







Mushroom Research Laboratory, Division of Plant Pathology




Mushrooms are amazing sculptors created by nature. Thomas Carlyl rightly expressed this as "Nature alone is antique and the oldest art a mushroom". For thousands of years fungi in general and mushrooms in particular have evoked mixed response of adulation as expressed by John Ford "I am... a mushroom; On whom the dew of heaven drops now and then" to fear and loath. Culturally mushrooms have been an integral part of ancient Greek, Indian, Mesoamerican, Mayan and Egyptian cultures. Mushrooms have been used for food, medicine and euphoric experiences to poisoning tools through the usage of deadly Amanita. Scientifically Mushrooms have been a part of fungal diversity for around 300 million years. The Western culture was largely ignorant about the usage of mushrooms and often termed as 'mycophobic'. Mushrooms were largely collected from wild for food and medicine, a practice still prevalent among the people living near forests. Wild mushrooms are an important component of forest products and global trade. The earliest record of mushroom cultivation dates back to A.D. 600, when the Jelly mushroom (*Auricularia auricula*) was first

cultivated by Chinese on wooden logs. This was the stepping stone for the experiments to cultivate other wood inhabiting mushrooms like *Flammulina velutipes* (A.D.800); a delicacy in Japan till date and *Lentinula edodes* (A.D. 1000); the most sought after edible and medicinal mushroom of modern times.

It is estimated that about 1.5 million species of fungi inhabit earth out of which 1,40,000 species are categorized as mushrooms. Among the 14,000 known mushroom species, 7000 species are considered to have varying degree of edibility and more than 3000 species of mushrooms of 31 genera are known to be prim edible mushrooms. To date, 200 mushroom species are experimentally grown, 100 specie economically cultivated, 60 commercially cultivated and 10 have reached industrial status. Further, 2000 mushroom species are regarded as medicinal mushrooms with a variety of health attributes. The number of Poisonous mushrooms which is the major phobia for non consumption of mushrooms are very few (Approximately 1%) and some 30 species are considered to be lethal. The diversity of mushroom germplasm is enormous in tropical and subtropical regions and is least known. Macrofungi survive in diverse climate ranging from highly temperate arctic region (*Lycoperdon Molle*, to highly tropical desert mushrooms found in Sahara and Kalahari (desert truffles, *Terfizia* spp.,). Indian sub-continent with extremely diverse climate from temeperate – subtropical - tropical to arid harbours high variability of macrofungi.

COMMONLY CONSUMED MUSHROOMS

	<p>Shiitake mushroom (<i>Lentinula edodes</i>):</p> <p>World's No 1 variety, occupies 22% of global production, excellent edible and medicinal mushroom. Production, processing technology and spawn available at ICAR-IIHR</p>
	<p>Oyster mushrooms (<i>Pleurotus</i> spp.):</p> <p>World No 2 occupying 19% of global production. This mushroom can be pink, yellow, gray, brown, blue, black or white. Excellent culinary medicinal mushroom extremely suitable for Indian conditions. Production, processing technology and spawn available at ICAR-IIHR.</p>
	<p>Wood ear mushroom (<i>Auricularia Polytricha</i>):</p> <p>At No 3 position occupies 18% of global production. Extremely popular in North east India. Production technology and spawn available in India</p>
	<p>Button mushroom (<i>Agaricus bisporus</i>):</p> <p>With 15% of global production this mushroom is at No 4 position. Extremely popular in Europe and highly industrialized. Production technology and spawn available in India</p>

	<p>Enoki or winter mushroom (<i>Flammulina velutipes</i>): Occupying 11% of global production, this one of the most sought after temperate (10-12°C) mushrooms in Japan.</p>
	<p>Paddy Straw mushroom (<i>Volvariella volvaceae</i>): 5% global production, grown mainly in China, popular in Odisha state in India. Production technology and spawn available in India</p>
	<p>Milky mushroom (<i>Calocybe indica</i>): The first indigenous mushroom commercialized by ICAR-IIHR in 1993. A tropical mushroom suitable for temperature range of 30-38°C. Production technology and spawn available at ICAR-IIHR.</p>



Other Mushrooms: 10% - More than 100 mushroom varieties are under experimental cultivation which will very soon become the part of mainstream global mushroom industry.

Where does India stand in mushroom production: The global mushroom production in 2014 was 10.37 million tonnes with China contributing 73.57% (7.62 million tonnes) of the world production . Although India's potential for mushroom production can be more than 5 million tonnes based on mere 10% utilization of the surplus agro-residues burnt every year, availability of diverse agricultural residue, cheap work force and suitable diverse climate; yet it contributes merely 0.27% of the global production.

India's mushroom consumption status: Although mushrooms are extremely healthy food yet its consumption is very meagre in India. The per capita per annum mushroom consumption in India is 80grams as compared to 22kg in China.

ROLE OF ICAR-IIHR IN ENHANCING MUSHROOM PRODUCTION AND CONSUMPTION IN INDIA

Mushroom Research laboratory at ICAR-IIHR is involved in multifarious activities which include Research, quality spawn production, training and extension towards dispelling many myths associated with mushroom cultivation and consumption and making mushrooms an important ingredient of the Indian diet. Mushroom technology is one of the most eco-friendly technologies which can mitigate many social and environmental maladies like air pollution, malnutrition, unemployment and women empowerment.

Conserving the Mushroom wealth: ICAR-IIHR is involved in conserving the wild culinary medicinal mushroom germplasm from different geographical regions

of the country. The lab has documented more than 400 species of wild mushrooms of which 11 genera are seasonally collected from the wild and consumed in different parts of the country. Conservation and development of domestication package of such mushrooms is an important aspect being undertaken in the laboratory. Pink oyster mushroom, *Pleurotus djamor* (Western ghats), Wild strain of *Pleurotus cystidiosus* (Bengaluru), Species of *Macrocybe* (Bengaluru), *Lentinula tuber-regium* (Tripura), *Clitocybe* and *calocybe* species (Gujarat) are some of the wild strains which have been domesticated.



Changing the mindset: Many people in urban and rural India have many reservations about consuming mushrooms. ICAR-IIHR has been working towards addressing this challenge through imparting scientific knowledge about the vegetarian status of mushrooms. The demonstration of the entire process of oyster, Milky and shiitake mushroom production from making mushroom seeds (spawn) on sterilized Jowar grains to cultivation on steam sterilized straw, usage of potable water during cultivation, no chemicals used in the process of cultivation, extremely hygienic conditions in mushroom farms convinces people that Oyster, Milky and Shiitake mushrooms are the most hygienic and chemical free vegetables available in the market

Diversity in my food plate: Mushroom in India had become synonymous with



Button mushroom cultivation and consumption.

Realizing the importance of food diversity for sustainable nutrition, ICAR-IIHR undertook



research on numerous other mushroom varieties and developed the complete End to End technologies of oyster, Milky and shiitake mushrooms. Many more

varieties like King oyster mushroom, Beech mushroom, Lion's mane mushroom, Black poplar mushroom are under investigation.

Mushroom in my daily diet: Numerous value added products like Arka Mushroom rasam powder, Mushroom nutritive powder (chutney powder, chutney poodi) have been developed through dehydrated mushrooms. These value added products can enhance nutrition in the daily diet and also prevent post harvest losses due to surplus production. Mushrooms as a helping hand to mitigate malnutrition: Mushroom lab is also focussing towards production of iron, calcium and vitamin D enriched mushrooms which can also be a helping hand in mitigating malnutrition. The lab has also developed nutrition data of 20 species of indigenous mushrooms.



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Mechanization:

ICAR-IIHR was the first institution in the country to develop the indigenous spawn production machinery, developed systems to integrate solar energy



in spawn production and cultivation processes to make the entire mushroom technology more labour, energy and time efficient.

Support through quality spawn:

Mushroom Research lab has been supporting the mushroom farmers through the supply of quality spawn of many mushroom species. The laboratory supplies 35-40 tons of spawn per annum. Since the demand for spawn is very high and non availability of spawn is one of the major reasons for the slow progress of this crop,



ICAR-IIHR is also involved in giving technical consultancy for establishing and modernizing the spawn laboratories of the public and private sector.

Bringing mushrooms to every home:

Ready to fruit (RTF) bags is a novel concept initiated by ICAR-IIHR in 2013 to enable women to grow mushrooms at home and utilize it in their daily diet.



Since then more than 15000 RTF bags have been supplied to 1500 women who have made mushroom as a part of their daily diet. This concept has also been taken as a start up project to further the cause of enhancing rural employment and income.

Sharing knowledge: The laboratory conducts both entrepreneurial and basic orientation trainings to make mushrooms as successful social enterprise which can be socially, environmentally and economically be sustainable.

