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Macrofungal Diversity of some districts of Assam, India with special reference to their uses

Manalee Paul[1*], T.C. Sarma[1] and D.C. Deka[2]

[1]*Department of Botany, Gauhati University, Guwahati-14, Assam, India*
[2]*Department of Chemistry, Gauhati University, Guwahati-14, Assam, India*

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ABSTRACT

The state of Assam is endowed with great biodiversity, it abounds in rich flora and fauna. Macrofungal diversity also forms an integral part of the floristic diversity yet very less work has been done on the macrofungal diversity as compared to that of higher plants. In the present work an attempt has been made to document the macrofungal diversity of some districts of Assam and also special emphasis has been laid on documenting the uses of the macrofungi. Surveys were carried out in various parts of Assam from the period of April 2014 to February 2017. The surveys were carried out in various seasons to ensure that the macrofungi occurring in various seasons are collected. The macrofungi were photographed in their natural habitat, collected and brought to the laboratory for their proper identification. A total of 82 species belonging to 51 genera, 34 families and 12 orders, were collected out of which 11 orders belong to division Basidiomycota and only 1 order, viz. Xylariales belong to Ascomycota. The frequency of occurrence and uses of the collected macrofungi have also been documented in the present study.

Key words: Macrofungi, Macrofungal Diversity, Assam

INTRODUCTION

Macrofungi have always been an object of awe and fascination for mankind since time immemorial. This group of organisms have been regarded with high importance in various cultures of the world and have been an integral part of their food and medicine .As such, the study of diversity of occurrence of macrofungi also holds immense importance. The term macrofungi is generally applied to the fruiting bodies of fungi belonging to Ascomycota and Basidiomycota which are either epigeous or hypogeous, large enough to be seen by naked eyes and can be picked by hand (Chang and Miles, 1992). The Ascomycota contains at least 40,000 different species worldwide while Basidiomycota contains at least 30,000 different species (Rahi and Malik, 2016).Macrofungi are characterised by their distinct fruiting bodies which include agarics, cup fungi, jelly fungi, flask fungi, chanterelles, corticoid fungi, club and coral fungi, boletes, earth stars, polypores, puffballs, stinkhorns, bird's nest fungi. Most terrestrial macrofungi are saprophytic or form symbiotic mycorrhizal associations while some are plant pathogens (Singh *et al.* 2019) . The number of known species of fungi is about 69,000 while 1.5 million species are estimated to exist in the world (Hawksworth, 1991). The number of known fungi had significantly increased to 100, 000 (Hawksworth,2004) which still is just 7% of the world's fungi. Macrofungi are an important part of the ecosystem and play a major role in ecosystem dynamics such as litter decomposition, nutrient cycling and nutrient transport (Mohanan, 2014). Macrofungal studies have long been of interest to scientists as well as the public due to their important roles in human life, such as their beneficial and harmful effects on forests, their use in the pharmaceutical industry, and the mass production of cultivated fungi in the food industry, as well as their vital role in biodegradation (Stojchev *et al*.1998). The diversity of macrofungi of various parts of India has been studied by various workers (Abraham ,1991; Atri *et al.*1997; Das ,2010, Dwivedi *et al.*2012; Lakhanpal ,1995; Manoharachary *et al.*2005, Sing and Sing ,1993; Sing *et al.*2002, Stojchev *et al.*1998; Verma *et al.*1995, Vishwakarma *et al.*2012) but much study has not been done on the macrofungal diversity of Assam and it is poorly documented as compared to higher plants. Sarma *et al.*(2010) has described some wild edible mushrooms used by ethnic tribes of Western Assam. An ethnomycological survey in some areas of Dhemaji district was carried out by Gogoi and Sarma (2012). Gogoi and Vipin (2015) studied the diversity of Gasteroid fungi in Hollongapar Gibbon Wildlife Sanctuary, Jorhat. Gogoi and Parkash(2015) prepared a checklist of gilled mushrooms of Hollongapar Gibbon Wildlife Sanctuary. Devi and Shrivastava(2016) studied the macrofungal diversity of Jalukbari Reserve Forest of Kamrup district, Assam. Parveen *et al.* (2017) studied the diversity and habitat specificity of macrofungi of Assam. Nath and Sarma(2018) reported some edible macrofungi from Kaliabar sub-division of Nagaon. In this study an attempt was made to document the macrofungal diversity of some districts Assam with special emphasis on their uses.

MATERIALS AND METHODS

Study Area: The state of Assam lies between $26^0 07'$N to $28^0 00'$N and $89^0 42'$E to $96^0 02'$ E in the north eastern

**Corresponding Author's E-mail: manalee.paul01@gmail.com*

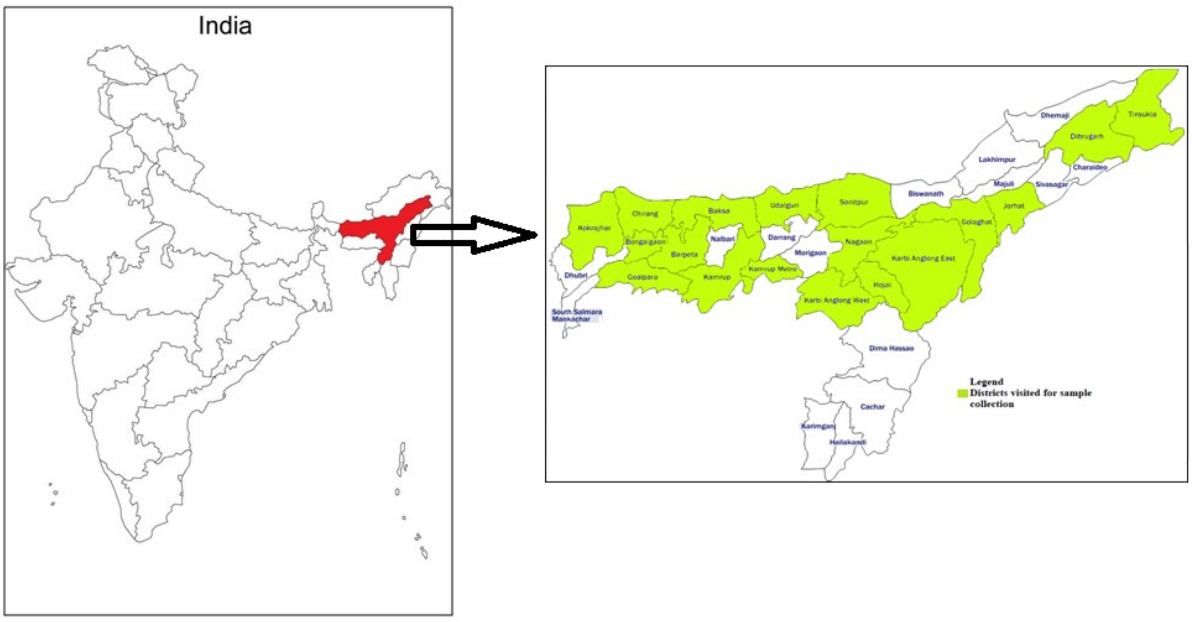

Figure 1. Map of the study area

part of India. It is bordered by Bhutan and Arunachal Pradesh in the North, Bangladesh, Tripura, Meghalaya and Mizoram in the South, Nagaland and Manipur in the east and West Bengal in the west. Assam is a part of the Eastern Himalayas, one of the major biodiversity hotspots in India. The state abounds in rich flora and fauna . The vegetation type in Assam is mainly tropical which can be divided into five forest types viz. Tropical Wet Evergreen, Tropical Semi Evergreen, Tropical Moist Deciduous, Tropical Dry Deciduous and Sub Tropical Pine Forests. The total forest area recorded is Assam is 26,832 sq.km. The protected forest areas include 5 National Parks and 18 Wildlife Sanctuaries of which two national parks viz. Kaziranga National Park and Manas National Park are World Heritage Sites. The state is divided mainly into two major valleys viz. the Brahmaputra Valley and the Barak Valley. The Brahmaputra is the main river flowing through the state with its tributaries criss-crossing the state, along with the rivers various water bodies such as lakes and beels are scattered throughout the state. The climate of Assam can be mainly classified as tropical monsoon rainfall type. The humidity level is high while rainfall is heavy with an average annual rainfall of 1927mm.

Sample Collection and Identification

Surveys were carried out in the study areas from April 2014 to February 2017. The collections were made in various season viz. summer, winter, dry and rainy. Different areas including wildlife sanctuaries, reserve forests as well as hilly terrains in various districts were visited for sample collection. A total of 20 sites were visited for collection. The survey sites along with their GPS coordinates are listed in Table 1. A map of Assam showing the study sties is shown in Figure 1. Opportunistic sampling method of collection of macrofungi described by Mueller *et al.* (2004) was used for collection of macrofungi. This method involves carefully walking through a study site and collection of conspicuous sporocarps. Sampling was done repeatedly at the sites to increase the chances of finding different species of macrofungi. Various habitats were also explored. The most common macrofungal habitats include living trees as well as wood logs and rotting wood, animal excreta, leaf litter, termite nests and some are found in mycorrhizal association with higher plants. The collection of macrofungi was done very carefully and it was ensured that no damage was done to the fruiting bodies during collection. The soft fruiting bodies were picked up directly from the substratum while for the harder ones a sharp knife was used. The fruiting bodies were picked up in a way so that minimum damage was done to the fruiting body as well as the substratum. The fruiting bodies were cleaned properly to remove soil and dirt using a soft brush (Stojchev *et al*.1998) and placed in cellophane bags, some of the softer varieties were wrapped in wax papers and aluminium foil while some were preserved in 70% alcohol to prevent rapid deterioration of the samples. Before collection the samples were photographed in their natural habitat and they were further photographed closely after bringing to the laboratory. The hard woody samples were air dried, while soft samples were preserved in 2% formalin while those with leathery texture were preserved in 4% formalin. Field labels were attached to every specimen which include a date, location, habitat, a brief note on distinguishing macroscopic features, collection number, microhabitat and the collectors code (Swapna *et al.*2008) and deposited in herbarium of Department of Botany, Gauhati University . Identification of the macrofungi were carried out by studying the micro morphological features (Roy and De,1996; Gilbertson and Ryvarden,1987) and also by studying the macro morphological features .

Data Analysis

The frequency of occurrence of the macrofungi (%) was calculated by the following formula:

Frequency (%)=(Number of sites in which the species is present/ Total number of sites) x 100.

Table 1. List of sample collection sites with their geographical coordinates.

Sl. No.	Collection Site	District	Latitude and Longitude	Elevation (m)
1	Ultapani Reserve Forest	Kokrajhar	26º68´N, 90º41´E	49
2	Bhalukpong	Sonitpur	26º51´N, 92º40´E	213
3	Nambor Wildlife Sanctuary	Golaghat	26º24´N, 93º51´E	94
4	Hoollongapar Gibbon Sanctuary	Jorhat	26º43´N, 94º 23´E	116
5	Dabaka Reserve Forest	Hojai	26º7´N, 92º 52´E	78
6	Amsoi Reserve Forest	Nagaon	26º13´N, 92º42´E	62
7	Hamren	Karbi Anglong	26º 35´N, 92º67´E	405
8	Kakoijana Reserve Forest	Bongaigaon	26º33´N, 90º87´E	36
9	Kohora	Golaghat	26º32´N, 93º34´E	76
10	Rani Reserve Forest	Kamrup (Rural)	25º80´N, 91º27´E	53
11	Garbhanga Reserve Forest	Kamrup (Rural)	26º05´N, 91º69´E	58
12	Agia	Goalpara	26.43°N, 90.36°E	35
13	Chandubi	Kamrup (Rural)	25º87´N, 91º42´E	53
14	Surya Pahar	Goalpara	26°6´N,90°42´ E	35
15	Tinsukia	Tinsukia	27º35´N,95º15´E	116
16	Laokhowa Wildlife Sanctuary	Nagaon	26º50´N, 92º7´E	62
17	Soraipung and adjoining areas	Dibrugarh	27º47´N, 94º91´E	152
18	Khalingduar Reserve Forest	Udalguri	26º 16´N, 92º 43´E	225
19	Hojai	Hojai	26ºN ,92º87´E	78
20	Barpeta	Barpeta	26º33´ N ,91º00´E	35

RESULTS AND DISCUSSION

A total of 82 macrofungal species belonging to 51 genera,34 families and 12 orders, were collected out of which 11 orders belong to division Basidiomycota and only 1 order, viz. Xylariales belong to Ascomycota. A complete list of the collected and identified macrofungi with their scientific names, common names, family, frequency of occurrence and uses has been presented in Table 2. The family containing the highest number of macrofungal species is Polyporaceae (13) and Inocybaceae with 1 species is the family containing the lowest number of species. *Ganoderma lucidum* (Curtis) P. Karst, *Pleurotus ostreatus* (Jacq. ex Fr.) P. Kumm. and *Pycnoporous sanguineus* (L.) Murril are the species having the highest frequency of occurrence (100%) while the lowest frequency of occurrence was recorded for *Cyathus striatus*(Huds.) Willd(10%). Most of the collected macrofungi have medicinal or various other uses , some of them are edible, while some are poisonous. The photographs of the collected macrofungi are presented below (Figure.2 – Figure.83).

The study showed that macrofungal diversity was almost similar among the sites visited.Soft and fleshy fungi were more common during the rainy seasons while some species such as *Ganoderma lucidum*(Curtis) P. Karst , *Trametes hirsuta* (Wulfen) Pilát , *Trametes versicolor* (L.) Lloyd were found in almost all the seasons. Moreover appearance of macrofungal fruiting bodies are also highly dependent on other environmental conditions like light, temperature, relative humidity etc. (Swapna *et al.*2008). Most of the species have one or multiple uses while a few are plant pathogens. Some of the species such as *Pleurotus ostreatus* (Jacq. ex Fr.) P. Kumm, *Pleurotus tuber-regium*(Rumph. ex Fr.), S*chizophyllum commune* Fries. and *Auricularia auricula-judae*(Bull.) J. Schröt are popular among the local ethnic people as items of food. Besides culinary uses these mushrooms have plethora of medicinal uses. Though macrofungi are not as famous as items of food and medicine among Indians in comparison to other parts of the world, use of macrofungi in culinary practices is quite popular among the various ethnic groups of Assam. They are both cultivated and collected from the wild as well. As such the study and conservation of macrofungal diversity as important as the study of other components of biological diversity. This study was an attempt to document the macrofungal diversity of Assam which has rather been poorly explored.

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Table 2. List of collected macrofungi along with their frequency of occurrence.

Sl. No	Scientific Name	Common Name	Family	Frequency of occurrence(%)	Edibility and other uses
1	*Agaricus arvensis* Schaeff ex Seer	Horse Mushroom	Agaricaceae	40	Edible
2	*A. bisporus* Quél.	Button Mushroom	Agaricaceae	55	Edible
3	*A. impudicus* (Rea) Pilát	Tufted Wood Mushroom	Agaricaceae	25	Inedible
4	*Amanita citrina*(Schaeff.) Pers	False Death Cap	Agaricaceae	15	Inedible
5	*Auricularia auricula-judae*(Bull.) J. Schröt	Jew's Ear	Auriculariaceae	95	Edible, medicinal
6	*A. polytricha*(Mont.) Sacc	Cloud Ear	Auriculariaceae	80	Edible
7	*Cantharellus cibarius* Fr	Golden Chanterelle	Cantharalleceae	70	Edible, Medicinal
8	*C.lateritius* (Berk.) Singer	Smooth Chanterelle	Cantharalleceae	35	Edible
9	*C. subalbidus* A.H. Sm & Morse	White Chanterelle	Cantharalleceae	80	Edible
10	*Clavulina cristata* (Holmsk) J. Schröt	Coral Fungi	Clavariaceae	90	Edible
11	*C. straminea* Cotton	NA	Clavariaceae	40	Inedible
12	*Clavulinopsis fusiformis* (Sowerby) Corner	Golden Spindle	Clavariaceae	45	Not known
13	*Collybia esculenta* (Wulfen) Fr.	Sprucecone Cap	Tricholomataceae	35	Inedible
14	*Coprinellus micaceus*(Bull.) Vilaglys, Hopple&Jacq. Johnson	Glistening Ink Cap	Psathyrellaceae	70	Edible
15	*Coprinopsis atramentaria* (Bull.:Fr.)	Inky Cap	Psathyrellaceae	65	Edible but toxic when consumed with alcohol.
16	*Coprinus comatus* (O.F. Müll)	Shaggy Inkcap	Agaricaceae	50	Edible at young stage.
17	*Crepidotus variabilis* (Pers.) P. Kumm.	Variable Oysterling	Inocybaceae	15	Edible
18	*Cyathus striatus*(Huds.) Willd	Fluted Bird's Nest	Nidulariaceae	10	Inedible
19	*C. olla* (Batsch) Pers.	Bird's Nest Fungi	Nidulariaceae	15	Inedible
20	*Dacryopinax elegans*(Berk. & M.A. Curtis) G.W. Martin	Fan Shaped Jelly Fungus	Dacrymycetaceae	85	Not known
21	*D. spathularia* (Schwein) G.W. Martin	Fan Shaped Jelly Fungus	Dacrymycetaceae	80	Edible
22	*Daedalea quercina* (L.) Pers.	Maze-Gill Fungus	Fomitopsidaceae	60	Inedible
23	*Daldinia concentrica* (Bolton) Cesati & de Notaris	King Alfred's Cakes	Xylariaceae	25	Inedible, used as tinder for fire.
24	*Earliella scabrosa* (Pers.) Gilb. & Ryvarden	NA	Polyporaceae	75	Inedible, has antifungl properties
25	*Fomitopsis pinicola* (Sw. Fr.) P. Karst.	Belt Conk	Fomitopsidaceae	15	Not known
26	*Ganoderma applanatum* (Pers.) Pat	Artist's Fungus	Ganodermataceae	85	Used as flavour enhancer in Asian cuisines, used as a drawing medium by artists.
27	*G. lucidum* (Curtis) P. Karst	Reishi/Lingzhi	Ganodermataceae	100	Medicinal
28	*G. resinaceum* Boud	Lacquered Bracket	Ganodermataceae	20	Inedible
29	*G. tsugae* Murrill	Hemlock Varnish Shelf	Ganodermataceae	80	Inedible
30	*Geastrum triplex* (Junghuhn)	Earth Star.	Geastraceae	55	Inedible, Medicinal
31	*Hygrocybe miniata* Fr. P. Kumm	Vermilion Waxcap	Hygrophoraceae	25	Inedible
32	*Hypholoma capnoides* (Fr.) P. Kumm.	Conifer Tuft	Strophariaceae	30	Edible
33	*H. sublateritium* (Fries) Quelet	Brick Cap	Strophariaceae	35	Poisonus
34	*Irpex lacteus* (Fr.) Fr.	Milk White Toothed Polypore	Phaenerochaetaceae	30	Inedible, possesses antibacterial properties.
35	*Lactarius piperatus* (Scop. Ex. Fr.) S.F. Gray	Peppery Milk-Cap	Russulaceae	65	Edible, medicinal
36	*Laccaria laccata* (Scop.) Cooke	Waxy Laccaria	Hydnangiaceae	55	Edible, medicinal.
37	*Laetiporus sulphureus* Murr.	Chicken of the Woods	Polyporaceae	15	Edible
38	*Lenzites betulina* (L.) Fr.	Gilled Polypore	Polyporaceae	65	Inedible, medicinal

Continued.

Table 2 continued

39	*Lepista nuda* (Bull.) Cooke	Wood Blewit	Tricholomataceae	20	Edible
40	*Lepiota decorata* Zeller	Pink Parasol	Agaricaceae	30	Inedible
41	*Lycoperdon perlatum* Pers.	Common Puffball	Lycoperdaceae	80	Edible when young, medicinal
42	*L. pyriforme* Schaeff.	Pear Shaped Puffball	Lycoperdaceae	35	Edible when young, medicinal
43	*Macrolepiota procera* (Scop.) Singer	Parasol Mushroom	Agaricaceae	30	Edible
44	*Marasmius haematocephalus* (Mont) Fr.	Purple Pinwheel Mushroom	Marasmiaceae	55	Inedible
45	*M. siccus* Schwein ex. Fr.	Orange Pinwheel	Marasmiaceae	65	Inedible
46	*M. urens (Bull.) Fr.*	Wood Woolly Foot	Marasmiaceae	15	Inedible
47	*Microporus xanthopus*(Fr.) Kuntze	Yellow Footed Polypore	Polyporaceae	90	Inedible, medicinal
48	*Oxyporus populinus* (Schumacher) Donk	Mossy Cap Polypore	Schizoporaceae	10	Inedible
49	*Panus fulvus*(Berk.) Pelger& R.W. Rayner	NA	Polyporaceae	70	Inedible
50	*Phallus indusiatus* Vent	Long Net Stinkhorn	Phallaceae	65	Inedible, medicinal
51	*P. multicolor* (Berk. and Broome) Cooke.	Stinkhorn	Phallaceae	35	Poisonous
52	*Phellinus gilvus* (Schwein.)	Mustard Yellow Polypore	Hymenochaetaceae	30	Inedible, medicinal
53	*P. rimosus* (Berk) Pilát	Cracked Cap Polypore	Hymenochaetaceae	65	Inedible, medicinal
54	*Pleurotus ostreatus* (Jacq. ex Fr.) P. Kumm.	Oyster Mushroom	Pleurotaceae	100	Edible, medicinal
55	*P. pulmonarius* (Fr.) Quél	Indian Oyster Mushroom	Pleurotaceae	55	Inedible, medicinal
56	*P. tuber- regium* (Rumph ex Fr.) Singer	King Tuber Mushroom	Pleurotaceae	30	Edible, medicinal
57	*Podaxis pistillaris* (L.) Fr.	Desert Shaggy Mane	Podaxaceae	55	Inedible, medicinal
58	*Podoscypha petalodes* (Berk.) Pat.	Wine Glass Fungus	Meruliaceae	90	Inedible
59	*Polyporous alveolaris* (DC.) Bondarstev & Singer	Hexagonal Pored Polypore	Polyporaceae	75	Inedible
60	*P. squamosus* (Huds.) ex Fr.	Dryad's Saddle	Polyporaceae	85	Edible, medicinal
61	*Pycnoporous sanguineus* (L.) Murril	Cinnabar Bracket	Polyporaceae	100	Inedible, medicinal
62	*Rhizopogon luteolus* Fr. Nordholm	Yellow False Truffle	Rhizopogonaceae	25	Edible, medicinal
63	*Rhodocollybia butyracea* (Bull. Fr.) Quélet	Buttery Collybia	Marasmiaceae	35	Edible
64	*Russula emetica*(Schaeff.) Pers.	Vomiting Russula	Russulaceae	40	Edible
65	*R. insignis* Qúel	NA	Russulaceae	25	Inedible
66	*Scleroderma citrinum* Pers.	Pigskin Poison Puffball	Sclerodermataceae	35	Poisonous
67	*Schizophyllum commune* Fries.	Split Gill Mushroom	Schizophyllaceae	90	Edible, medicinal
68	*S. radiatum* Fr.	NA	Schizophyllaceae	25	Inedible
69	*Termitomyces microcarpus* (Berk & Br.) Heim	NA	Lyophyllaceae	35	Edible
70	*T. mammiformis R.* Heims	NA	Lyophyllaceae	10	Edible
71	*T. striatus* (Beeli) R. Heim	NA	Lyophyllaceae	20	Edible
72	*Trametes elegans* (Spreng.) Fr.	White Maze Polypore	Polyporaceae	85	Inedible
73	*Trametes gibbosa* (Pers.) Fr.	Lumpy Bracket Fungus	Polyporaceae	65	Inedible, medicinal
74	*T. hirsuta* (Wulfen) Pilát	Hairy Bracket Fungus	Polyporaceae	90	Inedible, medicinal
75	*T. versicolor* (L.) Lloyd	Turkey Tail Fungus	Polyporaceae	75	Inedible
76	*Tremella foliacea* Fries.	Brown Witch's Butter	Tremellaceae	35	Edible
77	*T. fuciformis* Berk.	Silver Ear Fungus	Tremellaceae	40	Used in cosmetics
78	*Trichaptum biforme*(Fr.) Ryvarden	Purple Tooth Fungus	Polyporaceae	20	Inedible
79	*Tricholoma pardinum* (Pers.) Quél	Tiger Tricholoma	Tricholomataceae	30	Inedible
80	*T. vaccinum* (Schaef.) P. Kumm.	The Scaly Knight	Tricholomataceae	45	Inedible
81	*Xylaria hypoxylon* (L.) Grev	Candlestick Fungus	Xylariaceae	95	Inedible
82	*X. polymorpha* (Pers.) Grev.	Dead Man's Fingers	Xylariaceae	75	Inedible

*NA=Not Available

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Fig. 2. *Agaricus arvensis* Schaeff ex Seer

Fig. 3. *Agaricus bisporus* Quél.

Fig . 4. *Agaricus impudicus* (Rea) Pilát

Fig .5. *Amanita citrina*(Schaeff.) Pers

Fig .6. *Auricularia auricula-judae*(Bull.) J. Schröt

Fig .7. *Auricularia polytricha* (Mont.)Sacc.

Fig. 8. *Cantharellus cibarius* Fr

Fig. 9. *Cantharellus lateritius* (Berk.) Singer

Fig. 10. *Cantharellus subalbidus* A.H. Sm & Morse

Fig. 11. *Clavulina cristata* (Holmsk.) J. Schröt

Fig. 12. *Clavulina straminea* Cotton

Fig.13.*Clavulinopsis fusiformis*(Sowerby)

Fig.14. *Collybia esculenta* (Wulfen) Fr.

Fig.15.*Coprinellus micaceus*(Bull.) Vilaglys, Hopple&Jacq. Johnson

Fig.16.*Coprinus atramentarius* (Bull. ex Fr.)

Fig.17. *Coprinus comatus* (O.F. Mull)

Fig.18.*Crepidotus variabilis* (Pers.) P.Kumm.

Fig.19.*Cyathus striatus* (Huds.) Wild

Fig. 20. *Cyathus olla* (Batsch) Pers.

Fig. 21. *Dacryopinax elegans* (Berk. & M.A. Curtis) G.W. Martin

Fig. 22. *Dacryopinax spathularia* (Schwein) G.W. Martin

Fig. 23. *Daedalea quercina* (L.) Pers.

Fig. 24. *Daldinia concentrica* (Bolton) Cesati& de Notaris

Fig. 25. *arliella scabrosa* (Pers.) Gilb &Ryvarden

Fig. 26. *Fomitopsis pinicola*(Sw. Fr.) P. Karst.

Fig. 27. *Ganoderma applanatum* (Pers.) Pat

Fig.28. *Ganoderma lucidum*(Curtis) P. Karst

Fig.29.*Ganoderma resinaceum* (Boud.) Pat

Fig. 30. *Ganoderma tsugae* Murrill

Fig. 31.*Geastrum triplex* (Junghuhn)

Fig. 32. *Hygrocybe miniata* Fr. P. Kumm

Fig.33. *Hypholoma capnoides* (Fr.) P. Kumm.

Fig.34. *Hypholoma sublateritium* (Fries) Quelet

Fig.35. *Irpex lacteus* (Fr.) Fr.

Fig.36. *Lactarius piperatus* (Scop. Ex. Fr.) S.F. Gray

Fig. 37. *Laccaria laccata* (Scop.) Cooke

Fig. 38. *Laetiporus sulphureus* Murr.

Fig.39. *Lenzites betulina* (L.) Fr.

Fig. 40. *Lepista nuda* (Bull.) Cooke

Fig. 41. *Lepiota decorata* Zeller

Fig. 42. *Lycoperdon perlatum* Pers.

Fig. 43. *Lycoperdon pyriforme* Schaeff.

Fig. 44. *Macrolepiota procera* (Scop.) Singer

Fig.45. *Marasmius haematocephalus* (Mont) Fr.

Fig.46. *Maramiuss siccus* Schwein ex. Fr.

Fig. 47. *Marasmius urens* (Bull.) Fr.

Fig. 48. *Microporus xanthopus* (Fr.) Kuntze.

Fig. 49. *Oxyporus populinus* (Schumacher) Donk

Fig. 50. *Panus fulvus* (Berk) Pelger & R.W. Ray

Fig. 51. *Phallus indusiatus* Vent

Fig. 52. *Phallus multicolor* (Berk. and Broome) Cooke.

Fig. 53. *Phellinus gilvus* (Schwein.)

Fig.54. *Phellinus rimosus* (Berk) Pilát

Fig. 55. *Pleurotus ostreatus* (Jacq. ex Fr.) P. Kumm.

Fig.56. *Pleurotus pulmonarius* (Fr.) Quél

Fig.57. *Pleurotus tuber-regium*(Rumph. ex Fr.)

Fig. 58. *Podaxis pistillaris* (L.) Fr.

Fig.59. *Podoscypha petalodes* (Berk.) Pat.

Fig.60. *Polyporous alveolaris* (DC.) Bondarstev

Fig. 61. *Polyporous squamosus* (Huds.) ex Fr.

Fig. 62. *Pycnoporous sanguineus* (L.) Murril

Fig. 63. *Rhizopogon luteolus* Fr. Nordholm

Fig. 64.*Rhodocollybia butyracea* (Bull. Fr.) Quélet

Fig. 65. *Russula emetica*(Schaeff.) Pers.

Fig. 66. *Russula insignis* Qúel

Fig. 67. *Scleroderma citrinum* Pers.

Fig. 68. *Schizophyllum commune* Fries.

Fig. 69. *Schizophyllum radiatum* Fr.

Fig.70. *Termitomyces microcarpus* (Berk & Br.) Heim

Fig.71. *Termitomyces mammiformis* R. Heims

Fig. 72. *Termitomyces striatus*.(Beeli) R. Heim

Fig. 73. *Trametes elegans* (Spreng.) Fr.

Fig. 74. *Trametes gibbosa* (Pers.) Fr.

Fig. 75. *Trametes hirsuta* (Wulfen) Pilát

Fig. 76. *Trametes versicolor* (L.) Lloyd

Fig. 77. *Tremella foliacea* Fries.

Fig .78. *Tremella fuciformis* Berk.

Fig. 79. *Trichaptum biforme(*Fr.) Ryvarden

Fig. 80. *Tricholoma pardinum* (Pers.) Quél

Fig. 81. *Tricholoma vaccinum* (Schaef.) P. Kumm.

Fig. 82. *Xylaria hypoxylon* (L.) Grev.

Fig. 83. *Xylaria polymorpha* (Pers.) Grev.