy hair loss, a papulocrustous eruption, an exfoliative dermatosis, erythematous plaques, and to a suppurative nodular disorder (kerion reaction) [10]. As a result, this infection can mimic many other diseases, such parasitism, bacterial infections, allergies, immunologic diseases, nutritional related dermatosis, hormonal disorders, some skin cancers and keratinisation disorders [1]. These issues may justify either the relatively low rate of laboratorial confirmation of dermatophytes in dogs with suspected lesions of dermatophytosis, or the misdiagnosis with acari, found in 4.7% of the samples. Since samples processed in this study were collected in distinct veterinary clinics, and most clinicians do not usually disclose the complete clinical history of their patients, we did not have access to the animals with skin disorders. Consequently, it became difficult to reconcile the clinical signs and the laboratory results to the misdiagnoses.

Yeast infections in dogs are usually the result of *Malassezia pachydermatis*. This is considered a normal resident of the skin and an opportunistic pathogen, thus only cultures presenting high number of colonies were accounted in this study. Malasseziosis can be a primary problem but is more commonly seen as a secondary infection and tends to complicate other problems, especially allergies, keratinisation disorders, skin fold dermatitis, immunodeficiency and previous antibiotic administration. Candidosis is rare in pets, and predominantly causes mucocutaneous disea-

ses and interdigital dermatitis, being typically associated with immune dysfunction and antimicrobial therapy [1]. It is assumed that *S. schenckii* were isolated from dogs presenting initial development of disease, since the lesions in this stage resembled dermatophytosis. Diseases that cause immunosuppression have been associated with cryptococcal infections; however we did not performed further analyses for concurrent viral infectious diseases in the subject cats used in this study.

Since yeast isolation from dogs and cats provides only supportive evidence of infection, histopathologic studies are required to confirm the diagnosis [1,10]. Hence, in cases where *Candida* or *Malassezia* were isolated from skin scrapings, we have emphasized to veterinary clinicians that such findings do not necessarily imply that the yeasts were the primary cause of the skin disorder.

Considering that only 12% (148/1,240) of all suspected samples directed to our laboratory were positively confirmed, it becomes evident that many animals presenting skin lesions by the clinical examination are misdiagnosed with dermatophytosis. This emphasizes the difficulty to perform an immediate diagnosis of dermatophytosis, which may lead to mistreatment in a number of cases. Consequently, we conclude that the laboratory diagnosis of dermatophytosis is necessary for the most efficient treatment or management decision to be made in a case-by-case basis.

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