



## A REVIEW

# Diversity in Mushrooms

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**Abstract :** This review paper present literature about the types and diversity of mushrooms which belong to a class of basidiomycetes of fungi. Mushrooms are spongy, fleshy, umbrella like structures which grow above the ground in dark and damp environment. The global production of mushrooms is 34 million tons out of which larger share is of china while in India Utter Pradesh is leading in mushroom production. Mushrooms had a history of being used as medicine and due to this, it is in high pharmaceutical demand now a days. Apart from edible and medicinal mushrooms which have high nutrient value there are mushrooms which are toxic in nature and are not safe for consumption.

**Key Words :** Mushrooms, diversity, edible, medicinal value

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## INTRODUCTION

Fungi are multicellular, eukaryotic, heterotrophic organism with tissue level of organisation. They have high diversity in morphology and habitat. Their cell wall is made up of chitin (NAG)<sub>n</sub> fungal cellulose *i.e.*, N-acetyl glucosamine. Body is made up of mycelium which is of two types *i.e.*, Aseptate (coenocytic) and Septate. Fungus includes mushrooms, rust, smut, puffballs, truffles, morels, yeast and many more which are less known (Blackwell *et al*, 2011). Till now more than 700,00 species of fungi have been known and described and still many more to discover (James *et al*, 2006). Most of the Mushrooms belong to the class Basidiomycetes and fungi of this class is also known as the “club fungi”. Common method of reproduction among the members of

Basidiomycetes is somatogamy. Mushrooms are the macro fungi that can be seen with naked eyes and have a distinct fruiting body which can be either epigenous or hypogenous (Chang and Miles, 1982). In the traditional beliefs and stories which passes from generation-to-generation mushrooms are called as ‘witches egg and fairy egg’ (Molitoris, 2001).

Mushrooms have become the part of the cuisine across the globe because of their flavour, taste and texture. There are more than 2000 species of mushrooms which are available in the nature but only few are widely used for consumption as a food or as medicine and out of these also very less are commercially cultivated (Chang and Miles, 2008; Erg“on“ul *et al.*, 2013). Example: *Ustilago*, *Agaricus*. Mushrooms are umbrella like and

often grown in rainy season and can be delicious as well as poisonous. [Toadstool]

These are fleshy spores bearing fruiting body of a fungus.

### Types of Mushrooms:

#### Edible Mushrooms:

These mushrooms which are safe for human/animal consumption. These edible mushrooms are divided into five categories according to taste, morphology, growth, habit, texture and habitat. (Oso, 1975). One of the important source of nutritive food are the edible mushrooms and should be in the diet of everyone's they are easily digestible and highly nutritive in nature. On the basis of fresh weight the protein content is very much high in mushrooms as compared to vegetables and fruits but they are still inferior to meat and dairy products which are the conventional and main source of protein (Aremu *et al.*, 2009).

Taste: *Volvariella volvacea*; Morphology: *Termitomyces manniformis*; Texture: *Pleurotus squarrouslus*; Growth Habit: *Termitomyces globulus*; Habitat: *Francolimus bicalcaratus*

#### Agaricus sp.:

The mushrooms belonging to this genus are most cultivated mushrooms around the world. Now a days mushrooms of this group are widely studied for its medicinal and therapeutic use. Lectin extracted from *A. bisporus* and protein from *A. polytricha* are found to be a good immune stimulant due to this these mushrooms have pharmaceutical utilization (Wasser 2002; Firenzuoli *et al.*, 2008; Lima *et al.*, 2011).

*Agaricus blazei* is also called as sun mushroom originally from Brazil but cultivated mainly in Japan. It is not only consumed as food but also consumed as tea due to its medicinal properties. It has immunomodulatory, anticarcinogenic and anti-mutagenic properties (Chang *et al.*, 2007; Adams *et al.*, 2008; Patel and Goyal, 2012; Hakime-Silva *et al.*, 2013).

*Agaricus subrufescens* is also known as almond mushroom as it tastes like almond and it is mainly consumed as well as cultivated in United States. It produces mainly bioactive compounds which are helpful in preventing cancer, diabetes etc. (Delmanto *et al.*, 2001; Takaku *et al.*, 2001; Kaneno *et al.*, 2004; Wisitrassameewong *et al.*, 2012).

#### Pleurotus sp.:

Mushrooms of this genus are called as Oyster

mushrooms and has approximately 40 species all edible. These mushrooms have high nutritional as well as medicinal values (Finimundy *et al.*, 2013)

#### Lentinula edodes (Shiitake):

It is used for many years and its compounds are isolated for pharmaceutical use. It is used for the aviation of common cold and still research is going on this mushroom. It is also a potential source of antioxidant and anticancer components (Mattila *et al.*, 2001; Finimundy *et al.*, 2013).

#### Non-edible toxic (poisonous) mushroom:

Some species of mushroom produces secondary metabolites that can be toxic, mind altering or bioluminescent i.e., not safe for consumption. Identification of mushroom for the medicinal or edible purpose is very much important to prevent the toxication and health issues due to poisonous mushrooms. Effects caused by poisonous mushrooms are carcinogenicity, alteration in respiratory and cardiac rates and renal failure. Some mushrooms have toxins that have ill effect even when consumed in small quantity. They are mainly called Toadstool (Lima *et al.*, 2012; Karlson-Stiber and Persson, 2013)

#### Amanita sp.:

The family of this genus i.e., Amanitaceae have many toxic species. The toxins of these genus are called Amatoxins. (Amatoxins: it is a cytotoxic and cause harm to kidney and liver). The family of Amatoxin consist of neutral components which are called alpha amanitin, acidic one are called beta amanitin and non-poisonous are called amanullin. Other toxin belonging to this genus are called as phallotoxins which include phalloin, phalloidin, phallisin, phallacidin, phallacin and phallisacin. Some important species are *A. muscaria* (also called as the world's most poisonous mushroom), *A. phalloides*, *A. virosa*, *A. verna*, *A. ocreata* (Wong and Ng, 2006).

*Amanita phalloides* is also called "Death caps". The phallotoxins present in this causes alteration of enterocytes cellular membrane, inhibit protein synthesis. Just after the intake of *A. phalloides*, toxins start their work causing necrosis of liver cells (Mas, 2005)

#### Clitocybe amoenolens:

The intoxication caused by this mushroom is paresthesia of the fingers and toes, piin for 2 to 3 nights.

A sensation of heat and numbness is also associated with this (Bessard *et al.*, 2004). Some species of this genus also caused muscarinic syndromes i.e., *C. dealbata*, *C. rivulosa*, *C. candicans*. After the intake of mushrooms within 15 min to 2 hrs the person faces gastrointestinal problems, hypersecretion etc. (Dehay *et al.*, 2009).

#### **Gyromitra sp.:**

The family belongs to the genus *Gyromitra* in the Helvellaceae which are attractive to hunters and gourmets because of their taste. Some species of *Gyromitra* have a toxin called gyromitrin. *Gyromitra esculenta* commonly known as false morels and is often confused with morels such as *Morchella elata*. Intoxication is caused not only when eaten false morels but also from the vapours which are produced while cooking (White *et al.*, 2003; Flesch and Saviuc, 2004)

#### **Medicinal mushrooms:**

Mushrooms are not only used as a source of food but also have many medicinal as well as nutrient values. It is used as complementary medicines/dietary supplements for anticancer, antiviral, immunopotentiators, hepatoprotective. These medicinal mushrooms also help in lowering cholesterol and triglycerol levels (Chang and Miles 2008; Ergonul *et al.*, 2013)

#### ***Ganoderma lingzhi* (Lingzhi/Reishi mushroom):**

It is also called as mushroom of Immortality and it is used in China for medicinal purposes for many years. It is very much popular in China, Japan, Korea. It is used for the treatment of neurasthenia, hypertension, hepatopathy and carcinoma. By modern studies it is found out as immune booster, effective in viral infection, improves lung function, effective in anxiety treatment, also used in HIV/AIDS treatment (Wasser, 2002; Mahajna *et al.*, 2007 and 2009).

#### ***Cordyceps sinensis***

There are more than 400 species of *Cordyceps* genus in which *Cordyceps sinensis* is also known as winter worm, summer grass and it is the most famous Chinese medicine. It helps in maintaining immune response, controlling cholesterol level in plasma, improves the functioning of hepatic cells i.e., proper functioning of liver and improves vasorelaxation activity. It is anti-inflammatory, antioxidant, anti-tumour and

immunomodulator. Nucleosides, polysaccharides, sterol, protein, amino acid, polypeptide are components of *Cordyceps sinensis* (Qin *et al.*, 2015).

#### ***Hericium erinaceus*:**

It is a temperate region mushroom and commercially grown in China. It has cryoprotection activities against ethanol-induced gastric ulcer (Qin *et al.*, 2015)

#### ***Inonotus obliquus* :**

It is found in Europe and Asia and used as a medicine in China. It has anticancer, antioxidant and anti-inflammatory activities (Qin *et al.*, 2015)

#### ***Agrarius brasiliensis*:**

It is originated in Brazil and it is a non-prescription medicinal purpose edible mushroom. From the extraction of this mushroom many products are formed which are helpful in preventing cancer, tumour, diabetes etc. (Qin *et al.*, 2015)

#### ***Lentinula edodes* (Shiitake):**

It is used for many years and its compounds are isolated for pharmaceutical use. It is used for the alleviation of common cold and still research is going on this mushroom. It is also a potential source of antioxidant and anticancer components. (Mattila *et al.*, 2001; Finimundy *et al.*, 2013)

#### **Nutrition values of mushrooms:**

Mushrooms have high nutritional values this tells us that mushrooms have diversity not only in its type but also in its use. On a fresh weight basis mushrooms have more protein than any vegetable or fruit leaving aside meat and dairy products (Aremu *et al.*, 2009). Mushrooms have 93-95% of water and minerals like iron, potassium, calcium and rich source of Vitamin B and Vitamin D. i.e., High protein and low-calorie diet. Mushrooms have all the essential amino acids (Koyyalamudi *et al.*, 2009)

Mushrooms are the rich source of Riboflavin and nicotinic acid along with pantothenic acid and ascorbic acid (Ukpebor *et al.*, 2007). Mushrooms are the meat of the vegetarians. (Hass and James, 2009).

#### **Ceremonial uses of mushrooms:**

Mushrooms are used in religious ceremonies of

many ancient people and primitive tribes. According to Romans, mushrooms can produce superhuman strength for finding lost objects and to make soul pure to meet god (Grube *et al.*, 2001). People in Nigeria also consume these mushrooms in one of their festivals (Lebo, 2004).

#### Other uses:

Mushrooms are in the race to become an alternative source of antimicrobial compounds mainly the secondary metabolites i.e., terpenes, steroids, anthraquinones, derivatives of benzoic acid and quinolones. Some primary metabolites can also be extracted from them such as oxalic acid, peptides and proteins.

#### Lentinus edodes:

One of the most studied species of mushrooms and from the studies we come to know that it has antimicrobial action against both gram positive as well as gram negative bacteria. (Alves *et al.*, 2012). Mushrooms are also used for dyeing wood and other natural fibres. The organic compounds extracted from the mushrooms produces strong colours i.e., source of some natural Dyes (Bechtold, 2009). Mushrooms are also used in fire starters in USA and used in gun powder (Akrpaya *et al.*, 2005).

#### Conclusion:

There is a wide diversity of mushrooms present with thousands of species. They are edible, non-edible, medicinal and toxic. They have history of being used as a medicine mainly in China and India and with the advancement of science and technology now there is a huge pharmaceutical utilization. Due to their edible nature along with nutritive as well as medicinal value mushrooms have high demand and also high price in the market. Some other uses are also their like ceremonial use, used as natural dyes and used to mix in gun powder in some countries. It is very much important to identify mushrooms as edible and poisonous as sometime two mushrooms of same genus can be different one can be edible while other may be toxic.

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