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Edible Macrofungi of Borail Reserve Forest of Dima Hasao District, Assam, India

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ABSTRACT

The present study aims to find out the edible macrofungi in Borail Reserve Forest of Dima Hasao district of Assam. Survey was carried out between the month of April to September, 2022. A total of 09 edible macrofungi belonging to lignicolous and humicolous habitat were identified belonging under 8 genera and 8 families, i.e. Agaricaceae, Auriculariaceae, Fomitopsidaceae, Lyophyllaceae, Phallaceae, Polyporaceae, Schizophyllaceae and Tremellaceae. Among the collected species, Polyporaceae family is found to be the most dominant family and all the edible macrofungi species belongs to Basidiomycota group.

Key words : *Basidiomycota, Borail Reserve Forest, Edible microfungi*

Introduction

Macrofungi are fungi that produce visible mature sporophore. Edible macrofungi are of high nutritional value and play a crucial role in ecological functioning. Available literature also provided a good indication of certain ethnic groups used wild mushrooms as a food source. Wild edible mushrooms are important parts of the livelihood of people in different parts of the world (Boa, 2004; Manoharachary *et al*., 2005). These non-timber forest resources are used by mycophilic societies and their utilization has been documented in many countries (Thatoi and Singdevsachan, 2014). Around 2000 species of macrofungi are edible and about 650 of these possessing medicinal properties (Rai *et al.,* 2005). Edible mushrooms have high content of proteins, vitamins, minerals, fibers, trace elements, and have low calories and cholesterol (Murugkar and Subbulakshmi, 2005). Besides, edible macrofungi have rich sources of various bioactive substances, i.e. anti-bacterial, anti-viral, anti-fungal, anti-parasitic, anti-oxidant, anti-inflammatory, anti-proliferative, anti-cancer, anti-tumour, cytotoxic, immunomodulating, hypocholesterolemia, anti-diabetic, anti-coagulant, and hepatoprotective compounds (Wasser and Weis, 1999; Ajith and Janardhanan, 2007).

North-Eastern region of India is very rich in mushroom flora (Verma *et al.,* 1995) in general and Assam in particular. The Borail Reserve Forest of Dima Hasao district of Assam is the only high range with flora and fauna. Subsequently, this region is also very rich in edible macrofungi species. Even then, only few studies were conducted on edible macrofungi in different parts of Assam and reported that most of the indigenous people of the region consumed it. Despite being rich in edible macrofungi in the region, no studies were found in Borail Reserve Forest of Assam. Therefore, edible fungi of the area

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still scientifically need to be explored. However, climate change, habitat destruction may pose adverse effects on wild edible mushrooms. Hence, the present study is undertaken on extensive survey in order to identify and characterize the edible macrofungi of the area.

Materials and Methods

Study area

Borail Reserve Forest of Dima Hasao district of Assam is located in between 25°03'07.76'' N - 25°05'56.86'' N and 92°48' 52.56'' E - 92°52' 24.28'' E. It is mainly occupied by semi-evergreen and evergreen vegetation. The region is typical Subtropical Monsoon Climate. The climate is characterized by adequate relative humidity ranging from moderate to fairly high degrees depending on the distribution of annual rainfalls. The annual average temperature ranges from 9 °C to 36 °C.

Collection of edible macrofungi

Regular survey was carried out just after the rain from the month of April to September 2022. The fleshy fruiting bodies were collected from different habits and habitats and were properly photographed in their natural habitat. Samples were carefully wrapped in wax paper and were brought to the laboratory for proper identification. Parameters viz. habit, growth substratum, shape, size and the macrochemical test of the sample with various chemicals such as 5% KOH, NH_4OH, $FeSO_4$ were also tested and noted in the study sites. Then the collected sample were dried using field dryer at 50–60° C and preserved in silica gel packets. Color codes and terms were followed by Methuen Handbook of Colour (Kornerup and Wanscher, 1978).

Identification of Macrofungi

Collected edible macrofungi were identified morphologically and microscopically based on the available literature viz., Arora (1986); Alexopoulos (1996); Hall *et al.* (2003); Lodge *et al.* (2004); Rogers *et al.* (2005); Desjardin and Ovrebo (2006); Karun and Sridhar (2013); Semwal *et al.* (2014), etc. For systematic and nomenclatural correctness, Index Fungorum (http://Indexfungorum.org) and Mycobank (https://www.mycobank.org) websites were consulted.

Results and Discussion

Characterization of the collected edible macrofungi

1. *Auricularia auricula-judae* (Bull.) Quél.
   Basidiocarp ranged from small to medium sized. **Pileus** 2-14 cm in wide, 3–6 cm tall, upto 1 mm thick, irregular, semi-circular, cup-shaped or ear-shaped, thin flesh, brown (7D8) in colour at younger stage but darker in colour at maturity, fruiting bodies gelatinous, rubbery, slippery, soft and fragile when fresh and moist, but turned hard and brittled when dried. **Margin** inrolled, upto 1 mm thick. **Stipe** sessile or shows rudimentary, brownish (7D8) in colour. **Spore print** white (7A1) in colour. **Basidiospores** 12.5–19.5 × 4–8 µm, ellipsoidal in shaped, smooth surface.
2. *Calvatia cyathiformis* (Bosc) Morgan
   Fruiting body ranged from 8–20 cm high and 8–24 cm wide at matured stage, rounded or ball shaped when young, soon turned pear-shaped when attained maturity. The outer layer of basidiocarp or peridium is smooth and whitish (15A1) in colour later turned purplish (15B7) in

Table 1. List of edible macrofungi showing family, habit, habitat and month of occurrence (2022)

Sl. No.	Species Name	Family	Habit	Habitat	Month of Occurrence
1.	*Auricularia auricula- judae*	Auriculariaceae	Grown in group or in clusters	Lignicolous	June
2.	*Calvatia cyathiformis*	Agaricaceae	Grown in single or in group	Humicolous	September
3.	*Laetiporus sulphureus*	Fomitopsidaceae	Grown in single or in clusters	Lignicolous	April
4.	*Lentinus sajor-caju*	Polyporaceae	Grown in group or in clusters	Lignicolous	August
5.	*Lentinus squarrosulus*	Polyporaceae	Grown in clusters	Lignicolous	September
6.	*Phallus indusiatus*	Phallaceae	Grown in single	Humicolous	June
7.	*Schizophyllum commune*	Schizophyllaceae	Grown in group or in clusters	Lignicolous	June
8.	*Termitomyces heimii*	Lyophyllaceae	Grown in single or in group	Humicolous	May
9.	*Tremella fuciformis*	Tremellaceae	Grown in single	Lignicolous	August

colour after maturity. The inner layer white (14A1) and firmed when young, and then turned dark purple (14F6) in colour. At matured stage the top surface of the basidiocarp ruptured and released spore mass. **Spore print** purple (15B7) in colour. **Basidiospores** 3.5–6.5 µm, globose or rounded shaped.

3. *Laetiporus sulphurous* (Bull.) Murrill
Pileus ranged from 10–60 cm broad and upto 3–4 cm thick, semi-circular or fan shaped, smooth surface, orange red (8B7) or orange (6A7) in colour but soon colour faded to yellowish (3A7) with maturity and with old aged. Flesh thick, smooth, soft, watery when fresh, stiffed and toughed when old, dried and matured. **Margin** smooth, thick upto 4–5 cm. **Stipe** sessile. **Spore print** white (6A1) in colour. **Basidiospores** 5.5–6.5 × 3.5–5.5 µm, ellipsoidal in shaped.

4. *Lentinus sajor-caju* (Fr.) Fr
Pileus ranged from 2–10 cm in diam., 3–10 cm in length, shiny, soft coriaceous, glabrous, with deep umbilicate centre, whitish (7A1) to creamy white colour (6A1) and then light brown (7D6) when maturity or dried completely. **Lamellae** thin and whitish (7A1), deep decurrent, densely crowded with 4–6 mm wide with regular spacing of 1–2 mm. **Stipe** short 2–2.5 cm in length, 3–4 mm wide, frequent curved, whitish, lateral, central, cylindric, solid and showed abrupt base. **Context** upto 7–8 mm thick at the centre. Presence of abundant hyphal pegs. **Basidiospores** 6–9 × 2–3 µm, cylindrical in shaped, smooth, hyaline.

5. *Lentinus squarrosulus* Mont

Pileus 2–10 cm in diam., 3–8 cm in length, thin, pliant, umbilicate to infundibuliform, with deep centre. **Surface** whitish (10A1) in colour, smooth or glabrous, silky, shiny, when fresh, but firm, hard and stiffed when dried. **Margin** incurved or downcurved, involute, thin upto 0.5–0.8 mm. **Gills** deeply decurrent, whitish (10A1) in colour, thin, crowded with 2–3 mm broad, with regular spacing. **Stipe** 1.5–3 cm in length, 2–6 mm thick, excentric, central, often curved stipe, whitish (10A1) surface concolorous, showed sub-bulbous base, solid and cylindric. **Context** white (2A1) in colour upto 1–2 mm thick, fleshy, coriaceous. **Basidiospores** 5–7 × 1.5–2.5 µm, cylindrical in shaped, hyaline and thin walled.

6. *Phallus indusiatus* Vent

Fruiting body ranged upto 4–10 cm high, 3–4 cm wide, cap broadly convex or bell shaped covered with layer of deep brown (8F6) spore slime and with perforated apex, a whitish (8A1) net like structure extended from down the head, surface white (8A1) to creamed in colour. **Stalk** upto 5–8 cm high and 2–3 cm thick, whitish, gelatinous, soft, fragile, slimy, hollow and cylindrical. Presence of volva, white (7A1) in colour at the base of the stalk. **Basidiospores** 4.5–5.5 × 1.8–2.5 µm, elliptical in shaped, smooth, hyaline in 5% KOH.

7. *Schizophyllum commune* Fr

Pileus ranged from 10–30 mm in diam., semi-circular, irregular shaped or fan-shaped, pliable when fresh and moist, brittle upon drying, length upto 5–20 mm, surface tomentose to velvety, whitish (1A1) or grey white (1B1) in colour. **Margin** incurved and lobed upto 2–3 mm thick. **Gills** greyish white (1B1) in colour with regular spacing of 0.5–1 mm, edge split. **Stipe** concolorous, sometimes sessile or rudimentary, central and solid upto 1–2 mm long and 2–3 mm thick. **Context** whitish (1A1) in colour upto 1–2 mm thick. **Spore print** white (1A1) in colour. **Basidiospores** 3–6.5 × 1–1.75 µm, cylindrical in shaped, smooth, hyaline, inamyloid.

8. *Termitomyces heimii* Natarajan

Pileus ranged from 3.1–5.2 cm in diam., with 2–3 mm thick. Surface smooth, silky, shiny, soft, rounded shaped when young, later convex shaped, eventually flattened when matured, white (4A1) in colour, without depressed centre, but with broadly roundish or umbo centre with greyish (3C1) in colour. **Margin** upto 3–4 mm

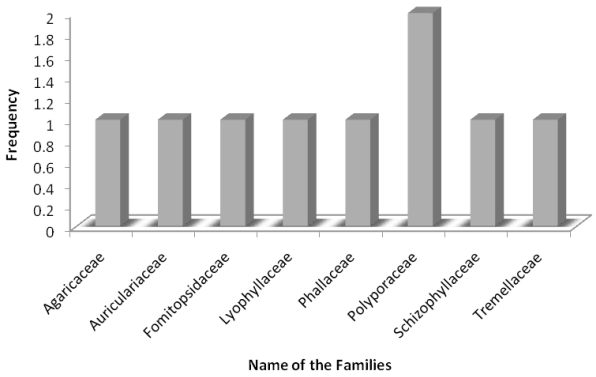

Fig. 2. Dominant familiy of macrofungi

thick, regular. **Gills** white (5A1) in colour, moderately crowded, short gills of 2.5–3 cm in length. Stipe very long upto 15–20 cm, 1.8–2 cm thick, central, cylindrical, fibrillose, solid, smooth and white (4A1) in colour. Pseudorrhiza present upto 14–16 cm long, cylindrical, white (4A1) concolorous with the pileus and stipe. Annulus with double. Volva is absent. Basidiospores 5.75–8.75 × 4.75–5.5 µm, ellipsoidal in shaped, smooth, somewhat hyaline, Melzer's reaction negative, inamyloid.

9. ***Tremella fuciformis* Berk**

Pileus ranged from 2.5–4 cm tall, 4–5 cm across, upto 1 mm thick. Surface gelatinous, smooth, soft, fragile, shiny, slippery, translucent, watery, presence of lobes, white (4A1) in colour when fresh. **Margin** irregular in shaped, upto 0.8–1 mm thick. **Stipe** sessile. **Context** concolorous, white (4A1) upto 0.5 mm thick. **Spore print** white (4A1) in colour. **Basidiospores** 6.5–14 × 5.5–8.5 µm, ovoid and smooth.

In the figure 2, dominant familiy of macrofungi is observed in the study area. During the study a total of 09 edible species of macrofungi belonging to 8 genera and 8 families were encountered and identified. All the collected species belongs to Basidiomycota group only, 6 species belongs to lignicolous habitat and 3 species belongs to

Photoplates of collected macrofungi

Plate 1 Plate 2 Plate 3

Plate 4 Plate 5 Plate 6

Plate 7 Plate 8 Plate 9

Fig. 3. Photo Plates of edible macrofungi of Borail Researve Forest
(1) *Auricularia auricula-judae* (2) *Calvatia cyathiformis* (3) *Laetiporus sulphureus*
(4) *Lentinus sajor-caju* (5) *Lentinus squarrosulus* (6) *Phallus indusiatus*
(7) *Schizophyllum commune* (8) *Termitomyces heimii* (9) *Tremella fuciformis*

humicolous habitat. Among the identified species, 1 species belongs to Agaricaceae family, 1 species belongs to Auriculariaceae, 1 species belongs to Fomitopsidaceae, 1 species belongs to Lyophyllaceae, 1 species belongs to Phallaceae, 2 species belongs to Polyporaceae, 1 species belongs to Schizophyllaceae and 1 species belongs to Tremellaceae.

The adjacent area of Borail Reserve Forest of Dima Hasao district is predominant by the ethnic local tribes. Wild edible macrofungi are potential food resource for their livelihood. This area is utterly unexplored and further scientific investigations are required to unveil the macrofungal diversity. Deforestation and climate change are the major threat to the biodiversity. Due to loss of habitat many species could get extinct before exploration because of which updated taxonomic surveys to enlist out unexplored mushroom species is vital (Chattopadhyay *et al.*, 2022). Therefore, conservation as well as sustainable utilization of edible macrofungi is a major concern at this juncture. The awareness could be spread among local population through ecotourism targeting the mushroom walks or mushroom treks in well vegetated areas (Mishra *et al.*, 2020).

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Conflict of interest

Authors have no conflict of interests.

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