

MYCOLOGY OVERVIEW

1. OVERVIEW. It is estimated that there are 1.5 million extant species of fungi on Earth, of which 60,000 have been described/named; of these only approximately 400 species have ever been described to cause disease in humans and only approximately 20 do so with any frequency. Many others are plant pathogens or symbionts. At least 13,500 fungal species form lichens, symbiotic partnerships between fungi (usually ascomycota) and photosynthetic microbes (eg. algae, cyanobacteria).

2. CLASSIFICATION. There are several confusing/overlapping classifications systems for fungi.

2.1 Biological

Kingdom FUNGI; Phyla:

2.1.1 Phylum Zygomycota – Agents of zygomycosis, “mucormycosis”. Most primitive fungi. Broad, ribbon-like hyphae, no septae. Generally grow fast on agar (“lid-lifters”).

2.1.1.1 Order Mucorales – eg. Rhizopus, Rhizomucor, Mucor, Saskanaea, Cuninghamella

2.1.1.2 Order Entomophthorales – Basidiobolus, Canidiobolus

2.1.2 Phylum Basidiomycota – Mushrooms, jelly fungi, smuts, rusts, stinkhorns . . . and the teleomorph of cryptococcus!

2.1.3 Phylum Ascomycota – e.g. Pseudoallescheria, Curvularia, Saccharomyces.

2.1.4 Phylum Deuteromycota, or Fungi Imperfecti.

Not a true phylum. Contains asexual (“imperfect”) forms of fungi (anamorphs), most of which have not had a sexual form described. Most human pathogens are in this group – eg: Aspergillus, Candida, Cryptococcus, Scedosporium, Alternaria, Trichophyton, Cladosporium etc. etc.



1. Sporotrix at 37 and 25 degrees; 2. Aspergillus fumigatus, niger, terreus, flavus (L to R); 3. Candida albicans

2.2 Morphological

2.2.1 Broad classification - Yeasts, Moulds and Dimorphic Fungi

2.2.1.1 Yeasts are single-celled organisms which reproduce by budding and grow as smooth colonies on agar. e.g. Candida, Malassezia, Cryptococcus, Trichosporon.

2.2.2.2 Moulds form “mycelia”, a collection of branching hyphae which may bear spores, and grow as furry large colonies. e.g. Aspergillus, and most human pathogens.

2.2.2.3 Dimorphic fungi grow as yeasts at 37 degrees (and within hosts) and moulds at 25 degrees (and in the environment). e.g. Histoplasma, Coccidioides, Paracoccidioides, Blastomyces and Sporothrix. The first 4 are the “endemic dimorphic mycoses” and are dangerous to lab staff.

2.2.2 More detailed but non-biological morphological classification of moulds

2.2.2.1 Dematiaceous (pigmented) moulds.

Top 10: Alternaria; Biploaris; Cladosporium; Curvularia; Exophiala; Fonsecaea; Phialophora; Phaeoacremonium; Scedosporium; Veronaea.

2.2.2.2 Hyaline (non-pigmented) moulds.

Top 10: Acremomium; Aspergillus; Beauveria; Fusarium; Geotrichum; Madurella; Paecilomyces; Penicillium; Scopulariopsis, Trichoderma

2.2.2.3 Zygomycetes – see above

2.3 Clinical

2.3.1 Superficial (No host immune response)

Syndrome	Synonyms/Notes	Causative Organisms
Tinea versicolor	Pityriasis versicolor	Malassezia furfur (a yeast)
Tinea nigra		Exophiala werneckii
White piedra		Trichosporon beigellii

2.3.2 Cutaneous

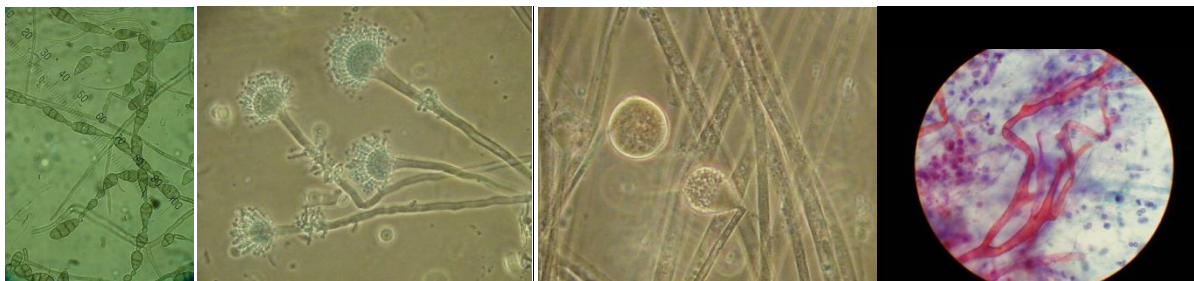
Syndrome	Synonyms/Notes	Causative Organisms
Dermatophytosis	Ringworm. Tinea capitis, tinea crura, unguum, manum, pedis etc	Genera: Microsporum, Trichophyton, Epidermophyton
Candidiasis (nb role of low cell mediated immunity in HIV)	Of mucous membranes, hair, nails. Thrush; paronychia	Candida spp.

2.3.3 Subcutaneous (usually implantation infections)

Syndrome	Synonyms/Notes	Causative Organisms
Sporotrichosis		Sporothrix schenckii
Chromoblastomycosis	Plaque-like skin lesions. Implantation. Tropics	Fonsecaea, Phialophora, Cladosporium
Mycetoma	“Madura foot”. Draining sinuses with sulphur granules. Eumycotic mycetoma (fungi); other (Actinomycetes, Nocardia)	Madurella, Acremonium, Exophiala, Pseudoallescheria
Zygomycosis	Usually subcutaneous but can invade further	See 2.1.1

2.3.4 Invasive (apart from dimorphic, usually in compromised hosts)

Syndrome	Synonyms/Notes	Causative Organisms
Dimorphic systemic mycoses		See 2.2.2.3
Phaeohyphomycosis	Dematiaceous fungi. Can be subcutaneous or deep	Cladosporium, Exophiala, Wangiella, Bipolaris, Curvularia
Hyalohyphomycosis	Non (or less) pigmented fungi	Penicillium, Paecilomyces, Fusarium, Scopulariopsis
Aspergillosis	Really a hyalohyphomycosis, but so common that it deserves its own category	Aspergillus fumigatus, flavus, terreus, nidulans, nigrans



1. Alternaria spp; 2. Aspergillus fumigatus 3. Apophysomyces elegans; 4. Rhizopus spp (bronchial washing)

NOTES: All photos were taken by Josh Davis. Recommended sources for further info: 1. Books: Margulis L and Schwarz K, Five Kingdoms, Freeman and Co 1998. 2. Mandell 3. Website: www.mycology.adelaide.edu.au (David Ellis’ site).