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Subcutaneous Phaeohyphomycosis caused by *Moniliella suaveolens* in Two Cats

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Abstract. *Moniliella suaveolens* was isolated in pure culture from histologically typical phaeohyphomycotic granulomas containing dematiaceous fungi in two cats. One cat had several slow-growing black lesions up to 2 cm in diameter in the abdominal subcutis. These lesions recurred after surgical excision was attempted. The second cat had a single black subcutaneous 0.5 × 1.5-cm lesion near one dewclaw. This lesion was successfully removed surgically without recurrence. *M. suaveolens* has not been isolated previously from lesions in animals including man.

The recognition of opportunistic infections caused by fungi not previously known as pathogens has increased recently. To clarify the nomenclature for infections caused by the dematiaceous (darkly pigmented) fungi, the name phaeohyphomycosis was proposed for those cases in which the dematiaceous fungi grow in tissue as hyphae, pseudohyphae, yeast cells, or any combination of these forms.[1,2] Phaeohyphomycoses lack the dematiaceous, thick-walled, muriform cells which characterize chromoblastomycoses, and the granules which characterize mycetomas.[4] It has been proposed that phaeohyphomycoses be categorized into superficial, cutaneous and corneal, subcutaneous, and systemic types.[10]

Several cases of phaeohyphomycosis have been described in the subcutis of cats.[3,5–7,13,15] The fungi isolated from these lesions were *Drechslera spicifera*,[13] *Exophiala jeanselmei*,[3] and *Phialophora verrucosa*.[5] This variety is consistent with the many fungal species obtained from phaeohyphomycotic lesions in man and other animals.[4] To this growing list of pathogens we now add *Moniliella suaveolens* from subcutaneous granulomas in two cats.

Case Histories

Cat 1: A nine-year-old castrated male domestic short-haired cat was first seen in June 1981 with several ulcerated lesions on the ventral abdomen. The cat was born at Gosford in New South Wales in 1972 and was moved to the Gold Coast in Queensland in 1981. Similar lesions appeared at intervals—beginning when the cat was two years old—without obviously affecting its well-being. These lesions were removed surgically from time to time, but others developed at the same sites. The lesions were first seen as sharply defined 2 to 3 mm diameter dark foci which slowly enlarged up to about 2 cm in diameter over a period of several months. They were confined to the skin and subcutis and were painless on palpation. The overlying skin began to ulcerate when the lesions reached about 1 cm in diameter. Yeast-like organisms were seen in scrapings from an ulcerated lesion and a tentative diagnosis of a subcutaneous mycosis was made. The lesions were excised surgically, and portions were submitted for histology and mycology. By August 1981, three more lesions developed (fig. 1). These were excised and examined similarly. By September 1982, further lesions had developed, but the cat remained otherwise healthy. The owner refused further therapy for the lesions.

Cat 2: A 15-year-old ovariectomized female domestic short-haired cat was seen in July 1982 with eosinophilic granulomas ("rodent ulcers") of the upper lip, a focus of dermatitis over the left maxilla and coronitis of both fore dewclaws. The cat was born at Ipswich, Queensland in 1967 and brought to the Gold Coast in 1974. It had not suffered any previous illness. Dark exudate had collected at the base of the left dewclaw. Gram-stained smears of this exudate revealed various bacteria but no fungi. It was given 50 mg amoxicillin (Amoxil, Beecham Veterinary Products, Clayton, Victoria) *per os* twice daily for two weeks concurrently with 5 mg prednisolone (Prednisolone Tablets, Apex Labs., St. Marys, New South Wales) *per os* twice daily for one week and once daily for the following week. Healing of all lesions was satisfactory on completion of this regimen. In an attempt to prevent the recurrence of the "rodent ulcers," therapy was then started with 5 mg megestrol acetate (Ovarid Tablets, Glaxo Australia, Boronia, Victoria) *per os* on alternate days.

Fig. 1: Dark phaeohyphomycotic lesions (arrows) in abdominal subcutis of cat 1.

Two weeks later, a black crescent-shaped lesion measuring 5 × 15 mm was seen below the right fore dewclaw. The lesion surface ulcerated three days later. Scrapings contained dematiaceous hyphae. The lesion and the adjacent dewclaw were surgically excised and submitted for culture and histology. No further lesion has appeared to date.

Materials and Methods

Histopathology: Selected representative cross sections of the lesions were fixed in 10% buffered neutral formalin, embedded in paraffin, sectioned at 6 μm, and stained with hematoxylin and eosin (HE). The dimensions of fungal elements were measured using a micrometer eyepiece graticule. A sample of 20 elements was measured for each dimension recorded.

Mycology: Portions of lesions from cat 1 were cultured on sheep blood agar and Sabouraud's glucose agar with 0.01 mg thiamine/ml and incubated at 28°C. For cat 2, only Sabouraud's glucose agar was used. The minimal inhibitory concentration of nystatin was tested.[14]

Results

Cat 1

Lesions: The excised lesions were up to 5 mm deep and black on the cut surface. Histologically, a predominantly macrophage and giant cell inflammatory response comprised most of the lesions (fig. 2). A diffuse neutrophil infiltrate with scattered focal accumulations was present. Numerous foci of plasma cells and other mononuclear leukocytes occurred around the periphery of the lesions in the adipose tissue of the subcutis.

Fungal elements were demonstrated clearly in HE-stained sections. Short branching pseudohyphae with golden-brown cell walls were numerous and evenly distributed throughout the lesion. The fungi were contained largely within the cytoplasm of epithelioid macrophages and giant cells. The pseudohyphae had a mean diameter of 4 μm (range 2–6 μm) and were up to 90 μm long. They consisted of from two to over ten segments which tended to be ovoid and were 4 to 10 μm long. Single budding yeast cells of about 4 μm in diameter were also present.

Mycology: Portions of the ulcerated lesion, non-ulcerated lesion, and dry surface crusts yielded pure cultures of *M. suaveolens* on both media. Colonies were dark, velvety, and raised. Microscopically, the fungus consisted of elongated budding yeasts 3 to 5 μm in diameter that frequently formed pseudohyphae. Pseudohyphae rapidly formed single-celled, smooth, ovate, hyaline to subhyaline arthroconidia that became brown as they matured (fig. 3). Undifferentiated conidiogenous cells gave rise to acropetal chains of apiculate blastoconidia that were one-celled, hyaline to subhyaline, smooth truncate and ellipsoidal in shape (fig. 4). The chains of conidia typically were branched. The central area of the colony contained one-celled, subglobose, large, thick-walled, brown cells (fig. 5). Some chains of blastoconidia had intercalary subglobose, single-celled, thick-walled, brown cells (fig. 6).

The isolate has been deposited in the culture collection at the North Carolina Memorial Hospital as NCMH 1412. The minimal inhibitory concentration of nystatin was found to be 100 IU/ml.

Cat 2

Lesions: The excised lesion was 5 mm deep. Both its pathological features and the appearance of the fungi in sections were identical to those of lesions from cat 1.

Mycology: Microscopically, masses of dark arthroconidia were seen in the lesion material. On Sabouraud's glucose agar, pure cultures of *M. suaveolens* grew. This isolate was identical to that from cat 1 and has been designated NCMH 1710.

Discussion

Several dematiaceous fungi cause phaeohyphomycoses in cats.[3,5,13] These infections and our cases were histologically typical of phaeohyphomycosis in man and other animals.[4] *P. verrucosa* has caused phaeohyphomycosis in a cat[5] as well as chromoblastomycosis in man.[4] However, the identification of *Phialophora gougerotii* (a later synonym of *Exophiala jeanselmei*[11]) as the cause of a case of cutaneous feline phaeo-

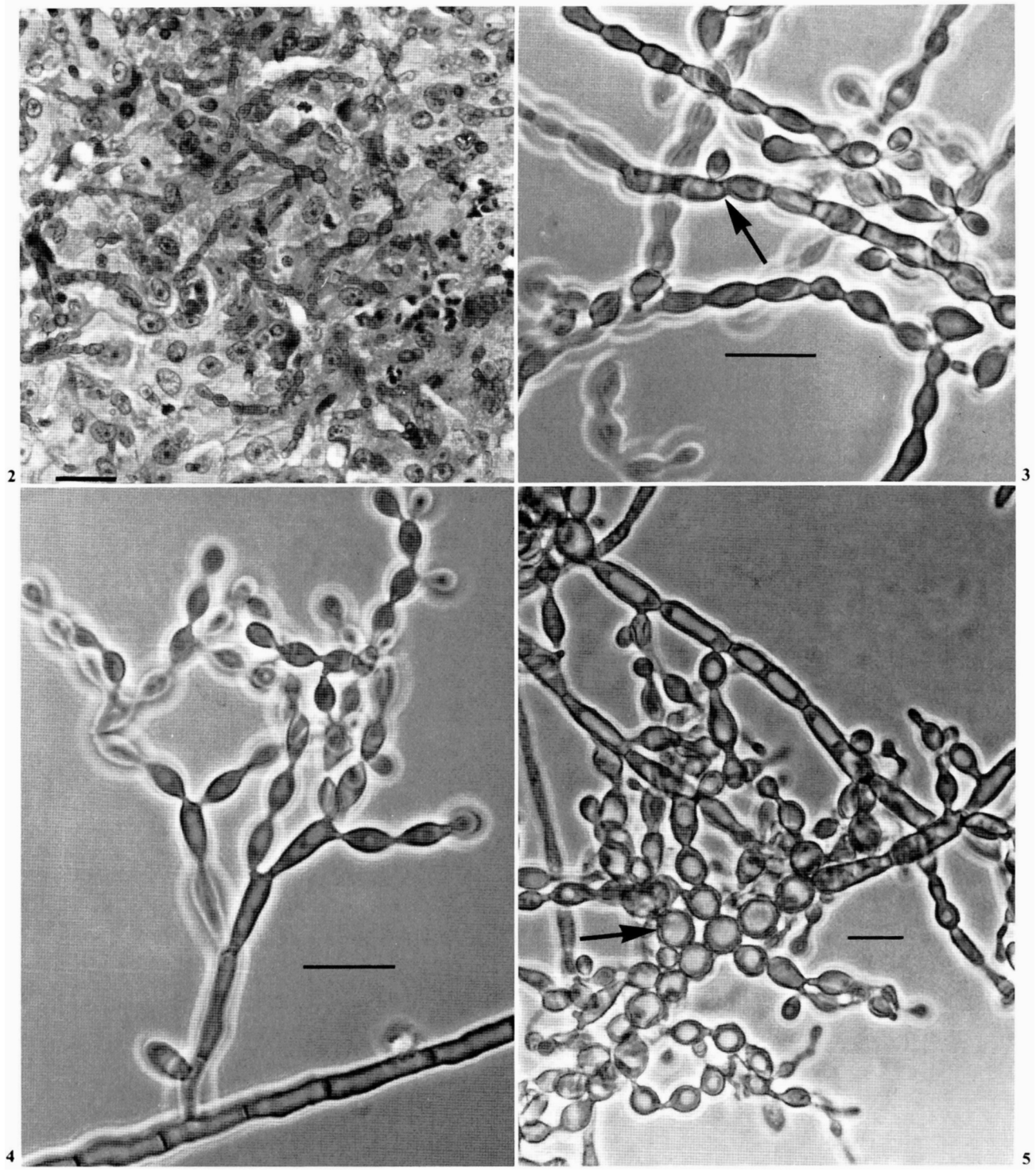

Fig. 2: Phaeohyphomycotic granuloma, cat 1. HE. Bar = 20 μm.
Fig. 3: *Moniliella suaveolens.* Young hypha (arrow) beginning to form arthroconidia. Bar = 10 μm.
Fig. 4: Acropetal chains of blastoconidia. Bar = 10 μm.
Fig. 5: Thick-walled brown cells (arrow); typically at colony center. Bar = 10 μm.

hyphomycosis[6] without isolation of the fungus is questionable.

The appearance in tissue of the fungal elements of subcutaneous phaeohyphomycosis is extremely variable, ranging from budding forms to distinct hyphae with many intermediate morphological forms. The tissue form of *M. suaveolens* which we saw consisted of occasional yeast cells producing blastoconidia and long

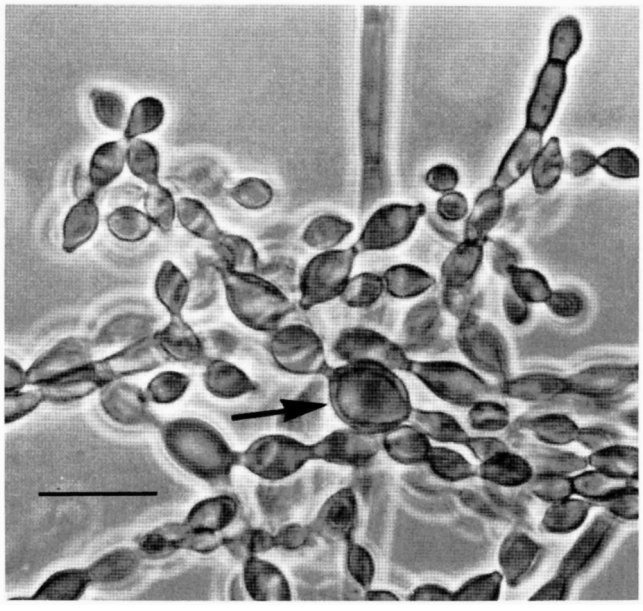

Fig. 6: Intercalary thick-walled cell (arrow) in chain of blastoconidia. Bar = 10 μm.

fungal elements that were either pseudohyphae or moniliform hyphae. Because these structures had distinct constrictions at the septa, they were probably pseudohyphae, that is, blastoconidia which remained attached to each other to form hypha-like filaments. Muriform cells or sclerotic bodies, which are characteristic of the tissue form of chromoblastomycotic fungi, were not seen in any of the tissue sections. The tissue form of *M. suaveolens* is the same as that of *E. jeanselmei*, a common cause of subcutaneous phaeohyphomycosis in man. Without cultural studies, it is not possible to determine the identity of the various agents of phaeohyphomycosis.

The genus *Moniliella* was established in 1966.[16] It contains two species, *M. acetoabutens* and *M. suaveolens*, which are distinguished from one another on the basis of growth rate and pigmentation of the conidia. *M. suaveolens* forms conidia that are initially hyaline to subhyaline and which rapidly become darker with age.[8] It forms colonies which are less than 40 mm in diameter after 30 days of incubation. In contrast, *M. acetoabutens* produces conidia which remain hyaline to subhyaline, colonies which are greater than 40 mm in diameter after 30 days of incubation, and chlamydoconidia which are dark and thick-walled.

Moniliella is similar to the genera *Trichosporonoides*, *Hyalodendron*,[8,12] *Trichosporon*, and *Blastoschizomyces*. *Moniliella* has been distinguished from *Trichosporonoides* by the development of conidia that are slightly larger in size, more rounded with narrow scars, and ends that are not truncated.[8] It is distinguished from *Hyalodendron* by forming conidia that become dematiaceous and colonies that are pale olivaceous to black in color which are initiated by a yeast form. The genera *Hyalodendron* and *Moniliella* form truncated arthroconidia and chains of blastoconidia. *Moniliella* differs from *Trichosporon* by forming chains of blastoconidia, and having colonies which are neither waxy nor cream to white in color. Species of both genera form arthroconidia and budding cells that often form pseudohyphae. *Blastoschizomyces* forms annelides which give rise to anneloconidia that divide by fission, and blastoconidia which may form rudimentary pseudohyphae. Because *M. suaveolens* var. *nigra* may form annelides, there is a distant similarity between these two fungi.

Of the various agents of subcutaneous phaeohyphomycosis reported in animals, only *Moniliella* forms arthroconidia, chains of blastoconidia, and has a yeast form that initiates the colony. Even though *E. jeanselmei* has a yeast form classifiable in the genus *Phaeococcomyces*, it is significantly different from the yeast of *Moniliella*. The yeast cells and conidiogenous cells of *Exophiala* are annelides. The phialides of *P. verrucosa* and the sympodial conidiophore giving rise to multicelled conidia produced by *D. spicifera* are distinctive for those agents of phaeohyphomycosis. Even though species of *Cladosporium* may cause either phaeohyphomycosis[9] or chromoblastomycosis, *C. carrioni* and *C. bantianum* do not form arthroconidia, a key characteristic of *M. suaveolens*.

M. suaveolens has been recovered from cheese, butter, and margarine,[8] so its growth in the fatty tissue of the subcutis is not surprising. To our knowledge, *M. suaveolens* has not been associated previously with disease in animals including man. We presume that the fungi in the subcutis of both cats studied entered directly through skin wounds. The corticosteroid treatment of cat 2 may have suppressed the inflammatory response sufficiently for the infection to prosper. Any predisposing factors to infection in cat 1 are not known.

More intensive investigation of dark lesions by veterinarians may reveal more phaeohyphomycoses in cats. Certainly, the differentiation of these lesions from melanomas is indicated.

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