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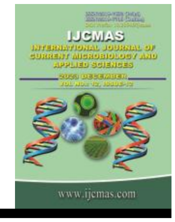

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Biodiversity of Wild Mushrooms in Aizawl, Mizoram, India

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A B S T R A C T

In this study, a total of 27 distinct species were collected from various locations within the Aizawl district of Mizoram, India. These species were then identified based on their morphological characteristics and indicating the presence of 21 genera, 16 families, and 7 orders within the phylum Basidiomycota. Among the identified species, 19 species were recorded as edible and 6 species were recorded to be inedible/poisonous and 2 species with unknown edibility status. *Microporus xanthopus* appeared as the predominant species. Certain species such as *Amanita flavoconia*, *Amanita jacksonii*, *Amanita vaginata*, *M. xanthopus*, *Russula cyanoxantha*, and *Schizophyllum commune* were found consistently across all sampling site. However, species such as *Phallus indusiatus*, *Podoscypha petalodes*, *R. emetica*, and *Termitomyces heimii* were found within a single study sites.

Introduction

The biological world is enriched by the natural beauty and diversity of fungi, with India being a significant contributor to the field (Manoharachary *et al.*, 2005). Fungi are an extensive species of creatures that play important roles in ecosystems as decomposers, mycorrhizal partners thatregulate nutrient and carbon cycles, food and medicinal sources, and contribute greatly to both ecological balance and human well-being (Blackwell, 2011; van der Heijden *et al.*, 2015) and new species are described at the rate of approximately 1200 per year (Kirk *et al.*, 2008). The total number of fungal species considered to exist is estimated to be 1.5 million (Hawksworth, 2001). However, based on next-generation sequencing, estimates of fungal species numbers ranged between 3.5 and 5.1 million (Blackwell, 2011).

They improve resource efficiency, develop renewable alternatives to fossil-based products, repurpose waste into valuable food and feed, combat lifestyle diseases and antibiotic resistance by supporting gut health, increase crop resilience in the face of climate change, and make it easier to develop new biological drugs (Lange, 2014). Wild edible macrofungi are appreciated for their nutritional benefits, and they are a popular choice for consumption in many parts of the worlds

(Kurtzman, 1997; Yan *et al.*, 2017; Roncero-Ramosand Delgado-Andrade, 2017; Khumlianlal *et al.*, 2022). They are rich in vitamins, minerals, and dietary fiber that can help to boost overall health and wellbeing (Valverde *et al.*, 2015). Moreover, they contain antioxidants that can help to combat cell damage from free radicals, potentially preventing aging and degenerative diseases (Sánchez, 2017; Mwangi *et al.*, 2022).

Mizoram is part of the Indo-Burma biodiversity hotspot, hosts a rich variety of wild macrofungi including edible and ecologically important fungi (Zothanzama, 2011; Lallawmsanga *et al.*, 2016; Lalrinawmi *et al.*, 2017; Vabeikhokhei *et al.*, 2019; Zohmangaiha *et al.*, 2019) highlighting the importance of nutritional value (Thachunglura *et al.*, 2023; Zohmangaiha *et al.*, 2023) and comprehensive research to uncover and understand its fungal diversity for conservation and sustainable utilization have been documented (Zothanzama *et al.*, 2018). Recently, some species from the family Polyporaceae and Russulaceae are also documented within the state of Mizoram (Chawngthu, *et al.*, 2023; Thachunglura *et al.*, 2023b). However, the region has yet to be studied for many types of fungi. The tropical area, which contains a huge diversity of macrofungi, has not been adequately explored. Therefore, the present study sets out to document the wild mushroom specifically within this tropical area.

Materials and Methods

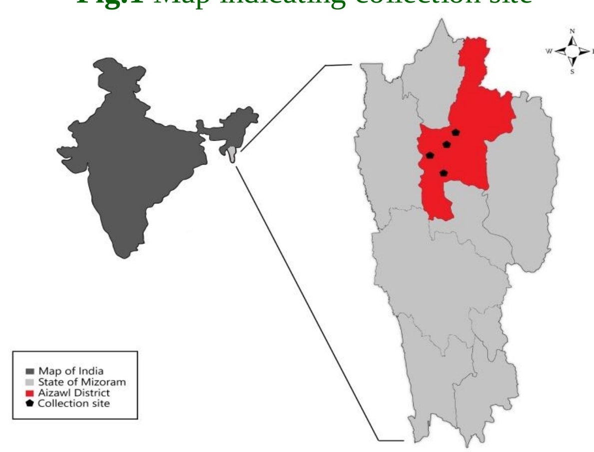
Study site and area

Mizoram covers an area of 21,081 sq. km and geographically lies between the coordinates of 23.1645° N, 92.9376° E. Mizoram is also recognized as a biodiversity hotspot, owing to its remarkable diversity of plant and animal species. The tropic of Cancer passes through the state at 23.500° N. The collection site Aizawl District covers an area 3,577 sq. kilometres, is positioned to the north of the tropic of Cancer in the northern region of the state. The Aizawl city is perched on a ridge, elevated at an approximate altitude of 1,132 meters (3,715 feet) above sea level (Figure 1). The samples were collected from Hlimen forest, Hmuifang forest, Lungleng forest and Mizoram University campus.

Collection and identification

The samples were collected from different parts of Aizawl District, India during rainy season in 2020-2022. The collected specimens were cleaned from forest debris before transporting back to the laboratory. Photograph of each sample collected were taken both in the field and in the laboratory (Zothanzama, 2011). The specimens are preserved by air drying and deep freezing. The morphological characters like color of the fruiting body (stipe and pileus), size, shape, coordinates and collection site of the mushrooms were recorded carefully. The collected specimens were subsequently identified based on micro and macro-morphological characteristics with the help of appropriate literature (Arora, 1986; Gilbertson and Ryvarden, 1986; Phillips *et al.*, 2010; Bisht, 2011; Sawhasan *et al.*, 2011; Furtado *et al.*, 2016; Tarafder *et al.*, 2017) and reliable website (Mushroomexpert.com). For microscopic study, following Zohmangaiha *et al.*, (2019), thin sections of dried specimens were taken with a sharp razor blade andthen mounted in 3% potassium hydroxide (KOH) solution and stained in 2% aqueous phloxine. Sections were mounted in Lactophenol or 60% lactic acid + cotton blue. Spore prints of the collected specimens were taken by cutting a section of the pore layer, placing it on a piece of white paper, and covering it.

Fig.1 Map indicating collection site



Results and Discussion

The present study documented a total of 28 species belonging to the phylum Basidiomycota, 21 genera, 16 families, and 7 orders, all of which were identified based on their morphological characteristics. Detailed information about the collection sites and edibility is outlined in Table 1, while their fruiting bodies are depicted in Figure 2. Among the identified species, 15 species were considered to be edible and fit for consumption after harvesting, along with 3 other edible species; however it is crucial to clearly identify them as edible to avoid mistakenly consuming potentially poisonous species. Additionally, one species was considered edible only when its fruiting body was young. On the other hand, 4 species were labeled as inedible, and two were identified as poisonous. The status of two other species remained unknown.

The species such as *Agaricus placomyces, Podoscypha petalodes* and *Pycnoporus coccineus* were not known to be documented from Mizoram. However, the remaining species had been previously reported by various authors across the region (Zothanzama, 2011; Lalrinawmi *et al.,* 2017; Vabeikhokhei *et al.,* 2019; Thachunglura *et al.,* 2023b). Russulaceae is the dominant family and *M.xanthopus* was found to be the most abundant species from the four study site. It was observed that the species *A. flavoconia*, *A. jacksonii*, *A. vaginata*, *M. xanthopus*, *R. cyanoxantha*, and *S. commune* were found in all the collection sites. On the other hand, species like *P. indusiatus*, *P. petalodes*, *R. emetica* and *T. heimii* were only found in specific one study site.

Agaricus placomyces Peck

Cap 4.5-13 cm, at first convex, then broadly convex or nearly flat with age, covered with radiating grayish brown pigment, dry, whitish underneath, or pinkish in wet weather, often yellowing when rubbed. Gills crowded, short-gills frequent, whitish at first, becoming pink and turning brown with age. Stem 6–11 x 1-2.5 cm, whitish to brownish, bruising yellow. Flesh white. Spore print brown. Spores 4–6 x 3.5–4.5 µm, ellipsoid, smooth (Specimen examined: TPZ/18/007).

Amanita flavoconia G.F. Atk

Cap 3- 8.5cm wide, ovoid at first, then expanding to convex or flat with umbo; bright yellow to orange, with small bright yellow veil fragments loosely spread over surface; margin of cap without radial grooves. Gills free, crowded, white or with faint flush of yellow. Stem 5-11.5 x 0.5-1 cm, white to yellow, with swollen basal bulb, covered on lower half with yellow floccose-crumbly veil fragments; with membranous white or yellow ring. Flesh white, unchanging. Spores ovate, ellipsoid, smooth, amyloid, 7-9 x 4.5-6µmT (Specimen examined: PZ/18/021).

Amanita jacksonii Pomerl

Cap 7-14cm wide, oval at firstat first becoming convex, usually with a slight umbo and a margin with rather long siations; orange to reddish orange on the disc, fading to yellowish orange on the margin; smooth, slightly sticky when moist, very occasionally with a few white patches of volval remains. Gills free, crowded, yellow, yellow to orange yellow. Stem 9-15 x 1-1.5 cm, tapering toward the slightly expanded apex, stuffed to hollow; pale yellow, occasionally with darker orange fibers. Flesh white to yellowish. Spore print white. Spores inamyloid, ellipsoid, 7.8-11 x 5.5-7µ. (Specimen examined: TPZ/18/002).

Amanita vaginata (Bull.) Lam

Cap 5-10cm across, oval at first, becoming convex or expanding to almost flat with an umbo, sticky at first or when wet, grayish brown, darker toward the disc, lighter toward margin; smooth and sticky when moist. Gills fee, moderately close, moderately broad; whitish Stem 6.5-13 x 0.5-1.8 cm, hollow, slightly tapering to apex; white flushed with cap color; no ring; no basal bulb, but base enclosed in a large, white, thin bag-like volva, often torn with age. Flesh white. Spore print white.Spores9.1-11.2 x 8.7-10.5µ, subglobose, inamyloid (Specimen examined: TPZ/18/009).

***Auricularia auricula-judae* (Bull.) J. Schrot**

Fruiting body wavy and irregular, typically ear-shaped, 2-15 cm, gathered together and attached at a central or lateral position, fertile surface, gelatinous, tan to brown, sterile surface (usually the "upper" one) silky to downy, veined, irregular, brown. Flesh thin, gelatinous-rubbery. Sporeprint white. Spores 12-19 x 4-8 µ, ellipsoid, allantoid, smooth (Specimen examined: TPZ/18/004).

***Auricularia delicate* (Mont.) Henn**

Fruiting body1.0–8.0 cm long and 1.5–3 cm wide, sessile to substipitate, reniform to semicircular, gelatinous when rehydrated, pinkish when fresh, dark brownish to vinaceous brown, cap minutely tomentose to almost glabrous, with fine hyaline hairs. Spores allantoid, hyaline, thin-walled10–13.5×5-6µm (Specimen examined: TPZ/18/031).

***Cantharellus cibarius* Fr**

Cap 3-15 cm broad, cap shallowly convex, becoming plane to depressed, surface smooth or occasionally cracked, yellow, light yellow or lemon yellow to deep egg-yolk yellow with age, moist, glabrous tominutely tomentose, margin split, enrolled, at first margin incurved, non-striate.

Flesh is whitish to tinged yellow to orange under the cuticle, thick, firm. Gills well-spaced to close, shallow blunt, deeply decurrent gills which are often forked or cross-veined, colored like cap or more paler. Stalk is 2- 9 x 0.5-4 cm, concolorous with the cap, equal or tapered downward or sometimes enlarged at base, solid and dry. Spores smooth, ellipsoid, 5.5-9.5 x 4.5-6µ (Specimen examined: TPZ/18/028).

***Clavulinopsis laeticolor* (Berk.&M.A.Curtis) R.H.Petersen**

Fruiting body 17–50 mm high; 1–4 mm wide; cylindrical and unbranched, sometimes flattened, or with a groove or a twist; dry, bald; bright orange or yellow, fading with age, whitish at the extreme base, at maturity often with a somewhat pointed tip that ages or discolors somewhat reddish or orange. Flesh whitish to pale yellow or orange, thin. Spores 5.5−7 × 3.5−5.5 µ, ellipsoid, hyaline, smooth, inamyloid (Specimen examined: TPZ/18/013).

***Coprinellus disseminates* (Pers ex Fr)**

Cap 0.5-1.7 cm high, oval at first, expanding to convex or bell-shaped, at first almost white, then pale buff with buff or, grayish brown, hairy when young, minutely scruffy. Gills attached, nearly distant, broad, white at first, then amber to black, but no inky. Stem 1.5-4.5 x 0.1-0.3 cm, hollow, fragile, smooth, white. Flesh thin, fragile. Spore print black. Spores ellipsoid, smooth6-9.5 x 4-5.5 µ. (Specimen examined: TPZ/18/017).

***Dacryopinax spathularia* (Schwein.) G.W. Martin**

Fruiting body cylindrical, club shaped to funnel shaped, jelly like, 0.4–1.4 cm high. Cap 0.3- 0.8 cm, slimy, yellow or orangish yellow in colour. Stipe 0.1-0.3cm diam., concolorous with the cap or orange red, slightly darker towards the base. Spores 8– 9.5 x 3-.3.5µ, ellipsoid, smooth septate and hyaline. Specimen examined: TPZ/18/011.

***Fistulina hepatica*(Schaeff.)With.**

Cap 7 - 25 cm wide, irregular in shape but often fan-shaped, sometimes fused laterally with other caps, velvety, or fairly smooth, margin lobed, reddish orange, or liver colored. Pore surface whitish or pale pinkish, becoming reddish brown with age, bruising reddish brown. Flesh streaked with reddish areas, thick, soft, exuding a reddish juice when squeezed. Spore print pinkish to pinkish brown. Spores 3.5-4.5 x 2-3 µ, smooth, ovoid, inamyloid (Specimen examined: TPZ/18/015).

***Ganoderma applanatum* (Pers.) Pat.**

Fruiting body perennial, sessile, applanate, reflexed, becoming woody with age, upto 65 cm wide, 4-13 cm thick, fan-shaped to slightly convex. Upper-surface hard crust, reddish-brown to brown, irregular, often zonate, frequently dusted with brown spores. Flesh up to 6-7.5 cm thick, brown, tough, corky. Pores surface white, bruising when injured. Spores ellipsoid, 6-9.5 x 4-7 µm (Specimen examined: TPZ/18/026).

Lactifluus piperatus (L.) Roussel

Cap 3-15cm wide, broadly convex, becoming flat, shallowly depressed, dry, margin even, bald, white or whitish, sometimes discoloring a little yellowish or brownish with age. Flesh white, thick, sometimes discoloring yellowish with age. Milk copious, white, unchanging after exposure, or changing slowly to yellowish.

Gills attached to the stem or running slightly down it, very crowded, forking frequently, white becoming pale cream. Stalk 2-7.5x 1-2 cm, white, more or less equal, or tapering a little to base, bald, without potholes, solid. Spore print white to off white. Spores 4-7 x 4.5-5.5 µ, elliptical to nearly round with inconspicuous amyloid warts and ridges (Specimen examined: TPZ/18/022).

Lactifluus corrugis (Peck) Kuntze

Cap 4-15 cm in diam., convex at first becoming plane or depressed, sometimes with a distinctly wrinkled margin, minutely velvety to nearly smooth, dry, reddish brown to dark red, sometimes yellowish brown. Gills adnate to subdecurrent, close, occasionally forking, pale buff when young but soon orangish to yellowish or brownish, discoloring brown when sliced. Flesh whitish to yellowish, thick, firm, brittle, staining slowly dark brown when sliced.

Latexwhite, copious, slowly staining brown. Stipe 2-11 x 1.5-3 cm, concolorous with the cap, brown to reddish brown or paler, solid, smooth. Spore print white. Spores globose to sub globose, ornamented, amyloid, 9-12.1 x 8.7-11 µm (Specimen examined: TPZ/18/016).

Lentinus squarrosulus Mont

Cap 3.5-8 cm broad, at first convex then plane and umbilicate to infundibuliform, dry, squamulose often with small scales, varying appressedly sub squamulose, margin often becoming scrape, yellowish brown to brown. Stipe 1.5-5 cm, fibrous, scurfy - squamulose downwards to the abrupt and often blackish base. Gills deeply decurrent, crowded. Spore print white. Spores 6-8 x 1.8-3µm, smooth, sub-cylindric, inamyloid (Specimen examined: TPZ/18/020).

Lycoperdon perlatum Pers.

Fruit body 2.5- 7 cm across, 3- 8 cm high,shaped like an inverted pear, subglobose, white at first, becoming yellowish brown; outer layer of short pyramidal warts, dense at the head. Spore mass white, then change to olive-brown at maturity. Sterile base spongy, occupying the stem. Spores globose, minutely warted, olive- brownish, 3.2-4.5 x 3.5-4.5 µm (Specimen examined: TPZ/18/014).

Microporus xanthopus(Fr.) Kuntze

Cap up to7-10cm wide, 0.1-0.3 cm thick, funnel shaped, glabrous, shining when fresh, dull when dry, circular to dimidiate in young specimens, yellow to brown to deep reddish brown. Pores tiny, 0.8-1 cm. Stipe 1-4 x 0.2-0.8 cm, glabrous, light yellowish to light brown. Spore print white. Spores hyaline, cylindrical, smooth, inamyloid, 6-7 x 2-2.5 µm (Collection ID: TPZ/18/034).

_Phallus indusiatus_Vent.

Fruit body egg-shaped to roughly spherical when young, whitish to pale brown, up to 4.5 cm in diam. Cap 2-4.5 cm high, covered with a greenish-brown slime or gleba, campanulate. Stipe 7 – 14 x 0.25 to 0.5 cm, spore mas sticky, sharp. Spores thin-walled, smooth, ellipsoid, straight to slightly curved, hyaline, 2-3 x 1-1.5µm (Collection ID: TPZ/18/006).

Table.1 Identified specimen with their collection site and edibility status

No	Species	Family (Order)	Collection Site	Edibility
1	*Agaricus placomyces*	Agaricaceae (Agaricales)	HL, LL	Poisonous
2	*Amanita flavoconia*	Amanitaceae (Agaricales)	HL, HM, LL, MZU	Edibility unknown, not recommended
3	*Amanita jacksonii*	Amanitaceae (Agaricales)	HL, HM, LL, MZU	Edible, but not recommended
4	*Amanita vaginata*	Amanitaceae (Agaricales)	HL, HM, LL, MZU	Edible, but not recommended
5	*Auricularia auricula-judae*	Auriculariaceae (Auriculariales)	HL, HM MZU	Edible
6	*Auricularia delicata*	Auriculariaceae (Auriculariales)	HL, HM, MZU	Edible
7	*Cantharellus cibarius*	Cantharellaceae (Cantharellales)	HM, MZU	Edible
8	*Clavulinopsis laeticolor*	Clavariaceae (Agaricales)	HL, LL	Edibility unknown, fruiting body too small to be of culinary value.
9	*Coprinellus disseminatus*	Psathyrellaceae (Agaricales)	HL, LL, MZU	Edible, but not recommended
10	*Dacryopinax spathularia*	Dacrymycetaceae (Dacrymycetales)	HM, LL, MZU	Edible
11	*Fistulina hepatica*	Fistulinaceae (Agaricales)	HM, MZU	Edible
12	*Ganoderma applanatum*	Polyporaceae (Polyporales)	HM, LL	Inedible
13	*Lactifluus piperatus*	Russulaceae (Russulales)	HL, HM, MZU	Edible
14	*Lactifluus corrugis*	Russulaceae (Russulales)	HL, HM, MZU	Edible
15	*Lentinus squarrosulus*	Polyporaceae (Polyporales)	HL, HM, LL,	Edible
16	*Lycoperdon perlatum*	Agaricaceae (Agaricales)	HL, LL, MZU	Edible when young, not recommended
17	*Microporus xanthopus*	Polyporaceae (Polyporales)	HL, HM, LL, MZU	Inedible
18	*Phallus indusiatus*	Phallaceae (Phallales)	MZU	Edible
19	*Pleurotus pulmonarius*	Pleurotaceae (Agaricales)	HL, HM	Edible
20	*Podoscypha petalodes*	Meruliaceae (Polyporales)	HL	Inedible
21	*Pycnoporus coccineus*	Polyporaceae (Polyporales)	HM, LL,	Inedible
22	*Russula cyanoxantha*	Russulaceae (Russulales)	HL, HM, LL, MZU	Edible
23	*Russula emetica*	Russulaceae (Russulales)	HL	Poisonous
24	*Russula subfragiliformis*	Russulaceae (Russulales)	HL, HM	Edible
25	*Schizophyllum commune*	Schizophyllaceae (Agaricales)	HL, HM, LL, MZU	Edible
26	*Termitomyces heimii*	Lyophyllaceae(Agaricales)	HM	Edible
27	*Volvariella taylorii*	Pluteaceae (Agaricales)	LL, MZU	Edible

HL – Hlimen, HM - Hmuifang, LL – Lungleng, MZU – Mizoram University.

Fig.2 Fruiting body of (1) *Agaricus placomyces*, (2) *Amanita flavoconia*, (3) *A. jacksonii*, (4) *A. vaginata*, (5) *Auricularia auricula-judae*, (6) *A. delicata*, (7) *Cantharellus cibarius*, (8) *Clavulinopsis laeticolor*, (9) *Coprinellus disseminatus*, (10) *Dacryopinax spathularia*, (11) *Fistulina hepatica*, (12) *Ganoderma applanatum*, (13) *Lactifluus piperatus*, (14) *L. corrugis*, (15) *Lentinus squarrosulus*, (16) *Lycoperdon perlatum*, (17) *Microporus xanthopus*, (18) *Phallus indusiatus*, (19) *Pleurotus pulmonarius*, (20) *Podoscypha petalodes*, (21) *Pycnoporus coccineus*, (22) Russula cyanoxantha, (23) *Russula emetica*, (24) *Russula subfragiliformis*, (25) *Schizophyllum commune*, (26) *Termitomyces heimii*, (27) *Volvariella taylorii*.

***Pleurotus pulmonarius* (Fr.) Quél.**

Cap: 3–10 cm, at first convex, then flat or somewhat depressed, fan-shaped, greasy when young and fresh, whitish to beige or pale tan, usually without dark brown colorations; fading as it dries out, often resulting in a two-toned appearance; the margin inrolled when young, later wavy and sometimes very finely lined.

Gills: Running down the stem; close or nearly distant; short-gills frequent; whitish; sometimes discoloring yellowish with age. Stipe 1–3 cm long and 0.5–1.1 cm thick, eccentric or lateral or central; whitish, bald, basal mycelium white. Spore Print whitish or grayish. Spores 7–10.5 x 2–3.5 µm, cylindric-ellipsoid, smooth; hyaline, inamyloid (Specimen examined: TPZ/18/019)..

***Podoscypha petalodes*(Berk.)Boidin**

Fruiting bodies often appear in groups and form rosettes. Cap 1.5-7 cm high, 0.5–3 cm wide, funnel shaped, pseudoinfundibuliform, thin, tough, margin entirely wavy, pale golden brown, brownish yellow to chestnut brown. Stipe 0.8–1.5 × 0.2-0.4 cm, brownish to dark brown, solid. Spores ovoid, ellipsoid, hyaline, 3-4 × 2.5-3µm (Specimen examined: TPZ/18/032).

***Pycnoporus coccineus*(Fr.) Bond & Sing**

Cap dimidiate, orange when young and becomes reddish orange, hard, smooth. Obtuse margin, concolorous with the upper surface. Context corky pale, 3.5-9.5 mm thick, hymenophore with pores. Basidia 10.5-13.2 x 4.0-5.2 µm, bearing four spores; spores hyaline, even, non-amyloid, short cylindric, slightly flattened on one side, minutely apiculate, 4.0-4.6 x 1.6-2.0 µm (Specimen examined: TPZ/18/010).

***Russula cyanoxantha*(Schaeff.)Fr.**

Cap 5-15 cm across, at first globose then convex, becoming broadly convex to flat with a shallow depression, fragile, dry or slightly greasy, smooth, streaked or cracked, extremely variable in color, usually shades of lilac to purple to green or olive green, the cuticle peeling about halfway to the center.

Flesh white, brittle, thick. Gills narrow, crowded, white to pale cream, not forking, or occasionally forking, flexible and greasy to touch. Stalk 3-11.5x 1.5-3 cm, dry, smooth, white to yellowish white but sometime flushed with purplish, brittle, dry, smooth. Spore print white. Spores ellipsoid 7- 9 x 5-8µ (Specimen examined: TPZ/18/001).

***Russula emetica* (Schaeff. ex Fr.) S. F. Gray**

Cap 5-11cm wide, convex, sulcate margin, bright red, scarlet red or blood red, peels easily or fading in wet weather. Gills adnexed or free, crowded, pure white to pale cream. Stem 5-9 x 1.2-2.2 cm, fragile, pure white, sometimes changing to yellowish with age. Flesh white. Spore print white or pale cream. Spores 9-11 x 7.5-8.5u, ovoid, large warts (Specimen examined: TPZ/18/018).

***Russula subfragiliformis*Murr.**

Cap 5-9 cm across, convex, red to pinkish red, smooth, dry but sticky and shiny when wet, incurved margin. Flesh white, thick, firm, brittle. Gills widely spaced, deep ochre. Stem 2-5.5 cm long, 1-2 cm thick, dry, brittle, firm, white but soon partly pink, solid, becoming hollow. Spore print white. Spores ellipsoid 6-8 x 5.5-7.5 µ, ornamented with warts, amyloid (Specimen examined: TPZ/18/008).

***Schizophyllum commune* Fr.**

Fruiting body 1-5 cm wide, fan-shaped when attached to the side of the log, irregular to shell shaped when attached above or below, upper surface covered with small white or grayish hairs, dry, white to grayish or tan, under surface composed of gill like folds that are split down the middle, whitish to grayish, without a stem. Flesh tough, whitish, not changing when sliced. Spore print white. Spores 3.5-

5.5 x 1-2.5µ, cylindrical to elliptical, inamyloid, smooth (Specimen examined: TPZ/18/023).

Termitomyces heimii Natarajan

Pileus 4-8 cm wide, convex to plano-convex with eroded margin, prominently sub-umbonate when young, surface silky white, scarcely striate, smooth. Stipe 5-10.5 × 1-2 cm, solid, surface white, smooth, cylindrical, equal and fleshy. Pseudorhiza 7-34 cm long, white, smooth, hollow. Lamellae present, white to pink, crowded and free. Spore print pink, with a brownish tinge. Spores 5-7.5 × 3 -4.5 µm, ovoid to ellipsoid, imamyloid. (Specimen examined: TPZ/18/012).

Volvariella taylorii(Berk.& Broome) Sing.

Cap 3–7 cm across, at first convex, becoming convex or broadly convex, surface dry, finely hairy; brownish gray, margin not lined, but occasionally splitting with maturity. Gills: Free from the stem; close or crowded; short-gills frequent; whitish when young, becoming pink to brownish pink with maturity. Stem 3–6 cm long; 0.8–1.2 cm thick, tapering to apex, with slightly small basal bulb, finely hairy near the apex but bald elsewhere, whitish, changing to brown, thick base, whitish to gray or brownish, sack-like volva. Flesh white; unchanging when sliced. Spores ellipsoid, smooth, inamyloid, 6–7.5 x 4–5 µ. Spore print brownish pink (Specimen examined: TPZ/18/003).

Among the species, the Mizo people favour certain species like *Lactifluus piperatus*, *L. corrugis*, *Russula subfragiliformis*, *Schizophyllum commune*, *Termitomyces heimii*, and *Volvariella taylorii* as primary food choices, often selling them in local markets. Additionally, other species which are not commonly consumed by the local people of Mizoram (Tab 1) are also acknowledged for their edibility and has been used widespread as a traditional medicine and cultivated in various parts of the world (Liang *et al.,* 2011; Omar *et al.,* 2011; Ao and Deb, 2016; Milenge *et al.*, 2018; Wangkheirakpam *et al.*, 2018; Wongaem *et al.*, 2020; Niazi and Ghafoor, 2023).

Consuming poisonous mushrooms remains a critical issue, resulting in fatalities in various regions. Due to limited knowledge of wild edible mushrooms in Mizoram, only a few kinds of edible mushrooms are harvested and sold in local markets. In this study, we highlighted various species of mushrooms based on their edibility, providing additional resources to assist mushroom foragers in better discerning between edible and poisonous mushrooms. Certain edible mushrooms are not recommended for consumption due to the possibility of misidentification, while others, although edible, might be too small to harvest. Moreover, further research on the diversity, nutritional content, medicinal properties, and broader potential applications of wild mushrooms is essential for a better understanding and knowledge among the people of Mizoram.

References

Ao, T., Deb, C. R., & Khruomo, N. (2016). Wild edible mushrooms of Nagaland, India: a potential food resource. Journal of Experimental Biology and Agricultural Sciences, 4(1), 59–65. https://doi.org/10.18006/2015.4(1).59.65

Arora, D. (1986). Mushrooms Demystified (2nd editions). Ten Speed Press, New York, pp. 959.

Blackwell, M. (2011). The fungi: 1, 2, 3 … 5.1 million species? American Journal of Botany, 98(3): 426–438.

Chawngthu, Z., Tluanga, L., Zothanzama, J., Thachunglura, V.L., Lalbiakmawia, B., & Renthlei, L. (2023). Wood rotting polyporales from the biodiversity reserves within the Indian subtropical habitat. Indian Journal of Microbiology Research, 10(3), 140–148. Clockss https://doi.org/10.18231/j.ijmr.2023.025

Furtado, A. N. M., Daniels, P. P., & Neves, M. A. (2016). New species and new records of Clavariaceae (Agaricales) from Brazil.Phytotaxa, 253(1), 1. https://doi.org/10.11646/phytotaxa.253.1.1

Gilbertson, R. L. and L. Ryvarden, North American Polypores. Volume 1: Abortiporus - Lindtneria. 433 S., 209 Abb. Oslo 1986. Fungiflora A/S

Hawksworth, D. L. (2001). The magnitude of fungal diversity: the 1.5 million speciesestimate revisited. Mycological Research 105:1422-1432

Khumlianlal, J., Sharma, K. C., Singh, L. M., Mukherjee, P. K., & Indira, S. (2022). Nutritional Profiling and Antioxidant Property of Three Wild Edible Mushrooms from North East India.*Molecules*, 27(17), 5423. https://doi.org/10.3390/molecules27175423

Kirk, P. M., Cannon, P. F., Minter, D. W., and Stalpers, J. A. (2008). Dictionary of the Fungi. 10 Edition. CAB International, Wallingford, UK.

Kurtzman, R. H. (1997). Nuition from mushrooms, understanding and reconciling available data. Mycoscience, 38(2), 247–253. https://doi.org/10.1007/bf02460860

Lallawmsanga, Passari, A. K., Mishra, V. K., Leo, V. V., Singh, B.P., Valliammai Meyyappan, G., Gupta, V. K., Uthandi, S., & Upadhyay, R. C. (2016). Antimicrobial Potential, Identification and Phylogenetic Affiliation of Wild Mushrooms from Two Sub-Tropical Semi-Evergreen Indian Forest Ecosystems.PLOS ONE, 11(11), e0166368. https://doi.org/10.1371/journal.pone.0166368

Lalrinawmi, H., Vabeikhokhei, J. M. C., Zothanzama, J., & Zohmangaiha. (2017). Edible mushrooms of Mizoram. Science Vision, 17(4), 172–181. https://doi.org/10.33493/scivis.17.04.01

Lange, L. (2014). The importance of fungi and mycology for addressing major global challenges. IMA Fungus, 5(2), 463–471. https://doi.org/10.5598/imafungus.2014.05.02.10

Liang, Z.-C., Wu, K.-J., Wang, J.-C., Lin, C.-H., & Wu, C.-Y. (2011). Cultivation of the Culinary-Medicinal Lung Oyster Mushroom, Pleurotus pulmonarius (Fr.) Quél. (Agaricomycetideae) on Grass Plants in Taiwan. International Journal of Medicinal Mushrooms, 13(2), 193–199. https://doi.org/10.1615/intjmedmushr.v13.i2.120

Manoharachary, C., Sridhar, K., Singh, R., Adholeya, A., Suryanarayanan, T. S., Rawat, S., Johri, B. N. (2005). Fungal biodiversity: Disibution, conservation and prospecting of fungi from India. Curr. Sci. 89, 58–71.

Milenge K. H., Nshimba Seya WaMalale, H., MasumbukoNdabaga, C., Degreef, J., & De Kesel, A. (2018). Uses and importance of wild fungi: traditional knowledge from the Tshopo province in the Democratic Republic of the Congo. Journal of Ethnobiology and Ethnomedicine, 14(1). https://doi.org/10.1186/s13002-017-0203-6

Mwangi, R. W., Macharia, J. M., Wagara, I. N., & Bence, R. L. (2022). The antioxidant potential of different edible and medicinal mushrooms.Biomedicine & Pharmacotherapy, 147, 112621. https://doi.org/10.1016/j.biopha.2022.112621

Niazi, A.R., & Ghafoor, A. (2023). Domestication of a magic therapeutical wine glass fungus (*Podoscypha petalodes*) from Pakistan. Heliyon, 9(6), e16146. https://doi.org/10.1016/j.heliyon.2023.e16146

Omar, N. A. M., Abdullah, N., Kuppusamy, U. R., Abdulla, M. A., & Sabaratnam, V. (2011). Nutritional Composition, Antioxidant Activities, and Antiulcer Potential of *Lentinus squarrosulus* (Mont.) Mycelia Extract. Evidence-Based Complementary and Alternative Medicine, 2011, 1–8. https://doi.org/10.1155/2011/539356

Phillips, R., Foy, N., Kibby, G., & Homola, R. L. (2010). *Mushrooms and other fungi of North America*. Richmond Hill, ON, Firefly Books.

Roncero-Ramos, I., & Delgado-Andrade, C. (2017). The beneficial role of edible mushrooms in human health. Current Opinion in Food Science, 14, 122–128. https://doi.org/10.1016/j.cofs.2017.04.002

Sánchez, C. (2017). Reactive oxygen species and antioxidant properties from mushrooms. Synthetic and Systems Biotechnology, 2(1), 13–22. https://doi.org/10.1016/j.synbio.2016.12.001

Sawhasan, P., Worapong, J. & Vinijsanun, T. (2011). Morphological and Molecular Studies of Selected Termitomyces Species Collected from 8 Districts of Kanchanaburi Province, Thailand. Thai Journal of Agricultural Science, 44(3): 183-196.

Tarafder, E., Dutta, A. K., Pradhan, P., Mondal, B., Chakraborty, N., Paloi, S., Roy, A., & Acharya, K. (2017). Contribution to the Macromycetes of West Bengal, India: 13–17. Research Journal of Pharmacy and Technology, 10(4), 1123. https://doi.org/10.5958/0974-360x.2017.00203.7

Thachunglura, V. L., Chawngthu, Z., Zothanzama, J., Lallawmkima, Lalbiakmawia, B., Khumlianlal,

J. & Rai, P. K. (2023b). Russulaceae of Ailawng forest with an emphasis on *Russula purpureoverrucosa* (Russulaceae): A first report for India. *Science Vision*, 23 (3), 41-47 https://doi.org/10.33493/scivis.23.03.01

Thachunglura, V. L., Rai, P. K., Zohmangaiha, Lalbiakmawia, B., Lalmuansangi & Zothanzama, J. (2023). Pleurotus giganteus as a Valuable Source of Nutrients. Indian Journal Of Science And Technology, 16(sp1), 89–94. https://doi.org/10.17485/ijst/v16sp1.msc12

Vabeikhokhei, J. M. C., mangaiha, Z., Zothanzama, J., & Lalrinawmi, H. (2019). Diversity Study of Wood Rotting Fungi from Two different Forests in Mizoram, India. International Journal of Current Microbiology and Applied Sciences, 8(04), 2775–2785. https://doi.org/10.20546/ijcmas.2019.804.323

Valverde, M. E., Hernández-Pérez, T., & Paredes-López, O. (2015). Edible Mushrooms: Improving Human Health and Promoting Quality Life. International Journal of Microbiology, 2015, 1–14. https://doi.org/10.1155/2015/376387

van der Heijden, M. G. A., Martin, F. M., Selosse, M., & Sanders, I. R. (2015). Mycorrhizal ecology and evolution: the past, the present, and the future. New Phytologist, 205(4), 1406–1423. Portico. https://doi.org/10.1111/nph.13288

Wangkheirakpam, S. D., Joshi, D. D., Leishangthem, G. D., Biswas, D., & Deb, L. (2018). Hepatoprotective Effect of *Auricularia delicata* (Agaricomycetes) from India in Rats: Biochemical and Histopathological Studies and Antimicrobial Activity. International Journal of Medicinal Mushrooms, 20(3), 213–225. https://doi.org/10.1615/intjmedmushrooms.2018025886.

Wongaem, A., Reamtong, O., Srimongkol, P., Sangtanoo, P., Saisavoey, T., & Karnchanatat, A. (2020). Antioxidant properties of peptides obtained from the split gill mushroom (*Schizophyllum commune*). Journal of Food Science and Technology, 58(2), 680–691. https://doi.org/10.1007/s13197-020-04582-4

Yan, X., Wang, Y., Sang, X., & Fan, L. (2017). Nutritional value, chemical composition and antioxidant activity of three Tuber species from China.AMB Express, 7(1). https://doi.org/10.1186/s13568-017-0431-0

Zohmangaiha C, Thachunglura V L, Lalnuntluanga, & Zothanzama J. (2023). Morphological characterization and nutritional value of Lentinula edodes. Journal of Agriculture, Food and Environment, 04(03), 09–12. https://doi.org/10.47440/jafe.2023.4302

Zohmangaiha.,Vabeikhokhei, J. M. C., Zothanzama, J., & Lalrinawmi, H. (2019). Ganoderma Species of Mizoram, India. *International Journal of Current Microbiology and Applied Sciences*, 8(04), 2871–2879. https://doi.org/10.20546/ijcmas.2019.804.335

Zothanzama J., Blanchette, A. R., Lalrinawmi H. (2018). Identification of the Edible and Poisonous Mushrooms of Mizoram. Project Report – New Land Use Policy. Memo No. B.15012/1/2016. Govt of Mizoram. pp. 1-24.

Zothanzama, J. (2011). Wood Rotting Fungi of Mizoram. In H. Lalramnghinglova and F. Lalnunmawia (eds). Forest Resources of Mizoram: Conservation and Management. Department of Environmental Science, Mizoram University and Regional Centre, National Afforestation and Eco-development Board; North Eastern Hill University. 345: 326-345.

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