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Cover: The breathtakingly beautiful Silver Jubilee cover of JoTT is done in color pencils and ink by the 13-year old darling, Elakshi Mahika Molur.



A checklist of wild mushroom diversity in Mizoram, India

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Abstract: The northeastern part of India is one of the biodiversity hotspots having a wide variety of flora and fauna. High humidity during monsoon provides ideal conditions for the growth of diverse group of macrofungi. Mizoram is one of the northeastern states of India which has a large number of edible and non-edible mushroom species. Wild edible mushrooms are an important food source for rural communities of Mizoram and provide additional income to the households if sold in regional markets. The key objective of this study was to explore the macrofungal diversity, and its richness in Mizoram with the aim of preparing a checklist along with the present geographical distribution of the important wild edible mushrooms. The macrofungal survey was undertaken during 2017–2020 in 24 different sites in Mizoram. A total of 152 (54 edible and 98 inedible) mushroom species have been documented belonging to 85 genera, 54 families, and 19 orders. Habitat-wise distribution of macrofungi revealed that maximum species were found on soil (61), followed by associated with roots (36), dead wood (30), living trees (22), and associated with termite mound (three). From a morphological point of view, the wild mushrooms have been divided into gilled fungi (95), boletes (18), polypores (17), coral fungi (10), chanterelles (3), puffballs (3), jelly fungi (3), stinkhorns (2), and cup fungi (1). This documentation of wild mushrooms of Mizoram will be a reference database for future.

Keywords: Coral fungi, ectomycorrhizae, jelly fungi, macrofungi, northeastern India, polypores, puffballs.

Assamese: ভাৰতৰ উত্তৰ-পূব অংশ জৈৱ বৈচিত্ৰ্যৰ অন্যতম হটস্পট য'ত বিভিন্ন ধৰণৰ উদ্ভিদ আৰু প্ৰাণী আছে। বাৰিষাৰ সময়ত উচ্চ আৰ্দ্ৰতাই বিভিন্ন গোটৰ কাঠফুলা বৃদ্ধিৰ বাবে আদৰ্শ পৰিস্থিতিৰ সৃষ্টি কৰে। মিজোৰাম ভাৰতৰ উত্তৰ-পূবৰ অন্যতম ৰাজ্য য'ত বৃহৎ সংখ্যক খাব পৰা আৰু অখাদ্য কাঠফুলাৰ প্ৰজাতি আছে। বনা খাব পৰা কাঠফুলা মিজোৰামৰ গ্ৰাম্য জনগোষ্ঠীৰ বাবে এক গুৰুত্বপূৰ্ণ খাদ্যৰ উৎস আৰু আঞ্চলিক বজাৰত বিক্ৰী হ'লে পৰিয়ালক অতিৰিক্ত উপাৰ্জন প্ৰদান কৰে। এই অধ্যয়নৰ মূল উদ্দেশ্য আছিল গুৰুত্বপূৰ্ণ বনা খাব পৰা কাঠফুলা বৰ্তমানৰ ভৌগোলিক বিতৰণৰ লগতে এখন পৰীক্ষা তালিকা প্ৰস্তুত কৰাৰ লক্ষ্যৰে মিজোৰামত কাঠফুলাৰ বৈচিত্ৰ্য, আৰু ইয়াৰ সমৃদ্ধি অৱেৰণ কৰা। ২০১৭-২০২০ চনৰ ভিতৰত মিজোৰামৰ ২৪টা ভিন্ন স্থানত এই কাঠফুলাৰ জৰীপ কৰা হৈছিল। মুঠ ১৫২টা (৫৪টা খাব পৰা আৰু ৯৮টা অখাদ্য) কাঠফুলাৰ প্ৰজাতি ৮৫টা বংশ, ৫৪টা গোত্ৰ আৰু ১৯টা বৰ্গ অন্তৰ্গত বুলি নথিভুক্ত কৰা হৈছে। বাসস্থান অনুসৰি কাঠফুলাৰ বিতৰণ প্ৰকাশ কৰে যে সৰ্বোচ্চ প্ৰজাতি মাটিত পোৱা গৈছিল (৬১), তাৰ পিছত শিপাৰ সৈতে জড়িত (৩৬), মৰা কাঠ (৩০), জীৱিত গছ (২২), আৰু উই হাফলুৰ সৈতে জড়িত (তিনি)। ৰূপগত দৃষ্টিকোণৰ পৰা বনা কাঠফুলাবোৰক গিলযুক্ত ভেকুৰ (৯৫), বালটছ (১৮), পলিপৰ (১৭), প্ৰবাল ভেকুৰ (১০), চাণ্টেৰেল (৩), পাফবল (৩), জেলী ভেকুৰ (৩), ষ্টিংকহৰ্ন (২), আৰু কাপ ভেকুৰ (১) ত ভাগ কৰা হৈছে। মিজোৰামৰ বনা কাঠফুলাৰ এই নথিপত্ৰ ভৱিষ্যতৰ বাবে এটা ৰেফাৰেন্স ডাটাবেছ হ'ব।

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INTRODUCTION

Mushrooms are the fruiting bodies of higher fungi that release spores for dissemination. Spores are only a small part of a much larger organism. Mushrooms are integral part of the forest ecosystem that helps in the recycling of forest waste. They are fleshy and seen in (on) the forest soils, dead wood, twigs, dung, and litter as saprobes, symbionts, or on the living trees as parasites. Their edibility, poisonous nature, psychotropic properties, mycorrhizal and parasitic associations with the forest trees make them economically important. Fungi play an incredibly important role in breaking down organic material and returning those nutrients to the soil. Ectomycorrhizal mushrooms establish mutually beneficial relationships with the roots of trees and other plants, increasing their capabilities to absorb water and nutrients that help them to survive and flourish. They also play a significant role in the daily life of human beings besides their utilization in industry, agriculture and medicine. Wild edible mushrooms are appreciated not only for texture and flavor but also for their chemical and nutritional potential (Manzi et al. 2001; Sanmee et al. 2003). Their consumption is increasing due to a good content of proteins and trace minerals. It is important to understand their existence in plant communities, their ecological functions and their impact on nature (Martin et al. 2011). In India, the first fungal list was published by Butler & Bisby (1931, 1960) and later revised by Vasudeva (1960). Sathe & Rahalkar (1987) reported a checklist of 44 species of wild edible mushrooms from southwestern India. Natarajan et al. (2005a) reported a checklist of Indian agarics and boletes. Natarajan et al. (2005b) also reported 195 species of agarics from Tamil Nadu and 28 species from Kerala. Brown et al. (2006) published 163 morphotypes of macrofungi from Kodagu District of Karnataka. Swapna et al. (2008) published 778 species of macrofungi from Shivamogga district of Karnataka. Mani & Kumaresan (2009a,b) reported 18 and 39 macrofungal species from Tamil Nadu; Mohanan (2011) reported 550 species of macrofungi from Kerala. Pushpa & Purushothama (2012) recorded 90 species of mushrooms in and around Bangalore (Karnataka). Farook et al. (2013) reported a literature-based checklist of agarics with 616 species occurring in Kerala. Pradhan et al. (2013) recorded 120 species of macrofungi in the lateritic region of West Bengal. Usha & Janardhana (2014) published 135 species of macrofungi from Karnataka.

According to Myers et al. (2000), northeastern India (a part of Indo Burma) is a biodiversity hotspot of the world. The northeastern India is very rich in macrofungal

diversity and very few reports on macrofungal diversity have been carried out in this region (Verma et al. 1995). Tapwal et al. (2013) reported 30 macrofungal species from six different sites in wet evergreen tropical forest of Assam. Gogoi & Parkash (2014, 2015a,b) reported wild macrofungi from Assam. Debnath et al. (2020) reported 217 macrofungi from different districts of Tripura. Roy et al. (2022) published a literature-based checklist of macrofungi of northeastern India and listed 733 species.

Wild edible mushrooms are important as a food source for rural communities of Mizoram. They also provide additional income to the households, if the collected mushrooms are sold in the local markets. People go to forests and collect the edible mushrooms with help of the knowledge acquired from their forefathers but sometimes they turn out to be poisonous and have harmful effects. The people of Mizoram have very limited knowledge on edible mushrooms. Only few species of edible mushrooms are known and consumed by the Mizo people at present. In order to know the distribution of a particular fungal species a checklist is very important. A checklist of wild mushrooms of Mizoram was not prepared earlier by any author. The present study was conducted (made) to deal with the status of macrofungal diversity and its distribution pattern in the State of Mizoram and to prepare a checklist of wild mushrooms

MATERIALS AND METHODS

Study Area

The state has a geographical area of 21,081 km², which lie between 21.967–24.583 °N and 92.250–93.483 °E. The total forest cover of Mizoram is 17,820 km² and it has the highest percentage cover (84.53%) with respect to total geographical area of the state (ISFR 2021). Mizoram falls within a region which receives heavy annual rainfall with an average of 250–300 cm. Tropical semi-evergreen, tropical moist deciduous, subtropical broad-leaved hill, and subtropical pine forests are the most common vegetation types found in Mizoram. Survey and collection of mushrooms were undertaken during 2017–2020 in different localities, namely: Aibawk, Hmuifang, Muallunghu, Murlen, Ngengpu, Reiek, Sialsuk, Siphir, Sapiamaksak, Zokawthar, Zote, College Veng, Durtlang, Gosen Veng, Project Veng, Hnahthial, Lungpuitlang, Tlabung, Lengte, Phura, Sangyu, Tipa, Buangpui, and Chhim Veng. These localities are belonging to different forest types of Mizoram. A map of Mizoram showing different forest types is given in the Image 1.

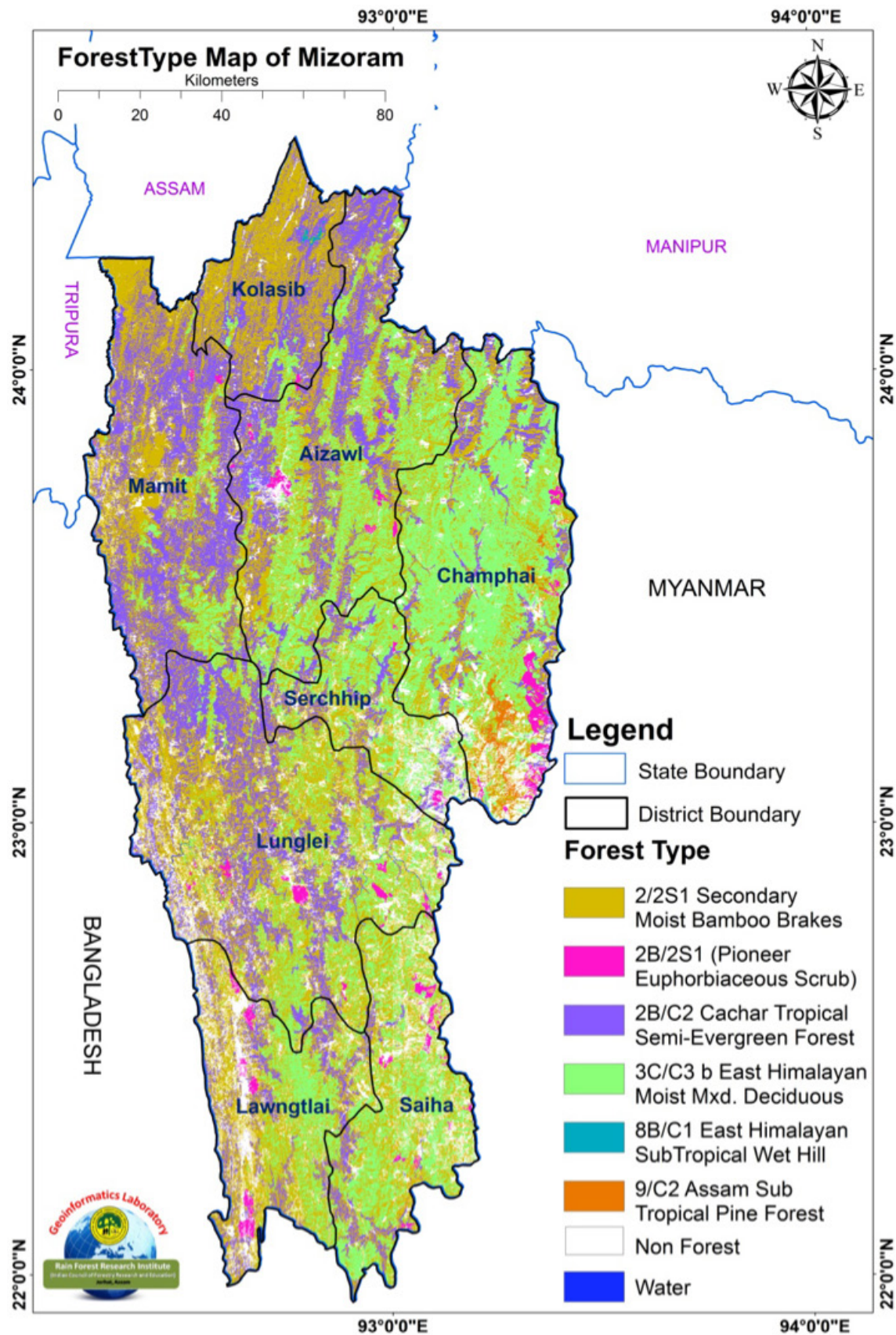


Image 1. Forest type map of Mizoram.

The current names, systematic positions and nomenclature of mushrooms were taken from Index Fungorum and MycoBank. In the checklist of wild mushrooms, species are arranged alphabetically followed by accession number, families, orders, and classes.

Mushroom survey and collections

The sampling and collection of mushrooms were done from April 2017 to February 2020 as per the method suggested by Largent (1977). Field notes such as habit, habitat, odour, colour, and size of the pileus (cap), stipe and the presence or absence of volva, indusium or veil, and ring were noted in the field before collection and the samples were photographed in their natural habitats. The colour terminology as suggested by Kornerup & Wanscher (1978) was used to confirm mushroom colour. The macrofungi with leathery texture were preserved in 4% FAA solution (formaldehyde + acetic acid + ethyl alcohol + distilled water) whereas samples with soft texture were preserved in 2% FAA solution. Dried specimens were also preserved for identification, characterization, and documentation. Identification of the specimen was carried out by standard microscopic methods (Roy & De 1996) also considering various morphological characteristics of mushrooms such as their size, colour, presence or absence of volva, stipe, ring, scales, reticulum, zonation, striation, warts, cap, areolae, and gills. Identification of the specimens were carried out by standard microscopic methods (Gilbertson & Ryvarden 1986) using microscope (Olympus BX-50). All the dry mushroom samples were deposited in the mycology division under the Forest Protection Department of ICFRE-Rain Forest Research Institute, Assam for future reference.

RESULTS AND DISCUSSION

A total of 152 wild mushrooms (Images 2–9) have been documented from 24 different localities of Mizoram which belong to 85 genera, 54 families, 19 orders, six classes, and two phyla (Table 1, Table 2 & Table 3). Out of the 152 wild mushrooms, 143 spp. belong to the phylum Basidiomycota and nine spp. to Ascomycota. The class Agaricomycetes (142 spp.) was found dominant followed by Pezizomycetes (3 spp.), Sordariomycetes (3 spp.), Leotiomycetes (two spp.), Dacrymycetes (1 sp.) and Geoglossomycetes (1 sp.) (Table 3). The order Agaricales (55 spp.) was found dominant followed by Polyporales (30 spp.), Boletales

(21 spp.), Russulales (14 spp.), Hymenochaetales (6 spp.), Cantharellales (5 spp.) and so on (Table 2). The family Polyporaceae was found dominant with 19 species followed by Boletaceae (18 spp.), Russulaceae (11 spp.), Agaricaceae (6 spp.), Amanitaceae (6 spp.), Hydnaceae (5 spp.), Hymenochaetaceae (4 spp.), Clavariaceae (4 spp.), Hydnangiaceae (4 spp.), Inocybaceae (4 spp.), Omphalotaceae (4 spp.), and so on (Table 2). The five most represented genera were *Ganoderma* (7 spp.), *Amanita* (6 spp.), *Russula* (5 spp.), *Boletus* (5 spp.) and *Lactarius* (5 spp.). The frequency of occurrence was found maximum in *Clavulina rugosa* (83.33%) and *Lactarius croceus* (83.33%) followed by *Lysurus periphragmoides* (79.16%), *Cantharellus formosus* (70.83%) and so on (Table 1).

Termitomyces heimii and *Termitomyces clypeatus*, have been characterized based on their vast heterogenous phylogeny, morphological traits, habitat and phenotypical appearance, such as the shape of their perforatorium, stipe length (cm), pileus length, margin and colour of fruiting body, gills, flesh, annulus, pseudorrhiza and spore print. Which was similar to earlier reported by Kumari et al. (2022). Genus Identification was done as per key given by Antonio (2020).

Recently, Akshaya et al. (2023) reported 62 macrofungi belonging to 43 genera, 24 families, and eight orders. Out of the eight orders, seven orders belong to the phylum Basidiomycota and the order Xylariales belongs to Ascomycota and they found Polyporaceae as the dominant family in the wet evergreen forests of Agasthyamala Biosphere Reserve, Western Ghats. They also found that Russulaceae is the most dominant family followed by Hygrophoraceae, Amanitaceae, Polyporaceae and so on. Gogoi & Parkash (2015b) found the order Agaricales with the highest number of species followed by Russulales, Polyporales, Cantharellales, and Boletales in Hollongapara Gibbon Wildlife Sanctuary, Assam. They reported the family Agaricaceae with the highest number of species followed by Tricholomataceae, Russulaceae, Marasmiaceae, Lyophyllaceae, and Psathyrellaceae. Roy et al. (2022) also found the order Agaricales with the highest number of species followed by Polyporales in northeastern India. They also found the three most represented genera, viz.: *Russula*, *Amanita*, and *Lactarius*. Paul et al. (2019) found the highest number of macrofungal species in the family Polyporaceae in Assam. They reported 82 species belonging to 51 genera, 34 families and 12 orders, out of which 11 orders belong to the phylum Basidiomycota and only one order – Xylariales belongs to Ascomycota. They also reported *Ganoderma lucidum*, *Pleurotus*

Table 1. List of mushroom species, their accession numbers, and families collected from Mizoram, India.

	Name of species	Accession no.	Family	Frequency (%)
1	<i>Abortiporus biennis</i> (Bull.) Singer	RFRI-MZ-93	Podoscyphaceae	54.16
2	<i>Agaricus bisporus</i> (J.E.Lange) Imbach	RFRI-MZ-46	Agaricaceae	37.50
3	<i>Agaricus bitorquis</i> (Quél.) Sacc.	RFRI-MZ- 1	Agaricaceae	33.33
4	<i>Agaricus silvaticus</i> J.C.Schäffer	RFRI-MZ-2	Agaricaceae	41.66
5	<i>Albatrellus ellisii</i> (Berk. ex Cooke & Ellis) Pouzar	RFRI-MZ-15	Albatrellaceae	37.50
6	<i>Amanita citrina</i> Pers.	RFRI-MZ-179	Amanitaceae	37.55
7	<i>Amanita fulva</i> Fr.	RFRI-MZ-20	Amanitaceae	54.16
8	<i>Amanita macerisolum</i>	RFRI-MZ-173	Amanitaceae	37.55
9	<i>Amanita marmorata</i> (Cleland & E.-J.Gilbert) E	RFRI-MZ-23	Amanitaceae	41.66
10	<i>Amanita phalloides</i> (Vaill. ex Fr.) Link	RFRI-MZ-105	Amanitaceae	33.33
11	<i>Amanita vaginata</i> (Bull.) Lam.	RFRI-MZ-21	Amanitaceae	45.83
12	<i>Auricularia cornea</i> Ehrenb.	RFRI-MZ-48	Auriculariaceae	33.33
13	<i>Baorangia bicolor</i> (Kuntze) G.Wu	RFRI-MZ-170	Boletaceae	41.66
14	<i>Bisporella citrina</i> (Batsch) Korf & S.E.Carp.	RFRI-MZ-72	Helotiaceae	66.66
15	<i>Boletinus merulioides</i> (Schwein.) Murrill	RFRI-MZ-16	Boletinellaceae	37.50
16	<i>Boletus bicolor</i> Raddi	RFRI-MZ-34	Boletaceae	50.00
17	<i>Boletus edulis</i> Bull.	RFRI-MZ-13	Boletaceae	16.66
18	<i>Boletus luridiformis</i> Rostk.	RFRI-MZ-51	Boletaceae	66.66
19	<i>Boletus mirabilis</i> (Murrill) Murrill	RFRI-MZ-49	Boletaceae	58.33
20	<i>Boletus zelleri</i> (Murrill) Murrill	RFRI-MZ-50	Boletaceae	41.66
21	<i>Calbovista subsculpta</i> Morse	RFRI-MZ-131	Lycoperdaceae	50.00
22	<i>Campanella caesia</i> Romagn.	RFRI-MZ-28	Marasmiaceae	41.66
23	<i>Cantharellus formosus</i> Corner	RFRI-MZ-32	Hydnaceae	70.83
24	<i>Cantharellus lateritius</i> (Berk.) Singer	RFRI-MZ-61	Hydnaceae	37.50
25	<i>Cerrena unicolor</i> (Bull.) Murrill	RFRI-MZ-83	Cerrenaceae	41.66
26	<i>Clavaria fragilis</i> Holmsk.	RFRI-MZ-18	Clavariaceae	58.33
27	<i>Clavaria miniata</i> Purton	RFRI-MZ-17	Clavariaceae	33.33
28	<i>Clavaria zollingeri</i> Lévl.	RFRI-MZ-27	Clavariaceae	45.83
29	<i>Clavulina cristata</i> (Holmsk.) J.Schröt.	RFRI-MZ-60	Hydnaceae	45.83
30	<i>Clavulina rugosa</i> (Bull.) J.Schröt.	RFRI-MZ-59	Hydnaceae	83.33
31	<i>Coltricia cinnamomea</i> (Jacq.) Murrill	RFRI-MZ-11	Hymenochaetaceae	29.16
32	<i>Coltricia montagnei</i> (Fr.) Murrill	RFRI-MZ-3	Hymenochaetaceae	41.66
33	<i>Coltricia perennis</i> (L.) Murrill	RFRI-MZ-66	Hymenochaetaceae	45.83
34	<i>Conocybe apala</i> (Fr.) Arnolds	RFRI-MZ-126	Bolbitiaceae	37.50
35	<i>Cookeina tricholoma</i> (Mont.) Kuntze	RFRI-MZ-75	Sarcoscyphaceae	45.83
36	<i>Coprinus disseminatus</i> (Pers.) Gray	RFRI-MZ-134	Agaricaceae	45.83
37	<i>Coprinus leiocephalus</i> P.D.Orton	RFRI-MZ-7	Agaricaceae	37.55
38	<i>Coprinus plicatilis</i> (Curtis) Fr.	RFRI-MZ-8	Agaricaceae	54.16
39	<i>Cortinarius corrugatus</i> Peck	RFRI-MZ-30	Cortinariaceae	16.66
40	<i>Cortinarius crassus</i> Fr.	RFRI-MZ-136	Cortinariaceae	62.50
41	<i>Craterellus tubaeformis</i> (Fr.) Quél.	RFRI-MZ-169	Hydnaceae	29.16
42	<i>Dacrymyces palmatus</i> Bres.	RFRI-MZ-62	Dacrymycetaceae	37.50
43	<i>Daldinia concentrica</i> (Bolton) Ces. & deNotaris	RFRI-MZ-316	Hypoxylaceae	20.83

	Name of species	Accession no.	Family	Frequency (%)
44	<i>Enteridium splendens</i> (Morgan) T.Macbr.	RFRI-MZ-74	Reticulariidae	20.83
45	<i>Entoloma abortivum</i> (Berk. & M.A.Curtis) Donk	RFRI-MZ-84	Entolomataceae	29.16
46	<i>Entoloma lividum</i> Quéél.	RFRI-MZ-73	Entolomataceae	33.33
47	<i>Entoloma squamatum</i> Hesler	RFRI-MZ-129	Entolomataceae	41.66
48	<i>Fomes fomentarius</i> (L.) Fr.	RFRI-MZ-94	Polyporaceae	25.00
49	<i>Fomitopsis ochracea</i> Ryvarden & Stokland	RFRI-MZ-87	Fomitopsidaceae	37.50
50	<i>Fomitopsis pinicola</i> (Sw.) P.Karst.	RFRI-MZ-88	Fomitopsidaceae	45.83
51	<i>Galiella rufa</i> (Schwein.) Nannf. & Korf	RFRI-MZ-76	Sarcosomataceae	37.50
52	<i>Ganoderma adspersum</i> (Schulzer) Donk	RFRI-MZ-81	Polyporaceae	16.66
53	<i>Ganoderma applanatum</i> (Pers.) Pat.	RFRI-MZ-90	Polyporaceae	58.33
54	<i>Ganoderma formosanum</i> T.T.Chang & T.Chen	RFRI-MZ-9	Polyporaceae	20.83
55	<i>Ganoderma lucidum</i> (Curtis) P.Karst.	RFRI-MZ-91	Polyporaceae	29.16
56	<i>Ganoderma oregonense</i> Murrill	RFRI-MZ-89	Polyporaceae	33.33
57	<i>Ganoderma sinense</i> J.D.Zhao	RFRI-MZ-112	Polyporaceae	41.66
58	<i>Ganoderma tsugae</i> Murrill	RFRI-MZ-137	Polyporaceae	50.00
59	<i>Geoglossum fallax</i> E.J.Durand	RFRI-MZ-24	Geoglossaceae	62.50
60	<i>Gloeophyllum sepiarium</i> (Wulfen) P.Karst.	RFRI-MZ-65	Gloeophyllaceae	45.83
61	<i>Grifola frondosa</i> (Dick.) Gray	RFRI-MZ-92	Grifolaceae	45.83
62	<i>Gymnopilus junonius</i> (Fr.) P.D.Orton	RFRI-MZ-31	Hymenogastraceae	16.66
63	<i>Gymnopilus luteofolius</i> (Peck) Singer	RFRI-MZ-68	Hymenogastraceae	70.83
64	<i>Helvella atra</i> J.König	RFRI-MZ-57	Helvellaceae	29.16
65	<i>Hericium coralloides</i> (Scop.) Pers.	RFRI-MZ-111	Hericiaceae	16.66
66	<i>Heterobasidion annosum</i> (Fr.) Bref.	RFRI-MZ-110	Bondarzewiaceae	29.16
67	<i>Hygrocybe coccinea</i> (Schaeff.) P.Kumm.	RFRI-MZ-78	Hygrophoraceae	50.00
68	<i>Hygrocybe conica</i> (Schaeff.) P.Kumm.	RFRI-MZ-319	Hygrophoraceae	66.66
69	<i>Hypholoma fasciculare</i> (Huds.) P.Kumm	RFRI-MZ-86	Strophariaceae	33.33
70	<i>Inocybe flocculosa</i> Sacc.	RFRI-MZ-37	Inocybaceae	41.66
71	<i>Inocybe lapponica</i> Kokkonen & Vauras	RFRI-MZ-164	Inocybaceae	45.83
72	<i>Inocybe napipes</i> J.E.Lange	RFRI-MZ-71	Inocybaceae	29.16
73	<i>Inocybe sindonia</i> (Fr.) P.Karst.	RFRI-MZ-38	Inocybaceae	37.50
74	<i>Ischnoderma resinosum</i> (Schrad.) P.Karst.	RFRI-MZ-85	Ischnodermataceae	45.83
75	<i>Kuehneromyce smutabilis</i> (Schaeff.) Singer & A.H.Sm.	RFRI-MZ-45	Strophariaceae	25.00
76	<i>Laccaria affinis</i> (Singer) Bon	RFRI-MZ-36	Hydnangiaceae	29.16
77	<i>Laccaria fraterna</i> (Sacc.) Pegler	RFRI-MZ-133	Hydnangiaceae	37.50
78	<i>Laccaria laccata</i> (Scop.) Cooke	RFRI-MZ-35	Hydnangiaceae	50.00
79	<i>Laccaria vinaceoavellanea</i> Hongo	RFRI-MZ-26	Hydnangiaceae	58.33
80	<i>Lactarius croceus</i> Burl.	RFRI-MZ-166	Russulaceae	83.33
81	<i>Lactarius fragilis</i> (Burl.) Hesler & A.H.Sm.	RFRI-MZ-115	Russulaceae	37.50
82	<i>Lactarius piperatus</i> (L.) Pers.	RFRI-MZ-33	Russulaceae	29.16
83	<i>Lactarius vietus</i> (Fr.) Fr.	RFRI-MZ-82	Russulaceae	45.83
84	<i>Lactarius volemus</i> (Fr.) Fr.	RFRI-MZ-147	Russulaceae	29.16
85	<i>Lactifluus corrugis</i> (Peck) Kuntze	RFRI-MZ-128	Russulaceae	54.16
86	<i>Laetiporus cincinnatus</i> (Morgan) Burds.	RFRI-MZ-108	Laetiporaceae	16.66
87	<i>Laetiporus sulphureus</i> (Bull.) Murrill	RFRI-MZ-106	Laetiporaceae	41.66
88	<i>Leccinum scabrum</i> (Bull.) Gray	RFRI-MZ-179	Boletaceae	29.16

	Name of species	Accession no.	Family	Frequency (%)
89	<i>Lentinula lateritia</i> (Berk.) Pegler	RFRI-MZ-6	Omphalotaceae	45.83
90	<i>Lentinus polychrous</i> Lév.	RFRI-MZ-130	Polyporaceae	41.66
91	<i>Lentinus sajor-caju</i> (Fr.) Fr.	RFRI-MZ-95	Polyporaceae	37.50
92	<i>Lentinus tigrinus</i> (Bull.) Fr.	RFRI-MZ-143	Polyporaceae	54.16
93	<i>Lenzites betulinus</i> (L.) Fr.	RFRI-MZ-96	Polyporaceae	16.66
94	<i>Leotia lubrica</i> (Scop.) Pers.	RFRI-MZ-77	Leotiaceae	29.16
95	<i>Lepiota brunneoincarnata</i> Chodat & C.Martin	RFRI-MZ-41	Agaricaceae	33.33
96	<i>Lepiota rubrotinctoides</i> Murrill	RFRI-MZ-10	Agaricaceae	41.66
97	<i>Lysurus periphragmoides</i> (Klotzsch ex Hook.) Dring	RFRI-MZ-79	Phallaceae	79.16
98	<i>Macrolepiota dolichaula</i> (Berk. & Broome) Pegler & R.W.Rayne	RFRI-MZ-123	Agaricaceae	33.33
99	<i>Marasmiellus candidus</i> (Fr.) Singer,	RFRI-MZ-39	Omphalotaceae	45.83
100	<i>Marasmiellus ramealis</i> (Bull.) Singer	RFRI-MZ-40	Omphalotaceae	37.50
101	<i>Marasmius corrugatififormis</i> Singer	RFRI-MZ-19	Marasmiaceae	29.16
102	<i>Marasmius crinis-equi</i> F.Muell. ex Kalchbr.	RFRI-MZ-59	Marasmiaceae	58.33
103	<i>Mycena pura</i> (Pers.) P.Kumm.	RFRI-MZ-314	Mycenaceae	41.66
104	<i>Omphalotus illudens</i> (Schwein.) Bresinsky & Besl	RFRI-MZ-107	Omphalotaceae	42.67
105	<i>Panus rudis</i> Fr.	RFRI-MZ-22	Panaceae	20.83
106	<i>Phaeotrametes decipiens</i> (Berk.) J.E.Wright	RFRI-MZ-103	Polyporaceae	45.83
107	<i>Phallus indusiatus</i> Vent.	RFRI-MZ-80	Phallaceae	50.00
108	<i>Phellinus igniarius</i> (L.) Quél.	RFRI-MZ-67	Hymenochaetaceae	70.83
109	<i>Phylloporus rhodoxanthus</i> (Schwein.) Bres.	RFRI-MZ-55	Boletaceae	33.33
110	<i>Piptoporus betulinus</i> (Bull.) P.Karst.	RFRI-MZ-101	Fomitopsidaceae	62.50
111	<i>Pleurotus floridanus</i> Singer	RFRI-MZ-125	Pleurotaceae	54.16
112	<i>Pleurotus pulmonarius</i> (Fr.) Quél.	RFRI-MZ-127	Pleurotaceae	20.83
113	<i>Polyporus arcularius</i> (Batsch) Fr.	RFRI-MZ-100	Polyporaceae	50.00
114	<i>Polyporus badius</i> (Pers.) Schwein.	RFRI-MZ-109	Polyporaceae	54.16
115	<i>Postia caesiaca</i> (Schrad.) P.Karst.	RFRI-MZ-120	Polyporaceae	58.33
116	<i>Psathyrella candolleana</i> (Fr.) Maire	RFRI-MZ-43	Psathyrellaceae	41.66
117	<i>Pycnoporus cinnabarinus</i> (Jacq.) P.Karst.	RFRI-MZ-99	Polyporaceae	29.16
118	<i>Pycnoporus sanguineus</i> (L.) Murrill	RFRI-MZ-98	Polyporaceae	33.33
119	<i>Ramaria formosa</i> (Pers.) Quél.	RFRI-MZ-176	Gomphaceae	25.00
120	<i>Ramaria myceliosa</i> (Peck) Corner	RFRI-MZ-64	Gomphaceae	50.00
121	<i>Ramaria stricta</i> (Pers.) Quél.	RFRI-MZ-63	Gomphaceae	70.83
122	<i>Ramariopsis kunzei</i> (Fr.) Corner	RFRI-MZ-29	Clavariaceae	25.00
123	<i>Russula brevipes</i> Peck	RFRI-MZ-175	Russulaceae	54.16
124	<i>Russula cremoricolor</i> Earle	RFRI-MZ-113	Russulaceae	16.66
125	<i>Russula emetica</i> (Schaeff.) Pers.	RFRI-MZ-114	Russulaceae	54.16
126	<i>Russula ochroleuca</i> Fr.	RFRI-MZ-116	Russulaceae	58.33
127	<i>Russula variata</i> Banning	RFRI-MZ-117	Russulaceae	33.33
128	<i>Schizophyllum commune</i> Fr.	RFRI-MZ-44	Schizophyllaceae	50.00
129	<i>Schizopora paradoxa</i> (Schrad.) Donk	RFRI-MZ-69	Schizoporaceae	50.00
130	<i>Scleroderma cepa</i> Pers.	RFRI-MZ-56	Sclerodermataceae	41.66
131	<i>Scleroderma citrinum</i> Pers.	RFRI-MZ-124	Sclerodermataceae	33.33
132	<i>Strobilomyces confusus</i> Singer	RFRI-MZ-52	Boletaceae	20.83

	Name of species	Accession no.	Family	Frequency (%)
133	<i>Strobilomyces strobilaceus</i> (Scop.) Berk.	RFRI-MZ-53	Boletaceae	45.83
134	<i>Suillus bovinus</i> (L.) Roussel	RFRI-MZ-168	Boletaceae	50.00
135	<i>Suillus granulatus</i> (L.) Roussel	RFRI-MZ-135	Boletaceae	41.66
136	<i>Suillus luteus</i> (L.) Roussel	RFRI-MZ-58	Boletaceae	16.66
137	<i>Termitomyces clypeatus</i> R.Heim	RFRI-MZ-12	Lyophyllaceae	16.66
138	<i>Termitomyces fuliginosus</i> R.Heim	RFRI-MZ-102	Lyophyllaceae	25.00
139	<i>Termitomyces heimii</i> Natarajan	RFRI-MZ-4	Lyophyllaceae	29.16
140	<i>Thelephora anthocephala</i> (Bull.) Fr.	RFRI-MZ-119	Thelephoraceae	37.50
141	<i>Thelephora palmata</i> (Scop.) Fr.	RFRI-MZ-118	Thelephoraceae	35.12
142	<i>Trametes pubescens</i> (Schumach.) Pilát	RFRI-MZ-97	Polyporaceae	41.66
143	<i>Trichia decipiens</i> (Pers.) T.Macbr.	RFRI-MZ-121	Trichiidae	20.83
144	<i>Tylopilus badiceps</i> (Peck) A.H.Sm. & Thiers	RFRI-MZ-54	Boletaceae	54.16
145	<i>Tylopilus felleus</i> (Bull.) P.Karst.	RFRI-MZ-104	Boletaceae	45.83
146	<i>Tylopilus griseocarneus</i> Wolfe & Halling	RFRI-MZ-14	Boletaceae	37.50
147	<i>Volvariella bombycine</i> (Schaeff.) Singer	RFRI-MZ-42	Pluteaceae	54.16
148	<i>Volvariella taylorii</i> (Berk. & Broome) Singer	RFRI-MZ-5	Pluteaceae	58.33
149	<i>Xerocomus ripariellus</i> Redeuilh	RFRI-MZ-301	Boletaceae	58.33
150	<i>Xerocomus subtomentosus</i> (L.) Quéf.	RFRI-MZ-174	Boletaceae	41.66
151	<i>Xylaria nigripes</i> (Klotzsch) Cooke	RFRI-MZ-122	Xylariaceae	33.33
152	<i>Xylaria polymorpha</i> (Pers.) Grev.	RFRI-MZ-25	Xylariaceae	33.33

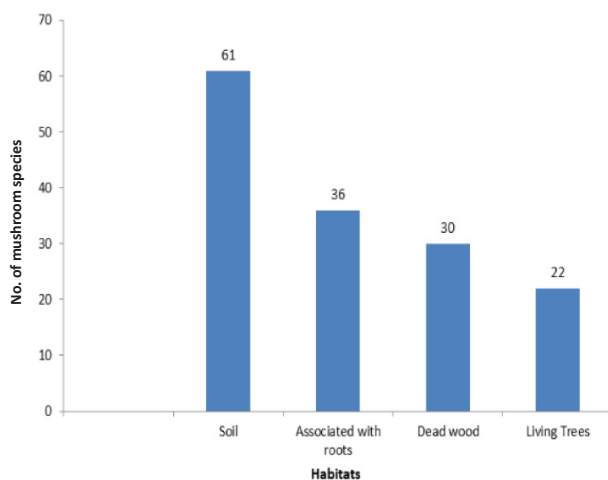


Figure 1. Ecological preference of habitats of wild mushrooms of Mizoram.

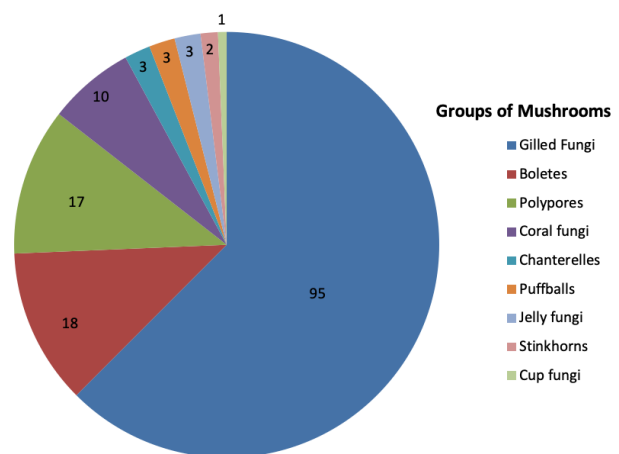


Figure 2. General groups of wild mushrooms of Mizoram.

ostreatus and *Pycnoporous sanguineus* are the species having the highest frequency of occurrence (100%) while the lowest frequency of occurrence was recorded for *Cyathus striatus* (10%).

Habitat-wise distribution of wild mushrooms of Mizoram revealed that maximum number of species were found on soil (61 spp.), followed by species associated with roots (30 spp.), dead wood (30 spp.),

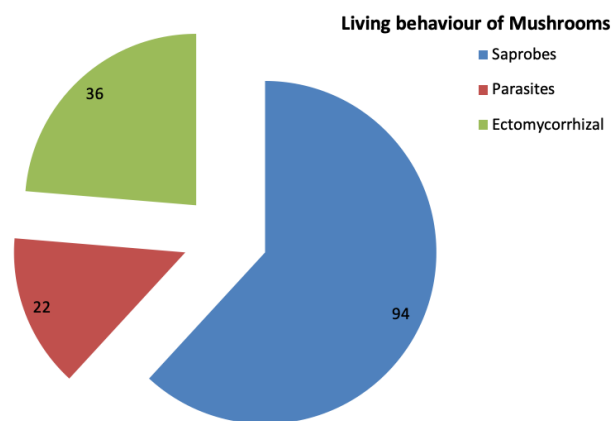
living trees (22 spp.), and termite mounds (3 spp.) (Figure 1). On the basis of morphological features, the collected species were grouped into nine groups, viz.: gilled fungi (95 spp.), boletes (18 spp.), polypores (17 spp.), coral fungi (10 spp.), chanterelles (3 spp.), puffballs (3 spp.), jelly fungi (3 spp.), stinkhorns (2 spp.), and cup fungi (1 sp.) (Figure 2). Based on living behaviour, they have been classified into three groups, viz.: saprobes (94 spp.),

Table 2. Number of mushroom species present in each family and order.

	Name of families	No. of species	Name of orders	No. of species
1	Agaricaceae	9	Agaricales	55
2	Albatrellaceae	1	Auriculariales	1
3	Amanitaceae	6	Boletales	21
4	Auriculariaceae	1	Cantharellales	5
5	Bolbitiaceae	1	Dacrymycetales	1
6	Boletaceae	18	Geoglossales	1
7	Boletiniellaceae	1	Gloeophyllales	1
8	Bondarzewiaceae	1	Gomphales	3
9	Cerrenaceae	1	Helotiales	1
10	Clavariaceae	4	Hymenochaetales	6
11	Cortinariaceae	2	Leotiales	1
12	Dacrymycetaceae	1	Liceales	1
13	Entolomataceae	3	Pezizales	3
14	Fomitopsidaceae	3	Phallales	2
15	Geoglossaceae	1	Polyporales	30
16	Gloeophyllaceae	1	Russulales	14
17	Gomphaceae	3	Thelephorales	2
18	Grifolaceae	1	Trichiidia	1
19	Helotiaceae	1	Xylariales	3
20	Helvellaceae	1	Total species	152
21	Hericiaceae	1		
22	Hydnaceae	5		
23	Hydnangiaceae	4		
24	Hygrophoraceae	2		
25	Hymenochaetaceae	4		
26	Hymenogastraceae	2		
27	Hypoxylaceae	1		
28	Inocybaceae	4		
29	Ischnodermataceae	1		
30	Laetiporaceae	2		
31	Leotiaceae	1		
32	Lycoperdaceae	1		
33	Lyophyllaceae	3		
34	Marasmiaceae	3		
35	Mycenaceae	1		
36	Omphalotaceae	4		
37	Panaceae	1		
38	Phallaceae	2		
39	Pleurotaceae	2		
40	Pluteaceae	2		
41	Podoscyphaceae	1		
42	Polyporaceae	19		
43	Psathyrellaceae	1		
44	Reticulariidae	1		
45	Russulaceae	11		
46	Sarcoscyphaceae	1		
47	Sarcosomataceae	1		
48	Schizophyllaceae	1		
49	Schizoporaceae	1		
50	Sclerodermataceae	2		
51	Strophariaceae	2		
52	Thelephoraceae	2		
53	Trichiidae	1		
54	Xylariaceae	2		
	Total species	152		

Table 3. Numbers of mushroom species present in each order and division.

	Name of classes	No. of species	Name of divisions	No. of species
1	Agaricomycetes	142	Ascomycota	9
2	Pezizomycetes	3	Basidiomycota	143
3	Sordariomycetes	3	Total species	152
4	Leotiomycetes	2		
5	Dacrymycetes	1		
6	Geoglossomycetes	1		
	Total species	152		

**Figure 3. Habit of wild mushrooms of Mizoram.**

ectomycorrhizal (36 spp.), and parasites (22 spp.) (Figure 3). Tapwal et al. (2013) reported that the ecological preference of the fungal species was maximum as saprophyte followed by ectomycorrhizal and parasites in wet ever green tropical forest in Assam.

CONCLUSION

The wild edible mushrooms play a vital role in strengthening the livelihood of the tribal people. The current environmental issues of global warming and climate change would adversely affect the delicate fungi's regeneration and growth pattern, which requires a specific micro-climate. Meticulous scientific screening of the wild edible mushrooms of Mizoram will help in understanding their henceforth unknown medicinal properties which will consequently be the source of nutritionally enriched diet to the tribal community along with additional therapeutic benefits.

Many reports have been published about the deaths caused by mushroom poisoning. There needs to be an immediate effort to prevent future loss of life. An

awareness program should be initiated using radio, television, and newspapers to make people better aware of the hazards of mushroom poisoning. Exploration of hitherto unknown wild edible mushrooms will facilitate in developing and popularizing their artificial cultivation technology among the tribal masses which will ultimately be a new source of their livelihood.

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Image 2. Wild mushrooms of Mizoram: 1—*Abortiporus biennis* | 2—*Agaricus bisporus* | 3—*Agaricus bitorquis* | 4—*Agaricus silvaticus* | 5—*Albatrellus ellisii* | 6—*Amanita citrina* | 7—*Amanita fulva* | 8—*Amanita macerisolum* | 9—*Amanita marmorata* | 10—*Amanita phalloides* | 11—*Amanita vaginata* | 12—*Auricularia cornea* | 13—*Baorangia bicolor* | 14—*Bisporella citrina* | 15—*Boletinellus merulioides* | 16—*Boletus bicolor* | 17—*Boletus edulis* | 18—*Boletus luridiformis* | 19—*Boletus mirabilis* | 20—*Boletus zelleri*. © Rajesh Kumar.

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Image 3. Wild mushrooms of Mizoram: 21—*Calbovista subsculpta* | 22—*Campanella caesia* | 23—*Cantharellus formosus* | 24—*Cantharellus lateritius* | 25—*Cerrena unicolor* | 26—*Clavaria fragilis* | 27—*Clavaria miniata* | 28—*Clavaria zollingeri* | 29—*Clavulina cristata* | 30—*Clavulina rugosa* | 31—*Coltricia cinnamomea* | 32—*Coltricia montagnei* | 33—*Coltricia perennis* | 34—*Conocybe apala* | 35—*Cookeina tricholoma* | 36—*Coprinus disseninatus* | 37—*Coprinus leiocephalus* | 38—*Coprinus plicatilis* | 39—*Cortinarius corrugatus* | 40—*Cortinarius crassus*.

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Image 4. Wild mushrooms of Mizoram: 41—*Craterellus tubaeformis* | 42—*Dacrymyces palmatus* | 43—*Daldinia concentrica* | 44—*Enteridium splendens* | 45—*Entoloma abortivum* | 46—*Entoloma lividum* | 47—*Entoloma squamatum* | 48—*Fomes fomentarius* | 49—*Fomitopsis ochracea* | 50—*Fomitopsis pinicola* | 51—*Galiella rufa* | 52— *Ganoderma adpersum* | 53—*Ganoderma applanatum* | 54—*Ganoderma formosanum* | 55—*Ganoderma lucidum* | 56—*Ganoderma oregonense* | 57—*Ganoderma sinense* | 58—*Ganoderma tsugae* | 59—*Geoglossum fallax* | 60—*Gloeophyllum sepiarium*. © Rajesh Kumar.

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Image 5. Wild mushrooms of Mizoram: 61—*Grifola frondosa* | 62—*Gymnopilus junonius* | 63—*Gymnopilus luteofolius* | 64—*Helvella atra* | 65—*Hericium coralloides* | 66—*Heterobasidion annosum* | 67—*Hygrocybe coccinea* | 68—*Hygrocybe conica* | 69—*Hypholoma fasciculare* | 70—*Inocybe flocculosa* | 71—*Inocybe lapponica* | 72—*Inocybe napipes* | 73—*Inocybe sindonia* | 74—*Ischnoderma resinosa* | 75—*Kuehneromyces mutabilis* | 76—*Laccaria affinis* | 77—*Laccaria fraterna* | 78—*Laccaria laccata* | 79—*Laccaria vinaceoavellanea* | 80—*Lactarius croceus*. © Rajesh Kumar.

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Image 7. Wild mushrooms of Mizoram: 101—*Marasmius corrugatifomis* | 102—*Marasmius crinis-equi* | 103—*Mycena pura* | 104—*Omphalotus illudens* | 105—*Panus rudis* | 106—*Phaeotrametes decipiens* | 107— *Phallus indusiatus* | 108—*Phellinus igniarius* | 109—*Phylloporus rhodoxanthus* | 110—*Piptoporus betulinus* | 111—*Pleurotus floridanus* | 112—*Pleurotus pulmonarius* | 113—*Polyporus arcularius* | 114—*Polyporus badius* | 115—*Postia caesia* | 116—*Psathyrella candolleana* | 117—*Pycnoporus cinnabarinus* | 118—*Pycnoporus sanguineus* | 119—*Ramaria formosa* | 120—*Ramaria myceliosa*. © Rajesh Kumar.



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