ECONOMIC IMPORTANCE OF FUNGI

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Secondly I would also like to thank my Parents and friends who helped me a lot in finishing project within the limited time.

Contents :→

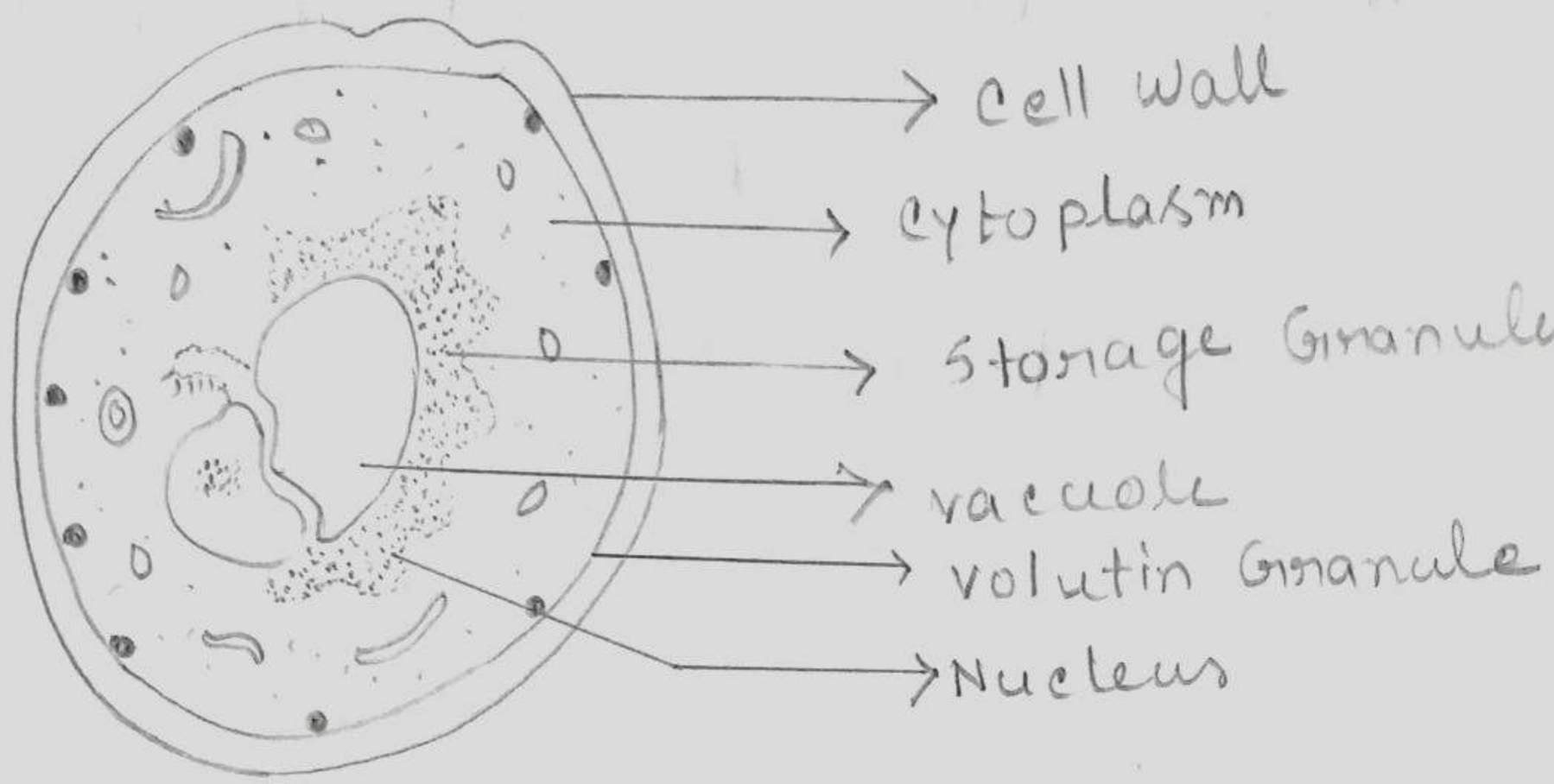
Defination of fungi :-

Fungi can be defined as achlorophyllous organism whose mucleatid somatic bodies are usually surrounded by cell walls containing cellulose or Chitin or both and which reproduce asexually and sexually. Fungi are eukaryotic organisms - that it their cells contain membrane-bound organelles and clearly defined nuclei. Historically, fungi were included in the plant kingdom. however, because fungi lack chlorophyll and are distingeished by unique structural and physiological features, they have been separated from plants. In addition, fungi are clearly distingeish from all other living organism, including animals, by their principal modes of vegetative growth and nutrient intake. Fungi grow from the tips of filaments that make

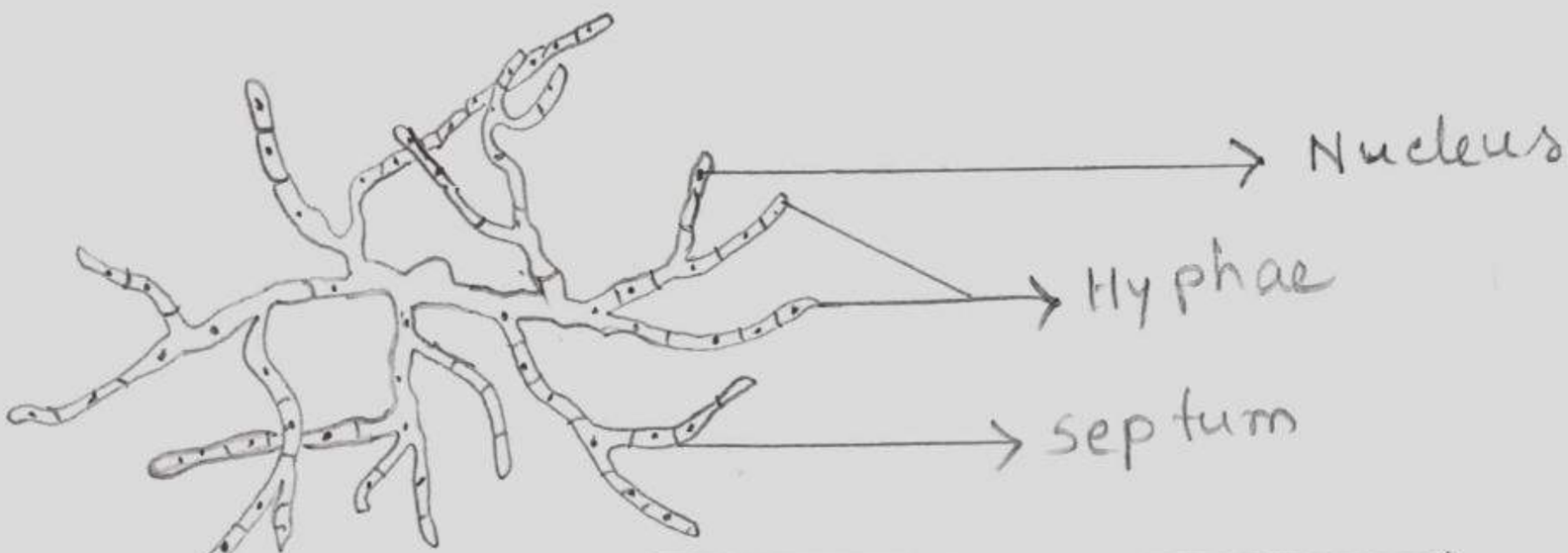
up the bodies of the organisms, and they digest organic matter externally before absorbing it into their mycellia.

while mushrooms and toadstools are by no means the most numerous or economically significant fungi, they are the most easyly recognized. The Latin word for mushroom, fungus has come to stand for the whole group. Similarly, the study of fungi is known as mycology —— a broad application of the Greek word for mushroom, mykes. Fungi other than mushrooms are sometimes collectively called molds, although this term is better restricted to fungi of the sort represented by bread mold.

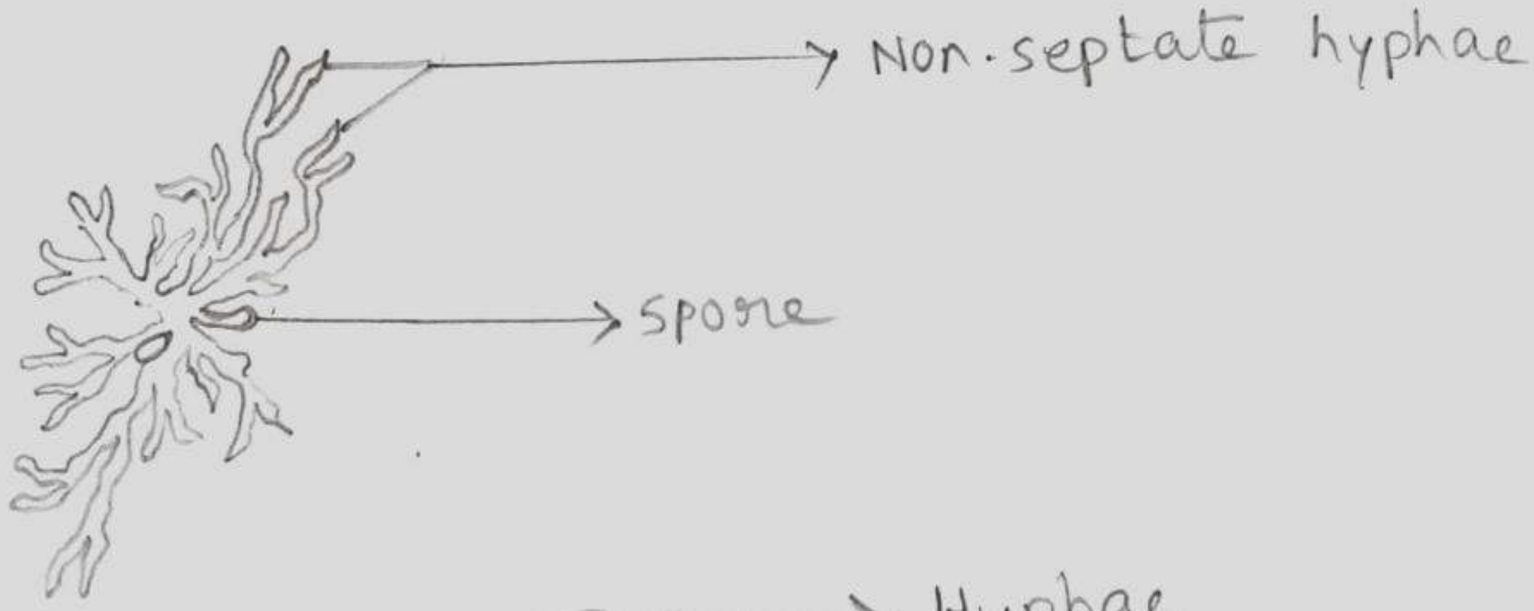
For information about slime molds, which exhibit features of both the animal and the fungal worlds, see protist. Fungi are among the most widely distributed organism on Earth and are of great Environmental and medical importance.

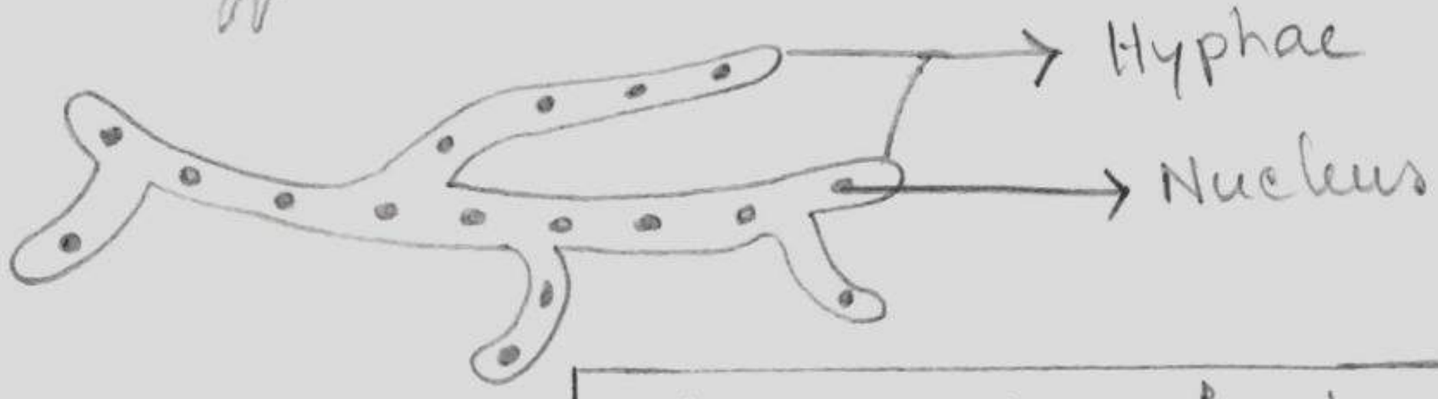


Yeast - Unicellular thallus



Septate Hyphae





Coenocytic hyphae

Range of thallus structure in fungi →

In almost all fungi the hyphae that make up the thallus have cell walls. A hyphae is a multibranched tubular cell filled with cytoplasm. The tube itself may be either continuous through out or divided into compartments, or cells by cross walls called septa. In non septate hyphae the nuclei are scattered through out the cytoplasm. In septate hyphae each cell may contain one to many cuclei, depending on the type of fungas or the stage of hyphal development. The cells of fungi are similar in structure to those of many other organisms. The minute nucleus readily seen only in young portions of th hyphae, is sorrounded by a double membrane and typically contains one nucleolus. In addition to the nucleus, various organelles — such as the endoplasmic reticulum, Golgi apparatus, ribosomes, and liposomes are scattered throughout the cytoplasm.

Economic importance of fungi →

A) Beneficial aspects →

Many types of fungi may cause diseases in humans and inflict losses of crops, other provide essential nutrients for the growth of the plants. Fungi are used in the production of chemicals and also in the drug manufacturing industries.

- (i) Environmental Benefits →

Fungi feed on dead organic matter which includes leaf letter, soil, dung, wood and dead animals. They recycle 85 percent of carbon from dead organic matter and released the locked up nutrients so they can be used by other organisms. This makes the fungi vital for the ongoing health of eco-systems — defined as a biological environment consisting of all the living organism in a particular area, along with the non living factors with which they interact.

• ii) Medicinal Uses →

Certain meshrooms such as Ganoderma lucidum, Agaricus subrufescens. and Cordyceps sinensis. enjoy usage as therputic in traditional chinese medicine. A 2008 study published in the "Journal of Natural Products" found that mushrooms contain unique compounds and nutrients that are effective against viruses. The shiitake mushroom is a source of a clinical drug called Lentinan. In Japan, Lentinan is approved for use in cancer treatment. The well-known antibiotic drug penicillin is derived from the fungus Penicillium. Pieces of fungus were discovered near the body of a neolithic traveler in the Alps; it is theorized that he used some fungus as tinder, and other types possibly medicinally.

• iii) culinary Benefits →

Several fungi are edible. These includes:

- ▲ Straw mushrooms
- ▲ oyster mushrooms
- ▲ Shiitakes
- ▲ truffles
- ▲ milk mushrooms
- ▲ black trumpets

Button mushrooms and portobello mushrooms are commonly used in salads and soups. Mushrooms add flavour to any dish they accompany. Mushrooms contain large amount of vitamin D2, when exposed to ultraviolet light. Recent research conducted by Pennsylvania State University showed that an hour of ultra violet light exposure right before the mushrooms are harvested raises the vitamin D2 content in the mushrooms.

P.T.O

• iv) Chemical industries →

Fungi are also used to produce industrial chemicals including citric, malic and lactic acids. They are also used in the production of industrial enzymes such as lipase, cellulase and amylase. Lipase is used in laundry detergents. Fungi are also used as insect biocontrol agents. Insecticidal toxins produced by fungi can kill insects at very low concentration. Fungi have been used as tool for producing different types of secondary metabolites by providing different nutrients at different laboratory conditions. The fungi have been engineered for the desired secondary metabolites by using different laboratory techniques, for example, homologous and heterologous expressions. Fungi have recently helped to produce other innovative and important drugs and anti-rejection substance that has aided the development of organ-transplant surgery over the last few years.

• v) In the maintainance of soil fertility →

Beneficial plant-microbe interactions in the rhizosphere are primary determinants of plant health and soil fertility. Arbuscular mycorrhizas are the most important microbial symbioses for the majority of plants and under conditions of p-limitation, influence plant community development, nutrient uptake, water relations of above ground productivity. They also act as bioprotectants against pathogens and toxic stresses. The review discusses the mechanism by which these benefits are conferred through abiotic and biotic interactions in the rhizophere.

Attention is paid to the conservation of biodiversity in arbuscular mycorrhizal fungi. Examples are provided in which the ecology of AMF has been taken into account and has had an impact in landscape regeneration, horticulture, alleviation of desertification and in the bioremediation of contaminated soils. It is vital that soil scientists and agriculturists pay

due attention to the management of AMF in any schemes to increase, restore or maintain soil fertility.

Most soil fungi decompose recalcitrant organic residues high in cellulose and lignin. Fungi carbon use efficiency is about 40-55 percent so they store and recycle more c and less N in their cells than bacteria while fungi are smaller in number, they equal or exceed the biomass of bacteria due to their greater size. Fungi are more specialized but need a constant food source and grow better under undisturbed soil conditions. Fungus and bacteria recycle soil nutrients and generally have a symbiotic relationship with most plants.

The fungi are able to break down all kinds of organic matters, decomposing soil components and thereby regulating the balance of carbon and nutrients for maintain soil health. This allows fungi to bridge gaps in the soil to transport nutrients relatively far distances back to the plants.

• vi) In the production of antibiotic substance alkaloids →

Antibiotics are one of the impontant metabolic product Produced by fungi. The either destroy or inhibit the growth of bacteria for other microorganism. Therefore, antibiotic produced by various fungi are used in the manufacture of drugs. The wonder drug 'Penicillin' is an antibiotic substance extracted from Penicillium notatum. The antibiotic Streptomycin obtained from Streptomyces griseus. is widely used for treatment of primary tuberculosis. Antibiotics have saved millions of lives since they were discovered in the 1940s. But recently we're had to learn a new term antibiotic resistance. More and more bacteria are developing there own protection against antibiotics, thereby becoming resistance to treatment. This will lead to simple infections becoming

lethal once again. our need for new antibiotics are urgent.

The first antibiotic to be mass-produced was Penicillin, derived from Penicillium fungi. In their quest for new antibiotics, chalmeres researchers sequenced the genomes of nine different types of Penicillium species. And the finding are amazing. The research group scanned the genomes of 24 different kinds of fungi to find genes responsible for the production of various bioactive compound, like antibiotics. More than 1000 Pathways were discovered, showing immense potential for fungi to produce a large variety of natural and bioactive chemicals that could be used as pharmaceuticals.

In about 90 cases, the researchers were able to predict the chemical products of the pathways. As evidence of this, they followed the production

of antibiotics. and identified new fungi able to Produce the compound but also that some species could produce a new version of the drug.

All in all, the study shows vast potential for fungi, not only in producing new antibiotics but also in enabling more efficient production of existing ones- and maybe also more effective versions of the existing ones. It is important to find new antibiotics in order to give physicians a broad Palette of antibiotics, existing ones as well as new ones; to use in treatment. This will make it harder for bacteria to develop resistance.

Apart from penicillin, the most important antibiotics from fungi are the cephalosporins (beta-lactams with similar mode of action) and griseofulvin which is used to treat althlete's foot and related fungal infections.

vii) Use as food →

The use of fungi as a component in the food making Process is more common now than in the recent past, these food products, with some notable exceptions, are still not a familiar sight to western cultures. The use of the term food-making process is used here to mean those food products that require the aide of fungi in their production. For example, the one with which you are most familiar is baked bread. The yeast is utilized in making the dough rise so that bread will come out light and fluffy. without yeast, bread would be much denser and harder. Blue cheese would be another examples. Asian cultures, however, have a large varities of such food, some of which have become well known in this country.

This is possibly because large number of american have become more adventurous in their dietary habits that has led to these types of food becoming more common place in our society. This is particularly true, in Hawaii, where there is a large asian population. I have excluded mushrooms from such foods since they are the actual food product rather than being utilized to creat another food product. We will cover some examples of such products and the processes by which fungi are integrated into their production.

The growth of grains made civilization possible. Its use as bread did not common about immediately. People first had to learn about separating the bran and husk of the grain from the seed itself and eaten or cooked.

Many fungal enzymes are used either for enhancing the overall process on to generate additional flavours. Besides this, enzyme mediated processes are preferred due to their high specifity and least by product. The food processed in this way in close to the natural products and are thus categorised as 'Green'. The applications of enzymes in food processing industry has been known for ages and the oldest known enzyme-mediated process in alcoholic fermentation involving yeasts. Fungi are used in bakery, brewing, dairy, meat, sugar, fruit processing and other food industry. It could enhance the yields and modify their specificity to meet consumer's requirement in terms of cost, calorie and taste. In this chapter, a comprehensive attempt has been made to elaborate the present states of fungal enzymes in various food industry.

• viii) useful for academic purpose →

The fungus Gibberella fujikuroi is known to produce a wide variety of secondary metabolites among which gibberellins, carotenes, bikaverins and hydroxylated anthraquinones.

The constraints created by immobilisation inside polysaccharide gels can modify the physiological behaviour of Gr. fujikuroi compared to free cell conditions. The metabolites synthesised by immobilised and free mycelia of Gibberella fujikuroi show differences concerning the kind and the number of secondary metabolites excreted in the media, The immobilisation favours the biosynthesis of polyketides to the detriment of terpens. In order to determine if the production of red pigment was dependant on the concentration of glucose, cultures using

different concentrations of this carbon source were tested for this work. Similarly different concentrations of this carbon source were tasted for this work and were also used to compare the influence of the carbon source on the production of red pigments.

Since the immobilisation within beads of calcium alginate induced the production of red pigments, cultures of free cells with increased concentrations of calcium ions, in one hand, and with increased concentrations of alginate in the media, in the other hand were realised in order to verify the influence of both factors.

The responce surface analysis has shown the important role played by the interaction of both parameters on the metabolic responce. of immobilised Gibberella fujikuroi.

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Fungus such as Neurospora is a multicellular filamentous fungus, it has also provided a system to study cellular differentiation and development as well as other aspects of eukaryotic biology.

It is a genus of widespread species, produces bakery mold, or red bread mold. It has been used extensively in genetic and biochemical investigations.

Fungus such as saccharomyces is a genus of fungi that includes many species of yeasts. many members of this genus are considered very important in food production. It is known as the brewer's yeast or baker's yeast. They are unicellular and saprotrophic fungi.

These are widly used by cytologists, geneticists, biochemists as important research tools in the studies of fundametal, genetical and biochemical process.

Harmful aspects :→

▲ i) Plant Diseases → Fungi are important crop pathogens, as they reproduce rapidly, affect a wide range of crops around the world, cause some 85% of plant diseases, and can creat serious economic losses! The range of types of fungi involved is also wide, including Ascomycetes such as Fusarium causing smuts and puccinia causing cereal rusts. and Oomycetes such as Phytophthora causing potato late blight and the resulting great Irish Famine of 1845-1849. where crop diversity is low, in particular where single varities of major crops are nearly universal, fungal diseases can cause the loss of a entire crop. as with the potato in Ireland, and as with the monocultured crop of maize (corn) in the USA in 1970, where over a billion dollars worth of

Production was lost. Similarly, the Gros Michel seedless banana crop was essentially completely destroyed worldwide in the 1950s by the wild fungus, Fusarium oxysporum. It was replaced by the Cavendish banana, which in turn was in 2015 facing total destruction by the same disease.

Disease causing fungi are found in class phycomycetes, Ascomycetes, Basidiomycetes and Fungi Imperfecti. No species of Myxomycetes are known to cause diseases in plants, except mushroom. Some of the diseases are listed in given table:

Name of the Diseases	Fungus
1. Ergot of bajra	1. Claviceps microcephaia
2. Green ear disease of bajra	2. Sclerospora sp.
3. loose smut of barley	3. Ustilago nuda hordei
4. wilt of cotton	4. Fusarium vasinfectum
5. Tikka diseases of ground nut	5. Carcospora Personata or carcospora arachidicola

▲ ii) Spoilage of food and other essential commodities

Food spoilage is the process where a food product becomes unsuitable to ingest by the consumer. the cause of such a process is due to many outside factors as a side effect of the type of product it is, as well as how the product is Packaged and stored. Due to food spoilage one-third of the world's food produced for the consumption of human is lost every year. Various fungi are the cause of spoilage and can creat serious consequences for the consumers, but there are Preventive measures that can be taken.

Fungi has been seen as a method of food Spoilage, causing only an undesirable appearance to food, however, there has been significant evidence of various ~~fungi~~ fungi being a cause of death of many people spanning across hundreds of years in many places through the world. Fungi are caused by acidifying, fermenting, discolouring and disintegrating

process and can creat fuzz, powder and slimes of many different colours, including black, white, red brown and green.

Mold is a type of funges but the two terms are not reciprocal of each other; they have their own defining features. and perform their own tasks. very well known types of molds are Aspergillus and Penicillium, and like regular fungi, creat a fuzz, powder and slime of various colour.

Yeast is also a type of funges that grows vegetatively via single cells that either bud or devide by way of fission, allowing for yeast to multiply in liquid environments favouring the dissemination of single celled microorganism. yeast also produces at a slower rate than bacteria, therefor being at a disadvantage in environments where bacteria are. yeasts can be responsible for the decomposition of food with a high sugar content. The same effect is useful in the production of various types of food and such as bread, yogurt and alcoholic beverages.

▲ iii) Induced diseases of animals and human beings :→ The fungal infections in both human and animals has increased over the last decades. This article represents an overview of the different categories of fungal infections that can be encountered in animals originating from environmental sources without transmission to humans. In addition, the endemic infections with indirect transmission from the environment, the zoophilic fungal pathogens with near-direct transmission, the zoonotic fungi that can be directly transmitted from animals to humans, mycotoxicoses and antifungal resistance in animals will also be discussed. Opportunistic mycoses are responsible for a wide range of diseases from localized infections to fatal disseminated diseases, such as aspergillosis, mucormycosis and infections caused by melanized fungi. The amphibian fungal diseases chytridiomycosis and the bat-white-nose syndrome are due to obligatory fungal pathogens.

Zoonotic agents are naturally transmitted from vertebrate animals to humans and vice versa. The list of zoonotic fungal agents is limited but some species, like Microsporum canis and sporothrix bnasilliensis from cats, have a strong public health impact. Mycotoxins are defined as a chemicals of fungal origin being toxic for warm—blooded vertebrates. Intoxications by aflatoxins and ochratoxins represent a threat for both human and animals health. Resistance to antifungals can occure in different animal species that receive these drugs, although the true epidemiology of resistance in animal is unknown, and options to treat infections caused by resistant infections are limited.

Accoriding to the official definition from the world Health Organization, Zoonoses are diseases and infections that are transmitted between vertebrate animals and humans. Among transmitted fungal pathogens, a few species should be considered as Zoonotic.

Mycotoxins cause intoxications in both animals and humans, resulting in servere diseases called acute or chronic mycotoxicoses, depending on species and suspectibility of the host. Mycotoxins produced by the invading fungi can suppress immunity, therefore increasing the infectivity of the fungus. Acute mycotoxicoses have a rapid onset and an obvious toxic response, while the most frequent type of mycotoxicoses occurs after the long-lasting exposure of an animal/human to low dosages of the toxin. The negative effects of mycotoxins on various animals have been extensively described in the literature. cattle, sheep, goats, and deer are generally resistance to the direct adverse effects of mycotoxins, which appear to be due to capability of rumen's microbiota to degrade mycotoxins. However, boving producting, reproduction, and growth. can be altered when ruminants consume mycotoxin contaminated feed for extended periods of time. Negative effects of the mycotoxins have been also documented on the pig's reproductive function.

Poisonous fungi →

There are three kinds of poisonous fungi :

- ones that will kill you.
- ones that will make you seriously ill.
- ones that will give you hallucinations.

The most deadly is the Amanita phalloides - Death cap, responsible for 90% of the deaths attributable to fungal poisoning in the world. Death is painful and unpleasant. There are no symptoms for the first 12 hours or so, then the victim experiences violent stomach pain and gastroenteritis, followed by vomiting and diarrhoea. Then the effects pass, but only for a couple of days. By that time the toxin has smashed its way through the victim's liver and kidneys, giving A. Phalloides an unenviable 50% death rate. Should you survive, you are likely to have major kidney and liver damage. It is found in Southern Australian states from southern WA to NSW, but its territory may be expanding.

Other Australian fungus have very similar toxins to Amanita phalloides, including Galerina sp., Gyromitra sp., Lepiota and continarius.

A much larger group will make you very ill. This may be due to poisonous in the fungus, an allergy, or sensitisation. Some species, notably Paxillus involutus, can cause acute sensitisation, resulting in death in some cases.

Amanita muscaria - Fly agaric, easily identified by almost everyone from its constant presence in pictures from fairy stories, will cause gastrointestinal upsets, as will many other fungi. It is easy to recognise so poisoning from this speeies is almost unheard of. Apparently everyone knows its poisonous.

The hallucinato or psychotropic fungus or mushrooms are most popular. Psiloeybe subaeruginosa often known as 'Golden Tops'. While there are obvious dangers to those who drive under the influence of phychotropic fungus or mushrooms.

Conclusion →

- As an organism, fungi influence over life knowingly or unknowingly.
- It proves to be beneficial as it helps in maintain balance of the ecosystem by serving as an integral component in the ecological recycling.
- It contribute to the economy also.
- However, the negetive face these organisms should also be well understood, its ability to spoil things and diseases to other organisms.
- through Proper understanding and management few of fungi could be envented and made to good use.

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