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Association of *Malassezia pachydermatis* with Systemic Infections of Humans

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Thirty-two *Malassezia* spp. isolates from human clinical specimens represented *M. furfur* and *M. pachydermatis*. Both species reportedly were obtained from patients with similar febrile systemic syndromes, including infections of the lungs or other tissues.

The genus *Malassezia* Baillon includes two species, *M. furfur* (Robin) Baillon and *M. pachydermatis* (Weidman) Dodge. *M. furfur* is a common obligate saprophyte of humans. It causes tinea versicolor, which is characterized by scaling patches of apigmented skin. The lesions are superficial and mostly asymptomatic. *Pityrosporum ovale* (Bizzozero) Castellani et Chalmers and *Pityrosporum orbiculare* Gordon, whose names are synonyms of *M. furfur*, have been associated with dacryocystitis (6). Recently, systemic infections by *M. furfur*, including pneumonia with extensive pulmonary vasculitis, peritonitis, and catheter-associated fungemia of neonates, have been reported (2, 3, 5).

Malassezia species are lipophilic. *M. furfur* has an essential requirement for fatty acids (C_{12} or longer), whereas *M. pachydermatis* requires fatty acids for growth in simple defined medium. On the skin, *M. furfur* occurs in hyphal and yeast forms, but in culture it typically grows as a unipolar budding cell (enteroblastic and basipetal-phialidic), less than 6 μm in its largest dimension. In tissues from systemic infections, only yeast forms have been observed.

M. pachydermatis is commonly associated with canines, particularly with otitis externa of dogs (1). *M. pachydermatis* is distinguished by its ability to grow on complex mediua without supplementation with fatty acids. It is further distinguished by a guanine-plus-cytosine content in its DNA of about 56%, contrasted to a guanosine-plus-cytosine content of near 63% for *M. furfur* (7). A hyphal stage has not been described for *M. pachydermatis*. The probable basidiomycetous relationship of the *Malassezia* spp. is supported by the multilaminar ultrastructure of their cell walls, correlated with a positive diazonium blue B staining reaction (4).

Since 1984, 32 *Malassezia* spp. isolates from human clinical specimens have been received at the Centers for Disease Control, Atlanta, Ga., for identification. Seventeen isolates were identified as *M. furfur*: one from spinal fluid, one from a wound, one from lung tissue, two from sputa, three from blood, three from ears, and six from the skin. *M. pachydermatis* isolates ($n = 15$) were as follows: 1 each from tissue fluids and the eye, ear, and vagina; 3 from the skin; 4 from blood; and 4 from unidentified specimens (presumably the skin). Tissue specimens were not available to us. All isolates were diazonium blue B positive and urease positive. The primary distinction between the two species was based on growth on Sabouraud dextrose agar with and without supplementation with olive oil. This basis of separation was supported in an examination of representative strains by a difference in guanosine-plus-cytosine content between the species of about 10% (Table 1).

TABLE 1. Sources and characteristics of *Malassezia* spp.

Species	Code no.[a]	Source[b]	mol% G+C[c]
M. furfur	CBS 1878[d]	Scalp	66.7
	CDC 42	Sputum	66.0
	CDC 71	Blood	66.7
M. pachydermatis	CBS 1879[e]	Ear (dog)	55.4
	CDC 33	Urine	55.2
	CDC 34	Sputum	55.5
	CDC 52	Blood	55.6
	CDC 24	Vagina	55.1

[a] CBS, Centraal Bureau voor Schimmelcultures, Delft, The Netherlands; CDC, Centers for Disease Control, Atlanta, Ga.
[b] Unless otherwise indicated, the source is human.
[c] G+C, Guanosine plus cytosine.
[d] Authenticated culture for *P. ovale*.
[e] Authenticated culture for *Pityrosporum canis*.

Systemic infections by *M. furfur* are characterized by fever with progression to severe and sometimes fatal pneumonia. The infection is most often associated with infants who are receiving fat emulsions intravenously (3). We have received isolates of *M. pachydermatis* reportedly from neonates with the above-described syndrome and from compromised adults with various syndromes. The clinical presumption was that these patients had infections caused by *M. furfur*. The epidemiology of *M. pachydermatis* with systemic diseases of humans is unclear. It is unclear whether *M. pachydermatis* is harbored by a significant number of humans or whether some individuals are simple vectors for commensal or infectious associations between house pets and predisposed humans.

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