Ecology & fungal physiology
Lec. (1)

Introduction to Fungal Physiology

Fungal physiology refers to the nutrition, metabolism, growth, reproduction and death of fungal cells. It also generally relates to interaction of fungi with their biotic and a biotic environment, including cellular responses to stress.

The physiology of fungal cells impacts significantly on the environment, industrial processes and human health. In relation to ecological aspects, the biogeochemical cycling of carbon in nature would not be possible without the participation of fungi acting as primary decomposers of organic material. Furthermore, in agricultural operations, fungi play important roles as mutualistic symbionts, pathogens and saprophytes, where they mobilize nutrients and affect the physico-chemical environment.

Fungal metabolism is also responsible for the detoxification of organic pollutants and for bio remediating heavy metals in the environment. The production of many economically important industrial commodities relies on the exploitation of yeast and fungal metabolism, and these include such diverse products as whole foods, food additives, fermented beverages, antibiotics, pro biotic, pigments, pharmaceuticals, bio fuels, enzymes, vitamins, organic and fatty acids and sterols. In terms of human health, some yeasts and fungi represent major opportunistic life-threatening pathogens, whilst others are life-savers, as they provide antimicrobial and chemotherapeutic agents.

Why study physiology of fungal?
In fact, fungi are easy tools as are search materials, for fundamental physiological ,biochemistry and genetics studies

1- The physiology studies on fungal metabolism have helped in improving the industrial production of various substance such as citric acid and other organic acid by *Aspergillus niger* alchohols by yeast , antibiotic like penicillin by *Penicillium notatum* and P. chrysogenum , alkaloids of medicinal value by *claviceps purpurea* .

Some other fungal products have been suggested for industrial exploitation such as fats by *Penicillium javanicum ,Pestalotia palmarum Microxyphiella hibscifolia and Botryodiplodia theobromae* . gibberellins by *Fusarium moniliforme* glycerol by Saccharomyces cerevisiae , compler steroids like progesterone by *Rhizopus arrhizus*, nematoxin by *Nematoctonus haptocladus* .

2- The physiology studies have also played significant role in the industrid production of vitamins

Some strain of yeasts belonging to the genus *Rhodotorula* can synthesize significant quantities of β-carotene . the concentration is too small to be economically important.

3- The physiology studies have an important bearing in agricultures as pathogens and strong agents in recycling process by bringing about decay of plant (and animal) .remains to release nutrients essential for plant growth. The important of microbial activities is so strong that no one even thought of manuring aland occupied by forest. The important of mycorrhizd fungi has also been much emphasized in agriculture in recent past.
4- The study of fungal metabolism has suggested some of them as tests organisms for various such as vitamins , amino acid , macro and micro nutrient elements.

The rate of growth is often directly proportional to the quantity of thiamine supplied in glucose-aspargine medium. Employing a suitable range of concentration.

5- The physiology studies are academically important is systematic mycology to gain the knowledge of structure , ultra-structure development , growth and reproduction and numerous factors affecting them in pure culture.
6- Nutritional studies play a very important in understanding the close association between two species of un related fungi

Ecology & fungal physiology
Lec. (1)

The physiological as well as biochemical studies have played an important role in the field now known as " Single Cell P protein SCP".

Q:1Why are fungi important?

Fungi are key to the ecosystem because they act as major decomposers, plant symbiotes and parasites. Decomposing fungi are extremely well-adapted to breaking down plant tissues, particularly wood, and return large amounts of carbon to the atmosphere by doing so. They are thus major parts of the carbon cycle.

Though decomposing wood is one of their most important roles, fungi decompose other organic materials as well. Fungi also help process soil, break down grasses and break down animal dung. Without these decomposers, these materials would sit in the environment for longer before being transformed into materials useful to other organisms.

Other types of fungi help trees grow. These types of fungi grow intertwined with tree roots, receiving water and organic compounds in exchange for making certain essential minerals more accessible to the trees. Individual species of fungi are often specific to a particular species of tree. The fungi usually cannot survive without the trees, while the trees do not grow as well without the fungi.

Parasitic fungi can be very destructive, attacking both plants and animals. These include the most dangerous plant pathogens. One species alone is suspected of destroying billions of chestnut trees. Fungal parasites can also attack humans, causing diseases such as certain types of pneumonia.

Q:2What is the role of fungi in the ecosystem?

Fungi are vital decomposers in the ecosystem, breaking down dead organisms and biological waste, freeing nutrients for use by other organisms and clearing away their remains. Fungi also act in partnership with some plants and algae, and are often vital to the survival of these organisms. Some species are parasites.

Fungi all receive energy and nutrition from their environments, and are incapable of generating food for themselves as plants do. Fungi grow as masses of thread-like structures known as hyphae. These have a very high surface area for their volume, and allow the fungi to absorb nutrients easily. They are generally buried deep in the soil and in decaying organisms, such as rotting wood. Parasitic fungi have specialized hyphae for penetrating living organisms, usually plants.

Fungi in mutualistic relationships with algae are called lichens. The associations between the fungal species and the species of algae are often so complete that each type is given a species name as a whole, despite containing two different organisms. Because of this association, lichens can survive where no other photosynthetic organism can, and they are a vital food source in some very cold environments. Other fungi grow in association with

plant roots, where they provide vital nutrients in exchange for sugars and amino acids. It is estimated that 90 percent of vascular plants have associated species of fungi in mutualistic relationships with them.

The economic significance of fungi

- Fermentation technology.
- Enzymes production technology.
- Production of acids and chemical.
- Cultivation of fungi for protein.
- Production of bioactive compounds(Antibiotics).
- Fungi can be used in many applications in (industry, agriculture, medicine, and environmental)

  1- *Saccharomyces* used in production of beer, wine and bread.
  2- Many important for cheese production.
  3- Fungi used in genetic and biochemical studies .yeast genetically engineered to produce human insulin.
  4- Fungi in paper making .
  5- Commercially important fungal metabolites

Fungi are one of the most important groups of organisms on the planet. This is easy to overlook, given their largely hidden, unseen actions and growth. They are important in an enormous variety of ways.

- **Recycling**
  Fungi, together with bacteria, are responsible for most of the recycling which returns dead material to the soil in a form in which it can be reused. Without fungi, these recycling activities would be seriously reduced. We would effectively be lost under piles many meters thick, of dead plant and animal remains.

- **Mycorrhizae and plant growth**
  Fungi are vitally important for the good growth of most plants, including crops, through the development of mycorrhizal associations. As plants are at the base of most food chains, if their growth was limited, all animal life, including human, would be seriously reduced through starvation.

- **Food**
  Fungi are also important directly as food for humans. Many mushrooms are edible and different species are cultivated for sale worldwide. While this is a very small proportion of the actual food that we eat, fungi are also widely used in the production of many foods and drinks. These include cheeses, beer and wine, bread, some cakes, and some soya bean products.

Ecology & fungal physiology
Lec. (1)

While a great many wild fungi are edible, it can be difficult to correctly identify them. Some mushrooms are deadly if they are eaten. Fungi with names such as 'Destroying Angel' and 'Death Cap' give us some indication that it would not be a terribly good idea to eat them!

- **Medicines**
  Penicillin, perhaps the most famous of all antibiotic drugs, is derived from a common fungus called *Penicillium*. Many other fungi also produce antibiotic substances, which are now widely used to control diseases in human and animal populations. The discovery of antibiotics revolutionized health care worldwide.
  A fungus which parasitises Rye crops causes a disease known as Ergot. The fungus can occur on a variety of grasses. It produces small hard structures, known as sclerotia. These sclerotia can cause poisoning in humans and animals which have eaten infected material. However, these same sclerotia are also the source of a powerful and important drug which has uses in childbirth.

- **Biocontrol**
  Fungi such as the Chinese caterpillar fungus, which parasitise insects, can be extremely useful for controlling insect pests of crops. The spores of the fungi are sprayed on the crop pests. Fungi have been used to control Colorado potato beetles, which can devastate potato crops. Spittlebugs, leaf hoppers and citrus rust mites are some of the other insect pests which have been controlled using fungi. This method is generally cheaper and less damaging to the environment than using chemical pesticides.

- **Crop Diseases**
  Fungal parasites may be useful in biocontrol, but they can also have enormous negative consequences for crop production. Some fungi are parasites of plants. Most of our common crop plants are susceptible to fungal attack of one kind or another. Spore production and dispersal is enormously efficient in fungi and plants of the same species crowded together in fields are ripe for attack. Fungal diseases can on occasion result in the loss of entire crops if they are not treated with antifungal agents.

- **Animal Disease**
  Fungi can also parasitise domestic animals causing diseases, but this is not usually a major economic problem. A wide range of fungi also live on and in humans, but most coexist harmlessly. Athletes foot and Candida infections are examples of human fungal infections.