Lecture No.1

Mycology = Study of Fungus

Fungus: is a member of a large group of eukaryotic organisms, filamentous, heterotrophs with cell walls made of chitin that includes microorganisms such as yeasts and molds, as well as mushrooms. These organisms are classified as a kingdom Fungi, which is separate from plants, animals, protists and bacteria.

Why Study Fungi?

-Are microorganisms can cause human disease directly or by toxins.

-Can affect plants we eat.

-Wheat rust is a fungus.

-The famous potato famine in Ireland was caused by a fungu.

Role of fungi in the economy

A) **Industrial uses of fungi**

1- Mushrooms (Class Basidiomycetes) .

2- Natural food supply for wild animals .

3- Yeast as food supplement, supplies vitamins.

4-Fungi used to alter texture, improve flavor of natural and processed foods .

B. Fermentation : Metabolic activities, particularly yeasts, are used in many industrial fermentation processes (wine, cheese, bread).

C- Antibiotics : First observed by Fleming; noted suppression of bacteria by a contaminating fungus of a culture plate.

D - Plant pathology : Most plant diseases are caused by fungi.

E- Medical importance : Species recognized are human pathogens , and to be pathogenic, they must tolerate the temperature of the host site and possess enzymatic system that allows them to parasitize animal tissues.

Used to produce Antibiotics and other drugs Penicillium, Streptomycium , Cephalosporin , Cyclosporin.

Habitat and Nutriention of Fungi:

All fungi are heterotrophs; that is, they require some preformed organic carbon source for growth. Fungi do not ingest food particles as do organisms such as protozoa, but depend upon transport of soluble nutrients across their cell membranes.

They accomplish this by growing through and within the substrate on which they are feeding. Numerous hyphae network through the wood, cheese, soil, or flesh from which they are growing. The hyphae secrete digestive enzymes which break down the substrate, making it easier for the fungus to absorb the nutrients which the substrate contains.

Therefore, the natural habitat of almost all fungi is soil or water containing decaying organic matter.

***General Properties of Fungi:**

1- Fungus is a member of eukaryotic organisms which includes yeasts and

Molds.

2- Scientific study of fungi is known as mycology.

3- Fungi feed by absorption of nutrients from environment.

4- Hyphae secrets digestive enzymes which breaks down the substrate and makes it easier for fungus to absorb the nutrients

5- Fungi vary widely in size & shape from unicellular microscopic organism

to multicellular organism.

6- Spore size, shape & structure are used in the classification & identification

of fungi.

7- Hypae and other structures form mycelium.

8- Fungi reproduces sexually and asexually.

9- Fungi that produce asexual spore are Deuteromycetes fungi imperfect.

10- Fungi are classified based upon hypae, spore and reproduction.

11- Colony morphology are used to describe individual colony of fungi.

12- Fungal infections are localised skin infections and systemic infections.

13- Mycoses are diseases caused by fungi.

***Fungi form two key mutualistic symbiotic associations:**

1- Lichens: A lichen is a mutualistic symbiotic association between a fungus and a photosynthetic algae or cyanobacterium.

2-Mycorrhizae: Mycorrhizae are mutualistic symbiotic associations between fungi and the roots of plants.

*MORPHOLOGY OF FUNGI

(a) **General:** Fungi vary widely in size and shape, from unicellular, microscopic organisms to multicellular forms easily seen with the naked eye. Individual cells range from 1 µ to 30 µ. Microscopic fungi exist as either molds or yeasts or both. Internally, fungal cells are fairly typical eucaryotic cells.

(b) **Molds:** The molds form large multicellular aggregates of long branching filaments, called hyphae. There are vegetative hyphae and reproductive hyphae. Spores are borne on the reproductive hyphae. (Fungal spores should not be confused with bacterial spores that are resistant bodies formed for bacterial survival rather than reproductive purposes.) Spore size, shape and structure are used in the classification and identification of fungi. The tube-like hyphae are responsible for the fluffy appearance of the macroscopic mold colony. The hyphae and other structures combine to form an elaborate network called a mycelium.

(c) **Yeasts:** These are large (5 to 8 µ), single-celled organisms that rarely form

filaments. Most yeasts reproduce by the asexual process of budding. Yeast colonies are usually characterized by a smooth surface similar to that of many bacteria.

PHYSIOLOGY OF FUNGI:

a**) Nutrition:** Most fungi contain complex enzymes and other chemical

substances which, when diffused into the host, break down the complex

substances available – wood, vegetation, leather, bread, and so forth – into

simpler substances that can be used for food. The chemical products of

digestion are, therefore, completed outside of the organism, and the fungus absorbs the end products..

b) Reproduction: Fungi reproduce sexually or asexually, or both, depending upon the species and the environmental conditions. As the name implies, sexual reproduction is the result of the union of two spores. Most fungi reproduce both sexually and asexually. Those that produce only asexual spores are known as Deuteromycetes Fungi imperfecti. This group is important because it contains most of the pathogenic fungi. The yeasts reproduce both by spores and by a process known as budding, which is similar to binary fission. The yeast cell forms a small knoblike protrusion, or bud, that separates from the mother cell and grows until it reaches full size, at which time the process is repeated.

c) Growth: Fungi grow well under the same conditions that favor the growth of bacteria – warmth and moisture. It is for this reason that fungal infections pose a serious problem to troops in the tropics. As the temperature decreases, fungal activity also decreases; however, the spores are very resistant to cold, some surviving freezing temperatures for long periods of time. On the other hand, fungi are easily killed at high temperatures.

Laboratory identification:

Most fungi can be propagated on any nutrient agar surface. The standard medium is Sabouraud dextrose agar, which, because of its low pH (5.0), inhibits bacterial growth while allowing fungal colonies to form. Various antibacterial antibiotics can also be added to the medium to further inhibit bacterial colony formation. Cultures can be started from spores or hyphal fragments. Clinical samples may be pus, blood, spinal fluid, sputum tissue biopsies, or skin scrapings. Identification is usually based on the microscopic morphology of conidial structures. Serologic tests and immunofluorescent techniques are also useful in identification of fungi from clinical isolates.

CLASSIFICATION OF FUNGI

Fungi are usually classified according to biological taxonomy based upon the type of hypha, spore, and reproduction. There are four classes of fungi,

a) Class Phycomycetes: The algal fungi: bread molds and leaf molds. The only known mycosis (fungal disease) caused by fungi of this class is mucormycosis, a very rare fungal growth of the upper respiratory tract, bronchial mucosa, and lungs. It occurs largely as a complication of a chronic, debilitating disease, such as uncontrolled diabetes.

b) **Class Ascomycetes.** The sac fungi: yeasts, mildews, and cheese molds. Fungi of this class are implicated in only three fungus diseases, all of which are rare.

c) **Class Basidiomycetes**. Mushrooms, toadstools, rusts, and smuts. The only

pathogens in this class are the mushrooms of the genus Amanita, which cause severe systemic poisoning (sometimes death) when eaten.

d) **Class Deuteromyceters.** Fungi imperfecti: a heterogeneous collection of fungi without sexual reproduction. Most of the pathogens encountered in medical mycology belong to this class.