Fungi:

It is simple, heterotrophic organism ranging from unicellular to multicellular form. They are eukaryotic in nature. They are generally grown on that substratum which is very rich in organic solvent.

The name mycota derived from the word ‘mykos’ which means mushroom.

Characteristics:

1. They are commonly grown on death and decayed part of living organism which are very rich in organic substances (molecules).
2. The plant body is thallus.
3. The vegetative body is thread like structure named as hypha. It is unified to give rise mycelium.
4. The hypha contains numerous cells which may or may not septate.
5. They are generally multicellular. Some are unicellular. eg: Yeast.
6. Cell wall is made up of chitin.
7. Chlorophyll is absent. Hence are of heterotrophic.
8. They are generally saprophytic. Some are parasite and some are symbiotically associated with others.
9. Reserve food material is in the form of glycogen.
10. Vascular tissue is absent.

Reproduction:

Fungi reproduce all of the three different ways.

1. **Vegetative reproduction:** The reproduction which occurs from vegetative part of the plant is known as vegetative reproduction. It is again divided into following headings.
   a. **Fragmentation:** It is the reproduction where vegetative plant body breaks up into numerous small fragments due to various reasons. Each of these fragments germinates into a new individual under favourable condition.
   b. **Fission:** The mature vegetative cell splits into two equal daughter cells followed by a constriction. Each daughter cell develops into a new vegetative cell.
   c. **Budding:** Here, the mature vegetative cell produces a small outgrowth, the bud. It is finally separated from the mother cell by a constriction and survives independently. There is only one or large number of buds is formed at the same time.
   d. **Oidia:** In some fungi, the hyphae break up into numerous small rounded or oval segments, called oidia. Each oidium behaves as an accessory spore and germinates to form a new individual under favourable condition.

2. **Asexual reproduction:** Asexual reproduction takes place by means of spores. The spores are the most common types of the reproductive units. They are small usually unisexual asexual spores that are formed various ways.
   a. **Sporangiospores:** These are produced in special sac-like structure called sporangium. The sporangium borne on a specialized hypha called sporangiophore. The motile sporangiospores are called zoospores and non-motile sporangiospores are called aplanospores.
   b. **Conidia:** These are non-motile asexual spores produced at the tip of ordinary vegetative hypha or specialized hypha known as conidiophores. The conidiophores may be free from each other or aggregated to form complex structure. Conidia are formed singly or in chains.
3. **Sexual reproduction:** The sexual reproduction is carried by the fusion of two nuclei which may contain motile or non-motile gametes in gametangia or somatic cells of the thallus. There are three different phases in sexual reproduction.
   a. **Plasmogamy:** It consist the union of two protoplasts to bring two haploid nuclei of opposite sex together in one cell.
   b. **Karyogamy:** It consist the fusion of two nuclei resulting in the formation of diploid nucleus.
   c. **Meiosis:** The diploid nucleus undergoes reduction division to reduce the number of chromosomes to the haploid number.

Mucor:

It is commonly known as black mould which is widely distributed. They are mostly saprophytic grown on bread, jam, jellies, cheese, pickles, leather, dung etc.

Vegetative structure:

It consists of long slender much branch coenocytic hyphae. The hyphae spread in all directions over the substratum.

Reproduction:

It reproduces asexually as well as sexually.

Asexual reproduction: It reproduces asexually by spores and oidia.

Sexual reproduction: It is carried by the fusion of two nuclei of two different strains.

There are found numerous aerial hyphae developed from prostrate hyphae. Among them, two arial hyphae act as gametangia that grow parallel to each other. These two hyphae developed from either same or different prostrate hyphae.

These hyphae produce small protuberance towards opposite sides with each other. They continuously grow and meet with each other. The tip of protuberance then

degenerates by which two nuclei from opposite hyphae fuse with each other. Then zygote is form which turns into zygospore with thick outer wall. Then it undergoes meiosis and enters into resting period. Out of four cells formed meiosis, three cells are degenerated and only one functional. This functional one then absorbs water and swells up and germinates to produce new hyphae.

Aspergillus:
It is widely distributed genus. They grow mostly as saprophytes on almost all the dead organic materials like decaying vegetables, damp fruits, fatty substances like butter, ghee, starchy materials like bread, rice, jam, jellies, wood and leather goods.

Vegetative structure:
The somatic body consists of profusely branched mycelium. Mycelium consists of a loosely interwoven mass of much branched septate hyphae. The hyphae distribute in and on the surface of substratum and serve to absorb food materials.

Reproduction: It reproduces vegetatively, asexually and sexually.
Vegetative reproduction: It takes place by fragmentation.
Asexual reproduction: It takes place by conidia.
Sexual reproduction: The male and female sex organs are formed close together on the hyphal branches of the same mycelium. They are multicellular structures.
The female sex organ arises as a tightly coiled multicellular hyphal branch. The male sex organ arises as a upright branch either from the same hyphae or from an adjacent one. A single celled antheridium is cut off at its apex which is unicellular and multinucleate. The male and female branch may become coiled around each other. The antheridium may fuse with the female structure and male nuclei pass into the female nuclei where they pair with each other.
After pairing of the nuclei, the female nucleus becomes divided into a number of binucleate cells from which hyphae begin to form.
The young ascus is binucleate. After the fusion of nuclei with the ascus, the diploid nucleus is formed. It undergoes successive divisions after meiosis to form eight haploid nuclei. Then it turns into ascospore. The mature asci are globose, ovoid or pear shaped which undergoes germinates by germ tube to produce a new mycelium.

Penicillium:
It is widely distributed genus. It is commonly called blue mould or green mould. They grow mostly saprophytic on decaying fruits, vegetables, breads meat, jellies etc.

Vegetative structure:
The vegetative body is a mycelium which consists of freely branched, hyaline or coloured, septate hyphae. The cells of the hyphae are thin walled and contain more than one nucleus.

Reproduction:
It reproduces asexually and sexually.

Asexual reproduction: It takes place by conidia.

Sexual reproduction: The sexual stages are not known for most species but in some species the sexual reproduction takes place by functional male and female gametangia (antheridia and ascogonia).

Ascogonium arises as an erect, long and tubular branch from uninucleate mycelium. The nucleus divides to form 32-64 nuclei.

Antheridia arise generally from adjacent hypha. It grows and coil around ascogonium and cuts off an apical cell. The tip of antheridium is opposed to the ascogonium. Then the common wall becomes degenerate and antheridial nuclei migrate into ascogonium.

The multinucleate ascogonium divides and redivides to give rise ascospore mother cell. It undergoes meiosis to produce ascospores.

These ascospores release after maturation by decaying the wall of ascocarp. They start to germinate after getting suitable environment.

Difference between edible and poisonous mushroom

Economic Importance:

1. The fungi are used as food. eg: morels, mushroom, yeast.
2. The fungi are used for fermentation.
3. Some species of *Penicillium* are used in cheese industry.
4. Various kinds of enzymes are synthesized by using different fungi. eg: amylase, pectinase, protease are produced by *Aspergillus oryzae*; rennet protease is produced by *Mucor* sp.
5. Different fungus produces various vitamins. eg: Yeast produce vit. B and Ergosterol (precursor of vit. D), *Rhodotorula gracilis* produce vit. A.
6. Various antibiotics are produce by different fungi. eg: *Penicillium notatum* produce penicillin, *Aspergillus fumigatus* produce fumigatin and fumagillin, *Aspergillus clavatus* produce patulin, *Ustilago maydis* produce ustilagic acid etc.
7. Ephedrine, extracted from yeast, is used in asthma disease.
8. *Claviceps purpurea* contain a number of alkaloids as ergotamine, ergometrine, ergometrinine and ergotaminine which are used to induce uterine contraction

and to check haemorrhage after child birth. These are also used in the treatment of certain circulatory disorders and migraine headache.

Lichens:

Lichens are composite organisms consisting of a symbiotic association of a fungus (the mycobiont) with a photosynthetic partner (the photobiont or phycobiont), usually either a green alga (commonly *Cladophora, Trentepohlia*) or cyanobacterium (commonly *Nostoc, Rivularia*). The morphology, physiology and biochemistry of lichens are very different from those of the isolated fungus and alga in culture. Lichens occur in some of the most extreme environments on Earth— arctic tundra, hot deserts, rocky coasts and toxic slag heaps. However, they are also abundant as epiphytes on leaves and branches in rain forests and temperate woodland, on bare rock and on exposed soil surfaces.

Classification of Lichen

Lichens are named based on the fungal component, which plays the primary role in determining the lichen's form. The lichen fungus is typically a member of the Ascomycota—rarely a member of the Basidiomycota, and then termed **basidiolichen** to differentiate them from the more common **ascolichens**.

Structure of Lichen

The vegetative body consists of thallus. The size of thallus varies from 1 mm to 1 meter in diameter. In colour, it is grayish green, white, orange, yellow yellowish green, brown or black. According to its external appearance, they are of three types:

1. Crustose lichen: Crustose is a habit of some types of algae in which the plant grows tightly appressed to a substrate forming a biological layer of the adhering organism. Many lichens also grow close to the surface of rocks, tree trunks and other substrata, and are referred to as crustose lichens. It cannot be separated without damaging it. eg: *Graphis, Lecanora*, *Lecidea, Verrucaria* etc.

2. Foliose lichen: these lichens occur as flat and leaf-like lobed thalli, attached to the rocks and twigs by means of rhizoid like outgrowths, called rhizinae. The rhizinae develop from the lower surface of the thalli. eg: *Physcia, Parmelia, Collema* etc.

3. Fruticose lichens: They have a much branched, cylilndrical or ribbon-like thallus, which is either upright. These are attached to the substratum by their basal portions composed of strands of densely packed hyphae. The thalli show no differentiation into an upper and lower surface. eg: *Usnea, Cladonia, Ramalina* etc.

Economic Importance of Lichens

1. Food: Lichens are eaten by many different cultures across the world. Although some lichens are a staple food or even a delicacy. Very few lichens are poisonous, but those high in vulpinic acid or usnic acid are toxic. Most poisonous lichens are yellow.

2. Medicine: Several species of lichen were of use in the treatment of various diseases, but today, they have been replaced by more effective drugs. *Lobaria pulmonaria* was used for the treatment of lung diseases, *Xanthoria parientina* was used in cases of jaundice, *Peltigera canina* was used in hydrophobia, *Cladonia pyxidata* used in whooping cough.

3. Perfume: Several species of lichens are used in the preparation of dhup, hawan samagris and other perfumes. *Evernia prunastri* yields an excellent perfume.

4. Dyes: Some species of lichens are used as source of dyes of various colours. But some dyes such as litmus, are still widely obtained from them. *Roccella*, *Parmelia*, *Evernia* and *Ochrolechia* are some dye-yielding lichens.