

## MUSHROOMS: A POTENTIAL SOURCE FOR HUMAN HEALTH

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Romans regarded mushroom as food of God while Chinese termed them as elixir of life (Boa, 2004; Moerman, 2008). Mushroom is a macro-fungus generally found in moist places on soil, cow-dung, wood/dead wooden material, stone crevices and trees. They may be hypogeous or epigeous, large enough to be seen with the naked eye and to be picked by hand (Chang & Miles, 1992). *Lentinus edodes*, *Grifola frondosa*, *Chaterellus carius*, *Agaricus bisporus*, and *Pleurotus florida* serve as repositories of B-vitamins such as niacin, flavin and pyridoxine (Solomko & Eliseeva, 1988); organic acids such as ascorbate, shikimate, malate and fumarate; carbohydrates such as the glucans; monoterpenoid and diterpenoid lipids; proteins such as hydrophobins and trace elements such as selenium (Iwalokun et al., 2007).

Edible mushrooms have become an integral part of the normal human diet and considered as nutraceutical product (Solomko & Eliseeva, 1988). Mushrooms are also known for its medicinal properties like antitumor (Wandati et al., 2013), antigenotoxic, bioantimutagenic (Fillipie et al., 2002), anti-inflammatory, antilipidaemic, antihypertensive, and antihyperglycaemic (Hu et al., 2006), antibacterial and antifungal (Nehra et al., 2012), immunomodulators (Jeong et al., 2010). Oso (1975) reported that Yoruba traditional doctors used *Termitomyces microcarpus* mushroom as a medicine for the treatment of gonorrhoea. Mushroom antioxidants like ergothioneine and selenium protect body cells from damage that might lead to chronic diseases. Carcinostatic polysaccharide drugs like Krestin, Kawaratake and Schizophyllan have been isolated from mushrooms such as *Trametes versicolor*, *Lentinus edodes* and *Schizophyllum commune* (Mizuno et al., 1995).

Sheetal & Savita (2012) reported that the methanol, acetone and water extracts of *Ganoderma lucidum* inhibited the growth of *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, and *Salmonella typhimurium*. Paul et al. (2017) found that mushroom and fungi metabolites inhibited the growth of plant pathogens *Erwinia* spp. and *Ralstonia* spp. and of animal pathogens *Enterococcus faecalis*, *Staphylococcus aureus*, *Streptococ-*

*cus pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Proteus vulgaris*. Mushrooms are superior in protein content (Aremu et al., 2009) in comparison to all vegetables and fruits.

Mushrooms are found in different shapes, colour, aroma, texture. Mushrooms are neither large nor hard but highly perishable and contain lots of minerals and are very difficult to store for longer duration because edible varieties of mushroom generally contain lots of moisture so it is advisable to consume mushrooms fast. Mushrooms have been exploited in industrial sectors like agriculture, pharmaceutical, biowastes management and bio-filtration for commercial benefits. Nutrient rich biological products of mushroom can be processed into various commercial products, like pickles, jam, mushroom juice or powder, papad etc, enhancing its economical and consumptive values. It appears to be the need of hour to conserve mushroom biodiversity and to promote its value added products for their health benefits. Mushroom cultivation and commercialization will cater to the needs of rural people by enhancing their economy and also open a new window for industrial sectors.

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### Ganga Won't be Cleaned

For North India, Ganga is at the heart of its cultural and economic landscape. The 2,525 km long Ganga flows through Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and Bengal before reaching the Bay of Bengal. Along with its tributaries, it covers 11 states that are home to 600 million people and serves water to 40% of India's population. The river is currently struggling to cope with the sewage waste and industrial effluents dumped into it.

In his Budget speech, finance minister has claimed that cleaning of Ganga "has gathered speed, and 47 out of 187 sanctioned projects have been completed." Whereas, the latest National Mission for Clean Ganga report updated on December 2017 reveals that only 18 projects have been completed in the last four years.

Namami Gange lays much emphasis on pollution abatement through improvement of sewage infrastructure. A majority of sanctioned and completed projects therefore are sewage treatment plants (STPs). Yet, until December 2017, Namami Gange had created only 228.13 million litres per day of the 2,278.08 mld sewage treatment capacity it aimed for.

In the absence of well-connected underground sewage system, STPs would continue to suffer from shortage, under-evaluation and under-utilisation. More advance ground-work at the primary stage of assessing the scope of the problem is imperative to develop adequate supportive infrastructures for successful execution of STPs.

A plan to clean Ganga needs to shift focus from such centralised large capital expenditure projects, to a decentralised

process that undertakes cleaning-up from upstream to downwards, progressing through each watershed before entering the major trunk channel. Creating a comprehensive and robust real-time map of pollutants and their respective sources would help in effective monitoring of the problem. As 12 major tributaries source the Ganga, its rejuvenation would not be possible without clear rejuvenation strategies for each of its tributaries.

Ganga's freshwater ecosystem has also been severely affected by industrial discharge. A CAG report has revealed that during 2016-17, the level of pollutants in the river across Uttar Pradesh, Bihar and Bengal was six to 334 times higher than the prescribed levels. Strict monitoring and action is required from NGT against the polluting industries found non-compliant with prescribed effluent discharge standards. Introducing new statutes on making the polluter pay or treating the polluted water before it enters the system would prove to be an effective solution.

The most delicate problem is the pollution associated with cultural and religious festivities. The Uttar Pradesh Pollution Control Board estimated that the Maha Kumbh Mela in 2013—where 120 million people participated—saw 70% increase in the organic pollution level in the river. As the Ardh Kumbh is scheduled for next year, both the central and state government should put in place well thought out strategies to deal with the problem.

The Supreme Court once remarked, "it seems Ganga won't be cleaned even after 200 years."

—Aparana Roy