

Fungi

General characterized of Fungi:

- Eukaryotic
- Non photosynthetic "distinguished them from plant and algae "
- Unicellular to filamentous.
- Rigid cell wall .
- Reproduce by sexual and asexual reproduction.
- Most fungi prefer moist environment with humidity of 70% or more.
- Can grow at (-6) to 50C with optimal temp for it is (20-35C).
- Most fungi grow well on acidic ph=5 or below &thus grow well on sabourad agar
- Fungi produce antibiotic example:

Penicillin produced from penicillium fungi .

- Fungi can form symbiotic relationship ((mutually beneficial relationship)) example:
 - **Lichens** : fungi grow with algae .
 - **Mycorrhizas** : fungi grow among plant root .

Structure and function:

-Mycelium (mold): mass of hyphal elements.

- Conidia (spore): aerial hyphae often produce asexual reproduction

There are two type of conidia: -

- 1- Macroconidia.
- 2- Microconidia.

* When the conidia are enclosed in sac called ((endospore))

Cell wall of fungi:

Cell wall rigid composed of:

- Chitin
- Mannans
- Glucans
- Protein.

Different between fungi and bacteria:

Deference	Fungi	Bacteria
Cell wall	Chitin – mannans –glucan Protein	Peptidoglycan
Cell membrane	Sterol present	Sterol absent
ell type	Eukaryotic	Prokaryotic

Fungi Morphology:

- Yeast
- Mould
- Dimorphic.

Yeast:

- Unicellular
 - Oval to round.
 - Reproduce by budding.
 - Pasty colonies
- Most classified with ascomycetes.

Mould:

- Multicellular
 - Hyphae spore.
 - Cottony woolly granular.
- Cell joined in thread – like strand.

Dimorphic:

- Capable growing in mould and yeast.

Classification of hyphae:

- Septate: hyphae with septa.
- Non septate "aseptate": (coenocytic): Hyphae lacking septate.

Definitions

- **Monokaryotic:** compartment has single nuclei.
- **Dikaryotic:** compartment has two nucleus.
- **Heterokaryotic:** dikaryotic or multinucleate has nuclei from genetically distinct individuals.

- ☒ Homokaryotic: hyphae have nuclei are genetically similar to one another.
- ☒ All fungi are heterotrophs ((organism that require organic carbon source))
- ☒ Do not chlorophyll.
- ☒ Anamorph: asexual stage ((Mitosis))
- ☒ Teleomorph: sexual stage ((Meiosis))

Asexual spore:

- Conidiospore
- Sporangiospore.
- Arthrospore.
- Chlamydospore.
- Budding.

Examples for asexual spore:

- Rhizopus species.
- Aspergillus species.
- Penicillium species.

Examples Sexual spore:

- Zygosporangium.
 - Ascospore.
 - Basidiospore.
 - Oospore.
- ☒ Sexual spore resistance to drying, heat & freezing.

Fungi Taxonomic Classification:

- **Depend on type of sexual spore**

Sexual spore	Class	Hyphae
Zygospor	Zygomycetes	Coenocytic (Non-Septate)
Basidiospor	Basidiomycetes	Septate
Ascospore	Ascomycetes	Septate
Non spore	Deuteromycetes	Septate
Oospore	Oomycetes	Coenocytic (Non-Septate)

Kingdom of Fungi:

- 1- Zygomycota: zygospor fungi
- 2- Ascomycota: sac fungi
- 3- Basidiomycota: club fungi
- 4- Deuteromycete: imperfect fungi
- 5- Oomycota: water molds

Sexual Reproduction hyphal nuclei are haploid, it includes:

1- **Plasmogamy**: fusion of cytoplasm from hyphae of two " mating types " to give heterokaryotic cell.

2- **Karyogamy**: fusion of nuclei to give multinucleated diploid cell.

3- **Meiosis**: later give haploid spores.

☒ Spores: can formed in the sexual or asexual part of life cycle.

Zygomycota:

- Zygote fungi (bread molds)
- Some are parasites & grow on stored food e.g.: *Rhizopus* spp ((black bread mold))
- Zygomycosis caused by:
 - *Rhizopus* spp
 - *Absidia* spp
 - *Mucor* spp

Ascomycota:

-Sac fungi (yeast, cup fungi and morels, and form sac- shape spores))

- Body yeast or mycelium

-Decomposer and pathogens.

-Candidiasis (yeast infection): caused by *Candida albicans*, found in New-born and AIDS, it also causes diaper rash

Basidiomycota:

- Club fungi ((Mushrooms and puffballs))
- Spores are formed in club shaped.

Deuteromycota:

- Imperfect Fungi
- Sexual reproductive is unknown.
- There are beneficial ((penicillin form penicillium)) ((soy sauce and citric acid from Aspergillus)) and Harmful ((Aspergillus toxic if inhaled)).
- Aspergillosis causes Aspergillus

Classification of fungal diseases:

- ☒ Any fungal infections are mycosis
- ☒ There are 5 groups according the degree of tissue involvement:
 - Systemic (Endemic)
 - Subcutaneous.
 - Cutaneous.
 - Superficial.
 - Opportunistic.

Systemic: The infection deep in the body

- include histoplasmosis & coccidioidomycosis.

Systemic mycosis:

- 1- Histoplasma capsulatum: cause histoplasmosis.
- 2-Blastomyces dermatitidis: cause blastomycosis.
- 3- paracoccidioides brasiliensis: cause paracoccidioidomycosis
- 4- coccidioides immitis: cause coccidioidomycosis.
- 5- Cryptococcus neoformans: cause meningitis in HIV and AIDS.

Subcutaneous

- the infection is beneath the skin. (dermis, muscle, fascia) - caused by saprophytic fungi, enter through puncture wound , example of disease is sporotrichosis .

Subcutaneous mycosis

- *Sporothrix schenckii*: cause sporotrichosis.

. Cutaneous:

- They infect only hair, nails, epidermis
- dermatophytes produce enzyme degrade keratin (keratinase).
- can spread by contact.
- dermatophytes include: - trichophyton, epidermophyton, microsporum.

Cutaneous mycosis:

- Ringworm and tinea: cause dermatophytes.

Superficial:

- ☒ localized along hair shafts and in superficial (surface) epidermal cells.
- ☒ prevalent in tropics (hot and wet area)

Superficial mycosis:

- *Exophiala werneckii*: cause Tinea nigra
- *Piedraia hortai*: cause Black Piedra.
- *Trichosporum beigeli*: cause White Piedra.

Opportunistic

- ☒ Harmless in normal habitat but can become pathogen if given the opportunistic "

Opportunistic mycosis :-

- Candida albicans: cause candidiasis
- Aspergillus: cause aspergillosis.

Opportunistic mycosis seen in the people with

- AIDS
- Diabetes mellitus
- Malignancy.
- Immunosuppressive therapy

Laboratory diagnosis of mycosis:

- ☒ Direct microscope examination: - Gram stain, KOH, India Ink
- ☒ Cultures:
 - Sabouraud dextrose agar ((favor fungi growth because of the low PH))
 - Mycobiotic agar.

Identification of yeast: -

- Biochemical tests.
- Behavior in broth and serum (germ tube)
- behavior in cornmeal agar (pseudohyphae formation)

Antifungal Agent: -

- Azoles
- Pyrimidine
- Miscellaneous