SKML 2006-2 MYCOLOGY **EVALUATION**

Sample A ***Microsporum gypseum***

Pathogenicity:
M. gypseum is a geophilic fungus which can cause infections in animals (cats, dogs, rodents and horses) and humans, especially in children having frequent contacts with soil. It can infect the scalp (tinea capitis, invaded hairs show an ectothrix infection with large spores (Fig. 3)) and the skin in various body parts (tinea corporis) (2).

Distribution:
World-wide (1).

Lab diagnosis:

1. Macroscopic morphology:
   On Sabouraud agar at 30°C: colony growing rapidly (6-7 days), flat, powdery, cinnamon-tan; reverse yellowish-buff, sometimes with pinkish tinges (Fig. 1).
2. Microscopic morphology (Fig. 2):
   Macroconidia:
   Numerous, in large clusters, fusiform, 3-6(-8) compartments, thin-walled (septal- and outer cell wall thickness are the same) and set with small prickles.
   Microconidia:
   Smooth, thin-walled, club-shaped.
3. Supplementary test:
   Hairperforation test: positive (Fig. 4)

Fig. 1. Macroscopic morphology on Sabouraud agar (front)

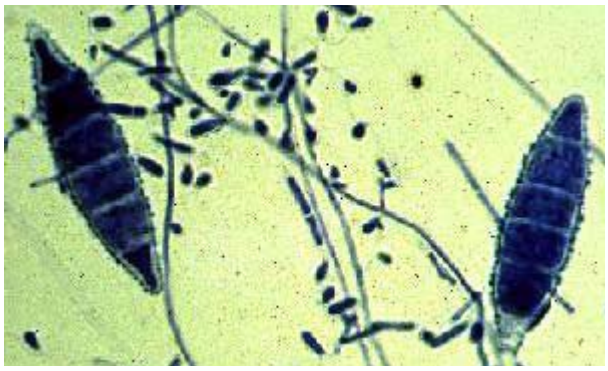

Fig. 2. Microscopic morphology

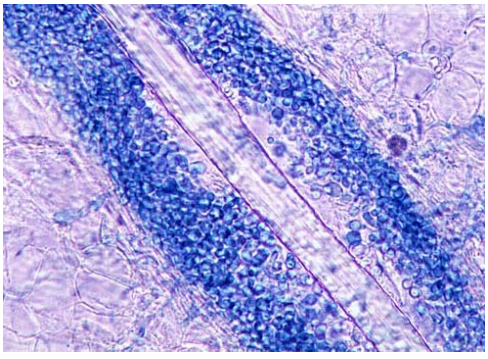

Fig. 3 Ectothrix invasion of hair

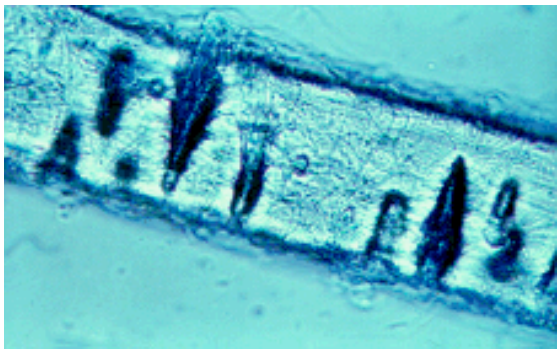

Fig. 4 Positive hair perforation test

Difference between *M. gypseum* and other species are shown below.

Strain	Macroscopic morphology	Microscopic morphology	Supplementary test(s)
M. gypseum	Flat, powdery, cinnamon-tan; reverse yellowish-buff, sometimes with pinkish tinges	Macroconidia: numerous, in large clusters, fusiform, multi-celled, thin-walled and set with small prickles. Microconidia: Smooth, thin-walled, club-shaped.	Hair perforation test: positive
M. persicolor	Expanding, powdery to fluffy, pale yellowish-buff to pinkish-buff,; reverse ochraceous.	Macroconidia: thin-walled, rough-walled at the tip, cigar-shaped, 4-7 celled. Microconidia: in dense clusters, spherical.	
M. praecox	Moderately expanding, powdery, with concentric, cloudy growth waves, buff; reverse yellow-orange	Macroconidia: moderately thin-walled, echinulate, lanceolate with narrow apex, 6-9 walled. Microconidia: when present, in orthotropic arrangement, pyriform.	Hair perforation test: negative
M. canis	Spreading, thin, wooly, strongly radiating, greyish- to tannish-white; reverse deep ochraceous-yellow	Macroconidia: 6-12 celled, rough walled, with thick cell walls and thinner septa, spindle shaped, with slightly bent rostrate apex.	
Trichophyton sp.	Waxy, glabrous or cottony, white, pinkish, yellowish or cream-coloured to brownish; reverse cream-colored, brown, red, violet or yellow	Macroconidia: 2-or multi-celled, generally thin-walled, frequently absent, smooth-walled, hyaline, cylindrical, or clavate to cigar-shaped	

Sample B ***Trichophyton erinacei***

Also known as *Trichophyton mentagrophytes* var. *erinacei*.

Pathogenicity:
T. erinacei is a zoophilic fungus associated with hedgehogs and the epidermal mites which they often harbour. Human infections occur most frequently on the exposed parts of the body; but tinea of the scalp and nails can also occur. Invaded hairs show an ectothrix infection (Fig. 3) (6)

Distribution:
Europe and sporadic New Zealand (6).

Lab diagnosis:

1. Macroscopic morphology
   On Sabouraud agar at 30°C: colonies expanding, cottony or farinose (mealy), white; reverse becoming bright lemon yellow (Fig. 5 and 6) (1).
2. Microscopic morphology
   Macroconidia:
   When present, cylindrical to clavate, variable in size, 2-6 celled (Fig. 8) (1).
   Microconidia:
   Abundant, slender, clavate, at right angles alongside hyphae, first widely interspaced, finally closer together (Fig. 7) (1).
   Arthroconidia common (1)

Fig. 5. Macroscopic morphology on Sabouraud agar (front)

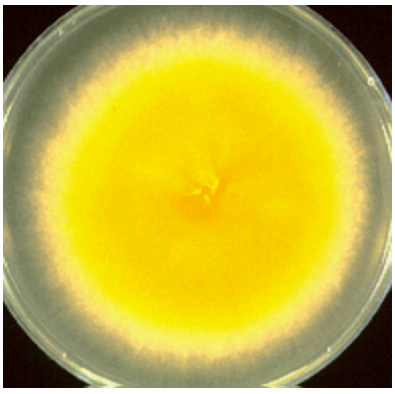

Fig. 6 Macroscopic morphology on Sabouraud agar (reverse)

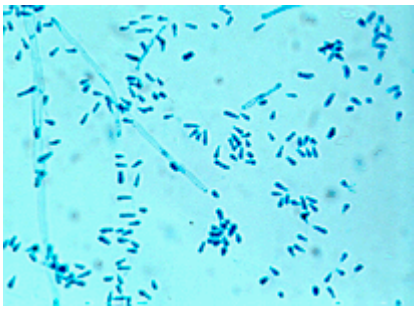

Fig. 7. Microscopic morphology Microconidia

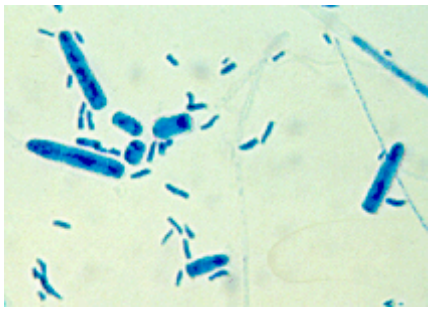

Fig. 8. Microscopic morphology Macroconidia

Difference between *T. erinacei* and other species are shown below.

Strain	Macroscopic morphology	Microscopic morphology	Supplementary test(s)
T. erinacei	Expanding, cottony or farinose (mealy), white; reverse becoming bright lemon yellow	Macroconidia: when present, cylindrical to clavate, variable in size, 2-6 celled. Microconidia: abundant, slender, clavate, at right angles alongside hyphae, first widely interspaced, finally closer together	Hair perforation test: +, - Urease: +, weak
T. mentagrophytes	Powdery to floccose, cream-coloured to yellowish-buff; reverse ochre to red-brown, occasionally yellow, or dark brown, occasionally yellow	Macroconidia: 3-8 celled, smooth- and thin-walled, clavate to cigar-shaped, usually sparse. Microconidia: in dense, grape-like clusters	Hair perforation test: +, - Urease: +
T. tonsurans	Variable; mostly suede-like white to greyish, yellowish or brownish-buff, sometimes with pinkish or pale ochraceous centre; reverse mahogany-red, yellow to brown	Macroconidia: when present, variable, often somewhat thick-walled, 2-6 celled, cylindrical to cigar-shaped. Microconidia: variable size, produced in abundance, formed on loosely clustered branches or thickened terminal hyphae.	Hair perforation test: - Urease: -,+
T. rubrum	Fluffy to cottony, white; reverse wine-red to olive, sometimes yellow	Macroconidia: mostly absent, when produced thin-walled, cylindrical to cigar-shaped. Microconidia: peg-shaped to pyriform, sessile alongside undifferentiated hyphae.	Hair perforation test: negative
T. verrucosum	Growing very slowly, heaped or button-like, glabrous, later slightly velvety, cream-colored or greish-white; reverse pale-cream- or salmon-coloured.	Sporulation absent or reduced. Macroconidia: 4-7 celled, smooth, thin walled Microconidia: ovoidal to pyriform Chlamydospores common in fresh isolates	Hair perforation test: - Urease: +
Microsporum sp.	Slow or rapid growth, powdery, cottony to glabrous, white, buff to yellowish; reverse cream-colored, reddish or yellowish.	Macroconidia: mostly arising in groups at acute angles, 2- to several-celled, thin- to thick-walled, echinulate to roughened, spindle- or cigar-shaped Microconidia: solitary, 1-celled, smooth- and thin-walled, ovoidal to clavate	

Sample C ***Geotrichum candidum***

The yeast Geotrichum is found in soil, water, air, and sewage, as well as on plants, in cereals, and dairy products. It is also found as part of normal human flora and is isolated from sputum and feces. Apart from its clinical significance, there are very recent claims on environmental damages that Geotrichum might have caused (see article Telegraph). It has been blamed for destroying the aluminium and data-storing polycarbonate resin that are found in the structure of compact discs. This in turn led to discoloration of the disc, with the disc becoming partly transparent. The exact role of Geotrichum in this destruction process requires confirmation (5).

The genus Geotrichum includes several species. The most common one is *Geotrichum candidum*.

Pathogenicity:
Geotrichum sp. is a colonizer of the intestinal tract and may cause opportunistic infections in immunocompromised host; these infections are referred to as geotrichosis. The infections are usually acquired via ingestion or inhalation. Bronchial and pulmonary as well as disseminated infections and fungemia due to Geotrichum have been reported. It has also been isolated from infections resulting from trauma (5).

Distribution:
Worldwide

Lab diagnosis:

1. Macroscopic morphology
   On Sabouraud agar at 30°C: colonies rapidly growing, white, dry, powdery to cottony (Fig. 9). When disturbed on the surface, the colony becomes yeast-like or slimy. The optimal growth temperature is 25°C. Most strains either do not grow at all or grow weakly at 37°C

2. Microscopic morphology
   Arthroconidia and coarse true hyphae are observed. Blastoconidia, conidiophores and pseudohyphae are absent. Arthroconidia (6-12x3-6 µm) are unicellular, in chains, hyaline, and result from the fragmentation of undifferentiated hyphae by fission through double septa (Fig. 10). They are either rectangular in shape or rounded at the ends resembling the barrel shape. (5)

Fig. 9 Macroscopic morphology on Sabouraud agar (front)

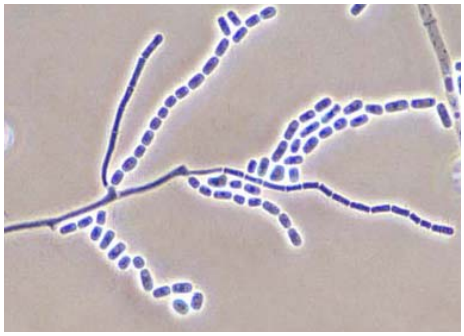

Fig. 10 Microscopic morphology

Difference between *G. candidum* and other species are shown below.

Strain	Macroscopic morphology	Microscopic morphology	Supplementary test(s)
G. candudum	Rapidly growing, white, dry, powdery to cottony	Arthroconidia (6-12x3-6 µm) are unicellular, in chains, hyaline	Most strains either do not grow at all or grow weakly at 37°C Urease: -
G. klebahni Synonym: *G. penicillatum*	White colored.	Arthroconidia	
G. capitatum	Moderate growth, whitish, butyrous	Rectangular arthroconidia often present	Growth at 40^{o}C: +
Candida sp.	Slimy or dry, white to cream-colored.		Most species growth 37^{o}C: +
Trichosporon sp.	Initially yeast-like, later becoming dry.	Arthroconidia: abundant.	Urease: +

Sample D ***Malassezia pachydermatis***

Malassezia is a lipophilic yeast found on skin and body surfaces of humans and animals. It has been shown that colonization with Malassezia may occur as early as the neonatal period. It is a member of the normal skin flora in as much as 90% of adults and may occasionally cause superficial and deep mycoses.
There are seven proposed species in the genus Malassezia based on molecular, morphological, and biochemical profiles. The most common and well-known species are *Malassezia furfur* and *Malassezia pachydermatis*.
This species is primarily associated with animals, most notably with canines, but has also been implicated in a hospital outbreak in a neonatal unit (5).

Pathogenicity:
Malassezia infections are mostly endogenous and originate from the colonized skin. They may occur in otherwise healthy individuals as well as immunocompromised hosts, such as bone marrow transplant recipients, patients with cancer or AIDS (5)

Distribution:
Worldwide

Lab diagnosis:

1. Macroscopic morphology
   On Sabouraud agar at 30^{o}C: Colonies are cream to yellowish, and typically smooth to slightly wrinkled with lobate margins (Fig. 11). *M. pachydermatis* is the only non-lipid dependant isolate in the genus Malassezia. Adequate growth occurs without addition of olive oil but some strains may exhibit enhanced growth when olive oil is added.

2. Microscopic morphology
   Yeast cells with daughter cells being produced from a very broad base and leaving behind distinct collarettes (Fig. 12).

3. Supplementary test
   Differentiated from other Malassezia sp. by its ability to grow on routine laboratory media without the addition of an oleic acid source

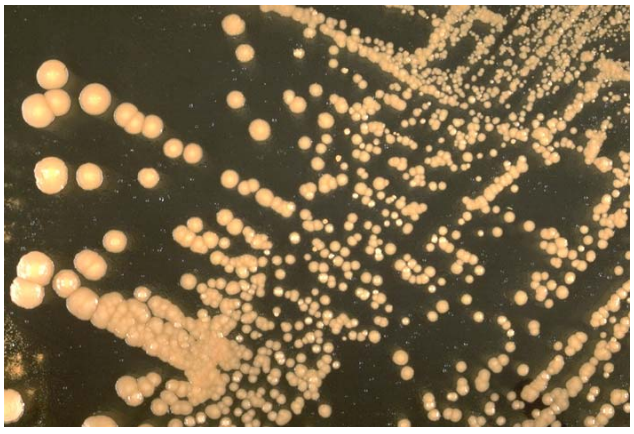

Fig. 11 Macroscopic morphology

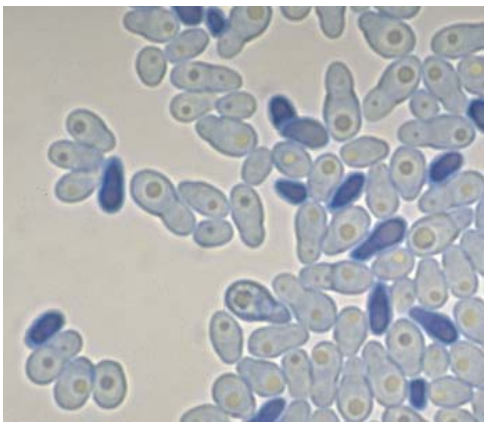

Fig. 12 Microscopic morphology

Difference between *M. pachydermatis* and other species are shown in subjoined table.

Strain	Macroscopic morphology	Microscopic morphology	Supplementary test(s)
M. pachydermatis	Cream to yellowish, and typically smooth to slightly wrinkled	Yeast cells with daughter cells being produced from a very broad base; budding monopolair	Ability to grow on routine laboratory media without the addition of an oleic acid source Growth 40^{o}C: +
M. furfur	Cream-colored to yellowish, convex or slightly wrinkled, glistering or dull; margin entire or lobed on media with lipids.	Budding percurrent; buds nearly as wide as the mother cell; budding monopolair.	Lipid dependent; no growth on routine laboratory media without the addition of an oleic acid source. Growth 40^{o}C: -
Candida sp.	Slimy or dry, white to cream-colored.	Budding cells and/or pseudomycelium present; budding multilateral.	
Zygosaccharomyces sp. Include several species of Saccharomyces and Torulaspora	Cream colored, moist	Budding multilateral.	
Trichosporon sp	Initially yeast-like, later becoming dry.	Arthroconidia: abundant.	

The inquiry shows that of all participants:

- 20% identify Malassezia as non-Malassezia sp.
- 12% do not perform Malassezia culturing. From this 12% 57% identifies *M. pachydermatis* as non-Malassezia. *M. pachydermatis* growth on Sabouraudagar is identified with the regular yeast identification methods, this lead to mis-identifications.
- 6% only perform microscopic examination of clinical material in case of Malassezia request; this lead to false negative results.
- 80% perform dermatophyte identification according to macroscopic- and microscopic descriptions and literature; 2% use PCR techniques; 18% did not indicate the sort of dermathophyte identification.
- 15% identify Microsporum as Trichophyton sp.; from this 15% 63 % did not indicate the sort of dermatophyte identification.
- 2% identify Trichophyton as Microsporum sp..
- 7% mis-identify Geotrichum; these participants use Auxacolor 2-, Api Candida- and Vitek system for yeast identification. 16% of all participants did not indicate the sort of yeast identification they used.

Literature

1. de Hoog GS, Guarro J, Gené J, Figueras MJ. Atlas of clinical fungi. 2nd ed. Nederland: Centraal bureau voor schimmelcultures, 2000
2. Andreoni S., Farina C., Lombardi G. Medical mycology atlas. GRAFIK@rt srl – Paderno Dugnano, 2004
3. Larone DH. Medically important fungi. ASM Press, 2002
4. Kane J., Summerbell R., Sigler L., Krajden S., Land G. Laboratory handbook of dermatophytes. Star publishing company, 1997
5. http://www.doctorfungus.org
6. http://www.mycology.adelaide.edu.au/

The macroscopic descriptions is according to the literature above. This may differ from your results that can depend on the composition of the Sabouraud agar plates.

Brun S, Bouchara JP, Bocquel A, Basile AM, Contet-Audonneau N, Chabasse D. Evaluation of five commercial Sabouraud gentamicin-chloramphenicol agar media. Eur. J. Clin. Microbiol. Dis. 2001; 20:718-723

Telegraph.co.uk

SCIENTIST FINDS FUNGUS THAT EATS THROUGH COMPACT DISCS

By Robert Uhlig, Technology Correspondent
(Filed: 18/06/2001)

FIRST there was the computer virus. Now scientists have found a fungus that eats compact discs.

Victor Cardenes, of Spain's leading scientific research body, stumbled across the microscopic creature two years ago, while visiting Belize. Friends complained that in the hot and sticky Central American climate, a CD had stopped working and had developed an odd discoloration that left parts of it virtually transparent.

Dr Cardenes and colleagues at the Superior Council for Scientific Research in Madrid discovered a fungus was steadily eating through the supposedly indestructible disc. The fungus had burrowed into the CD from the outer edge, then devoured the thin aluminium layer and some of the data-storing polycarbonate resin.

Dr Cardenes said: "It completely destroys the aluminium. It leaves nothing behind." Biologists at the council had never seen this fungus, but concluded that it belonged to a common genus called geotrichum.

Philips, the Dutch electronics company that invented the compact disc, said it believed the Belize case was probably a freak incident caused by extreme weather conditions.