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Mushrooms - Some Ethnomycological and Sociobiological Aspects

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ABSTRACT

Mycophilic society around the world has always been looking for wild edible mushrooms during monsoon season since times immemorial. People have been collecting these mushrooms for several purposes including culinary, medicinal and sacred as well. Local inhabitants of various regions of the world belonging to different civilizations possessed ethnic information regarding uses of mushrooms in day to day life. This information has been capitalized and even strengthened through regular inputs from different parts of the world. Because of their time tested importance in human welfare over a period of time, mushrooms has earned the status of special creation of God. These mushrooms have played a pivotal role in the upliftment of social and economic status of the rural people by adding to their economic profits and serving their culinary needs at their door steps. The indigenous knowledge about utility of these wild mushrooms is an important area which needs to be explored scientifically for its wider use in human welfare. This manuscript presents a compilation of the published information about sociobiological and ethnomycological aspects of mushrooms at one place which otherwise is lying scattered in the published literature around the world.

Key words: Ethnomycology, food, income, medicine, sociobiology, traditional knowledge, wild edible mushrooms.

ABBREVIATION

vn. Vernacular name(s)

INTRODUCTION

Wild mushrooms have always fascinated man with their beautiful colors and forms. Not only this, their delicious taste, exotic aroma and appetizing flavors have put them at a special place in the food menu all over the world (Chang and Buswell, 1996; Chang and Miles, 2004). Collecting wild mushrooms especially for culinary purposes has been a traditional practice since times immemorial. However, mycophilic people have also been hunting these mushrooms for traditional medicinal uses or even for performing some sacred rituals. The fungus *Fomes officinalis* was thought by Dioscoroides (1st Century AD) to be a powerful drug with properties against variety of ailments including asthma, jaundice, dysentery, kidney diseases, bruises from fall, fractured limbs, cases of hysteria, etc. (Singh, 1999). Mushrooms have been treated in different ways in various civilizations and are known with a number of folk names in various languages and dialects. A comprehensive account on the utility of fungi in folklore and rituals from pre-historic times has been nicely documented by Wasson (1968). Collecting wild mushrooms in bulk and selling them has become an income generating activity in many parts of the world (Smith, 1949; Jordan and Wheeler, 1995; Sysouphanthong *et al.*, 2010). The global market for edible mushroom is estimated to be worth US \$ 42 billion per year, including wild and cultivated ones. About 350 species of fungi belonging to only 18 orders are being collected and consumed on worldwide basis. Amongst the mushroom genera the species of which are most commonly collected and traded are *Russula*, *Lactarius*, *Cantharellus*, *Amanita*, *Boletus*, *Morchella*, *Tuber* and *Cordyceps* (Boa, 2004; K.S.I., 2017; Atri *et al.*, 2018). Other than this, people have also been connecting the wild mushrooms with various myths and stories. Native people, especially the tribals and village folks are known to possess important traditional useful information with them which is being passed on from one generation to another. They use seasonal mushrooms for various purposes

as per the knowledge gained by them from their forefathers or elders. It is necessary to document this information with a view to make it available to the future generation in its original form and also relate it with present day information. This information is quite important to familiarize the present generation about the long drawn dependence of mankind on such minor forest products in traditional uses. In the present article, efforts have been made to compile the information about sociobiological and ethnomycological aspects of mushrooms in particular from various regions of the world which otherwise is lying scattered in the published literature by various investigators.

There is a need to adopt a precautionary approach while dealing with wild mushrooms from culinary point of view since many are poisonous (Ammirati *et al.*, 1985; Bresinsky and Besl, 1990; Lincoff and Mitchel, 1997).

WORLD SCENARIO

The utility of mushrooms has been reported from various corners of the world (Boa, 2004). Folks of various geographical locations have their own culture and custom of collecting and consuming wild mushrooms. Some of the reports are being discussed in the ongoing account.

ASIA

Christensen *et al.* (2008) reported 228 edible species of wild mushrooms which are collected and consumed in **Nepal**. Some of the commonly collected mushrooms are *Laetiporus sulphureus*, *Boletus edulis*, *Cantharellus cibarius*, *Pleurotus ostreatus*, *Astraeus hygrometricus*, *Termitomyces heimii*, etc. (Kharel and Rajbhandary, 2005). Some of these species are being sold fresh in the local markets while few are sold in dried forms like *Ramaria* spp. @ NPR 100 per 100 g and dried *Morchella conica* @ NPR 3,000 to NPR 7,000 per kg. Besides this Aryal and Budhathoki (2013) reported the use of *Agaricus augustus* (vn. Kaile Chyau), *Macrolepiota fuliginosa* (vn. Gobbre chyau), *Amanita caesarea* (vn. Suntale Chyau), *Amanita chepangiana* (vn. Salleu, Kukhura, phule chyau), *Volvariella bombycina* (vn. Kathemuse), *Scleroderma bovista* (vn. Alu chyau) as fresh vegetables.

Some of them including *Russula nigricans* (vn. Handi chyau) are reported to be used for preparing pickle. Dried powder of *Coprinus comatus* (vn. Gobre Chyau) is given to children with rice or milk to induce good sleep, while *Termitomyces clypeatus* and *T. eurhizus* (vn. Dhamere chyau) are being used as medicine against fever and measles. A mixture of *T. eurhizus* with other herbs is reported to be used as a lotion against skin problems. *Schizophyllum commune* is reported to be used for culinary purposes and in religious rituals.

As in India, *Morchella esculenta* is a highly prized edible mushroom in Pakistan (Ajmal *et al.*, 2015). Most of its collection in Pakistan is being undertaken from Hindukush and Himalayan mountain ranges. It is reported to be used for preparing different recipes in many three star and five star hotels. Local inhabitants of Pakistan think that person who finds *Morchella* is the luckiest (Ajmal *et al.*, 2005).

Wild mushrooms are also collected and consumed in **Philippines** (Lazo *et al.*, 2015). Here Gaddang, the indigenous people who locally call mushrooms as “tarulok” and “uong” collect these for use as food and in medicine. They cook mushrooms by boiling or sautéing with meat, vegetables or fermented fish sauce. Some of the mushrooms are thought to cure cough, cold, arthritis, stomachache and headache. For the medicinal use, they are reported to boil mushrooms with water and drink or eat it along with meal. Gaddang tribals are reported to differentiate edible and poisonous mushrooms with their experience by visualizing and smelling. They also consider mushrooms with ring on the stipe as poisonous. Commonly consumed species in this area include *Auricularia auricula*, *A. fuscusuccinea*, *Schizophyllum commune*, *Volvariella volvacea*, *Lentinus* sp., *Pleurotus* sp. (Lazo *et al.*, 2015).

Chuxiong city of **China** is known as 'the city of fungi' because of its rich fungal diversity as well as the traditional knowledge among the people regarding the use of fungi. Therefore it is also reported to be an attractive destination for eco-tourists (Liu *et al.*, 2018). Most of the collectors are reported to sell the wild edible mushrooms to a purchasing company. Many ethnic minority groups are engaged in this activity, they locally refer mushrooms as pinyin and Yi. They use wild mushrooms for food, as medicine and in religious worships. On an average a family is reported to earn about 1500 USD by selling wild mushrooms during a harvesting season. Some of the common species in this regard are *Boletus edulis*., *Termitomyces albuminosus*, *Morchella esculenta*, *Phallus indusiatus* and *Tricholoma matsutake*. It is an interesting notable point that as per the traditional culture mushrooms are not just uprooted from the ground but these are harvested without destroying the basal mycelium. There is an advanced commercialization of wild edible fungi in Chuxiong because of governmental support. *Ophiocordyceps sinensis* and *Tricholoma matsutake* are steeped in liquor by the local people for personal consumption due to their medicinal properties.

In Nanhua County (**China**), “Mushroom Food Culture Festival” is reported to be celebrated every year due to its rich mushroom diversity. Additionally, National Protection of Geographical Indications is protecting “Nanhua *Tricholoma*

matsutake”. It has been reported that the annual income from wild edible fungi is about 80 million USD (Liu *et al.*, 2018).

AFRICA

There are reports of traditional use of mushrooms for culinary purposes from different parts of the world. From the African subcontinent the people living in rural areas of **Cameroon** are reported to collect mushrooms from the wild for selling in the local markets (Yongabi *et al.*, 2004). They are reported to collect these in raffia baskets and sell a basket containing 3-5 kg fresh mushrooms @ US \$ 35. The common species of mushrooms which are used as food in this region are *Agaricus campestris* (vn. Kikul cocombiyako, Aghog), *Agaricus bitorquis* (vn. Cocombiyako), *Volvariella volvacea* (vn. Cocombiyako), *V. gloiocephala* (vn. Aghog), *V. caesiostincta*, *Clathrus* sp., *Amanita* sp., *Ganoderma lucidum*, *Dictyophora* sp., *Omphalotus olearius*, *Chlorophyllum molybdites*, *Macrolepiota* sp., *Flammulina velutipes* (vn. Aghog), *Auricularia auricula* (vn. Cocombiyako), *Termitomyces titanicus* (vn. Pohwett, Lemukwali), *T. robustus* (vn. Kep, Pohwett), *T. clypeatus*, *T. mammiformis*, *Pleurotus tuberregium*, *P. ostreatus*, *P. pulmonarius* and *P. sajor-caju*. *Termitomyces titanicus* is one such mushroom which has been reported to be in use for treatment of patients suffering from diabetes. For this purpose, it is dried, grinded and mixed with pastry and then fed to the children. Many of the mushrooms being used by people are dried and preserved for several months (Yongabi *et al.*, 2018).

Mushroom collection is a socioeconomic activity in Southern Highlands of **Tanzania** among Benna and Hehe communities which give them food and financial security. Women are reported to be more actively involved in the collection of mushrooms as compared to men. It has been reported that mushroom collectors of this region earn US \$ 500 to 650 per season from 1000-1500 kg mushrooms while retailers earn US \$ 750 to 1000 per season from 750-800 kg of mushrooms (Chelela *et al.*, 2014). Some species of *Lactarius*, *Russula*, *Cantharellus* and *Amanita* are reported to be commonly collected and consumed in Tanzania (Chelela *et al.*, 2014).

In **Ethiopia**, mushrooms are locally called as Angudai and are reported to be used for culinary purposes by Majangir tribe and Wacha inhabitants of southwestern Ethiopia (Tuno, 2001; Teferi *et al.*, 2013; Semwal *et al.*, 2014a).

People are also reported to collect wild mushrooms in **Ghana** for culinary purposes (Apetorgbor *et al.*, 2006; Yafetto and Osei-Bonsu, 2017). Commonly gathered species are *Volvariella volvacea* (vn. Domo), *Calvatia cyathiformis* (vn. Efu), *Pleurotus tuberregium* (vn. Mirefufuo), *Termitomyces robustus* (vn. Nkankum), *T. schimperi* (vn. Sibire), and *Coprinus disseminatus* (vn. Sesea, Nidiwa, Tsloyumu). For this, fresh mushrooms are washed, chopped and used in the preparations of stew and soup. *Volvariella volvacea* and *Termitomyces robustus* are used by the local people as blood tonic. *T. schimperi*, *T. globules* and *V. volvacea* are used for the treatment of high blood pressure. People here consider mushrooms as supplement or alternative to meat or fish.

It has been reported that in **Western Burundi**, edible mushrooms are preferred over meat, especially *Termitomyces*

sp. Other commonly consumed species belong to genera *Cantharellus*, *Amanita*, *Russula*, *Lactarius*, *Tricholoma*, etc. (Buyck and Nzigidahera, 1995).

NORTH AND SOUTH AMERICA

It has been recorded that in the city of **Mexico**, 30 species of wild edible mushrooms are collected for personal consumption and are also sold in the markets by the local people (Montoya *et al.*, 2008). The minimum income from mushroom selling in the State of Tlaxcala was reported to be 15.44 Mexican pesos (USD 2.54) per day in 1995. The average mushroom earnings per family in Javier Mina have been reported to range from 62 to 82 Mexican pesos (USD 10.27-13.47) for each day for collecting. Some of the commonly preferred species are *Amanita franchetii*, *Clitocybe gibba*, *Gomphus floccosus*, *Gymnopus dryophilus*, *Hebeloma mesophaeum*, *Helvella* sp., *Hygrophorus chrysodon*, *Hygrophorus purpurascens*, *Laccaria trichodermophora*, *Lactarius* cf. *salmonicolor*, *Ramaria* spp. *Russula* cf. *delica*, *Suillus* spp. and *Tricholoma* cf. *equestre*.

Kaul (2007) has reported that wild edible mushrooms are collected at commercial scale in Sweden, Munich (Germany) and North America. Some of the species which are commonly collected in Pacific Northwest region of USA are *Morchella* sp., *Cantharellus* sp., *Tricholoma* sp. and *Boletus edulis*. It has also been documented that 2 million kg of these mushrooms fetch around 41.1 million USD.

EUROPE

There are many varieties of edible mushrooms out of which *Boletes edulis*, *Morchella esculenta*, *Cantharellus cibarius*, Truffles, *Laetiporus sulphureus* are reported to be amongst the best from edibility point of view. Fresh truffles are reported to be the most precious of all. All these mushrooms are reported to fetch high price from the consumers in the European markets (Jordan and Wheeler, 1995).

Gathering wild mushrooms for personal consumption as well as livelihood is reported to be a common traditional practice in rural areas of **Finland** (Cai *et al.*, 2011). The species including *Lactarius trivialis*, *Lactarius rufus*, *Cantharellus cibarius* and *Russula* sp. are commonly harvested for culinary purposes.

INDIAN SCENARIO

In different parts of India, there is lot of variation in cultures and customs, so is the case with the use of forest based minor products by people including mushrooms in their day to day life. Purkayastha and Chandra (1985) listed a number of edible mushrooms along with their trivial names from different parts of India in their 'Manual of Indian Edible Mushrooms'. The use of mushroom *Fomes fomentarius* by Portuguese in Goa is reported to be amongst the earliest of references of its use in local medicine (Dymock *et al.*, 1890).

NORTHERN INDIA

There are many reports regarding consumption of wild mushrooms in the state of Jammu and Kashmir. Kumar and Sharma (2009) reported the collection of seven species of wild edible mushrooms including *Cantharellus cibarius* (vn.

Haildii), *Coprinus comatus* (vn. Chaitar), *Geopora arenicola* (vn. Kundii, Gav Padur, Khuduz), *Ramaria formosa* (vn. Shairii), *Ramaria flavo-brunnescens* (vn. Shairee), *Sparassis crispa* (Baidth Shairee) and *Termitomyces striatus* by the local people of Jammu province for their personal consumption. *Geopora arenicola* is reported to be one such species which is widely consumed by the people and also sold in the local markets @ Rs. 50 per kg. Other such mushrooms are *Ramaria formosa* which is reported to be sold @ Rs. 40-50 per kg, *Ramaria flavo-brunnescens* @ Rs. 30 per kg, *Sparassis crispa* @ Rs. 50-60 per kg and *Termitomyces striatus* @ Rs. 70 per kg. Besides these, the species of *Morchella* are being traded on large scale because of their culinary preference in the urban markets. These are being sold by the villagers to the middleman @ Rs. 2000-3000 per kg, who further sell these to the wholesalers at a high price ranging from Rs. 5000 to 7000 per kg (Kumar and Sharma, 2010). Women and children of 'Gaddi and Shippi' tribes are reported to be more involved in gathering the wild mushrooms from the forested areas in comparison to men (Kumar and Sharma, 2011). Many of these species including *Geopora arenicola*, *Sepultaria sumneriana*, *Morchella* sp., *Pleurotus* sp., *Russula* sp. and *Sparassis* sp. are reported to be sun dried for preservation. The fresh sporocarps of *Geopora arenicola* and *Sepultaria sumneriana* are washed thoroughly, dried in sun, salted and then mixed with turmeric powder for off season storage. As far as consumption is concerned, *Rhizopogon* sp. is reported to be eaten raw after washing thoroughly. Another mushroom *Boletus luridus* (vn. Bhutol, Dailoo, Bhutoo) is reported to be consumed after gentle roasting by placing it directly on fire. Several dishes which are being prepared with the morels include 'Chaschni' (a local dessert), 'Thunthoo Yakhni' (curd + morels), 'Thunthoo Kheer' (milk + morels), and 'Thunthoo Pullaow' (rice + morels) (Kumar and Sharma, 2011).

It has been reported by Yangdol *et al.* (2014) that *Laetiporus sulphureus* is a commonly consumed macrofungus in **Ladakh** which is locally called as 'Chasha' which means chicken, as its texture and flavor is reported to be quite similar to chicken. People are reported to use it for preparing various dishes including mixed vegetable or mushroom soup. Some traditional recipes which are being prepared include 'Skyu', 'Mok Mok' and 'Thukpa'. These are consumed with whole wheat bread locally referred as 'Tagi Rsamo' (Yangdol *et al.*, 2014).

In the hilly areas of North West Indian states including **Punjab** and **Himachal Pradesh**, mostly elder men and women of rural areas are involved in collecting wild mushrooms especially during the early morning time regularly in monsoon seasons (Sharma *et al.*, 2009; Kumari *et al.*, 2012; Atri *et al.*, 2012). They are reported to select the edible mushrooms on the basis of their own experiences gained from older people in the trade or from their own parents. This knowledge is being passed on from one generation to other during the course of one's life time. For consumption, they are reported to prefer the sporocarps growing on the rotting wood, dry stumps of *Euphorbia royleana* and other trees, termite mounds and paddy straw, while those growing on debris or dung are regarded as

inedible. The fruit bodies with thick flesh and mild taste are preferred but those which taste bad or give burning sensation on tongue are avoided. People consider that those mushrooms which are eaten by rodents, snails or monkeys are suitable for human consumption. The sporocarps with annular ring on the stipe or which changes the color on exposure are treated as poisonous. In this region termitophilous mushroom with long rooting stipe base are the most preferred one's for personal consumption. These are also sun dried and preserved for future use. *Termitomyces microcarpus*, *T. radicans*, *T. medius*, *T. badius* (vn. Bhatolian, Baat koir, Mohtran), *T. mammiformis*, *T. striatus*, *T. heimii* (vn. Goal Tatmour, Joru Koir), *Macrolepiota procera*, *M. dolichaula*, *M. rhacodes* (vn. Kandi Koir, Tatmour, Badi Chattri), *Lepiota cristata*, *L. clypeolaria*, *Leucoagaricus albidus* (vn. Laseri, Chaachi, Goal Tamotaran) are some such preferred species. People generally eat them as mushroom curry which is prepared either pure or mixed with other vegetables and spices. Small sized termitophilous species are cooked with rice to make 'rice pulao'. Mushroom soup is also used during indigestion or anemic conditions for the betterment. Species like *T. heimii* and *T. mammiformis* are also sold by the vegetable vendors in the local markets of Punjab at the rate of Rs. 50 to 60 per kg (Atri et al., 2005, 2010). Species of *Hericium* are also consumed in the state of Himachal Pradesh. These are chopped into small pieces for consumption. People also preserve it by drying for the future use (Lakhanpal, 1994).

A report from **Kinnaur** district of Himachal Pradesh documented that local inhabitants of the district commonly consume wild mushrooms including *Agaricus campestris*, *Gyromitra* sp., *Helvella compressa*, *Hygrophorus* sp., *Lactarius deliciosus*, *Lycoperdon* sp., *Morchella conica*, *Morchella deliciosa*, *Morchella esculenta*, *Ramaria botrytis*, *Rhizopogon vulgaris* and *Sparassis crispa* (Chauhan et al., 2014). For preparing recipes fresh or dried sporocarps, are first boiled, then after squeezing water, these are fried in oil. All of these are primarily collected for domestic consumption. Out of these, *Morchella* species are reported to be traded in the markets at a very high price ranging between Rs.8000-12,000/kg (Chauhan et al., 2014).

The local, tribal and Nepali communities living in Garhwal are also fond of wild mushrooms (Singh et al., 2017). As many as 21 wild species have been recorded as edible out of which *Macrolepiota procera*, *Chlorophyllum rachodes*, *Agaricus augustus*, *Hericium coralloides*, *H. erinaceus*, *Laetiporus sulphureus*, *Pleurotus ostreatus* and *Ramaria sanguinea* are the preferred ones. For preparing recipes, they fry them in butter or ghee with tomatoes, onions and other general ingredients just like any other vegetable recipes. *Aleuria aurantia* is commonly used for preparing pickle while some other species like *Tremella mesenterica*, *Ramaria sanguinea* are stored after air or sun drying for use during off season (Singh et al., 2017).

The collection, consumption and sale of wild mushrooms is reported to be a common practice in the **North West Himalayan** region of India (Lakhanpal, 2002; Semwal et al., 2014b). Some common edible mushrooms of this area belong to the genus *Amanita*, *Astraeus* (vn. Phutphut), *Cantherellus*,

Cordyceps (Keeda ghas or Keeda-jari), *Hericium* (vn. Bakri-cheun), *Ramaria* (vn. Ungli-cheun), *Morchella* (vn. Guchhi, Chunchuroo), *Termitomyces* (Shinghani), *Tricholoma* (vn. Til-cheun), *Pleurotus*, *Russula* and *Lactarius*, etc. In this region **Brahmin** families consider the taste of mushrooms similar to the animal flesh, so being pure vegetarian they do not include the mushrooms in their diet. *Cordyceps sinensis* is collected by the local people of the area and sold to the local vendors who are reported to export it to the traders in Nepal and China. Being of huge medicinal value, it is reported to be sold at a high premium of Rs. 55,000 to 80,000 per kg. In the higher reaches of Uttarakhand, *Cordyceps sinensis* (vn. Yarsagumba, Jeeban booti) is taken in soups or tea as an aphrodisiac, revitaliser, anti-aging invigorative (Semwal et al., 2014b). Most of the species of mushrooms are cooked for consumption just like other vegetables. Fresh fruit bodies are cleaned in saline water, and then fried in oil/ghee with onion, garlic, tomatoes and other common ingredients. People of Chamoli district of Uttarakhand are reported to consume *Morchella esculenta* by making its decoction after boiling in water while people of Kullu district of Himachal Pradesh are reported to boil it in milk for consumption. In cooking *Termitomyces*, a drop of lemon juice is also added, with a thought that it will do away poisoning effect of the mushrooms, if any.

Haryana is another north Indian state where mushroom hunting is a common traditional practice among the rural population. Edible mushrooms are locally called as 'Khumbi' while inedible as 'Saap ki Chhatri' in Hindi (Mridu and Atri, 2015). Wild species of *Calocybe*, *Termitomyces*, *Pleurotus*, *Macrolepiota*, *Podaxis pistillaris*, etc. are commonly consumed mushrooms. Besides culinary purposes, *P. pistillaris* is also used as a medicine. Its fresh sporocarp is mashed as a paste with mustard oil and applied on the wounds for treatment. The blackish powder of mature fruit bodies is also used for this purpose. *P. pistillaris* is also sold in the local markets when found in bulk at the rate of Rs. 120 to 170 per kg. The unopened button stage of the sporocarps are used for the culinary purposes, which are first cleaned up with lukewarm water and then fried in oil/butter with tomato, onion, garlic, ginger and other common spices. The dishes made from *Podaxis pistillaris* are considered as a special cuisine during festive occasions (Mridu and Atri, 2015).

EASTERN INDIA

It has been recorded by Sarma et al. (2010) from Western **Assam** that, Bodo and Garo tribes in Western Assam especially the women folks collect wild mushrooms for their personal consumption. About 25 species identified as edible by these tribes include the species of genera *Auricularia*, *Boletus*, *Cantherallus*, *Lentinus*, *Laetiporus*, *Termitomyces*, *Morchella*, etc. (Sarma et al., 2010). Besides consuming these as food, people are also known to use them for medicinal purposes. *Auricularia auricula* is used in the treatment of rheumatic pains and injuries, while *A. delicata* is being used to stop bleeding.

In Kohima district of **Nagaland** also rural people are reported to relish collecting and eating wild mushrooms (Tanti et al., 2011). The common species which are preferred for

consumption by them are *Lentinus connatus*, *Termitomyces eurrhizus*, *Schizophyllum commune*, *Tricholoma giganteum* and *Pleurotus* sp. Besides personal consumption, people also sell these mushrooms in the market throughout the year. Among the mushroom sellers, more than 80% are reported to be the local women. These are packed in nylon bags or wrapped in banana leaves and sold at the rate of Rs. 200 per kg in the local market (Tanti *et al.*, 2011).

The practice of consumption of wild mushrooms is reported to be a common tradition among the people of **West Bengal** (Dutta and Acharya, 2014). Mostly women folk are actively engaged in the collection of mushrooms which are used for food, medicine and also as a source of income. The preferred species for food belong to genera *Amanita*, *Astraeus*, *Armillaria*, *Auricularia*, *Fistulina*, *Grifola*, *Hericeum*, *Coprinus*, *Pholiota*, *Meripilus*, *Termitomyces*, *Pleurotus*, *Calocybe*, *Russula*, *Lentinus*, *Tricholoma* and *Volvariella* while the species of *Cordyceps*, *Ganoderma*, *Termitomyces* and *Schizophyllum*, etc. are being used for medicinal purposes in various forms. For the culinary purposes, most of the species are cooked in mustard oil and spices, *Auricularia auricula* is fried with noodles, *Schizophyllum commune* is mixed with gram flour to make 'pakodas'. People are reported to add more amount of garlic and ginger to the dishes as they think these ingredients will help in countering the poisoning affects of mushrooms (Dutta and Acharya, 2014). Many of the species are being sold in the local markets at varying prices like *Termitomyces heimii* @ Rs. 200 per kg, *Auricularia auricula* @ Rs. 1200 per kg. Some of these mushrooms like *Daldinia concentrica* (Kath chhatu) and *Pisolithus arhizus* (vn. Sonajhuri chhatu, Bomb chhatu) are reported to be mixed with coconut oil for use against skin ailments like itching, burning and minor skin infections. *Schizophyllum commune* (vn. Pakha chhatu) is reported to be used as tonic in the form of soup made in water. *Termitomyces clypeatus* (vn. Bali chhatu, Kalunge chiyau) is another mushroom which is being used in the form of paste for the treatment of pox (Dutta and Acharya, 2014).

The collection of wild macrofungi and selling them in local markets is reported to be a common tradition among Khasi tribe of **Meghalaya** (Khaund and Joshi, 2013). Some of the edible species which are reported to be traded by them are *Gomphus floccosus* (vn. Tit duma/Tit thlong/Tit tydong) @Rs. 200/kg, *Tricholoma viridiolivaceum* (vn. Tit kseh/Tit kdait) @Rs. 200/kg, *T. saponaceum* @ Rs. 200/kg, *Craterellus odoratus* (vn. Tit stem) @Rs.280/kg, *Lactarius volemus* (vn. Tit doh/ Tit tung), *Cantharellus cibarius* (vn. Tit khangai pylleng) @Rs.280/kg, *Laccaria lateritia* (vn. Tit tyngab/ Tit iong) @Rs. 280-300/kg, *Albatrellus* sp. @ Rs. 200/kg, *Ramaria* sp. (vn. Tit lbong hati) @Rs. 250-300/kg and *Clavulina* sp. (vn. Tit thnat syiar) @Rs. 300-350/kg. These mushrooms are collected by the tribal people from forests and meadows and transported to the sellers by wrapping them in the leaves of Banana and *Pyrnium pubinerve*. These are being sold in the local markets mostly by the women folks (locally called as 'Kong'). There is a unique traditional technique called as 'narsuh' which is practiced while cooking. An iron rod with a wooden handle is heated to red hot at its tip. This hot rod is then immediately put in the

centre of the bowl containing the cooked mushrooms. It is thought that the heat of the rod absorbs or destroys the harmful substances, if present in the mushrooms (Khaund and Joshi, 2013). People here use the mushrooms in many different ways to make cuisines. Some of the dishes include mushroom soup (vn. Syrwa tit), which is made just like any other soup. Sometimes mustard greens (*Brassica juncea*) are also added to it. Mushroom pork (vn. Tit tung bad doh sniag) which is one of the favorite dishes of tribal people is cooked with black sesame seed, *Capsicum frutescens* and pork. Mushrooms with fermented fish (vn. Tit tyngab bad tungtap) which is cooked with a traditionally fermented fish product 'tungtap', both are boiled together adding spices and served with rice. A traditional rice based mushroom dish, locally called as 'Tit tyngab bad Jadoh', in which mushrooms and pork are fried in oil with common spices and vegetables and then boiled rice is added to it. The species of *Clavulina* are commonly consumed as 'chicken mushroom' (Khaund and Joshi, 2013). Some of the mushrooms are also used to add flavor to other dishes or chopped into small pieces and used as dumplings. Mushrooms are also cooked with **Bamboo** shoots or *Capsicum* (Khaund and Joshi, 2013).

WESTERN AND CENTRAL INDIA

A number of traditional practices using mushrooms are reported to be undertaken by the Jessore community and Purna community in **Gujrat** (Lahiri *et al.*, 2010). *Xylaria* sp. (vn. More-Pankh) is reported to be used in the form of paste, made by triturating 5-6 sporocarps with fresh water. The paste is consumed orally for the treatment of pneumonia and constipation while in case of eczema patients it is applied on the affected part of the skin and covered with bandage. The spores of *Coprinus comatus* (vn. Ajjio) are reported to be used for the treatment of skin ailments such as lesions, infections, wounds or bruised skin. For this purpose, the pileus is opened and gills are placed on the skin. *Phallus* sp. (vn. Datto), *Coprinus comatus* (vn. Chatri) and *Scleroderma* sp. (vn. Dado) are also used for skin treatment in the form of paste (Lahiri *et al.*, 2010). The dried form of *Termitomyces tyleranus* (vn. Adim) is reported to be used for general protection from the diseases especially chicken pox as a prophylactic measure. It is also burned and inhaled to speed up the occurrence, maturation and scaling of chicken pox, also consumed orally as raw or in cooked form. The spore mass of *Bovista* sp. (vn. Bhupid) is applied on the skin for the treatment of bruised skin infections (Lahiri *et al.*, 2010). The cooked *Pleurotus* sp. is consumed orally. It is thought to provide strengthening effect. The species of *Lentinus* are prized edible mushrooms of the area. Some of the species are difficult to chew and hard to digest, therefore these are being consumed after thorough cooking. These are also dried and stored in the form of powder. The powder is used to add flavor to the other dishes throughout the year. These species are used medically during convalescence, nausea and stomach ache. *Termitomyces microcarpus* (vn. Sita-adim, Kulambi-kunwar) as well as other species of *Termitomyces* (vn. Adim, Rombadia-adim) are consumed orally for general health maintenance (Lahiri *et al.*, 2010).

Vaidya and Rabba (1993) gave an account of ethnomedical

importance of *Agaricus campestris* as nutritious tonic and documented its use against tuberculosis and sinusitis. Other such mushrooms with ethnomedical utility documented by them are *Inonotus obliquus* (vn. Tehaga) used against chronic gastritis, ulcers and cancer and *Daedaleopsis flavida* (vn. Snuff fungus) against jaundice. Wild edible mushrooms are documented to have an important place in the tribal's life because of being regular part of their diet and medicine (Vaidya and Rabba, 1993). *Phellinus gilvus* (vn. Phansomba) is reported to be used in pregnancy. *Ganoderma lucidum* var. *capense* is reported to be commonly used by the tribals of **Maharashtra** and **Madhya Pradesh** for treatment of human diseases and even for veterinary uses (Vaidya *et al.*, 2005).

The wild species of mushrooms are also collected and sold in the local markets by the inhabitants of **Madhya Pradesh** (Harsh *et al.*, 1999). The tribal families especially the women are reported to be actively involved in this venture. Some of the species including of *Termitomyces* are sun-dried for long storage. It has been documented that for drying during cloudy days, a special mat made up of Bamboo with mushrooms to be dried is hanged on a fireplace (vn. Chulha) (Harsh *et al.*, 1999).

People of **Chhattisgarh** are also reported to use mushrooms for food as well as for medicinal purposes (Tiwari *et al.*, 2009). The commonly used wild edible mushrooms of this region are *Agaricus* sp. (vn. Dharti phool), *Cantharellus* sp. (vn. Bans Pihari), *Calvatia* sp., *Lycoperdon* sp., *Lentinus* sp. (vn. Lakri Pihari), *Amanita vaginata* (vn. Sua Munda), *Russula delica* (vn. Sarai Pihari), *Russula pseudodelica*, *Pleurotus florida*, *Termitomyces microcarpus* (vn. Kanki Pihari), *T. striatus* (vn. Dilwa Pihari), *T. heimii*, *Volvariella volvacea* (vn. Para Pihari), *Sinotermitomyces* sp. (vn. Putu), *Rhizopogon* sp. (vn. Gol Putu), etc. Besides culinary purposes, many species of mushrooms are reported to be in use for pharamocological purposes (Tiwari *et al.*, 2009). *Agaricus* sp. is being used for the treatment of goiter. *Cantharellus* sp. and *Termitomyces* sp. are given to the women as a tonic for easy delivery of the child. *Russula* sp. and *Calvatia cyathiformis* are used for the healing of wounds. *Termitomyces microcarpus* is used as a tonic for treating weakness. *Lycoperdon* sp. is used for blood coagulation (Tiwari *et al.*, 2009).

SOUTHERN INDIA

Wild edible mushrooms are also reported to be consumed by the tribal communities of Wayanad area of **Kerala** including the species of *Termitomyces*, *Pleurotus* and *Lentinus* (Varghese *et al.*, 2010). Women and children are the major mushroom collectors. *Termitomyces* species are sometimes consumed raw by the children. Different species are used for different medicinal purposes including the treatment of body pain, stiffness, arthritis, etc (Varghese *et al.*, 2010).

Kaani tribe in **Kanyakumari** are reported to prefer hunting forest products including mushrooms for their livelihood (Johnsy *et al.*, 2011). The commonly collected mushroom species for this purpose include *Pleurotus roseus* (vn. Vellathazan Kumizh), *P. ostreatus*, *P. sajor caju*, *Termitomyces microcarpus* (vn. Ari kumizh), *T. heimii* (Puttu

Kumizh), *Auricularia auricula* (Murukan Kumizh), *Volvariella volvacea* (Vaikol Kumizh), *Lentinus squarrosulus* (vn. Kollaam Kumizh), *L. tuberregium* (Mulan Kumizh) and *Grifola frondosa* (Vella Murukan Kumizh).

It has been reported that tribal people of lateritic scrub jungle of **Southwest India** consume wild edible fungi including *Amanita* sp., *Astraeus odoratus* and *Termitomyces striatus*. *Amanita* sp. is locally called 'motte anabe' in Kannada which means 'egg mushroom' (Greeshma *et al.*, 2015).

In **Western Ghats and west coast of India**, species of *Termitomyces* are reported to be widely distributed and are collected by tribal and local population for personal consumption (Karun and Sridhar, 2013). Various commonly collected species with their vernacular names are *T. clypeatus* (vn. Naikodae, Pillukum), *T. eurrhizus* (vn. Kodaekum), *T. heimii* (vn. Alukum or Alandikum), *T. microcarpus* (vn. Nuchikum or Pullaekum) and *T. unkowaan* (vn. Kodaalambu).

MYTHS AND STORIES ASSOCIATED WITH MUSHROOMS

There are some indigenous beliefs among the Gaddang people in Philippines related to the mushrooms. They think that mushrooms are guarded by the spirits and cannot be collected easily, therefore they have to ask permission from spirits before collecting the mushrooms. They also believe that the growth of mushrooms is enhanced by the spontaneous lightening (Lazo *et al.*, 2015). Some people think that all the mushrooms are tasted by snakes, so these are poisonous (Semwal *et al.*, 2014b). People of West Bengal prefer mushroom hunting on full moon days and new moon days (Dutta and Acharya, 2014). Folk of Himachal Pradesh have a mythological belief that sudden appearance of mushrooms is linked with thunder storm and lightening (Kumari *et al.*, 2012). People in Haryana believe that snakes resides where poisonous mushrooms grow. In Western Burundi (Africa), there is a fear among the folks regarding mushrooms, according to them if once poisonous mushroom is picked up, it should be placed back to its place in order to avoid any disaster (Buyck and Nzigidahera, 1995). The Mexican Indians regarded hallucinogenic mushrooms as mediators with God while Nahua Aztecs referred mushrooms as teonanacatl, meaning God's flesh. (Singh, 1999).

CONCLUSION

Despite varied perception and associated myths in different parts of the world, wild edible mushrooms remain a precious forest based minor resource which is traditionally being consumed in all regions of the world. People can differentiate among edible and the poisonous ones based on their own experiences as well as what their ancestors have taught them. Still there have been many instances of fatal mushroom poisoning in different parts of the world. Wild mushrooms are satisfying people's hunger and livelihood. Especially the tribal communities and rural populace is more dependent on them. Besides this, being nutritionally rich, these are helpful in overcoming malnutrition. Species of genus *Termitomyces* have been found to be the most widely used mushroom all over the world. Commonly all the mushroom species are

cooked as a vegetable for culinary purposes. Over a period of time people indulging in mushroom collection activity learnt about their medicinal benefits because of which mushrooms have found utility as home remedies against skin ailments, fever, indigestion and other such ailments in different parts of the world. The traditional ways of using mushrooms as medicine are interesting as well as important which are worth examining on scientific parameters. For which primary requirement is to document the ethnomycological information from the unexplored areas. On the other hand, there is also a need to conserve this mushroom diversity for their long term availability and sustenance of the forest ecosystem. Yearly unchecked bulk collection is adversely impacting the ecosystem sustenance in general and mushroom availability in particular. *In-situ* and *ex-situ* conservation strategies besides identification of the threatened species and enforcement of blanket ban on their bulk collection needs to be adopted with conviction (Atri and Lakhanpal, 2002).

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