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STUDY OF WILD EDIBLE MUSHROOMS FOR IMPROVING HUMAN HEALTH AND LIVELIHOODS SUPPORT IN BASTAR PLATEAU INDIA

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ABSTRACT

Chhattisgarh state has the huge diversity of mushroom flora among which some are edible. Present study was conducted in Bastar Plateau during rainy season for naturally grown wild edible mushrooms. Mushroom have become attractive as a functional food and as a source for the development of drugs and nutraceuticals responsible with their antioxidant, antitumor and antimicrobial properties. Besides their pharmacological features, mushrooms are becoming more important in our diet due to their nutritional value, related to high protein and low fat. There are so many types of fungi are present in Bastar palateu Chhattisgarh. Wild edible mushrooms are collected by tribal peoples for their food as well as livelihood support. Mushrooms are used as food supplement in various cultures and known for their edibility and delicacy for which, they are collected from wild and also cultivated. Nutritionally, edible mushrooms provide essential nutrients and contribute significantly to human diet & helth. Mushrooms are not only sources of nutrients but also have been reported as therapeutic foods, useful in preventing diseases such as hypertension, hypercholesterolemia and cancer etc. 30 village of 6 Tehsil covered under survey and 50 tribal/ rural peoples were contacted from different study villages and different local markets for information about wild edible mushroom at their surrounding locality. Information on wild edible mushrooms was collected from forests of Bastar plateau, Chhattisgarh by visiting different sites in forest areas. Tribal people were contacted and informations recorded by personal interviews. 16 fleshy mushrooms were identified and collected from Bastar Plateau of Chhattisgarh state during the study especially in mansoon season in the year 2021, two species of *Termitomyces* and *Russula* were predominantly observed from most of the locality in study area. We observed that environmental factors like rainfall, light, temperature, nutrients and relative humidity etc. Greatly influence the growth and development of mushrooms in the study area. In nature, mushrooms grow wild in almost all types of soils, on decaying organic matter, wooden stumps, and termite comb especially in Bastar plateau due to presence of red lateritic soil etc. They appear in all seasons; however rains favor rapid growth when organic matter or its decomposition products are easily available. This preliminary study shows that the Bastar forests and soils are very rich in mushroom diversity during rainy season in year.

***Keywords*:** Bastar Plateau, Mushroom, Boda, *Shorea robusta*, Wild edible fungi, Substrate, Termites and Organic matter etc.

Introduction

The species diversity of fungi and their natural beauty occupy prime place in the biological world and India has been a cradle for these species. Defining the number of fungi on earth has been a point of discussion and several studies have focused on enumerating the worlds fungal diversity (Crous *et al.,* 2006). The diversity of climatic conditions prevalent in India made this country had natural habitat of a number of mushrooms species. There are over 2000 species of edible fungi known to man out of 10,000 species of macrofungi. Watling and Gregory (1980) predicted that since India is richer in flowering plants than any other country of its size, the fungal wealth of India is also expected to be equally diverse. But, no concerted efforts have been made for any detailed study of natural mushroom flora in different parts of the country till today, although some sporadic attempts were made by some workers around the country (Verma, 1997). The history of the use of wild mushrooms as

food and in medicine is well documented for many countries, and India is just one example (Sarkar *et al.,* 1988; Kaul 1993; Rai *et al.,* 1993; Sharma & Doshi 1996; Singh & Rawat 2000; Sharma *et al*., 2009; Karwa, 2010; Giri *et al.,* 2012). However, reports that describe the collection of wild edible mushrooms are rather limited (Christensen & Larsen 2005) or documented in papers published in less circulated journals. FAO (2004) stated that mushrooms are an important nutrient source in rural areas of India, and indicated that the species generally collected included members of the genera *Termitomyces* and *Russula*.

In India, some efforts have been made into the identification of the country's mushroom flora occurring in the diverse bio-geographical regions of the country. Attempts were made to survey the areas mostly from South India, North West Himalayas and Eastern part but the North India including M.P., U.P. and Chhattisgarh have received lesser attention (Thakur *et al*., 2005). Edible mushrooms belong to genera *Astraeus*, *Russula* and *Termitomyces* are used in food by tribes and non tribal people of Bastar region of Chhattisgarh state. The gasteroid fungus *Astraeus hygrometricus* was reported as early as in 18th century as *Geastrum* (Persoon, 1801). A. *hygrometricus* is distributed in 11 Indian states of India including, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Odisha, Punjab, Uttarakhand, Uttar Pradesh and West Bengal (Verma *et al*., 2017). Role of wild edible mushrooms collected from *Shorea robusta* forest ecosystem by the Santal in lateritic region of West Bengal was studied and inventoried (Pradhan *et al*., 2010). Studies were conducted in dry deciduous forests of lateritic eastern parts of India on economic contribution of wild edible mushrooms of a forest fringe ethnic community (Manna and Roy, 2014) and its tribal relation to spatio-temporal variation were reported (Manna *et al*., 2014). Mushrooms have been considered as ingredient of gourmetcuisine across the globe; especially for their unique flavor and have been valued by humankind as a culinary wonder. More than 2,000 species of mushrooms exist in nature, but around 25 are widely accepted as food and few are commercially cultivated. Mushrooms are considered as a delicacy with high nutritional and functional value, and they are also accepted as nutraceutical foods; they are of considerable interest because of their organoleptic merit, medicinal properties, and economic significance (Chang & Miles 2008, Ergonul *et al.,* 2013). However, there is not an easy distinction between edible and medical mushrooms because many of the common edible species have therapeutic properties and several used for medical purposes are also edible (Guillamon *et al.,* 2010). However, wild mushrooms are becoming more important for their nutritional, sensory, and especially pharmacological characteristics (Ergonul *et al.,* 2013).

They have a great nutritional value since they are quite rich in protein, with an important content of essential aminoacids and fiber, poor fat but with excellent important fatty acids content .Moreover, edible mushrooms provide a nutritionally significant content of vitamins (Heleno *et al.,* 2010). A large variety of mushrooms have been utilized traditionally in many different cultures for the maintenance of health, as well as in the prevention and treatment of diseases through their immunomodulatory and antineoplastic properties. A balanced diet is the supporting treatment for the prevention of illness and especially against oxidative stress. In this context, mushrooms have a long history of use in the oriental medicine to prevent and fight numerous diseases. Nowadays, mushroom extracts are commercialized as dietary supplements for their properties, mainly for the enhancement of immune function and antitumor activity (Brown *et al.,* 2003; Wang *et al.,* 2004; Barros *et al.,* 2007; Ferreira *et al.,* 2009; Guillamon *et al.,* 2010; Finimundy *et al.,* 2013). Wild edible mushrooms are collected by tribal peoples for their food as well as livelihood. Mushrooms are used as food supplement in various cultures and known for their edibility and delicacy for which they are collected from wild and also cultivated (Tripathy *et al.,* 2014). Nutritionally, edible mushrooms provide essential nutrients and contribute significantly to human diet. Mushrooms are not only sources of nutrients but also have been reported as therapeutic foods, useful in preventing diseases such as hypertension, hypercholesterolemia and cancer. All the essential amino acids minerals are present in mushrooms (Buigut, 2002).

Seventy five mushroom flora were collected from Chhattisgarh plain and Bastar plateau of Chhattisgarh State during survey of mushroom fungi conducted during monsoon season in the year 2005 and 2006 (Thakur *et al.,* 2017). Bastar is the southern most district of Chhattisgarh in central India which has escaped excessive human interference and exploitation of its forests. Bastar is endowed with a unique blend of traditional knowledge and rich floral diversity. The region is well known as the Island of *Shorea robusta* tree forest which is a key source for white and black truffle called Boda. It is mainly of two types *viz.,* black pulp truffle (Jathaboda) and white pulp truffle (Rakhadiboda). Mushrooms have delicate flavours and have been considered as potential source of proteins, amino acids, vitamins and minerals. Several fleshy fungi appear during rainy season in grass land, abandoned areas and forest on decaying organic matter. The naturally grown fleshy fungi are collected by tribes, consumed by them as well as sold in local market. There were many mycorrhizal mushroom species which have been used as a food source by people traditionally from the wild and these species don t just grow on soil or wood but associate mutualistically with the roots of various host plants (Lakhanpal, 1995).

Role of wild edible mushrooms collected from *Shorea robusta* forest ecosystem by the Santal in lateritic region of West Bengal was studied and inventoried (Pradhan *et al*., 2010). Likewise in Bastar plateau, varieties of wild edible mushrooms are prevailing and collected by local people for own consumption and sold out in local market at higher rate. In this study effort was made to collect informations about wild edible mushroom found in forest and grassland area of Bastar plateau of Chhattisgarh state

Materials and Methods

The present research was carried out in Bastar region of Chhattisgarh during year 2021. The study deals with wild edible mushrooms for livelihood support to tribal people & improving human health and promoting quality life in Bastar Plateau. Chhattisgarh state is located in the centre of 17.43' to 24.5 degree North latitude and 80.15 to 84.20 degree East longitude. Chhattisgarh state share 4.14% of the geographical area of India of which 41% geographical area in covered by forest (State Forest Report, 2017). The state is divided into three agroclimatic zones *viz.,* Chhattisgarh Plains, Northern Hill Surguja regions and Southrn Bastar Plateau. Most of the flora and fauna of these forests including mushroom flora is unattended and unexplored. North hilly region including Manpat of Surguja district, which is at higher altitude, had typical mushroom flora, which needs to be conserved and exploited. Bastar plateau is one, which is predominated by thick forest covers and most of the area is still unattended and unexplored. Sporadic attempts have been made in Chhattisgarh in the past to collect, conserve, identify and maintain the mushroom flora available so for. Geographically the Bastar is located in the southern part of Chhattisgarh and situate at a highest of 2000 ft plateau from sea level. Bastar plateau known for its beautiful forests and unique tribal cultural, because of this, it is called as the Cultural Capital of the state. Administratively Jagdalpur city is both district and divisional headquarter of Bastar region. It is surrounded by Bijapur, Dantewada, Kondagaon, Narayanpur and, Sukma district of the state. Bastar region is full of dense forests, high hills, waterfalls, caves and wild beasts are the main centers of tourism. Baster district lies between 19°45’ and 20°30’ N latitude and 80°88’ and 82°15’ E longitude.

The areas are generally undulating with the red sandy soil but in some area it is rocky and boulder; deficiency of humus and nitrogen the land area are less fertile. Adequate amount of calcium and iron present in soil but these are not sufficient for proper crop production. The total area of Bastar divided in rocks groups based upon presence in different types of rocks in that areas mainly Quarts rocks, Fieldspar rocks, Granite rocks, Besalt rocks and Calcium carbonate rocks etc. The climate of Bastar region is hot and humid and the climate of whole year can be divided into four seasons *i.e*. summer, rainy, spring and winter season. The mean annual maximum temperature is 30.5^{o}C. The temperature in the month of December is 27.5^{o}C and in the month of May is 24^{o}C the mean maximum temperature gradually increase, after December, which is maximum in the up to. The summers extend from the March to mid June in this period the mean daily temperature ranges from a maximum 32^{o}C temperature have been recorded. Rainfall in India varies from place to place and from year to year. In Bastar district the annual rainfall is 1404.40 mm and normal rain days is 72 days in a year. Most of the rainfall occurs during the southeast monsoon season *i.e.* in the months of July to September.

Based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period Nov 2017 to January 2018, the forest cover in the State is 41 % of the State's geographical area. Bastar region is mostly covered by moist deciduous forest which spread over three-fourth of the region area. Teak, Sal, account for 80% of the volume of wood found in these forests. The forest of the state fall two major forest types, *i.e.* Tropical Moist Deciduous forest and Tropical Dry Deciduous forest. The state of Chhattisgarh is endowed with about 22 varied forest sub-types existing in the state Sal (*Shorea robusta*) and Teak (*Tectona grandis*) are the two major tree species in the state. Other notable over wood species are Bija (*Pterocarpus marsupium*), Saja (*Terminalia tomentosa*), Dhawda (*Anogeissus latiffolia*), Arjun (*Terminalia arjuna*) etc.. Constitute a significant chunk of middle canopy of the states forest. Biogeographically, the state falls in Deccan Bio-region comprising representative fauna of central India like the Tiger (*Panthera tigris*), Leopard (*Panthera pardus*), Sambhar (*Cervusuni colour*), Chital (*Axis axis*) etc. The state is proud possessor of rare wild life like the Wild Buffalo (*Bubalus bubalis*), and Hill Myna (*Gracula religiosa*) which have been declared as rare and endangered apart from the species diversity, state is also endowed with rich genetic diversity.

Data collection and identification of Mushrooms

Geographically Bastar region comes under the Southern Plateau region of Chhattisgarh in Central India. Survey was conducted during rainy season of 2021 and visited at different local market and rural/tribal peoples of 6 Tehsil (Batar, Bakawand, Jagdalpur, Lohandiguda, Tokapal and Darbha). 10 villages were included for data collection from each Tahsil of the study area.

Mushrooms was found associated according to genera with *Shorea robust*a, *Madhuca indica*, *Dandrocalamus strictus* and other Bamboo *spp.*, abandoned land, Sal forest and Termite mount and nearby area. During the survey various mushrooms encountered *viz.*: edible, medicinal as well as poisonous/non edible but attention had given only in wild edible mushroom flora and identification was done with the help of earlier published monograph and literatures (Christensen *et al*., 2008; Fangfuk *et al*., 2010; Mohanan, 2011; Pradhan *et al*., 2013; Semwal *et al*., 2014; Hembrom *et al*., 2014; Karun and Sridhar, 2014; Pavithra *et al*., 2015;). Local markets were also visited for collection of information on sale of mushrooms. Local village markets and road sides were also observed for sale of mushrooms. Information was collected from mushrooms sellers/ collectors. 50 local mushroom collectors/ sellers were contacted and information on collection of wild mushroom was collected

Astraeus hygromatricus growing on ground

Straw mushrooms are grown on rice straw

Collection of Mushroom.

Collection of Mushroom

Termitomyces heimii Collected from Termite Mounds

Termitomyces spp. Collected from Sal forest

Fig. 1: Different types Mushrooms found in Bastar Region of Chhattisgarh State

Results and Discussion

The research studied were conducted in different 6 Tahsil of Bastar district (i.e., Bastar, Bakawand, Jagdalpur, Lohandiguda, Tokapal and Darbha etc.). Visited and surveyed in study sites to fulfill the observations and data collection. After complation datas were analyzed and tabulated in table no. 1 and described & discussed with its relevant results.

Table 1: Wild edible mushrooms collected and consume in Bastar region of Chhattisgarh

SN	Scientific name	Common name	Location /Sites	Period of Collection	Habitat	Estmated quantity of Mushroom collected /day/family (kg)	Market Price per kg (Rs.)
1.	*Russula emitica*	Paan futu (Red colour)	Darbha	July-August	Leaf litter	4-5	600/-
2.	*Russula delica*	Paanfutu (white colour)	Jagdalpur, Darbha, Bastar	July-August	soil/Leaf litter	4-5	600/-
3.	*Russula foetens*	Paan futu (yellow colour)	Bastar	July-August	Soil/Leaf litter	3-4	400/-
4.	*Russula nigricans*	Paan futu (Black colour)	Tokapal	July-August	Leaf litter	3-4	600/-
5.	*Russulaatro purpurea*	Paan futu (Purple colour)	Bakawand	August-October	Leaf litter	4-5	400/-
6.	*Termitomyces heimii*	Dengur futu	Lohandiguda, Tokapal	July-August	Termite mounds	5-6	1000/-
7.	*Volvariella volvacea*	Paira futu	Bastar, Bakwand, Tokapal	August-September	Paddy straw heap	4-5	200/-
8.	*Termitomyces albuminosa*	Manai futu	Darbha Road	July-August	Termite/soil	5-6	600/-
9.	*Termitomyces spp. (Big size)*	Dashahra futu	Darbha-Sukma Road	August-September	Leaf litter /soil	5-7	600/-
10.	*Syzygium jambolana*	Jamun futu	Lohandiguda, Tokapal, Darbha	July-August	Leaf litter	2-3	500/-
11.	*Cantharellus spp.*	Bans futu	Bastar, Bakawand, Jagdalpur	June-August	On Bamboo trunk	5-7	500/-
12.	*Amanita bisporigera*	Manjur dhundha	Bastar, Bakawand, Jagdalpur	July-August	soil	2-4	600/-
13.	*Pesilocybe cubensis*	Gobar futu	Darbha, Tokapal	July-August	Cow dung	2-4	Own consumption
14.	*Astraeus odoratus*	Jatha boda	Bastar, Bakawand, Jagdalpur	July-August	Leaf litter/ soil	10-20	800/-
15.	*Astraeus hygromtrious*	Rakhdi boda	Bastar, Bakwand, Tokapal	July-August	Leaf litter/ soil	10-15	600/-
16.	*Termitomyces microcarpus*	Kanki futu	Darbha-Sukma Road	July-August	Termite mounds	3-4	500/-

Wild edible mushrooms occurring in forests of Bastar region of Chattisgarh were collected by local people for their self use and for sale in local markets. Mushroom is being frequently collected from the forest belongs to 3 genera namely; Astraeus, Russula and Termitomyces, these mushrooms were collected on large scale. Besides these few species of Amanita and Pleurotus were also collected on small scale. Information on sale of these mushrooms in local markets and road side were also collected from different study sites including 6 Tahsil of Bastar district *i.e.,* Bastar, Bakawand, Jagdalpur, Lohandiguda, Tokapal and Darbha. These places were personally visited and informations were collected. 50 Persons were interviewed for data collection and marketing of mushroom. In nature, mushrooms grow wild in almost all types of soils, on decaying organic matter, wooden stumps, etc. They appear in all seasons; however rains favor rapid growth when organic matter or its decomposition products are easily available (Dwivedi *et al*., 2012). During the study in Bastar plateau, 16 mushroom fungi and their species during monsoon season were collected and identified from different substrates. All these mushroom fungi were found associated mainly in termite mounds, soil, wood logs, Bamboo, tree trunk and leaf litter etc.

There were many mycorrhizal mushroom species which have been used as a food source by people traditionally from the wild and these species don't just grow on soil or wood but associate mutualistically with the roots of various host plants (Lakhanpal, 1995). These mycorrhizal mushrooms are actually fruit bodies of ectotomycorrhizal fungi associated with roots of sal plants and bamboo tree trunk in Chhattisgarh. The edible mycorrhizal mushrooms are doubly beneficial, they are a source and income and increment to people and plants, respectively. Hence, these wild edible mushroom species need to be studied and researched for their biology, ecology and social aspects, particularly in relation to their role in stabilizing the forest ecosystem. Due to deforestation or environmental degradation the existence of these mushrooms may be put into danger. Hence, attempts are required to conserve them *In situ* (Thakur *et al.,* 2017). In Chhattisgarh most of mushrooms have also been reported by Thakur *et al.* (2011); Sharma *et al.* (2012); Sarbhoy (1997)

during survey of mushroom fungi under AICRP on Mushroom at Raipur during 1997-2004. During the extensive survey of Chhattisgarh Plains and North Hilly Regions by Thakur *et al.* (2017), 18 mushroom fungi and their species during monsoon season were collected from different substrates. Many of these fungi like *Termitomyces spp.* and others were also reported by Kumar *et al*. (1991). Two species of *Termitomyces* and *Russula* were predominantly observed from most of the locality confirmed by many workers in Chhattisgarh.

In the present study data on collection of wild edible mushrooms by tribal people/local inhabitants from the forest of Bastar, Chhattisgarh was compiled from different places. Earlier such type of study was conducted from forests in the aid of tribal people including woman of MP (Harsh *et al.,* 1993; 1996). Information related to the collection of wild edible mushrooms from Nagaland was reported by Bhaben *et al.* (2011). The list also include many mushrooms collected from central India including, *Agaricusbisporus*, *Boletellus ananas* (Verma and Pandro, 2018), *Laccaria laccata*, *Lentinussajor-caju*, *Macrocybelo bayensis*, *Strobilomyces floccopus*, *Termitomyces clypeatus, T. eurhizus, T. globules, T. heimii, T. microcarpus*. *Amanita hemibapha* an edible mushroom was reported to be collected from Khasi Hills, Meghalaya; Thiruvananthapuram, Wayanad, Malappuram, Kerala; Rudraprayag, Jakholi, Pauri, Kanda; Dehradun and Uttarakhand (Vrinda *et al*., 2005; Pradeep and Vrinda, 2010; Mohanan, 2011; Semwal *et al*., 2014).

Astraeus hygromatricus is generally collected from Sal forest of central India in bulk and sold in local markets. Another species of this genus, *Astraeus odoratu*s mushroom which formed ecto-mycorrhiza with trees was also collected mainly from the fire affected scrub jungle of lateritic soils in Konaje, Karnataka, (Pavithra *et al.*, 2015). These mushrooms were also associated with tree species like *Shorea robusta* in Bastar region of Chhattisgarh and similar results reported from Rajmahal Hills and Dalabari region of Jharkhand by Hembrom *et al*. (2014). Burning reduces the diversity of saprophytic macro-fungi, but ectomycorrhizal mushrooms survive in subsoil along with roots it support the growth of selected macro-fungi like, *A. hygrometricus* in northern Thailand (Sysouphanthong *et al*., 2010). Dwived, *et al*. (2012) studied diversity of macrofungi in semi evergreen and moist deciduous forest of Amarkantak where more than 50 samples were collected, the genera like *Agaricus, Amanita, Nyctalis, Russula, Boletus, Macrolapiota, Ganoderma, Termitomyces* were identified. Out of 50 samples only 16 samples were identified up to species level. This preliminary study shows that the forests of central India especially Madhya Pradesh and Chhattisagrh is very rich in mushroom diversity. Mushrooms belonging to genera, *Astraeus*, *Russula* and *Termitomyces* were collected by local and tribal people from the forest especially Sal forests of Bastar region and sold in local markets with high price. Thus the sal forests provide a source of income to local inhabitants in the form of wild edible mushrooms. Several mushroom species have been pointed out as sources of bioactive compounds, in addition to their important nutritional value. The inclusion of whole mushrooms into the diet may have efficacy as potential dietary supplements. The emergence of the fungus has also been noticed from Termite comb, found mostly in shady moist places. *Cantharellus* species occurrence scattered in associated with bamboo root because it's a mycorrhizal fungus and *Russula rosea* grows on decomposed substrates of tree leaves and grasses in sal forest land. Edible mycorrhizal and mutualistic symbionts fungi (*Astraeus and Termitomyces*) found in large quantity than *Cantharellus* and *Russula* spp. and these two mushrooms is not much popular among people that is why market rate also lowest. 75 mushrooms flora were reported by Thakur *et al.* (2017) from Chhattisgarh plains and Bastar plateau of Chhattisgarh State during survey of mushroom fungi conducted during monsoon season in the year 2005 and 2006. Simlar findings are also confirmed by Verma *et al.* (2019) collected wild edible mushrooms (*Astraeus hygrometricus, Russula congoana, Termitomyces clypeatus, T. eurhizus, T. microcarpus* and *Termitomyces*sp.) from Sal forest of Dindori district, of Madhya Pradesh.

Nutritional Values & Health benefits of Mushrooms

In our study, we aimed to review the nutritional value as well as the chemical and nutraceutical composition, and commercial potentialities of the most wild edible mushrooms found in Bastar region. The nutritional value of edible mushrooms is due to their high protein, fiber, vitamin and mineral contents, and low-fat levels (Barros *et al.,* 2008). They are very useful for vegetarian diets because they provide all the essential amino acids for adult requirements; also, mushrooms have higher protein content than most vegetables. Besides, edible mushrooms contain many different bioactive compounds with various human health benefits (Gruen *et al.,* 1982). It is important to remark that the growth characteristics, stage and postharvest condition may influence the chemical composition and the nutritional value of edible mushrooms (Valverde, *et al*., 2015)

Mushrooms contain a high moisture percentage that ranges between 80 and 95 g/100 g, approximately. As above mentioned, edible mushrooms are a good source of protein, 200–250 g/kg of dry matter. Mushrooms are low-calorie foods since they provide low amounts of fat, 20–30 g/kg of dry matter. Edible mushrooms contain high amounts of ash, 80–120 g/kg of dry matter (mainly potassium, phosphorus, magnesium, calcium, copper, iron, and zinc) (Mattila *et al.,* 2001; Ribeiro *et al.,* 2009; Guillamon *et al.,* 2010; Kalac *et al.,* 2013).

On dry-weight basis, however, mushrooms are similar with respect to dried-yeast and superior to dried peas and beans. The nutrient content varies from species and depends on their growth requirement. They also contain valuable minerals such as iron, potassium, phosphorus, calcium and copper, carbohydrate, protein, fat and also ash on dry weight basis. They are also rich in vitamin B and vitamin D. Mushrooms provide a high protein and low caloric diet and can thus be recommended to heart patients. Mushrooms is reported to be an excellent source of riboflavin and nicotinic

acid; a good source of pantothenic acid and ascorbic acid (Ukpebor *et al.,* 2007). The carbohydrate and fat contents of edible mushrooms are quite low. The absence of starch in mushrooms makes it an ideal food for diabetic patients and for persons who wants to shed excess fat. Edible mushrooms known as the meat of the vegetable world (Haas and James, 2009) can be prepared into a variety of delicious dishes and as flavours for other dishes.

Polysaccharides are the best known and most potent mushroom derived substances with antitumor and immune modulating properties (Zaidman *et al.,* 2005; Ferreira *et al.,* 2010; Heleno *et al.,* 2012).

Edible mushrooms are important sources of food. They form very nourishing meals especially for invalids, for they are easily digestible. They are consumed not only for their innate flavour and taste, but also for their important nutritional value. On fresh weight basis mushrooms are superior in protein content (Aremu *et al.,* 2009) to all vegetables and fruits, but are inferior to meat and dairy products, which are the conventional protein sources. There is evidence that consumption of plant foods such as fruits and vegetables, provide protection against various diseases, especially chronic degenerative diseases (Selvi *et al.,* 2007). Kettawan *et al.* (2011) and Selvi *et al.* (2007) have demonstrated that mushrooms contain antioxidants. Apart from their nutritive values, mushrooms also have potential medicinal benefits especially used in combination with other herbs as ingredients to care ailments such as chest pain, cold, dropsy, fever, headache, smallpox and stomach pains. The low carbohydrate content of mushrooms makes it an ideal food for diabetics and people w1ho intend to control their body weight.

Tribal community of Bastar uses it as food and medicine to heal several ailments. The boda is an important source of nutritive food and is easily digestible. It is consumed not only for its innate flavor and taste but also for its immense nutritional value. It is also rich sources of protein, lipids, amino acids, glycogen, vitamins, minerals, polysaccharide, glycoprotein and proteoglycans. It is an excellent source of protein and contains all the essential amino acid required by an adult.

Since thousands of years, edible fungi have been revered for their immense health benefits and extensively used in folk medicine. Specific biochemical compounds in mushrooms are responsible for improving human health in many ways. These bioactive compounds include polysaccharides, tri-terpenoids, low molecular weight proteins, glycoprotins and immunomodulating compounds. 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. Increasing recognition of mushrooms in complementing conventional medicines is also well known for fighting many diseases. Mentioned below are the best health benefits of Mushroom. You can make healthy mushroom snacks, soups and recipes offer right amount of nutritonal value.

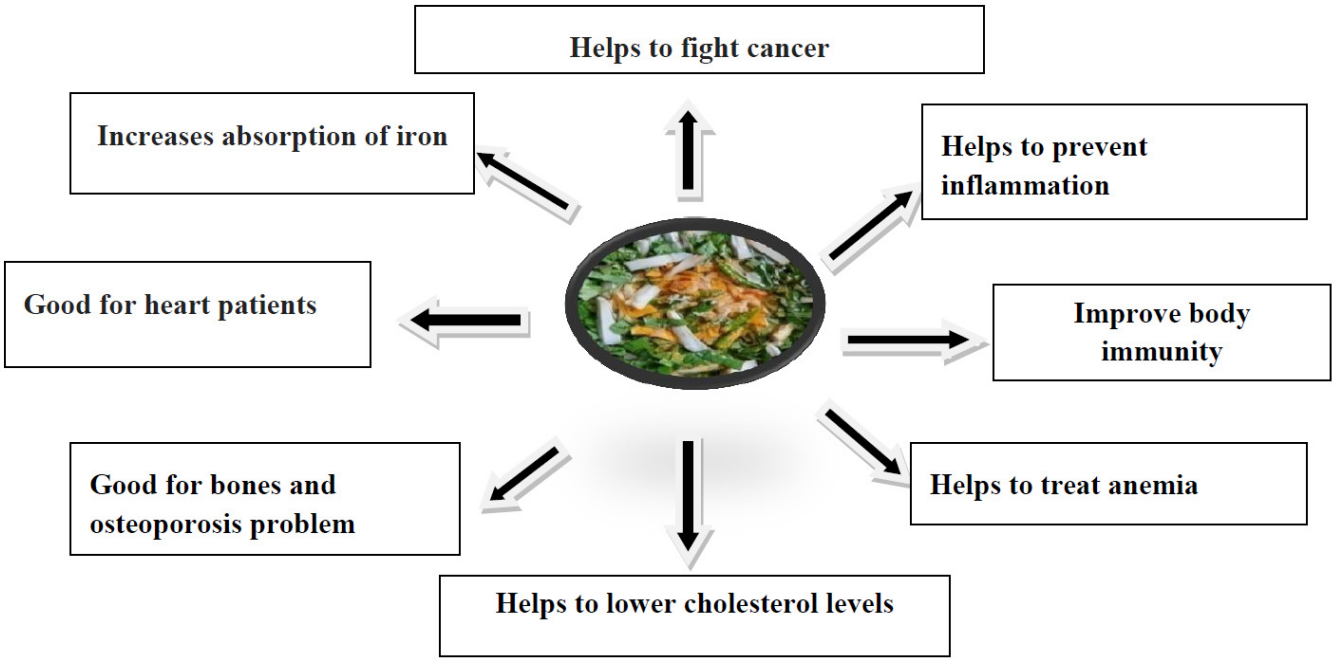

Fig. 2 : Health Benefits of Mushrooms

Russula emetica

Russula delica

Russula foetens

Russula nigricans

Russula atropurpurea

Termitomyces microcarpus

Termitomyces heimii

Volvariella volvacea

Syzygium jambolana

Cantharellu spp.

Amanita bisporigera

Pesilocybe cubensis

Astraeus hygromtrious

Astraeus odorathus

Termitomyces albuminosa

Termitomyces spp. (big size)

Fig. 3: Wild edible mushrooms collected and consume in Bastar Region of Chhattisgarh

Livelihood support income through local market

There are two distinct patterns of wild edible fungi use; for subsistence or personal use and commercial harvesting. Information about personal collections is scarce, but the extent of this practice is global and there are increasing reports that help to demonstrate the importance of wild edible mushrooms to rural people in country like India. Many more species are eaten locally compared to the small number

involved in commercial harvesting. There is a stronger tradition of collecting and consuming wild edible fungi in the different state of the country especially tribal dominated and highly forest covered state of India. In present study, the financial contributions to rural livelihoods are not properly known though the widespread sale of wild edible fungi within Bastar Plateau of Chhattisgarh state. Similar observation noted in Malawi showed that money earned by local collectors is small but substantial, and that there is an expanding local market for wild edible fungi (Boa *et al*., 2000). Women frequently go on collecting trips in forests. Same results also confirm by Richards, (1939), and Thomson, (1954).

The distance from collecting sites to potential markets is a crucial factor in selling wild edible fungi. The roadside markets at Bastar region are close to the forest areas where wild edible fungi are collected more. There is no shortage of people wanting to collect and sell, and this has led to increased competition for fungal resources: people now have to walk further to collect (Lowore and Boa, 2001). The market structure in Bastar is typical small-scale and local. Sales at Bastar and elsewhere depend on the flow of traffic and some days few buyers stop. Some traders wait until the end of the day and buy the unsold produce, moving it quickly to more central markets in the bigger cities. The prices they offer are low but the alternatives are either to dry the fungi or discard them. Local markets in Madhya Pradesh, India, are also small-scale (Harsh *et al.,* 1999) and appear to operate in a similar manner, but within towns rather than by the roads.

Mushroom picking for food with the onset of monsoon showers have been customary in Bastar amongst the different communities. In recent times, mushroom growing is becoming popular because it adds to the income of especially those growers having no or insufficient land. Mushroom can directly improve livelihoods through economic, nutritional and medicinal contributions. Various reasons have been cited for this neglect, several studies have been conducted on Mushroom collection and cultivation for rural livelihood and it's challenges of collection and cultivation India. Market price of Mushrooms in Jagdalpur is 500 – 600/kg. Thus, in light of vast potentiality of boda and other mushrooms as a rich source of protein and essential nutrients for dietary source among local tribal inhabitants of Bastar. Villagers collect mushrooms from their forests and sale them at low prices to Kochia within or outside the city due to lack of facilities to go to big cities for their living. He sales Kochia at a higher price. If someone else who buys it in bulk at a higher price, which is from big cities sales it at a higher price. Which he sales in the public market of big cities at the highest price.

Fig. 4: Mushroom collected from Sal forest and sale in local markets at Bastar, Chhattisgarh

Summary & conclusion

Wild edible fungi are collected for food and to earn money in Bastar district, Chattisgarh. There is a huge diversity of different types from truffles to milk-caps, chanterelles to termite mushrooms, with 16 mushrooms recorded during the study in Bastar Plateau. A small group of species are of economic importance in terms of consumption pattern, but the wider significance of wild edible fungi lies with their extensive subsistence uses in county like India. They provide a notable contribution to diet mostly in tribal dominated and highly forested states in India. In Bastar region during the months of the year when the supply of food is often perilously low, elsewhere they are a valued and valuable addition to diets of rural people. This primarily study looks at the ways in which wild edible fungi are important to people, particularly those in developing state in country and attempts to relate this information to the way in which people live. Wild edible fungi already play an important role in the lives of many people and more benefits could be achieved.

Edible mushrooms are collected from the wild, they are currently threatened by deforestation. A study was carried out in Bastar Plateau to gather informations on their household consumption, and income generation to determine how could improve rural livelihood. Mushrooms are sources of food, income and of health benefit to the people of forest frangile area, they are harvested at the onset of the rains and sold in markets and along roadsides in Bastar region.

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