

Ethno-mycological Studies and Biodiversity of Edible and Medicinal Mushrooms in West-Siang District of Arunachal Pradesh, India

Raghuveer Singh, R. Bhagawati, S. V. Ngachan

Received 8 March 2016; Accepted 8 April 2016; Published online 30 April 2016

Abstract An ethno-mycological survey was conducted with the aim of documenting the indigenous knowledge of mushrooms as a prelude to conservation efforts. We also sought to assess the mycophilic and mycophobic tendencies of the tribal inhabitants in West Siang District. It was revealed that traditionally, mushrooms were used by ethnic peoples as supplementary food and medicines. An attempt had been made to study the biodiversity of wild mushrooms, 32 specimens were collected and identified as *Agaricus* sp., *Auricularia auricula-judae*, *A. delicata*, *A. polytricha*, *Boletus* spp., *Crinipellis* spp., *Cantherellus* spp., *Clavulinopsis* spp., *Cordyceps* spp., *Favolus* spp., *Fomes* spp., *Fomitopsis pinicola*, *Ganoderma applanatus*, *G. lucidum*, *Inonotus* sp., *Lepiota* spp., *Lenzites betulina*, *Lycoperdon* sp., *Marasmius* spp., *Macrolepiota* sp., *Morchella* spp., *Oudemansiella* spp., *Pleurotus* spp., *Polyporus* spp., *Russula* spp., *Schizophyllum commune* Fr., *Suillus* spp., *Schizopora* sp., *Trametes gibbosa*, *Volvaria* sp., *Termitomyces microcarpus* and *Tricholoma* spp. These species were represented by 32 different gen-

era, 20 families and 10 orders. This work also highlights the potentials of wild edible mushrooms as supplementary food and needs to be attention towards *in-situ* conservation of these important species to cater the need of nutritional requirements of the populations.

Keywords Arunachal Pradesh, Biodiversity, Ethno-mycology, Ethnic-Supplementary food.

Introduction

Mushrooms have nearly always been around, with a very long interesting history. Mushrooms have been found in fossilized wood that is estimated to be 300 million years old, and almost certainly prehistoric man used mushrooms collected in the wild as food. There are at least 12, 000 species of fungi that can be considered as mushrooms with at least 2,000 species showing various degrees of edibility [1].

Mushroom is a macro-fungus with a distinctive fruiting body, which can be either epigeous or hypogeous and large enough to be seen with naked eye and to be picked by hand. They attracted the attention of naturalists even before the invention of microscope and discovery of micro fungi. The adaptation of mushroom to the environment is nutrition

Raghuveer Singh* R. Bhagawati,
ICAR Research Complex for NEH Region, A. P. Center,
Basar 791101, Arunachal Pradesh, India

S. V. Ngachan
ICAR Research Complex for NEH Region,
Umiam 793103, Meghalaya, India
e-mail : singhraghuver@gmail.com

*Correspondence

based. They live as saprophytes, parasites and symbionts. They can produce extensive enzymes that can degrade lignocelluloses materials for their own nutrients for growth and fruiting. Mushrooms have been in service of humanity since times immemorial. China has been the source of much early cultivation of mushrooms ,e.g. *Auricularia auriculata* (600 AD), *Flammulina velutipes* (800 AD), *Lentinus edodes* (1000 AD) and *Tremella fuciformis* (1800) [2].

Indigenous knowledge about edible and medicinal mushrooms has not been given significant attention in west Siang district of Arunachal Pradesh. It is scarce and mainly restricted to few elderly people. Therefore, it is important to carry out an ethno-mycological study, document the biodiversity and uses of mushrooms.

Materials and Methods

The West Siang District lies between 27°32' to 28°59' N latitudes and 93°58' to 94°58' E longitudes. An ethno-mycological knowledge was documentation through semi-structured questionnaire interviews and discussions with the tribal residents of the study areas. Frequent mushrooms forays were carried, throughout the years (2013-2015) in different locations of West Siang District. This involved reconnaissance survey and interactions with the village headman and the people in groups, so as to build confidence with them and to get acquainted with area. The mushroom specimens were collected from different habitats. Each of specimen samples was wrapped in wax paper and brought to the laboratory for identification. The identification of each sample was done with the help of standard manuals.

Table 1. Wild mushroom flora identified during ethno-mycological survey in West Siang District of Arunachal Pradesh. * Altitudes in meters from average mean sea level (AMSL).

Order	Family	Scientific name	Location with altitude
Agaricales	Agaricaceae	<i>Agaricus</i> sp.	ICAR farm, Gori & 680 m
		<i>Lepiota</i> spp.	KVK farm, Bame & 782 m
		<i>Lycoperdon</i> sp.	Basar forest & 652—788 m
		<i>Macrolepiota</i> sp.	KVK farm, Bame & 782 m
		<i>Clavulinopsis</i> spp.	ICAR farm, Gori & 680 m
		<i>Pleurotus</i> spp.	KVK farm, Bame & 782 m
		<i>Volvaria</i> sp.	Basar forest & 652—788 m
		<i>Termitomyces microcarpus</i>	ICAR farm, Gori & 680 m
		<i>Tricholoma</i> spp.	Basar forest & 652—788 m
		<i>Oudemansiella</i> spp.	Basar forest & 652—788 m
		<i>Crinipellis</i> spp.	Basar forest & 652—788 m
		<i>Marasmius</i> spp.	Basar forest & 652—788 m
		<i>Schizophyllum commune</i>	Basar & 650 m
		Boletales	Boletaceae
<i>Suillus</i> spp.	Basar forest & 652—788 m		
Polyporales	Polyporaceae	<i>Polyporus</i> spp.	ICAR farm, Gori & 680 m
		<i>Fomitopsis pinicola</i>	ICAR farm, Gori & 680 m
		<i>Fomes</i> spp.	ICAR farm, Gori & 680 m
		<i>Trametes gibbosa</i>	KVK farm, Bame & 782 m
		<i>Favolus</i> spp.	KVK farm, Bame & 782 m
		<i>Lenzites betulina</i>	ICAR farm, Gori & 680 m
		<i>Schizopora</i> sp.	KVK farm, Bame & 782 m
Hymenochaetales	Schizoporaceae	<i>Inonotus</i> sp.	ICAR farm Gori & 680 m
	Hymenochaetaceae	<i>Auricularia delicate</i>	ICAR farm, Gori & 680 m
Auriculariales	Auriculariaceae	<i>A. auricula-judae</i>	ICAR farm, Gori & 680 m
		<i>A. polytricha</i>	ICAR farm, Gori & 680 m
		<i>Ganoderma applanatum</i>	Basar & 650 m
Ganodermatales	Ganodermataceae	<i>Ganoderma lucidum</i>	Basar & 650 m
		<i>Russula</i> spp.	KVK farm, Bame & 782 m
Russulales	Russulaceae	<i>Cantharellus</i> spp.	KVK farm, Bame & 782 m
Cantharellales	Cantharellaceae	<i>Cordyceps</i> spp.	Menchuka & 3332—3829 m
Hypocreales	Cordycipitaceae	<i>Morchella</i> spp.	Menchuka & 2935—3325 m
Pezizales	Morchellaceae		

Results and Discussion

Ethno-mycology studies revealed that West Siang district is rich in the mushroom biodiversity. During the studies, 32 specimens were collected and identified as *Agaricus* sp., *Auricularia auricula-judae*, *A. delicate*, *A. polytricha*, *boletus* spp., *Crinipellis* spp., *Cantherellus* spp., *Clavulinopsis* spp., *Cordyceps* spp., *Favolus* spp., *Fomes* spp., *Fomitopsis pinicola*, *Ganoderma applanatum*, *G. lucidum*, *Inonotus* sp., *Lepiota* spp., *Lenzites betulina*, *Lycoperdon* sp., *Marasmius* spp., *Macrolepiota* sp., *Morchella* spp., *Oudemansiella* spp., *Pleurotus* spp., *Polyporus* spp., *Russula* spp., *Schizophyllum commune* Fr., *Suillus* spp., *Schizopora* sp., *Trametes gibbosa*, *Volvaria* sp., *Termitomyces microcarpus* and *Tricholoma* spp., These species were represented by 32 different genera, 20 families and 10 orders (Table 1). Many of the identified species have also been reported by few workers from the North-Eastern states of India [1—3].

Many of the edible and medicinal mushroom species like *Auricularia delicate*, *A. polytricha*, *Cordyceps* spp., *Pleurotus* spp., *Schizophyllum commune* Fr., *Termitomyces microcarpus* and *Tricholoma* sp. are collected by the local people during the season not only for their own consumption but also for sale (Table 2). All edible mushrooms identified are used fresh as well as in dried form depending upon the quantity of the collection by the local people. Fresh fruiting bodies of edible mushrooms are boiled, water squeezed and fried in oil. Similar mode of preparation is also followed for dried form of mushrooms. Wild mushrooms collected in larger quantity are sun dried on the roof of houses or in open and stored for winter uses. The best time for wild edible mushroom collection in the study areas starts with the onset of rains, the period when the conditions are conducive for the mushroom growth and these are available in more quantity. Wild edible mushrooms were mainly collected from forest, decaying woods, *jhum* fields, rotting plant parts and termitarium. While comparing the edibility status of these mushrooms, the choice of the local people was clear. Mushrooms such as *Auricularia polytricha* and *Auricularia delicate* were reported edible and the most preferred by the all the respondent interviewed. During the study it

was found that the knowledge about the use of edible mushroom is dwindling and is mainly restricted to elderly people. Study also revealed that *Cordyceps* spp. was considered as medicinal mushrooms by more than 30% respondents interviewed.

It was found that North alpine zone of the district is a vast reservoir of high-altitude medicinal mushrooms. Its ethnic people possess a treasury of knowledge related to uses of *Cordyceps* spp. Initially local herders observed that yak, goat, sheep consuming cordyceps during their grazing in the forest became very strong and stout. This observation paved the way for the discovery of its medicinal value. Thereafter, local people and herders used the fungus powder with juggery to increase milk production, and improve reproductive capacity and vitality of their cattle. Then its relevant medicinal properties were explored, collecting only the aerial part (stroma), which they dried in sunlight as primary processing. Then they themselves consumed it and became convinced of its medicinal effects in enhancing vigor and vitality. They further claimed that it has aphrodisiac effects, and hence they used to give it as a gift to relatives and friends. Edibility of some of these wild edible Mushrooms has been reported throughout the North-Eastern states of India [1, 4, 5]. The usage of these fruiting bodies both commercially and domestically may be in part a result of their better taste and easily identifiable by the locals as safe for consumption. Several mycologists in India have also been reported the edibility of these species from various states [5].

From the total of interviews, peoples from the urban area (20% of informants) did not provide information when asked about mushrooms. On the other hand, peoples from the rural area (40% of informants) possessed more mushroom related knowledge although they did not particularly appreciate them as food product. However, local residents of the rural area (40% of informants) showed a more detailed local ethno-mycological knowledge as well as a wider acceptance as an edible resource. Although most of the interviewees were mycophilic, a percentage of them were truly mycophilic and they all shared the fact of being indigenous and residents of rural study areas. Therefore, ethnic inhabitants of

Table 2. Important wild edible and medicinal mushrooms in the local markets in West Siang district of Arunachal Pradesh.

Order	Family	Scientific name	Local name	≈ Price (per kg) in INR	Name of market	Period of availability	Traditional uses
Auriculariales	Auriculariaceae	<i>Auricularia polytricha</i>	<i>Imbuk</i>	250—300	Basar	April-June	Fruiting bodies are used fresh as well as dried for making vegetables by boiling in water and decanting
		<i>Auricularia delicate</i>	<i>Takek</i>	250—300	Basar		
Agaricales	Scizeophyllaceae	<i>Schizophyllum commune</i>	<i>Marek</i>	250-300	Basar	June-August (fresh)	decanting hot water. These are also dried and stored for winter uses. Species is likened by the people of area very much and collect it more quantity.
			<i>Hubsu</i>			Throughout the yr(dried)	
	Tricholomataceae	<i>Tricholoma</i> spp.	<i>Inde</i>	200—250	Gori & Bame	June-July	Fresh fruiting bodies are used for making delicious vegetables. These are boiled , hot water decanted and fried in edible oils.
	Lyophyllumaceae	<i>Termitomyces microcarpus</i>	<i>Inyak</i>	280—500	Gori	June—July	
	Pleurotaceae	<i>Pleurotus</i> spp.	<i>Aatar</i>	250—350	& Basar	Bame May—July	
Hypocreales	Cordycipitaceae	<i>Cordyceps</i> spp.	<i>Yarsa gumba</i>	100/- per piece. (Avg weight 300-400 mg)	Mechuka	April-August	At present, local folk practitioners use the product alone or in combination with other medicinal herbs to treat various diseases, administering different doses for different ailments according to their experience. Put one piece of cordyceps in a cup of hot water, leave it for 1 h, and drink it morning and evening as a tonic.

West Siang district are considered to be mycophilic and to have extensive ethno-mycological knowledge. Due to increasing stresses of population, urbanization and human greed, there is a rapid decline in the great mushroom biodiversity present in this of the state. The conservation of biodiversity *in-situ* is therefore needed to cater the need of nutritional requirements of the future generations.

References

- Singh R, Bhagawati R, Sharma PK, Ramakrishna Y (2015) Wild Edible Fungal Resources : An Alternate Source of Food for Mizoram and Arunachal Pradesh. *Environ Ecol* 33 : 1936—1939.
- Kumar S, Sharma YP (2013) An update of wild mushroom in Jammu and Kashmir, India. In : Proc Ind Mushroom Conference 2013, Ludhiana : Abstracts of Lead, Oral & Poster Presentations, pp 5—6.
- Singh TC, Nivedita I, Singh NI (2007) Endemic Bio-Resources of India Conservation and Sustainable Development with special reference to North-East India. Singh NI (eds) Dehradun, India, pp 67—94.
- Bhaben T, Gurung L, Sarma GC (2011) Wild edible fungal resources used by ethnic tribes of Nagaland. *Ind J Traditional knowledge* 10 : 512—515.
- Chauhan J, Negi AK, Rajasekaran A, Pala NA (2014) Wild edible macro-fungi-a source of supplementary food in Kinnaur district of HP. *J Med Pl Studies* 2 : 40—44.