MUSHROOM CULTIVATION

- Mushrooms are earliest known fungal organisms used as food for their taste and aroma.
- In Latin it means to '**flourish'** and in Greek '**sponge'**.
- Mushrooms belong to *Basidiomycotina* and *Ascomycotina*.

Morphology of Mushrooms

- It is the **fruiting body** of fleshy mushrooms. Its vegetative mycelium is usually in the soil.
- It is produced either aerially or in the soil.
- It has a stalk known as **Stipe** and a broadly expanded structure known as **Pileus**.
- On the undersurface of the pileus many membranous structures known as **gills** are present.
- Each gill has a fertile layer at the periphery known as **hymenium**. It has basidia with basidiospores and sterile structures known as **paraphyses**.
- In younger mushrooms the pileus and stipe are connected by a membranous structure known as **veil** or **veilum**. It is broken at maturity.
- In younger stages, the fruiting body of *Agaricus* resembles a button. Hence this stage is referred as Button stage. Usually its basidiocarps are harvested at this button stage.
- The other fleshy fungus of *Ascomycotina* known as *Morchella* produces spores inside a sac like structure.

Types of Mushrooms

- There are **200 species** of edible mushrooms. Out of these only 40 are economical and only 8 are experimentally grown.
- Chinese were first to cultivate **black ear mushroom** (*Auricularia*) about 1000 years ago.
- **Shiitake** (*Lentinus edodes*), Paddy straw mushroom (*Volvariella volvacea*), Oyster mushroom (*Pleurotus sojar-caju*) and white button mushroom (*Agaricus bisporous*) are commercially cultivated mushrooms.
- **Morels** (*Morchella*), a very costly mushrooms belong to *Ascomycotina* are collected from Jammu and Kashmir, Uttar Pradesh and Himachal Pradesh and exported to other countries.
- Mushrooms grow either **symbiotically** or **saprophytically**. They vary in shape, size and colour.
- Some mushrooms are mild to deadly poisonous. Poisonous mushrooms are called as **toad –stools**. Poisonous mushrooms cause ill health and some times even death.
- Deadly poisonous mushrooms belong to genus *Amanita*. *Amanita muscaria* (Fly Agaric), *Amanita virosa* (Destroying angel), and *Amanita phalloides* (Death cap).
- These have endotoxins such as **Phallotoxins** and **Amatoxins**.

Uses of Mushrooms

- They have **low carbohydrate** and **fat** content. Hence recommended as food for diabetics and persons with high cholesterol.
- They have **high protein** content (**19 – 35%**) than conventional protein foods.
- They are rich in amino acids such as **Tryptophan** and **Lysine** required by adult human beings.
- They are rich in vitamins like **Pantothenic acid**, **Vitamin B_{12}** and **Ascorbic acid**.
- A. bisporous contains high amounts of Potassium, Phosphorous, Copper and iron but calcium percentage is very low.
- These are used to prevent heart attacks, diabetes, cancer and tumours. They have substances that can cure infectious viral, bacterial, fungal, and protozoan diseases. They are known to decrease blood cholesterol.
- They are used in dyeing, decoration, luminosity and hallucination.
- Mushrooms like *Armillaria mellea* and *Fome anosus* emit light and hence used in mines for light.
- By degrading the plant organic wastes in the forests, mushrooms act as agents to provide nutrition to forest plants.
- The spent compost is a good organic manure and better substrate for biogass production.

Mushroom cultivation in India

- These are grown in various agri-wastes and compost.
- The most commonly cultivated mushrooms in India are **White button mushroom** (*Agaricus bisporous*), **Oyster mushroom** (*Pleurotus sojar-caju*) and **Paddy straw mushroom** (*Volvariella volvacea*).

Cultivation of White Button Mushrooms

- These are popularly known as **European** or **temperate** mushrooms. It is cultivated throughout the World.
- The two main steps of this mushroom cultivation are Spawn production and Mushroom production.

1. Spawn production

- The actively growing vegetative mycelium of mushroom present in suitable sterile organic matter used as seed is called as **spawn**.
- The spawn is grown in aseptic conditions in plastic bags or bottles.
- Growers demand must be kept in mind before choosing a strain for spawn production.

- Sorghum, rice, rye, wheat grains, straw cuttings, cotton waste, cottonseed, hulls etc. are used either singly or in combinations for spawn making.
- For grain spawn, the grains are boiled and **Calcium carbonate** is added **20 g/kg** of grain. It is filled into the bottles up to ¾th.
- For straw spawn, the straw is cut into **5 cm** long pieces, soaked in water for **5 – 10 minutes** and later mixed with **lime**.
- The above-prepared substratum must be autoclaved at **120°C**, **15 lb** pressure for **1 hour 30 minutes**.
- After cooling, the bottles must be inoculated with required fungal culture under aseptic conditions and incubated for **2** weeks at **25°C**. The fungus covers the inoculated material. This is known as **spawn**.

2. Mushroom Production

- It has four steps known as Compost preparation, spawning, Casing and Cropping.

i) Compost preparation

- The method of preparing raw materials for mushroom cultivation is called as **composting**.
- The organic material taken as substratum undergoes degradation by microbes to make the substratum suitable for mushroom growth.
- Some additives are added to the raw materials to provide suitable conditions for microbial growth. These are usually Chicken manure, molasses, wheat bran, nitrogenous sources, organic or inorganic fertilizers and cakes.
- The nitrogen content must be maintained at **1.5%** of the dry weight of raw materials.
- Earlier, horse dung and cow dung were used to prepare compost.
- Now-a-days synthetic compost is prepared by locally available materials like saw dust; paddy, ragi and wheat straw; horse or cattle dung or chicken manure and sewage sludge. These are used either singly or in combinations.
- Good substrate for compost preparation is obtained by using either paddy straw alone or mixture of paddy and maize straw. For higher yields it may be supplemented with cottonseed and molasses.
- After incubation of compost materials for several days, the good compost is in **dark brown** colour, free of **ammonia smell**, pH between **7 – 7.5**, lack of **greasiness**, moisture content of **65 – 70%** and nitrogen content around **2.2%**.
- The prepared compost must be filled into the trays or boxes or shelves to make the beds and transferred into the room of **pasteurisation**.

Spawning

- It is spreading the spawn over compost beds under aseptic conditions and covering the mycelium with thin layer of compost.
- The fungus spreads in the beds and it is known as **Spawn running**.
- In **15 – 20** days, at **90%** relative humidity and **23–27^{o}C** temperature, the fungus grows luxuriantly.

iii) Casing

- After spawn running, the mycelial growth of the beds must be covered with **pasteurised soil**. It is known as **Casing**.
- Incubation must be continued for another **8 – 10** days till the white button mushrooms start appearing.
- At this stage the temperature must be brought down to **14 – 18°C** and humidity is increased to **95%**.
- Fresh air must be passed and beds are wetted with water as and when required.

iv) Cropping

- Crop production is started in the **3rd week** after casing and continued up to **10 – 12 weeks**.
- **Heavy mist of moisture** must be applied to the beds at **pinhead stage** of mushrooms.
- Each crop of mushrooms is called as **Flush**. Flushes appear once in every **7 – 10 days**.
- Crops are harvested when the mushrooms are **3–5 cm** height by gently gripping the cap and twisting.
- Production of **10 – 15 kg / 100 kg** compost within a period of **8 – 9 weeks** is the best yield. It is dependent on the quality of spawn, compost and management practices.
- The spent out compost can be used as manure.
- The shelf life of mushrooms is very short and it can be extended to **one week** by **storing at 5^{o} C**.
- They become brown coloured and rotten when stored at high temperatures.
- For transport to far off places, the mushrooms are specially processed and preserved in cans known as canning.