

Macro-fungal diversity and nutrient content of some edible mushrooms of Nagaland, India

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Abstract. Kumar R, Tapwal A, Pandey S, Borah RK, Borah DP, Borgohain J. 2013. Macro-fungal diversity and nutrient content of some edible mushrooms of Nagaland, India. *Nusantara Bioscience* 5: 1-7. The northeast region of India abounds in forest wealth, including variety of flora and fauna. The high humidity during monsoon period provides ideal atmospheric conditions for the growth of diverse group of macrofungal fruit bodies. Nagaland, the northeastern state of India is rich in biodiversity and encompasses large numbers of edible and non-edible mushroom species. Young and matured carpophores of 15 wild edible mushroom species were collected from 12 locations in different districts of Nagaland. Out of these four species belongs to family Agaricaceae, two belongs to Tricholomataceae and rest belongs to Boletaceae, Cantharellaceae, Russulaceae, Sarcoscyphaceae, Auriculariaceae, Polyporaceae, Schizophyllaceae, Pleurotaceae, and Lyophyllaceae. The selected species were analyzed for proximate analysis of nutritional values. The protein content varies from 22.50-44.93% and carbohydrates were recorded 32.43-52.07% in selected species. The documentation of wild edible mushrooms is very scanty in Northeast India. The key objective of the present study was to generate a database on macrofungal diversity, ecology, ethnomycology, utilization and nutrient status of important wild edible mushroom species of Nagaland, which forms a part of the food culture of the native peoples.

Keywords: Proximate analysis, carpophores, ethnomycology

Abstrak. Kumar R, Tapwal A, Pandey S, Borah RK, Borah DP, Borgohain J. 2013. Keanekaragaman makrofungi dan kandungan gizi beberapa jamur yang dapat dimakan dari Nagaland, India. *Nusantara Bioscience* 5: 1-7. Wilayah timur laut India memiliki kekayaan hutan yang berlimpah, termasuk berbagai spesies flora dan fauna. Kelembaban yang tinggi pada musim hujan memberikan kondisi udara yang ideal untuk pertumbuhan berbagai kelompok makrofungi. Nagaland, negara bagian India yang terletak di timur laut kaya akan keanekaragaman hayati, termasuk sejumlah besar spesies jamur yang dapat dan tidak dapat dimakan. Kaprofora muda dan masak dari 15 spesies jamur liar yang dapat dimakan dikumpulkan dari 12 lokasi di berbagai distrik di Nagaland. Dari jumlah tersebut, empat spesies milik keluarga Agaricaceae, dua milik Tricholomataceae dan sisanya milik Boletaceae, Cantharellaceae, Russulaceae, Sarcoscyphaceae, Auriculariaceae, Polyporaceae, Schizophyllaceae, Pleurotaceae dan Lyophyllaceae. Spesies terpilih dianalisis untuk mengetahui proksimat nilai gizi. Kadar protein bervariasi 22.50-44.93% dan karbohidrat tercatat 32.43-52.07% pada spesies yang dipilih. Dokumentasi jamur liar yang dapat dimakan sangat minim di timur laut India. Tujuan utama dari penelitian ini adalah untuk menghasilkan sebuah database tentang keragaman makrofungi, ekologi, etnomikologi, pemanfaatan dan status gizi spesies jamur liar penting yang dapat dimakan di Nagaland, yang merupakan bagian dari budaya makanan dari penduduk asli.

Kata kunci: Analisis proksimat, kaprofora, etnomikologi

INTRODUCTION

Mushrooms have been the objects of much curiosity and speculation since time immemorial. They are one of the most important components of the forest ecosystem. Their edibility, poisonous nature, psychotropic properties, mycorrhizal and parasitic associations with the forest trees make them economically important and interesting to study. The northeast region of India abounds in forest wealth, including many species of trees and other woody plants. The biodiversity of woody flora is correlated with an equally diverse mycoflora. The high humidity during monsoon period provides ideal atmospheric conditions for the growth of many saprophytes, including the mushrooms.

There are many mushrooms growing in the forests of Nagaland and local relish on them. They have diverse shapes, sizes, and colors and also have varied appearance, ranging from patches on wood to brackets, coral-like tufts simple clubs rosettes cauliflower-like structure or centrally or laterally stalked fruit bodies. Mushrooms can be categorized as edible or non-edible. The poisonous effects of mushrooms were dealt with in an epigram written by Euripides in about 450 B.C (Giovanni 1989). Right from the beginning man has learned to differentiate the edible and non-edible mushroom through numerous observation, trials, and errors. Through these experiences, man has learned to use mushrooms as a part of their diet. Seasonal mushroom hunting and collection are the part of seasonal

activity of the people. Barros et al. (2008) reported the wild mushrooms are richer sources of protein and have a lower amount of fat than commercial mushrooms. The proteins of wild edible mushroom contain considerable amounts of non-essential amino acids like alanine, arginine, glycine, glutamic acid, aspartic acid, proline and serine (Manzi et al. 1999; Manzi and Pizzoferrato 2000). The add-value arising from mushrooms are bioactive materials which lead to an increase in its consumption and therefore, stimulating the commercialization of edible species. Mushrooms also have been used extensively in traditional medicine for curing variety of diseases including viral infection, bacterial infection, cancer, tumor, inflammation, cardiovascular diseases (Benedict and Brady 1972; Iwalokum et al. 2007)

Many researchers have been working on wild mushroom and reported more than 2000 species of edible mushroom all over the world (Adhikari 2000; Purakasthya and Chandra 1985) have reported 283 edible species from India, out of which some are cultivated. Production of mushroom all over the world exceeds three million tones. Most of the exporting countries are the Netherlands, Poland, Ireland, Belgium, India, and China. Among these countries, China is the largest exporter of preserved mushrooms. In India most commonly cultivated mushroom species are Button (*Agaricus bisporus*), Oyster (*Pleurotus* spp.) and Paddy straw mushroom (*Volvariella volvacea*) as documented by (Harsh and Joshi 2008). In India, mushroom is a unique non-traditional cash crop and as popular as food among the tribal people of northeast India. Many rural communities of Nagaland are using mushrooms in their traditional dishes because of their delicious flavor. The favorable climatic condition of north-eastern states of India leads to rich mushroom diversity and form a valuable non-timber forest resource for local folk. Mushrooms are sold in traditional markets or commercially exploited as food or medicines (Tanti et al. 2011). Some of the edible species like *Termitomyces eurhizus*, *Lentinus conatus*, *Schizophyllum commune*, *Tricholoma giganteum*, and *Pleurotus* are sold in the markets of Kohima district of Nagaland by the local people (Tanti et al. 2011). In spite of rich diversity of mushrooms in Nagaland state very few studies have been reported on diversity and market survey from North-Eastern Hills of India (Verma et al. 1995; Singh et al. 2007; Sarma et al. 2010).

The main objective of the present study was to generate a database on ecology, ethnomycology, utilization and nutrient status of important wild edible mushroom species of Nagaland, which forms a part of the food culture of the Nagaland people.

MATERIALS AND METHODS

Study area

Nagaland is situated northeastern part of India having longitude of 93°20' E to 95°15' E and Latitude 25°6' N to 26°4' N and having eleven districts with 16,579 Km² area. The forest cover is about to 86% including reserve forests. The prominent tribes of Nagaland are Chakhesang, Angami, Zeliang, Ao, Sangtam, Yimchunger, Chang, Sema, Lotha,

Khemungan, Rengma, Konyak, Pachury and Phom. The average annual rainfall ranges from 2000-2500 mm, and average temperature during the summer ranges between 15 to 30°C, and in the winter it can fall below to 4°C.

Sample collection and diversity analysis

The periodic surveys were made to Lahorijan, Puliebbie, Zakhama, Pherma, Mankoi, Chungtia, Nongkham, Namcha, and Tigit forest for the collection of macrofungi during rainy season (June to September) and winter (October to December) in 2010-2011. The collected samples were wrapped in wax paper and brought to the laboratory for identification and proximate analysis. The taxonomy has been worked on the basis of macro and microscopic characteristic following available literature (Zoberi 1973; Alexopoulos et al. 1996; Purakasthya and Chandra 1985). The softly textured specimens were preserved in 2% formaldehyde and leathery textured were preserved in 4% formaldehyde and kept in museum of Forest Protection Division, Rain Forest Research Institute, Jorhat, Assam by assigning identification number. The traditional knowledge on the wild mushrooms was gathered from the local tribes and used to know the edibility and medicinal value. The frequency and density of different species have been determined by the following formulas:

$$\text{Freq. of fungal sp. (\%)} = \frac{\text{No. of site in which the sp. is present}}{\text{Total no. of sites}} \times 100$$

$$\text{Density} = \frac{\text{Total no. of individual of a particular species}}{\text{Total no. of species}} \times 100$$

For proximate analysis, the fruit bodies were oven dried and powdered in a Moulinex blender. The fine powdered samples were stored in the desiccators and utilized for proximate and mineral nutrients analysis following Anthrone method (Fasidi and Kadiri 1993).

Moisture content: The fresh and oven dried weight (80°C for 48h) of each mushroom species was recorded moisture content was determined (Raghuramulu et al. 2003) by formula:

$$\text{Moisture content (\%)} = \frac{\text{Fresh weigh} - \text{dry weight}}{\text{Fresh weigh}} \times 100$$

Dry matter content: Weight obtained after oven drying at 80°C for 48 h.

Crude fiber: The Crude fibers content was calculated as following equation:

$$\text{Crude fiber (g/100 g sample)} = [100 - (\text{moisture} + \text{fat})] \times (\text{We-Wa})/\text{Wt of sample (Raghuramulu et al. 2003)}.$$

Protein content: 0.5 g of the powdered mushroom sample was extracted with 50.0 cm of 2% NaCl in a water-bath at 60°C for 1 h. The extract was filtered out and 50.0 cm of 3% copper acetate monohydrate was added to the filtrate to precipitate protein. The precipitated protein was then centrifuged out and dissolves in 50 cm of 0.1 M NaOH. The quantity of protein in the alkaline solution was

then determined using the folin-phenol method (Kadiri and Fasidi 1990).

Total carbohydrate estimation: The content of the available carbohydrate was determined by the following equation:

$$\text{Carbohydrate (g/100 g sample)} = 100 - [(\text{moisture} + \text{fat} + \text{protein} + \text{ash} + \text{crude fiber}) \text{ g/100 g}] \text{ (Raghuramulu et al. 2003).}$$

Ash content: The powdered mushroom sample (3.0 g) was ashed in a Gallenkamp furnace in previously ignited and cooled crucible of known weight at 550°C for 6 h. Fairly cooled crucibles were put in desiccators and weighed (Raghuramulu et al. 2003). The ash content (g/100g) was calculated as following equation:

$$\text{Ash content (\%)} = \frac{\text{Weigh of ash}}{\text{Weigh of sample taken}} \times 100$$

Statistical Analysis: Experimental values are given as means \pm standard deviation (SD). Statistical significance was determined by one-way variance analysis (ANOVA). Differences at $P < 0.05$ were considered to be significant.

RESULTS AND DISCUSSION

The macroscopic characters like shape, size, color, texture, attachment of stipe, smell, spore print, habit, and habitat have documented during the present study. The microscopic details like spore size, shape, color, and hyphal characteristics worked out in the laboratory (Figure 1-2). The description of the collected specimens is recorded as follows:

Agaricus arvensis (Schaeff. ex Secr. s.). It grows on litter in the forest, cap 7-22 cm Convex to shield-shaped creamy white or pale yellowish, stem 4-12 cm long; 1-2 cm thick; slightly bulbous and smooth, the ring is present with a double membrane, the lower splitting into a star-shape around the stem, gills Free from the stem; crowded, whitish to brown, spores ellipsoid, smooth, 7-8x4.5-5 μ m, spore print dark brown (Figure 1D, 2D).

Agaricus langei (Moller) Moller. It Grows on the ground, cap 4-12cm across, convex, densely covered in fine rust brown fibrous scales, gills pale fawny-pink at first becoming darker with age, stem 30-120x15-30mm, whitish with pink tinge and slightly mealy beneath the white pendulous ring, spores elliptic, 7-9x3.5-5 μ m, spore print purple-brown (Figure 1E, 2E).

Lepiota lilacea (Bres.). It Grows on the ground, cap 2-3.6 cm, convex, bell-shaped, dry, by maturity with a purple-brown to dark brown center and colored scales over a whitish to pinkish color, gills Free from the stem, white, close, stem 4-7 cm long, up to 5 mm thick, more or less equal, smooth, sheathing ring present, spores smooth; elliptical. Pileipellis hymeniform, 4-5x2-4 μ m; spore print white (Figure 1L, 2L).

Lepiota magnispora (Murrill). Its growing scattered, gregariously, or in clusters in forest litter, cap 3-6 cm; convex to bell-shaped, dry; scaly; yellow to yellow-brown

or rusty brown with a darker, contrasting center, gills: Free from the stem; white; close, stem 3-8cm long, 1.5 cm thick, more or less equal, with a slightly swollen base, hairy to shaggy with scattered brownish scales, spores smooth, dextrinoid, fusiform, with a convex curve on the adaxial side but not on the other side 14-22x5-6.5 μ m, spore print: dirty pink (Figure 1J, 2J).

Auricularia auricula-judae (St. Amans). It's found on branches, fruit body 3-8 cm, gelatinous, ear-shaped, outer surface brown with minute hairs, inner surface tan-brown, spore white, sausage-shaped, 14-17x5-8 μ m, basidia cylindrical with three transverse septa, spore print white. Fig. 1F, 2F).

Boletus aestivalis (Fr.). It Grows in woods, grows on the ground, fungus color white to cream, cap 7-20cm, pale straw-color to pale snuff-brown, dry, soon becoming rough and cracking into small scales, particularly at center, tubes white then greenish-yellow pores small, round, similarly colored, stem 60-150x20-50mm, robust, covered in a dense white network. Flesh white throughout, sometimes with slight yellowish tinges, spore subfusiform, 13-15x4.5-5.5 μ m, spore print olivaceous snuff-brown (Figure 1O, 2O).

Cantharellus cibarius (Fr. Pfifferling). It grows in woods and on the ground, cap 3-5 inches wide convex at first with inrolled margin (edges), funnel-shaped with a wavy margin with yellow-orange color, the length of the stipe is similar to the width of the cap, gills are forked ridges and with blunt edges, the flesh is yellowish white, spore elliptical, 8-10x4.5-5.5 μ m, spore print white (Figure 1H, 2H).

Hypsizygus tessulatus (Bull. ex Fr.). It grows Singly or scattered on old hardwood trees, cap 2-5 cm; convex, flat at maturity, smooth; white to buff yellow, minutely hairy, stem is 4-24 cm, smooth, tapering towards the base, white hairs at the base, gills adnexed to sinuate, attached to the stem; nearly distant, cross-veined, spore globose, smooth, 4-5 μ m (Figure 1C, 2C).

Pleurotus pulmonarius (Fr.) Quélet. It grows on the tops of logs, Cap white to cream, 2-10cm, convex to flat, fan-shaped in overlapping groups, very finely lined margin. Stem is rudimentary, gills whitish, cylindrical, running down the stem; close or nearly distant; spore Cylindric, 7-10x2-4 μ m, spore print White (Figure 1A, 2A).

Panus fulvus (Berk.). It grows on rotten wood of broad-leaved forest, fungus color white, cream or yellowish, pileus 4-9 cm, funnel-shaped, yellowish brown, tomentous, margin with strips, gills decurrent, brown, stipe central, 3.5-5 \times 0.4-0.6 cm, solid, brown, covered with ark brown hairs, spores elliptical, hyaline, smooth, I-, 6.5-7.5 \times 2.5-3 μ m; spore print white (Figure 1M, 2M).

Lactarius hygrophoroides (Berk. et Curt). It grows in woods and on the ground, cap 3-10 cm; convex to shield-shaped dusted with a whitish bloom; velvety; dry; the margin slightly rugged, stem 3-6 cm long; 0.6-1.4 cm thick; colored velvety like the cap, the length of the stipe is similar to the width of the cap, gills attached to the stem distant, the flesh is white, exudes watery latex, spores 7-9x5.5-7 μ m; Macrocystidia absent, spore print is white (Figure 1I, 2I).



Figure 1. Fruiting body of collected mushrooms. **A.** *Pleurotus pulmonarius*, **B.** *Schizophyllum commune*, **C.** *Hysizygyus tessulatus*, **D.** *Agaricus arvensis*, **E.** *Agaricus langei*, **F.** *Auricularia auricula-judae*, **G.** *Lepista irina*, **H.** *Cantharellus cibarius*, **I.** *Lactarius hygrophoroides*, **J.** *Lepiota magnispora*, **K.** *Cookeina sulcipes*, **L.** *Lepiota lilacea*, **M.** *Panus fulvus*, **N.** *Melanoleuca grammopodia*, **O.** *Boletus aestivalis*

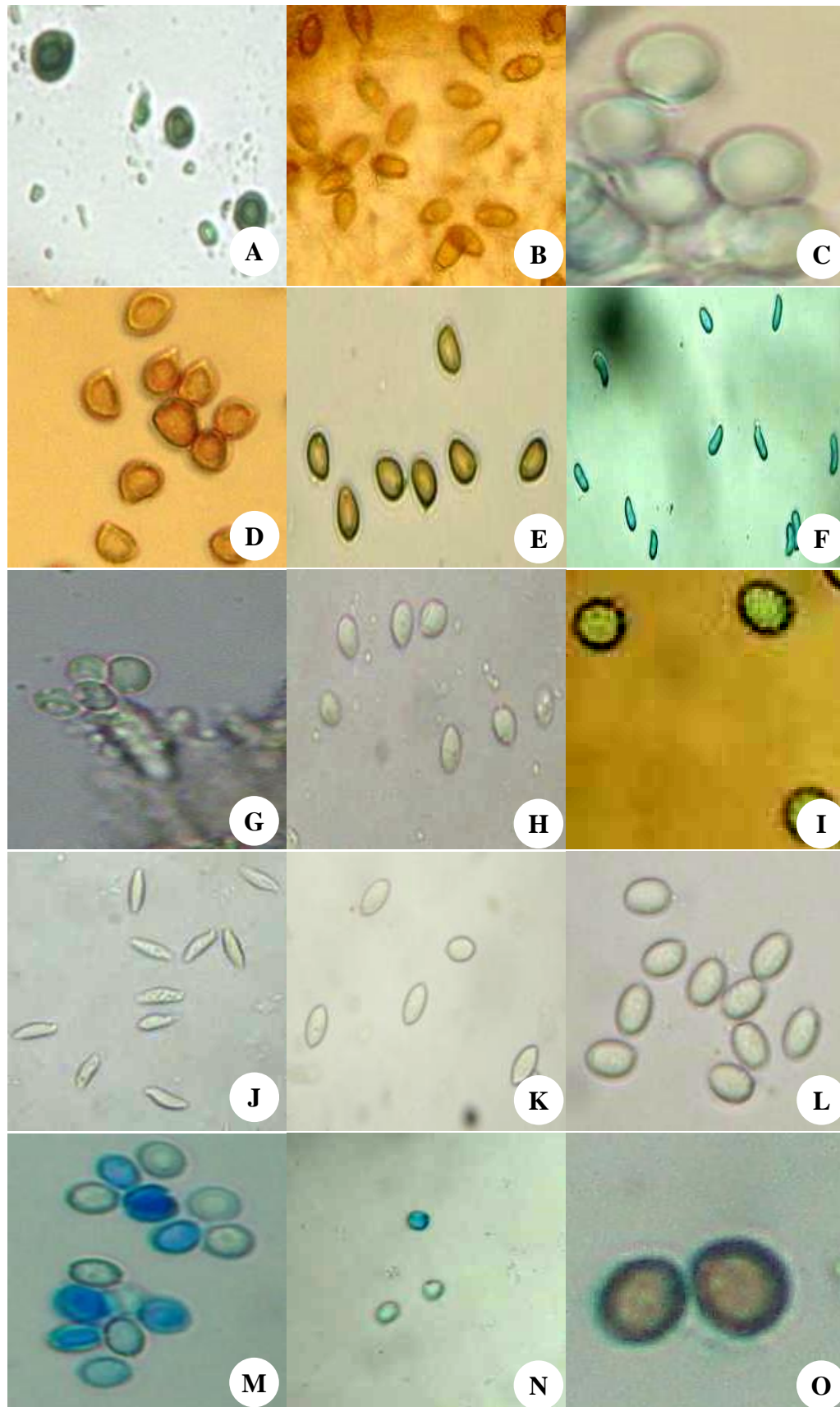


Figure 2. Spores of the collected mushrooms. **A.** *Pleurotus pulmonarius*, **B.** *Schizophyllum commune*, **C.** *Hypsizygos tessulatus*, **D.** *Agaricus arvensis*, **E.** *Agaricus langei*, **F.** *Auricularia auricula-judae*, **G.** *Lepista irina*, **H.** *Cantharellus cibarius*, **I.** *Lactarius hygrophoroides*, **J.** *Lepiota magnispora*, **K.** *Cookeina sulcipes*, **L.** *Lepiota lilacea*, **M.** *Panus fulvus*, **N.** *Melanoleuca grammopodia*, **O.** *Boletus aestivalis*

Cookeina sulcipes (Berk.) Kuntze. It grows as saprotrophs on dead wood, fruiting bodies cup-shaped to funnel-shaped, brightly-colored, and yellow to red. The outer surface is less brightly colored the walls of the apothecium, is thin and flexible and has tiny hairs on the upper rim of the cup, asci are constricted abruptly below and form a blunt, rounded base with a slim, tail-like connection, ascospores ellipsoidal and smooth 20-40.5µm long (Figure 1K, 2K).

Schizophyllum commune (Fr. Gemeiner Spaltblättling). It grows in dead wood of deciduous trees, fruiting body 1-5 cm wide, fan-shaped small hairs on the upper surface, white to grayish, stem rudimentary or absent, gills Under surface of the fruiting body composed of gill-like folds in the undersurface that are distinctively split, spore Cylindric, 5x3µm, cystidia absent spore print White (Figure 1B, 2B).

Lepista irina (Fr.) H.E. It's found in open woodland, cap light brown, 5-11cm across, flattened-convex, wavy at the margin, stem 55-97x8-20mm, dirty white, covered in long fibers, ochraceous near the base, gills emarginate, crowded, spores oval, 7-9x3.5-4µm, spore print dirty pink (Figure 1G, 2G).

Melanoleuca grammopodia (Bull.) Murrill. It found in woods on leaf mulch and composted soil, cap convex, then flattened, with a broad central bump, often depressed, smooth, gills broad, emarginate, whitish, or cream, stem equal with a broad base, whitish, with brown fibres along the length, spores ellipsoidal, smooth 8.5-9.5x 5-6 µm, basidia four-spored, spore print white (Figure 1N, 2N).

Species diversity of macrofungi is related to the particular habitats. The factors like geographic location, elevation, temperature, humidity, light, and surrounding flora greatly influence the growth and development of macrofungi. In the present study, the fungal fruit bodies were collected from 12 different locations of nine districts of Nagaland. 15 species of edible mushrooms were found, out of which 4 belongs to family Agaricaceae, 2 belongs to Tricholomataceae, and one each in Boletaceae, Cantharellaceae, Russulaceae, Sarcoscyphaceae, Auricula-

riaceae, Polyporaceae, Schizophyllaceae, Pleurotaceae, and Lyophyllaceae. The diversity analysis revealed that maximum frequency occurrence was exhibited by *Auricularia auricula-judae* (66.6%), followed by *Agaricus langei* and *Lactarius hygrophoroides* (58.3% each), *Pleurotus pulmonarius* (50%) and minimum (16.6%) by *Melanoleuca grammopodia*. The rest of species exhibited the frequency of distribution between 16.6-50%. All of the selected species are edible and among which four have medicinal importance also (Table 1). Recently, Tanti et al. (2011) have recorded 13 number of macrofungi under 9 genera and six families available in the market of Kohima town of the Nagaland.

Mushrooms are delicious food due to their high-quality protein, vitamins, and minerals. The proximate composition of the selected edible mushroom species has been presented in Table 2. Fresh mushrooms contained about 90% moisture and 10% dry matter and dry mushrooms contained about 90% dry matter and 10% moisture (Chang and Buswell 1996). In the present study, it was observed that the moisture content of the collected mushroom samples ranges from 52.11-95.13%. The *Pleurotus*, *Agaricus*, and *Lepiota* have higher moisture content in comparison to other species. The dry matter content ranged from 2.1-4.2% with exception to *S. commune*, having 12.9% dry content. Crude fibers were recorded minimum for *A. arvensis* (0.14%) and maximum 12.9% for *H. tessulatus*, rest were in between. Edible mushrooms are highly valued as a good source of protein and their protein contents usually range from 28.93% to 39.1% of dry weight (Ragunathan et al. 2003; Sanmee et al. 2003). Following similar trend, the highest protein content was recorded for *L. hygrophoroides* (44.93%) and lowest for *S. commune* (22.50%). The carbohydrates content of edible mushrooms usually ranges from 40.6% to 53.3% of dry weight (Khanna et al. 1992; Ragunathan et al. 1996). In the present study, species have carbohydrates between 32.43-52.07%. The ash content has exhibited quite variation from 0.18-14.97% in different species.

Table 1. Frequency of occurrence and density of macrofungi

Name of the species	Family	Host/Substratum	Use	Freq. of occurred (%)	Density	ID number
<i>Agaricus arvensis</i>	Agaricaceae	Grows on litter	Edible	25.0	66.6	NL-000256
<i>Agaricus langei</i>	Agaricaceae	Grows on ground	Edible	58.3	108.3	NL-000312
<i>Lepiota lilacea</i>	Agaricaceae	On ground	Edible	41.6	58.3	NL-000305
<i>Lepiota magnispora</i>	Agaricaceae	Forest litter	Edible	33.3	33.3	NL-000291
<i>Auricularia auricula-judae</i>	Auriculariaceae	Dead bamboo culm, Underwood	Edible, medicine	66.6	133.3	NL-000270
<i>Boletus aestivalis</i>	Boletaceae	On wood, ground	Edible	25.0	25.0	NL-000280
<i>Cantharellus cibarius</i>	Cantharellaceae	On live coconut/Deadwood logs	Edible	33.3	41.6	NL-000255
<i>Hypsizygus tessulatus</i>	Lyophyllaceae	Old hardwood trees	Edible, medicine	33.3	91.6	NL-000286
<i>Pleurotus pulmonarius</i>	Pleurotaceae	Wood logs	Edible	50.0	116.6	NL-000105
<i>Panus fulvus</i>	Polyporaceae	Rotten wood	Edible	33.3	33.3	NL-000172
<i>Lactarius hygrophoroides</i>	Russulaceae	Wood, litter	Edible, medicine	58.3	91.6	NL-000258
<i>Cookeina sulcipes</i>	Sarcoscyphaceae	Deadwood	Edible	25.0	50.0	NL-000307
<i>Schizophyllum commune</i>	Schizophyllaceae	Deadwood of deciduous trees	Edible, medicine	41.6	75.0	NL-000143
<i>Lepista irina</i>	Tricholomataceae	Woodland	Edible	50.0	58.3	NL-000290

Melanoleuca grammopodia Tricholomataceae Leaf mulch, composted soil Edible 16.6 33.3 NL-000112

Table 2. Proximate composition (g/100g) of 15 selected wild edible mushroom species (mean \pm SD)

Mushrooms	Moisture	Dry matter	Crude fibre	Protein	Carbohydrates	Ash
<i>Agaricus arvensis</i>	94.90 \pm 1.80	4.20 \pm 0.60	0.14 \pm 0.02	32.87 \pm 1.69	32.91 \pm 1.80	0.18 \pm 0.01
<i>Agaricus langei</i>	84.82 \pm 1.72	4.10 \pm 0.65	3.28 \pm 0.05	35.14 \pm 1.04	34.83 \pm 1.82	14.10 \pm 0.61
<i>Lepiota lilacea</i>	83.20 \pm 1.73	4.20 \pm 0.67	11.98 \pm 0.64	28.12 \pm 1.40	49.33 \pm 1.94	8.09 \pm 0.77
<i>Lepiota magnispora</i>	93.31 \pm 2.02	2.40 \pm 0.53	5.20 \pm 0.29	27.55 \pm 1.25	35.00 \pm 1.58	3.05 \pm 0.57
<i>Auricularia auricula-judae</i>	95.17 \pm 2.03	2.20 \pm 0.59	2.81 \pm 0.04	36.30 \pm 1.33	33.23 \pm 1.67	7.07 \pm 0.52
<i>Boletus aestivalis</i>	77.01 \pm 1.25	4.10 \pm 0.65	12.13 \pm 0.58	32.76 \pm 1.47	52.07 \pm 2.81	14.97 \pm 0.73
<i>Cantharellus cibarius</i>	87.82 \pm 1.63	2.20 \pm 0.51	1.40 \pm 0.28	34.17 \pm 1.26	47.00 \pm 2.24	7.78 \pm 0.63
<i>Hypsizygus tessulatus</i>	83.40 \pm 1.39	3.10 \pm 0.87	12.90 \pm 0.35	37.80 \pm 1.25	51.20 \pm 2.27	9.09 \pm 0.78
<i>Pleurotus pulmonarius</i>	95.13 \pm 1.83	3.90 \pm 0.64	4.12 \pm 0.64	37.63 \pm 1.24	43.40 \pm 2.15	10.17 \pm 1.26
<i>Panus fulvus</i>	52.11 \pm 1.14	2.10 \pm 0.63	6.08 \pm 0.52	27.06 \pm 1.62	33.04 \pm 1.28	3.11 \pm 0.47
<i>Lactarius hygrophoroides</i>	70.00 \pm 1.28	3.30 \pm 0.86	10.58 \pm 0.35	44.93 \pm 1.79	42.00 \pm 1.64	2.00 \pm 0.29
<i>Cookeina sulcipes</i>	88.48 \pm 1.51	2.30 \pm 0.58	0.16 \pm 0.02	28.93 \pm 1.65	50.20 \pm 2.38	6.55 \pm 0.58
<i>Schizophyllum commune</i>	87.30 \pm 1.29	12.90 \pm 1.74	6.50 \pm 0.67	22.50 \pm 0.67	32.43 \pm 1.21	10.10 \pm 1.14
<i>Lepista irina</i>	83.82 \pm 1.58	2.10 \pm 0.47	6.08 \pm 0.52	26.12 \pm 1.50	50.20 \pm 2.34	3.16 \pm 0.59
<i>Melanoleuca grammopodia</i>	67.34 \pm 1.89	3.10 \pm 0.84	8.12 \pm 0.64	36.27 \pm 1.52	33.04 \pm 1.43	4.13 \pm 0.68
CD (p < 0.05)	4.72	2.34	1.32	4.12	5.88	2.07

CONCLUSION

The identification and use of wild edible mushrooms play a vital role in enrichment of the socio-economic life of the tribal people. The current environmental issues of global warming and climate change would adversely affect the regeneration and growth pattern of the delicate fungi which requires a specific micro-climate. Consequently, the high nutritional quality and unique flavor of these mushrooms are likely to be lost if these wild edibles are not properly documented. However, a thorough screening is needed to delimit their different medicinal properties which will not only help in solving the food crisis which is prevalent in the rural poor population but will also add medicinal touch to their food.

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