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Source: Journal of Wildlife Diseases, 16(4) : 509-514

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-16.4.509

ASSOCIATION OF *Malassezia (Pityrosporum) pachydermatis* WITH SARCOPTIC MANGE IN NEW YORK STATE

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Abstract: Malassezia (Pityrosporum) pachydermatis consistently accompanied sarcoptic mange in all red foxes *(Vulpes fulva),* porcupines *(Erethizon dorsatum),* and coyotes *(Canis latrans)* examined. This yeastlike microorganism has not heretofore been reported on any of these hosts. Its presence on the exoskeleton of *Sarcoptes scabiei* taken from these animals suggests a carrier role for the mite. The yeast may be saprophytic or a secondary pathogen.

INTRODUCTION

Sarcoptic mange, or scabies, caused by *Sarcoptes scabiei* occurs throughout the world in both wild and domestic mammals. The burrowing of the females in the skin to lay eggs and the feeding activities of the larvae and nymphs cause irritation and inflammation, leading to hyperkeratinization, skin cracking, and loss of hair [17,18] In New York State sarcoptic mange has been reported in several wild mammals, with especially severe clinical manifestations in the red fox *(Vulpes fulva).*[16]

Malassezia (Pityrosporum) pachydermatis, a bottle-shaped, budding, yeastlike organism, was first isolated by Weidman[19] from an inflamed area on the skin of an Indian rhinoceros *(Rhinoceros unicornis).* Subsequent authors reported its association with the auditory canal of healthy domestic dogs *(Canis familiaris),*[6] otitis externa of dogs and domestic cats *(Felis domesticus),*[1,2,3,6,12,13] ulcerated conjunctiva of dogs,[12] and the skin of an Indian elephant *(Elephas maximus),*[8] a North American black bear *(Ursus americanus)*[11] and man.[14,15]

We describe in this report (1) a regular association of *M. pachydermatis* with sarcoptic mange; (2) three heretofore undescribed hosts of this yeast: the red fox, porcupine *(Erethizon dorsatum),* and coyote *(Canis latrans);* and (3) the possible phoresy of *M. pachydermatis* by *S. scabiei.*

MATERIALS AND METHODS

Skin lesions on the carcasses of the red foxes, porcupines, and coyotes were scraped with a sterile scalpel. The scrapings were then mounted in Berlese fluid and microscopically examined for mites. Portions of skin containing *S. scabiei* from each animal were submitted to the Laboratories for Mycology and Mycobacteriology for examination. The areas from which specimens were taken tended to be more or less alopectic, bore crusts and/or scabs, or had excessive epidermal sloughing similar to severe dandruff in man. A portion of each specimen was frozen at -2 C for 7 to 10 days to kill the adhering mites. The tissue was then thawed at room temperature and cultured at both 27 C and 37 C on three different media: (1) Bacto-cysteine heart agar supplemented with Bacto-hemoglobin, penicillin, and streptomycin; (2) Mycosel agar (BBL); and (3) modified Sabouraud dextrose

agar (2% dextrose) fortified with penicillin and streptomycin. Portions of the specimen were also streaked on microscope slides and stained by the Giemsa method for direct microscopic observations; or fixed in 10% formalin, embedded in paraffin, sectioned, and stained with hematoxylin and eosin, Giemsa, and methenamine-silver.

To determine the presence of viable yeast cells on the mites, portions of tissue from several red foxes were first placed in a sterile glass petri dish and refrigerated for 3-4 h at 4 C to lower the activity of the parasites. Individual mites were then removed with a sterile jeweler's forceps and streaked over the surface of the media listed above. Cultures were incubated at both 27 C and 37 C.

RESULTS

Animal infections

M. pachydermatis was found by direct examination in the skin of all 23 animals studied (Table 1). These observations were confirmed by direct culture for 13 of 19 animals (8 foxes, 2 coyotes, and 3 porcupines) and by tissue section for 9 of 10 foxes, 1 of 3 porcupines, and 3 of 6 coyotes. Only 2 observations by direct examination (both on coyotes) were not confirmed by direct culture in the absence of tissue sections. Due to the decomposed condition of the tissue, neither confirmatory test could be performed on specimens from 4 foxes.

Mycology

In cases in which *M. pachydermatis* was isolated directly from tissue, a single species of yeastlike microorganism appeared on all media incubated at 37 C. In subsequent studies with pure cultures this yeast developed best at 35-37 C, formed no germ tubes when incubated in normal human serum, formed no hyphae or blastospores when cut into cornmeal + 1% Tween 80 agar, and fermented none of the common carbohydrates. It was rapidly urease-positive on Christensen's[4] medium at 37 C and assimilated only glucose in the Wickerham[20] tube turbidity test. Colonies were pasty, smooth, and white at first, becoming cream to cream-yellow with age. Microscopically the yeast was oval to cylindrical and ranged in size from 2.5-2.8 μm by 4.0-5.3 μm. It reproduced by unipolar budding, forming a cell wall collarette from successive bud scars. All of these morphologic and physiologic characteristics are consistent with those of *M. pachydermatis*.

In Giemsa-stained smears and stained tissue sections (Fig. 1) *M. pachydermatis* was readily recognizable by its size and shape, unipolar budding, and formation of a distinctive cell-wall collarette.

All nutrient media streaked with mites and incubated at 37 C yielded colonies of *M. pachydermatis*. To further verify the presence of the yeast on the mites, the acarids from diseased tissue were crushed between glass slides, heat- and methanol-fixed, and stained by the Giemsa method. These preparations clearly revealed yeastlike cells with morphological features characteristic of *M. pachydermatis*.

DISCUSSION

Taxonomy of *M. pachydermatis*

Until recently *M. pachydermatis* had been designated *Pityrosporum pachydermatis*. However, since *P. pachydermatis* is accepted as being congeneric with *P. orbiculare* and *P. ovale* (the causative agent of pityriasis versicolor and the possible agent of pityriasis simplex capitis respectively), and since the latter 2 species are morphologic forms of *Malassezia furfur*,[10] Gordon[7] recommended the transfer (proposed by Dodge[5] in 1935) of *P. pachydermatis* to the genus *Malassezia*.

Association with sarcoptic mange

The observation of *M. pachydermatis* in all smears, confirmed by its cultural isolation from several specimens of dis-

TABLE 1. Association of *M. pachydermatis* with scabies in red foxes, coyotes, and porcupines, 1977-79.

Animal and case no.	Date specimen received	County	Sex	Age[a]	Description	*M. pachydermatis* found by[b] Direct examination	Direct culture	Tissue section
Red fox								
1	2/77	Albany	M	A	Early mange, lesions on hocks and abdomen	+	+	-
2	7/78	Cattaraugus	M	A	Extreme mange, all body surfaces involved	+	+	+
3	8/78	Cattaraugus	F	J	Extensive alopecia, necrotic skin over most body surfaces	+	+	+
4	8/78	Cattaraugus	F	J	Extensive alopecia, necrotic skin over most body surfaces	+	+	+
5	8/78	Suffolk	F	J	Most body surfaces involved	+	-	+
6	9/78	Allegany	M	J	Lesions restricted to head and abdomen	+	ND	ND
7	9/78	Onondaga	M	J	Extreme mange, all body surfaces involved	+	ND	ND
8	10/78	Cattaraugus	M	J	Extensive alopecia, necrotic skin over most body surfaces	+	+	+
9	10/78	Cattaraugus	M	J	Extensive alopecia, necrotic skin over most body surfaces	+	-	+
10	10/78	Allegany	M	J	Extensive alopecia, necrotic skin over most body surfaces	+	ND	ND
11	11/78	Columbia	F	A	Encrusted lesions on tail, hind legs, and abdomen	+	ND	ND
12	7/79	Orange	F	A	Extreme mange, all body surfaces involved	+	+	+
13	7/79	Niagara	M	J	Extreme mange, all body surfaces involved	+	+	+

TABLE 1. (continued)

Animal and case no.	Date specimen received	County	Sex	Age[a]	Description	*M. pachydermatis* found by[b] Direct examination	Direct culture	Tissue section
14	9/79	Tompkins	M	A	Extreme mange, all body surfaces involved	+	+	+
Coyote								
1	11/78	Allegany	M	A	Alopecia on hind legs, few lesions	+	-	ND
2	12/78	Columbia	F	J	Extensive mange, all body surfaces involved	+	+	ND
3	12/78	Delaware	M	A	Mange restricted to face and tail	+	-	ND
4	7/79	Erie	M	A	Severe sarcoptic mange	+	+	+
5	10/79	Oneida	F	J	Extensive mange, all body surfaces involved	+	-	+
6	10/79	Oneida	F	J	Extensive mange, all body surfaces involved	+	-	+
Porcupine								
1	11/78	Jefferson	M	A	Extreme mange, all body surfaces involved	+	+	ND
2	11/78	Jefferson	F	A	Extreme mange, all body surfaces involved	+	+	ND
3	10/79	Allegany	F	A	Severe mange, most extensive on face and abdomen	+	+	+

[a] A = adult and J = juvenile
[b] + = positive, - = negative, and ND = not done

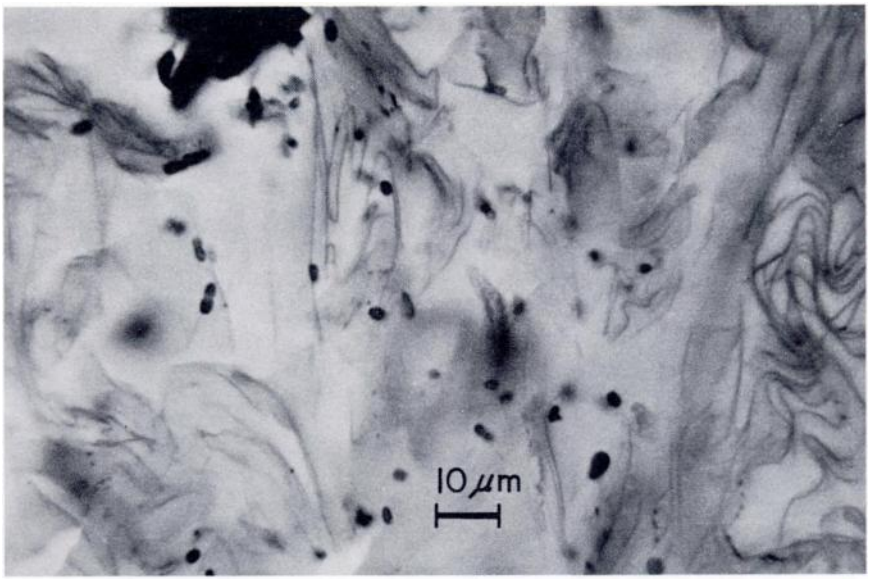

FIGURE 1. *Malassezia pachydermatis* cells in section of tissue from mangy red fox (Grocott methenamine-silver stain).

eased tissue and its presence in sections from those tissues, clearly establishes an association of the yeast with sarcoptic mange and with three previously undescribed hosts. However, the extent of this association appears to depend upon the severity of the mange. Microscopically the yeast was consistently more prevalent in tissue specimens from the most advanced cases.

We have established that *S. scabiei* carries live *M. pachydermatis* cells on its exoskeleton, which suggests that the yeast may be transported between hosts by the invading mite. Excessive sloughing of epidermal scales and other disturbances caused by the mites may then create the proper conditions for saprophytic development of the yeast. Leyden *et al.*[9] argued that *P. ovale (M. furfur)* does not cause dandruff in man but that the excessive proliferation of epidermal scales associated with dandruff facilitates saprophytic development of the yeast. It is possible, however, that *M. pachydermatis* is a secondary pathogen, contributing to the debilitation of the host and/or to invasion by other fungal or bacterial pathogens. We are now investigating the possible role of *M. pachydermatis* as a secondary pathogen in sarcoptic mange of red foxes.

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Received for publication 11 December 1979