

## Economic Importance of Mushroom and Their Uses

Sardar Singh Kakraliya

Ph.D. Scholar, Department of Plant Pathology

Sher-e- Kashmir University of Agricultural Science and Technology of Jammu-Jammu

ARTICLE ID: 025

### Introduction

The word mushroom is derived from the French word for fungi and moulds. However, since then, better and more effective methods have been developed and there has been a huge increase in mushroom cultivation. In the last 50 years, the Netherlands has grown into the largest mushroom production country within the European Union, with an annual production of 270 million kilograms and more than 10,000 jobs. Next to China and the United States, the Netherlands holds 3rd place in the market. China is the largest producer of mushrooms in the category of top ten nations with a market share of 70 per cent followed by Italy 10.67 per cent, USA 5.29 per cent. Every year, millions of tons of mushrooms are cultivated worldwide. However, Poland was the largest exporter of mushroom in the world. In terms of consumption, Netherland with 11.62 kg per head per annum topped in the list of major mushroom consumers. In China, Japan, Poland and India, the per capita mushroom consumption stood below 1 kg per annum.

Since ancient times, mushrooms have been treated as a special kind of nutritious food. Greeks regarded mushrooms as commodity providing strength for warriors in battle and the Romans regarded mushrooms as the “Food of God”. In the earlier times, mushrooms were collected from their natural growing habitats, but with the passage of time, several attempts have been made to domesticate mushrooms under controlled conditions. So far, more than 2,000 edible fungal species are widely accepted for human consumption, but only a few of them are commercially cultivated worldwide and only 5 mushroom species *viz*; *Agaricus bisporus*, *Pleurotus* spp., *Volvariella volvacea*, *Calocybe indica* and *Lentinula edodes* are popularly cultivated in different parts of India.

Mushrooms have been considered one of the world’s greatest natural resources since they have the ability to transform required input into nutritional substance and high protein

food. In the event of large increase in population resulting in scarcity of nutritious food, the mushrooms offer a good source of nutrition due to being rich in minerals and vitamins. At present, three mushrooms namely, the button mushroom (*Agaricus bisporus*), paddy straw mushroom (*Volvariella spp.*) and oyster mushrooms (*Pleurotus spp.*) are cultivated in different parts of the world. *Agaricus bisporus* is mostly grown on commercial scale throughout the world. Globally, mushroom is traded mostly in processed form.

### **Production in India**

Mushroom production in India started in the 1970s but with the development of technologies for environmental control and understanding of the cropping systems, mushroom production has risen considerably. In 2010, button mushroom accounted for 89% of the total production of mushrooms in India, followed by oyster (6%), milky (1%) and others (4%). However, presently the total white button mushroom produced in India from both seasonal and high tech cultivation units is estimated at 94,676 metric tons and it contributes around seventy three percent of mushroom production in India.

### **1. Economic Importance**

Mushrooms are popular for their delicacy and flavor rather than food. However, it is an established fact that they are excellent sources of vitamins and minerals. In view of their high food value to man and their medicinal properties mushrooms can help in solving the problems of malnutrition and diseases. Besides, the being an important food article, mushroom are variously exploited by man. They are at the same time, also beneficial to forest.

#### **❖ Decomposition of Dead Organic Matter Importance**

There are few species of mushrooms which attack living trees where as large number of them grows on fallen timber, bark, sap wood etc. The mycelium of mushroom grows in few years and completes disintegration of wood take place. It gradually mixes with forest soil and provides food for living trees. Thus mushrooms are one of the important agents in providing available food for virgin forest. One of the key roles that mushrooms play in natural systems is the decomposition of dead organic matter. Decomposition is accomplished by a succession of saprophytic fungi. The primary decomposers such as Shiitake, Oyster, and Wine Cap mushroom (*Stropharia rugoso-annulata*), start the process by breaking down the lignin and cellulose in wood, straw and other plant matter. Secondary decomposers take over

after the substrate has been partially broken down. Secondary decomposers typically grow on compost and include the White Button mushrooms and Portobello (*Agaricus spp.*). Tertiary decomposers are typically soil dwellers existing in reduced substrates. These include some *Agaricus species*, the Peel mushroom, *Conocybe*, *Agrocybe*, and *Pluteus*. Primary and secondary decomposers are the most suitable for cultivation since the mycelium of these species is usually quite vigorous and with proper techniques there is a high rate of success. In addition, substrates are readily available. Mushrooms are then to be given a very high rank among the natural agencies, which have contributed to the good of the world.

- ❖ **Writing Materials:** Inky cap mushroom *Coprinus comatus* is very deliquescent and soon become black liquid which can be used for writing purposes.
- ❖ **Mushroom Used for Flower Pots:** Shaped fruit bodies of *Polyporus fomentarius* and *P. ignitarius* are used for flower pots.
- ❖ **Luminosity:** The ability of organism to produce light in dark is well known in bacteria, plants and animals. Many fungi are also luminescent and either fruit body or mycelium or both may be luminous, depending on the species. Luminous is well known to woodmen, foresters, timber men and others who have occasion to pass through a wood in darkness. The decayed wood itself permeated with the mycelium of *Armillaria mellea*, glow strongly as long growth continues and remains damp. *Fomes anosus* is also a luminous fungus. This fungus grows in mines and both the mycelium and fruit bodies are luminous. *Pleurotus japonicus* also emits light.

## 2. Medicinal Uses

Since thousands of years, edible fungi have been revered for their immense health benefits and extensively used in folk medicine. Specific bioactive compounds in medicinal mushrooms viz., polysaccharides, triterpenoids, low molecular weight proteins, glycoproteins and immune modulating compounds possess medicinal properties. Hence mushrooms have been shown to promote immune function; boost health; lower the risk of cancer; inhibit tumor growth; help balancing blood sugar; ward off viruses, bacteria, and fungi; reduce inflammation; and support the body's detoxification mechanisms. Mushroom diet is good for heart due to its low fat content, higher proportion of unsaturated fatty acids and absence of cholesterol. Minimal sodium with rich potassium in mushroom enhances salt balance and facilitates blood circulation in human and found suitable for high blood pressure patients. The

diabetic and obese patients choose mushroom as an ideal food owing to its low calorific value, no starch, and less sugars. The fermentable dietary fibre in mushrooms augments healthy functioning of bowel system as fibre serves as a food for beneficial microbes in human digestion system. Compounds restricting tumor activity such as Kresin is widely used as a leading cancer drug in pharmaceutical industries. Ergothioneine is a specific antioxidant found in *Flammulina velutipes* and *Agaricus bisporus*, which is necessary for healthy eyes, kidney, bone marrow, liver and skin consequently reducing the aging process. Antioxidants present in mushroom scavenge the free radicals present in body system and reduce cell maturity. Thus by it acts as an anti-aging agent. A diverse collection of polysaccharides (beta-glucans) and minerals, isolated from mushroom is responsible for regulation and strengthening the human immune system.

- a) **White Mushroom:** White mushroom contains selenium which aids in weight loss and is known to prevent prostate cancer. These mushrooms have special carbohydrate that gives a strong metabolism rate and also maintains equal blood sugar levels.
- b) **Shiitake Mushroom:** Shiitake mushrooms have the potential to fight tumors, as they have high amount of lentinan, which is a natural antitumor compound. These flavourful, meaty mushrooms contains excellent source of vitamin D and helps in fighting infections.
- c) **Oyster Mushroom:** Oyster mushrooms are high in nutrients. They have significant level of zinc, iron, potassium, calcium, phosphorus, vitamin C, folic acid, niacin, vitamins B-1 and B-2. It has a high anti-oxidant compounds and is known to save us from variety of diseases and also helps us in beating stress.
- d) **Reishi Mushroom:** Reishi mushroom has properties which serves all the needs to defending us from diseases. They are known to have properties that are anti-cancer, anti-oxidant, anti-bacterial, anti-viral and anti-fungal. Apart from that these mushrooms contain gandodermic acid which helps reduce bad cholesterol which in turn can lower high blood pressure
- e) **Shimeji Mushroom:** Shimeji Mushroom can fight tumors. They can also help diabetes, asthma and certain allergies by enhancing the immune system and boosting its healing capabilities. They are high in essential nutrients such as zinc, copper, manganese and have high amount of Vitamin D.

- f) **Maitake Mushroom:** Maitake mushroom are good for preventing breast cancer. Including mushroom in our daily diet is known to cleanse our body system and also keep our immune system strong
- g) **Chanterelle Mushroom:** Chanterelle Mushroom is known to be good for our eyes, lungs and makes our immune system strong. These mushrooms are known to have the properties which are anti-microbial, bacterial and fungal. They are also high in vitamin C, D and potassium.
- h) **Porcini Mushroom:** Porcini Mushroom are known to be anti inflammation. This meaty mushroom contains the compound called ergosterol which is capable of fighting against infection causing diseases. They are high in calcium level which makes our bones strong and also fiber content, which of course avoids us from having constipation.

### 3 .Other Uses

Mushrooms can be used for dyeing wool and other natural fibers. The chromophores of mushrooms produce strong and vivid colors and all colors of the spectrum can be achieved with mushroom dyes. Before the invention of synthetic dyes the mushrooms were the primary sources of dyeing textiles. Some mushrooms have been used as fire starters and are known as tinder fungi. The Criminic and Oysters are being used for cleaning up of the environment. The technique called myco-remediation uses mycelium to breakdown the contaminants like petroleum, fertilizers, pesticides, explosives and agricultural, medical and industrial wastes.

#### Antibiotic Activities

- ❖ **Antibacterial effect:** Antibacterial properties compounds are poly acetylene was mostly found in genera *Aleurodiscus*, *Clitocybe*, *Marasminus*, *Polyporus*, *Tricholoma* etc. Antibacterial activity in the genera which parasites on tree, such as *Fomes*, *Ployporus* and *Trametes* reported antibacterial property in *Agaricus bisporus* and found quinoid and phenolic derivatives.
- ❖ **Anti-Fungal Effect:** Sparossol from *Sparassis ramosus*, Examples of anti-fungal activity among edible fungi include *Lentinus edodes*, *cortenellin*, *Coprinus comatus* and *Oudemansiella mucida*.
- ❖ **Anti-Protozoal Effect:** *Omphalotus olearius* is toxic mushroom with *Terpenoid illudin* M and S, reported to be active against *Plasmodium gallinaceum*. *Irpex flavous* was active against protozoan.

- ❖ **Antiviral Effect:** *Ganoderma nutraceuticals* have exhibited promising antiviral effects like anti-HIV, antihepatitis B and Epstein Barr vims. In *L. edodes* a polysaccharide fraction has been found to be active in-vivo and in-vitro against influenza.
- ❖ **Anti-Tumor Effect:** Calvacin from giant puffball *Calvatia gigantea* has anti-tumour activity. Chemical nature of calvacin shows that it is a non-diffusible basic micro protein. The anti-tumor activity in *Boletus edulis*. It reported the anti-tumour effect of edible mushroom. Mushroom derived chemical compounds associated with anti-tumour activities and their source includes polysaccharide Lentinan from *Lentinus edodes*, *Pleurotus ostreatus*. Flammulin from *Flammulina velutipes*, the acid protein from *Poria corticola* protein and quinoid from *Agaricus bisporus*, *Ganoderma lucidum* has been reported to certain many immune regulating compounds is called as longevity mushroom. It has shown that Maitake (*Grifola frondosa*) had stronger anticancer and anti-tumor effect.

#### 4. Nutritional Values

Mushroom is considered to be a complete, health food and suitable for all age groups, child to aged people as it contains all nutrient element required for human in desired proportion. The nutritional value of mushroom is affected by numerous factors such as species, variety, stage of development and environmental conditions. Mushrooms are rich in protein, dietary fiber, vitamins and minerals. The major proportion of carbohydrate is occupied by dietary and fermentable fibers and it do not contain starch with insignificant proportion of sugars. Edible mushrooms contain rich proteins that are composed of theronine and valine but deficient in sulphur containing amino acids (ethionine and cysteine). The low lipid level with no cholesterol and higher proportion of polyunsaturated fatty acids is further advantage. The ergosterol present in mushrooms is the precursor for Vitamin D synthesis in human body. Nutritive values of different mushroom are given in Table 1.

Table 1. Nutritive values of different mushrooms (dry weight basis g/100g)

Mushroom	Carbohydrate	Fibre	Protein	Fat	Ash	Energy (kcal)
<i>Agaricus bisporous</i>	46.17	20.90	33.48	3.10	5.70	499
<i>Pleurotus sajor-caju</i>	63.40	48.60	19.23	2.70	6.32	412
<i>Lentinula edodes</i>	47.60	28.80	32.93	3.73	5.20	387

<i>Pleurotus ostreatus</i>	57.60	8.70	30.40	2.20	9.80	265
<i>Vovarella volvaceae</i>	54.80	5.50	37.50	2.60	1.10	305
<i>Calocybe indica</i>	64.26	3.40	17.69	4.10	7.43	391
<i>Auricularia auricular</i>	82.80	19.80	4.20	8.30	4.70	351

- ❖ **Vitamin D:-** The vitamin D content of a mushroom depends on postharvest handling, in particular the unintended exposure to sunlight. The US Department of Agriculture provided evidence that UV-exposed mushrooms contain substantial amounts of vitamin D. When exposed to ultraviolet (UV) light, even after harvesting, ergosterol in mushrooms is converted to vitamin D<sub>2</sub>, a process now used intentionally to supply fresh vitamin D mushrooms for the functional food grocery market. In a comprehensive safety assessment of producing vitamin D in fresh mushrooms, researchers showed that artificial UV light technologies were equally effective for vitamin D production as in mushrooms exposed to natural sunlight, and that UV light has a long record of safe use for production of vitamin D in food.

In addition to these, mushroom is an excellent source of vitamins especially C and B (Folic acid, Thiamine, Riboflavine and Niacin). Minerals viz., potassium, sodium and phosphorous are higher in mushroom fruit bodies besides other essential minerals (Cu, Zn, Mg) in traces but it is deficient in iron and calcium in general. Above all, growth promoting substances viz., enzymes, alkaloids, sterols, antioxidant and other undefined organic complexes also present in mushrooms.

### 5. Environmental value

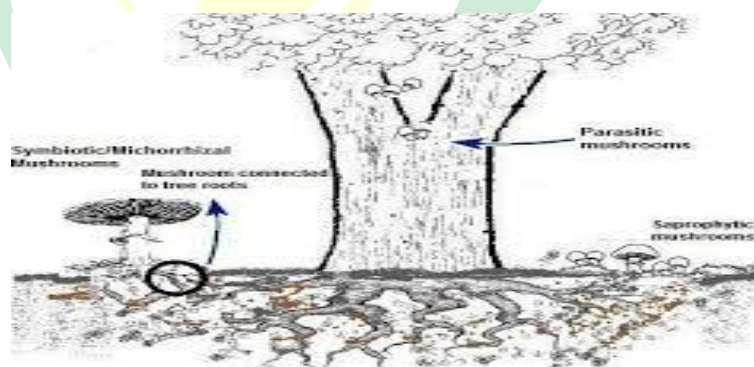
Environment refers to the sum total of all biotic and abiotic components surrounding the organism. In earth, living beings are coexists together in one or other form. Similarly, macro fungus otherwise referred as mushrooms plays many significant roles in environment. Mushrooms degrade complex lignin rich compounds and thus by it decomposed all lignin rich organic waste materials from surrounding leading to clean environmental conditions. Mushroom production in India consumes wheat and paddy straw residues mostly otherwise these residues are burned in open field which causes significant air pollution. Many mushroom mycelia are successfully exploited in the certain bioremediation program.



**Fig 1. Paddy straw burning in field**

## 6. Ecological value

Every organism in this earth has unique values in its ecosystem. Every living organism has its own role in maintaining eco balance in this earth as all are interrelated in a particular ecosystem. Mushroom contributes different nutrient cycles in various ecosystems by participating in decomposition of organic debris. Few funguses have symbiotic micorrhizal association with certain plants and trees. Wild mushroom acts as a source of food for many wild lives, which includes insects (beetles, flies, gnats, springtails, centipedes, *etc.*), slugs, squirrels and deer. The parasitic mushroom adversely influences the ecosystem health by means of causing diseases, reducing growth and fertility of many wild floras. The role of soil health maintenance, bioremediation and pollution reduction is some other ecological functions of wild mushrooms. Many other ecological roles played by mushroom is yet to known to this world.



**Fig 2. Ecological role played by mushrooms**