



DIVERSITY OF WILD EDIBLE MACROFUNGI OF NAGALAND, INDIA

Botany

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ABSTRACT

Mushrooms are the fructification of macrofungi which are of great nutritional and economic importance for the local people because of their great nutritional content, taste, flavor etc. and also the collection and selling of wild edible mushroom by the local people as small time business in the local market bring about significant improvement of their economy. A survey was conducted to ascertain the diversity of wild edible macrofungi in Nagaland during 2014-2016. A total of 83 edible mushrooms were found of which 48 belonged to gilled fungi, 19 belonged to pore and tooth fungi, 4 were puffballs and 6 belonged to jelly fungi and 6 were club and coral fungi respectively

KEYWORDS

Macrofungi, mushrooms, gilled, pore and tooth, jelly, coral.

INTRODUCTION:

Macrofungi are those fungi which bears large easily observed spore bearing structures that are formed above or below ground. They are distinguished by having spore bearing structures visible to the naked eyes called as sporocarp. Many macrofungi are edible and they have the taste and texture of meat, appellations such as chicken of the woods and beefsteak fungus etc. reflect its gastronomic value. The edible macrofungi are a natural resources of high nutritional and economic value. They are also used in the production of many bioactive compounds including industrially important enzymes. Sometimes, the edible macrofungi are called as mushroom and the poisonous ones are referred to as toadstools which are not taxonomic terms. Almost all macrofungi belongs to class Ascomycetes and Basidiomycetes.

The consumption of wild mushroom is certainly an ancient origin which must have started and evolved through trials and error throughout the human history beginning from hunter-gatherers time to till date. Like any tribal society of the world, Nagas too are familiar with a variety of wild edible mushrooms and therefore these edible mushrooms have been associated with their lives for centuries.

MATERIAL AND METHOD:

Area of study: Nagaland is the sixteenth state of the Indian union which lies between 25°6' N and 27°4' N latitude and 93°2' E and 95°15' E longitude. The state is bordered by Myanmar in the East, the state of Assam in the West, Arunachal Pradesh and a part of Assam in the North and Manipur in the South. It covers a geographical area of 16,579 Sq. Km, the average annual rainfall ranges from 2000mm to 2500mm (200-250cm). The temperature during the summer season remains between 16°C - 31°C and drops below 4°C during winter and frost is a common occurrence in higher elevation. The vegetation in the state consists mainly of tropical evergreen forests and tropical deciduous forests. The tropical evergreen forests usually occurs in areas receiving more than 200cm annual rainfall and having temperature of 15°C-30°C. It has a luxuriant vegetation of all kinds of trees, shrubs and creepers giving it a multilayered structure with thick undergrowth at ground level. The tropical deciduous forests are also called as monsoon forests. It spreads over the region which receives annual rainfall between 70cm - 200cm. Trees of this forest shed their leaves for about six to eight weeks during the dry season.

METHODOLOGY:

The basic way to sample or survey macrofungi is based on the presence of sporocarp (Lodge *et al* 2004). This method is also known as opportunistic approach because the sample collection is done in those sites where the fungi is most likely to occur by traversing and carefully observing high probable habitats across a large areas.

During sample collection, the sporocarp (fruiting bodies) are removed from the substratum with great care to avoid damage. The habit and the morphological characteristics of the macrofungi were noted and colour photographs were taken. The specimens were wrapped in aluminum foils or brown paper and collected in plastic boxes for further identification in the laboratory. The collected sporocarp were identified based on their morphological and anatomical features and the standard microscopic method (Lodge *et al* 2004).

EDIBLE MACROFUNGI WITH GILLS:

The gilled mushrooms also called as the agarics bears their spores on radiating blades or plates called gills. They are the most diverse and complex group of fleshy fungi. The structure of a typical gilled mushroom consists of a cap, gills and a stalk. A ring or a volva may also be present in some species. A mature fruiting body of macrofungi is essentially a bundle of filamentous hyphae which terminates either in special spore-producing cells called basidia and sterile cells such as cystidia and paraphyses. The basidia bears the spores..

MUSHROOMS WITH PORES, SPINES and TOOTH.

It includes the genus such as *Favolaschia*, *Boletus*, *Leccinum*, *Suillus* and *Hydnum* etc. The *Boetus* have a sponge like layer of tubes on underside of the cap which are easily separated from the cap. The *Boletus* produce their spores on basidia which line the inner surface of the tube which are arranged vertically so that when the spores are discharged they are drop into the air through the mouth of the tube called the pores. They exhibits colour change when they are bruised or damaged and the upper portion of their stem may be reticulate or netted. In *Leccinum* the stem is always decorated with rough tufts or scales called scabrous stem. In *Suillus* the stalk is frequently speckled with brown spots called glandular dots, a ring is present on the stalk and their cap surface is viscid.

PUFFBALL and ALLIES (Stomach fungi): They are known colloquially as the stomach fungi. The spore material is contained within the body of the fungus and is released when the outer covering is broken.

JELLY MUSHROOM: They have gelatinous texture and different fruiting bodies.

CLUB and CORAL FUNGI: The club, spindle and coral fungi forms a large group of fungi with neither gills nor pores. Their spores develop outside of the fruiting body and are distributed by rain and wind when they are matured.

Sl. No	Type	Name	Synonym	Common Name
1	Gilled	<i>Agaricus augustus</i> Fr.	<i>Psalliota augustus</i> (Fr.) Quel.	The Prince.
2	Gilled	<i>Agaricus compestris</i> L.	<i>Agaricus edulis</i> Bull.	Meadow mushroom.
3	Gilled	<i>Agaricus rotalis</i> K.R. Peterson,		
4	Gilled	<i>Amanita caesarea</i> (Scop.) Pers.	<i>Agaricus caesareus</i> Scop.	Caesar's mushroom
5	Gilled	<i>Amanita vaginata</i> (Bull.) Lam.	<i>Agaricus vaginatus</i> Bull	Grisette.
6	Gilled	<i>Armillaria mellea</i> (Vahl) P. Kummer	<i>Agaricus melleus</i> Vahl / <i>Omphalia mellea</i> (Vahl) Quel	Honey fungus
7	Gilled	<i>Cantharellus cibarius</i> Fr.	<i>Agaricus cantharellus</i> L.	Chanterelle or girolle.
8	Gilled	<i>Cantharellus lateritius</i> (Berk.) Singer.	<i>Craterellus lateritius</i> Berk.	Smooth canterelle.

9	Gilled	<i>Coprinus comatus</i> (O.F. Mull.) Pers.	<i>Agaricus comatus</i> O.F Mull	Shaggy inkcap	38	Gilled	<i>Russula vinosa</i> Lindblad.	<i>Russula pubescens</i> Velen.	Darkening brittlegill.
10	Gilled	<i>Coprinus disseminatus</i> (Pers.) Gray.	<i>Agaricus pallescens</i> Schaeff	Fairy Inkcap.	39	Gilled	<i>Russula virescens</i> (Schaeff.) Fr.	<i>Agaricus virescens</i> Schaeff.	Green cracking brittlegill.
11	Gilled	<i>Flammulina velutipes</i> (Curtis) Singer.	<i>Agaricus velutipes</i> Curtis	Enoki mushroom	40	Gilled	<i>Russula xerampelina</i> (Schaeff.) Fr.	<i>Agaricus xerampelina</i> Schaeff.	Crabbrittlegill
12	Gilled	<i>Gomphus floccosus</i> (Schw.) Singer.	<i>Cantharellus floccosus</i> Schw.	Scaly vase chanterelle	41	Gilled	<i>Schizophyllum commune</i> Fr.	<i>Merulius communis</i> (Fr.) Sprin & Zmitr.	Gillies or Split gills
13	Gilled	<i>Lactarius indigo</i> (Schwein.) Fr.	<i>Agaricus indigo</i> Schwein	Indigo milkcap	42	Gilled	<i>Termitomyces clypeatus</i> R. Heim	<i>Sinotermitomyces taiwanensis</i> M. Zang & C.M. Chan	
14	Gilled	<i>Lactarius rubidus</i> (Hesler & A.H.Sm.) Methven	<i>Lactarius fragilis</i> var. <i>rubidus</i> Hesler & A.H. Sm	Candy cap.	43	Gilled	<i>Termitomyces eurhizus</i> (Berk.) R. Heim	<i>Agaricus eurhizus</i> Berk.	
15	Gilled	<i>Lactarius volemus</i> (Fr.) Kuntze	<i>Agaricus volemus</i> Fr.	Tawny milkcap.	44	Gilled	<i>Termitomyces heimii</i> Natarajan		
16	Gilled	<i>Lactarius camphoratus</i> (Bull.) Fr,	<i>Agaricus camphoratus</i> Bull	Candy cap	45	Gilled	<i>Termitomyces mammiformis</i> R. Heim.		
17	Gilled	<i>Laccaria amethystina</i> Cooke.	<i>Agaricus amethystine</i> Huds,	Amethyst deceiver.	46	Gilled	<i>Termitomyces microcarpus</i> (Berk. & Broome) R. Heim	<i>Agaricus microcarpus</i> Berk. & Broome	
18	Gilled	<i>Laccaria laccata</i> (Scop.) Cooke.	<i>Clitocybe laccata</i> (Scop.) P. Kumm,	The deceiver.	47	Gilled	<i>Volvopluteus gloiocephalus</i> (DC.) Vizzini, Contu & Justo	<i>Agaricus gloiocephalus</i> DC.	Big sheath mushroom.
19	Gilled	<i>Lepista nuda</i> (Bull.) Cooke	<i>Clitocybe nuda</i> (Bull.),	Wood blewit.	48	Gilled	<i>Xerula radicata</i> (Relhan) Dorfall	<i>Agaricus radicans</i> Relhan.	Rooting Shank
20	Gilled	<i>Lentinula edodes</i> (Berk.) Pegler.	<i>Lentinus edodes</i> (Berk.) Singer	Shiitake mushroom.	49	Pore & Tooth	<i>Boletus appendiculatus</i> Schaeff.	<i>Boletus appendicule</i> Gelbfleischiger Steinpilz.	Butter bolete or Oak bolete.
21	Gilled	<i>Lentinula lateritia</i> (Berk.) Pegler	<i>Lentinus lateritius</i> Berk.	Australian Shiitake	50	Pore & Tooth	<i>Boletus bicolor</i> Peck.	<i>Ceromyces bicolor</i> (Peck.) Murril.	Two colored Bolete.
22	Gilled	<i>Lentinus cladopus</i> Lev.	<i>Lentinus ramosipes</i> Har & Pat, Bull		51	Pore & Tooth	<i>Boletus edulis</i> Bull	<i>Tubiporus edulis</i> (Bull.) P. Karst.	Penny bun, Porcini
23	Gilled	<i>Lentinus polychrous</i> Lev.	<i>Panus polychrous</i> (Lev.) Singer		52	Pore & Tooth	<i>Boletus erythropus</i> Pers.	<i>Boletus luridus</i> var. <i>erythropus</i> (Pers.) Fr.	Dotted stem bolete
24	Gilled	<i>Lentinus strigosus</i> (Schwein.) Fr.	<i>Agaricus strigosus</i> Schwein	Ruddy panus.	53	Pore & Tooth	<i>Boletus mirabilis</i> (Murril) Murril.	<i>Ceromyces mirabilis</i> Murril	
25	Gilled	<i>Lentinus sajor-caju</i> (Fr.) Fr.	<i>Pleurotus sajor-caju</i> (Fr.) Singer		54	Pore & Tooth	<i>Boletus porosporus</i> Imler ex. G. Moreno & Bon	<i>Xerocomus porosporus</i> Imler, Bull.	Sepia bolete.
26	Gilled	<i>Macrolepiota procera</i> (Scop.) Singer.	<i>Lepiota procera</i> (Scop.) Gray.	Parasol mushroom.	55	Pore & Tooth	<i>Boletus rubellus</i> Krombh	<i>Xerocomus rubellus</i> (Krombh.) Quel	Ruby bolete.
27	Gilled	<i>Oudemansiella mucida</i> (Schrad.) Hohn.	<i>Agaricus mucidus</i> Schrad.	Porcelain fungus.	56	Pore & Tooth	<i>Boletus pruinatus</i> Fr. & Hok.	<i>Xerocomus pruinatus</i> (Fr. & Hok) Quel	Matt bolete.
28	Gilled	<i>Pleurotus pulmonarius</i> (Fr.) Quel	Indian Oyster or Italian Oyster or Phoenix mushroom.		57	Pore & Tooth	<i>Climacodon septentrionalis</i> (Fr.) P. Karst	<i>Hydnum septentrionale</i> Fr.	
29	Gilled	<i>Pleurotus citrinopileatus</i> Singer	<i>Pleurotus cornucopia</i> subsp. <i>Citrinopileatus</i> (Singer) O. Hilber	Golden Oyster mushroom.	58	Pore & Tooth	<i>Fistulina hepatica</i> (Schaeff) With	<i>Boletus hepatica</i> Schaeff	Beef Steak fungus / or Ox tongue.
30	Gilled	<i>Pleurotus cornucopiae</i> (Paulet) Rolland.	<i>Agaricus cornucopiae</i> (Paulet)Pers.	Branched Oyster	59	Pore & Tooth	<i>Hericium erinaceus</i> (Bull.) Pers,	<i>Hydnum erinaceus</i> Bull,	Lion's Mane Mushroom
31	Gilled	<i>Pleurotus ostreatus</i> (Jacq.) P. Kumm	<i>Agaricus ostreatus</i> Jacq.	Oyster Mushroom.	60	Pore & Tooth	<i>Hydnum repandum</i> L.	<i>Hydnum flavidum</i> Schaeff,	Hedgehog Fungus
32	Gilled	<i>Russula albonigra</i> (Krombh.) Fr.	<i>Agaricia albonigra</i> Krombh.	BlackeningB rittlegill.	61	Pore & Tooth	<i>Polyporus arcularius</i> (Batsch.) Fr	<i>Favolus arcularius</i> (Batsch.) Lev.	Spring polypore.
33	Gilled	<i>Russula cyanoxantha</i> (Schaeff.) Fr.	<i>Agaricus cyanoxanthus</i> Schaeff.	Charcoal burner.	62	Pore & Tooth	<i>Polyporus brumalis</i> (Pers.) Fr.	<i>Lentinus brumalis</i> (Pers.) Zmitr.	Winter polypore.
34	Gilled	<i>Russula paludosa</i> Britzelm.	<i>Russula integra</i> var. <i>paludosa</i> (Britzelm.) Singer.	Brittlegill mushroom	63	Pore & Tooth	<i>Polyporus tenuiculus</i> (P. Beauv.) Fr.	<i>Favolus tenuiculus</i> P. Beauv.	
35	Gilled	<i>Russula parvovirescens</i> Buyck, D. Mitch & Parrent		Quilted green Russula.					
36	Gilled	<i>Russula rhodopus</i> Zvara	<i>Russula rhodopoda</i> Zvara.						
37	Gilled	<i>Russula rosea</i> Quel.	<i>Agaricus roseus</i> Schaeff.	Rosy brittlegill.					

64	Pore & Tooth	<i>Polyporus squamosus</i> (Huds.) Fr.	<i>Favolus squamosus</i> (Huds) Ames.	Pheasant's back polypore.
65	Pore & Tooth	<i>Phylloporus rhodoxanthus</i> (Murrill) Singer.	<i>Gomphidius foliiporus</i> Murrill	The gilled Bolete.
66	Pore & Tooth	<i>Strobilomyces floccopus</i> (Vahl.) Karsten	<i>Boletus floccopus</i> Vahl.	Old Man of the forest.
67	Pore & Tooth	<i>Suillus luteus</i> (L.) Roussel	<i>Boletus luteus</i> L.	Slippery Jack
68	Puffball	<i>Lycoperdon molle</i> Pers	<i>Bovista cepiformis</i> Wallr	Smooth puff ball
69	Puffball	<i>Lycoperdon perlatum</i> Pers.	<i>Lycoperdon gemmatum</i> var. <i>perlatum</i> (Pers.) Fr.	Warted puffball
70	Puffball	<i>Lycoperdon pyriforme</i> Schaeff.	<i>Utraria pyriforme</i> (Schaeff.) Quel.	Pear-shaped puffball
71	Puffball	<i>Vascellum pretense</i> (Pers.) Kreisel	<i>Lycoperdon pretense</i> Pers.	Meadow puffball.
72	Jelly	<i>Auricularia auricular-judae</i> (Bull.) J. Schrot.	<i>Tremella auricular-judae</i> Bull	Wood ear/jelly ear
73	Jelly	<i>Auricularia delicata</i> (Mont.) Henn.	<i>Laschia delicate</i> Fr.	Jelly fungus.
74	Jelly	<i>Auricularia polytricha</i> (Mont.) Sacc.	<i>Exidia polytricha</i> Mont.	Cloud ear fungus
75	Jelly	<i>Tremella foliacea</i> Pers.	<i>Exidia foliacea</i> (Pers.) P. Karst.	Brown witches'Butter
76	Jelly	<i>Tremella fuciformis</i> Berk.		Snow fungus
77	Jelly	<i>Tremella mesenterica</i> (Schaeff.) Retz.	: <i>Helvella mesenterica</i> Schaeff.	Golden jelly fungus or Witch's butter
78	Club & coral	<i>Arctomyces pyxidatus</i> (Pers.) Julich.	<i>Clavaria pyxidata</i> Pers	Crown-tipped coral.
79	Club & coral	<i>Clavulina cristata</i> (Holmsk) J. Schrost	<i>Clavaria cristata</i> (Holmk.) Pers	White coral
80	Club & coral	<i>Dacryopinax spathularia</i> (Schwein.) G.W. Martin	<i>Merulius spathularius</i> Schwein	Little spade.
81	Club & coral	<i>Ramaria aurea</i> (Schaeff.) Quel	<i>Clavaria aurea</i> Schaeff.	Golden coral
82	Club & coral	<i>Ramaria botrytis</i> (Pers.) Ricken.	<i>Clavaria botrytis</i> Pers	Cauliflower coral.
83	Club & coral	<i>Sparassis crispa</i> (Wulfen) Fr.	<i>Clavaria crispa</i> Wulfen,	Wood cauliflower.

DISCUSSION:

Wild edible mushrooms have been collected and consumed by people for thousands of years. The consumption of wild mushrooms was reliably recorded in China several years before Christ (Aaronson 2000) and many wild mushroom species have been valued for centuries for food as well as for their medicinal properties.

Edible mushrooms are the fleshy and edible fruit bodies of many species of macrofungi that produces visible fruiting bodies. The edibility of a particular mushroom can be defined by the criteria that includes absence of poisonous effects on human and good taste and aroma. Thus, the wild edible fungi are important because, they serve as a source of food including health benefits and as a source of income specially for the local people. There is a total of 1154 edible and food species of mushrooms recorded from the total of 2327 species of wild useful species compiled from 85 countries of the world. Often, the number of edible species is only a fraction of those available species and those considered useful species. Also, the species eaten in one country or region differ from another country because it is considered as inedible or poisonous in that country or there are often conflicting reports in the field guides about edibility of some species.

CONCLUSION:

Mushroom species are the indicator of forest life support system. The presence of fungal species is a useful indicator to assess the damage or the maturity of the ecosystem. A total of 83 edible macrofungi recorded from Nagaland is little as compared to 283 recorded from India. The vegetation in Nagaland is mostly tropical evergreen and tropical deciduous types with relatively high rainfall which supports the growth of diverse macrofungi. Thus, the data obtained can be used as a baseline data for further research works.



Fig: 1. Agaricus compestris. 2. Amanita caesareus. 3. Armillaria mellea. 4. Cantharellus cibarius. 5. Coprinus comatus. 6. Gomphus floccosus. 7. Lactarius rubidus. 8. Lepista nuda. 9. Lentinula edodes. 10. Lentinus cladopus. 11. Pleurotus citrinopileatus. 12. Russula rhodopus. 13. Termitomyces heimii. 14. Schizophyllum commune. 15. Boletus edodis.

Fig: 15. Fistulina hepatica. 17. Hericium erinaceus. 18. Hydnum repantium. 19. Polyporus squamosus. 20. Lycoperdon pyriforme. 21. Auricularia auricular-judae. 22. Tremella fuciformis. 23. Ramaria aurea.

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