F. No. 23/15/2006 - RE

Biodiversity of Terricolous and Lignicolous Macrofungi of the Western Ghats, Kerala

(Final Technical Report: F. No. 23/15/2006 - RE)

Submitted to the Ministry of Environment and Forests
Government of India, New Delhi

Dr. C. Mohanan
Forest Pathology Department

KFRI
2011

Kerala Forest Research Institute
(An Institution of Kerala State Council for Science, Technology and Environment)
Peechi 680 653 Thrissur, Kerala, India

F.No. 23/15/2006-RE

Biodiversity of Terricolous and Lignicolous Macrofungi of the Western Ghats, Kerala

(Final Technical Report: F.No. 23/15/2006-RE)

Submitted to the Ministry of Environment and Forests,
Government of India, New Delhi

Dr. C. Mohanan

Forest Pathology Department

Kerala Forest Research Institute

(An Institution of Kerala State Council for Science, Technology and Environment)
Peechi 680 653 Thrissur, Kerala, India

CONTENTS

PART- I : PROJECT DETAILS

1	Title of the Project	Biodiversity of Terricolous and Lignicolous Macrofungi of the Western Ghats, Kerala
2	Name of members of research team and their designation	Dr. C. Mohanan Principal Investigator Scientist F & Head Forest Pathology Division Kerala Forest Research Institute, Peechi, Kerala Mr. P.M. Sumesh Senior Research Fellow Mr. P. Rajesh Technical Assistant
3	No. and date of sanction letter	F.No. 23/15/2006-RE Dated June 27, 2007
4	Duration of the Project	3 years
5	Total outlay of the Project	Rs. 12, 22, 470
6	Date of start of the Project	01-10-2007
7	Date of completion of the Project	30-09-2010

EXECUTIVE SUMMARY

A project entitled "Biodiversity of Terricolous and Lignicolous Macrofungi of the Western Ghats, Kerala" was undertaken with the financial assistance from the Ministry of Environment and Forests, Government of India. Representative research areas in different forest ecosystems in the Western Ghats *viz.*, grasslands, moist-deciduous, semi-evergreen, evergreen forests, shola forests, Myristica swamp forests, forest plantations, and sacred groves were selected for the study. Both opportunistic and fixed-size plots sampling were carried out during pre-monsoon, monsoon and post-monsoon periods. Systematic sampling, collection, documentation, and processing of macrofungal specimens were made; a total of 4000 fungal specimens were collected from different forest ecosystems and processed during the course of the study. Macro- and micro-morphological characters of the specimens were studied and identification up to species level was made.

The three years inventory data reveal that Western Ghats of Kerala State is endowed with a remarkably rich macrofungal flora. A total of 550 species of macrofungi belonging to 166 genera falling in 51 fungal families of Basidiomycota and Ascomycota were encountered in different forest ecosystems of the State. Each forest ecosystem supports unique assemblage of macrofungal communities and their occurrence, abundance and species composition, depend largely on the prevailing microclimatic conditions and level of anthropogenic disturbances. Among the forest ecosystems studied, moist-deciduous and semi-evergreen forests support maximum number of macrofungi, followed by evergreen and shola forests. The grassland ecosystem supports only a few macromycetes, while Myristica swamp forests harbour an array of different interesting groups of macrofungi. Macrofungal species assemblage, species abundance and frequency are very characteristic in the shola forests. Among the macrofungi encountered, terricolous, humicolous and lignicolous form the major groups, while coprophilous or macrofungi inhabiting on dung of herbivores are the insignificant group.

Of the 51 macrofungal families, members belonging to Agaricaceae, Amanitaceae, Boletaceae, Entolomataceae, Hygrophoraceae, Inocybaceae, Lyophyllaceae, Marasmiaceae, Pluteaceae and Tricholomataceae are the major players in ecosystem functioning. In the family Agaricaceae, 10 genera and 53 species were recorded. These include both edible and poisonous species. *Agaricus, Chlorophyllum, Clarkeinda, Coprinus, Lepiota, Leucocoprinus, Leucoagaricus, Macrolepiota* are the significant genera. In Boletaceae, 16 species belonging to 6 genera were recorded. Members of this family form ectomycorrhizal association with trees and are distributed in moist-deciduous to evergreen forests. A few are edible; poisonous species also occur. In the family Entolomataceae, 28 species of *Entoloma* and 2 species of *Rhodocybe* were recorded. In Hygrophoraceae, 23 species of *Hygrocybe* and *Camarophyllus umbrinus* were recorded. Most of them are terricolous and a few are humicolous and litter decomposers. In Inocybaceae a total of 11 species of *Inocybe* and one species of *Pleuroflammula* (*P. flavomarginata*) were recorded. These include both poisonous and edible species. Most of the *Inocybe* species form ectomycorrhizal association with native tree species. In Lyophyllaceae, *Calocybe* (*C. cyanocephala*) and 13 species of *Termitomyces* were encountered. Species of *Termitomyces,* the highly preferred edible macrofungi, were found widely distributed in deciduous to semi-evergreen forests and highly degraded forest stands.

In the family Marasmiaceae, a total of 27 species belonging to 12 genera *viz.*, *Calyptella, Campanella, Gerronema, Gymnopus, Hydropus, Lactocollybia, Marasmiellus, Marasmius, Trogia* were recorded. Most of them are primary colonizers and litter decomposers. In Mycenaceae, *Filoboletus, Mycena* and *Xeromphalina* were encountered. In the family Pluteaceae, 14 species of *Pluteus* and 7 species of *Volvariella* were recorded from different forest ecosystems. In Russulaceae 2 species of *Lactarius* and 13 species of *Russula* were recorded. In Suilaceae, 3 species of *Suillus* were recorded. In Hydnangiaceae 4 species of *Laccaria* were recorded. All the four species form ectomycorrhizal association with eucalypts, pine and also native trees. In Tricholomataceae, a total of 20 species belonging to 6 genera *viz. Clitocybe, Collybia, Lepista, Macrocybe, Tricholoma, Tricholomopsis* were recorded. Most of them are edible. In the family Bolbitaceae, 6 genera and 15 species were recorded. *Bolbitius, Conocybe, Copelandia, Panaeolus, Panaeolina, Pholiotina* were recorded. In Crepidotaceae, 9 species of *Crepidotus* and in Psathyrellaceae, *Cystoagaricus trisulphuratus* and 7 species of *Psathyrella* were recorded from different forest ecosystems. In Physalacreaceae, 5 genera and 9 species were encountered. *Armillaria, Cyptotrama, Gloiocephala, Oudemansiella, Xerula* were recorded. Species of *Oudemanseiella* and *Xerula* are edible. In Strophariaceae, altogether 30 species belonging to 7 genera were encountered in different forest ecosystems. *Agrocybe, Galerina, Gymnopilus, Hypholoma* (2 species), *Pholiota, Psilocybe* (10 species) and *Stropharia semiglobata* were recorded. Species of *Galerina* and *Gymnopilus* are toxic, while species of *Psilocybe, P. cubensis* and *P. subcubensis* are hallucinogenic.

Among the lignicolous edible macrofungi, in the family Pleurotaceae, 3 species of *Hohenbuehelia* and 5 species of *Pleurotus* were recorded. In Auriculariaceae, 3 species of *Auricularia* were recorded. In the family Clavariaceae, *Clavaria, Clavulinopsis* (6 species), *Ramariopsis* (2 species) were encountered. In Dacrymycetaceae, 2 species of *Calocera,* and 2 species of *Dacryopinax* were recorded. In Tremellaceae, 3 species of *Tremella* and in Astraeaceae, *Astraeus hygrometricus* and in Nidulariaceae, *Cyathus striatus* were recorded. In Lycoperdaceae 8 species of *Lycoperdon* and in Sclerrodermataceae one species of *Pisolithus* (*P. albus*) and 5 species of *Scleroderma* were recorded. In Geatraceae 5 species of *Geastrum* were encountered. Members of Phallaceae belong to Phallales are the most colourful and attractive macrofungi and the significant members encountered include: *Aseroe rubra* var. *zylanica*, *Clathrus archeri*, *C. pusillus, Ileodictyona gracile, Dictyophora cinnabarina, Lysurus brahmagirii, Mutinus caninus, Phallus anamudii, P. indusiatus*. These comparatively rare groups of macrofungi were recorded from semi-evergreen, evergreen and shola forests. Most of them are new record for the State. *Lysurus brahmagirii* and *Phallus anamudii* are hitherto unrecorded taxa. Macromycetes belong to Cantharellaceae: 2 species of *Cantharellus,* Hydnaceae: 2 species of *Hydnum*, Gomphaceae: *Gomphus clavatus* and 8 species of *Ramaria,* Boletinellaceae: (*Boletinellus meruloides*; *Phlebopus portentosus*), Cortinariaceae (*Anamika indica, Cortinarius pholideus, Cortinarius* sp.), Gyroporaceae (*Gyroporus castaneus*) were encountered. *Cantharellus cibarius*, the most widely exploited edible ectomycorrhizal fungi occurs in semi-evergreen and evergreen forests, associated with a range of native host plants.

Wood inhabiting macrofungi are the major component of the forest ecosystem and play a vital role in the ecosystem dynamics. These include mostly the bracket fungi

and 114 species belonging to 48 genera under 7 families were encountered in different forest ecosystems of the State. In the family Fomitopsidaceae, 7 genera *viz.*, *Antrodia, Daedalea, Fomitella, Fomitopsis, Laetiporus* were recorded. *Laetiporus sulphureus*, popularly known as 'chicken mushroom' or sulphur shelf' is one of the highly prized edible mushroom of the world. In Ganodermataceae, 3 species of *Amauroderma* and 3 species of *Ganoderma* were recorded. In Hymenochaetaceae 29 species belonging to 8 genera *viz.*, *Aurificaria, Coltricia, Cyclomyces, Hymenochaete, Inonotus, Phellinus, Pseudochaete* were encountered from different forest ecosystems. In Meripilaceae 2 species of *Rigidoporus* were recorded. In the family Meruliaceae species of *Bjerkandera, Flaviporus, Flavodon, Gloeoporus, Irpex, Podoscypha* were recorded. In the family Stereaceae, *Stereum hirsutum* was recorded. In the family Polyporaceae a total of 57 species belonging to 23 genera were recorded. Species of *Cinereomyces, Coriolopsis, Dichomitus, Earliella, Echinochaete, Favolus, Fomes, Hexagonia, Lentinus, Panus, Lenzites, Microporellus, Microporus, Navisporus, Nigroporus, Oxyporus, Perenniporia, Polyporus, Pycnoporus, Pyrofomes, Royoporus, Trametes,* and *Trichaptum* were recorded from different forest ecosystems.

Macromycetes belonging to Ascomycota are comparatively less represented in the forests. *Bulgaria indica* (Bulgariaceae), *Aleuria aurantia, A. rubra, Sowerbyella rhenana, Scutellinia setosa* (Pyrenomycetaceae), *Cookeina indica, C. speciosa, C. tricholoma, Sarcoscypha occidentalis* (Sarcoscyphaceae), *Daldinia concentrica* and 7 species of *Xylaria* were encountered. Species of *Cookeina* and *Sarcoscypha* are widely distributed in semi-evergreen, evergreen and shola forests and are the primary colonizers of decaying forest litter.

Occurrence and distribution pattern of ectomycorrhizal macrofungi in different forest ecosystems depend largely on the distribution of host plant species, irrespective of the ecosystem specific environmental gradients. A large number of species of ectomycorrhizal macrofungi like *Amanita, Aseroe, Astroboletus, Boletus, Laccaria, Lactarius, Pisolithus, Russula, Suillus*, among others, possibly introduced along with their host plants seem to be naturalized in the State and invading into the natural forests, harbouring the native tree species and widening their mutualistic relationships.

Most saprophytic macrofungal species exhibit definite patterns of distribution in different forest ecosystems which are highly influenced by the environmental factors, mainly rainfall and atmospheric humidity. Also, occurrence, abundance, species richness are largely depended on the nature of humus/litter load and their level of decomposition or deterioration. Erratic rainfall, large-scale removal of forest litter and humus from the forest floor and other human interventions are adversely affecting the diversity of terricolous, lignicolous and humicolous macrofungi, especially in the moist-deciduous and semi-evergreen forests. Among the 550 species of macrofungi recorded from the Western Ghats of Kerala, more than 360 species are new record for the State, more than 300 species are new record for the country and 15 are hitherto unrecorded macrofungi.

INTRODUCTION

Macrofungi are distinguished by their fruiting structures (sporocarps) visible to the naked eyes. Most macrofungi belong to Classes Basidiomycota and Ascomycota. Their fruiting bodies vary much in shape, size, colour, texture, odour and taste. Many of them are edible, while a few are hallucinogenic, toxic or highly poisonous. In general, macrofungi are important component of forest ecosystem and play a major role in ecosystem dynamics, such as litter decomposition, nutrient cycling and nutrient transport. Most of the macrofungi are saprobes and occur in soil, humus, decaying wood, litter, dung, among others. Many are ectomycorrhizal members having mutualistic association with roots of trees and shrubs belonging to both angiosperms and gymnosperms. The mutualistic association helps in the uptake of poorly mobile nutrients including nitrogen and phosphorus by plants in the nutrients deficient or problematic soils. Thus, the ectomycorrhizal members play a vital role in nutrient transport as well as maintaining the health and vitality of planted and natural stands. A few macrofungi also form mutualistic relationship with termites belonging to Macrotermitinae, and grow from the termite nests or mounts. Some are pathogens of woody plants, insects, and fungi.

Fruiting bodies of macrofungi are formed only when ecological conditions are favourable, but their mycelia exists on soil, humus, plant litter, decaying wood or other substrata inconspicuously for a very long period. Most of the saprophytic members constitute major recyclers of nutrients. They are known to break down the lignocelluloses and thus help in litter degradation, converting large molecular complexes into simpler compounds. The activities of these macrofungi aid in return of carbon, hydrogen, nitrogen and minerals back into the ecosystem to be utilized by plants and other organisms.

Macrofungi fruiting on woody substratum are usually either saprobes or pathogens causing root rot, butt rot, heart rot and decay of wood, branches and twigs. The wood inhabiting macrofungi inhabit the substrata that differ in size, state of decay, and levels of moisture content. A succession of wood decaying saprobic species occurs in an organized manner as the wood deteriorates slowly and gradually, thus, ecologies of fungi growing on different wood substrata differ. The fruiting bodies of heart rot causing macrofungi appear only at the advanced stage of decay of the inner core or the heartwood. Macrofungi not only play a vital role in ecosystem functioning but some of them are also useful in production of a range of bioactive compounds including industrially important enzymes. Wild collected edible and medicinal macrofungi are enjoyed by the tribals as well as the other forest dwellers. A large number of wild collected edible macrofungi form an important source of income in both temperate and tropical countries. While a few macrofungi are being cultivated and commercially exploited worldwide. Most macrofungi are widely distributed both in tropical and temperate regions, however, some of them are confined to particular ecological zones.

Mycodiversity, as with all other sub-sects of biodiversity exhibits distinct patterns in both space and time. Such fungal biodiversity patterns are to a large extent unexplored. The Western Ghats of Kerala, covering an approximate area of 20,000 km^2 is biologically one of the richest tracts. Earlier, studies were undertaken on specific groups of mushrooms and more than 90 genera have been reported from the

Western Ghats (Leelavathy *et al.*, 1983,1986,2006; Manimohan and Leelavathy, 1987, 1988, Manimohan et al., 2002,2006; Pradeep *et al.*,2006; Vrinda *et al.*, 1995,1997,2000, 2002,2003). Similarly, polypores have also been studied from selected forest areas in this region (Mohanan, 1994, 2007; Leelavathy and Ganesh, 2000). The present study was aimed at to increase our knowledge of macrofungal diversity in the entire forest ecosystems of the State.

MATERIALS AND METHODS

Forest ecosystems selected for the study

The forests of the Western Ghats exhibit considerable variations in floristic composition, physiognomy, life forms, etc. because of the climatic, edaphic, and physiographic variations. The forests in this region have been classified into seven major types which are divided into 20 sub-types and many further sub-divisions depending upon the floristic composition. Study areas were selected in the following major types of forests falling in different Forest Divisions of the State.

1. West coast tropical evergreen forests

This type of forests constitute the climax vegetation of Kerala, characterized by at least three tiers, the highest often attaining a height of 40-45 m. These forests occupy between 600 and 1100 m a.s.l. and prefer an annual rainfall of more than 2000 mm, temperature between 15 ^{0}-30 ^{0} C and humidity between 70 and 100 per cent.

The upper storey consists of trees such as *Artocarpus heterophyllus, Bischofia javanica, Calophyllum elatum, Canarium strictum, Cullenia exarillata, Drypetes elata, Dysoxylum malabaricum, Elaeocarpus tuberculatus, Holigarna arnottiana, H. grahamii, Mesua ferrea, Palaquium ellipticum, Persea macrantha, Poeciloneuron indicum, Polyalthia coffeoides, Vateria macrocarpa,* etc. The second storey is characterized by tree species like *Aglaia elaeagnoidea, Actinodaphne hookeri, Baccaurea courtallensis, Cinnamomum malabathrum, Democarpus longan, Elaeocarpus serratus, Garcinia morella, Gomphandra polymorpha, Litsea wightiana, Meliosma pinnata, Myristica dactyloides, Oreocnide integrifolia*, etc. These trees attain a height of 15 to 30 m. The third storey which is less than 15 m in height consists of small trees like *Agrostistachys meeboldii, Euonymus angulatus, Jambosa munroii, J. latea, Memecylon sisparense, Turpinia malabarica, Xanthophyllum flavescens*, etc. Profuse growth of shrubs like *Dendrocnide sinuate, Sarcococca brevifolia, Solanum surattense, Thottia siliquosa, Psychotria* sp., *Moghania* sp., *Strobilanthes* spp., and many others are seen in these forests.

Only a few monocot species like *Arenga wightii, Calamus gamblei, C. thwaitesii, C. hookerianus, Pandanus fructus, Pinanga dicksonii, Ochlandra travancorica, O. ebracteata, Oxytenanthera* sp., etc. occur. Ground flora is composed of herbs like *Elettaria cardamomum, Amorphophallus* sp., *Heckeria* sp., ferns, etc. Climbers like *Pothos scandens, Piper* spp., *Caesalpinia bonduc*, *Smilax* sp., etc. are common. Ecologically, this type of forest is the most advanced stage with high floristic richness and provides much of the tangible and intangible benefits. These forests are the store house of many wild relatives of the cultivated plants. About 25 per cent of the total forest cover in the Kerala part of the Western Ghats belongs to this category. The

forest floor is rich in humus, litter and fallen logs at various stages of decay and decomposition which support a rich flora of macrofungi.

2. West coast tropical semi-evergreen forests

This forest type is generally considered a transitional stage between evergreen and moist deciduous forests. It is also found in localities where the evergreen forests are subjected to high disturbances. It occurs between 600 to 800 m a.s.l. and in some places it extends up to 900 m a.s.l. The floristic composition is an admixture of both evergreen and deciduous species in the top storey. The prominent evergreen species are *Artocarpus heterophyllus, Bischofia javanica, Calophyllum elatum, Evodia lunaankenda, Hopea wightiana, Mangifera sylvatica, Mesua ferrea, Myristica dactyloides,* etc.

The deciduous floral elements are *Acrocarpus fraxinifolius, Bombax ceiba, Chukrasia tabularis, Dalbergia latifolia, Grewia tiliifolia, Lagerstroemia microcarpa, Pterospermum rubiginosum, Terminalia bellirica, Toona ciliata,* etc. The species occurring in the lower layer are almost the same as seen in the evergreen forests. This forest types constituted about 11 per cent of the forest area of the State. This forest type supports trees of more commercial value. These forests are mostly selection felled during the past and contain severely decaying trees and snags. Decaying fallen logs are also common in these forests which support luxuriant growth of both annual and perennial macrofungal species. Removal of litter and severe anthropogenic intervention affects the distribution and diversity of the macrofungi.

3. South Indian moist deciduous forests

The trees in this type of forests reach 30 to 35 m in height. Compared to the evergreen forests, the species diversity is very poor. Buttressed trees are rare and fluting is common in species like *Xylia xylocarpa, Tectona grandis*, etc. Bamboos and reed bamboos are common. The differentiation into various layers is not very distinct. This type of forests thrive well at 200-1250 m a.s.l. The temperature regime is 20-35^{0}C. Relative humidity varies from 40-70 per cent. This type of forests prefer rainfall between 1500 to 2500 mm. The principal species commonly found are *Albizzia procera, Bombax ceiba, Dalbergia latifolia, Grewia tiliifolia, Lagerstroemia microcarpa, Schleichera oleosa, Tectona grandis, Terminalia bellirica, Terminalia paniculata, Tetrameles nudiflora, Xylia xylocarpa, etc.* Giant lianas like *Spatholobus roxburghii, Entada pursetha*, etc. are very common. Common ground flora consists of many herbs, which possess medicinal properties. These forests are in the seral stage in the succession towards climatic climax vegetation which is the wet evergreen forests. But due to successive fire incidence and anthropogenic disturbances, the forests have advanced towards the climax stage. The present extent of moist deciduous forests is about 44 per cent of the total forest cover in the State. The forest floor is rich in humus, however, frequent forest fire in many areas affects the humus formation and thus the production of humicolous and lignicolous macrofungi.

4. Southern subtropical broadleaved hill forests

The forests are much inferior to wet evergreen forests of lower elevations and are commercially very poor. The forests are exposed to high winds. The height of the

trees seldom exceed 20 m and are heavily fatooned with mosses, lichens, aroids, orchids, etc. This types of forests exists between 1300-1800 m a.s.l. where the temperature is 10^0 -20 ^{0}C. These type of forests receive a rainfall ranging from 3000 – 5500 mm and in some areas reaching more than 6500 mm. The relative humidity is also very high (80-100%). These forests contain tree species like *Calophyllum elatum, Cinnamomum sulphuratum, Elaeocarpus munroii, Dimocarpus longan, Garcinia sp., Gordonia obtusa, Memecylon* sp., *Mesua ferrea, Syzygium* spp., etc. These type of forests constitute only 0.5 per cent of the total forest area of the State and is ecologically important as it is the storehouse of water which is slowly released to the streams. The forest floor is rich in humus and support rich macrofungal flora.

5. Southern montane wet temperate forests

This type of forests occurs in the upper reaches of the hills, especially on cliffs and sheltered folds above 1900 m a.s.l. Southern montane wet temperate forests are also known as shola and are found in pockets supporting stunted trees which seldom attain more than 10 m. The temperature is very low (10^0-15^0C) and the forests receive a very high rainfall (> 4000 mm). The relative humidity is very high (80-100%). The altitude and high winds control the height growth of the trees. These forests are interspersed with rolling grasslands. The vegetation comprised of less number of tree species like *Elaeocarpus munroii, Gordonia obtusa, Meliosma pinnata, Schefflera pinnata, Symplocos* sp., with many Lauraceous and Myrtaceous members. *Strobilanthes* forms the main understorey. The shola forests constitute only 0.2 per cent of the total area of the State and play an important role in the hydrological cycle as the soil stores plenty of rain water. The forest floor is rich in humus and support rich macrofungal flora.

6. Southern tropical dry deciduous forests

This forest type is open with trees reaching 15 to 20 m. The presence of this type of forests in high elevation is mainly due to the aspect, low rainfall and frequent fires. These forests receive less rainfall (<1000 mm) and the temperature is very high (25^0-40^0C) with low atmospheric humidity (30-60%). The principal species in this type of forest are *Acacia leucophloea, Anogeissus latifolia, Bauhinia* sp., *Chloroxylon swietenia, Cleistanthus collinus, Grewia tilaefolia, Pavetta indica, Pterocarpus marsupim, Radermachera xylocarpa, Santalum album, Tectona grandis,* etc. The lower storey is comprised of *Cycas circinalis, Holarrhena pubescens, Lantana camera, Wrightia tinctoria,* etc. *Dioscorea* sp. and *Ichnocarpus frutescens* are the common climbers. Many annual herbs make their appearance during rainy season. The total extent of this type of forests is about 100 km^2 which constitutes about 1 per cent of the total forest cover of the State.

7. Grasslands

Grasslands are considered to be the retrogression stage of the woodlands due to the action of regular annual fires which destroy the tree growth. In the higher elevation, the grasslands in many areas are in the progressive seral stages. The total extent is about 130 km^2 *i.e.* about 1.4 per cent of the total forest cover in the State. Depending upon the type of growth and distribution, the grasslands are classified into low level and high level grasslands. The low level grasslands are distributed within the wet

evergreen forests in areas like Silent Valley, Munnar, Wayanad, etc. The regular annual fires and excessive grazing prevent these grasslands from progressing towards woodlands. The main floristic composition of this type is *Allophylus serratus, Breynea vitis-idaea, Careya arborea, Canthium dicoccum, Dalbergia latifolia, Emblica officianalis, Gordonia obtuse, Phoenix humilis, Rubus ellipticus, Wendlandia thirsoidea, Zizyphus rugosa,* etc. and herbs like *Commelina, Curculigo, Oxalis, Polygala, Tridax,* etc. and grasses like *Cymbopogon, Heteropogon, Themeda*, etc. The tree species, most of them are pyro-resistant make their appearance in these grasslands giving the appearance of a savanna.

High level grasslands are found in the upper reaches of Silent valley, Attapady, Goodrical, Munnar, etc. above 1500 m a.s.l. This areas receive high rainfall and exposed to heavy winds. The grasslands are interspersed with patches of forests called shola (montane temperate forests) and subtropical hill forests. The important tree species are *Gaultheria fragrantissima, Rhododendron nilagiricum*, grasses like *Arundinella fuscata, Botriochloa pertusa, Heteropogon contortus* and many herbs.

8. Forest plantations

Forest plantations are man-made forests by reforesting different types of natural forests. Plantations of different forestry species have been raised throughout the State. *Tectona grandis, Eucalyptus tereticornis, Eucalyptus grandis, Eucalyptus regnans, Eucalyptus globulus, Bombax ceiba, Ceiba pentandra, Ailanthes triphysa, Gmelina arborea, Hevea brazilensis, Elaeis guineensis, Acacia auriculiformis, Acacia mangium, Acacia mearnsii, Swietenia macrophylla*, etc. A total of 1, 63 555 ha area in different forest types has been converted into plantations.

Macrofungal sampling

Opportunistic sampling of macrofungi

Opportunistic sampling was done by carefully walking through the selected study areas in different forest ecosystems *viz.*, West coast tropical evergreen forests (evergreen forests), West coast tropical semi-evergreen forests (Semi-evergreen forests), South Indian moist deciduous forests (moist-deciduous forests), Southern subtropical broadleaved hill forests, Southern montane wet temperate forests (Shola forests), Southern tropical dry deciduous forests (Dry deciduous forests), Grasslands and Forest plantations and collecting conspicuous sporocarps, from as many habitats in the areas as possible. Sampling was carried out during pre- and post-monsoon periods of both South-West monsoon and North-East monsoon. Although this technique does not yield quantitative data, it is an important adjunct to the plot-based quantitative methods. Additional collection of macrofungi was also made from "off plots". Thus, a combination of opportunistic and plot-based sampling was carried out to maximize the documentation of the macrofungal diversity at a site.

Fixed-size plots sampling

Sample plots (3 Nos.) of 100 x 100 m in four locations viz., Nilambur (Moist-deciduous forests) and Iringole (Semievergreen forests), Nelliampathy (Evergreen forests), Mannavan shola (Shola forest) were selected by following line transect

sampling method. The sample plots were visited during pre-monsoon (December-May), monsoon and post-monsoon periods (June-November) frequently for documentation of the macrofungi. These activities include: collecting sporocarps at the field site, labelling them, taking photographs, chemical spot tests, setting up spore-prints, recording the macro-morphological data in the Illustrated Data Sheet, writing morphological descriptions, details on substratum, and processing the specimens for recording microscopic characters and identification of the specimens up to species level. Quantitative data on macrofungi were also recorded the sample plots periodically for biodiversity analyses.

Data sheet

An Illustrated Data Sheets (IDS) for recording the morphological and microscopic characteristics of the specimens were prepared (A4 sheet) for Polypores, Agarics and Ascomycetes separately incorporating line drawings on various characteristics of pileus (shape, size, colour, surface ornamentation), stipe (shape, size, surface characteristics), gill attachment, lamellae, lamellulae, annulus, volva, etc. Most of the characteristic were recorded in the field during the collection. Filled in IDS for each specimen was kept as record along with spore-print slide and processed specimen for further microscopic details.

Protocols for sampling macrofungi

A reconnaissance survey was carried out to assess the fungal fructification production in different types of forests in the Western Ghats during pre-monsoon period. Representative areas in each forest type (moist deciduous, semi-evergreen, evergreen, wet evergreen, shola forests, grasslands, deciduous forests, forest plantations), were selected in each Forest Circles (Northern, Central, Southern and High Ranges). Macrofungal collection trips were planned and organized.

Macrofungal collection

For many taxa it is important to have data on all stages of sporocarp development. Thus, sporocarps exhibiting a range of developmental stages for each taxon were collected as far as possible. Specimens were photographed and removed from the substratum by excavating around the base of the stipe to reveal any volva, rooting base, bulb, or attachment to a sclerotium or buried substrata, e.g. wood, fruits, other fungi and insects/animals). If the specimen was on wood or litter, including some parts of the substratum were collected for facilitating its identification. Digging into the substratum was made to collect the underground specimens and rhizomorphs.

Documentation

As fleshy fungi are particularly difficult to work with because the fruiting bodies dry or decompose rapidly, thus characteristics needed for identification often lost; many macro-morphological features such as shape and colour of sporocarps are lost with preservation. An Illustrated Data Sheets (IDS) for recording the morphological and microscopic characteristics of the specimens were prepared (A4 sheet) for Polypores, Agarics and Ascomycetes separately incorporating line drawings on various characteristics of pileus (shape, size, colour, surface ornamentation), stipe (shape, size, surface characteristics), gill attachment, lamellae, lamellulae, annulus, volva, etc.

Most of the characteristic were recorded in the field during the collection. Specimen documentation includes details on cultures (only for potential species), data on chemical tests, photographs, spore-prints, and written descriptions. Field labels were provided to each specimen. As all taxa or specimens require equal documentation, specimens were put into priority order by taxon; within each taxon they are processed in order according to condition of the specimens (best to poorest), which provides the most accurate and efficient documentation of diversity. Filled in IDS for each specimen was kept as record along with spore-print slide and processed specimen for further microscopic details.

Colour photographs

Colour photographs (digital images taken with 8 megapixel digital camera) of sporocarps were taken in the field and also of specimens brought to the laboratory. Specimens were photographed on neutral grey or natural background in a way that illustrates important diagnostic features of the sporocarps and allow easy comparison of features.

Macromorphological features

Descriptions of macromorphological characteristics (e.g., colour, shape, size, odour, surface ornamentation, texture, etc.) of sporocarps are among the most critical data for identification of agarics, boletes and other macrofungi. These were recorded on a Illustrated Data sheet. Accurate and consistent notation of sporocarp colour, including colour changes of mature sporocarps was also recorded. The colour guide by Kornerup and Wanscher (1978) was used in the study.

Spore print

Spore deposits were prepared on microscopic slides to determine the spore print colour. Spore deposits were obtained by placing a small portion of the fruiting body with hymenial surface touching the glass slide. In the case of agarics, cap was removed from the stipe and placed on a clean slide. The setups were placed in a humidity chamber for 6 to 12 h. The colour of the spore print was noticed immediately.

Processing of specimens

Most agarics and other fleshy fungi require a heat source for drying; large agarics and boletes were split in half or quartered from top to bottom before placed in a dryer. For most polypores and ascomycetes, air drying is preferable, because, the fungus is not killed but merely goes dormant. These specimens subsequently can be used for preparing cultures. For the first few months of the study, oven-drying of the specimens was done. Later, freshly collected specimens were kept in open dish/tray at 5 ^{0}C for 5-7 days and this method was found most desirable for preserving the important micro-characteristics of the specimens. After proper air drying/oven drying the specimens were stored in polythene zip-cover.

Culturing macrofungi

Cultures are often helpful in distinguishing similar taxa and identifying them to species. Cultures are especially important for some groups of Ascomycetes in which

the anamorph is required for accurate species identification. Cultures of macrofungi were prepared from tissues or from germinated basidiospores or ascospores. Cultures of ectomycorrhizal fungi like *Laccaria, Pisolithus, Scleroderma* and potential edible and medicinal mushrooms (*Ganoderma, Laetiporus, Macrocybe, Pleurotus, Lentinus,* etc.) were prepared on Malt extract agar, Oatmeal agar and Potato dextrose agar medium.

Micromorphological features

Sections of the tissues from different parts of the basidiomes were cut by hand or Cryostat Microtome and observed under Research Microscope. Different stains including Melzer's reagent, Phloxin, Cresil blue, Aniline blue, etc. were used and micro-morphological features of the fungus, including hyphal system, size, colour, hymenium (fertile layer – basidia and cheilocystidia, pleurocystidia) and pileipellis or periderm (cap cuticle), hymenial trama, caulocystidia, veil remnants, pileus, stipe trama, spore wall structure and spore ornamentation, size, shape, inclusions, etc. were recorded. Line drawings of fungal structure were made by using Phototube of the Microscope. Digital photographs of the fungal structures were also made.

Colours and chemical reactions

Chemical colour reactions or spot tests have been used for identification of boletes as well as other macrofungi. Colours and chemical reactions of tissues and spores in water, KOH, Melzer's reagent, etc. were studied and used for identification of the taxa.

RESULTS AND DISCUSSION

Diversity of Macrofungi

The Kerala part of the Western Ghats is endowed with a remarkably rich macrofungal flora. A total of 550 species of macrofungi belonging to 166 genera falling in 51 families of Basidiomycota and Ascomycota were encountered in different forest ecosystems of the State. Each forest ecosystem supports unique assemblage of macrofungal communities and their occurrence, abundance and species composition, depend largely on the prevailing microclimatic conditions and level of anthropogenic disturbances. Among the forest ecosystems studied, moist-deciduous and semi-evergreen forests support maximum number of macrofungi, followed by evergreen and shola forests (Table 1). The grassland ecosystem supports only a few macromycetes, while Myristica swamp forests harbour an array of different groups of macrofungi. Macrofungal species assemblage, species abundance and frequency are very characteristic in the shola forests. Among the macrofungi encountered, terricolous, lignicolous and humicolous form the major groups, while coprophilous or macrofungi inhabiting on dung of herbivores are the insignificant group (Table 2).

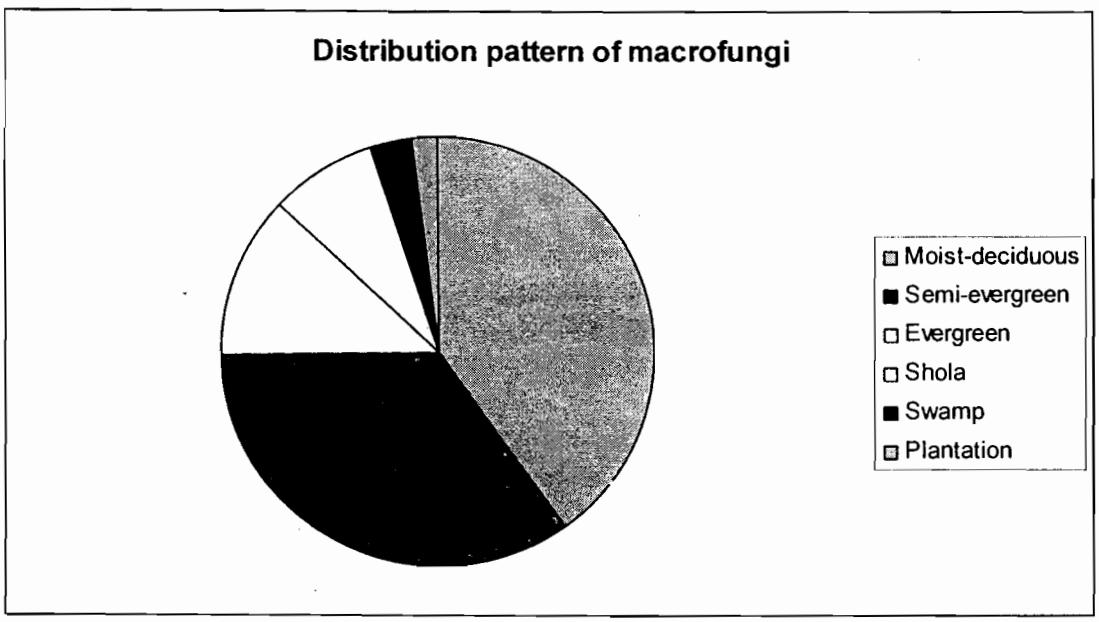
Table 1: Details on macrofungal specimens collected from different substrata and forest ecosystems

Forest ecosystem	No. of specimens collected from different substrata						Total
	soil	wood	humus	Termite mount/nest	dung	insect	
Moist-deciduous	864	567	112	45	8	2	1598
Semi-evergreen	695	545	131	10	11	1	1393
Evergreen	218	235	24	2	4	-	483
Shola forests	120	185	12	-	5	-	322
Swamp forests	37	65	10	1	4	-	117
Forest plantation	32	36	6	6	1	2	83
Grand total	1966	1633	295	64	34	5	3997

Table 2: Details on different groups of macrofungi

Macrofungi	Total No. of collections made	Per cent to total accession
Terricolous (soil including termite mount/nest)	2030	50.78
Lignicolous (wood)	1633	40.85
Humicolous (humus)	295	7.38
Coprophilous (dung)	34	0.85
Total	3997	

Figure 1. Distribution pattern of macrofungi in different forest ecosystems in the Western Ghats



Of the 550 macrofungal species encountered in different forest ecosystems, members belonging to Agaricaceae, Amanitaceae, Boletaceae, Entolomataceae, Hygrophoraceae, Inocybaceae, Lyophyllaceae, Marasmiaceae, Pluteaceae and Tricholomataceae are the major players in ecosystem functioning. In the family Agaricaceae, 10 genera and 53 species were recorded. *Agaricus* (11 species: *Agaricus caribaeus, A. crocopeplus, A. endoxanthus, A. fiardii, A. griseorimosus, A. johnstonii, A. magnivelaris, A. ochraceosquamulosus, A. silvaticus, A. simulans, A. volvatulus*), *Chlorophyllum* (2 species: *Chlorophyllum molybdites, C. rhacodes*), *Clarkeinda trachodes*, *Coprinus* (5 species: *Coprinopsis fibrillose, C. plicatilis var. plicatilis, C. comatus, C. disseminatus var. disseminatus*), *Cystolepiota* sp., *Lepiota* (20 species: *Lepiota* (20 species : *Lepiota alopochroa, L. citrophylla, L. clypeolaria, L. erythrogramma, L. erythrosticta, L. flagellate, L. guatopoensis, L. phlyctaenodes, L. lepidophora, L. leprica, L. metabola, L. metulispora, L. phlyctaenodes, L. plumbicolor, L. pyrrhaes, L. spongodes, L. thrombophora, L. viridiflava, L. viriditincta, L. xanthophylla*), *Leucocoprinus* (8 species: *Leucocoprinus birnbaumii, L. brebissonii, L. cepistipes,L. caldariorum, L. fragilissimus, L. holospilotus, L. squamulosus, L. zeylanicus*), *Leucoagaicus* (3 species; *Leucoagaricus americanus, L. leucothites, L. rubrotinctus*), *Macrolepiota* (2 species: *Macrolepiota procera, M. dolichaula*), *Micropsalliota pleurocystidiata* are the significant genera and are widely distributed in moist-deciduous to evergreen forests. In the family Amanitaceae, *Amanita* (10 species; *A. angustilamellata, A. aureofloccosa, A. bisporigera,A. ceciliae, A. elata, A. griseofarinosa, A. hemibapha, A. muscaria, A. porphyria, Amanita* sp. 1) and *Limacella guttata* have been recorded.

In Boletaceae, 16 species belonging to 6 genera viz., *Austroboletus* (*A.gracilis* var. *laevipes*), *Boletus* (8 species: *Boletus alutaceus* var. *subalutaceus, B. edulis, B. edulis* subsp. *clavipes, B. hongoi, B. huronensis, B. pallidus, B. patriciae, B. reticulates*), *Leccinum* (2 species: *Leccinum scabrum, L. scabrum*), *Rubinoboletus* (1 species), *Strobilomyces* (3 species: *Strobilomyces annulatus, S. mollis, S. strobilaceus*), Tylopilus (*T.alboater*) were encountered. Members of this family form ectomycorrhizal association with trees and are distributed in moist-deciduous forest to evergreen forests.

In Entolomataceae, 28 species of *Entoloma* (*E. albidoquadratum, E. allocybesimilis,E. anamikum, E. brihadum, E. brunneoquadratum,E. calliviolaceum, E. flavidum, E. gnaphalodes, E. griseolazulinum, E. griseoviolascens, E. haematinum, E. hyalodepas, E. indoviolaceum, E. keralense, E. lomapadum, E. mridulum,E. niranjanum, E. nirupamum, E. perflavidum, E. perinfundibuliforme, E. pervelutinum, E. proprium, E. rugosopruinatum, E. serrulatum, E. shwethum, E. tectonicola, E. theekshnagandhum, E. vanajum*) and 2 species of *Rhodocybe* (*R. caelatoidea, R. retroflexa*) were recorded from moist-deciduous to evergreen and shola forests.

In Hygrophoraceae, 23 species of *Hygrocybe* (*Hygrocybe acutoconica* var. *acutoconica, H. alwisii, H. anisa, H.apala* var. *indica, H. astatogala, H. aurantioalba, H. aurantiocephala, H. brunneosquamulosa, H. cantharellus, H. cinerascens, H. cuspidate, H. deceptiva, H. diversicolor, H. firma, H. gregaria, H. keralensis, H. mexicana, H. nivosa* var. *nivosa, H. nivosa* var. *pallidolutea, H. ortoniana, H. parvula, H. pratensis, H. smaragdina*) and 1 species of *Camarophyllus*

(*C.umbrinus*) were recorded from different forest ecosystems. Most of them are terricolous and a few are humicolous and litter decomposers.

In Inocybaceae a total of 11 species of *Inocybe* (*I. antillana, I. crassicystidiata, I. cutifracta, I. ianthinofolia, I. ingae, I. lasseri, I. petchii, I. purpureoflavida, I. squamata, I. viridiumbonata, I. virosa*) and one species of *Pleuroflammula* (P. flavomarginata) were recorded. These include both poisonous and edible species. Most of the Inocybe species form ectomycorrhizal association with native tree species.

In Lyophyllaceae, *Calocybe* (*C. cyanocephala*) and *Termitomyces* (13 species: *Termitomyces clypeatus, T. eurhizus, T. globules, T. le-testui, T. mammiformis, T. microcarpus, T. microcarpus f. longipus, T. robustus, T. schimperi, T. striatus, T. subcervinus, T. tylerianus, T. umkowaan,*) were encountered. Species of *Termitomyces,* the highly preferred edible macrofungi, were found widely distributed in deciduous to semi-evergreen forests and highly degraded forest stands.

In the family Marasmiaceae, a total of 27 species belonging to 12 genera viz., *Calyptella* capula, *Campanella pustulata, Gerronema tenue, Gymnopus dryophilus, Hydropus* (2 species), *Lactocollybia epia*, , *Marasmiellus* (3 species: *Marasmiellus ignobilis, M.stenophyllus, M. subaurantiacus*), *Marasmius* (12 species: *Marasmius atrorubens, M. confertus, M. corrugatiformis, M. elaeocephalus, M. florideus, M. haematocephalus, M. hakgalensis, M. hypochroides, M. kisangensis, M. leveilleanus M. rigidichorda, M. spegazzinii*), *Megacollybia platyphylla, Omphalotus olearius, Tetrapyrgos nigripes*, *Trogia* (2 species: *Trogia cantharelloides, T. infundibuliformis*) were recorded. Most of them are primary colonizers and litter decomposers. In Mycenaceae, *Favolaschia* (*Favolaschia thwaitesii, F. tonkinensis*), *Filoboletus* (Filoboletus manipularis), *Mycena* (*Mycena auroricolor, M.pura*) and *Xeromphalina* (*Xeromphalina tenuipes*) were encountered.

In the family Pluteaceae, 14 species of *Pluteus* (*P. aeolus, P. aglaeotheles, P. atromarginatus, P. conizatus, P. escharites, P. fastigiatus, P. fusconigricans, P. glyphidiatus, P. haywardii, P. pelinus, P. podospileus, P. pulverulentus, P. subcervinus, P. salicinus*) and 7 species of *Volvariella* (*V. cubensis, V. glandiformis, V. nigrodisca, V. pseudovolvacea, V.gloiocephala, V. taylorii, V. volvacea*) were recorded from different forest ecosystems.

In Russulaceae 2 species of *Lactarius* (*L. ignifluus, L. nebulosus*) and 13 species of *Russula* (*R. aciculocystis, R. adusta, R. atropurpurea, R.cinerella, R.congoana, R. delicula, R. hygrophytica, R. leelavathyi, R. luteotacta, R. mariae, R. martinica, R. michiganensis, R. periglypta*) were recorded from different forest ecosystems. In Suilaceae, 3 species of *Suillus* (*S. brevipes, S. Suillus placidus, S. tomentosus*) were recorded. In hydnangiaceae 4 species of *Laccaria*, viz. *Laccaria amethystine, L. fraternal, L. laccata, L. ohiensis* were recorded. All the four species form ectomycorrhizal association with eucalypts, pine and other native trees.

In Tricholomataceae, a total of 20 species belonging to 6 genera viz. *Clitocybe* (2 species: *C.dealbata, C. minuta*), *Collybia* (9 species: *Collybia aurea, C. bakeri, C. coracicolor, C. chrysoropha, C. leucophaea, C. multijuga, C. rufipicta, C. sublaccata, C. syringea*), *Lepista* (2 species: *L. hyalodes, L.sordida*), *Macrocybe* (2 species: *M.*

lobayensis, M. pachymeres), *Tricholoma* (3 species: *T. ceriniceps, T. rimosoides, T. subrimosum*), *Tricholomopsis* (2 species: *Tricholomopsis crocobapha, T. tropica*) were recorded from different forest ecosystems. Most of them are edible.

In the family Boletaceae, 6 genera and 15 species were recorded. *Bolbitius* (2 species: *B. fissus, B. titubans*), *Conocybe* (6 species: *Conocybe crispa, C. ochracea, C. pubescens, C. rickenii, C. tenera, C. zeylanica*), *Copelandia* (*C. wayanadensis*), *Panaeolus* (4 species: *Panaeolus antillarum, P. cyanescens, P. acuminatus* var. *rickenii, P. subbalteatus*), *Panaeolina* (*P. foenisecii*), *Pholiotina* (*P. indica*) were recorded.

In Crepidotaceae, 9 species of *Crepidotus* (*Crepidotus calolepis, C.citrinus, C. cystidiosus, C. epicrocinus, C. grumosopilosus, C. melleus, C. nephrodes, C. reverses, C. uber*) were recorded from different forest ecosystems. In Psathyrellaceae, *Cystoagaricus* (*C. trisulphuratus*) and 7 species of *Psathyrella* (*Psathyrella candolleana, P.candolleana var. condolliana, P. lithocarpi, P. lucipeta, Psathyrella efflorescens, P. trechispora, P. myceniformis*) were recorded from different forest ecosystems.

In Physalacreaceae, 5 genera and 9 species were encountered. *Armillaria mellea, Cyptotrama asprata, C. lachnocephalum, Gloiocephala resinopunctata, Oudemansiella canarii, Xerula furfuraceae, X. megalospora, X. radicata rubrobrunnescens* were recorded. Species of *Oudemanseiella* and *Xerula* are edible. In Strphariaceae, altogether 30 species belonging to 7 genera were encountered in different forest ecosystems. Agrocybe (3 species: *Agrocybe pediades, A. retigera, A. wayanadensis*), *Galerina* (1 species: *Galerina vittiformis*), *Gymnopilus* (10 species: *Gymnopilus bryophilus, G. crocias, G. chrysopellus, G. dilepis, G. hispidellus, G. lateritius, G. junonius, G. subbellulus, G. terricola, G. zenkeri*), *Hypholoma* (2 species: *Hypholoma subviride, H. trinitense*), *Pholiota* (2 species: *Pholiota gregariiformis, P. squarrose*), *Psilocybe* (10 species: *Psilocybe argentina, P. aztecorum, P. cubensis, P. inquilina, P. pegleriana, P. plutonia, P. samuiensis, P. subcubensis, P. squarrosipes, P. wayanadensis*) and *Stropharia* (*S. semiglobata*) were recorded from different forest ecosystems. Species of *Galerina* and *Gymnopilus* are toxic, while species of *Psilocybe, P. cubensis* and *P. subcubensis* are hallucinogenic.

Among the lignicolous edible macrofungi, in the family Pleurotaceae, 2 genera and 8 species were recorded: Hohenbuehelia (3 species: Hohenbuehelia aurantiocystis, H. petaloides, H. testudo) and Pleurotus (5 species: Pleurotus citrinopileatus, P. djamor, P. flabellatus, P. ostreatus, P. eöus). In Auriculariaceae, 3 species of Auricularia viz., Auricularia auricula-judae, A. polytricha, A. mesenterica, were recorded.

In the family Clavariaceae, *Clavaria* (*C. zollingeri*), *Clavulinopsis* (6 species : *Clavulinopsis aurantiocinnabarina, C. corniculata, C. dichotoma, C. fusiformis, C. laeticolor,C. luteoalba*), *Ramariopsis* (2 species: *Ramariopsis kunzei, R. pulchella*) were encountered.

In Dacrymycetace, 2 species of *Calocera,* (*Calocera viscose, C.cornea*) , and 2 species of *Dacryopinax* (*D. elegans, D. spathularia*) were recorded from different forest ecosystems. In Tremellaceae, 3 species of *Tremella* (*T. foliacea, T.*

mesenterica, T. reticulata) were recorded. In Astraeaceae, Astraeus hygrometricus and in Nidulariaceae, *Cyathus striatus* were recorded.

In Lycoperdaceae 8 species of *Lycoperdon* (*Lycoperdon decipiens, L. echinatum, L.excipuliforme, L. lividum, L. nigrescens, L. perlatum, L. pyriforme, L. utriforme*) and in Sclerrodermataceae 1 species of *Pisolithus* (*P. albus*) and 5 species of Scleroderma (*Scleroderma areolatum, S. bovista, S.citrinum, S. verrucosum, S.polyrhizum*) were recorded. In Geatraceae 5 species of *Geastrum* (*Geastrum elegans, G. quadrifidum, G. rufescens, G. saccatum, G.triplex*) were encountered.

Members of Phallaceae belong to Phallales are the most colourful and attractive macrofungi and the significant members encountered include: Aseroe rubra var. zylanica, Clathrus archeri, C. pusillus, Ileodictyona gracile, Dictyophora cinnabarina, Lysurus wayanadensis, Mutinus caninus, Phallus anamudii, P. indusiatus. These rare comparatively rare groups of macrofungi were recorded from semi-evergreen, evergreen and shola forests.

Macromycetes belong to Cantharellaceae (*Cantharellus cibarius, Cantharellus lateritus and C. minor*), Hydnaceae (*Hydnum rufescens*, *Hydnum* spl.), Gomphaceae (*Gomphus clavatus; Ramaria*: *R. apiculata, R. cokeri, R. eumorpha, R. flava, R.gracilis, R. formosa, R.pallida, R.versatilis*), Boletinellaceae (*Boletinellus meruloides*; *Phlebopus portentosus*), Cortinariaceae (*Anamika indica, Cortinarius pholideus, Cortinarius* sp.), Gyroporaceae (*Gyroporus castaneus*) are of restricted distribution. *Cantharellus cibarius*, the most widely exploited edible ectomycorrhizal fungi occurs in semi-evergreen and evergreen forests, associated with a range of native host plants.

Wood inhabiting macrofungi are the major component of the forest ecosystem and play a vital role in the ecosystem dynamics. These include mostly the bracket fungi and 114 species belonging to 48 genera under 7 families were encountered in different forest ecosystems of the State. In the family Fomitopsidaceae, 7 genera viz. *Antrodia* (*A. albida, A. serialis*) , *Daedalea* (3 species: *D. flavida, D.dochmia, D. sulcata*), *Fomitella* (*F. rhodophaea*), *Fomitopsis* (3 species: *F. feei, Fomitopsis* sp. I, *Fomitopsis* sp.2), *Laetiporus* (*L. sulphurous*), *Postia* (*P. pelliculosa*) were recorded.

In Ganodermataceae, 3 species of *Amauroderma* (*A. conjunctum, A. fuscoporia, A. rugosum*) and 3 species of *Ganoderma* (*G. applanatum, G. colossus, G. lucidum*).

In Hymenochaetaceae 29 species belonging to 8 genera viz., *Aurificaria* (*A. indica*), *Coltricia* (*C.cinnamomea, Coltricia* sp.), *Cyclomyces* (*C. setiporus*), *Fuscoporia* (*F. senex*), *Hymenochaete* (*H. rubiginosa*), *Inonotus* (6 species: *Inonotus tabacinus, I. nothofagi, I. patouillardii, Inonotus* sp. 1, *Inonotus* sp. 2, *Inonotus* sp. 3), *Phellinus* (15 species: *Phellinus adamantinus, P. durissimus, P. fastuosus, P. ferreus, P. ferruginosus, P. gilvus, P. grenadensis, P. hoehnelii, P. pachyphloeus, P. punctatiformis, P. punctatus, P. rhytiphloeus, P. rimosus, P. robiniae, P. wahlbergii*), Pseudochaete (*P. tabacina*) were encountered from different forest ecosystems.

In Meripilaceae 2 species of *Rigidoporus* viz., *Rigidoporus microporus* and *R. ulmarius* were recorded. In the family Meruliaceae *Bjerkandera adusta, Flaviporus minutisporus, Flavodon flavus, Gloeoporus thelephoroides, Irpex lacteus,*

Podoscypha venustula were recorded. In the family Stereaceae, *Stereum hirsutum* was recorded.

In the family Polyporaceae a total of 57 species belonging to 23 genera were recorded. Cinereomyces lindbladii, *Coriolopsis* (2 species: *Coriolopsis caperata, C. occidentalis*), *Dichomitus* sp., *Earliella scabrosa, Echinochaete ruficeps, Favolus tenuiculus, Fomes pseudosenex, Hexagonia* (2 species: *Hexagonia apiaria, H. tenuis*), *Lentinus* (9 species: *Lentinus bambusoides, L. dicholamellatus, L. giganteus, L. patulus, L. polychrous, L. sajor-caju, L. strigosus, L. squarrosulus, L. tigrinus*), Panus (2 species: *Panus conchatus, P. similes, P. similes*), *Lenzites* (3 species: *Lenzites betulina, L. elegans, L. vespacea*).

Two species of *Microporellus* (*Microporellus obovatus, M. violaceocinerascens*), *Microporus* (3 species: *Microporus affinis, M. vernicipes, M. xanthopus*), *Navisporus floccosus*, *Nigroporus* (2 species: *Nigroporus durus, N. vinosus*), *Oxyporus cervinogilvus, Perenniporia ochroleuca, Polyporus* (12 species: *Polyporus alveolaris, P. arcularius, P.dictyopus, P. leptocephalus, P. grammocephalus, P. leprieurii, P. melanopus, P. squamosus, P. tricholoma, P. virgatus, P. rugulosus, Polyporus* sp.), *Pycnoporus sanguineus, Pyrofomes albomarginatus, Royoporus spathulatus, Trametes* (7 species: *Trametes cingulata, T. cotonea, T. maxima, T. modesta, T. pubescens, T. versicolor, T. villosa*), and *Trichaptum biforme* were recorded from different forest ecosystems.

Macromycetes belonging to Ascomycota are comparatively less represented in the forests. *Bulgaria indica* (Bulgariaceae), *Aleuria aurantia, A.rubra, Sowerbyella rhenana, Scutellinia setosa* (Pyrenomycetaceae), *Cookeina indica, C. speciosa, C. tricholoma, Sarcoscypha occidentalis* (Sarcoscyphaceae), *Daldinia concentrica* and *Xylaria escharoidea, X. hypoxylon, X. longipes, X. nigripes, X. poiteani, X. polymorpha X. symplocosii* (Xylariaceae) were encountered in different forest ecosystems. Species of *Cookeina* and *Sarcoscypha* are widely distributed in semi-evergreen, evergreen and shoal forests and are the primary colonizers of decaying forest litter.

Most saprophytic macrofungal species exhibit definite patterns of distribution in different forest ecosystems which are highly influenced by the environmental factors, mainly rainfall and atmospheric humidity. Also, occurrence, abundance, species richness are largely depended on the nature of humus/litter load and their level of decomposition or deterioration. Erratic rainfall, large-scale removal of forest litter and humus from the forest floor and other human interventions are adversely affecting the diversity of terricolous, lignicolous and humicolous macrofungi, especially in the moist-deciduous and semi-evergreen forests.

Occurrence and distribution pattern of ectomycorrhizal macrofungi in different forest ecosystems depend largely on the distribution of host plant species, irrespective of the ecosystem specific environmental gradients.

A large number of species of ectomycorrhizal macrofungi like *Amanita, Astroboletus, Boletus, Laccaria, Lactarius, Pisolithus, Russula, Suillus*, among others, possibly introduced along with their host plants seem to be naturalized in the State and

invading into the natural forests, harbouring the native tree species and widening their mutualistic relationships.

Table 3: Macrofungi recorded from the Kerala State

Sl. No.	Family	Genera	Species
1.	**Agaricaceae**	**Agaricus**	*Agaricus caribaeus, A. crocopeplus, A. endoxanthus, A. fiardii, A. griseorimosus, A. johnstonii, A. magnivelaris, A. ochraceosquamulosus, A. silvaticus, A. simulans, A. volvatulus*
		Chlorophyllum	*Chlorophyllum molybdites, C. rhacodes*
		Clarkeinda	*Clarkeinda trachodes*
		Coprinus	*Coprinopsis fibrillose, C. plicatilis var. plicatilis, C. comatus, C. disseminatus var. disseminatus*
		Cystolepiota	*Cystolepiota* sp.
		Lepiota	*Lepiota alopochroa, L. citrophylla, L. clypeolaria, L. erythrogramma, L. erythrosticta, L. flagellate L. guatopoensis, L. phlyctaenodes, L. lepidophora L. leprica, L. metabola, L. metulispora, L. phlyctaenodes, L. plumbicolor, L. pyrrhaes, L. spongodes, L. thrombophora, L. viridiflava, L. viriditincta, L. xanthophylla*
		Leucoagaricus	*Leucoagaricus americanus, L. leucothites, L. rubrotinctus*
		Leucocoprinus	*Leucocoprinus birnbaumii, L. brebissonii, L. cepistipes, L. caldariorum, L. fragilissimus, L. holospilotus, L. squamulosus, L. zeylanicus*
		Macrolepiota	*Macrolepiota procera, M. dolichaula*
		Micropsalliota	*Micropsalliota pleurocystidiata*
2.	**Amanitaceae**	**Amanita**	*A. angustilamellata, A. aureofloccosa, A. bisporigera, A. ceciliae, A. elata, A. griseofarinosa, A. hemibapha A. muscaria, A. porphyria, Amanita sp. 1*
		Limacella	*Limacella guttata*
3.	**Astraeaceae**	**Astraeus**	*Astraeus hygrometricus*
4.	**Auriculariaceae**	**Auricularia**	*Auricularia auricula-judae, A. polytricha, A. mesenterica*
5.	**Bolbitiaceae**	**Bolbitius**	*Bolbitius fissus, B. titubans*
		Conocybe	*Conocybe crispa, C. ochracea, C. pubescens, C. rickenii, C. tenera, C. zeylanica*
		Copelandia	Copelandia wayanadensis

		Panaeolus	*Panaeolus antillarum, P. cyanescens, P. acuminatus* var. *rickenii, P. subbalteatus*
		Panaeolina	*Panaeolina foenisecii*
		Pholiotina	*Pholiotina indica*
6.	**Boletaceae**	**Austroboletus**	*Austroboletus gracilis var. laevipes*
		Boletus	*Boletus alutaceus var. subalutaceus, B. edulis, B. edulis subsp. Clavipes, B. hongoi, B. huronensis, B. pallidus, B. patriciae, B. reticulates*
		Leccinum	*Leccinum scabrum, L. scabrum*
		Rubinoboletus	*Rubinoboletus caespitosus*
		Strobilomyces	*Strobilomyces annulatus, S. mollis, S. strobilaceus*
		Tylopilus	*Tylopilus alboater*
7.	**Boletinellaceae**	**Boletinellus**	*Boletinellus merulioides*
		Phlebopus	*Phlebopus portentosus*
8.	**Bondarzewiaceae**	**Amylosporus**	*Amylosporus campbellii*
9.	**Bulgariaceae**	**Bulgaria**	*Bulgaria indica*
10	**Cantharellaceae**	**Cantharellus**	*Cantharellus cibarius, C. lateritus, C. minor*
11	**Clavariaceae**	**Clavaria**	*Clavaria zollingeri*
		Clavulinopsis	*Clavulinopsis aurantiocinnabarina, C. corniculata, C. dichotoma, C. fusiformis, C. laeticolor,C. luteoalba*
		Ramariopsis	*Ramariopsis kunzei, R. pulchella*
12	**Clavulinaceae**	**Clavulina**	*Clavulina cristata, C. rugosa*
13	**Cortinariacea**	**Anamika**	*Anamika indica*
		Cortinarius	*Cortinarius pholideus, Cortinarius sp.*
14	**Crepidotaceae**	**Crepidotus**	*Crepidotus calolepis, C.citrinus, C. cystidiosus C. epicrocinus, C. grumosopilosus, C. melleus C. nephrodes, C. reverses, C. uber*
15	**Dacrymycetacea**	**Calocera**	Calocera viscose, Calocera cornea,
		Dacryopinax	Dacryopinax elegans, D. spathularia

16	**Entolomatacea**	**Entoloma**	*Entoloma albidoquadratum, E. allocybesimilis E. anamikum, E. brihadum, E. brunneoquadratum E. calliviolaceum, E. flavidum, E. gnaphalodes E. griseolazulinum, E. griseoviolascens, E. haematinum, E. hyalodepas, E. indoviolaceum E. keralense, E. lomapadum, E. mridulum, E. niranjanum, E. nirupamum, E. perflavidum E. perinfundibuliformе, E. pervelutinum E. proprium, E. rugosopruinatum, E. serrulatum E. shwethum, E. tectonicola, E. theekshnagandhum E. vanajum*
17	**Fomitopsidaceae**	**Rhodocybe**	*Rhodocybe caelatoidea, R. retroflexa*
		Antrodia	*Antrodia albida, A. serialis*
		Daedalea	*Daedalea flavida, D.dochmia, D. sulcata*
		Fomitella	*Fomitella rhodophaea*
		Fomitopsis	*F. feei, Fomitopsis sp. I, Fomitopsis sp.2*
		Laetiporus	*Laetiporus sulphureus*
18	**Ganodermataceae**	**Postia**	*Postia pelliculosa*
		Amauroderma	*Amauroderma conjunctum, A. fuscoporia, A. rugosum*
		Ganoderma	*Ganoderma applanatum, G. colossus, G. lucidum*
19	**Geastraceae**	**Geastrum**	*Geastrum elegans, G. quadrifidum, G. rufescens, G. saccatum, G.triplex*
20	**Gomphaceae**	**Gomphus**	*G. clavatus*
21	**Gyroporaceae**	**Ramaria**	*Ramaria apiculata, R. cokeri, R. eumorpha, R. flava R.gracilis, R. Formosa, R.pallida, R.versatilis*
		Gyroporus	*Gyroporus castaneus*
22	**Hydnaceae**	**Hydnum**	*Hydnum rufescens, Hydnum sp1.*
23	**Hydnangiaceae**	**Laccaria**	*Laccaria amethystine, L. fraternal, L. laccata, L. ohiensis*
24	**Hygrophoraceae**	**Camarophyllus**	*Camarophyllus umbrinus*

		Hygrocybe	*Hygrocybe acutoconica var. acutoconica, H. alwisii, H. anisa, H.apala var. indica, H. astatogala H. aurantioalba, H. aurantiocephala, H. brunneosquamulosa, H. cantharellus, H. cinerascens, H. cuspidate, H. deceptive H. diversicolor, H. firma, H. gregaria, H. keralensis H. mexicana, H. nivosa var. nivosa H. nivosa var. pallidolutea, H. ortoniana, H. parvula H. pratensis, H. smaragdina*
25	**Hymenochaetaceae**	**Aurificaria**	*Aurificaria indica*
		Coltricia	*Coltricia cinnamomea, Coltricia sp.*
		Cyclomyces	*Cyclomyces setiporus, Fuscoporia senex*
		Hymenochaete	Hymenochaete rubiginosa
		Inonotus	*Inonotus tabacinus, I. nothofagi, I. patouillardii Inonotus sp. 1, Inonotus sp. 2, Inonotus sp. 3*
		Phellinus	*Phellinus adamantinus, P. durissimus, P. fastuosus P. ferreus, P. ferruginosus, P. gilvus, P. grenadensis P. hoehnelii, P. pachyphloeus, P. punctatiformis P. punctatus, P. rhytiphloeus, P. rimosus, P. robiniae P. wahlbergii*
		Pseudochaete	*Pseudochaete tabacina*
26	**Inocybaceae**	**Inocybe**	*Inocybe antillana, I. crassicystidiata, I. cutifracta I. ianthinofolia, I. ingae, I. lasseri, I. petchii I. purpureoflavida, I. squamata, I. viridiumbonata I. virosa*
		Pleuroflammula	*Pleuroflammula flavomarginata*
27	**Lycoperdaceae**	**Lycoperdon**	*Lycoperdon decipiens, L. echinatum, L.excipuliforme, L. lividum, L. nigrescens, L. perlatum, L. pyriforme, L. utriforme*
28	**Lyophyllaceae**	**Calocybe**	*Calocybe cyanocephala*
		Termitomyces	*Termitomyces clypeatus, T. eurhizus, T. globules, T. le-testui, T. mammiformis, T. microcarpus, T. microcarpus f. longipus, T. robustus, T. schimperi T. striatus, T. tylerianus, T. umkowaan, P. subcervinus*
29	**Marasmiaceae**	**Calyptella**	*Calyptella capula*
		Campanella	*Campanella pustulata*
		Gerronema	*Gerronema tenue*
		Gymnopus	*Gymnopus dryophilus*

		Hydropus	*Hydropus cylindrocystis* *H. sphaerosporus*
		Lactocollybia	*Lactocollybia epia*
		Marasmiellus	*Marasmiellus ignobilis, M.stenophyllus,* *M. subaurantiacus*
		Marasmius	*Marasmius atrorubens, M. confertus,* *M. corrugatiformis, M. elaeocephalus, M. florideus* *M. haematocephalus, M. hakgalensis,* *M. hypochroides, M. kisangensis, M. leveilleanus* *M. rigidichorda, M. spegazzinii*
		Megacollybia	*Megacollybia platyphylla*
		Omphalotus	*Omphalotus olearius*
		Tetrapyrgos	*Tetrapyrgos nigripes*
		Trogia	*Trogia cantharelloides, T. infundibuliformis*
30	**Meripilaceae**	**Rigidoporus**	*Rigidoporus microporus* *R. ulmarius*
31	**Meruliaceae**	**Bjerkandera**	*Bjerkandera adusta*
		Flaviporus	*Flaviporus minutisporus*
		Flavodon	*Flavodon flavus*
		Gloeoporus	*Gloeoporus thelephoroides*
		Irpex	*Irpex lacteus*
		Podoscypha	*Podoscypha venustula*
		Steccherinum	*Steccherinium* sp.
32	**Mycenaceae**	**Favolaschia**	*Favolaschia thwaitesii, F. tonkinensis*
		Filoboletus	*Filoboletus manipularis*
		Mycena	*Mycena auroricolor, M.pura*
		Xeromphalina	*Xeromphalina tenuipes*
33	**Nidulariaceae**	**Cyathus**	*Cyathus striatus*
34	**Phallaceae**	**Aseroe**	*Aseroe rubra var. zylanica*
		Clathrus	*Clathrus archeri, C. pusillus*
		Ileodictyon	*Ileodictyona gracile*
		Dictyophora	*Dictyophora cinnabarina*

		Lysurus	*Lysurus brahmagirii*
		Mutinus	*Mutinus caninus*
		Phallus	*Phallus anamudii, P. indusiatus*
35	**Pleurotaceae**	**Hohenbueheli a**	*Hohenbuehelia aurantiocystis, H. petaloides H. testudo*
		Pleurotus	*Pleurotus citrinopileatus, P. djamor, P. eöus P. flabellatus, P. ostreatus*
36	**Pluteaceae**	**Pluteus**	*Pluteus aeolus, P. aglaeotheles, P. atromarginatus P. conizatus, P. escharites, P. fastigiatus P. fusconigricans, P. glyphidiatus, P. haywardii P. pelinus, P. podospileus, P. pulverulentus P. subcervinus, P.salicinus*
		Volvariella	*Volvariella cubensis, V. glandiformis, V. nigrodisca V. pseudovolvacea, V.gloiocephala, V. taylorii V. volvacea*
37	**Polyporaceae**	**Cinereomyces**	*Cinereomyces lindbladii*
		Coriolopsis	*Coriolopsis caperata*
			Coriolopsis occidentalis
		Dichomitus	*Dichomitus sp.*
		Earliella	*Earliella scabrosa*
		Echinochaete	*Echinochaete ruficeps*
		Favolus	*Favolus tenuiculus*
		Fomes	*Fomes pseudosenex*
		Hexagonia	*Hexagonia apiaria H. tenuis*
		Lentinus	*Lentinus bambusoides, L. dicholamellatus L. giganteus, L. patulus, L. polychrous L. sajor-caju, L. strigosus, L. squarrosulus L. tigrinus*
		Panus	*Panus conchatus, P. similes*
		Lenzites	*Lenzites betulina, L. elegans, L. vespacea*
		Microporellus	*Microporellus obovatus, M. violaceocinerascens*
		Microporus	*Microporus affinis, M. vernicipes, M. xanthopus*
		Navisporus	*Navisporus floccosus*

		Nigroporus	*Nigroporus durus, N. vinosus*
		Oxyporus	*Oxyporus cervinogilvus*
		Perenniporia	*Perenniporia ochroleuca*
		Polyporus	*Polyporus alveolaris, P. arcularius, P.dictyopus P. leptocephalus, P. grammocephalus, P. leprieurii P. melanopus, P. squamosus, P. tricholoma P. virgatus, P. rugulosus, Polyporus sp.*
		Pycnoporus	*Pycnoporus sanguineus*
		Pyrofomes	*Pyrofomes albomarginatus*
		Royoporus	*Royoporus spathulatus*
		Trametes	*Trametes cingulata, T. cotonea, T. maxima T. modesta, T. pubescens, T. versicolor, T. villosa*
		Trichaptum	*Trichaptum biforme*
38	**Psathyrellaceae**	**Cystoagaricus**	*Cystoagaricus trisulphuratus*
		Psathyrella	*Psathyrella candolleana, P.candolleana var. condolliana, P. lithocarpi, P. lucipeta, Psathyrella efflorescens, P. trechispora, P. myceniformis*
39	**Physalacreaceae**	**Armillaria**	*Armillaria mellea*
		Cyptotrama	*Cyptotrama asprata, C. lachnocephalum*
		Gloiocephala	*Gloiocephala resinopunctata*
		Oudemansiella	*Oudemansiella canarii*
		Xerula	*Xerula furfuracea, X. megalospora, X.radicata, X. rubrobrunnescens*
40	**Pyronemataceae**	**Aleuria**	*Aleuria aurantia, A.rubra*
		Sowerbyella	*Sowerbyella rhenana*
		Scutellinia	*Scutellinia setosa*
41	**Russulaceae**	**Lactarius**	*Lactarius ignifluus, L. nebulosus*
		Russula	*Russula aciculocystis, R. adusta, R. atropurpurea R.cinerella, R.congoana, R. delicula, R. hygrophytica, R. leelavathyi, R. luteotacta, R. mariae, R. martinica, R. michiganensis, R. periglypta*
42	**Sarcoscyphaceae**	**Cookeina**	*Cookeina indica, C. speciosa, C. tricholoma*
		Sarcoscypha	*Sarcoscypha occidentalis*

43	**Schizoporaceae**	**Schizopora**	*Schizopora paradoxa*
44	**Schizophyllaceae**	**Schizophyllum**	*Schizophyllum commune*
45	**Sclerodermataceae**	**Pisolithus**	*Pisolithus albus*
		Scleroderma	*Scleroderma areolatum, S. bovista, S.citrinum, S. verrucosum, S.polyrhizum*
46	**Stereaceae**	**Stereum**	*Stereum hirsutum*
47	**Strophariaceae**	**Agrocybe**	*Agrocybe pediades, A. retigera, A. wayanadensis*
		Galerina	*Galerina vittiformis*
		Gymnopilus	*Gymnopilus bryophilus, G. crocias, G. chrysopellus, G. dilepis, G. hispidellus, G. lateritius, G. junonius, G. subbellulus, G. terricola, G. zenkeri*
		Hypholoma	*Hypholoma subviride, H. trinitense*
		Pholiota	*Pholiota gregariiformis, P. squarrosa*
		Psilocybe	*Psilocybe argentina, P. aztecorum, P. cubensis, P. inquilina, P. pegleriana, P. plutonia, P. samuiensis P. subcubensis, P. squarrosipes, P. wayanadensis*
		Stropharia	*Stropharia semiglobata*
48	**Suillaceae**	**Suillus**	*Suillus brevipes, S. Suillus placidus, S. tomentosus*
49	**Tremellaceae**	**Tremella**	*Tremella foliacea, T. mesenterica, T. reticulata*
50	**Tricholomataceae**	**Clitocybe**	*Clitocybe dealbata, C. minuta*
		Collybia	*Collybia aurea, C. bakeri, C. coracicolor, C. chrysoropha, C. leucophaea, C. multijuga C. rufipicta, C. sublaccata, C. syringea*
		Lepista	*Lepista hyalodes, L.sordida*
		Macrocybe	*Macrocybe lobayensis, M. pachymeres*
		Tricholoma	*Tricholoma ceriniceps, T. rimosoides, T. subrimosum*
		Tricholomopsis	*Tricholomopsis crocobapha, T. tropica*
51	**Xylariaceae**	**Daldinia**	*Daldinia concentrica*
		Xylaria	*Xylaria escharoidea, X. hypoxylon, X. longipes, nigripes, X. poiteani, X. polymorpha X. symplocosii*

Even though, a large number of species and genera under each family have been reported from Kerala, taxonomic details of most significant and representative

genera/species of the family are provided. Wherever possible, distribution, phylogenetic status, and economic potential of the species are given. Colour photographs of species described are also provided.

1. AGARICACEAE Chevall. 1826

Agaricales : Basidiomycota

Members of this family are widespread in distribution and are primarily saprobes in grassland and forests, with some species commonly forming typical 'fairy rings'. *Agaricus, Chlorophyllum, Clarkeinda, Coprinus, Cystolepiota, Lepiota, Leucoagaricus, Leucocoprinus, Macrolepiota, Micropsaliota* are the significant genera widely distributed in different forest ecosystems of Kerala. Most of them are terricolous, humicolous and lignicolous, while a few occur on dung of herbivores.

Species of *Leucocoprinus* are well known as colonizers of compost, forest litter and woodchips. Few species of genera *Chlorophyllum*, *Clarkeinda*, and *Lepiota* are toxic. Many species of the genus *Agaricus* are edible. Among many well known species, *Agaricus bisporus* is the most widely cultivated edible mushroom in the world. A total of 10 species of *Agaricus* have been reported from Kerala (Mohanan, 2011). *Agaricus endoxanthus* and *A. silvaticus* are described here.

Agaricus endoxanthus Berk. & Broome, *J. Linn. Soc.*, Bot. 11(no. 56): 548 (1871)

Agaricus endoxanthus is a well known species with a widespread distribution in most of the forest ecosystems in the State. Usually occurs in large numbers near bamboo clumps (*Bambusa bambos*) every year. This species can be easily recognized by the yellow discolouration of the stipe base, characteristic of the subsect. Xanthodermateae (Singer) Wasser.

Fruit bodies medium to large sized. Pileus 2-15 cm diam., at first companulate to convex then plano-depressed, often obtusely umbonate; surface pinkish grey to grayish brown, blackish brown towards the centre, fissile, splitting radially and concentrically into large and small appressed squamules. Lamellae free, pink then purplish brown, moderately ventricose, up to 4 mm broad, crowded, with lamellulae of 4 lengths. Stipe 5-12.5 cm x 4-10 mm, cylindric or tapering above, lacking a bulbous base, solid to fistulose; surface brownish, smooth or floccose below the annulus. Context immediately discolouring bright chrome yellow at the stipe base. Annulus large, pendulous, membranous-floccose, attached to the upper quarter of the stipe. Context up to 4 mm thick at the centre, white discolouring on exposure to pale yellow then reddish brown, consisting of much inflated, thin-walled hyphae, 5-25 µm diam., lacking clamp-connections. Spores 5-6 x 3-4 µm ovoid to short ellipsoid, dark fuscous brown, smooth, thick-walled. Basidia 14-23 x 5.5-7 µm clavate, bearing 4 sterigmata. Lamella-edge sterile with crowded cheilocystidia. Cheilocystidia 18-25 x 7-10 µm, ovoid to pyriform, hyaline, thin-walled. Hymenophoral trama regular, hyaline with inflated hyphae, 4-20 µm diam. Pileipellis a well-developed, disrupted epicutis of repent hyphae with short doliiform elements, 11-28 x 6-10 µm, thin-walled, containing dark vacuolar pigment.

Agaricus silvaticus Schaeff. ex Secr. *Mycograph. Suisse* 1: 98 (1833)

Agaricus silvaticus is widely distributed in moist deciduous to evergreen forests of the State. In *Bambusa bambos* stands, this species occurs usually in large numbers during South West monsoon period, June to September.

Fruit bodies medium to large sized. Pileus 7-11 cm diam., convex with a large flat disk; surface cinnamon brown and entire at the disk, elsewhere conspicuously squamose with large, appressed, brown fibrillose-squamules on a whitish background; margin appendiculate, especially in young specimens. Lamellae free, pale pinkish brown becoming chocolate brown with purplish tints, 4-7 mm broad, crowded, with lamellulae of several lengths; edge white, floccose. Stipe 6.5-9.5 cm x 8-10 mm, more or less flexuous, cylindric with a small basal bulb, solid or narrowly hollow; surface greyish white with inconspicuous concolorous fibrils. Annulus superior, white, fragile, pendant and evanescent. Context up to 8 mm thick at the disk, white but spotted pink, finally dirty pinkish brown, on exposure, with thin-walled, much inflating hyphae, 4-20 µm diam., lacking clamp-connections. Spores 5-6 x 3-4.5µm, ovoid, fuscous, with a thickened wall. Basidia 14-19 x 6-7 µm, clavate, with four sterigmata. Lamella edge sterile, with crowded cheilocystidia. Cheilocystidia 25-29 x 7-11 µm, inflated clavate, pyriform to globose, thin-waleld, hyaline or brown. Subhymenial layer well developed, 12-16 µm wide, pseudoparenchymatous. Hymenophoral trama regular, hyaline, thin-walled, inflating, 2-10 µm diam. Pileipellis a disrupted epicutis of repent, radially parallel hyphae, 2-6 µm diam., thin-walled, hyaline or brownish, after fragmenting.

Chlorophyllum Massee , 1898.

Chlorophyllum molybdites and *C. rhacodes* are the species reported from Kerala (Mohanan, 2011). Both the species are toxic and causes severe gastric upset over several hours. Most of the mushroom poisoning in the State is due to the ingestion of the species of this genus.

Chlorophyllum molybdites (G. Mey.) Massee, Bull. Misc. Inf. , Kew: 136 (1898).

Chlorophyllum molybdites is widely distributed in moist-deciduous to semi-evergreen forests, grasslands and homesteads. This species occuurrs in small groups on soil and decaying vegetable waste, during South West monsoon period. This mushroom is commonly called 'Green spored Lepiota' morphologically very close to *Macrolepiota procera*, an edible species. However, *C. molybdites* is poisonous and contain Type 8 toxin and causes severe gastric upset over several hours. It is one of the common causes of mushroom poisoning since it is usually mistaken for *Macrolepiota procera* or *Chlorophyllum rachodes*. Most of the mushroom poisoning occurring in the State may possibly be due to the ingestion of this mushroom.

Fruit bodies medium to large sized. Pileus 10-25 cm diam., at first globose, expanding to convexo-companulate; surface yellowish brown to dark brown, disrupting at the disk into large, dark brown, plate-like squamules on a pale background; margin at first incurved then straight. Lamellae free, collariate, pale greenish grey, about 10 mm wide, very crowded. Stipe 8-22 x 1-2 cm, cylindric with a bulbose base up to 3 cm diam., hollow; surface dark brown disrupting into regular transverse bands on a pale

background. Annulus presistant, movable, complex, white above, brown below. Context white, fairly firm, up to 12 mm or more thick, composed of loosely interwoven, very thin-walled, hyaline hyphae, 4-6 µm diam., inflated to 18 µm diam., with inconspicuous clamp connections. Spore print creamy white. Spores 11.5-16 x 7.5-8.5 µm, ovoid to ellipsoid, lacking a suprahilar depression, hyaline with a thick, stratified, smooth wall with a small germ-pore which scarcely truncate the apex, dextrinoid. Basidia 20-30 x 10-12µm, clavate bearing four sterigmata up to 6 µm long. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 30-55 x 12-16 µm, polymorphic, pyriform, ellipsoid or lageniform, sometimes cylindric, hyaline, thin-walled. Pleurocystidia absent. Hymenophoral trama subregular, hyaline with thin-walled hyphae. Subhymenial layer 10-16 µm wide, pseudoparenchymatous. Pileal surface a trichodermal palisade of erect hyphae; terminal elements 40-60 x 4-10 µm, lanceolate or obtusely cylindric, with a brown encrusting pigment.

Chlorophyllum rhacodes (Vittad.) Vellinga [as '*rachodes*'], *Mycotaxon* 83: 416 (2002)

Chlorophyllum rhacodes is widely distributed in grasslands, moistdeciduous and evergreen forests, and homesteads. This species occurs in small groups on soil immediately after the premonsoon showers. Though this species is edible, some people have experienced gastric upset when ingesting this species. Dark chocolate brown to reddish brown, plate-like squamules and flesh changing to reddish or slightly brownish when exposed to the air are characteristic features of this species.

Fruit bodies medium to large sized. Pileus 10-22 cm diam., globose then broadly convex, sub-umbonate; surface remaining entire at the disk, elsewhere cracking into large, thick, dark chocolate brown to reddish brown, plate-like squamules, on a white background; margin shaggy. Lamellae free, collariate, pale cream bruising pinkish red, up to 2.5 cm broad, crowded with numerous lamellulae; edge crenulate, spotted brown. Stipe 10-20 cm x 6-20 mm, cylindric with an abrupt basal bulb up to 5 cm diam., hollow; surface white to grayish white, bruising reddish brown, fibrous, silky. Annulus movable, complex with a double margin white above, grayish brown squamules below. Context up to 2 cm thick at the disk, white, on exposure turning yellowish orange in the pileus, reddish in the stipe, of thin-walled hyphae, 3-6 µm diam., inflated to 16 µm diam. Spores 8-12 x 6-8 µm, oblong ellipsoid to ellipsoid, truncated at the apex by a broad germ-pore, hyaline, dextrinoid, smooth with a thick complex wall, and a single refringent guttule. Basidia 20-30 x 8-10 µm clavate bearing four sterigmata. Lamella-edge sterile, crowed with cheilocystidia. Cheilocystidia 18-30 x 11-20 µm, ovoid to pyirform, hyaline, thin-walled. Pleurocystidia absent. Hymenophoral trama regular, hyaline, of thin-walled hyphae, 3-8 µm diam., inflated to 20 µm diam. Subhymenial layer pseudoparenchymatous, 4-8 µm wide; pileal surface a trichodermial palisade of more or less septate hyphae; terminal elements 20-40 x 6-14 µm clavate, with a thin brown wall, often with granulate contents.

Clarkeinda trachodes (Berk.) Singer, *Lilloa 22: 413 (1951) [1949].*

Clarkeinda is closely related to *Chlorophyllum* Massee, by virtue of the green, truncated spores. *C. trachodes* is widely distributed in moist-deciduous and semi-

evergreen forests of the State. This species occurs solitary or in small groups on soil and is poisonous.

Fruit bodies medium to large sized. Pileus 8-20 cm diam., hemispherical expanding to convex or almost applanate; surface pale brown to greyish brown, sometimes white, with the central region forming a large, non-expanding, cartilaginous, vinaceous brown pellicle, often with a recurved margin; remainder of surface radially rimose disrupting to form narrow, revolute, greyish brown to vinaceous brown squamules, together with numerous, small, loosely floccose verrucae; margin appendiculate. Lamellae free, remote from stipe, at first white becoming dull yellow to greyish yellow, up to 12 mm wide, very crowded, with lamellulae of two lengths; edge entire. Stipe 9-15 cm x 8-20 mm, up to 3 cm at the swollen base, obclavate to almost cylindric, solid then fistulose; surface concolorous with pileus or paler above the annulus, bruising reddish brown, striate, with minute, furfuraceous squamules. Annulus present, attached to upper part of the stipe, complex, thick, very broad, white, lobed, pendulous, with floccose squamules on underside. Volva present, 2-4 cm deep, grey to purplish grey, floccose, lobed, usually closely appressed to the stipe and often inconspicuous. Context up to 1 cm thick at disk, white, rapidly discolouring orange-red on exposure, consisting of loosely woven, much inflated, thin-walled, hyaline hyphae, 6-40 µm diam.; clamp-connections absent. Spore print pale grayish yellow. Spores 6-7 x 4-5 µm, ovoid to ellipsoid, pale yellowish green to greenish brown, dextrinoid, not metachromatic with cresyl blue, smooth, with a thickened wall, truncated by an apical germ-pore. Basidia 22-27 x 6-9 µm, clavate, bearing four short sterigmata. Lamella-edge heteromorphous to sterile, with scattered to crowded cheilocystidia. Cheilocystidia 50-60 x 20-25 µm, pyriform to inflated clavate, or clavato-cylindric with a long pedicel, hyaline, thin-walled, occasionally crystalline encrusted. Hymenophoral trama regular or nearly so, hyaline, with inflated hyphae, 2-16 µm diam. Subhymenial layer well developed, 11-22 µm wide, pseudoparenchymatous. Pileipellis formed by an agglutinated, stratified trichodermium, consisting of short, branching chains of about 5-8, subisodiametric elements, 10-30 x 4-16 µm; terminal elements 8-24 x 7-15 µm, globose to short pyriform, thin-walled, with a pale brown vacuolar pigment. Towards the pileal margin the exposed hypodermium consists of radially repent hyphae, with short doliiform elements.

Coprinus comatus (O.F. Müll.) Pers., *Tent. disp. meth. fung.* (Lipsiae): 62 (1797)

Coprinus comatus is distributed in grasslands and canopy open up areas in moist-deciduous and semievergreen forests of the State. This species occurs solitary on soil amongst grass.

Fruit bodies small sized. Pielus 2.5 cm diam., ovoid becoming expanded and finally revolute; surface pale grayish with dark brown conical squamules at the disk, becoming appressed and sparse at the margin; margin striate. Lamellae free, black up to 4 mm thick. Stipe 10 cm x 7 mm, central cylindric, equal, hollow; surface white, finely floccose, then glabrescent. Context thin, white. Annulus absent. Spores 10-12.5 x 6-8.5 µm, ovoid to short ellipsoid with a broad apical germ-pore, smooth with a thickened wall. Basidia 14-29 x 10-12.5 µm, with 4 sterigmata. Lamella-edge sterile; cheilocystidia 24-62 x 15-28 µm clavate, subglobose, hyaline, thin-walled, soon collapsing. Pleurocystidia absent. Pileal surface an epicutis.

Coprinus disseminatus var. **disseminatus** (Pers.) Gray, *Nat. Arr. Brit. Pl.* (London) 1: 634 (1821)

Coprinus disseminatus var. *disseminatus* is widely distributed in deciduous to evergreen forests of the State. This species occurs in large troops on decaying wood, logs, stumps and branches.

Fruit bodies small sized. Pileus 6-20 mm diam., at first ovoid then companulate and remaining so, membranous; surface pale buff darkening to grayish lavender at maturity, often yellowish at the disk, sulcate striate almost to the centre. Lamellae broadly adnate, off white, soon grayish brown with a lilaceous tint, narrow, crowded, non-deliquescent. Stipe 3-5 cm x 1-2 mm, slender, cylindric, equal, hollow, surface white, almost translucent, glabrescent. Context very thin, whitish of closely interwoven, very thin-walled hyphae, 2-5 µm diam., inflated to 20 µm diam. Spore print dark brown. Spores 7-8.5 x 4-5 µm, ellipsoid, broadly ovate in face-view, truncated by an apical germ-pore, relatively pale brown. Basidia tetramorphic, 10-20 x 4-6 µm, short clavate to cylindric, with 4 sterigmata up to 3 µm long. Lamella-edge heteromorphous to sterile, with cheilocystidia evenly spaced or occasionally clustered. Cheilocystidia 26-56 x 9-12 µm, lageniform with a long cylindric neck 4-6 µm diam., thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama regular, hyaline thin-walled, hyphae 2-4 µm broad. Pileal surface an epithelium of globose to pyriform elements, 30-38 x 18-22 µm, inflated below, with a long cylindric neck 6-10 µm diam., hyaline, thin-walled, aseptate.

Lepiota (Pers.:Fr.) S.F. Gray, 1821

Lepiota species are widely distributed in different forest ecosystems of the State. More than 20 species of Lepiota have recently been reported from , Kerala (Mohanan, 2011). Most of them are terricolous and humicolous. *Lepiota alopochroa, L. citrophylla, L. clypeolaria, L. erythrogramma, L. erythrosticta, L. guatopoensis, L. phlyctaenodes, L. lepidophora, L. leprica, L. metabola, L. metulispora, L. phlyctaenodes, L. plumbicolor, L. pyrrhaes, L. spongodes* are the most widely distributed species in the State.

Lepiota clypeolaria (Bull.) P. Kumm., *Führ. Pilzk.* (Zwickau): 137 (1871)

Lepiota clypeolaria is widely distributed in moistdeciduous to semievergreen forests and sacred groves of the State. This species occurs solitary or in small groups on soil and on leaf litters, especially in bamboo stands.

Fruit bodies small sized. Pileus 2-3.2 cm diam., convex becoming applanate and then uplifted with a low obtuse umbo; surface pale cinnamon brown, umber brown at disk, with minute concentrically arranged umber brown squamules. Lamellae free creamy white. Stipe 4.5-6 cm x 2-3 mm, central, cylindric equal; surface creamy white becoming pale brown when handled, lower part covered with floccose remnants of the veil. Annulus cortinioid, white floccose, loosely attached to the stipe; spores 10-22 x 3.5-4 µm, ellipsoid, hyaline, strongly dextrinoid. Basidia 30-35 x 8-9.5 µm, 4 spored. Lamella-edge sterile; cheilocystidia 22-25 x 8-10, cylindric to clavate, sometimes constricted at base. Pleurocystidia absent. Pileal surface an indistinct trichodermium. All hyphae having clamp connections.

Lepiota xanthophylla P.D. Orton, *Trans. Br. mycol. Soc.* 43(2): 289 (1960)

Lepiota xanthophylla is distributed in semievergreen to wetevergreen forests of the State. This very attractive species occurs in small groups on soil.

Fruit body small sized. Pileus 15-20 mm diam., conico-convex then convex, often with a broad umbo; surface entire at the disk with minute pointed squamules, elsewhere disrupting into small, dark grayish brown, granular squamules on a pale sulphur yellow background. Lamellae free, sulphur yellow, narrow, up to 3 mm wide, moderately crowded; edge concolorous, serrated. Stipe 2.5- 3.5 cm x 2-3 mm, cylindric, slightly swollen at the base, hollow, surface pale sulphur yellow becoming brighter yellow towards the base, with floccose velar remnants, sometimes with brown squamules similar to the pileus. Veil not annulate, reduced to small remnants on the stipe. Context creamy buff, thin, up to 2 mm thick at the disk. Spores 4-5 x 2-3µm, narrowly ellipsoid to subcylindric to subamygdaliform, hyaline, dextrinoid, thin-walled. Basidia 20-26 x 5-6.5 µm clavate, bearing four sterigmata up to 3 µm long. Lamella-edge sterile. Cheilocystidia 25-33 x 7.5-10 µm, cylindric, clavate, to lageniform, hyaline, thin-walled. Pleurocystidia absent. Hymenophoral trama more or less regular, hyaline. Pileal surface a disrupted trichodermium, palisadic, of very elongated elements, 70-210 x 6-18 µm, either cylindric with an obtusely rounded apex; pyriform to lageniform elements of 10-20 µm also present.

Leucoagaricus (Locq.) Singer, 1948

Leucoagaricus americanus, L.leucothites and *L.rubrotinctus* are the widely distributed species in Kerala (Mohanan, 2011). Species include both edible and poisonous.

Leucoagaricus leucothites (Vittad.) Wasser, *Ukr. bot. Zh.* 34(3): 308 (1977)

Leucoagaricus leucothites is distributed in grasslands and on fringes of shola forests in Munnar Forest Division. This large mushroom occurs in large troops on soil amongst grass immediately after the pre-monsoon showers.

Fruit bodies large sized. Pileus 10-26 cm diam., at first globose, expanding to convexo-companulate; surface off white, with pale yellowish brown squamules at disk and sparsely distributed elsewhere; margin at first incurved then straight. Lamellae free, creamy white, about 8-10 mm wide, very crowded. Stipe 10-25 x 1-2 cm, cylindric with a bulbous base up to 3 cm diam., hollow; surface off white, smooth. Annulus presistant, memranous, white attached to top of the stipe. Context white, fairly firm, up to 10 mm or more thick, composed of loosely interwoven, very thin-walled, hyaline hyphae, 4-8 µm diam., inflated to 18 µm diam., with inconspicuous clamp-connections. Spore print creamy white. Spores 12-14 x 8-9 µm, ovoid to ellipsoid, lacking a suprahilar depression, hyaline with a thick, stratified, smooth wall with a small germ-pore which scarcely truncate the apex, dextrinoid. Basidia 26-33 x 8-10 µm, clavate bearing four sterigmata up to 6 µm long. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 18-38 x 9-17.5 µm, cylindro-clavate, or lageniform, sometimes hyaline, thin-walled. Pleurocystidia absent. Hymenophoral trama subregular, hyaline with thin-walled hyphae. Subhymenial layer 10-20 µm wide, pseudoparenchymatous.

Leucoagaricus rubrotinctus (Peck) Singer, *Sydowia* 2 (1-6): 36 (1948)

Leucoagaricus rubrotinctus is widely distributed in moist deciduous to semi-evergreen forests and occurs in small groups on soil and on decaying forest litter. This species usually occurs in bamboo stands immediately after the pre-monsoon showers. The distinctive colour of the cap together with the absence of any staining in the flesh, make easy to recognize.

Fruit bodies small sized. Pileus 3.5-5.5 cm diam., convex then plane, finally uplifted; surface flame red at the disk, reddish orange elsewhere, fibrillose squamose; margin exceeding the lamellae. Lamellae free, creamy white, up to 4 mm wide. Stipe 4-5 cm x 3.5-4 mm, central, cylindrical, equal, narrowly tapering upwards form a clavate bulbous base; surface creamy white turning yellowish, smooth and glabrous. Annulus superior, rarely central, white with a reddish brown rim, evanescent. Context white, unchanging. Spores 6.5-8.5 x 3.5-4.5 µm, ellipsoid to amygdaliform, mostly with a pipillate apex, sometimes with a inconspicuous germ-pore, hyaline, smooth, thick-walled, dextrinoid. Basidia 22-28 x 5.5-9 µm, clavate, 4-spored. Lamella-edge sterile, cheilocystidia 25-40 x8.5-14 µm, clavate elongate with an obtuse apex, hyaline. Pleurocystidia absent. Pileipellis an interrupted epicutis.

Leucocoprinus Pat., 1888

Lecocoprinus species are the dominant group in most of the forest ecosystems. More than 15 species of Leucocoprinus have been reported from Kerala (Mohanan, 2011). *Leucocoprinus birnbaumii, L. brebissonii, L. cepistipes, L. caldariorum, L. fragilissimus, L. holospilotus, L. zeylanicus* are the significant genera.

Leucocoprinus birnbaumii (Corda) Singer, *Sydowia* 15(1-6): 67 (1962) [1961]

Leucocoprinus birnbaumii is widely distributed in moist deciduous to evergreen forests in the State. This beautiful species usually occurs in small groups on soil, decaying wood, logs, forest litter, humus, etc.
Basidiome small to medium sized. Pileus 1-7 cm diam., subglobose, ovoid then conical, finally expanding to campanulate with a truncated apex; surface picric yellow, sometimes pale brownish at the centre, bearing loose scattered, concolorous, floccose squamules, closely plicate striate half-way to the disk; margin membranous. Lamellae free, sulphur yellow, thin, about 2 mm broad, moderately crowded. Stipe 4-8 cm x 2-4.5 mm, cylindric with a prominent swollen base, 5-6 mm diam., hollow; surface concolorous with the pileus, scurfy floccose below. Annulus membranous to fragmentary, somewhat evanescent, concolorous with the stipe surface and attached to the upper part of the stipe. Context thin, soft, yellow, of inflated, thin-walled hyphae. Spores 7.5-10 x 5.5-6.5 µm, ovoid to ellipsoid, truncated at the apex by a small but distinct germ-pore, hyaline, strongly dextrinoid, with a compound yet comparatively thin wall. Basidia 17.5-22 x 8-10 µm, inflated clavate, bearing four sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia dimorphic (a) 16-22 x 10-18 µm, short inflated pyriform; (b) 34-40 x 11-14 µm, elongate lageniform. Hymenophoral trama subregular, hyaline, narrow. Subhymenial layer pseudoparenchymatous. Pileipellis a poorly developed epicutis of loose branching chains of cylindric, thin-walled elements which become detersile; individual elements 20-80 x 2-10 µm, thin-walled, with an yellowish membrane pigment.

Leucocoprinus cepistipes (Sowerby) Pat. [as '*cepaestipes*'], *J. Bot.*, Paris 3: 336 (1889)

Leucocoprinus cepistipes is widely distributed in moist deciduous and semievergreen forest ecosystems in the State. This species usually occurs in small to large troops on decaying wood in cankered areas at butt region of living trees, on cow dung, wood chips, decaying stumps, and logs.

Fruit bodies small to medium sized. Pileus 2-8 cm diam., at first ovoid then conical, obtusely umbonate, finally companulate or expanded; surface pure white with pale pink tints, cream colour at disk, covered by loose granular-furfuraceous squamules which are removed by weathering, plicate striate towards the margin. Lamellae free, white or cream, thin up to 6 mm wide, crowded, with lamellulae of three lengths; edge concolorous, pruinose. Stipe 4-10 cm x 3-10 mm, cylindric, equal above, becoming inflated fusiform towards the base (6-20 mm) hollow; surface with white, cream or, slightly pinkish. Annulus membranous, mobile, white, soon fragmenting, attached to the middle zone of the stipe. Context thin, whitish, soft. Spores 8-10.5 x 5-6 µm, short ovoid, lacking a suprahilar depression, with a small but distinct germ-pore truncating the apex, hyaline, dextrinoid, with a complex wall. Basidia 16-18 x 6-8 µm, inflated clavate, bearing four sterigmata. Lamella-edge sterile with crowded cheilocystidia. Cheilocystidia 19-24 x 10.5-12.5 µm, very variable in shape but often clavate and nearly always with a mucronate, frequently constricted apex, thin-walled, hyaline. Pleurocystidia absent. Pileal surface an epicutis of loose chains of hyaline, thin-walled hyphae; individual elements 20-90 x 5-32 µm, sometimes forming erect, loose fascicles, producing squamulose which may include dermatocystidioid elements similar to the cheilocystidia.

Leucocoprinus zeylanicus (Berk.) Boedijn, *Bull. Jard. bot. Buitenz*, 3 Sér. 16(4): 407 (1940)

Leucocoprinus zeylanicus is widely distributed in moist deciduous to wet-evergreen forests of the State. This species occurs on soil, decaying wood, on rotting areas in exposed cankers at butt region of living trees, etc. This very attractive species occurs in small to large troops.

Fruit bodies small to medium sized. Pielus 2-11 cm diam., at first cylindrico-conical, becomes companulate and finally expanding to plano-convex although usually retaining a prominent umbo; surface white to pale yellowish or pale brownish, more deeply pigmented yellow or brown at the umbo, finely radially silky-striate, beset with sparse, minute, brown repent squamules, margin entire, sulcate-striate, often recurved. Lamellae free, remote, at first white finally reddening with age, often with an intermediate yellow stage, ventricose, up to 6 mm broad, moderately crowded, with lamellulae of three lengths. Stipe 5-11 cm x 2-9 mm, cylindric, fistulose; surface white or pale yellowish soon reddening at the base or on bruising, silky striate, arising from a white basal mycelium. Annulus persistent, mobile, narrow, membranous, whitish sometimes with a pink tint on the upper margin, attached to the upper third part of the stipe. Context white, reddening on exposure, thin up to 4 mm thick at the disk, of thin-walled hyphae, lacking clamp connections. Spores 7-10 x 5.5-7 µm, short ellipsoid with a small germ-pore which does not truncate the apex, hyaline dextrinoid. Basidia 20-35 x 8-12 µm, broadly clavate bearing 4 sterigmata. Lamella-edge sterile,

with crowded cheilocystidia. Cheilocystidia 35-45 x 5-8 µm, narrowly clavate to cylindric with an obtuse apex, thin-walled, hyaline, often grouped into small fascicles. Pleurocystidia absent. Hymenophoral tramà regular, hyaline, narrow. Peleipellis a repent epicutis of radially arranged, thin-walled, hyaline hyphae, 4.5-10 µm dia.

Macrolepiota Singer, 1948

Macrolepiota dolichaula and *M. procera* are the species reported from Kerala (Mohanan, 2011). Both the species are edible and widely distributed in moist-deciduous to semi-evergreen forests of the State.

Macrolepiota dolichaula (Berk. & Broome) Pegler & R.W. Rayner, *Kew Bull.* 23(3): 365 (1969)

Macrolepiota dolichaula is widely distributed in different forest ecosystems of the State *viz.*, grasslands, moistdeciduous, semi-evergreen, evergreen, wet-evergreen forests and forest plantations. This species differs from *M. procera* by the minute pileal sqamules, the glabrescent stipe, and the smaller spores. This species occurs soliatory or in small groups on soil.

Fruit bodies medium to large sized. Pileus 10-20 cm diam., fleshy, subglobose to convex or applanate, with a strongly umbonate centre; surface at first uniformly pale yellowish to pinkish brown and entire then disrupting to form numerous, minute, more or less concentric granular verrucae on a whitish ground, more at the disk, often covered at the margin zone with white, floccose velar remnants; margin down-curved, appendiculate. Lamellae free, remote, white drying pale yellow, ventricose, 1-2 cm broad, densely crowded, with lamellulae of 5 lengths. Stipe elongate, 19-35 cm x 7-14 mm, usually longer than pileal diameter cylindric or tapering above, with a conspicuous bulbous base,2-3 cm diam., hollow; surface white to pale ochraceous buff, bruising reddish, floccose, glabrescent. Annulus persistent, membranous, movable, pendent, lacerate, white, sqamulose on the underside, attached to upper quarter of stipe. Context 1-1.5 cm with clamp-connections. Spores 10.5-15 x 7-10 µm, ovoid to ellipsoid, hyaline, dextrinoid, with a thick, stratified wall, and a small, inconspicuous apical germ-pore. Basidia 30-42 x 10-15 µm, broadly clavate, bearing four sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 20-30 x 7.5-10 µm, mostly clavate, hyaline, thin-walled. Hymenophoral trama subregular, hyaline, narrow, of inflated hyphae, 2-14 µm diam. Subhymenial layer 8-10 µm wide, pseudoparenchymatous. Pileipellis a trichodermial palisade of non-agglutinate, short chains of cylindric elements, 8-32 x 7-10 µm, thin-walled, containing a pale brown vacuolar pigment.

Macrolepiota procera (Scop.) Singer, Pap. Mich. Acad.Sci. 32: 141 (1948) var. *procera*

Macrolepiota procera is widely distributed in different forest ecosystems viz., grasslands, moist deciduous, semievergreen, evergreen, wet evergreen forests and forest plantations of the State. This species occurs in soil solitary or in small groups. This species known as the 'Parasol mushroom' has red staining when cut or bruised. The lamellae and spores are never green as in *Chlorophyllum molybdites*, the Green

spored 'Lepiota''. The parasol mushroom is one of the outstanding wild edible species.

Fruit bodies medium to large sized. Pileus 10-22 cm diam., at first globose, expanding to convexo-companulate; surface dark brown, disrupting at the disk into large, dark brown, plate-like squamules on a pale background; margin at first incurved then straight. Lamellae free, collariate, creamy white, about 10 mm wide, very crowded, stipe 8-25 x 1-2 cm, cylindric with a bulbous base up to 3 cm diam., hollow; surface dark brown disrupting into regular transverse bands on a pale background. Annulus presistant, movable, complex, white above, brown below. Context white, fairly firm, up to 10 mm or more thick, composed of loosely interwoven, very thin-walled, hyaline hyphae, 4-6µm diam., inflated to 20 µm diam., with inconspicuous clamp connections. Spore print creamy white. Spores 13-16 x 8-11 µm, ovoid to ellipsoid, lacking a suprahilar depression, hyaline with a thick, stratified, smooth wall with a small germ-pore which scarcely truncate the apex, dextrinoid. Basidia 28-38 x 10-15 µm, clavate bearing four sterigmata up to 6 µm long. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 25-48 x 10-17 µm, polymorphic, pyriform, ellipsoid or lageniform, sometimes cylindric, hyaline, thin-walled. Pleurocystidia absent. Hymenophoral trama subregular, hyaline with thin-walled hyphae. Subhymenial layer 10-18 µm wide, pseudoparenchymatous. Pileal surface a trichodermal palisade of erect septate hyphal edgings; terminal elements 40-55 x 4-12 µm, lanceolate or obtusely cylindric, with a brown encrusting pigment.

2. **AMANITACEAE** Heim ex Pouzar, 1983

Amanita and *Limacella* are the significant genera of this family. Members are widespread in both temperate and tropical zones. The genus *Amanita* is worldwide in distribution and includes deadly poisonous mushroom species besides some edible ones. So far, more than 50 taxa of *Amanita* have been reported from India (Kaur and Singh, 2002; Bhatt *et al.*, 2003). From Kerala, so far, 11 species of *Amanita* have been reported, which include the recently reported species viz., *Amanita bisporigera, A. cecilliae, A. muscaria, A. porphyria* and *Amanita* sp.1(Mohanan, 2011).

Most of the *Amanita* species form ecto-mycorrhizal association with both tropical and temperate tree species. In Kerala, *Amanit*a species are widely distributed in different forest ecosystems ranging from moist-deciduous to wet-evergreen and shola forests and form ectomycorrhizal association with tree species like *Hopea parviflora, H. ponga, Calophyllum calaba, Calophyllum sp., Vateria indica, Myristica fragrans, Myristica travancoricus, Diospyros malabarica*, etc. *A. muscaria* was found associated with old pine stands in high elevated areas in Munnar Forest Division. While *Amanita* sp. 1. occurs in *Acacia* plantations and forms ectomycorrhizal association with *Acacia mangium* and *A. auriculiformis*. Of the 11 species, *A. angustilamellata, A. bisporigera, A. griseofarinosa,A. hemibapha* and *A. muscaria* are described here.

Amanita angustilamellata (Höhn.) Boedijn, *Sydowia* 5 (3-60): 318 (1951)

This mushroom is widely distributed in semi evergreen to evergreen forests of the State. This species forms ectomycorrhizal association with tree species and usually

occurs in soil solitary or scattered in small groups in mixed stands of *Vateria indica, Hopea parviflora* and *H. ponga.*

Fruit bodies medium to large sized. Pileus 5-19 cm diam., parabolic then expanding to convex or almost applanate; surface grayish brown at centre, gradually paling towards the margin; margin deeply sulcato-striate to almost half-way to centre. Lamellae free, white. Stipe 8-19 cm x 0.6-1.2 cm, central, cylindric or tapering above, hollow; surface off white, pinkish white, reddish grey, brownish orange or grayish, smooth. Volva saccate, off white, sheathing the stipe base, up to 6.5 cm high, 2 to 3-1obed, consisting of thin-walled hyphae and scattered oleiferous elements. Context white, up to 5 mm thick, consisting of loosely woven, thin-walled, inflated hyphae, 3-18 µm diam., with clamp-connections. Spores 9.5-13 x 9-11 µm, globose to subglobose, thin-walled, hyaline, inamyloid, with refractive contents. Basidia 38-60 x 12-20 µm, broadly clavate, 4-spored. Lamella-edge sterile, with scattered cheilocystidia, sometimes with detersile chains, 20-65 x 12-25 µm, globose to inflated clavate, thin-walled, hyaline. Hymenophoral trama bilateral, with divergent, thin-walled, inflated hyphae. Subhymenium pseudoparenchymatous. Pileipellis a repent epicutis of thin-walled radially arranged hyphae.

Amanita bisporigera G.F. Atk., *Saccardo's Syll. fung.* XIX: 44; XXI: 5 (1906)

Amanita bisporigera belongs to the most beautiful but most deadly group of fungal species collectively known as the 'Death Angel'. *Amanita virosa, A. bisporigera* and *A. verna* are the highly toxic white species. *A. bisporigera* is 2-spored species and difference between *A. virosa* and *A. verna* is very meager. All these *Amanita* species contain Toxin 2-amanitin. The toxin affects the central nervous system and kidneys. This mushroom is widely distributed in semi-evergreen forests in Wayanad Forest Division. *A. bisporigera* forms ectomycorrhizal association with tree species like *Diospyros malabarica, Hopea parviflora, Hopea ponga,* etc. This species occurs in small groups on soil.

Fruit bodies medium to large sized. Pileus 7-10 cm diam., conic to ovoid, convex to applanate, pure white, smooth, viscid when wet to sticky, margin smooth to faintly striate, without any volval warts. Lamellae free, close to subdistant, narrow up to 8 mm broad; lamellulae of 3-4 lengths. Stipe central, well-developed, smooth, white, 10-15 x 1-1.5 cm enlarging gradually to a club-shaped base, dry, finely fibrous above ring. Volva white, membranous, persistent, sac-like, and free from the stipe, 4-6 x 2.5-3 cm mostly 2-lobed. Partial veil membranous, white, smooth, faintly striate on upper surface, skirt-like, superior, 2.5-3 x 1-1.2 cm. Context white consisting of inflated hyphae, 4-5 µm diam., without clamp connections. Spores subglobose to globose, 8-10 x 6-7 µm, hyaline, amyloid, smooth. Spore print white. Basidia large clavate to cylindrical, 55-65 x 23-30 µm, two-spored. Lamella-edge sterile; cheilocystidia clavate, 52-55 x 25-26.5 µm, hyaline thin-walled. Hymenophoral trama bilateral with inflated hyphal elements. Subhymenial layer well-developed. Pileal surface viscid, forming a repent epicutis of radial to interwoven hyphae.

Amanita griseofarinosa Hongo, *Mem. Fac. Lib. Arts Educ. Shiga Univ., nat. sci.* 11: 39 (1961)

This mushroom is widely distributed in moist-deciduous to semi-evergreen forests

of the State. This species occurs solitary or in small groups under mixed *Hopea parviflora* - *Vateria indica* stands and forms ectomycorrhizal association. Appendiculate pileal margin, bulbous stipe base, amyloid spores and unpleasant odour are characteristic of the species. The floccose dark grayish squamules are easily removed on handling. This species is close to *A. cinereoconica* but differs significantly on having much smaller basidiospores.

Fruit bodies medium to large sized. Pileus 6-10 cm diam., convex to plano-convex; surface grayish brown at the centre, pale grayish brown elsewhere with appressed patches of dark grayish brown scales, entire at the centre, smaller and dispersed near margin, distributed over a off white ground, washed off during rain; margin weakly striate, appendiculate, exceeding the lamellae. Lamellae free, white, up to 7 mm wide, crowded, with lamellulae of different lengths; edge entire, concolourous to the sides. Stipe 9-15 cm x 9-12 mm, central, cylindric, tapering towards apex, with a bulbous rooting base; surface concolourous with pileus with dark grayish brown appressed fibrillose squamules, denser at the base. Annulus large, pendant, flaring, floccose, fugacious. Volva absent. Odour unpleasant. Context white, up to 3 mm wide, composed of filamentous, 3-10 µm wide, branched, septate hyphae, mixed with inflated cells.

Spores 8.5-12 x 7-11 µm, subglobose to broadly ellipsoid, thin-walled, amyloid. Basidia 50-70 x 9-15 µm, clavate, 4-spored. Marginal cells of lamellae 20-35 x 12-25 µm, clavate to pyriform, thin-walled, hyaline, sometimes catenulate. Hymenophoral trama bilateral. Subhymenium pseudoparenchymatous. Pileipellis made up of loosely interwoven, slightly gelatinized hyphae. Remnants of volva on pileus consisting of irregularly disposed, detersile rows of globose to ellipsoid cells, on scattered hyphae, intermixed with yellowish oleiferous hyphae. Annulus composed of filamentous, 3-6 µm wide hyphae, mixed with abundant inflated cells. Stipe hyphae thin-walled, mixed with filamentous hyphae.

Amanita hemibapha (Berk. & Br.) Sacc. *Syll. Fung.* (Abellini) 5: 13 (1887

Amanita hemibapha is widely distributed in semi evergreen to evergreen forests of the State. This beautiful *Amanita* occurs solitary or gregarious on soil in mixed stands of *Hopea parviflora, Calophyllum sp., Vateria indica, Myristica fragrans, Diospyros malabarica,* etc. and forms ectomycorrhizal association. This edible species is morphologically very close to *A. caesarea*, a highly prized edible mushroom of the world.

Fruit bodies small to large sized. Pileus 3.5-10 cm diam., hemispheric at first, expanding convex to plane, often depressed with the edge upturned in age, lacking an umbo, uniformly 'tomato red' (8C8) in the bud, 'capsicum red' (8B8) to 'tomato red' with deep orange margin, fading with age, smooth and glabrous; margin sulcate-striate about half way to the centre, non-appendiculate. Universal veil absent. Context up to 6 mm thick, whitish with yellow zone below pileipellis, unchanging when cut or bruised. Lamellae free, crowded, creamy white in the bud, pastel yellow to light yellow when mature, up to 12 mm broad, ventricose, at times bifurcated, with lamellulae of three lengths, edge concolourous with the sides, unchanging. Stipe 8-16 cm x 6-15 mm, central, cylindric, base enlarged, solid becoming hollow; surface 'maize yellow' (4A6) upward, pastel yellow below, narrowing upward slightly,

decorated with patches of bright yellow sub-felted squamules, sometimes darker, often in transverse zones below the partial veil, finely longitudinally striate above the annulus. Annulus superior, membranous, persistent, skirt-like, maize yellow, striate above. Volva saccate, white with patches of pale yellowish brown scales on the surface which soon disappear; yellowish on the inner surface, including limbus internus, thick, fleshy, up to 5 cm long, attached to the stipe at the end forming a cup with 2-4 lobes, majority 3-lobed, limbus internus short, about one third to half the distance from top of volval limb to base of stipe. Context creamy white, solid when young becoming narrowly hollow, composed of filamentous, undifferentiated hyphae, closely interwoven, thin-walled, 3-6 µm diam., inflated up to 20 µm, occasionally with clamp connections; oleiferous hyphae scattered.

Spores 8-10 x 6-8 µm ellipsoid to elongate, often adaxially flattened, sometimes expanded at one end, smooth, hyaline, inamyloid. Basidia 35-55 x 9-14 µm clavate with 4 sterigmata up to 3.5 µm long. Gill margin sterile; marginal cystidia like cells 19-25 x 6-9 µm, inflated clavate to versiform, thin-walled, hyaline. Pileipellis with the surface layer completely gelatinizing, coloured yellow; composed of filamentous undifferentiated hyphae somewhat interwoven, sub-radially arranged. Hymenophoral trama bilateral composed of filamentous, undifferentiated hyphae, 3-12 µm diam., without any inflated cells. Subhymenium cellular to sub-cellular, one to two cells below longest basidia. Pileipellis layer completely gelatinized, coloured yellow, composed of filamentous, undifferentiated hyphae, 3-8 µm diam., somewhat interwoven, sub-radially arranged; oleiferous hyphae present. Universal veil on stipe base exterior surface filamentous, composed of undifferentiated hyphae, 3-10 µm diam., inflated cells frequent, thin-walled, mostly subglobose, subpyriform, clavate, elongate, to 126 x 80 µm; on stipe base interior closely arranged filamentous, undifferentiated hyphae, 1.5-9 µm diam., with very few inflated cells, up to 40 x 20 µm, subovoid to ovoid, thin-walled. Oleiferous hyphae scattered.

Amanita muscaria (L.) Lam., *Encycl. Méth. Bot.* (Paris) 1: 111 (1783) var. *muscaria*

Amanita muscaria, a well known *Amanita* occurs in old pine stands in Munnar, Devikulam and Peerumede Forest Ranges. This beautiful species occurs in groups and forms ectomycorrhizal association with pines. The species contains Type 3 toxins and is considered as dangerous and inedible species. However, it has been eaten and characterized as a pleasurable intoxication.

Fruit bodies medium to large. Pileus 8-11 cm diam., ovoid then convex or applanate, yellowish orange to reddish orange ornamented with white powdery velar remnants; margin sulcate striate. Lamellae free, white up to 8 mm wide, crowded with lamellulae of different lengths. Stipe central, well developed, cylindric with a bulbous base, 5-18 cm x 2-4 mm, hollow, white. Universal veil well developed, initially enveloping the entire basidiome, leaving a free volva or friable remains at the stipe base and detersile remnants on the pileus; partial veil developed as persistent annulus; annulus membranous, skirt-like white, 3.5 x 2.5 cm, attached to the top of the stipe. Context firm to soft, white, consisting of inflated hyphae 3-4 µm wide without clamp-connections. Spore-print white to cream. Spores globose to ellipsoid, hyaline, smooth, 10-12 x 6-8 µm. Basidia large, clavate, 60-75 x 10-14 µm, tetrasporic. Lamella-edge sterile, covered with remnants of the partial veil. Cheilocystidia clavate to cylindrical, 25-32 x 10-13 µm. Hymenophoral trama, bilateral, with inflated hyphal elements.

Subhymenial layer well developed. Pileal surface dry to viscid, forming a repent epicutis of radial to interwoven hyphae of 2-3 µm wide.

Limacella guttata (Pers.) Konrad & Maubl., *Encyclop. Mycol.* 14: 70 (1949)

Limacella guttata is widely distributed in moist-deciduous to evergreen forests of the State. This species occurs solitary on soil during both South West and North East monsoons.

Fruit bodies medium sized. Pileus 3.5-10 cm diam., convex to plano-convex or applanate, with or without a low umbo; surface pale pinkish to pale brown, off white at margin, viscid to glutinous when moist, smooth, margin often denticulate-appendiculate with velar remnants. Lamellae sinuato-adnexed to adnexed, white with a faint ochraceous tint, 3-5 mm broad, rather crowded, with lamellulae of three lengths. Stipe 3.5-8 cm x 3-6 mm, slender, cylindric, sometimes expanded into a sub-bulbous base, solid to narrowly fistulose; surface whitish, floccose-squamulose below the annulus, glabrous above. Annulus superior, membranous, fugacious, white. Context thin, fragile, white, of much inflated, thin-walled hyphae, 4-30 µm, diam., with clamp-connections. Spores 5-6.5 x 3.5-4.5 µm, globose or nearly so, hyaline, with a weakly dextrinoid, smooth wall. Basidia 29-35 x 4-6.5 µm, clavate, bearing four sterigmata. Lamella-edge sterile; cheilocystidia clavate, 21-26 x 11.5-12.5; pleurocystidia absent. Hymenophoral trama distinctly bilateral, hyaline, with a narrow mediostratum and broadly inflated hyphae, 3-17 µm diam. Subhymenial layer well developed, 8-16 µm wide, pseudoparenchymatous. Pileipellis an ixotrichodermium of erect, filamentous, hyaline hyphae, 2-4 µm diam., embedded in a gelatinous matrix.

3. AURICULARIACEAE Fr. 1838

Auriculariales: Basidiomycota

Auricularia is the significant genus having widespread distribution in both temperate and tropical regions. *Auricularia* species are saprobic, occasionally weakly parasitic on wood of both gymnosperms and angiosperms. Most species are widely distributed in different forest ecosystems ranging from deciduous to wet-evergreen forests of the State and are recognized by the distinctive fruiting bodies. Fruiting bodies occur in large imbricate clusters on rotting wood, branches and twigs under high humid conditions. *Auricularia* species are edible and are grown commercially. *Auricularia auricula-judae, A. polytricha, A. mesenterica* are used in Asian cuisine. Recently, these species are widely cultivated on logs and wood-chip based substrata. Medicinal properties including cholesterol lowering properties and inhibition of blood clotting have been claimed. *Auricularia auricula-judae, A. polytricha* and *A. mesenterica* are the species recently recorded by the author (Mohanan, 2011).

Auricularia auricula-judae (Bull.) Quél., *Enchir. fung.* (Paris): 207 (1886)

Auricularia auricula-judae is widely distributed in moist-deciduous to evergreen to shola forests of the State. *A. auricula-judae* popularly known as 'wood ear fungus' or 'brown ear' is one of the jelly fungi, so-named because of the jelly-like consistency of the basidiomes. This species occurs scattered and in clusters on dead or dying

branches of trees, on main trunk, decaying logs, etc. This species occurs during the monsoon period in large imbricate clusters and under high humid conditions produces exceptionally large sized basidiomes. *A. auricula-judae* growing in wet evergreen and shola forests shows remarkable variation in size, shape and colour.

Fruit bodies 2-10 cm diam., shaped like an ear or a shell, attached laterally and sometimes by a very short stalk, flabby gelatinous, becoming horny, when dry but when wetted quickly returning to the original state; upper sterile surface reddish brown or tan, smooth to slightly wrinkled; lower hymenial surface reddish to purplish brown, with pinkish brown, wrinkled, coarsely reticulate or veined. Basidia cylindrical, hyaline, with three transverse septa, 60-72 x 4-7.5 µm; sterigmata lateral, well developed, 3-4.5 µm long. Spores smooth, hyaline, reniform to allantoid, 14-18 x 6-8 µm, guttulate.

4. BOLBITIACEAE Singer 1948

Agaricales : Basidiomycota

Bolbitius, Conocybe, Copelandia, Panaeolus, Panaeolina and *Pholiotina* are the significant genera of this family. Members are in worldwide distribution and occur on soil, humus, decaying litter, dung of domestic and wild animals, etc. Most species are found in grasslands and deciduous to moist-deciduous forests, some are drought adapted. Some species of this family are toxic, containing psilocybins, phallotoxins and cyclic peptide amatoxins. Bolbitiaceae includes members distributed in grasslands, deciduous to semi evergreen forests, lawns and pastures, mostly on fertile soil, dung of herbivorous wild and domestic animals.

So far, three species of *Bolbitius* including the *Bolbitius fissus* and *B. titubans* var. *titubans* have been reported from Kerala (Mohanan, 2011). The genus Conocybe consists of about 240 species. *Conocybe crispa, C. ochracea, C. pubescens, C. rickenii* and *C. tenera* have been recorded very recently by Mohanan (2011). All species of *Copelandia* are known to contain the hallucinogens psilocin and psilocybin. *Copelandia tropica* and *Copelandia wayanadensis* are the species reported from Kerala (Natarajan and Raman, 1983; Mohanan, 2011). The members of *Panaeolus* are mostly dung and grassland species. The closely related genus *Panaeolina* and *Panaeolus* contain the hallucinogen, psilocybin and it is suspected that a number of other members of these genera contain unidentified psychoactive compounds. *Panaeolus acuminatus, P. indicus, P. antillarum, P. cyanescens, P. rickenii* and *P. subbalteatus* are the species occurring in Kerala (Mohanan, 2011). *Panaeolina foenisecii* is also a newly added mushroom for the State (Mohanan, 2011). Of the three species of *Bolbitius* occurring in the State, taxonomic descriptions of *B. fissus* is given here.

Bolbitius fissus Berk. & Br. *Joum. Linn. Soc., Bot.* 11: 562 (1871)

Bolbitius fissus is widely distributed in moist-deciduous to evergreen forests and grasslands. This species occurs solitary or in small groups on soil, decaying forest litter, dung and humus.

Fruit body small sized. Pileus 1.5-4.5 cm diam., at first campanulate to umbonate, expanding to applanate; surface very pale, dull yellowish brown, glabrous, smooth, pellucid sulcate-striate; margin striate, fissile. Lamellae adnexed, clay brown to blackish brown, ventricose, up to 4 mm wide, crowded, with lamellulae of two lengths. Stipe 15-18 cm x 2-6 mm, terete, expanding below, fistulose to hollow; surface white, pruinose to smooth. Context up to 2 mm thick at centre, membranous elsewhere, consisting of inflated hyphae, 2-20 µm diam., with clamp-connections. Spores 5.5-6.5 x 3.5-4.5 µm, ovo-ellipsoid, rusty brown, smooth, thick-walled, apically truncated by a broad germ-pore. Basidia 26-32 x 5.5-7 µm, inflated clavate, bearing four sterigmata. Lamella-edge sterile, with cheilocystidia. Cheilocystidia 28-33 x 10-12 µm, lageniform, hyaline, thin-walled. Hymenophoral trama subregular, hyaline, with much inflated, very thin-walled hyphae, 3-18 µm diam. Subhymenial layer 9-15 µm wide, pseudoparenchymatous. Pileipellis a non-stratified epithelium of subglobose to pyriform elements, 60-80 x 40-65 µm, hyaline, thin-walled. Caulocystidia abundant, in large fascicles, 20-40 x 8-10 µm, sinuous clavate, hyaline, thin-walled.

Conocybe ochracea (Kühner) Singer, *Mycologia* 51(3): 395 (1959)

Conocybe ochracea is widely distributed in moist-deciduous to evergreen forests and grasslands. This species occurs scattered in small clusters on soil.

Fruit bodies small sized. Pileus up to 2.0 cm diam., convex to plano-convex; surface glabrous to minutely hairy, grayish orange when young, yellowish orange to pale orange in the margin and grayish yellow in the centre at maturity; margin regular. Lamellae free to adnate, up to 3 mm wide, yellowish white when young, yellowish brown at maturity; lamellulae present. Stipe 4.5-9 cm x 1-2 mm, cylindrical; surface white when young, light yellow at maturity, paler at apex. Spore-print yellowish brown. Spores 10-13 x 6-7 µm, ellipsoid, wall double layered, smooth, with truncate germ-pore, with refractive contents, pseudoamyloid. Basidia 24-30 x 8-10 µm, 4-spored, sterigmata thick, up to 6 µm long. Cheilocystidia abundant, 28-32 x 9-10 µm, lecythiform, thin-walled, hyaline, capitellum up to 3 µm diam. Pleurocystidia absent. Hymenophoral trama somewhat irregular with a narrow mediostratum and a broad hymenopodium, hyphae thin-walled, 5-11 µm diam. Context thin, hyphae thin-walled, hyaline. Pileal surface an epithelium, made up of clavate to napiform, pedicellate cells, 32-38 x 20-28 µm, thin-walled, hyaline; pileocystidia absent. Stipe tissue consisting of parallel hyphae, 3-8 µm diam., inflated up to 16 µm diam.; caulocystidia fusiform or lageniform, 12.5-15 x 6-6.5 µm, thin-walled, hyaline. All hyphae with clamp connections.

Conocybe zeylanica (Petch) Boedijn, *Sydowia* 5: 223 (1951).

Conocybe zeylanica is widely distributed in moist-deciduous to evergreen forests and grasslands and occurs scattered in small groups on soil, decaying forest litter, humus and on dung of wild and domestic animals. This species can be easily distinguished from the other species of the genus by the large fruit bodies, the white stipe with a sub-bulbous base, the large spores, and the absence of lecythiform cystidia on the stipe.

Fruit bodies small to medium sized. Pileus 2-5 cm diam., thin, conico-campanulate to conico-convex, uniformly pale buff except at the disk which varies from yellowish to grayish orange (5B3), glabrous, expallent, glistening when dry. Margin slightly striate, sometimes crenate. Lamellae adnexed to narrowly adnate, subdistant with lamellulae of two lengths, linear up to 3 mm wide, pale brown to rust brown; edge entire, concolorous. Stipe 7.5-12 cm x 2-4 mm, equal or slightly attenuated above, slightly bulbous at the base, hollow, brittle; surface white, not or little discolouring, longitudinally striate, somewhat fibrillose, glabrescent. Context very thin, 2 mm thick at the disk; brown, of closely interwoven, thin-walled hyphae, 2-4 µm diam., inflated to 22 µm diam., with a few interhyphal spaces. Spores 11-15 x 6-10 µm, ovoid to ellipsoid with a conspicuous truncate germ-pore; wall distinctly double-layered, yellowish brown, smooth; with guttulate contents. Basidia 24-30 x 5-13 µm, short and broad, with four sterigmata up to 4 µm long. Cheilocystidia intermixed with the basidia to form a heteromorphous gill-edge, lecythiform with body measuring 20-24 x 6-8 µm, and a small capitellum, 2.5-3 µm diam., subtended by a narrow neck 1.5-4 x 0.5-1. µm, hyaline, thin-walled and soon disappearing. Pleurocystidia absent. Hymenophoral trama, regular, hyaline, narrow, of inflated hyphae, 2-9 diam., sometimes with a narrow mediostratum and developing a broad hymenopodium in which the hyphae are inflated. Subhymenial layer 5-10 µm wide, pseudoparenchymatous. Pileal surface a monostratous epithelium of inflated, clavate-pedicellate elements, 20-80 x 9-28 µm, thin-walled hyaline, sometimes brown, with a fine, granular encrusting pigment particularly towards the base; pileocystidia absent. Caulocystidia in small fascicles confined to the upper part of the stipe, 16-42 x 5-10 µm, obovoid to fusiform. All hyphae with conspicuous clamp-connections.

Copelandia wayanadensis Mohanan

Copelandia wayanadensis is widely distributed in grasslands, canopy open up areas in moist-deciduous to semi-evergreen forests. This species occurs on dung of domestic and wild animals.

Fruit body small sized. Pileus up to 3-4 cm diam., subglobose to campanulate; surface smooth, hygrophanous, grayish white to reddish grey, areolate, margin regular. Lamellae free to adnate, dark grey, then black, with lamellulae of 2 lengths. Stipe 8-9.5 x 1.5-2 mm, cylindrical with a bulbous base; surface grayish white, blue on bruising. Veil not well represented. Spore-print colour black. Spores 16-20 x 10-12 µm, lenticular, limoniform to slightly hexagonal in face view, elliptic in side view, smooth, blackish brown, with a germ-pore. Basidia 28-31 x 10-12 µm, clavate-cylindric, 4-spored, sterigmata up to 6 µm long. Cheilocystidia 31-45 x 6-8 µm, lageniform, thin-walled, hyaline. Pleurocystidia 50-65 x 13-16 µm, ventricose-fusoid with mucronate apex, metuloidal, with a golden brown, thickened wall and apical encrustation. Hymenophoral trama regular, with hyaline hyphae, 5-12 µm diam., sometimes with brown pigments. Context thin, white, turning pale blue on exposure, of inter-woven hyphae, 3-8 µm diam., thin-walled, hyaline, with clamp-connections. Pileal surface an epithelium, epithelial elements 30-48 x 24-46 µm, globose to pyriform, thin-walled, hyaline; pileocystidia not observed. Stipe tissue consisting of parallel hyphae, 3-12 µm diam., with clamp-connections; caulocystidia 22-42 x 8-12 µm, lageniform, thin-walled, hyaline.

Panaeolus antillarum (Fr.) Dennis, *Kew Bull.* 15: 124 (1961)

Panaeolus antillarum is widely distributed in moist-deciduous to semi-evergreen forests. This species usually occurs solitary or in small groups on elephant dung.

Fruit bodies medium to large sized. Pileus up to 12 cm diam., conic to convex; surface smooth when young, becoming cracked, rimose areolate, off white when young, becoming yellowish white to grayish white at maturity. Lamellae adnate, up to 1.5 cm wide, mottled, black; with lamellulae. Stipe up to 10-20 x 0.6-0.9 cm, cylindric with a bulbous base, hollow; surface glabrous, yellowish white. Annulus absent. Spore-print colour black. Spores 14-17.5 x 10-15 µm, ellipsoid in side view, somewhat hexagonal in face view, double walled, smooth, with apical germ-pore. Basidia 15-35 x 12.5-15 µm, 4-spored, sterigmata up to 5 µm long. Cheilocystidia abundant, forming a sterile layer, 18-23 x 8.5-12 µm, clavate to lageniform, thin-walled, hyaline. Pleurocystidia in the form of chrysocystidia, 43-55 x 14-18 µm, inflated clavate to fusiform, mucronate, thin-walled, with a refractive body, pale yellow in KOH. Hymenophoral trama regular, up to 90 µm wide, hyphae thin-walled, hyaline, 2--5 µm diam., inflated up to 12 µm diam. Context white, unchanging, hyphae thin-walled, 4-8 µm diam., inflated up to 12.5 µm diam. Pileal surface an epithelium, made up of globose or pyriform elements, 30-56 x 14-28 µm; pileocystidia 28-53 x 8-11µm, cylindric, thin-walled, hyaline. Stipe tissue consisting of subparallel hyphae, thin-walled, hyaline, 7-14 µm diam.; caulocystidia in tufts, scattered, 28-56 x 8-148 µm, thin-walled, hyaline.

Panaeolus cyanescens (Berk. & Broome) Sacc., *Syll. fung.* (Abellini) 5: 1123 (1887)

Panaeolus cyanescens is widely distributed in grasslands, moist-deciduous forests and canopy open up areas in semi-evergreen forests. This species occurs on dung in small groups.

Fruit body small sized. Pileus up to 3 cm diam., subglobose to campanulate; surface smooth, hygrophanous, grayish white, yellowish brown at center, sometimes blue on bruising; margin regular. Lamellae free to adnate, dark grey, then black,with lamellulae. Stipe up to 6-8 cm x 1-1.3 mm, cylindrical with a bulbous base; surface white, blue on bruising. Veil not well represented. Spore-print colour black. Spores 13.5-15 x 10-11 µm, lenticular, limoniform to slightly hexagonal in face view, elliptic in side view, smooth, blackish brown, with a germ-pore. Basidia 25-28 x 10-13.5 µm, clavate-cylindric, mostly 4-spored, rarely 2-spored, sterigmata up to 5.6 µm long. Cheilocystidia 28-35 x 7-11 µm, lageniform, thin-walled, hyaline. Pleurocystidia 52-65 x 17.5-23.5 µm, ventricose-fusoid with mucronate apex, metuloidal, with a golden brown, thickened wall and apical encrustation. Hymenophoral trama regular, with hyaline hyphae, 4-11 µm diam., sometimes with brown pigments. Context thin, white, turning blue on exposure, of inter-woven hyphae, 3-70 µm diam., thin-walled, hyaline, with clamp-connections. Pileal surface an epithelium, epithelial elements 28-46 x 22-42 µm, globose to pyriform, thin-walled, hyaline; pileocystidia not observed. Stipe tissue consisting of parallel hyphae, 4-140 µm diam., with clamp-connections; caulocystidia 21-43 x 8-11 µm, lageniform, sometimes capitate, thin-walled, hyaline.

Panaeolina foenisecii (Pers.) Maire, *Treb. Mus. Ciènc. nat. Barcelona*, sér. bot. 15: 109 (1933)

Panaeolina foenisecii is distributed in grasslands, semi-evergreen to evergreen forests and fringes of shola forests and this species occurs on soil, decaying forest litter and on dung.

Fruit body small sized. Pileus 1-1.5 cm diam., convex, umbonate; surface smooth, viscid, grayish orange; margin regular, without velar remnants. Lamellae adnate, up to 3 mm wide, yellowish brown, finally turning to dark brown. Stipe 4-7 cm x 1-1.5 mm, cylindrical; surface smooth, yellowish white. Spore-print colour sepia brown. Spores 13-20 x 6.5-9 µm, broadly ellipsoid, distinctly verrucose, brown in KOH and water, with a distinct truncate apical germ-pore. Basidia 38-45 x 8-10 µm, 4-spored, hyaline, sterigmata up to 3 µm long; basidioles present, deep yellow to brown in KOH. Cheilocystidia 38-42 x 6-8 µm, cylindric to lageniform, occasionally with a slight constriction at the neck region so as to make the cystidia sub-capitate, thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama regular, up to 56 µm wide, hyphae thin-walled, hyaline, 3-12 µm diam. Context thin, of interwoven hyphae, 4-16 µm diam. Pileal surface an epithelial layer, made up of ellipsoid to broadly clavate or pyriform elements, 14-28 µm, thin-walled, hyaline; pileocystidia 28-32 x 4-9 µm, cylindric to clavate, thin-walled, hyaline, scattered. Stipe tissue consisting of parallel hyphae, 3-9 µm diam., inflated up to 19 µm diam. All hyphae without clamp-connections.

5. **BOLETACEAE** CHEVALL. 1826

Boletales: Basidiomycota

The boletes are reported to be the most popular edible fleshy fungi and are widely consumed all around the world. *Boletus edulis, B. pallidus, B. aureus, Gyroporus* spp. are the edible species most widely used and traded wild mushrooms in the world. However, some of the members are deadly poisonous, while a few possess psychotropic properties. Gasterointestinal irritants (Type 8 Toxins) are present in a number of species of boletes. Most of the poisonous species have red tube mouth, bruise blue or both. Several species have low level of muscarine (Type 2 Toxins). Boletes play a major role in forest ecosystem dynamics by establishing ectomycorrhizal association (ECM) with tree species of both Angiosperms and Gymnosperms. Boletes are found widely distributed in moist-deciduous to wet-evergreen forests of the State. *Boletus, Tylopilus, Austroboletus, Gyroporus, Strobilomyces*, and *Leccinum* form ectomycorrhizal association with hardwood trees, *Hopea parviflora, Hopea ponga, Diospyros malabarica, Myristica fragrans, M. malabarica, Vateria indica, Calophyllum calaba*, etc.

Most of the available information on boletes from India is from Himachal Pradesh (Sharma and Munjal,1971; Walting and Gregory, 1980; Sharma and Lakhanpal, 1981; Lakhanpal, 1996). Very meagre information is available on boletes from Southern India. Recently, the author has reported 8 species of *Boletus*, 3 species of *Strobilomyces*, one species each of *Austroboletus, Rubinoboletus, Gyroporus, Leccinum* and *Tylopilus* from different forest ecosystems of the State (Mohanan, 2011).

Austroboletus gracilis var. **laevipes** (Peck) Wolfe, *Bibl Myc.* 69: 69. 1979.

Austroboletus gracilis var. *laevipes* is widely distributed in *Hopea parviflora, Vateria indica* mixed stands in Nilambur Forest Division. This species occurs in small groups on soil and forms ectomycorrhizal association with *H. parviflora* and *V. indica.*

Fruiting bodies small to medium sized. Pileus 2.5-5 cm diam., convex when young, expanding to nearly planoconvex with age, often with a slight depression in the centre; surface dry sub-tomentose to velvetty, rimulose areolate in age, areolations more towards periphery; pale reddish brown to deep reddish brown, fading with age, usually evenly coloured except for the pale flesh showing in areolate pilei; margin with a faint sterile band, recurved in age. Context 4-8 mm thick, white to pinkish white, faint pink to pinkish brown below the cuticle; unchanging on exposure; taste mild, odour indistinct. Tubes 5-10 mm deep, adnate to subdecurrent, deeply depressed around the stipe, off white first, pinkish white finally, unchanging on exposure; pores small, angular, 1-2 mm, concolourous with tubes. Stipe 4.5-7 x 1-1.5 cm, 10-20 mm thick at base, unequal, base swollen, tapering upwards, uneven, finely granular to pruinose, deep reddish brown at the apex, fading to brown towards the base, off white at base; exannulate; flesh whitish unchanging on exposure or bruising.

Spores brownish to reddish brown, inamyloid, yellowish brown in Melzer's reagent, grayish yellow in KOH, acyanophyllous 10 -17 x 4-5 µm, narrowly ovoid to subelliptic in face view, inequilateral in profile, apiculus distinct; thick-walled, with an inconspicuous hyaline sheath, inner coloured wall with minute canals ending in the pits on the surface. Basidia 25-35 x 9-13 µm, hyaline in KOH, yellowish in Melzer's reagent, 2-4 spored. Pleurocystidia 25-35 x 4-6 µm, narrowly fusoid ventricose with gradually tapering neck and subacute apex, thin-walled, hyaline in KOH; cheilocystidia mostly narrowly clavate, 22-35 x 5-7 µm, hyaline, thin-walled. Tube trama bilateral, divergent, composed of inamyloid hyphae. Pileus surface composed of a palisade of trichodermium becoming subgelatinuous and finally an interwoven ixotrichodermium, cells 5-12 µm wide, hyaline in KOH, pale in Melzer's reagent. Stipe surface a layer of interwoven to suberect hyphal tips some of which are cystidioid, clamp connections absent. In KOH flesh pinkish white colour, cuticle-yellowish brown; in Melzer's reagent flesh negative, cuticle-negative.

Boletus edulis Bull., *Herb. Fr.* 2: tab. 60 (1782) [1781-82]

Boletus edulis is widely distributed in moist deciduous to semievergreen forests in Wayanad and Nilambur Forest Divisions. This species forms ectomycorrhizal association and occurs in groups under *Hopea ponga, H. parviflora* and *Vateria indica* stands. Fruit bodies small to medium sized. Pileus 3-9 cm diam., convex when young, broadly convex with age; surface dry, viscid when wet, glabrous, smooth, uneven, slightly wrinkled to somewhat shallowly pitted, pale purplish brown to brownish or with darker shades of brown, dusted with a whitish bloom, margin regular, smooth, incurved when young. Context firm, 10-15 mm thick, pure white, unchanging on exposure or bruising; odour pleasant. Tubes 4-10 mm deep, adnexed but depressed around the stipe, pale whitish when young. Pores minute, round, stuffed when young, pinkish brown to pale brown in age, unchanging on bruising. Stipe central, 4-10 cm x 1-2 cm across, bulbous at base or almost parallel, pale grayish

violet in apical part, whitish brown at base, reticulate in the upper half, base subradicating, flesh firm, white unchanging.

Spores olive brown, 9-10 x 4-5 µm, ellipsoid in face view, subfusiform, inequilateral in profile, yellowish to olive yellow in KOH, bright, yellow in Melzer's reagent, smooth-walled, hilum distinct. Basidia 25-28 x 6-8 µm, clavate, 4-spored, hyaline to pale in KOH. Pleurocystidia scattered 37-43 x 7-9 µm, narrowly fusoid ventricose, hyaline in KOH, yellowish in Melzer's reagent, smooth, thin-walled; cheilocystidia similar to pleurocystidia. Tube trama bilateral, divergent; pileus cuticle a trichodermium of hyphae, forming a palisade but collapsing in mature specimens, hyphae 8-12 µm wide; subcutis composed of interwoven hyphae, orange yellow in Melzer's reagent; stipe cuticle of loosly interwoven clavate to ventricose, hyaline, thin-walled, clamp-connection absent.

Boletus hongoi T.N. Lakh. & Sagar [as '*hongoae*'], in Lakhanpal, *Stud. Cryptog. Bot.* 1: 46 (1996)

Boletus hongoi is widely distributed in semi-evergreen to evergreen forests in the State. This species occurs in small groups on soil and forms ectomycorrhizal association with tree species, *Hopea parviflora, Terminalia paniculata, Calophyllum* sp., *Vateria indica, Dipterocarpus malabaricus*.etc.

Fruit bodies small to medium sized. Pileus 2.5-8 cm diam., convex to broadly convex when young, surface smooth, dry, viscid when wet, bright red, rarely blackish at centre, margin incurved. Context 5-10 mm thick, light grayish brown, unchanging on exposure; taste and odour not distinct. Tubes 3-8 mm deep, minutely depressed, tube surface light pinkish brown to pinkish red at maturity, unchanging on exposure; pores minute and round. Stipe 3-6 cm x 2-5 mm, unequal tapering at apex, network well developed at apex and pale reddish brown to deep red at maturity, smooth at base, surface grayish brown; flesh pale grayish brown unchanging on exposure.

Spores dark yellowish brown, 8-10 x 3.5-4 µm, subfusiform, darkening in KOH, pale orange in Melzer's reagent. Basidia 17-32 x 4-8.5 µm, 4-spored, clavate, pale yellow in KOH. Cheilocystidia 45-60 x 10-12.5 µm, clavate to sphaeropedunculate, pale brown in KOH. Pleurocystidia 30-40 x 9-10 µm, clavate to sphaeropedunculate, pale brown in KOH. Pielus cutis of long, cylindrical hyphae loosely arranged with dark yellowish brown to dark brown contents. Stalk cutis a compact layer or swollen cells with dark reddish brown contents, darker in KOH. In KOH flesh becomes pale grayish black, cuticle deep grayish black.

Boletus huronensis A.H. Sm. & Thiers, *Persoonia* 7(2): 306 (1973)

Boletus huronensis is distributed in semievergreen forests of the State. This species forms ectomycorrhizal association with *Vateria indica* trees. This species occurs after the North East monsoon and found attached to roots of *V. indica*.

Fruit bodies small to medium sized. Pileus 2-5 cm diam., convex to plane at maturity, reddish brown to brownish red, surface dry, powdery, margin irregular and incurved. Context 5-10 mm thick, yellowish white to pale yellow, changing to slightly blue on exposure. Tubes 8-10 mm deep, minutely depressed, tube surface pale yellow and

tubes yellow, changing to blue on exposure, pores wide and angular to roundish. Stipe 3-8.5 x 4-8 mm, unequal, tapering upward, light yellow at apex and pale purplish red at base, reticulate, changing to slightly blue on exposure.

Spores dark brown, 9-10 x 3-5 µm, oblong to subfusiform, yellowish brown in KOH and brownish in Melzer's reagent. Basidia 29-34 x 9-10.5 µm, clavate, hyaline in KOH and yellowish in Melzer's reagent. Pleurocystidia 34-45 x 6-8.5 µm, clavate to sphaeropedunculate. Cheilocystidia 32-42 x 6.5-8.5 µm. Pileus cutis of irregularly scattered ,clavate hyphae; caulocystidia present. Stalk cutis of narrow elongated cells.

Gyroporus castaneus (Bull.) Quél., *Enchir. fung.* (Paris): 161 (1886)

Gyroporus castaneus is distributed in semi-evergreen to evergreen stands in Wayanad Forest Division and sacred groves at Iringole, Perubavoor. This species occurs solitary or in small groups on soil and forms ectomycorrhizal association with trees such as *Hopea ponga, Vatteria indica,* etc.

Fruit bodies small to medium sized. Pileus 3-5.5 cm diam., broadly convex when young, expanding to plane, almost applanate with age with a shallow depression, dark yellowish brown at the centre, fading to yellowish brown towards periphery, margin entire and smooth, surface dry, finely pruinose to pulverulent. Context 3-8 mm thick, white to pale yellowish white, unchanging on exposure. Tubes 3-6 mm deep, free to deeply depressed around the stipe, whitish first, then pale yellow to yellow finally, unchanging on bruising; pores small, 1-2 mm, circular, pale yellow to bright yellow, unchanging. Stipe 4-9 cm x 5-10 mm, tapering upwards, very fragile, splitting transversely, surface dry, glabrous, uneven, dark brown at the base, lighter at the apex, context white, unchanging, stuffed with white wooly tissue, hollowing with age.

Spores yellow, 7-11 x 5-7 µm, smooth, hyaline in KOH, nonamyloid, thin-walled, ellipsoid to occasionally ovoid; hilum distinct. Basidia 18-35 x 8-14 µm, clavate, four spored, hyaline in KOH, yellow in Melzer's reagent. Pleurocystidia clavate, 16-32 x 6-11 µm, thin-walled, hyaline in KOH; cheilocystidia, numerous, clavate to narrowly fusoid to sub-ventiricose, 20-30 x 6.5-8 µm, thin-walled. Tube trama divergent, nonamyloid; hyphae 5-8 µm broad. Pileus cutis a trichodermium composed of pileocystidia as terminal cells of short hyphae; stipe cutis hyphae having numerous hyaline cystidioid end cells, clamp-connection present. In KOH flesh turns brown, cutis yellowish brown; in Melzer's reagent flesh negative, cutis negative.

Rubinoboletus caespitosus T.H. Li & Watling, *Edinb. J. Bot.* 56(1): 148 (1999)

Rubinoboletus caespitosus is distributed in semi-evergreen to evergreen forests in Nilambur Forest Division. This species occurs in large groups on soil in *Hopea parviflora* stands and forms ectomycorrhizal association with the trees.

Fruit bodies small to medium sized. Pileus 3-8 cm diam., plane to planoconvex when young, remaining plane with margins turning upwards and becomes wavy at maturity; surface viscid to subviscid, areolate, tomentose, pale pinkish brown to greyish brown. Context 2.5-5 mm thick, pale olive to pale yellow, unchanging on exposure. Tubes 2.5-6 mm deep, slightly depressed when young, deeply depressed and subdecurrent with age, tube surface medium pale pinkish brown to pale pinkish, unchanging; tubes concolorous with tube surface and unchanging on exposure; pores angular,

approaching boeletinoid shape, 0.8-0.9 mm wide. Stipe 2-6 x 1-1.8 cm, smooth, unequal, narrowing upwards, and slightly swollen at base, pale purplish brown to light yellowish brown at apex, flesh off white, unchanging.

Spores dark yellowish brown 7.5-11.5 x 3.5-4.5 µm, inequilateral with definite suprahilar depression in profile, long, oval to oblong in face view, smooth, hyaline in KOH and yellowish in Melzer's reagent. Basidia 29-31 x 5-6.5 µm, clavate, 4-spored, sterigmata 2-3.5 µm. Pleurocystidia 29-34 x 6-8 µm, similar to cheilocystidia. Pielus cutis of long hyphal cells, 3-4.5 µm wide, apical cells pointed, rough or smooth walled, pale yellowish brown, hyaline in KOH. Stipe cutis of short, swollen hyphal cells with dark yellowish brown contents.

Strobilomyces mollis Corner, *Boletus in Malaysia* (Singapore): 63 (1972

Strobilomyces mollis is distributed in semievergreen to evergreen forests of Wayanad and Olavakkode Forest Divisions. This species forms ectomycorrhizal association with tree species and occurs solitary to scattered under *Hopea ponga*, *Dipterocarpus malabaricus, Vateria indica,* etc. This bolete can be easily recognized. Pileus and stipe are covered with soft hairy or woolly scales and resistant to decay whereas most mushrooms in the Boletaceae are soft and decompose rapidly.

Fruit bodies small to medium sized. Pileus 4-7 cm diam., convex when young to planoconvex in age, grayish brown to dark grayish brown to brownish black, surface dry, densely set with soft, subfloccose, erect, conical, dark grayish brown warts, tomentose to finely hairy at intervening spaces, margin appendiculate with fragments of veil and warts projecting down, veil whitish to grayish white first, grayish black finally. Context firm, 10-12 mm thick, white to pinkish white, turning dull reddish and finally black on exposure. Tubes 7-12 mm deep, adnate, becoming minutely sinuate decurrent, white to grayish white first, grayish brown to grayish black in age, reddish first, changing to black on bruising; pores minute, angular, whitish first, dark grayish when mature, reddish first and then black on bruising. Stipe 5-9 cm x 7-15 mm, 20 mm diam. at base, concolourous with the pileus, surface dry, longitudinally rugulose with a poroid reticulate apex. Annulus absent; context whitish, reddish first and then black on exposure or bruising.

Spores dark brown to dark grayish brown, 7.5-10.5 x 7.5-9 µm, inamyloid, yellowish brown in Melzer's reagent, thick-walled, dark brown, body yellowish brown, subglobose, reticulate with a smooth adaxila patch, apicule distinct. Basidia 30-45 x 14 µm, 4-spored, clavate, hyaline in KOH. Pleurocystidia 50-70 x 12-15 µm, thin-walled, numerous, fusoid ventricose with brownish contents at the apex and base; cheilocystidia 30-45 x 10-15 µm, mostly clavate, basidioid, fusoid-ventricose, some with brownish contents. Pileus surface composed of loosely interwoven cells with apical cells slightly swollen; stipe cutis of long cystidioid cells with brown contents and numerous caulocystidia; clamp-connections absent. In KOH flesh turns brownish; in Melzer's reagent flesh-negative.

Strobilomyces strobilaceus (Scop.) Berk., *Hooker's J. Bot. Kew Gard. Misc.* 3: 78 (1851)

Strobilomyces strobilaceus is widely distributed in moist-deciduous to evergreen

forests of Wayanad, Nilambur and Thenmala Forest Divisions. This species forms ectomycorrhizal association with tree species and occurs solitary to scattered in small groups under *Hopea ponga, Holigarna arnottiana, Dipterocarpus malabaricus, Vateria indica,* etc.

Fruit bodies medium sized. Pileus 5-9 cm diam., convex becoming broadly convex in age; dry; covered with coarse, grayish black, soft and woolly scales over a whitish to grayish base colour; the margin frequently with hanging remnants of partial veil; the pileus becomes blackish in age. Hymenophore tubulate, ending in pores; pore surface greyish white, soon becoming grayish black and finally black; bruising reddish, then black; pores angular; tubes 0.8 to 1 cm deep, adnate to subdecurrent, often slightly depressed around the stipe, grey when mature, staining reddish, then black when injured. Stipe 4.5-8 cm x 5-15 mm, central, cylindric, more or less equal, solid; grayish to blackish; shaggy; sometimes reticulate above; surface grey to concolourous with the pileus, mid portion covered with a thick wooly sheath from the copious soft veil which leaves an annular zone or several belts lower down when it breaks. Context white then bruising red to brownish black. Odor and taste not distinctive.

Spore-print black. Spores 10-12.5 x 10-11.5 µm, subglobose, spiny to warty, covered entirely by a complete network of lines to form a reticulum, wall thick, with a more or less distinct germ pore. Basidia 45-55 x 12- 15 µm, 4-spored, clavate. Pleurocystidia numerous 60-80 x 9-12.5 µm, mucronate-apiculate to more or less fusoid-ventricose, containing a brown vacuolar pigment. Cheilocystidia 45-55 x 14-20 clvate to mucronate-apiculate or fusoid-ventricose containing brown vacuolar pigment. Tube trama bilaterally divergent composed of tubular to vesiculose hyphae. Pileus a trichodermium of cylindric elements, slightly constricted at septa, terminal elements rounded. Clamp-connections absent. In KOH flesh turns brownish; in Melzer's reagent flesh-negative.

6. BOLELTINELLACEAE P.M. Kirk, P.F. Cannon & J.C. David 2001

Boletales : Basidiomycota

Boletinellus and *Phlebopus* are the significant genera of this family. Members of this family are widespread in distribution and occur primarily in tropical zones. Most species are saprobic on buried wood and roots, normally not forming ectomycorrhizae. The genus *Phlebopus* contains some of the largest Agaricales known. The mycorrhizal status of *P. portentosus* is uncertain, however artificial inoculation trials proved ectomycorrhizal ability of the fungus and it is suspected to form ectomycorrhizae with many host trees. Recently mycorrhizal associations with *Eucalyptus* has been reported from Australia. *P. portentosus* is regarded as an edible species in Australia and is highly favoured in the cuisine of northern Thailand. This bolete is common in Kerala and is widely collected and appreciated by the local tribes.

Boletinellus merulioides (Schwein.) Murrill, *Mycologia* 1(1): 7 (1909)

Boletinellus merulioides is widely distributed in *Myristica* swamp forests in Trivandrum Forest Division. This species occurs solitary or in small groups on soil

and often attached on basal aerial roots of *Myristica malabarica, M. fatua* var. *magnifici, Knema attenuata* and knee roots of other trees growing in the swamp.

Fruit bodies medium to large sized. Pileus 5-15 cm, irregular, nearly convex when young, becoming wavy and nearly vase-shaped, or more or less flat; light to dark brown, to yellowish brown with reddish tint; dry, tacky when wet; soft and leathery; sometimes bruising darker brown. Pore surface yellowish to olive green, pores elongated radially, sometimes appearing almost like gills, with many cross-veins; tubes shallow; running down the stipe; yellow to olive, bruising brownish to olive to bluish green, not easily separable. Stipe 1-4 cm long, 0.5-1.5 cm thick; excentric to lateral, yellowish above, or darker below, bruising darker brown. Context pastel yellow to pale yellow, up to 5 mm thick, bruising slowly bluish green when exposed. Odour and taste not distinctive. Spore-print olive brown. Spores 8.5-11 x 5.5-6 µm, smooth, subglobose, or ellipsoid to ovoid, yellowish brown, pseudo-dextrinoid. Cystidia not observed. Pileipellis a cutis of mostly erect, cylindrical elements of 6-10 µm wide. Clamp-connections present. In KOH pileus surface becomes reddish to orange then blackish; flesh becomes pale brown.

Phlebopus portentosus (Berk. & Broome) Boedijn, *Sydowia* 5(3-6): 218 (1951)

Plebopus portentosus is widely distributed in moist-deciduous to semi-evergreen forests of the State and usually occurs solitary or scattered in small groups on soil or on decaying forest litter, especially in *Tectona grandis, Terminalia paniculata, Xylia xylocarpa* mixed stands.

Fruit bodies medium to large sized. Pileus 8-24 cm diam., fleshy, convex becoming plano-convex, often with a shallow depression at the centre; surface olive brown to 'sepia brown' (4F4/5F4) at the center, paler elsewhere, slimy when wet, otherwise dry, with a non-separable cuticle, smooth and glabrous; margin at first involute projecting beyond the hymenophore, undulate. Hymenophore tubulate, adnexed to adnate; tubes pale yellow, up to 15 mm long; darkening on bruising; pores greenish yellow, with a brownish tint, up to 0.8 mm diam., bluing on bruising. Stipe 6-17 cm x 3-5 cm, central, robust, clavate with a swollen base, solid; surface concolourous with the pileus, discolouring yellowish brown to orange brown when bruised, longitudinally sulcate below, sticky to touch when wet, smooth above, arising from brownish basal mycelium often with pale yellow mycelial codons. Context up to 5 cm wide at the centre, spongy, pale yellow to pastel yellow bluing on bruising or cutting when fresh and young, often the colour change is vey slow, consisting of loosely woven, inflated, thin-walled hyphae, mostly hyaline, rarely with yellow oleaginous contents, 4.5-15 µm wide, with clamp-connections. Odour pleasant. Spore-print olivaceous brown. Spores ellipsoid, 7-10 x 5-7 µm, with smooth , brown wall. Basidia 28-40 x 8-12, clavate to cylindro-clavate, 4-spored, sterigmata up to 5 µm long. Cheilocystidia 23-40 x 8-10, clavate, cylindro-clavate, versiform, hyaline. Pleurocystidia 20-75 x 4-5, versiform, clavate, mucronate, hyaline. Hymenophoral trama bilateral, with divergent hyphae, 2-6 µm diam., gelatinized, clamp-connections present. Subhymenium pseudoparenchymatous. Pileipellis an indefinite trichodermium, terminal elements cystidiform, 20-40 x 4-6 µm, clavate, thin-walled, hyaline. Stipitipellis similar to the pileipellis. Oleiferous hyphae present.

7. BULGARIACEAE FR. 1849

Helotiales : Ascomycota

Bulgaria indica Mohanan

Bulgaria is the significant genus of this family and known mostly from North and South temperate zones, also occurs in tropical zones. Members are saprobic on wood and bark and are primary colonizer and probably endophytic. *Bulgaria indica* is widely distributed in moist-deciduous to evergreen forests and occurs solitary or scattered in small clusters on decaying logs, during the rainy period, June-September. *Bulgaria indica* has recently been reported from the State (Mohanan, 2011).

Fruit bodies flat-topped at first becoming cup-shaped or globose with flattened top portion and tightly inrolled margin, scurfy brown exterior, later expanding then flattened, 3-10 cm diam., outer surface grayish brown to black, finely to prominently hairy or scaly, becoming smooth and blackish with age; upper surface pinkish brown, shiny, and smooth with fine hairs on the margin; flesh soft rubbery to gelatinous in wet weather but in dry condition it becomes tougher more like elastic; stipe absent or merely a pinched-off extension. Asci cylindrical, hyaline, 450-495 x 14-20 µm long, 8-spored, with the top 4 spores dark brown and guttulate and the bottom 4 spores poorly developed, multi-guttulate, and hyaline; Spores 9-18 x 6-7 µm, ellipsoid to broadly ellipsoid, smooth; paraphyses filiform.

8. CANTHARELLACEAE J. Schröt. 1888

Cantharellales : Basiodiomycota

Cantharellus is the significant genus of this family and the species are edible and widespread, known best from north temperate regions but also occurring in the tropics. Even though records of chanterelles being eaten date back to the 1500s, they first gained widespread recognition as a culinary delicacy with the spreading influence of French cuisine in the 1700s, where they began appearing in palace kitchens. For many years, they remained notable for being served at the tables of nobility. Nowadays, the usage of chanterelles is common throughout Europe and North America. Chanterelles as a group are generally described as being rich in flavor, with a distinctive taste and aroma difficult to characterize. Some species have a fruity odor, others a more woody, earthy fragrance, and others still can even be considered spicy. The golden chanterelle is perhaps the most sought-after and flavorful chanterelle. In Kerala, chanterelles are widely distributed in semi-evergreen to evergreen forest ecosystems and usually form ectomycorrhizal association with trees like *Vateria indica, Hopea parviflora, Diospyros malabarica, Dipterocarpus* sp., *Myristica* sp. etc. It seems that *Cantharelles* species belong to the introduced Ectomycorrhizal (EM) fungi along with their hosts and invaded the natural forests to form mycorrhize with the native tree species. *Cantherellus* species are quite distinctive in appearance, and their gills are fold like rather than plate-like, thick, blunt, shallow, well-spaced, decurrent and forked. The fruity odour, golden orange colour, firm flesh and wavy pileal margin at maturity are characteristic features. *Cantharellus cibarius*, *C. lateritus* and *C. minor* are the species recorded from semi-

evergreen to evergreen forests of Kerala (Mohanan, 2011). *C. cibarius* and *C. minor* are described here.

Cantharellus cibarius Fr., *Syst. mycol.* (Lundae) 1: 318 (1821)

Cantharellus cibarius is widely distributed in semi-evergreen to evergreen forests in Wayanad, Thenmala and Trivandrum Forest Divisions. This species occurs solitary, gregarious or occasionally sub-caespitose on soil or humus in *Vateria indica, Hopea parviflora, Diospyros malabarica, Myristica malabarica*, mixed stands and forms ectomycorrhizal association with the tree species.

Fruit bodies small to large sized. Pileus 3-10 cm diam., convex at first becoming nearly plane, disk shallowly depressed, finally broadly infundibuliform; surface uniformly deep yellow 'butter yellow' (4A5) or grayish yellow, fading in age and when exposed to weather, moist or dry, smooth and glabrous; margin inrolled and incurved when young, remaining so for sometime, non-striate. Lamellae decurrent, narrow, cream to pale orange, blunt, forked often dichotomously, not interveinose, well separated. Stipe 2.5-8 cm x 7-22 mm, central, cylindric to compressed, equal or often tapered at base, solid; surface pale yellow to yellowish white, to yellowish grey, smooth and glabrous. Annulus absent. Smell pleasant, fruity, like apricots when dried. Context yellowish white composed of thin-walled, hyaline 3-12 µm wide hyphae lacking clamp-connections. Spores 9-10 x 5-6 µm, ellipsoid, hyaline, inamyloid, smooth. Basidia elongate clavate, 60-87 x 9-11 µm. Lamella-edge fertile, cystidia absent. Hymenophoral trama interwoven, composed of thin-walled, hyaline 2-14 µm wide hyphae. Pileipellis a repent epicutis of radially arranged, thin-walled hyphae.

Cantharellus minor Peck, *Ann. Rep. Reg. St. N.Y.* 23: 122 (1872) [1870]

Cantharellus minor is distributed in semievergreen to evergreen forests in Wayanad, Thrissur and Trivandrum Forest Divisions. This species occurs solitary to scattered on soil or humus in *Vateria indica, Hopea parviflora, Diospyros malabarica, Myristica* sp. mixed stands and forms ectomycorrhizal association with the tree species.Fruit bodies small sized. Pileus 1-3 cm diam., convex, umbonate, often shallowly depressed, becoming infundibuliform in some; surface, dry, glabrous, smooth; margin narrowly recurved, and finally arched, undulate. Hymenophore decurrent, maize yellow, fading yellowish white, up to 3 mm wide, subdistant, thick with lamellulae. Stipe 2-4 cm x 3.5-7 mm, central, cylindric to compressed, stuffed, equal or often tapered at base, solid; surface concolourous with the pileus, glabrous. Context pale yellow, up to 2 mm wide, soft. Spores 7-8 x 4-5 µm, broadly ellipsoid, hyaline, inamyloid, smooth, with small guttules. Basidia elongate clavate, 50-54 x 6-7 µm, 4-spored. Lamella-edge fertile. Cystidia absent. Hymenophoral trama of interwoven hyphae; Pileipellis a repent epicutis of radially arranged, thin-walled hyphae; clamp-connections present.

9. CLAVARIACEAE Chevall. 1826
Agaricales : Basidiomycota

Members of this family are known as coral fungi with erect, finger-like beautiful fruiting bodies, with the spore-bearing surface over the upper half of the fruiting bodies and basal stalk. *Clavaria, Clavulinopsis* and *Ramariopsis* are the significant

genera of this family. Members of this family are widely distributed and best known from the north temperate regions. Most species are presumed saprobic and occur on soil or decaying wood and many members are lichenized with green algae. The Clavariaceae at one time included all basidiomycets fungi with cylindrical or club-shaped fruit bodies, have been demonstrated to have multiple evolutionary origins and the family is now recognized with a much restricted circumscription. *Clavaria zollingeri, Clavulinopsis aurantiocinnabarina, C. corniculata, C.dichotoma, C. fusiformis, Clavulinopsis laeticolor, C. luteoalba, Ramariopsis kunzei* and *Ramariopsis pulchella* have recently been recorded by the author (Mohanan, 2011).

Clavaria zollingeri Lév., *Annls Sci. Nat.*, Bot., sér. 3 5: 155 (1846)

Clavaria zollingeri is distributed in semievergreen to shola forests of the State and occurs scattered in small clumps on soil amongst decaying forest litter. *Clavulina amethystina* is closely related species but with 2-spored basidia. *Clavaria vermicularis* is also closely related species with pure white basidiome and with elliptical spores.

Fruit bodies erect, solitary, gregarious or in clumps, violet to deep pinkish violet, mostly branched and dichotomously forked towards the branch ends, tips acute, 4-8 cm tall, branches 1-5 mm thick, often compressed laterally. Hyphae up to 24 µm wide. Basidia without clamps, 50-60 x 7-9 µm, with 4 sterigmata. Spores hyaline, broadly ellipsoid, subspherical or pyriform, 4.5-7 x 3-5 µm.

Clavulinopsis aurantiocinnabarina (Schwein.) Corner, *Monograph of Clavaria and allied Genera (Annals of Botany Memoirs No. 1)*: 358 (1950)

Clavulinopsis aurantiocinnabarina is distributed in semi-evergreen to evergreen forests and occurs scattered in small clumps on soil amongst decaying forest litter. Fruit bodies small to medium sized, reddish orange (7A6) to orange red (8A8) to vivid red (9A8), 2-9 cm x 1-3 mm, with pale red stem base and pointed tip, tips often incurved; stalk 1-3 cm x 1-4 mm. Basidia 30-45 x 5-7.5 µm, clavate, hyaline with 2 to 4 sterigmata. Sterigmata up to 5 µm long. Spores ovoid to subspherical, 4.5-6.5 x 4-5 µm, hyaline, smooth with a large oil guttule.

Clavulinopsis fusiformis (Sowerby) Corner, *Ann. Bot. Mem.* 1: 367 (1950)

Clavulinopsis fusiformis is distributed in moist-deciduous to evergreen forests of the State and occurs in dense clumps on soil. *Clavulinopsis helviola* is very similar but has strongly warted spores. Fruit bodies yellow to ochraceous, usually in dense clumps, unbranched, narrowly fusiform with stalk-like base, sometimes twisted, laterally compressed and longitudinally grooved, 5-15 cm x 2-10 mm. Basidia 40-60 x 6-8.5 µm, cyndro-clavate, hyaline with 4 sterigmata. Spores broadly ellipsoid or subspherical, 5-8 x 4.5-7.5 µm with large oil guttule.

Clavulinopsis luteoalba (Rea) Corner, *Monograph of Clavaria and allied Genera (Annals of Botany Memoirs No. 1)*: 374 (1950)

Clavulinopsis luteoalba is distributed in semi-evergreen to evergreen forests of the State and occurs solitary or in clumps on soil amongst decaying forest litter.

Fruit bodies erect, yellow or creamy yellow to grayish yellow (1B6) with yellowish white or very pale tips, solitary, gregarious or in clumps, stalked, usually unbranched, rarely with 1 or 2 short branches near the apex, cylindrical to narrowly clavate, sometimes laterally compressed, 3-7 cm x 1-3 mm. Basidia 50-65 x 6-7 µm. Spores ovoid or ellipsoid, shortly apiculate, 5-8 x 3-4.5 µm, hyaline with a large oil guttule.

Ramariopsis kunzei (Fr.) Corner, *Monograph of Clavaria and allied Genera (Annals of Botany Memoirs No. 1)*: 640 (1950)

Ramariopsis kunzei is distributed in semi-evergreen to shola forests of the State and occurs scattered in dense clumps on soil and rarely on rotten wood. Fruit bodies erect, solitary, gregarious or clustered, 3-12 cm tall, tough, richly and closely branched, pure white to cream or pale brownish, rarely tinted pinkish, stalk up to 2.5 x 0.5 cm, downy or felted, lower main branches 20 mm thick, divided many times, upper ones branched dichotomously, 12 mm thick, somewhat flattened, tapered to a point or rounded at apex. Basidia 25-50 x 6-7 µm, cylindro-clavate, hyaline with 4 sterigmata. Spores broadly ellipsoid to subspherical, finely echinulate, 3.5-5.5 x 2.5-4.5 µm.

Ramariopsis pulchella (Boud.) Corner, *Monograph of Clavaria and allied Genera (Annals of Botany Memoirs No. 1)*: 645 (1950)

Ramariopsis pulchella is distributed in moist-deciduous to shola forests of the State and occurs solitary or in clumps on soil. Fruit bodies erect, solitary or clustered, rather soft, waxy, rose (11B3) to grayish ruby, 1-3 cm tall, slim, many times dichotomously branched, antler-like, with most violet colour in the spine-like tips; stalk short, 1-2 mm thick, off white, or reddish yellow, tomentose at base. Basidia 20-30 x 5-7 µm, clavate, cylindrical, 4-spored. Spores subspherical, finely verruculose, 3-4.5 x 2.5-3.5 µm.

10. CORTINARIACEA R. Heim ex Pouzar 1983
Agaricales : Basidiomyctoa

The family Cortinariaceae contains over 2100 species (Kirk *et al.*, 2008) and the family takes its name from its significant genus, *Cortinarius*. Many members of this family contain the deadly toxin orellanine which causes kidney failure. The equally deadly toxin amanitin has also been reported in at least 7 members of the Cortinariaceae (Kirk *et al.*, 2008). *Anamika* and *Cortinarius* are the significant genera of this family. Members of this family are widespread, especially in temperate climates. The Cortinariaceae family constitutes the dominant ectomycorrhizal groups in many forest ecosystems. Many species are poisonous, containing amatoxins, orellanine, muscarine, hallucinogens, among others.

Anamika indica K.A. Thomas, Peintner, M.M. Moser & Manim., *Mycol. Res.* 106 (2): 247 (2002)

Anamika indica is distributed in semi-evergreen to evergreen and shola forests of the State. This species occurs solitary, gregarious to scattered on soil under *Dipterocarpus* sp. probably forms ectomycorrhizae with tree species.

Fruit bodies small sized. Pileus 10-25 mm diam., brownish orange when young, becoming plano-convex to applanate when mature, sometimes with a small depression at the centre, non-hygrophanous, smooth, glabrous, slightly sticky when moist; margin incurved and entire when young, becoming decurved and fissile with age; context pale brown. Lamellae adnate, pale orange to light brown, subcrowded to close, up to 4 mm wide, with lamellulae of 3-4 lengths. Stipe 20-45 x 2.6 µm, central, terete, equal or enlarged towards both ends; surface off-white, orange white or pale orange towards the apex, pale brown towards the base, slightly furfuraceous with a cortina when young, which often leaves inconspicuous annular remnants. Spore-print brown.

Spores amygdaliform to sublimoniform, 6.5-9.5 x 4.5-5 µm thick-walled, epitunica strongly developed with cavernous type of ornamentation, with a conspicuous callus and without germ-pore. Basidia 31-36 x 4-6 µm, 4-spored; lamella-edge with numerous cheilocystidia, 26-35 x 6.5-10 µm, versiform, clavate to fusoid, usually with a subcapitate, mucronate or rostrate apex, thin-walled, hyaline. Pleurocystidia 16-40 x 5-10 µm, scattered, versifrom and similar to cheilocystidia. Hymenophoral trama regular. Pileipellis an epicutis of repent thin-walled hyphae with pale brownish incrustation. Caulocystidia, occurring in small clusters or scattered. Clamp-connections present in all tissues.

Cortinarius pholideus (Fr.) Fr., *Epicr. syst. mycol.* (Upsaliae): 282 (1838)

Cortinarius pholideus is distributed in semi-evergreen to evergreen forests of the State. This species occurs scattered in small groups on soil under *Dipterocarpus* sp., *Hopea parviflora,* probably forming ectomycorrhizal association. *C. pholideus* characterized by development of dark brown, pointed, erect scales on the pileus and stipe. This feature is universal in *Cortinarius*, but is very striking in certain species of *Pholiota.*

Fruit bodies small to medium sized. Pileus 2.5-6 cm diam., convex becoming plano-convex, sometimes with a broad blunt umbo, squarrose scaly, more erect and large dark brown scales at margin; surface yellowish brown when young, becoming purplish grey (13F2) to dark brown at maturity, margin somewhat incurved, becoming decurved, appendiculate when young, becoming entire with maturity, sometimes eroded or fissile; surface viscid when wet, hygrophanous, becoming dry and wrinkled. Lamellae purplish grey to dark brownish black, adnate, up to 12 mm wide, subcrowded to close, with lamellulae of 3 to 4 lengths. Stipe central, 7-8.5 cm x 5-6 mm, cylindric, almost equal or tapering apically, solid, becoming fistulose, dark yellowish brown, fibrillose scaly below the distinct annular zone. Cortina reddish grey to purplish grey. Spore-print dark blackish brown. Basidiospores amygdaliform to sublimoniform with apicular callus, dark brown, thick-walled, strongly verrucose with irregular warts, apiculus smooth, with suprahilar pseudoplage. Basidia 18-23 x 8-10 µm, 4-spored, sterigmata up to 5 µm long. Lamella-edge sterile with cheilocystidia. Cheilocystidia 33-40 x 7-12 µm, clavate, thin-walled. Pleurocystidia 32-40 x 8-12 µm, clavate, similar to cheilocystidia. Hymenophoral trama regular, hyphae thin-walled, hyaline, 3-12 um diam. Context 3 mm thick, pale brown of interwoven hyphae. Pileus surface made up of cutis of septate brown hyphae with encrusted walls, 3-9 µm diam. All hyphae with clamp-connections.

11. CREPIDOTACEAE SINGER 1951
Agaricales : Basidiomycota

Members of the genus *Crepidotus* are widely distributed in different forest ecosystems of the State. Currently approximately 150 species are widely accepted. Most species are secondary decomposers of plant materials and occur as saprobic on wood. *Crepidotus* species occur on wood, palm fronds herbaceous stem, etc., rarely parasitic on living woody tissues. *Crepidotus calolepis, C.citrinus, C. cystidiosus, C. epicrocinus, C. grumosopilosus, C. melleus, C.nephrodes,C. reversus*, and *C. uber* have recently been reported by the author (Mohanan, 2011). Of these, taxonomic details of *Crepidotus reversus* and *C. uber* are given here.

Crepidotus reversus (Berk. & Br.) Sacc., *Syll. Fung.* 5: 885 (1887).

Crepidotus reversus is widely distributed in moist-deciduous to evergreen forests of the State. This species occurs on decaying logs.

Fruit bodies small sized. Pileus 1-6 mm diam., convex becoming reflexed, orbicular; surface pale pink to deep red becoming brownish red towards the margin, pruinose or forming minute, punctate, reddish squamules, and a white basal tomentum. Lamellae adnexed to an excentric stipe, at first deep pink finally cinnamon brown, rather distant, with lamellulae. Stipe either absent or short, excentric and recurved, solid; surface paler than pileus, glabrous. Context very thin, of thin-walled, inflated hyphae, 2-12 µm diam., with clamp-connections. Spores 5-6.5 x 4-5 µm, subglobose, pale yellowish brown, with a thickened wall bearing coarse verrucae, and containing a large refractive guttule. Basidia 22-40 x 5-7.5 µm, clavate, bearing four sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 28-35 x 4-5 µm, ellipsoid to ellipso-cylindric, sometimes with 1-2 short, apical outgrowths, hyaline, thin-walled. Hymenophoral trama subregular, hyaline, of thin-walled hyphae, 2-12 µm diam. Subhymenial layer 16-20 µm thick, pseudoparenchymatous. Pileipellis a strongly differentiated epicutis of repent, radially parallel hyphae, 3-5 µm diam., slightly thick-walled and often coated with reddish granular encrustations.

Crepidotus uber (Berk. & M.A. Curtis) Sacc., *Syll. fung.* (Abellini) 5: 878 (1887)

Frit bodies small sized. Pileus 7-25 mm diam., dimidiate, flabelliform, or orbicular-reniform, thin, arising from a white basal mycelium; surface pinkish brown when moist, drying white to yellowish brown, glabrous, viscid to glutinous. Margin entire, sulcate-striate. Lamellae radiating from an excentric or lateral point, moderately crowded with lamellulae of three lengths, ventricose, up to 1.5 mm wide, pale pinkish white; edge entire. Stipe absent. Context whitish, of thin-walled, hyaline hyphae. Spores 5-8.5 x 4-5 µm, ovoid to broadly ellipsoid, slightly flattened on the adaxial side, with smooth, cinnamon brown wall, and usually containing a single, refractive guttule. Basidia 30-37 x 8-8.5 µm, clavate, bearing four sterigmata up to 4 µm long. Cheilocystidia 34-38 x 5-6 µm, very crowded and forming a sterile lamella-edge, arising directly from the trama, hyaline, filiform to irregularly clavate, thin-walled with a few contents. Pleurocystidia absent. Hymenophoral trama regular, hyaline, of thin-walled, parallel hyphae, 3 µm diam., inflated to

12 µm diam., with slight gelatinization. Subhymenial layer pseudoparenchymatous, 5-7 µm wide. Pileal surface not differentiated from the underlying context, although some hyphae suberect. Clamp-connection absent.

12. DACRYMYCETACEA J. Schrot. 1888
Dacrymycetales : Basidiomycota

Calocera, Dacrymyces, Dacryopinax, Guepiniopsis are the significant genera of this family. Members of this family are widely distributed in different forest ecosystems of the State and occur solitary or gregarious clusters on decaying branches, logs and stumps, occur as saprobic on wood and bark. Some of the members are known to produce antibiotics, but these are not exploited commercially

Dacryopinax spathularia (Schwein.) G.W. Martin, *Lloydia* 11: 116 (1948)

Dacryopinax spathularia is widely distributed in moist-deciduous to evergreen forests of the State and occurs in groups or clusters on decaying logs.

Fruit bodies caespitose, gregarious or scattered, bright yellow to yellowish orange when fresh, becoming dark brown to brownish orange on drying, spathulate to flabellate, 5-25 mm broad, tough, gelatinous, with a small stalk at base. Cortex and stipe tomentose, covered with simple, smooth, thick-walled hyphae. Hymenium smooth, unilateral, composed of dikaryophyses and basidia; dikaryophyses simple, projecting beyond the basidia. Basidia cylindrical to clavate, 45-65 x 5-7.5 um, 2-spored. Spores ovoid to ellipsoid, 8-12 x 4-5 um, thin-walled, 1-septate with guttules. The fungus forms dense clusters or rows when fruiting through cracks in the wood.

13. ENTOLOMATACEA Koll. & Pouzar 1972
Agaricales : Basidiomycota

Entoloma and *Rhodocybe* are significant genera of this family. Members are cosmopolitan in distribution, frequent in tropical forests. Some species of *Entoloma* are toxic and cause regular poisioning incidence. Recently, a total of 29 species of *Entoloma* and 2 species of *Rhodocybe* have been recorded from different forest ecosystems of the State. *Entoloma brehadam, E. niranjanam, E. rugosopruinatum* and *E. theekshnagandam* are described here.

Entoloma brihadum Manim., A.V. Joseph & Leelav., *Mycol Res.* 99 (9): 1083 (1995)

Entoloma brihadum is distributed in moist-deciduous to evergreen forests of the State. This species occurs solitary or in small groups on soil and forms ectomycorrhizal association with broad-leaved trees.

Fruit bodies medium to large sized, roubst. Pileus 2.5-9 cm diam., convex to applanate, subumbonate; surface cream to pinkish white, glabrous, faintly pellucid-striate near margin; margin plane to slightly upturned, finely fissile. Lamellae adnexed to slightly adnate, pale pinkish, crowded, up to 5 mm wide, with lamellulae

of several lengths; edge concolorous with the sides, entire. Stipe 4-12 cm x 8-14 mm, equal to tapering towards base, central portion slightly compressed, solid; surface pinkish white, glabrous, silky smooth. Odour none.

Spores 8.5-10 x 7-8 µm, quadrate in profile. Basidia 35-46 x 8-9.5 µm, clavate, 4-spored; sterigmata up to 6 µm long. Lamella-edge sterile. Cheilocystidia 25-32 x 4-5 µm, cylindrical, hyaline, thin-walled; pleurocystidia absent. Hymenophoral trama regular; hyphae 2-5 µm wide. Inflated up to 22 µm, thin-walled, hyaline. Pileal trama parallel-interwoven; hyphae 2-5 µm wide, often inflated 1-5 µm, thin-walled, hyaline. Pileipellis a cutis of repent, thin-walled, hyaline hyphae, 8-20 µm, wide. Stipe trama composed of parallel, thin-walled, hyaline, hyphae, 4-20 µm wide. Caulocystidia absent. Clamp-connections present in all tissues. Oleiferous hyphae present in all parts.

Entoloma niranjanum Manim., A.V. Joseph & Leelav., *Mycol. Res.* 99(9): 1095 (1995)

Entoloma niranjanum is distributed in semi-evergreen to evergreen forests of the State. This species occurs in small groups on soil among decaying leaf litter in bamboo stands.

Basidiome small to medium sized. Pileus 5-8 cm diam., convex to applanate with deep depression at the centre; surface 'violet grey' (17D2, 16E2), 'blackish blue' (19F6) or 'bluish grey (19E3), hygrophanous, squamulose towards the centre, pellucid-striate when young, becoming sulcate with age; margin straight, becoming fully upturned, strongly rimose. Lamellae adnexed to adnate, pinkish white, close 6-10 mm wide, with lamellulae of 2-3 lengths; edge concolorous with sides, smooth, entire. Stipe 3-6 cm x 5-11 mm, central, cylindric, hollow; surface concolorous with pileus, glabrous, smooth. Basal mycelium white, well-developed. Odour not distinctive.

Spores 9-11 x 6-8 µm, heterodiametric-ovate with 5-6 facets in profile. Basidia 30-38 x 8-10 µm, clavate, 4-spored; sterigmata 4 µm long. Lamella-edge sterile. Cheilocystidia 22-32 x 9-11 µm, clavate, thin-walled, hyaline; pleurocystidia absent. Hymenophoral trama regular; hyphae 3-16 µm wide, thin-walled, hyaline. Pileal trama parallel-interwoven; hyphae similar to those of hymenophoral trama. Pileipellis a cutis passing into a trichoderm; hyphae 4-19 µm wide, thin-walled, with or without a bluish plasmatic pigment. Stipe trama composed of parallel, thin-walled hyphae 4-21 µm wide. Caulocystidia and clamp-connections absent. Oleiferous hyphae present.

Entoloma rugosopruinatum Corner & E. Horak, Beih., *Nova Hedw.* 91: 261 (1980)

Entoloma rugosopruinatum is widely distributed in moist-deciduous to evergreen forests and occurs solitary on soil and humus. Basidiome small sized. Pileus 2.5-4 cm diam., convex with a prominent obtuse umbo; surface dark bluish black to dark turquoise (24F8) near the umbo, 'deep turquoise' (24D4) in the middle. 'greyish turquoise' (24C5) towards the margin, dry, velvety, non-striate; margin straight, entire. Lamella adnate to sinuate, pale pink, up to 4 mm wide, moderately crowded

with lamellulae; edge concolorous with sides, entire. Stipe 3.5-5 cm x 4-6 mm, central, cylindric, solid; surface white with tint of turquoise. Odour not distinctive.

Spores 9-10 x 5-6.5 µm, heterodiametric-ovate with 5-6 facets in profile. Basidia 15-35 x 5-6 µm. Lamella-edge sterile. Cheilocystidia 25-35 x 5-6 µm; pleurocystidia absent; hymenophoral trama regular to subregular; hyphae 2-10 µm wide, thin-walled, hyaline. Pileal trama parallel-interwoven; hyphae similar to those of hymenophoral trama. Pileipellis a palisadoderm; terminal cells 28-50 x 4-12 µm clavate, thin-walled, with blue plasmatic pigment. Stipe trama composed of parallel, thin-walled, hyaline hyphae 4-20 µm wide. Caulocystidia and clamp-conenctions absent. Oleiferous hyphae present in trama of both stipe and pileus.

Entoloma theekshnagandhum Manim., A.V. Joseph & Leelav., *Mycol. Res.* 99(9): 1088 (1995)

Entoloma theekshnagandhum is wdely distributed in moist-deciduous to evergreen and shola forests and occurs on soil scattered in small groups. This species has recently been described from Kerala. The diagnostic features are the robust, whitish, omphalinoid basidiomes, development of an yellow colour when the fresh fruit bodies are bruised, the strong, unpleasant odour, quadrate spores, versiform cheilocystidia and the darkening nature of the fruit bodies upon drying.

Fruit bodies small sized. Pileus 1.5-4 cm diam., convex with a depressed disk; surface pure white when young, turning pinkish with age, glabrous, pellucid-striate; margin straight, entire, becoming irregularly lobate. Lamellae adnate to slightly subdecurrent, white turning pinkish, close to crowded, up to 5 mm wide, with lamellulae of different lengths; edge concolorous with sides, entire. Stipe 3-8 cm x 5-8 mm, central, cylindric to somewhat compressed, hollow; surface white turning pinkish, glabrous. Odour none.

Spores 10-13 x 8.5-10 µm, quadrate in profile. Basidia 45-55 x 11-13.5 µm, clavate, 2-or 4-spored; sterigmata up to 7 µm long. Lamella-edge sterile. Cheilocystidia 32-40 x 9.5-15 µm; pleurocystidia absent. Hymenophoral trama regular; hyphae 4-16 µm wide, thin-walled, hyaline. Pileal trama parallel-interwoven; hyphae similar to those of hymenophoral trama. Pileipellis a cutis of repent, entangled, thin-walled, hyaline, hyphae 8-22 µm wide. Stipe trama composed of parallel thin-walled, hyaline hyphae 4-24 µm wide. Caulocystidia and clamp-connections present. Oleiferous hyphae abundant in all tissues.

14. FOMITOPSIDACEAE Jilich 1982

Polyporales : Basidiomycota

The family Fomitopsidaceae contains economically important wood rotting fungi which cause brown rot in a large number tree species in temperate and tropical regions. *Antrodia, Daedalia, Fomitella, Fomitopsis, Laetiporus* and *Postia* are the significant genera of this family. Members are widespread in distribution, in temperate and tropical regions.

Daedalea dochmia (Berk. & Broome) T. Hatt., *Mycoscience* 46(5): 307 (2005)

Daedalea dochmia is distributed in moist-deciduous to evergreen forests of the State and occurs solitary or scattered in imbricate clusters on decaying wood and stumps. Greyish to black pileus, radial cracks, and pinkish to buff pore surface and small pores, trimitic hyphal system and clamped generative hyphae are the key characters of this species.

Fruit bodies perennial, hard, woody, solitary, pileate, applanate, dimidiate, attached to the substratum with a narrow base, epixylous, attached to dead or living tree butt. Pileus brownish grey, greyish brown to dark greyish brown margin off white to greyish white, glabrous, rimose, radially cracking, concentrically sulcate, 15-43 x 10-24 x 2-4 cm. Pore surface greyish orange to brownish orange, with a pink tint, smooth, not visible; pores 4-7 per mm, pores tubes stratified, 1-2 mm deep, each strata separated by a thin layer of context tissue, old tubes filled with white mycelium. Margin sharp, slightly rounded. Pore dimension 100-225 x 90-175 µm. Dissepiments 40-190 µm thick. Context greyish orange, brown, pale orange, and brownish orange, homogenous, xanthochroic, 3-8 mm thick at middle. Hyphal system trimitic; generative hyphae hyaline, thin-walled, branched, septate with clamps, 2 µm wide; skeletal hyphae thick-walled, wide to narrow lumen, hyaline to pale yellowish brown in KOH, 3-6 µm wide; binding hyphae hyaline to pale brown, 2-3 µm wide, branched. Spores not found. Basidiole 13-15 x 3-4 µm, thin-walled, hyaline.

Daedalea flavida Lév., *Annls Sci. Nat.*, Bot., sér. 3 2: 198 (1844)

Daedalea flavida is distributed in moist-deciduous to evergreen forests of the State and occurs solitary or scattered in imbricate clusters on decaying logs and stumps.

Fruit bodies annual, dimidiate, corky, sessile. Pileus dark brown at disk, light yellow at middle, margin off white, brownish orange to brownish yellow, dull, glabrous, concentrically zoned, concentrically sulcate, radially wrinkled, 5.3-22 x 7-12 x 1.5cm. Pore surface brownish orange, off white near margin, daedaloid, poroid near base, lamellate elsewhere; pores 4-8 (9) per cm, pore tubes 4-11 mm deep, concolorous. Dissepiments 260-650µm. Context greyish orange to pale yellow homogenous, non-xanthochroic, 2 mm thick. Hyphal system trimitic;generative hyphae hyaline, branched, septate, with clamps, 2-4 µm wide; skeletal hyphae thick-walled, solid, 4-7 µm wide, cell wall 1-3 µm thick; binding hyphae hyaline, thick-walled, branched, 2-4 µm wide. Spores elliptic, to cylindric, smooth, hyaline, thin- walled, 6-9(9.5) x 2.5-4 µm. Basidiole 21-27.5 x 4-6.5 µm, hyaline, thin walled, smooth. Skeletal hyphae project in to the hymenium as cystidia, hyaline, thick walled, 2-2.5µm wide.

Fomitella rhodophaea (Lév.) T. Hatt., *Mycoscience* 46(5): 305 (2005)

Fomitella rhodophaea is distributed in semi-evergreen to evergreen forests of the State and occurs solitary or in small imbricate clusters on decaying wood on main trunk of living trees. Trimitic hyphal system with hyaline vegetative hyphae, biennial fruit body becoming woody hard, smooth pileus, small pores, pale context are the key features of this species.

Fruit bodies annual, to biennial, dimidiate, woody, corky, applanate, imbricate, sessile, attached with a narrow base. Pileus dull greyish brown, concentrically zoned, smooth, glabrous, concentrically sulcate with concentric ridges. Pore surface orange grey, round, regular; pores not visible, smooth, 6-8 per mm, pore tubes 1-2 mm deep, 2 strata present. Pore dimension: 80-170 x 80-100 µm. Dissepiments 20-100 µm thick. Margin thin, sharp, smooth, wavy. Context orange white to greyish orange, homogenous, non- xanthochroic, 4 mm thick. Hyphal system trimitic; generative hyphae hyaline, septate with clamps, branched, 4-5 µm wide; skeletal hyphae yellowish brown, 3-5 µm wide; binding hyphae hyaline, 2.5-4 µm wide, tortuously branched. Spores ellipsoid, 4-4.3 x 2-3 µm, pale brown, smooth, thin-walled. Basidiole 7.5-20 x 2.5-5 µm, clavate, hyaline, thin-walled.

Fomitopsis feei (Fr.) Kreisel, *Ciencias Biológicas*, Cuba 16: 83 (1971)

Fomitopsis feei is distributed in semi-evergreen to evergreen forests of the State and occurs solitary or in small imbricate clusters on decaying wood on main trunk of living trees.

Fruit bodies biennial, dimidiate, hard, corky, attached with a lateral converging base. Pileus brownish grey, reddish brown, margin off white, dull, concentrically sulcate, radially wrinkled, glabrous, concentrically ridged, 9.5 x 4.5 x 1.5cm. Pore surface greyish brown to dull red to off white; pores 4-6 per mm, not visible, smooth, 1-3.5 mm deep, 2 strata. Pore dimension: 100-140 x 80-115 µm. Dissepiments 40-65 µm thick. Margin thin, smooth, rounded to wavy. Context homogenous, yellowish brown, xanthochroic, 8mm thick. Hyphal system dimitic; generative hyphae hyaline, 2.5 µm wide, septate with clamps; skeletal hyphae pale brown, 2-2.5 µm wide. Spores subglobose, pale brown, 3.5-6.5 x 2-3.5 µm.

Laetiporus sulphureus (Bull.) Murrill, *Annls mycol.* 18(1/3): 51 (1920)

Laetiporus is a genus of edible mushroom distributed throughout the world. Species are known as sulphur shelf, chicken mushroom, etc. *Laetiporus sulphureus* is widely distributed in semi-evergreen and evergreen forests of the State and the fructifications appear immediately after the pre-monsoon shower.

Fruit bodies annual, pileate, semicircular to flabelliform, applanate, imbricate, fleshy and succulent when fresh, rather light of weight when dry and chalky friable, shiny, sulcate. Pileus orange, greyish orange, to sulphur yellow, glabrous, azonate, uneven and slightly undulating, 11-35 x 5-18 x 1.5-3 cm. Pore surface pale yellow to yellowish orange to off white; pores 2-4 per mm, angular, round, to radially elongated, irregular to irpicoid, 1.5-5 mm deep, tube layer very thin compared to thick context. Pore dimension: 170-610 x 140-270 µm. Dissepiments 40-240 µm thick. Context off white, homogenous, non-xanthochroic, 1.2-5 cm, thick, chalky, easily crumbling. Hyphal system dimitic. Generative hyphae hyaline, simple septate, branched, 4-10 µm wide; binding hyphae hyaline, thin- to thick-walled, profuse side branches arise from main axis, 3-20 µm wide. Spores hyaline, smooth, subglobose, thin-walled, 4-5 x 4-4.5 µm, no reaction with Melzer's reagent. Basidiole hyaline, clavate, smooth, 14-20 x 5-6 µm.

15. GANODERMATACEAE Donk 1948

Polyporales : Basidiomycota

Ganodermataceae is a widespread family of wood decaying macrofungi, most abundant in the tropics. The members cause white rot in living trees and dead wood. *Ganoderma* and *Amauroderma* are the significant genera. *Ganoderma* is a widespread genus reaching its greatest diversity in the tropics. The host range is broad, species within the genus attack both hardwood and conifers. *Ganoderma lucidum* has been used in oriental medicine.

Amauroderma conjunctum (Lloyd) Torrend, *Brotéria*, sér. bot. 18: 133 (1920)

Amauroderma conjunctum is widely distributed in semi-evergreen to evergreen forests of the State and occurs solitary or in small groups on soil around decaying trees or stumps. Trimitic hyphal system, clamped generative hyphae, ornamented spores, dark band in the context of stipe and pileus, mostly annual, centrally to laterally stipitate, growing from underground rhizome or root of host plant are the characteristic features of the species..

Fruit bodies annual, round to reniform, central to laterally stipitate, hard, corky, terrestrial to lignicolous. Pileus reddish brown (9D7), dull to shiny, laccate, varnished, concentrically ridged, and radially wrinkled, 2.5-13 cm diam. Cuticle consists of a compact palisade of dark brown, short, septate, 6-8 µm wide hyphal ends. Pore surface greenish grey (1B2) to grayish brown; pores round, regular, 4-6 per mm, and pore tubes grayish brown, 2-6 mm deep, pores become dark with age. Pore dimension 175-225 x 150-180 µm. Dissepiments 50-175 µm. Margin thick, rounded, smooth; context light to dark brown, homogenous, a thin dark band present in the context. Stipe central to excentric to lateral, dark brown to black, shiny, laccate, varnished, cuticle present, smooth, 7-13 cm long. Hyphal system dimitic to trimitic; generative hyphae-hyaline, simple septate, 3-5µm, wide, clamp not found; skeletal hyphae hyaline to pale brown, 4-6 µm wide, arborescently branched; binding hyphae hyaline, 3-4 µm wide branched. Spores subglobose, pale yellowish brown, bitunicate, inner wall finely ornamented, thick, outer wall thin, smooth, hyaline, 9-11 x 6-10 µm. Basidia 15-20 x 7.5-12.5µm, hyaline, clavate, with 4 sterigmata.

Amauroderma fuscoporia Wakef., *Bothalia* 4(4): 948 (1948)

Amauroderma fuscoporia is widely distributed in semi-evergreen to evergreen forests of the State and occurs solitary or in small groups on soil around decaying trees or stumps. Dull coloured pileus and medium to large pores are the characteristic features of this species.

Fruit bodies annual, centrally to laterally stipitate, round, reniform, 1.9-6.7 x 2.7-6.3 cm diam., moderately indented to infundibuliform, corky, solitary or gregarious. Pileus brownish orange to dark brown to black, dull to shiny, concentrically zoned, with concentric ridges, glabrous, radially sulcate, radially folded, wrinkled, a thin cuticle present consisting of a palisade of compactly arranged yellowish brown, thick-walled, clavate hyphal ends, 6-12 cm wide. Margin thick, smooth, wavy. Pore surface orange white to grayish white (5A2), brownish grey; pores round to angular, regular,

2-4 per mm, pore tubes 2.5-5 mm deep, pore tubes concolorous to pore surface. Stipe central to lateral, yellowish brown to grayish brown smooth, tomentose, hollow at centre, 3.2-11.5 x 0.5-1 cm. Context grayish orange (5B3), to brownish orange, homogenous, up to 6 mm thick. Hyphal system dimitic to trimitic. Generative hyphae hyaline, thin-walled, septate, with clamps, 2.5-4 µm, inflated hyphae hyaline, thin-walled, 10-20 µm wide. Skeletal hyphae hyaline, thick-walled 3-6 µm wide, arboriform type. Binding hyphae hyaline, thick-walled, pale brown, 5-9 µm wide, branched. Spores subglobose to broadly ellipsoid, hyaline to pale brown, bitunicate, inner wall thick, pigmented, ornamented, outer wall thin, hyaline, smooth, with large oil globule, 9-13 x 7-12 µm. Basidia 30-40 x 12.5-14 µm, clavate, hyaline, thin-walled with 4 sterigmata. Basidiole smooth, hyaline, thin-walled 20-30 x 8.5-13.5 µm.

Amauroderma rugosum (Blume & T. Nees) Torrend, *Brotéria*, sér. bot. 18: 127 (1920)

Amauroderma rugosum is widely distributed in semi-evergreen to evergreen forests of the State and occurs solitary or in small groups on soil around decaying trees or stumps. Small pores, thin black resinous bands in the context, presence of inflated hyphae, cuticle consisting of short cells, presence of cystidioles and size of spores are the characteristic features if this species.

Fruit bodies annual, stipitate, rounded, depressed at centre, hard, corky. Pileus dull, glabrous, dark grayish black with grayish rings, concentrically zoned, radially wrinkled, sulcate, 2.6-4.2 cm diam. Cuticle consists of compactly arranged pale yellowish, short hyphal ends, 5-8 µm wide. Pore surface grayish white when young, becomes brownish grey (6E3); Pores angular, 6 per mm, pore tubes 2-3 mm deep, concolorous with pore surface. Margin thick, wavy, deflexed. Context brownish orange, duplex; lower grayish yellow and upper brownish grey with a dark thin band in between, non-xanthochroic, 5-6 mm thick. Stipe central to excentric, dark brown (6F4); stipe surface smooth, cottony, inside hollow, and forms a continuation of the dark band in the context, irregular depression present; context brownish orange, 8 x 0.6 cm. Cuticle consists of compactly arranged pale yellowish, short hyphal ends, 5-8 µm wide. Hyphal system dimitic. Generative hyphae hyaline, septate with clamps, branched, 3-4 µm wide. Skeletal hyphae hyaline, thick- walled, branched at tip, 5-10 µm wide, and cell wall 2-3 µm thick. Inflated hyphae also present, 7-14 µm wide, hyaline, thin- walled. Binding hyphae not found. Spores hyaline, subglobose, bitunicate, inner wall thick, finely ornamented, outer thin, hyaline, large oil globules present, non-amyloid, 8-11 x 7-9 µm. Cystidiole 21-30 x 4-9 µm, hyaline, thin-walled, smooth, inclusions present.

Ganoderma applanatum (Pers.) Pat., *Hyménomyc. Eur.* (Paris): 143 (1887)

Ganoderma applanatum is widely distributed in moist-deciduous to evergreen forests and forest plantations of the State and occurs solitary or in large imbricate clusters on decaying wood at butt region of trees or on stumps. This species is close to *G. australe* but the crust of *G. applanatum* has hyphae protruding beyond the resinous layer and the spores are small.

Fruit bodies perennial, applanate to ungulate, dimidiate to semicircular, corky to woody hard. Pileus brown to dark brown, off white at margins, dull, smooth,

concentrically ridged, radially sulcate, surface often covered with a cinnamon to pale powder of deposited spores. Cracking with age and drying, black crust present, margin light coloured in actively growing specimens, 8.5-26 x 13-18 x 3-5.5 cm. Margin thick, sterile, grayish white. Pore surface grayish white (1B1) when young, brownish orange to dark ruby (12F3) when mature; pores round to angular, 4-6 per mm; pore tubes 5-36 mm deep , of 5-8 strata. Pore dimension 190-260 x 150-210 µm, Dissepiments 40-190 µm thick. Context dark brown to violet brown (10F3), homogenous to duplex, white mass of tissue present, xanthochroic, 2-5 mm thick. Stipe sessile to laterally sub-stipitate. Hyphal system trimitic; generative hyphae hyaline branched, septate with clamps, 2-4 µm wide; skeletal hyphae 3-7 µm wide, brown, arboriform; binding hyphae hyaline, thick-walled, 3-5 µm wide. Spores ellipsoid, bitunicate, truncated, inner wall thick, verrucose, pale brown, outer wall thin, hyaline, 9-10 x 5-8 µm. Cuticle golden yellow to yellowish brown, of thick-walled, compactly arranged, clavate hyphal ends, 8-13 µm wide.

Ganoderma colossus (Fr.) C.F. Baker, *Brotéria*: 425 (1918)

Ganoderma colossus is distributed in moist-deciduous to evergreen forests and forest plantations of the State and occurs solitary or in small clusters on decaying wood at butt region of trees or on stumps. This species differs from the closely related *G. neurosporum* in spore dimension (17-20 x 10-12 µm).

Fruit bodies annual, applanate, sessile to substipitate, dimidiate, 4.2-14 x 3.6-8.5 x 1.6-4.5 cm. Pileus dull to blackish, shiny, varnished, glabrous, azonate, variably radially wrinkled, margin thick, smooth round to wavy. Pore surface off white, turns brown on bruising. Pores (2)3-4(5) per mm, round; pore surface smooth, pore tubes 9-17 mm long, grayish brown. Context off white to pale yellow, homogenous, non-xanthochroic, 3-12 mm thick at middle. Hyphal system trimitic. Generative hyphae hyaline, nodose, septate, 3-4 µm wide. Skeletal hyphae hyaline to pale brown, thick-walled, arboriform, 4-8 µm wide. Binding hyphae thick-walled, lumen often not visible, 3-5 µm hyaline. Spores pale brown, finely ornamented, double walled, large oil globules present, ellipsoid, 12.5-17 x 9-11.5 µm. Basidia with 4 sterigmata, hyaline. Cuticle consists of thick walled, pale yellowish brown, compactly arranged palisade of clavate hyphal endings.

Ganoderma lucidum (Curtis) P. Karst., *Revue mycol.*, Toulouse 3(no. 9): 17 (1881)

Ganoderma lucidum is widely distributed in moist-deciduous to evergreen forests and forest plantations of the State and occurs solitary or in small to large clusters on decaying wood at butt region of trees or on stumps and logs. *G. lucidum* exhibits remarkable morphological variations depending on the prevailing environmental conditions and host species.

Fruit bodies pileate, hard, corky, sessile to stipitate, annual. Pileus 8.5-19 x 6.8-13 x 1.7-6.5 cm, shiny, laccate, radially to concentrically ridged, covered with spore mass. Pore surface off white, greenish white (29A2, 30A2), become grayish brown to dark brown; pores 4-6 per mm; pore tubes 9-13 mm long, brown. Margin round, smooth, sterile, 4 mm, thick. Dissepiments 50-230 µm thick. Pore dimension 150-270 x 100-210 µm. Stipe lateral, 8-15 x 1.6-4 cm, reddish brown (8F7), smooth laccate. Context light yellow (4A4) to brown, duplexed, 19 mm thick at middle, xanthochroic, a white

coloured tissue present. Cuticle pale yellowish brown, clavate, thick-walled, 7-15 µm wide. Hyphal system trimitic. Generative hyphae hyaline, septate with clamps, branched, 2-3 µm wide; skeletal hyphae thick-walled, pale brown arboriform, 4-6µm; binding hyphae hyaline, lumen not visible, 4-5 µm diam. Spores ellipsoid, pale brown, to golden brown, double walled, inner wall thick, outer thin, truncate, verrucose, 7-12 x 5-8.5 µm.

16. GEASTRACEAE Corda 1842
Geastrales : Basidiomyceta

Geastrum is the significant genus of this family. Members are cosmopolitan in distribution, terrestrial, rarely on wood or coprophilous. Most species are presumed saprobes, but at least some may be ectomycorrhizal.

Geastrum saccatum Fr., *Syst. mycol.* (Lundae) 3(1): 16 (1829)

Geastrum saccatum is distributed in semi-evergreen to shola forests of the State and occurs solitary or scattered in small to large groups on rotting logs. *G. saccatum* is distinguished from other earthstars by the distinct circular ridge or depression surrounding the central pore. Fruit bodies when young onion-shaped, outer wall yellowish to ochraceous, at maturity split into 6-9 equal narrow, pointed lobes, and then 3-7 cm diam. The lobes are deeply saccate at the base, soft, the flesh felted, spongy, made up of thick-walled non-septate hyphae. Spore-sac subtended by a thick, sessile, 1-2 cm diam., pale yellowish, smooth to some what grooved, peristome conical, projecting, silky, surrounded at base by a wide, smooth, depressed zone. Spores spherical 4-5 µm diam, dark brown, spiny.

Geastrum triplex Jungh. [as '*Geaster*'], *Tijdschr. Nat. Gesch. Physiol.* 7: 287 (1840)

Geastrum triplex is widely distributed in grasslands, moist-deciduous to shola forests of the State and occurs in groups on soil amongst decaying forest litter. Fruit bodies when young onion-shaped, at maturity outer wall split into 5-8 broad, non-hygroscopic, pointed lobes, and then 5-10 cm diam., lobes creamy at first, soon ochraceous or olivaceous brown, fleshy inner layer peeling off with the exception of a thick, collar-like portion which remains around the base of the spore-sac. Spore-sac sessile, sub-spherical, somewhat flattened, 2.5-4.5 cm diam., smooth, concolorous with lobes, peristome at first silky fibrillose, becoming puckered up to 11 mm diam.; spores 4-5 x 4-4.5 um diam, with rather large warts.

17. GOMPHACEAE Donk 1961
Gomphales : Basidiomycota

The family Gomphaceae contains 13 genera and 287 species (Kirk *et al.*, 2008). *Gomphus* and *Ramaria* are the significant genera of this family. Members are widespread in both temperate and tropical zones. Some species are edible. A number of taxa have been identified as of conservation concern. Members are terrestrial or lignicolous, either saprobic or forming ectomycorrhizal relationship with woody plants. Several species are edible, while a few like *Ramaria formosa, R. pallida* are

mildly toxic. Recently 8 species of *Ramaria* viz., *Ramaria apiculata, R. cokeri, R. eumorpha, R. flava, R. gracilis, R. pallida* and *R. versatilis* have been reported from Kerala (Mohanan, 2011).

Gomphus clavatus (Pers.) Gray, *Nat. Arr. Brit. Pl.* (London) 1: 638 (1821)

Gomphus clavatus is distributed in semi-evergreen to evergreen forests of the State and occurs scattered in small groups on humus rich soil under *Diospyros malabarica, Dipterocarpus indicus, Hopea parviflora* mixed stands (Mohanan, 2011).

Fruit bodies small sized, solitary or in small groups, clavate when young, becoming turbinate with a flat top overlapping the edge, when old depressed at the centre, and becomes infundibuliform. Pileus 3-5 cm diam., pale pinkish to flesh coloured when fresh. Hymenium pale pinkish with deeply decurrent, forked and anastomosing vein-like ridges, up to 1.5 µm wide. Context white, soft of hyaline hyphae 8-9 µm wide with -onnections. Stipe solid, equal, surface pale yellowish orange to pale pinkish, smooth, 3-5 cm x 5-9 mm. Basidia clavate, hyaline, 80-90 x 9-10 µm with 4 sterigmata. Spores ellipsoid, 13-18 x 5-7 µm, hyaline, verrucose with a large refractive guttule. Hymenophoral trama regular to subregular, hyaline, of parallel hyphae, 2-4 µm diam. Pileipellis a thin, repent epicutis of thin-walled, radially parallel hyphae, 4-8 µm diam.

Ramaria apiculata (Fr.) Donk, *Biblthca Mycol.* 21: 105 (1933)

Ramaria apiculata is widely distributed in moist-deciduous to evergreen forests of the State and occurs solitary or scattered in small groups on soil and humus. Fruit bodies solitary or in clumps, up to 7 cm tall, stalk 3-4 mm thick, richly branched from or near the base, branches long, somewhat flattened, terminating in 2 or 3 long points, at first pinkish ochraceous or pale yellowish cream, becoming darker to ochraceous brown from the base up, the tips remaining pale, whitish or sometimes greenish. Hyphae with clamps. Basidia 35-45 x 7-8 µm, 4-spored, with basal clamps. Spores ellipsoid, 12.5-16 x 6.5-10 µm finely verruculose.

Ramaria formosa (Pers.) Quél., *Fl. mycol. France* (Paris): 466 (1888)

Ramaria formosa is widely distributed in moist-deciduous to evergreen forests of the State and occurs solitary or scattered in small groups on soil and humus. This species is mildly toxic. Fruit bodies solitary or in groups, chalky, brittle when dry, 8-30 cm tall, 7-15 cm wide, stalk 3-6 x 2-6 cm, with white base, richly branched, with main branches 1.5-2 cm thick, pinkish ochraceous or pinkish orange, with lemon yellow tips. Hyphae with clamps. Basidia 48-56 x 7-9 µm, 4-spored, with basal clamps. Spores oblong-ellipsoid, 10-17 x 4-6 µm, verrucose.

Ramaria versatilis Quél., *Compt. Rend. Assoc. Franç. Avancem. Sci.* 21: 6 (1893)

Ramaria versatilis is distributed in moist-deciduous to evergreen forests of the State and occurs solitary or scattered in small groups on soil and humus. Fruit bodies solitary or gregarious, 4-12 cm tall, 3-6 cm wide, stalk 1-6 x 0.5-1 cm, pale, with white mycelial felt and rhizomorphs at base, richly branched, branches 1-5 mm thick, erect, more or less parallel, lilac to violet to purple, becomes brownish as spores

mature. Ultimate tips usually ending in two short and blunt processes, flesh white and brittle. Hyphae and basidia with clamps. Basidia 20-30 x 6-7 µm, 4-spored. Spores ellipsoid, 5.5-6.5 x 3-4 µm, verruculose. Mycelial felt contains thick-walled skeletal hyphae.

18. HYDNACEAE Chevall. 1826
Cantharellles: Basidiomycota

Hydnum is the significant genus of this family. Members of this genus are widespread in distribution and some species (e.g. *Hydnum repandum*) are well-known edible fungi, others are reported as a causing heartrot in standing trees. Most of the *Hydnum* species form ectomycorrhizal association with tree species. *H. repandum* is edible and commercially collected in some countries and often marketed under French name 'pied de mounton'. *H. rufescens*, a very closely relate species of *H. repandum* is terrestrial and distributed in moist-deciduous to evergreen forests of the State and probably forms ectomycorrhizal association with *Hopea parviflora, Myristica* sp.(Mohanan, 2011).

Hydnum rufescens Pers., *Observ. mycol.* (Lipsiae) 2: 95 (1800) [1799]

Hydnum rufescens is distributed in moist-deciduous to evergreen forests of the State and occurs solitary on soil. This species forms ectomycorrhizal association with *Hopea parviflora, Myristica* sp. Monomitic hyphal system with clamp, hyaline non-amyloid smooth spores, and absence of cystidia are key characters of this species. Fruit bodies annual, spongy, watery, stipitate, to pileate. Pileus yellow (3A7) to sulphur yellow, paler towards disk, 13-15 x 6.5-10 x 0.8 cm. Pore surface toothed, pale yellow to sulphur yellow, cylindric, tooth 3-4 per mm, up to 14 mm long. Margin thin, smooth, rounded. Stipe pale yellow, 6-6.5 x 0.8-2.5 cm, cylindric, tapering at base. Context homogenous, non xanthochroic, 5 mm thick, yellow (3A6). Hyphal system monomitic, hyaline, septate with clamp, 5-13 µm wide, fine granules attached to outer wall. Spores smooth, hyaline, subglobose to ellipsoid, thin-walled, 6-7 x 4-5 µm. Basidiole hyaline thin-walled, smooth, inclusions present, 30-32 x 4-7µm. Basidia clavate, 25-33 x 6-8 µm, hyaline, inclusions present, with 4 sterigmata.

19. HYDNANGIACEAE Gaum. & C.W. Dodge 1928

The members of Hydnangiaceae are widespread in temperate and tropical regions throughout the world and form ectomycorrhizal association with various tree species in both angiosperms and gymnosperms. *Laccaria* is the significant genus of this family and contains about 75 species distributed in temperate and tropical regions of the world. In Kerala, *Laccaria* species are widely distributed in different forest ecosystems ranging from moist-deciduous to evergreen, shola forests and forest plantations and form ectomycorrhizal association with native as well as exotic tree species. In forest plantations, especially in high elevated areas, *Laccaria* species form ectomycorrhizal association with different species of eucalypts and pines. Introduction of ectomycorrhizal (EM) fungal species is common in the State and encompasses many different genera and species. The majority of recorded introduction of EM fungi are associated with eucalypts and pines from Australia, New

Zealand, Europe and South America. In Kerala, *Laccaria fraterna* and *L. ohiensis* may possibly be introduced from Australia through the eucalypts.

Laccaria fraterna (Sacc.) Pegler, *Aust. J. Bot.*, Suppl. Ser. 13: 332 (1965)

Laccaria fraterna is widely distributed in moist-deciduous to evergreen forests and forest plantations of the State. This species occurs scattered densely or gregarious on soil and decaying leaf litter and forms ectomycorrhizal associations with a number of tree species including *Eucalyptus camaldulensis, E. citriodora, E. deglupta, E. regnans, E. pellita, E. grandis, E. tereticornis* and pines.

Fruit bodies small sized. Pileus 1-3 cm diam., convex, expanding to plane at maturity, slightly depressed at the center, surface pale orange to reddish orange, paler on drying. Lamellae adnate, pastel red to light pinkish brown, moderately spaced with lamellulae of three lengths. Stipe 2-7 cm x 1- 3 mm, rust brown to concolorous with the pileus, cylindric to slightly compressed at the apex, fistulose. Context composed of tightly interwoven hyphae, 2-4.5 µm diam. Spores 8.5-10 x 8-9 µm, globose to subglobose, hyaline, echinulate, thin-walled with few refractive guttules. Basidia 30-45 x 8-10 µm, clavate, bearing two large sterigmata, up to 6 µm long. Lamella-edge fertile. Cheilocystidia and pleurocystidia absent. Hymenophoral trama regular. Pileal surface a thin repent epicutis of thin-walled, hyaline hyphae. All hyphae bearing clamp-connections.

Laccaria laccata (Scop.) Cooke, *Grevillea* 12(no. 63): 70 (1884)

Laccaria laccata is widely distributed in moist-deciduous to evergreen forests and forest plantations of the State. This species occurs scattered densely or gregarious on soil and decaying litter and forms ectomycorrhizal associations with a number of native tree species in natural forests and with *Eucalyptus deglupta, E. grandis, E. tereticornis* in forest plantations. Fruit bodies small sized. Pileus 5-2.5 cm diam., convex to applanate often slightly depressed; surface grayish orange, pinkish brown to pinkish white, hygrophanous, drying pale ochraceous, weakly striate, glabrous to occasionally becoming fibrillose scaly. Lamellae subdecurrent to decurrent, pale pinkish brown to pale pinkish, subdistant. Stipe 1.5-4.5 cm x 1-6 mm, equal to slightly clavate, fibrous; surface concolourous with the pileus. Context pinkish brown to pale pinkish, up to 1 mm thick composed of tightly interwoven, hyaline 2-8 µm wide hyphae. Odour agreeable. Spores 7-10 x 7-9 µm diam., subglobose to globose or ellipsoid, echinulate. Basidia 35-60 x 9-10.5 µm clavate, 4-spored. Lamella-edge sterile; cheilocystidia 20-60 x 5-10 µm filamentous, hyaline. Pleurocystidia absent. Caulocystidia 25-35 x 4-12 µm. Hymenophoral trama regular composed of thin-walled, hyaline, 2.5-12 µm wide hyphae. Pileipellis of interwoven hyphae with scattered fascicles of erect to suberect hyphae, terminal cells slightly swollen, subclavate or capitate, pale yellowish brown in mass.

20. HYGROPHORACEAE Lotsy 1907
Agaricales : Basidiomyctoa

The family Hygrophoraceae, traditionally known as waxy caps or wax cap contains some of the most brightly coloured and beautiful fungi of the world. The family

contains 9 genera and about 325 species (Kirk *et al.*, 2008). Members of Hygrophoraceae are mostly decomposers of forest litter and are widely distributed in different forest ecosystems ranging from grasslands to shola forests. The fruiting bodies of *Hygrocybe* are small, delicate and brightly coloured. The fleshy and more robust *Hygrophorus,* another significant genus of the family could not record from any of the forest ecosystems in the State. Recently, a total of 23 species of *Hygrocybe* and one species of *Camarophyllus* have been recorded from different forest ecosystems of the State (Mohanan, 2011). *Hygrocybe acutoconica* var. *acutoconica*, *Hygrocybe alwisii, Hygrocybe anisa, Hygrocybe apala* var. *indica, Hygrocybe astatogala, Hygrocybe cantharellus, H. firma* are the important and widely distributed species.

Camarophyllus umbrinus (Dennis) Singer ex Pegler, *Kew Bull.*, Addit. Ser. 9: 49 (1983)

Camarophyllus umbrinus is widely distributed in moist-deciduous to semievergreen forests. This species usually occurs in bamboo (*Bambusa bambos*) and reed bamboo (*Ochlandra travancoricus*) stands solitary or scattered in small groups on soil and decaying leaf litter.

Fruit bodies small sized. Pileus 4-5.5 cm diam., convex to applanate, umbonate or depressed; surface pale yellowish orange, glabrous or innately fibrillose, opaque, dry, non-striate; margin undulate. Lamellae off white to pale yellowish orange, up to 3 mm wide, subdistant, with lamellulae of two to three lengths; edge obtuse. Stipe 3.5-5.5 cm x 4-7 mm, cylindric or tapering below, solid finally hollow; surface pale yellow, fibrous, glabrous. Context up to 5 mm thick, firm and fleshy, white, unchanging, of thin-walled, interwoven hyphae, 2-4 µm diam., inflated to 16 µm diam., with conspicuous clamp-connections. Spores 5-6.5 x 3-3.5 µm, subglobose, hyaline, smooth, with refractive contents. Basidia 42-50 x 3-6 µm, elongate clavate, bearing four sterigmata, up to 6 µm long. Lamella-edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama broad, hyaline, mostly irregular with tightly interwoven hyphae, 4-6 µm diam., but often showing a narrow mediostratum of parallel hyphae, 3-4 µm diam. Subhymenial layer well developed, 15-20 µm wide, interwoven. Pileipellis a repent, non-gelatinized epicutis of mostly radially arranged, repent hyphae consisting of chains of short elements, 10-35 x 4-10 µm, with clamp-connections.

Hygrocybe acutoconica var. **acutoconica** (Clem.) Singer, *Lilloa* 22: 153 (1951) [1949]

Hygrocybe acutoconica var. *acutoconica* is widely distributed in semi-evergreen to evergreen forests of the State. This species occurs solitary or scattered in small groups on soil among decaying forest litter. Fruit bodies small to medium sized. Pileus 2.5-5 cm diam., conico-convex at first, becoming plano-convex with an obtuse to conical umbo, reddish orange at centre, yellowish orange towards the margin, surface slightly sticky and translucently striate when moist, silky striate to smooth, glabrous; margin initially slightly involute, entire or lobate, becoming straight to revolute and deeply fissile. Lamellae free, up to 6 mm wide, subdistant, with lamellulae of 1-4 lengths, pastel-yellow with concolorous, somewhat eroded edge. Stipe 3-6 cm x 10-12 mm, central, cylindrical or slightly tapering towards apex, hollow, concolorous with pileus

at apex, downwards yellowish orange and yellowish white at base, twisted, fibrillose-striate lengthwise. Context concolorous with surface. Odour and taste not distinctive.

Spores 8-10 x 7-9 µm, hyaline, subglobose, ellipsoid-oblong to ellipsoid. Basidia 60-80 x 9-10 µm, clavate, mostly 4-spored, occasionally 2-spored with sterigmata up to 6 µm long. Lamella-edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama regular, made up of very long hyphae, thin-walled, pale yellowish, 2-16 µm broad elements with tapering ends. Pileipellis an ixocutis, made up of loosely entangled, thin-walled hyphae, 4-6 µm wide, with pale yellowish orange intracellular pigment. Stipitipellis a cutis with thin-walled, hyaline or pale yellowish hyphae, 1.5-8 µm wide. Clamp-connections present in all tissues of the basidiome.

Hygrocybe alwisii (Berk. & Broome) Pegler, *Kew Bull.*, Addit. Ser. 12: 66 (1986)

Hygrocybe alwisii is widely distributed in moist-deciduous to evergreen forests of the State. This species occurs scattered in small groups on soil and decaying forest litter. Fruit bodies medium to large sized. Pileus 3.5-8.5 cm diam., conico-convex at first, becoming applanate with a subumbonate centre, mostly entirely white with pale yellowish tint, often with a more distinct yellowish tint towards the disk; surface somewhat sticky when moist, smooth and glabrous; margin at first straight and entire, becoming recurved and fissile. Lamellae free to adnexed, crowded with lamellulae of 1-4 lengths, up to 6 mm wide, white or occasionally pale yellowish, waxy, with concolorous, eroded, finely pruinose edge. Stipe 6.5-11 cm x 6-10 mm, central, cylindrical, slightly tapering towards apex, hollow; white or pale yellowish, faintly striate lengthwise, occasionally with loose, somewhat recurved fibrils, especially in the lower half; odour not distinctive.

Spores dimorphic; macrospores 9-11 x 7-8 µm; microspores 5.5-7 x 3-4 µm; both types broadly ellipsoid, ovoid or subglobose. Basidia dimorphic; macrobasidia 45-57 x 9-11 µm; microbasidia 30-35 x 6-7 µm; both types clavate to narrowly clavate, thin-walled, hyaline, 4-spored with sterigmata up to 7 µm long, occasionally with basal clamp. Lamella-edge sterile. Cheilocystidia 25-40 x 7-11 µm, clavate, fusiform or cylindrical, thin-walled, hyaline. Pleurocystidia absent, but pseudocystidia on faces of lamellae present, 50-100 x 12-18 µm, fusiform to lanceolate to ventricose-rostrate, thin-walled, hyaline, originating from hyphae of the hymenophoral trama. Hymenophoral trama regular, made up of thin-walled, hyaline hyphae with very long (> 1100 µm) elements with tapering ends, 20-45 µm wide. Pileipellis a trichodermium, made up of loosely entangled, ascending and almost erect, 5-20 µm wide, thin-walled, hyaline hyphae. Stipitipellis a cutis with thin-walled hyphae, 3020 µm wide. Clamp-connections present in all tissues of the basidiome.

Hygrocybe firma (Berk. & Broome) Singer, *Sydowia* 11(1-6): 355 (1958) [1957]

Hygrocybe firma is widely distributed in semi-evergreen to evergreen forests, especially in canopy open up areas and occurs scattered in small groups among grass. Fruit bodies small sized. Pileus 2-4 cm diam., at first convex then applanate or depressed, finally perforate at the disk; surface orange red or scarlet becoming pale yellow with age, dry, uniformly minutely tomentose, at times scurfy squamulose, fibrillose and striate towards the margin; margin slightly incurved. Lamellae

decurrent, pale yellow, broadly ventricose, subdistant but with lamellulae of three lengths. Stipe 3-7 cm x 3-8 mm, equal or tapering below, often compressed, fistulose then hollow; surface concolorous or paler than the pileus, glabrescent. Context thin, of firm texture, yellowish orange, consisting of much inflated, thin-walled hyphae, 2-25µm diam., with clamp-connections. Spores dimorphous; macrospores 14-15 x 6-9 µm, oblong ellipsoid to ellipso-cylindric, thin-walled, hyaline with few contents; microspores 6-7.5 x 3-4 µm, oblong ellipsoid to ellipso-cylindric, thin-walled with dense refractive contents. Basidia dimorphous; large basidia 65-75 x 10-12.5 µm, clavate with dense refractive contents, 4-spored, bearing four sterigmata; sterigmata up to 12 µm long; small basidia 28-60 x 8-9 µm, narrowly cylindro-clavate, bearing four sterigmata. Lamella-edge sterile or heteromerous, with short, narrow basidioles, 28-40 x 8-9 µm. Hymenophoral trama regular, broad, yellowish with inflated hyphae, up to 25 µm diam. Subhymenial layer 15-30 µm wide, interwoven. Pileipellis a well developed trichodermium, composed of chains of erect, unbranched hyphae, 5-16 µm diam., sometimes forming fascicles.

21. HYMENOCHAETACEAE Imazeki & Toki 1954

Hymenochaetales : Basidiomycota

The family Hymenochaetaceae contains 27 genera and 487 species widely distributed in temperate and tropical regions (Kirk *et al.*, 2008). Most members are associated with heart rot, root rot, cankers in hard wood and conifers and decay of logs. *Phellinus*, *Inonotus*, *Coltricia*, *Cyclomyces, Fuscoporia, Hymenochaetae*, and *Pseudochaetae* have recently been recorded from different forest ecosystems of the State (Mohanan, 2011). *Phellinus* species are widespread in moist-deciduous to evergreen forests of the State, especially in highly disturbed, selection-felled stands (Mohanan, 1994). Most of the *Phellinus* species are associated with heartrot in standing trees and cause white rot or white pocket rot in affected wood. *Phellinus grenadensis, P. pachyphloeus, P. punctatiformis, P. rhytiphloeus* and *P. robinae* are newly reported species (Mohanan, 2011). *Inonotus patouillardii, I.nothofagi, I. tabacinus* and three hitherto unrecorded *Inonotus* sp.1, sp.2, sp.3 are also newly reported species (Mohanan, 2011).

Coltricia sp.

Coltricia sp.1. is widely distributed in moist-deciduous to evergreen forests of the State and occurs solitary or in small groups on soil amongst decaying forest litter.

Fruit bodies annual, circular, depressed to infundibuliform, centrally stipitate, fleshy, becomes brittle after drying, radially folded. Pileus greyish brown, brownish grey brown to dark brown, rough, asperulate, dull, finely velutinate, 2-26 cm wide. Margin thin, wavy. Pore surface off white, brownish orange to brownish grey on bruising turns black; pores angular to round, 1-2 per mm, pores entering to stipe, 4-10 mm deep. Dissepiments 80-300 µm thick. Stipe dark brown, velutinate, smooth, cylindric, central to excentric, 9-11 x 1.8 cm, solid, context greyish brown, pellicle yellowish brown, smooth, thin-walled, septate with clamp-connections. Context off white becomes greyish brown with pink tints, homogenous, xanthochroic, 3-6 mm thick. Pellicle pale brown, septate with clamps, 5-6 µm wide, thin- to thick-walled, smooth.

Hyphal system monomitic, to dimitic, hyaline, thin- to thick-walled, branched, septate, 2-3 µm wide, skeletal hyphae thick-walled hyaline branched, 5-10 µm wide. Spore broadly ellipsoid, pale brown, double walled, inner wall finely ornamented, outer thin hyaline, with large oil globules, 10-15 x 7.5-10(11) µm thick. Basidia 20-40 x 8-14 µm, clavate, hyaline, thin-walled, with 2 sterigmata. Basidiole: 30-42 x 11-16 µm, hyaline, thin-walled.

Cyclomyces setiporus (Berk.) Pat., *Essai Tax. Hyménomyc.* (Lons-le-Saunier): 98 (1900)

Cyclomyces setiporus is distributed in moist-deciduous to evergreen forests and shoal forests of the State and occurs in small imbricate clusters decaying wood and logs. Fruit bodies annual, dimidiate to spathulate, imbricate, sessile, laterally attached to the substratum with a contracted base, thin, leathery. Pileus dark brown, villose to adpressed tomentose with concentric zonation, 1.5-2.5 x 1.3-1.5 x 0.1 cm, Pore surface dark brown to yellowish brown, brownish yellow (5C7) near margin; pores angular, visible, 1-2 per mm. Dissepiments edge thin, irregular becoming irpicoid; pore tubes 1-2 mm deep, concolorous to pore surface. Margin thin, wavy, and incurved. Dissepiments 7-30 µm thick. Pore dimension 50-98.5 x 30-56 µm. Context dark brown, 0.5 mm thick, a thin black zone present in the context, fibrous, xanthochroic. Hyphal system monomitic; generative hyphae thin to slightly thick-walled, pale brown, septate, and branched, 2.5-5 µm wide. Setae thick-walled, hymenial, acuminate, dark brown, 27-60 x 5-10 µm. Spores cylindrical, smooth, thin-walled, hyaline, 3.5-4 x 1.5-2 µm. Basidiole smooth, thin- walled, pale yellow, 8.5-14 x 4-5.5 µm.

Hymenochaete rubiginosa (Dicks.) Lév., *Annls Sci. Nat.*, Bot., sér. 3 5: 150 (1846)

Hymenochaete rubiginosa is distributed in moist-deciduous to evergreen forests and shoal forests of the State and occurs on decaying wood and logs. Effused- reflexed to pileate fruit body, dimitic hyphal system, absence of paraphysate elements is the key characters of this species. Fruit bodies annual, effused-reflexed, imbricate, flabelliform, thin, becomes brittle, broadly attached to substratum, adpressed tomentose, 7.5-19.5 x 2.5-13.5 x 0.1-0.5 cm. Pileus dark brown, to brownish orange to brownish grey, margin orange, concentrically sulcate, radially folded, dull. Pore surface, smooth, purplish grey (14F2) to grey (4E1). Context brown (6F4) to reddish brown (8F8), homogenous, xanthochroic, 1 mm thick. Hyphal system dimitic. Generative hyphae hyaline, thin- to thick-walled, simple septate, 2-6.5 µm wide. Skeletal hyphae pale yellow to brown, un branched, non-septate, 3-4 µm wide. Hymenial setae thick- walled, subulate, dark brown in KOH, 27.5-45 x 5-9.5 µm. Spores hyaline, smooth, thin-walled, 3-5 x 1.5-3 µm, ellipsoid. Basidia 14-25 x 3-8 µm, clavate, thin-walled, smooth, with 4 sterigmata.

Inonotus tabacinus (Mont.) G. Cunn., *Bull. N.Z. Dept. Sci. Industr. Res., Pl. Dis. Div.* 78: 3 (1948)

Inonotus tabacinus (= *Cyclomyces tabacinus*)is distributed in moist-deciduous to evergreen forests and shoal forests of the State and occurs on decaying wood and logs.

Fruit bodies annual, thin, leathery, dimidiate, to flabelliform, sessile, attached to substratum with a narrow base, imbricate. Pileus adpressed tomentose to velvety, concentric zonation with dark bands, cuticle present, dark brown, 3-7 x 1.9-3.5 x 0.1-0.3 cm. Pore surface dark brown, brownish grey, yellowish brown to dull violet, purplish grey at margin; pores not visible, round to angular, smooth, shiny, 4-8 per mm; pore tube 1-3 mm long, concolorous. Margin thin, incurved, wavy, sterile, 2 mm. Dissepiments 30-130 µm thick. Pore dimension 125-205 x 90-175 µm. Context dark brown to brownish grey, xanthochroic, duplex, a thin black zone separate the upper tomentum from context. Hyphal system monomitic, simple septate, pale yellowish brown, thin- to slightly thick- walled, 3-5 µm wide. Setae hymenial, dark brown, thick-walled, acuminate, 20-35 x 5-12 µm. Spores oblong ellipsoid, thin- walled, smooth, hyaline, 2.5-3.5 x 2-2.5µm. Basidioles hyaline, smooth, thin walled, 7-17 x 2.3-5 µm.

Inonotus nothofagi G. Cunn., *Bull. N.Z. Dept. Sci. Industr. Res., Pl. Dis. Div.* 78: 1 (1948)

Inonotus nothofagi is distributed in moist-deciduous to evergreen forests and shola forests of the State and occurs on decaying wood and logs. Fruit bodies annual, hard, corky, dimidiate, laterally attached to the substratum. Pileus 4-6.8 x 2-3.4 x 1.8-4 cm, dimidiate, dull, glabrous, incrusted, brown; margin thick, rounded, smooth. Pore surface dark brown, pores 4-5 per mm, not visible, smooth, shiny; pore tubes 5 mm deep, brown. Pore dimension 125-200 x 125-175 µm. Dissepiments 50-100 µm thick. Context brown, homogenous, xanthochroic, 13 mm thick. Hyphal system monomitic. Generative hyphae golden yellow, simple septate, branched, dark brown with KOH, 2-5 µm wide. Spores pale yellowish brown, subglobose to ellipsoid, smooth, thin-walled, 5-6.5 x 4-5 µm. Setae hymenial, rusty brown, ventricose to subulate, 22.5-32.5 x 5-9 µm.

Phellinus adamantinus (Berk.) Ryvarden, *Norw. Jl Bot.* 19: 234 (1972)

Phellinus adamantinus is distributed in semi-evergreen to evergreen forests of the State and occurs on decaying wood and logs. Fruit bodies pileate, hard, woody, perennial, dimidiate to ungulate, sessile. Pileus yellowish brown to dark brown, margin yellowish brown, dull, glabrous, concentrically sulcate, concentrically ridged, radially wrinkled, 8-30 x 2.2-6.3 x 1.6 cm. Pore surface yellowish brown; pores not visible, hymenium rough, asperulate, old tubes become filled with context tissue, stratified, 5-9 per mm, pore tube 2.5 mm deep. Margin thin, sharp, smooth, paler than the disk. Context homogenous, xanthochroic, 4-6 mm thick, yellowish brown to brownish yellow. Hyphal system dimitic, generative hyphae hyaline, light to golden yellow in KOH, simple septate, branched, 2.5-3.5 µm wide. Skeletal hyphae pale yellow, reddish brown in KOH, 5-7 µm wide, inclusion present, septation rarely found. Spores subglobose, pale yellowish brown, smooth, thin-walled 4-7 x 3-5 µm. Pore dimension 75-150 x 75-130 µm; dissepiments 40-110 µm thick. Setae absent.

Phellinus punctatus (Fr.) Pilát, *Atlas Champ. l'Europe*, Polyporaceae (Praha) 3(1): 530 (1942)

Phellinus punctatus is distributed in semi-evergreen to evergreen forests of the State and occurs on decaying wood and logs.

Fruit bodies resupinate, perennial, hard, woody. Pileus 45-200 x 15-20 x 4.2 cm. Pore surface yellowish brown, margin brownish orange, smooth. Pores round, 5 per mm; pore tubes 3-5 mm deep, 11 strata present, context tissue present in between tube layers, pores not visible, pores obliquely arranged, old pore tubes filled with white context hyphae. Margin thin. Context brown, homogenous, xanthochroic, 2 mm thick, Hyphal system dimitic; generative hyphae thin-walled, hyaline, septate, branched, 3 µm wide; skeletal hyphae thick-walled, pale brown, 4 µm wide. Spores hyaline, smooth, thin-walled, 6-7 x 6 µm. Basidia, clavate, 16 x 7 µm, hyaline, thin-walled with 2 sterigmata. Basidiole hyaline, smooth, thin-walled, 11-16 x 5-8 µm.

22. INOCYBACEAE Julich, 1982
Agaricales : Basidiomycota

The family Inocybaceae contains 13 genera and about 820 species (Kirk *et al.*, 2008). Members of this family have a widespread distribution in tropical and temperate regions (Cannon and Kirk, 2007). In general, *Inocybe* species form ectomycorrhizal association with tree species and some evidence suggests that the high degree of speciation in the genus is due to the adaptation to different tree species and perhaps the local environmental conditions. Many species contain large doses of muscarine and are highly toxic, while a few are hallucinogenic and contain psilocybin. Only a few species are edible. *Inocybe antillana, I. crassicystidiata, I. ianthinofolia, I. ingae, I.lasseri, I. petchii, I. squamata* and *I. viridiumbonata, I. virosa* are newly reported species (Mohanan, 2011). Of these, *Inocybe virosa* and *I. petchii* are described here.

Inocybe petchii Boedijn, *Sydowia* 5 (3-6): 223 (1951)

Inocybe petchii is widely distributed in moist-deciduous to semi-evergreen forests and sacred groves of the State and occurs solitary or scattered in small groups on soil. This beautiful species forms ectomycorrhizal association with *Hopea ponga, H. parviflora,* among others. The abruptly acute umbo, the lack of veil remnants on pileus and stipe and the stellate spinose spores are characteristic of this species.

Fruit bodies mall to medium sized. Pileus 2.5-4.5 cm diam., conical to convex with a prominent, abruptly acute, conical or pointed umbo; surface yellowish brown, elsewhere dull, radially fibrillose, with very small radial cracks, striate near margin; margin straight, entire. Lamellae pale brown to pale yellowish brown, adnexed to adnate, close with lamellulae of different lengths, 3-4 mm wide; edge white, fimbriate. Stipe 7-14 cm x 2-4 mm central, cylindric, elongate, almost equal with a slightly enlarged base, solid; surface dark reddish brown longitudinally striate, silky fibrillose, pruinose above. Odour mild, pleasant. Spore-print dark brown. Context thin, yellowish brown.

Spores 10-15 x 11-13 µm, pale brown, globose to subglobose, with a thickened wall forming numerous, long conical, often furcated spines up to 3 µm long. Basidia 28-40 x 9-10 µm, short clavate, bearing 4 sterigmata; sterigmata up to 10 µm long. Lamella-edge sterile; cheilocystidia 45-50 x 15-20 µm, clavate to ventricose-clavate, metuloidal, with a thickened, hyaline wall and an apical crystalline encrustation; intermixed with dense clusters of thin-walled, clavate elements measuring 14-30 x 6-

10 µm, with a brown plasmatic pigment. Pleurocystidia similar to cheilocystidia, 28-40 x 10-15 µm, clavate to ventricose-clavate, metuloidal, with a thickened, hyaline wall and an apical crystalline encrustation. Hymenophoral trama regular, consisting of broad, inflated cells up to 40 µm wide. Subhymenium narrow, pseudoparenchymatous. Pileal surface a cutis of repent, radially-parallel, cylindric, 2.5-5 µm wide hyphae, often inflated up to 24 µm wide, encrusted with yellowish brown pigment. Caulocystidia 16-50 x 7-14 µm in clusters, abundant at the tip of the stipe, absent at the base, similar to cheilocystidia, thick-walled, fusoid, with crystalloid caps, intermixed with thin-walled, clavate cells. All hyphae with clamp-connections.

Inocybe virosa K.B. Vrinda, C.K. Pradeep, A.V. Joseph & T.K. Abraham, *Mycotaxon* 57: 171 (1996)

Inocybe virosa is widely distributed in semi-evergreen to evergreen forests of the State. This species occurs solitary or scattered in small groups on soil and forms ectomycorrhizal association with *Vateria indica*, *Aporosa acuminate, Aporosa sp.* and *Knema attenuata*. This species is closely related to the widespread species, *Inocybe fastigiata* (Schaeff.Fr.) Quel., but differs in the colour of the basidiome and the spore size. *Inocybe virosa* is reported to be a highly toxic species.

Fruit bodies small to large sized. Pileus 2.5-10 cm diam., conico-convex, soon expanding to plane, broadly umbonate; surface uniformly brown in bud, otherwide yellowish brown at the central umbonate region and paler elsewhere, radially appressed, fibrillose, rimose towards the margin. Lamellae adnexed, yellowish grey (4B2) becoming brownish with age, 2-4 mm wide, crowded with lamellulae. Stipe 4-10 cm x 4-15 mm, central, cylindric, equal, fistulose; surface yellowish white (4A2) to pale yellowish brown, longitudinally fibrillose striate. Annulus absent. Context pale brown, up to 6 mm wide at the centre, without any apparent colour change when cut or bruised, composed of hyaline, thin-walled, inflated hyphae, 4-20 µm diam., with clamp-connections. Spores 6-8 x 4-5 µm ellipsoid, with a smooth yellowish brown slightly thickened wall. Basidia 22-26 x 8-9 µm, clavate, bearing four sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 30-40 x 15-20 µm, clavate or clavato-clyndric, thin-walled, hyaline, sometimes pale brown in older specimens. Pleurocystidia absent. Hymenophoral trama regular, hyaline, of thin-walled hyphae, 2-10 µm. Subhymenial layer pseudoparenchymatous. Pileipellis a cutis of radially parallel, repent, thin-walled hyphae, often encrusted with a brown pigment. Caulocystidia absent.

23. LYCOPERDACEAE Chevall. 1926
Agaricales : Basidiomycota

The family Lycoperdaceae contains approximately 150 fungi now known to lie in the Agaricales. Historically they were placed in their own order Lycoperdales. Members of the Lycoperdaceae family are known as the true puffballs. The genus *Lycoperdon* has a widespread distribution in both temperate and tropical regions and contains about 50 species (Kirk *et al.*, 2008). In general, it contains the smaller species such as the pear shaped puffball and the gem studded puffball. A total of 8 species of

Lycoperdon have been recorded from different forest ecosystems of the State (Mohanan, 2011).

Lycoperdon excipuliforme (Scop.) Pers., *Syn. meth. fung.* (Göttingen) 1: 143 (1801)

Lycoperdon excipuliforme (=*Calvatia excipuliformis*) is distributed mostly along the borders of moist deciduous forests and occurs solitary or in small groups on soil.

Fruit bodies mostly pestle shaped or capitate, rarely pear-shaped, 5-12 cm diam., stalk cylindrical, narrowed and grooved or wrinkled towards the base; with branched white mycelial cords; Outer wall at first white then yellowish to yellowish brown, the upper part breaking away to expose the spores, leaving eventually the stalk. Gleba and subgleba when ripe dark olivaceous brown to brown, scarcely any trace of pseudodiaphram. Spores spherical, 4-6.5 µm diam., dichotomously branched, without swelling at fork, fragile, with small pores, without septa.

Lycoperdon pyriforme Schaeff., *Fung. Bavar.4: 128 (1774)*

Lycoperdon pyriforme is widely distributed in semi-evergreen to shola forests and occurs gregarious on decaying wood, mainly on branches and stumps. Fruit bodies pear-shaped to capitate, white at first then ochraceous to brown, 2-7 cm tall, 1-5 cm diam., with white rhizomorphs; outerwall finely warted or scurfy; inner wall off white, papery, with fairly large mouth. Gleba olivaveous brown. Subgleba remaining white. Spores spherical, smooth, 3-4.5 µm diam. Capillitium threads brownish, 3-6 µm thick, without pores.

24. LYOPHYLLACEAE JÜLICH 1982

The family Lyophyllaceae contains 8 genera and about 157 species (Kirk *et al.*, 2008). *Termitomyces* is the most significant and economically important genus of this family. *Termitomyces* is a paleotropical genus of agarics intriguing both to mycologists and entomologists. Species of this genus are considered obligate symbionts of termite belonging to the subfamily Microtermitinae. The termite culture the fungus by actively feeding the mycelium. The fungal mycelium grows on comb-like structure made from fecal pellets. The fungus degrades this pellet and it becomes palatable to the termites. The mushrooms fruit after heavy rains when moisture reaches the comb within the termite nests/mount. Most of the species are edible and highly nutritious. The genus includes the largest mushroom *T. titanicus* of West Africa, the pileus of which reaches more than 1 m in diam. Earlier, *Termitomyces* has been included under Tricholomataceae and later shifted to Pluteaceae. Recently, the genus has been included Lyophyllaceae (Kirk *et al.*, 2008).

At present more than 30 taxa of *Termitomyces* have been described including 8 forms/ varieties. However, only about 18 species collected and reported from Asia and Africa are well known. From India, so far about 16 species of *Termitomyces* have been reported. From Kerala, about 14 species have been reported (Leelavathy *et al.*, 1983; Bhavani Devi and Nair, 1983; Leelavathy *et al.*, 1991; Vrinda *et al.*, 2002; Mohanan, 2003, 2011). *Termitomyces clypeatus, T. eurhizus, T. globulus, T. le-testui, T. mammiformis, T. microcarpus, T. microcarpus* f. *longipus, T. robustus, T.*

schimperi, T. striatus, T. tylerianus and *T. umkowaan* are species reported from Kerala (Mohanan, 2011). Of these *T. cypeatus* and *T. microcarpus* are described here.

Termitomyces clypeatus R. Heim, *Bull. Jard. Bot. État* 21: 207 (1951)

Termitomyces clypeatus is widely distributed in moist-deciduous to evergreen forests, forest plantations and homesteads and associated with termite mounts. This species is characterized by the silky, grayish brown pileus, with a smooth, dark coloured perforatorium. It differs from *T. striatus* by the spiniform perforatorium.

Fruit bodies medium to large sized. Pileus 5-12 cm diam., at first cylindric-conical then convex with central, strongly spiniform perforatorium; surface at first dark brown becoming ochraceous brown, finally grayish at maturity, with the perforatorium remaining deeply pigmented, fibrillose silky, glabrous. Margin often irregularly lobed. Lamellae free, off white, broad, crowded with lamellae of two lengths, entire. Stipe 5-12 cm x 5-15 mm, solid, cylindric then swollen slightly at the base before developing a long tapering blackish pseudorrhiza; upper surface of pseudorrhiza whitish or with an ochraceous tint in the epigeal region. Veil absent. Context white, firm, thin in the pileus, of thin-walled hyphae, 2-10 µm diam. Spores 6-8 x 4.5-5 µm, obovoid to ellipsoid, hyaline, thin-walled, with few contents. Cheilocystidia 29-35 x 9-12 µm, pyriform, to short fusiform, fairly abundant, thin-walled or with a slightly thickened refringent wall. Pleurocystidia not observed. Hymenophoral trama indistinctly bilateral, with diverging thin-walled hyphae, 2-6 µm diam., sometimes inflated to 10 µm, diam., subhymenial layer pseudoparenchymatous, 5-8 µm wide, Pileal surface a repent epicutis of radially parallel, thin-walled hyphae, 2-8 µm diam. All hyphae lacking clamp-connections.

Termitomyces microcarpus (Berk. & Broome) R. Heim, *Arch. Mus. Hist. Nat.*

Termitomyces microcarpus is widely distributed in grasslands to evergreen forests, forest plantations and homesteads and occurs on termite nests and mounts.

Fruit bodies small sized, mycenoid. Pileus 0.5-3.5 cm diam., companulate to convex, expanding, dry or gelatinized, radially striate, often with an acute papillate projection, perforatorium; surface white to cream colour. Lamellae free to adnexed, white to off white, 1-2 mm wide, moderately crowded, with lamellulae. Stipe 2-6.5 cm x 1-3 mm, slender, sinuous, cylindric, solid; surface white, or concolourous but paler than the pileus, fibrillose, smooth, glabrous, with short rooting base but not developing a recognizable pseudorhiza. Context thin, 1-2 mm thick at the centre, white, unchanging, consisting of inflated, thin-walled hyphae, 5-30 µm diam., lacking clamp-connections. Spore-print pale pink. Spores 6-9 x 4-5 µm, ovoid to ellipsoid, subhyaline, smooth, with a slightly thickened wall, containing one or more refractive guttules. Basidia 20-25 x 5-8 µm, clavate, guttulate, bearing four sterigmata. Lamella-edge fertile or heteromorphous with a scattered cheilocystidia. Cheilocystidia and pleurocystidia similar, pyriform, clavate to cylindric, 20-30 x 12-16 µm. Hymenophoral trama hyaline, regular; pileipellis a poorly developed epicutis of radially parallel non-inflated, thin-walled hyphae, 2-8 µm diam. Odour and taste pleasant.

25. MARASMIACEAE Roze ex Kuhner 1980
Agaricales : Basidiomycota

The family Marasmiaceae contains 54 genera and 1590 species distributed in temperate and tropical regions (Kirk *et al.*, 2008). Among the 54 genera of this family, the genus *Marasmius* is most widespread and contains about 500 species (Kirk *et al.*, 2008). Members of this genus are small, unimpressive, tough brown mushrooms usually associated with decomposition of forest litter and play a major role in ecosystem functioning. A total of 29 *Marasmius* species have been reported from Kerala which include the recently reported *Marasmius atrorubens, M. confertus, M. corrugatiformis, M. elaeocephalus, M. hakgalensis, M. kisangensis, M. leveilleanus, M. rigidichorda* and *M. spegazzinii* (Mohanan, 2011).

The genus *Trogia* contains about 20 species that are widely distributed in tropical and subtropical regions (Kirk *et al.*, 2008). *Trogia infundibuliformi, T. cantharelloides* and *T. cyanea* are species occurring in Kerala (Mohanan, 2011). The genus *Gerronema* contains about 13 species that are primarily tropical in distribution. *Gerronema tenue* has recently been recorded from Kerala (Mohanan, 2011).

The genus *Hydropus* contains about 100 species, distributed mostly in tropical regions (Kirk *et al.*, 2008). Earlier, has been reported from Kerala (). *Hydropus cylindrocystis, H. anthidepas* and *H. sphaerosporus* are the species occurring in Kerala (Pradeep *et al.*, 1996; Mohanan, 2011). *Omphalotus olearis*, also known as American Jack O'lantern mushroom. *O. olearis* is a poisonous as well as bioluminescent mushroom widely distributed in the moist-deciduous to semi-evergreen forests of the State. The genus *Lactocollybia* contains 17 species, widely distributed in tropical regions (Kirk *et al.*, 2008). *Lactocollybia epia* is a newly reported species (Mohanan, 2011). The genus *Gymnopus* contains about 300 species and only *Gymnopus dryophilus* has recently been reported from the State (Mohanan, 2011).A total of 7 species of *Marasmiellus* have been reported from Kerala including the newly reported *Marasmiellus stenophyllus* and *M. subaurantiacus* (Manimohan and Leelavathy, 1989; Mohanan, 2011).

Gerronema tenue Dennis, *Index of Fungi* 3: 80 (1961) [1960]

Gerronema tenue is distributed in moist-deciduous to evergreen forests of the State and occurs solitary or scattered in small groups on decaying branches and twigs and on forest litter. Fruit bodies mall. Pileus 2-4 cm diam., convex to umbilicate to infundibuliform; surface hygrophanous, greyish yellow with violet tints at centre with appressed squamulose, pale yellow towards margin, irregularly translucent striate, margin entire becoming eroded. Lamellae decurrent, pale yellow, about 4 mm wide, distant, with lamellulae of two lengths; edge smooth. Stipe 1.5-3 cm x 1.5-3 mm, straight, slightly broader towards the base, hollow; surface greyish yellow, paler at the base, appressed squamulose above, glabrescent. Context membranous, up to 1 mm thick, cream, tough, of very thin-walled hyphae, 3-20 µm diam., with clamp-connections. Spores 6-10 x 4-5, subglobose to broadly ovoid, hyaline inamyloid, thin-walled, with a large central refractive guttule. Basidia 35-40 x 5-6 µm, elongate clavate, bearing four sterigmata. Lamella-edge sterile; cheilocystidia 30-38 x 4-6 µm, cylindro-clavate, hyaline, thin-walled. Hymenophoral trama regular or nearly so, with

thin-walled hyphae, 3-10 µm diam. Subhymenial layer interwoven. Pileipellis a repent epicutis of more or less parallel hyphae, thin-walled, 4-6 µm diam.

Gymnopus dryophilus (Bull.) Murrill, *N. Amer. Fl.* (New York) 9(5): 362 (1916)

Gymnopus dryophilus is widely distributed in semi-evergreen to evergreen forests of the State and occurs scattered in small clusters on decaying forest litter.
Fruit bodies small sized. Pileus 2-3.5 cm diam., convex soon applanate, finally depressed; surface hygrophanous, pale pinkish, finely striate when moist. Lamellae adnexed to adnate, whitish to pale yellow, narrow, very crowded, with lamellulae of 3 lengths, up to 2 mm wide. Stipe 3-7 cm x 1.5-4 mm, cylindric or compressed, solid then hollow; surface whitish soon pale pinkish, glabrous and shiny. Context, about 2 mm thick, white, thin, of thin-walled, inflated hyphae, 3-12 µm diam., with clamp-connections. Spores 3.5-7 x 2.5-3 µm; narrowly ellipsoid to subfusoid, hyaline, thin-walled. Basidia 17-20 x 4-6 µm, narrowly clavate, bearing 4 sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 30-36 x 4-6 µm, mostly inflated clavate or cylindric with a broadly rounded apex, at times nodulose, hyaline, thin-walled. Hymenophoral trama regular, hyaline, with inflated hyphae, 3-12 µm diam. Subhymenial layer interwoven, 6-8 µm wide. Pileipellis an epicutis of interwoven, thin-walled hyphae, 2-6 µm diam., often with numerous, lateral short branches.

Hydropus sphaerosporus (Dennis) Dennis, *Kew Bull.*, Addit. Ser. 3: 43 (1970)

Hydropus sphaerosporus is distributed in semi-evergreen to evergreen forests of the State and occurs solitary or scattered in small groups on decaying forest litter. The overall habit of the fungus is reminiscent of *Mycena* but both the context hyphae and the spores remain unstained in Melzer's reagent. Fruit bodies small sized. Pileus 2-3 cm diam., fragile, obtusely conico-convex to companulate; surface purplish grey to grayish lilac, paler towards margin, conspicuously striate. Lamellae adnexed, white with a pale greenish hue, thin, 2-3 mm wide, moderately crowded, with narrow lamellulae of 2 lengths; edge pruinose. Stipe 3.5-5 cm x 2-3 mm, elongate, cylindric, fistulose; surface white to grayish white, translucent, dry, finely pruinose at the apex, glabrous below. Context thin, white, not vinaceous with Melzer's reagent, of thin-walled hyphae, 3-15µm diam., with clamp-connections. Spores 6-8 x 4-5 µm, subglobose to obovoid, hyaline, inamyloid, thin-walled. Basidia 25-30 x 4-6 µm, clavate, bearing 4 sterigmata. Lamella-edge heteromerous, with numerous cheilocystidia. Cheilocystidia 35-45 x 9-11 µm ventricose fusoid, hyaline, with a thin to slightly thickened wall, frequently enveloped in a brown deposit. Pleurocystidia very abundant, 35-45 x 7-10 µm ventricose fusoid to lageniform, hyaline with a thickened wall, similarly encrusted to the cheilocystidia. Hymenophoral trama regular, hyaline, inamyloid. Pileipellis an epicutis of narrow, hyaline hyphae, 1-3 µm diam., with a highly developed Remeales-structure, overlying a well developed hypodermium of thin-walled, inflated elements containing a brown vacuolar pigment. Caulocystidia scattered over the stipe apex, similar to the hymenial cystidia, with a thickened wall.

Lactocollybia epia (Berk. & Broome) Pegler, *Kew Bull.*, Addit. Ser. 12: 77 (1986)

Lactocollybia epia is widely distributed in moist-deciduous to evergreen forests of the State and occurs in gregarious clusters on decaying branches, logs and stumps.

Fruit bodies small sized. Pileus 1-2.5 cm diam., thin, plano-convex, sometimes obtusely umbonate or depressed to subumbilicate; surface off-white, hygrophanous, almost translucent, drying yellowish ochraceous from the margin, smooth, not striate, glabrous; margin incurved, finely striate when moist. Lamellae adnexed to short decurrent, arcuate, white to pale cream colour, narrow, about 1-3 mm wide, crowded, with lamellulae of three lengths. Stipe 1-4 cm x 2-4 mm, cylindric or tapering below, solid to hollow; surface concolorous with the pileus, smooth, glabrous, arising from a white mycelial base. Context thin to moderately fleshy, up to 3 mm thick at disk, white, consisting of loosely woven, thin-walled hyphae, 2-9 µm diam., with clamp-connections. Gloeo-system present in context, hymenophoral trama, cutis and stipe, extensive but discontinuous, formed by short, elongate fusoid hyphal segments, 45-230 x 5-12 µm, with greenish yellow contents.

Spores 7.5-9.5 x 3.5-5 µm, ellipso-pyriform to subamygdaliform, rarely subfusoid, hyaline, thin-walled, with few contents. Basidia 15-23 x 4-6 µm, clavate, bearing four sterigmata. Lamella-edge sterile to heteromorphous, with crowded cheilocystidia. Cheilocystidia 24-45 x 3-10 µm, cylindrico-clavate, hyaline, thin-walled, with few contents. Gloeocystidia abundant, 25-35 x 5-8 µm, clavato-fusoid, often mucronate, thin-walled, subhyaline or with greenish yellow refractive contents, originating in the trama. Hymenophoral trama strictly regular, hyaline, of parallel hyphae, 2-8 µm diam. Subhymenial layer, narrow, 6-8 µm wide, interwoven. Pileipellis an un-pigmented cutis of repent, densely woven hyphae, 3-10 µm diam.

Marasmiellus stenophyllus (Mont.) Singer, *Sydowia* 15 (1-6): 58 (1962) [1961]

Marasmiellus stenophyllus is distributed in moist-deciduous to evergreen forests of the State and occurs solitary or scattered in small to large clusters on herbaceous stem, decaying branches and twigs and on forest litter. Fruit bodies small sized. Pileus 2-3 cm diam., convex soon applanate or depressed; surface whitish, pale vinaceous brown at the centre, hygrophanous, smooth, pruinose, glabrescent, faintly plicate-sulcate at the margin. Lamellae adnate or with a decurrent tooth, off white, narrow, with interveining at maturity, subdistant, 4-5 mm wide, with lamellulae. Stipe 6-9 x 0.5-3 mm, cylindric or tapering below, solid; surface whitish, discolouring brown, pubescent becoming strigose at base but insititious. Context white, thin, of loosely woven, narrow hyphae, 3-8 µm diam., with clamp-connections. Spores 9-12 x 4-5.5 µm, lacrymoid to subfusoid, hyaline, smooth, thin-walled, with refractive guttules. Basidia 17-25 x 5-6 µm, clavate, bearing four sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 18-23 x 5-10 µm, sinuous-cylindric, often constricted or occasionally nodulose, hyaline, thin-walled. Hymenophoral trama regular, hyaline, of parallel hyphae, 3-8 µm diam. Subhymenial layer interwoven. Pileipellis a repent epicutis of thin-walled, interwoven hyphae, 4-6 µm diam., with scattered, nodulose outgrowths, and some brown encrusting pigment.

Marasmius haematocephalus (Mont.) Fr., *Epicr. syst. mycol.* (Upsaliae): 382 (1838) [1836-1838]

Marasmius haematocephalus, a common litter fungus is widely distributed in moist-deciduous to evergreen forests and occurs scattered in small or large groups on decaying forest litter, especially in bamboo leaf litter. Fruit bodies small sized. Pileus

2-3.5 cm diam., campanulate to convex, umbilicate, sometimes with a papillate umbo; surface brownish red to vinaceous, sulcate striate, glabrous. Lamellae free to adnexed, white to pale purplish pink, distant, 8-14 complete lamellae, with very occasional lamellulae. Stipe setose, 2-9 cm x 1-2 mm, equal, fistulose; surface violet brown, glabrous, smooth, shiny arising from a well developed basal mycelium. Context thin, white dextrinoid, of thin-walled hyphae, 3-10 µm diam., with clamp-connections. Spores 9-11 x 4-5 µm, cylindric to subfusoid, hyaline, thin-walled. Basidia 21-28 x 6-8 µm, clavate, bearing four sterigmata. Lamella-edge sterile; cheilocystidia 24-26 x 6-8 µm, pyriform to oblong pedicillate, with numerous, erect apical setules, 2-6 µm long, hyaline, thin-walled. Pleurocystidia numerous, 25-37 x 5-6 µm, gloeocystidioid, clavate to ventricose, at times mucronate, hyaline, with opaque, refringent contents. Hymenophoral trama regular, hyaline, dextrinoid, Pileal surface hymeniodermic, with an epicutis of Siccus-type brown cells, 10-23 x 5-8 µm, clavate to cylindric with erect, apical setules, 3-6 µm long, thin- or thick-walled, pinkish to melleous.

Marasmius hakgalensis Petch, *Trans. Br. mycol. Soc.* 31(1-2): 42 (1948)

Marasmius hakgalensis is widely distributed in moist-deciduous to evergreen forests and occurs scattered in small groups or gregarious clusters on decaying forest litter. Fruit bodies small sized. Pileus 1.5-5 cm diam., membranous, subglobose to convex or broadly campanulate, finally depressed; surface pinkish brown, darker at the disk, weakly sulcate striate at the margin, glabrous. Lamellae adnate, white or pale yellow, fairly broad, up to 5 mm wide, moderately distant, 9-14 entire, with lamellulae. Stipe 5-7cm x 1-3 mm. filiform, equal, cartilaginous; surface at first pale, soon darkening to reddish brown, glabrescent. Context thin, white, inamyloid, of thin-walled, interwoven hyphae, 2-6 µm diam., with clamp-connections. Spores 7-10 x 3.5-4 µm, ellipsoid, hyaline, inamyloid, smooth. Basidia 28-40 x 6-6.5 µm, clavate, bearing four sterigmata. Lamella-edge broad, sterile. Cheilocystidia very crowded, 15-30 x 5-8 µm, versiform, often clavate, irregularly diverticulate over the apex, hyaline, thin-walled. Pleurocystidia absent. Hymenophoral trama regular, hyaline, with parallel hyphae, 2-6 µm diam. Pileal surface non-hymeniodermic, epicutis with crowded, irregular, diverticulate elements, 20-30 x 4-6 µm, arising from hypodermium of hyphae bearing a dark fuliginous brown membrane pigment.

Omphalotus olearius (DC.) Singer, *Pap. Mich. Acad. Sci.* 32: 133 (1946)

Omphalotus olearius is distributed in moist-deciduous to evergreen forests and occurs scattered in small caespitose clusters on soil or on decaying buried wood. This bioluminescent mushroom has recently been recorded from the State (Mohanan, 2011). Fruit bodies medium to large sized. Pileus 2-18 cm diam., fleshy, convex becoming applanate, then depressed, umbilicate or even infundibuliform; surface orange buff to ochraceous orange, sometimes darkening to amber brown, dry, non-hygrophanous, silky fibrillose or rarely subsquamulose; margin incurved, non-striate. Lamellae deeply decurrent, arcuate, pale orange-yellow to orange, 4-6 mm wide, often but not always luminescent in the dark, crowded, with lamellulae of four lengths; edge entire, concolorous. Stipe central or often slightly excentric, 2-12 cm x 5-26 mm, often curved, cylindric or attenuated towards the base, solid, fibrous-fleshy; surface orange buff to amber brown, dry, glabrous. Context thick whitish, inamyloid, consisting of fairly loosely interwoven hyphae, 3-10 µm diam., with a slightly thickened, refractive wall up to 1.5 µm thick. Spore 5-7 x 4.5-6 µm, subglobose to

broadly ellipsoid, smooth, hyaline, inamyloid, at first thin-walled but thickening slightly at maturity. Spore-print pure white. Basidia 22-30 x 4-6 µm, clavate to cylindric bearing 4 narrow sterigmata up to 5 µm long. Lamella-edge sterile, with numerous cystidioles, 20-30 x 3.5-6 µm, narrowly clavate to lanceolate, at times nodulose or constricted, hyaline, thin-walled. In some cases the cystidioles are basidiomorphous with sterigmata reduced to a single, attenuated, sterile appendage up to 6 µm long. Pleurocystidia absent. Hymenophoral trama subregular to irregular, inamyloid, of slightly thick-walled hyphae, 2-7 µm diam. Subhymenial layer interwoven, thin, 7-8 µm broad. Pileal surface an undifferentiated, agglutinated epicutis, 100-300 µm thick, of parallel branching, thin-walled hyphae, 3-6 µm diam., covered by a brown pigment. All hyphae with clamp-connections.

Trogia infundibuliformis Berk. & Broome, *J. Linn. Soc.*, Bot. 14(2): 45 (1875)

Trogia infundibuliformis is widely distributed in semi-evergreen to evergreen and shola forests of the State and occurs scattered in small to large clusters on decaying branches, fallen twigs and rotting logs. Fruit bodies small to medium sized. Pileus 2-5 cm diam., deeply infundibuliform, flabelliform, frequently splitting from the margin almost to the disk, soft and flaccid when fresh then drying hard and coriaceous, upper surface showing a wide range of colour, pale purple, salmon pink to ochraceous orange, drying fuscous, slightly translucent, weakly radially striate, sulcate on drying, slightly decurved. Hymenophore reduced to narrow veins, deeply decurrent, concolourous with the pileus. Stipe short 0.5- 5 x 0.1-0.5 cm, central, cylindric, expanding below, hollow, arising from a discoid base; surface concolourous with the pileus squamulose towards the base. Context thin, pale brown, membranous, hyphae hyaline, thin-walled with clamp- connections. Spore-print white; spores 7.5-10 x 4-6 µm ellipsoid to oblong-ellipsoid, hyaline, thin-walled, smooth with large refractive oil guttule. Basidia 30-35 x 11-18 µm, elongate clavate, with 4 sterigmata, up to 3 um long. Lamella-edge sterile with cheilocystidia; cheilocystidia 32-37 x 6-6.5 µm forming a sterile lamella edge; pleurocystidia absent. Hymenophoral trama subregular, hyaline consisting of thin-walled hyphae. Caulocystidia 24-28 x 4-5 µm. Pileipellis a repent epicutis.

26. MERIPILACEAE Julich 1982
Polyporales: Basidiomycota

Members of the family Meripilaceae are widespread in temperate and tropical forest ecosystems and are parasitic or saprobic on hardwood trees, often causing white rots. *Rigidoporus,* the significant genus is widespread in moist-deciduous to evergreen forests of the State and causes white rot in standing trees and decay of logs. So far, 4 species of *Rigidoporus* including *R. microporus* and *R. ulmarius* associated with white rot in many tree species have been reported from Kerala (Mohanan, 199,1977; Leelavathy and Ganesh, 2000).

Rigidoporus ulmarius (Sowerby) Imazeki, *Bull. Gov. Forest Exp. St. Tokyo* 57: 119

Rigidoporus ulmarius is widely distributed in moist-deciduous to evergreen shola forests of the State and occurs on decaying logs and stumps.

Fruit bodies annual to biennial, hard, woody, corky, dimidiate, dull, glabrous, incrusted, sessile, conchate. Pileus yellowish white to grayish orange, pale orange at margin, 14.5 x 7.5-10.5 x 3.5-5 cm. Pore surface pale yellow, grayish orange, with a pink tints; pores not visible, smooth, 4-5 per mm, pore tubes 8-23 mm deep, pinkish white, old tubes become filled with hyphae. Pore dimension 130-190 x 110-180 µm. Dissepiments 35-250 µm. Margin thick, rounded, smooth. Context off white to grayish orange (5B4), homogenous, non-xanthochroic, 1.2-2.5 cm thick. Hyphal system monomitic. Generative hyphae hyaline, septate, thin- to slightly thick-walled, branched, 3-5 µm wide. Spores subglobose, hyaline 6-8.5 x 4-7.5 µm, smooth, thin-walled, with large oil globules. Cystidia 12-22 x 7-12 µm, ventricose to mammillate, thin-walled, smooth. Basidia clavate, thin-walled, 19-20 x 8-10 µm with 4 sterigmata.

27. MERULIACEAE P. Karst. 1881
Polyporales: Basidiomycota

The family Meruliaceae contains 47 genera and 420 species (Kirk *et al.*, 2008). Most members are widely distributed in temperate and tropical regions and cause decay in standing trees, logs and timbers. *Bjerkandera, Flaviporus, Flavodon, Gloeoporus, Irpex, Phlebia, Podoscypha* and *Steccherinum* are the significant genera of this family.

Irpex lacteus (Fr.) Fr., *Elench. fung.* (Greifswald) **1**: 142 (1828)

Irpex lacteus is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs on decaying wood, logs and stumps. Annual, effused reflexed to resupinate fruit body, tomentose to hirsute pileus, irpicoid pore surface, dimitic hyphal system with simple septate generative hyphae, thick-walled encrusted cystidia, and cylindric spores are the key characters of this species.

Fruit bodies annual, resupinate to effused reflexed, becomes pileate, confluent, spreading in sheets of 9 x 22 cm, easily separable from substratum, pileate forms flabelliform, thin, leathery, flexible when dry, 3 mm thick. Pileus off white, becoming grayish brown, adpressed tomentose, concentrically zoned. Pore surface yellowish brown to dark brown, irpicoid, alveolar near margin, tooth flattened, 1-2 per mm, angular, 3 mm long, shorter towards periphery, 0.5 mm at margin. Pore dimension 400-870 x 280-740 um. Dissepiments 120-650 µm thick. Context yellowish brown, homogenous, non-xanthochroic, 0.5 mm thick. Hyphal system dimitic; generative hyphae hyaline, thin- to slightly thick-walled, simple septate, branched, 2.5-5 µm wide; skeletal hyphae pale coloured, thick-walled, unbranched, 3-6 µm wide. Spores ellipsoid, hyaline, smooth, thin-walled, 4-6 x 2-3µm.

Podoscypha venustula (Speg.) D.A. Reid, *Beih. Nova Hedwigia* 18: 260 (1965)

Podoscypha venustula is widely distributed in semi-evergreen to evergreen and shola forests of the State and occurs in small to large caespitose clusters on soil around trees, stumps or around decaying standing trees. Fruit bodies annual, thin, leathery, radially fibrillose, gregarious with flattened spathulate branches. Pileus smooth, glabrous, radially folded, dark brown to pinkish brown, paler towards margin, dull concentrically zoned. Pore surface smooth, stereoid, orange grey, brownish grey to grayish orange, radially folded. Margin thin, paler, wavy to serrate. Stipe lateral,

subcylindric to flattened, 1-4 x 0.2-.3 cm, off white to brownish orange, velutinate to smooth. Context homogenous, non-xanthochroic, orange grey, 0.5 mm thick. Hyphal system dimitic; generative hyphae hyaline, thin-walled, septate with clamp, branched, 2.5-5 µm wide; skeletal hyphae hyaline, thin-walled, 2.5-6 µm wide, un branched. Spores, 3.5-5x2.5-4 µm, hyaline, smooth, thin- walled, subglobose with oil globules. Pileal cystidia hyaline, thick-walled, 30-75 x 10-14 µm. Cystidiole smooth, thin-walled, pointed at tip, 25-37.5 x 6-10 µm. Basidia clavate, 27.5-30 x 5-6 µm with 4 sterigmata. Basidiole 17-30 x 4-8 µm, clavate, smooth, hyaline.

28. MYCENACEAE Roze 1876
Agaricales : Basidiomycota

The family Mycenaceae contains 10 genera and 705 species (Kirk *et al.*, 2008). Mycenaceae is one of the several families separated from Tricholomataceae based on recent phylogenetic analyses (Moncalvo *et al.*, 2002). Taxa belong to the family are saprobic and have cosmopolitan distribution, occur in almost all ecological zones (Cannon and Kirk, 2007). *Mycena*, the most significant genus of this family has about 500 species are widely distributed in both temperate and tropical regions. About 33 species of *Mycena* are known to be bioluminescent. Most *Mycena* species are primary colonizers of forest litter. So far, eight species of *Mycena* including the newly reported *Mycena pura* have been reported from Kerala (Mohanan, 2011). *Filoboletus manipularis,* a bioluminescent mushroom is widely distributed in semi-evergreen to evergreen and Shola forests of the State. This species exhibits morphological variation in clolour and size of the basidiomes. The genus *Favolaschia* contains 50 species and has widespread distribution, particularly in tropical regions (Kirk *et al.*, 2008). So far, no *Favolaschia* species has been reported from Kerala. *Favolaschia thwaitesii* and *F. tonkinensis* are newly reported species (Mohanan, 2011). The beautiful yellowish to reddish brown coloured mushroom *Xeromphalina tenuipes* is also a newly reocorded species from Kerala (Mohanan, 2011).

Favolaschia tonkinensis (Fr.) Singer, *Lloydia* 8: 197, t. 1/2 (1945)

Favolaschia tonkinensis is widely distributed in moist-deciduous to evergreen forests of the State and occurs scattered in large clusters on decaying wood and rotting bamboo culms. This species differs from the other species of the genus by the subglobose spores and the total absence of cystidioid structures. Fruit bodies small, laterally stipitate. Pileus 6-22 mm diam., at first orbicular soon becoming sub-reniform, laterally attached or occasionally sessile, surface plano-convex, pale yellowish with pale brown tints then pale grey to smoke grey, becoming very pale brown on drying, translucent, gelatinous, glabrous, tessellate-pustulate particularly on drying; margin obtuse, entire, undulate. Hymenophore poroid, consisting of 20-30 isolated pores immersed in a gelatinous matrix; pores 3-5 per cm, up to 1.8 mm diam., 1-1.5 mm deep, at first circular eventually becoming polygonal, separated by broad gelatinized dissepiments, 100-500 µm thick. Stipe 2-10 x 1.5-3 mm, lateral, obliquely attached, curved upwards, equal or slightly expanded towards the pileus, cylindric, concolorous with the pileus except for a solid core of more or less parallel hyphae which appear white through the more gelatinized outer layers, surface glabrous and smooth. Context up to 2 mm thick, hyaline, completely gelatinized but tough and

pliable, composed of very loosely interwoven, wavy-irregular hyphae, 3-4 µm diam., which are embedded in a gelatinous matrix; hyphae inamyloid, with granular contents, and bearing small but conspicuous clamp-connections. Spores 6-6.5 x 3-4 µm, subglobose to short ellipsoid with a small hilar appendix, hyaline, weakly amyloid, with granular contents or sometimes vacuolate. Spore-print very pale vinaceous buff. Basidia 20-40 x 6-8 µm, clavate-cylindric, bearing 4 large sterigmata, up to 5 µm long. Cheilocystidia and pleurocystidia absent. Hymenophoral trama indistinctly subregular but hyphae widely separated by the gelatinous matrix, hyaline, inamyloid. Subhymenial layer 12-16 µm wide, slightly gelatinized, interwoven. Pileal surface a poorly differentiated layer of isolated, repent hyphae interspersed with crystalline deposits; pileocystidia absent. All hyphae with clamp-connections.

Filoboletus manipularis (Berk.) Singer, *Lloydia* 8: 215 (1945)

Filoboletus manipularis is widely distributed in semi-evergreen to evergreen and shola forests of the State and occurs in densely caespitose clusters on rotting wood. Fruit bodies mycenoid, whitish. Pileus 1-3 cm dia., soft and thin, convex to conico-companulate, umbonate, sometimes almost umbilicate; surface hygrophanous, white with off white disk, translucent, viscid, smooth, tessellate or reticulate; margin at first incurved. Hymenophore adnate to subdecurrent, tubulate, white to pale cram; tubes 3-5 mm long, more or less radially arranged; pores large, 1-3 per mm, angular. Stipe 2-7 cm x 1-3 mm, slender cylindric, hollow; surface concolourous with pileus, pruinose, glabrescent, longitudinally striate, with a tomentose base. Context up to 2 mm thick at the disk, aqueous, brittle, consisting of much inflated hyphae, 3-40 µm diam., with slightly gelatinized walls and clamp-connections. Spores 6-8 x 4-5.5 µm, ovoid to broadly ellipsoid, hyaline, amyloid, thin-walled, with few contents. Basidia 32-35 x 5-7 µm, short clavate, bearing 4 sterigmata. Hymenophore edge heteromorphous to sterile, with scattered to crowded cheilocystidia. Cheilocystidia 35-70 x 8-12 µm, ventricoso-clavate to fusoid with apical outgrowth, hyaline, thin-walled. Hymenophoral trama regular, hyaline, inamyloid, of parallel, inflated hyphae. Pileipellis an indefinite epicutis of more or less radially arranged, repent hyphae, 1.5-3 µm diam., with diverticulate outgrowths, overlaying a hypodermium of short, inflated elements. Caulocystidia present, similar to cheilocystidia.

Mycena auroricolor (Berk. & Broome) Petch, *Trans. Br. mycol. Soc.* 27: 137 (1945) [1944]

Mycena auroricolor is widely distributed in moist-deciduous to evergreen and shola forests of the State and occurs in small clusters on decaying leaf litter. It is closely related to *M. pura* but lacks pleurocystidia and has smaller spores.

Fruit bodies small sized. Pileus 0.5-3 cm diam., broadly convex to campanulate becoming depressed in the centre; surface very pale lilac to rose-pink at centre, with purplish tints when young, paler when old, but drying dark brown, smooth and glabrous; margin undulate, striate when moist. Lamellae adnate to adnato-decurrent, with some interveining, paler than pileus, narrow, up to 3 mm wide, crowded, with lamellulae of 3 lengths. Stipe 3-9 cm x 2-3 mm, cylindric, tapering below, hollow; surface concolorous with pileus, smooth, shining, with a strigose base. Context thin, up to 3 mm thick at disk, white, of loosely woven, much inflated hyphae, 3-30 µm diam., with clamp-connections. Spores 6-7 x 3.5-5 µm, oblong ellipsoid, hyaline,

amyloid, thin-walled, with few contents. Basidia 25-32 x 6-7 µm, cylindro-clavate, bearing four sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 24-36 x 6-10 µm, sinuoso-cylindric, fusoid to lageniform, hyaline, thin-walled. Pleurocystidia absent. Hymenophoral trama regular, hyaline, vinoid, with more or less parallel hyphae, 3-30 µm diam. Subhymenial layer 8-10 µm wide, pseudoparenchymatous. Pileipellis a poorly differentiated epicutis of woven, narrow hyphae, 2-5 µm diam., sometimes with a membrane pigment, overlying a hypodermium of broadly inflated elements.

Xeromphalina tenuipes (Schwein.) A.H. Sm., *Pap. Mich. Acad. Sci.*: 84 (1953)

Xeromphalina tenuipes is widely distributed in semi-evergreen to evergreen and shola forests of the State and occurs in small clusters on decaying wood.

Fruit bodies small to medium sized. Pileus 1-8 cm diam., at first convex with an incurved margin then expanded and broadly umbonate, sometimes depressed with age; surface sub-hygrophanous, yellowish to reddish brown at the disk, becoming ochraceous orange, buff-yellow towards the margin, occasionally entirely yellow or with olivaceous tints, not viscid, striate to the disk and often reticulately rugose, pruinose to velutinate then sub-granulose, glabrescent, margin paler, thin, pellucid striate, entire and undulate. Lamellae sinuate adnexed, usually with a decurrent tooth, whitish soon becoming pale yellow, sometimes flushed vinaceous, ventricose, 2-8 mm broad, moderately distant, with numerous lamellulae of 5 lengths, and conspicuous interveining. Stipe 2.2-7 cm x 2-6 mm, equal or slightly inflated below, occasionally with a short tapering pseudorrhiza, tough and flexuous, cylindric, hollow; surface concolorous with the pileus above, darkening to umbrinous below, with a velutinate covering of short, fine hairs, more strigose at the base. Context up to 2 mm thick, brown, aqueous, inamyloid, of densely interwoven, hyaline hyphae, 7-16 µm diam., with clamp-connections and a very thick, up to 8 µm, gelatinized wall which almost obliterates the lumen. In the lower context, towards the hymenophore, the hyphae are narrower, 2.3-4.5 µm diam., with a less thickened wall; odour slight; taste sweetish.

Spores 7-9.5 x 4.5-5 µm, ellipsoid to subcylindric, applanate or slightly concave on the adaxial side, hyaline, amyloid, with a smooth, thin wall, containing oil-guttules. Basidia 40-50 x 6-6.5 µm, clavate, sometimes amyloid at the apex, bearing 4 sterigmata; sterigmata up to 5 µm long. Lamella-edge, sterile, with irregular, nodulose branching, hyaline, thin-walled cystidia, 45-50 x 3.5-4 µm. Basidioles abundant, 33-40 x 4.5-6 µm, fusoid with subacute apices, thin-walled. Hymenophoral trama subregular to irregular, hyaline, inamyloid, of interwoven, thick-walled, gelatinized hyphae, 1.5-4 µm diam. Subhymenial layer 5-8 µm broad, interwoven. Pileipellis an epicutis formed by a discontinuous trichodermial palisade of pileocystidioid hairs. Hairs of pileus 70-90 x 8-10 µm, erect or semi-repent, sinuous-cylindric, nodulose or occasionally branched, with rounded apices and a thickened, ferruginous wall, often grouped into fascicles. Hypodermium 15-40 µm thick, of repent, radially arranged hyphae, 8-16 µm diam., with thick, gelatinous walls and an incrusting pigment. Hairs of stipe crowded, 85-190 x 4-10 µm, mostly aseptate but not always so, cylindric, with a thick, brown wall which may also have an incrusting pigment, occasionally branched.

29. NIDULARIACEAE Dumort 1822
Agaricales : Basidiomycota

The family Nidulariaceae contains 5 genera and have a widespread distribution in most ecological zones. *Cyathus, Crucibulum* and *Nidularia* are the significant genera of this family and members are widespread in most ecological zones, saporbic on dead plant material or dung.

Members are commonly known as the 'bird's nest fungi', their fruiting bodies resemble tiny egg-filled birds' nests, complete with tiny 'eggs'. Members are saprobes often seen growing on decaying wood, coconut palm stem and in soils enriched with wood chips, bark mulch. The genus *Cyathus* contains about 45 species which are widely distributed throughout the world. Species of *Cyathus* are also known as 'splash cups', which refers to the fact that falling raindrops can knock the peridioles out of the open-cup fruiting body. Several *Cyathus* species produce bioactive compounds, some with medicinal properties, and several lignin degrading enzymes from the genus may be useful in bioremediation.

Cyathus striatus (Huds.) Willd., *Fl. berol. prodr.*: 399 (1787)

Cyathus striatus is distributed in moist-deciduous to evergreen forests of the State and occurs scattered in small groups on decaying logs and forest litter. Fruit bodies small sized, flower-pot shaped, 8-15 mm tall, 6-8 mm wide, brown and shaggy on the outside, grayish brown and vertically striate or fluted on the inside. Peridioles 8-16 grey to grayish black, about 1.5-2 mm diam., free within the peridium and immersed in mucilage. Spores 15-20 x 8-10 µm, ellipsoidal, smooth, hyaline and thin-walled. Hyphal system dimitic and clamp-connections present.

30. PHALLACEAE Corda 1842

Phallales : Basidiomycota

The family Phallaceae contains 21 genera and 77 species (Kirk *et al.,* 2008). Members of this family are commonly known as stinkhorn mushrooms and have worldwide distribution, but are especially prevalent in tropical regions. They are known for their foul smelling sticky spore masses, or gleba borne on the end of stalks called the receptaculum. The foetid odour attracts flies and other insects to help disperse the spores. Although there is a great diversity of body structure shape amongst the various genera, all species in the Phallaceae begin their development as a gelatinous, spherical or egg-shaped structure that may be completely or partially buried underground.

Aseroe rubra, commonly known as the anemone stinkhorn, sea anemone fungus and starfish fungus, is the first native Australian fungus formally described in 1800. This fungus is widely distributed in Australia and from its natural habitat and it has been introduced to other parts of the world through garden plants or soil products. *Aseroe rubra* var. *zeylanica* has earlier been reported from Munnar (Iyengar and Krishnamurthy, 1954). There are about nine valid species in *Clathrus*, though 26 have been described based on the colour of the receptacle and degree of roughening of the

arms. Among the red coloured ones *C. ruber* has a wide distribution in Europe, Asia, Africa, West Indies and Japan. *C. pusillus* is confined to Australia and India. *C. pusillus* differ from the most widely distributed *C. ruber* and *C. crispus* in receptacle size and width of the arms. The red colour and small size of the receptacle characterize the species. *Ileodictyon gracile* is confined to Australia and the closely related *I. cibarius* is confined to Australia and New Zealand. *Ileodictyon gracile* is a newly recorded fungus from Kerala (Mohanan, 2011). *Clathrus archeri* which forms a white squid like fungus is also a recently recorded fungus from Kerala (Mohanan, 2011).

Phallus indusiatus, commonly called bamboo fungus, long net stinkhorn, crinoline stinkhorn or veiled lady, has a widespread distribution in tropics. It is an edible mushroom used as an ingredient in Chinese 'haute cuisine'; the mushroom is grown commercially and commonly sold in Asian markets. Nutritional analysis has shown that the mushroom is rich in protein, carbohydrate and dietary fiber. The mushroom also contains various bioactive compounds and has antioxidant and antimicrobial properties. *Phallus indusiatus* and the hitherto unrecorded species *Phallus anamudii*, *Lysurus wayanadensis*, and *Mutinus caninus* are newly reported fungi from Kerala (Mohanan, 2011). *Mutinus* species are commonly known as 'Dog stinkhorn'.

Aseroe rubra var. zeylanica (Berk.) E. Fisch., *Denkschr. schweiz. naturf. Ges.* 32: 75 (1890)

Aseore rubra var. *zeylanica* an unusual stinkhorns, also called the flower fungus, starfish stinkhron or sea anemone fungus, is widely distributed in the shola forests and *Eucalyptus* stands at high elevated areas. Due to its unpleasant odour and exceptionally bright attractive colour, it is easy to locate the fungus in the leaf litter.

Fruit bodies when young spherical, dirty white, 3-4.5 cm diam. The immature basidiome enclosed in a thick layer of fungal tissue is known as "egg" or peridium. The peridium is whitish to grayish brown, develops in soil, attached by thick mycelial strands or rhizomorphs. As the basidiome develops, it elongates and breaks through the surrounding tissue, forming a funnel-shaped structure called the "receptacle". This composed of more or less cylindrical, white to salmon pink spongy stalk of 5-6 x 1.5-2 cm, sheathed by a volva at the base, expanded at the top into a pale red to salmon pink disk. Disk 5-8 cm diam., bears at the margin 8-16 salmon pink to reddish orange unbranched arms or tentacles of 3-8 cm long and 1-3 mm thick. Gleba slimy, olivaceous brown to black on the centre of the disk, foetid. Spores hyaline, hyaline, smooth, cylindrical to ellipsoid 4-6 x 1.5-2 µm, inamyloid. The lower portion of the basidiome, known as a "false stalk" or pseudostipe, is pale pinkish to white on the exterior. The base of the pseudostipe is surrounded by the remnants of the peridial tissues. There is a circular opening in the centre of the receptacle into the pseudostipe. The foetid odour attracts flies, which feed on the gleba and disperse the basidiospores.

Clathrus archeri (Berk.) Dring, **var. alba** Mohanan

Clathrus archeri var. *alba* is a rare fungus distributed in shola forests in Munnar Forest Division and occurs solitary on soil. In *C. archeri* (*Anthurus archeri*), the tentacles are reddish coloured. So far, no *Clathrus* species with white tentacles has been reported.

Fruit bodies when young is enclosed in a thick layer of fungal tissue and is known as "egg" or peridium. The peridium is whitish to grayish brown, 3-6 x 2.5-5 cm diam., ovoid; the immature basidiome develops in soil, attached by thick white mycelial strands or rhizomorphs. The exterior layer of the peridium is thin and furfuraceous, while the inner one thick and gelatinous; at maturity, the peridium opens by irregular splitting at apex. As the basidiome develops, it elongates and emerges through the surrounding tissue, forming a squid like structure with a white spongy stalk or pseudostipe 3.5-5.5 x 1.5-2.5 cm and 4-6 white spongy spreading arms or tentacles 4-7.5 cm long and 0.4-0.8 cm wide tapering at apex. At the early phase, the arms were attached together at the apex then become free. Gleba slimy, dark olivaceous, on inner side of tentacles. Spore mass greenish; spores narrowly ellipsoid, hyaline, 5-7 x 2-2.5 µm. The base of the pseudostipe is surrounded by the remnants of the peridial tissues.

Clathrus pusillus Berkeley, *J. Bot. Lond.* 4: 67 (1845)

Clathrus pusillus is distributed in moist-deciduous to evergreen forests and occur solitary or scattered in small groups on soil amongst decaying forest litter. This species differs from the most widely distributed *C. ruber* and *C. crispus* in receptacle size and width of the arms. The reddish orange colour and small size of the receptacle characterize the species.

Fruit bodies gasteroid, epigeous with a fertile receptacle developing from a strongly gelatinous 'egg'. The peridium spherical to obovate, 15-20 x 20-25 mm, greyish white attached to the soil with white rhizomorphs. The exterior layer of the peridium is thin and furfuraceous, while the inner one thick and gelatinous; at maturity, the peridium opens by irregular splitting at apex. The receptacle is composed of 4-6 arms organically anastomosed to form a clathrate sphere. Receptacle obovate, 3-4 cm diam., with arms somewhat columnar below, and often united into a rudimentary stem-like base or clathrate above and below. The apical portion of the sphere is reddish orange and base of the arms is yellowish orange. The arms are transversely rugulose, exterior longitudinally sulcate and tubular. Gleba strongly gelatinized and deliquescent, found on the inner surface of the arms, strongly foetid, olivaceous mass. Basidia small evanescent, basidiospores ellipsoidal, 4.5-5.5 x 1.5-2 µm; epispore hyaline, smooth, 0.75 µm thick.

Ileodictyon gracile Berk., *J. Bot.*, Lond. 4: 69 (1845)

Ileodictyon gracile is distributed in moist-deciduous to evergreen forests, especially in bamboo stands. This species occurs in large clusters on soil among decaying forest litter and on the base of decaying bamboo culms. This species is very close to the white coloured *Clathrus preussi* earlier recorded from East Africa, *C. chrysomyclinus*, recorded from Brazil, *C. gracilis* confined to Australia and *C. cibarius* recorded from Australia and New Zealand. *Ileodictyon gracile* differs from these white receptacled *Clathrus* species in its highly reduced receptacle, very delicate arms and comparatively less foetid smell of the gleba. Fruit bodies gasteroid, epigeous with a fertile receptacle developing from a strongly gelatinous peridium. Peridium ('egg') spherical to obovate, 15-20 x 20-25 mm, greyish white attached to the soil with white rhizomorphs. The exterior layer of the peridium is thin, furfuraceous; the inner wall

thick and gelatinous; at maturity, the peridium opens by irregular splitting at apex. The receptacle is composed of 3-4 delicate arms anastomosed to form a clathrate sphere. Receptacle white, obovate, 3-4 cm diam, with arms somewhat columnar below, and united into a rudimentary stipe-like base and clathrate above and below. The arms are smooth and tubular. Gleba strongly gelatinized and deliquescent, found on the inner surface of the arms, strongly foetid, olivaceous mass. Basidia small evanescent, basidiospores ellipsoidal, 4.5-5.5 x 1.5-2 µm; epispore hyaline, smooth, 0.75 µm thick.

Dictyophora cinnabarina W.S. Lee, *Mycologia* 49(1): 156 (1957

Dictyophora cinnabarina is distributed in moist-deciduous to semievergreen forests of the State and occurs solitary or in small groups on soil amongst decaying forest litter.

Fruit bodies 9-12 cm tall, 2-3.5 cm wide, pileus or receptacle grayish yellow to dull yellow, 2-4 cm high and 1.5- 2.5 cm diam., strongly chambered and with apical disk perforated in the middle, covered with dark metallic green to olive mucilaginous gleba. Inducium yellowish to yellowish orange, net-like or skirt-like, hanging out from under the lower margin of the pileus, 8-14 cm in length, 6-12 cm wide, semi-elastic, flaring at the bottom. Stipe 7-9 cm long, 2.5-3 cm broad, white, honey-combed, cylindrical, spongy, hollow, projecting from the oval 'egg' or peridium, from which the basidiome expands, leaving a membranous volva around the stipe base, attached to the ground by well-developed white rhizomorphs; volva 2-2.5 cm diam., off white to pale yellowish brown and thick. Odour foetid and disagreeable. Spores 3-4.5 x 1-2 µm, ellipsoid, smooth, thin-walled, hyaline, surrounded by a thin, transparent, sticky envelope.

Lysurus wayanadensis Mohanan sp. nov.

Lysurus wayanadensis is distributed in evergreen and shola forests of the State and occurs solitary on soil amongst decaying forest litter.

Fruit bodies when young spherical to ovoid, off white, 2-4 cm diam., 'egg' or peridium. Mature peridium splits open apically and basidiome emerges out. The mature basidiome composed of whitish, cylindrical, hollow, cellular, spongy pseudostipe or stalk, 6-12 x 2-2.5 cm, sheathed by a off white to pale brown peridial remnants as volva at the base; receptacle at the apex pale grayish brown, longitudinally grooved and transversely ribbed, incurved 4-6 arms or lobes, 2-3 cm long, and 0.5-0.8 cm wide, coated on the inside by olivaceous slimy glebal mass with spores, odour foetid. Spores grayish brown in mass, oblong-ellipsoid, 3-5 x 1.5-2 µm.

Mutinus caninus (Huds.) Fr., *Summa veg. Scand.*, Section Post. (Stockholm): 434 (1849)

Mutinus caninus is distributed in evergreen to shola forests of the State and occurs solitary or scattered in small groups on soil amongst decaying forest litter. Fruit bodies when young ellipsoid or ovoid peridium, up to 4-2.5 cm, white to pale yellowish with white, cord-like mycelium attached to the substratum. The peridium splits open apicaly and the mature basidiome emerges which consists of cylindrical,

spongy, hollow, thin-walled, delicate, salmon coloured psuedostipe or stalk, 8-16 x 1-1.5 cm, terminates into a slender, tapered slightly curved head or receptacle. The receptacle covered by the dark olivaceous, slimy gleba which often washes off to partly reveal the reddish-orange colour of the head. Spores hyaline, cylindrical, smooth, 4.5-6.5 x 1.5-2.5 µm. The base of the pseudostipe is surrounded by the off white remnants of the peridial tissues, as volva. Odour of the glebal mass foetid.

Phallus anamudii Mohanan sp. nov.

Phallus anamudii is distributed in shola forests in Anamudishola, Munnar and occurs in small groups on decaying logs. This bright yellow coloured *Phallus* was recorded only from one location in the shola. Fruit bodies when young often called 'witches eggs', spherical or ovoid, 1.5-2 cm diam., attached to white mycelial cords or rhizomorphs; outer wall membranous, covering a thick gelatinous layer which surrounds an olivaceous gleba, whitish glebal cavities and a compressed stalk. The egg eventually ruptures apically, basidiome emerges out and maturity is obtained within 3 hours. Mature basidiome consists of a long, cylindrical, hollow, spongy, cellular, white stalk, 6-15 x 1-1.5 cm with the remains of the peridium forming volva at the base and a bell-shaped to conical bright yellow head or receptacle 1.5-2.5 x 1-1.5 µm formed by a pendent, honey comb-like structure attached only at the apex of the stalk and surrounding it like a thimble; the receptacle is coated with dark olivaceous gleba containing the spores. Spores ellipsoid, 3.5-4.5 x 1.5-2 µm, smooth, thin-walled, pale olivaveous. Odour of gleba somewhat pleasant.

Phallus indusiatus Vent.,: 520 (1798)

Phallus indusiatus is distributed in moist-deciduos to semievergreen forests of the State and occurs in small groups on soil and amongst decaying bamboo litter. This species is usually found associated with bamboo stands. The colour of the indusium varies from pure white to pale yellow or pinkish. Fruit bodies 9-18 cm tall, 2-4 cm wide, pileus or receptacle off white, 2-4 cm high and 1.5- 2.5 cm diam., strongly chambered and with apical disk perforated in the middle, covered with greenish brown mucilaginous gleba. Inducium white, net-like, hanging out from under the lower margin of the pileus, 8-14 cm in length, 6-12 cm wide, semi-elastic, flaring at the bottom. Stipe 7-14 cm long, 3-4 cm thick, white, honey-combed, cylindrical, spongy, hollow, projecting from the large oval 'egg' or peridium, from which the basidiome expands, leaving a membranous volva around the stipe base, attached to the ground by well-developed white rhizomorphs; volva 2.5-3.5 cm diam., off white and thick. Odour foetid and disagreeable. Spores 3.5-4.5 x 1-2 um, ellipsoid, smooth, thin-walled, hyaline, surrounded by a thin, transparent, sticky envelope.

31. PHYSALACREACEAE CORNER 1970

Agaricales : Basidiomycota

Armillaria, Cyptotrama, Oudemansiella, Physalacria, Xerula are the significant genera of this family. Members are saprobic on wood and widespread in distribution, though most species occur in the tropics, notably South-East Asia and Australasia. Species of *Oudemansiella* and *Xerula* are edible and medicinal mushrooms. Several

Armillaria species are aggressive root pathogens of a wide range of woody pants, but others form mycorrhizae with orchids.

Armillaria mellea (Vahl) P. Kumm., *Führ. Pilzk.* (Zwickau): 134 (1871)

Armillaria mellea is widely distributed in evergreen to shola forests of the State and occurs in small clusters at butt region of trees and on stumps. *A. mellea* is important root pathogen of forest trees and is much more common in temperate areas than in the tropics.

Fruit bodies small to large sized. Pileus 4-9 cm diam., fleshy, subglobose expanding to convex, finally depressed at the centre or umbonate; surface varying from honey colour to tawny or deep brown, with small crowded, fibrillose squamules; margin entire, paler, striate. Lamellae adnate to subdecurrent, whitish to flesh pink, moderately distant but with lamellulae of four lengths, thick, tough, up to 6 mm wide; edge entire, concolorous. Stipe 5-11 x 0.6-1.3 cm, central, equal or slightly thickened towards the base fistulose, fibrous fleshy; surface ochraceous yellow when young, darkening to brown with age, pale yellowish white above the annulus; often arising from black rhizomorphs. Annulus persistent, rather thick, membranous, whitish becoming more yellow in the outer portions, attached to the upper part of the stipe. Context white, up to 8 mm at disk, fleshy, of thin-walled, hyaline hyphae, 2-8 µm diam., inflated up to 15 µm diam., with clamp-connections. Spore-print light cream colour. Spores 8-11 x 5.5-6.5 µm, short ovoid to ellipsoid, with a suprahilar depression, hyaline, inamyloid, with slightly thickened wall. Basidia 35-47 x 5-7 µm, elongate clavate, bearing four sterigmata up to 4 µm long. Lamella-edge sterile, crowded with cheilocystidia, 34-45 x 5.5-8 µm, fusoid, clavate to ventricose, hyaline, thin-walled. Pleurocystidia absent. Hymenophoral trama bilateral, with a broad mediostratum and diverging lateral strata, of hyaline hyphae, 3-8 µm diam., inflated to 16 µm diam. Subhymenial layer interwoven, up to 12 µm wide. Pileal surface a repent cutis, up to 25 µm thick, of loose, unbranched chains of cylindric elements, 15-40 x 5-7 µm, constricted at the septa, somewhat gelatinized.

Cyptotrama asprata (Berk.) Redhead & Ginns, *Can. J. Bot.* 58 (6): 731 (1980)

Cyptotrama asprata is widely distributed in moist-deciduous to evergreen and shola forests of the State and occurs solitary or scattered on decaying twigs and branches of living trees as well as on decaying logs on forest floor. This is a very distinctive lignicolous fungus and can be easily recognized by the very bright golden yellow basidiomes.

Fruit bodies small sized. Pileus 1-4 cm diam., subglobose to convex, finally applanate to depressed; surface yellowish orange, lemon yellow to golden yellow, more reddish orange at the apex, covered by crowded, granular, pyramidal furfuraceous squamules; margin at first inrolled, floccose. Lamellae adnate to subdecurrent, white, 2-4 mm wide, regular. Stipe 1.8-4.5 cm x 2-3 mm, equal, cylindric, fistulose, surface concolorous with the pileus, floccose, squamulose. Veil fugacious. Context thin, 1-1.5 mm wide, white, hyphae, hyaline, thin with clamp-connections. Spores 7.5-10 x 5-6.5 µm, ellipsoid-limoniform with attenuate apex, thin-walled, smooth. Basidia 25-40 x 5-6 µm, clavate, with 4 sterigmata. Lamella-edge heteromorphous. Cheilocystidia abundant, 50-65 x 7.5-10 µm, clavate-cylindric to fusoid with an obtuse to subacute

apex, hyaline, thin-walled. Pleurocystidia 35-65 x 6-12 µm, clavate-cylindric to fusoid with an obtuse to subacute apex, hyaline, thin-walled with oil guttules. Hymenophoral trama subregular. Pileipellis a disrupted trichodermial palisade formed by branching chains of thick-walled elements of 15-40 x 5-75 µm.

Oudemansiella canarii (Jungh.) Höhn., *Sber. Akad. Wiss. Wien*, Math.-naturw. Kl., Abt. 1 118: 276 [2 repr.] (1909)

Oudemansiella canarii is widely distributed in moist-deciduous to evergreen and shola forests of the State and occurs solitary or scattered in small clusters on decaying branches and wood and logs on forest floor. This species differs from *O. mucida* in the reduced development of the annulus, the velar squamules of the pileus, the presence of pigmented epithelial elements, and the larger spores.

Fruit bodies small to large sized. Pileus 2-8 cm diam., convex then applanate; surface white to grayish white, often darker at the centre, becoming paler, translucent striate, glutinous when moist, smooth to rugulose, at first covered with detersile, white, velar squamules. Lamellae adnexed to adnate, white to pale grayish, ventricose, up to 7 mm broad, thick, moderately spaced, with lamellulae of three or four lengths. Stipe 1-6 cm x 3-12 mm cylindric, attenuate above sometimes with a sub-bulbous base, solid; surface shiny whitish, finely striate. Veil sometimes retained as a narrow annulus, or absent. Context fleshy, white, unchanging, partly gelatinized, consisting of interwoven hyphae, mostly 3-8 µm diam., occasionally inflated to 14 µm diam., with clamp-connections. Spores 16-19 x 15-18 µm, globose to subglobose, hyaline, inamyloid, smooth, with a thickened wall containing large, refractive guttules. Basidia 65-75 x 20-28 µm clavate, bearing four sterigmata. Lamella-edge sterile or heteromorphous. Cheilocystidia similar to the pleurocystidia. Pleurocystidia 110-135 x 20-28 µm, ventricose fusoid with a broadly rounded apex, hyaline, thin-walled or with slightly thickened walls. Hymenophoral trama regular, hyaline, somewhat gelatinized, with hyphae, 4-8 µm diam., inflated to 15 µm diam. Subhymenial layer interwoven poorly developed. Pileal surface an epithelium of globose to pyriform or lageniform elements, 30-60 x 8-18 µm, thin-walled, hyaline or with brownish contents, arising from filamentous hyphae in a gelatinous matrix.

Xerula radicata (Relhan) Dörfelt, *Veröff. Mus. Stadt Gera*, Naturwissenschaftliche Reihe 2-3: 67 (1975)

Xerula radicata is widely distributed in semievergreen to shola forests, grasslands, *Eucalyptus grandis* and *E. deglupta* plantations in high elevated areas in Munnar, Devikulam, Vattavada, Pamba, and Peermedu. This species occurs solitary or scattered in small groups on soil.

Fruit bodies small to large sized. Pileus 2-10 cm diam., convex then applanate to depressed, umbonate; surface yellowish grey or paler to dark grayish brown, viscid and translucent when moist, ridged rugose particularly at the umbo; margin thin, straight. Lamellae adnate, white or pale cream, broad, ventricose, up to 10 mm wide, thick, moderately spaced to distant, with lamellulae. Stipe 6-14 cm x 5-15 mm, elongate, cylindric, attenuate above, fistulose then hollow; surface concolorous with pileus, much paler towards the apex, fibrillose-strigose, with a long pseudorhiza. Veil absent. Context thin, 3 mm at disk, white, unchanging, consisting of loosely

interwoven hyphae, 4-8 µm diam., strongly inflated to 30 µm diam., with small and at times inconspicuous clamp-connections. Spores 12-15 x 8-10 µm, ovoid to ellipsoid, hyaline, smooth, with a slightly thickened wall, and containing one to several refractive oil-guttules. Basidia 60-70 x 10-15 µm, clavate filled with refractive oil-guttules, bearing four sterigmata up to 6.5 µm long. Lamella-edge sterile or heteromorphous, with cheilocystidia abundant to rare. Cheilocystidia 53-68 x 11-18 µm, clavate, at time constricted, thin-walled, hyaline or sometimes filled with a pale brown vacuolar pigment. Pleurocystidia present, very large, 90-110 x 21-30 µm, cylindric to clavate or lageniform, thin-walled. Hymenophoral trama more or less regular, sub-gelatinous, hyaline, with thin-walled hyphae, 1.5-5 µm diam., inflated to 14 µm diam. Subhymenial layer poorly developed. Pileal surface hymeniodermic, with a palisade of capitate hyphae 25-60 x 10-25 µm hyaline or often with a brown vacuolar pigment, forming an epithelium, embedded in a gelatinous matrix.

32. PLEUROTACEAE Kuhner 1980

Agaricale : Basidiomycota

Pleurotaceae contains 6 genera and about 94 species (Kirk *et al.*, 2008). *Pleurotus* and *Hohenbuehelia* are the significant genera of this family. Many species of these genera are nematophagous. *Pleurotus* species are worldwide in distribution and represent a well-defined group characterized by the production of fruit bodies with an excentric stalk and a wide cap shaped like an oyster shell. They grow over a wide range of temperatures and are able to colonize a wide spectrum of natural, ligninocellulosic materials. Due to the fast mycelial growth rate, they colonize the substrates rapidly and produce fruitbodies in abundance. Among different species of *Pleurotus*, *P. ostreatus*, popularly known as oyster mushroom is grown commercially around the world for food and for mycoremediation purposes. *P. ostreatus* contains statins such as lovastatin which reduces cholesterol. How ever, it also contains small amount of arabitol, a sugar alcohol which may cause gastrointestinal upset in some people. In Kerala, oyster mushroom, popularly known as 'chippikkoon' is widely used and a variety of dishes are prepared from this mushroom.

Pleurotus eous and *P. ostreatus* are newly recorded species for Kerala (Mohanan, 2011). More than 50 species of *Hohenbuehelia* have been reported from different parts of the world (Kirk *et al.*, 2008). A total of 4 species including the newly reported species viz., *Hohenbuehelia aurantiocystis, H. petaloides* and *H. testudo* (Mohanan, 2011) occur in Kerala.

Hohenbuehelia testudo (Berk.) Pegler, *Kew Bull.*, Addit. Ser. 12: 173 (1986)

Hoenbuehelia testudo is widely distributed in moist-deciduous to evergreen forests of the State and occurs as densely imbricate clusters on decaying wood and rotting logs. This species is closely related to the neotropical species, *H. barbatula* (Berk. & Curt.) Dennis, differing only in the paler colour, the slightly more elongated spores, and the more deeply pigmented metuloids.

Fruit bodies small sized. Pileus 7-10 x 4-7.5 cm, sessile, convex, spathulate to subflabelliform, with narrow, lateral attachment; surface brownish orange with

purplish tints, paler towards margin, finely pruinose, dry, tomentose towards the base with scattered fascicles of white hairs; margin incised, irregularly lobate, undulate, not striate. Lamellae white to ochraceous, narrow, 1-2 mm wide, subdistant, with lamellulae of 3 lengths. Stipe absent. Context about 2 mm thick, white duplex, with an upper, grayish, gelantinous layer of narrow, loosely woven hyphae, 1-4 µm diam., embedded in a hyaline matrix, and a lower, non-gelatinized layer of thin-walled hyphae, 4-8 µm diam., with clamp-connections. Spores 8-9.5 x 4-5 µm, oblong-cylindric, hyaline, thin-walled, often with refractive contents. Basidia 17-21 x 6-7 µm, clavate, bearing 4 sterigmata. Lamella-edge sterile, with abundant cheilocystidia. Cheilocystidia 14-18 x 5-8 µm, lecythiform, with a minute capitellum, 1-2 µm diam., subtended by a narrow neck, hyaline, thin-walled. Metuloids very numerous, especially towards the lamella-edge, 40-60 x 17.5-10 µm, fusoid ventricose, thick-walled up to 7 µm thick, with a narrow lumen, deep yellowish brown. Hymenophoral trama regular, hyaline, not gelatinized, of more or less parallel hyphae, 4-6 µm diam. Subhymenial layer narrow, 6-9 µm wide, interwoven. Pileipellis a disrupted, repent epicutis of non-gelatinized hyphae, 2-4 µm diam., sometimes forming short, erect fascicles.

Pleurotus citrinopileatus, Pleurotus djamor, Pleurotus eous, *Pleurotus flabellatus, Pleurotus ostreatus* are the important *Pleurotus* species recorded from Kerala (Mohanan, 2011). Of these, *P. flabellatus* and *P. ostreatus* are described here.

Pleurotus flabellatus (Berk. & Broome) Sacc., *Syll. fung.* (Abellini) 5: 369 (1887)

Pleurotus flabellatus, a well-known edible species is widely distributed in moist-deciduous to evergreen and shola forests of the State and occurs in densely imbricate clusters on rotting logs and stumps.

Fruit bodies small to medium sized. Pileus 1.5-4.5 x 1-6 cm, orbicular, reniform to irregularly flabelliform with an attenuated base, more rarely with an excentric or central stipe; surface convex or depressed towards the base, white to ivory at maturity, sometimes with a pinkish tint when young, becoming yellowish or pale cinnamon with age, slightly tomentose towards the base otherwise glabrous, appearing radially striate when moist; margin at first incurved then undulate and curving upwards at maturity, sometimes incised, finely striate but not plicate. Lamellae decurrent, moderately crowded, with lamellulae of 5 lengths, white, thin, up to 4 mm wide, with slight inter-connections at the base; edge concolorous, entire. Stipe absent or present and then typically lateral but occasionally excentric or even central, 0.5-5 x 0.2-0.6 cm, short and thick, solid, firm, surface white, finely tomentose soon glabrescent, growing from an extensive basal mycelium. Context thin, up to 4 mm thick at the base, white fleshy coriaceous, with a monomitic hyphal system of hyaline generative hyphae, 3-8 µm diam., highly branched, with a thin to slightly thickened wall up to 1.5 µm thick, with clamp-connections. Spore-print white. Spores 6-9 x 2.5-4 µm, oblong cylindric, hyaline, thin-walled, with few contents. Basidia 20-25 x 6-6.5 µm, narrowly clavate, bearing 4 sterigmata, up to 4 µm long. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 20-32 x 9-12 µm, clavate, to cylindric, at times constricted, with a broad obtuse apex, sometimes with an elongate, mucronate outgrowth, up to 14 x 1 µm. Pleurocystidia absent. Hymenophoral trama subregular to irregular, hyaline, similar to the context. Subhymenial layer well-developed, up to 16 µm wide. Pileipellis an epicutis, 20-28 µm thick, of repent, parallel hyphae, somewhat

agglutinated, 2-8 µm diam., giving rise to scattered dermatocystidia, 16-26 x 4-6 µm, cylindric to narrowly clavate.

Pleurotus ostreatus (Jacq.) P. Kumm., *Führ. Pilzk.* (Zwickau): 24, 104 (1871)

Pleurotus ostreatus, a well-known edible species is widely distributed in moist-deciduous to evergreen forests of the State and occurs in densely imbricate clusters on decaying logs.

Fruit bodies small to medium sized. Pileus 5.5-10.5 cm diam., pileal surface smooth, brownish grey (11B2) with pale purplish tints, paler to cream colour at disk, margin incurved, convex to fan-shaped, striate. Stipe excentric, 2-3.5 cm x 1.5-2.5 mm, solid, pale yellowish. Lamellae white, crowded with lamellulae of three lengths. Lamella-edge sterile with cheilocystidia. Cheilocystidia 29-38 x 5-8 µm, clavate, thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama subregular to irregular. Basidia clavate, 32-34 x 4-6 µm, tetrasporic with sterigmata up to 3 µm long. Spore-print white. Spores 7-10 x 3-5 µm, hyaline, cylindric, with granular contents. Hyphae monomitic, generative hyphae thin-walled, septate with clamp-connections. Pileipellis a poorly differentiated epicutis.

33. PLUTEACEAE Kotl. & Powzar 1972

Agaricales : Basidiomycota

The family contains about 364 species (Kirk *et al.,* 2008). *Pluteus* and *Volvariella* are the significant genera of this family. Members are widespread in both temperate and tropical zones. *Pluteus* and *Volvariella* are the significant genera of this family. Members are widespread in both temperate and tropical zones. *Pluteus* is the largest genus in the family and over 100 species have been reported. Most of them are lignicolous and growing on decaying wood, while some grows on humus rich soil. Some members of *Pluteus* are edible, while a few contain psilocybin and are toxic. *Volvariella* contains about 50 species (Kirk *et al.*, 2008). Some species of *Volvariella* are popular edibles in Europe and Asia accounting for 16 per cent of the total production of cultivated mushrooms in the world. *V. volvacea*, well known paddy straw mushroom is cultivated in paddy straw and on wood chips in the Philippines and Southeast Asia. In Kerala, the members of this family are found widely distributed in different forest ecosystems. *Pluteus aeolus, P. aglaeotheles, P. atromarginatus, P. conizatus, P. escharites, P. fastigiatus, P. fusconigricans, P. glyphidatus, P. haywardii, P. pelinus, P. podospileus, P. pulverulentus, P. pulverulentus* and *P. spilopus* are all newly recorded species for Kerala (Mohanan, 2011). So far, 7 species of *Volvariella* have been reported from the State including the newly reported *Volvariella cubensis, V. gloiocephala* and *V. taylori* (Mohanan, 2011).

Pluteus aglaeotheles (Berk.& Br.) Sace., *Syll. Fung.* 5:676(1887)

Pluteus aglaeotheles is widely distributed in semi-evergreen to evergreen forests of the State and occurs solitary or in small groups on rotting wood.

Fruit bodies small to medium sized. Pileus 4.5-6 cm diam., convex expanded, obtusely umbonate; surface off-white, smooth, slightly wrinkled at apex, more or less radially striate at margin, rimose with pale grayish brown squamulose at the disk. Lamellae free, white to pale pink, up to 5 mm broad, with lamellae of 4 lengths, edge entire concolourous. Stipe central, 3-6.5 cm x 5-7 mm, cylindric or slightly expanded towards the base, solid, surface white, striate, smooth. Context white up to 8 mm thick at the disk, consisting of very inflated, thin-walled hyphae. Spores 6-8 x 4-5 µm, ovoid to oblong ellipsoid, pink with a slightly thickened, smooth wall, and with a few refractive guttules. Basidia 22-27 x 6-7 µm, Cylindro-clavate, bearing four short stigmata, up to 3 µm long with refractive guttules. Lamella-edge heteromerous with numerous cheilocystidia similar to the pleurocystidia. Pleurocystidia abundant over entire lamella-surface, 70-80 x13-18 µm, fusoid to lageniform, with 2-4 apical prongs. with grayish green tinge, hyaline, metuloidal, with a thick wall, up to 2.5 µm thick. Cheilocystidia 63-85 x13-16 µm. Hymenophoral trama inversely bilateral, hyaline, with much inflated, convergent, thin-walled hyphae; pileipellis an undifferentiated epicutis of repent, radially parallel, thin-walled, hyaline hyphae, 7-8 µm broad, much branched septate and with clamp-connection.

Pluteus conizatus (Berk. & Broome) Sacc., *Syll. fung.* (Abellini) 5: 674 (1887)

Pluteus conizatus is widely distributed in moist-deciduous to evergreen forests of the State and occurs solitary or in small groups on rotting wood.

Fruit bodies small to medium sized. Pileus 2-9 cm diam., convex or broadly campanulate then applanate with a shallow umbo; surface dull yellowish brown to pinkish brown, more grayish towards the umbo, becoming disrupted into minute pulverulent patches, at times forming a squamose disk, exposing an underlying white ground, radially striate; margin sulcate. Lamellae free, remote from stipe, white then pinkish white, ventricose, 6-8 mm wide, subcrowded, with lamellulae of two lengths; edge concolorous. Stipe 5-10 cm x 5-12 mm, subcylindric, tapering above, solid; surface pale yellowish brown, fibrillose-striate, glabrous. Context up to 5 mm thick at the disk, much thinner over the hymenophore, white, consisting of inflated, thin-walled hyphae, 2-20 µm diam., lacking clamp-connections. Spores 5-6 x 3.5-4.5 µm, subglobose to broadly ovoid, with a thickened, pink, smooth wall, and guttulate contents.

Basidia 19-30 x 4-9 µm, clavate, bearing four sterigmata. Lamella-edge heteromorphous, with scattered to crowded cheilocystidia. 40-92 x 6.5-12.5 µm, metuloidal, narrowly fusoid to lageniform with either an obtusely rounded or acutely pointed apex, lacking any apical or lateral outgrowths, wall thickened, up to 3 µm wide, hyaline. Pleurocystidia 50-78 x 15-27 µm, metuloidal, narrowly fusoid to lageniform with either an obtusely rounded or acutely pointed apex, lacking any apical or lateral outgrowths, with thickened, up to 3 µm wide, hyaline wall, and hyaline or occasionally pale brown contents. Hymenophoral trama inversely bilateral, with convergent hyphae 2-10 µm diam. Subhymenial layer narrow, pseudo-parenchymatous. Pileipellis a disrupted trichodermium of narrow semi-erect to erect, septate hyphae, with terminal elements 20-40 x 4-6 µm, cylindric to narrowly clavate, mostly with an obtusely rounded apex, containing a fuscous brown vacuolar pigment. Caulocystidia present, 30-45 x 8-12 µm, thick-walled, fusoid to lageniform with acute pointed apex.

Volvariella cubensis (Murrill) Shaffer, *Mycologia* 49(4): 564 (1957

Volvariella cubensis is distributed in moist-deciduous to semi-evergreen forests of the State and occurs solitary or scattered in small groups on soil and decaying forest litter. This species is very close to *V. bakeri* and *V. volvacea* but easily distinguished from either by virtue of the smaller spores. *V. congolensis* Pathak, from Zaire, is also similar but has slightly larger spores.

Fruit bodies medium to large sized. Pileus 7-9 cm diam., fleshy, strongly convex and not fully expanding; surface dark gray at the disk, paling to grayish brown at the margin with fine brown radial striae. Lamellae free, remote, off white with pinkish tints, ventricose, up to 11 mm wide, very crowded, with lamellulae of four lengths. Stipe 6-10 cm x 7-14 mm, cylindric, solid; surface white, smooth and glabrous. Volva saccate, large, thick and fleshy, 4-lobed, pale brown, 3-4.5 x 1.5-2.8 cm. Context up to 6 mm thick at the disk, white, firm, of much inflated, very thin-walled hyphae, 2-30 µm diam., lacking clamp-connections. Spores 6-7 x 5-6 µm, ovoid to short ellipsoid, with a stramineous, thickened wall. Basidia 27-32 x 8-9 µm, cylindro-clavate, bearing four short sterigmata. Lamella-edge heteromorphous, with numerous cheilocystidia. Cheilocystidia 40-75 x 12-24 µm, inflated, clavate to utriform or mucronate, hyaline, thin-walled. Pleurocystidia scattered, 70-83 x 20-27 µm, inflated clavate, utriform or mucronate, hyaline, thin-walled. Hymenophoral trama bilaterally inverse, of much inflated, thin-walled hyphae. Subhymenial layer pseudoparenchymatous, 12-14 µm wide. Pileipellis a repent epicutis of radially parallel hyphae, with cylindric elements, 40-90 x 5-15 µm, with fuscous brown vacuolar contents.

Volvariella volvacea (Bull.) Singer, in Wasser, *Lilloa* 22: 401 (1951) [1949]

Volvariella volvacea is widely distributed in moist-deciduous to evergreen forests and occurs solitary or scattered in small groups on soil amongst decaying forest litter.

Fruit bodies medium to large sized. Pileus 5-10 cm dia., ovoid, then companulate or convex, subumbonate, grayish brown, darkening to almost blackish brown at the disk, dry, adpressed fibrillose to radially rimose. Lamellae free, white then deep flesh pink, up to 7 mm broad, crowded with lamellulae of three lengths; edge fimbriate, concolorous. Stipe 4-14 cm x 3-16 mm, cylindric, broadening fibrillose, glabrescent. Volva free, membranous, irregularly lobed, brownish or sepia grey, floccose. Context 3-5 mm thick, white, soft, of very thin-walled, interwoven hyphae, 3-6 µm diam., inflated to 40 µm diam., lacking clamp connections. Spores 5-7 x 4-5 µm, ovoid to ellipsoid, occasionally with a suprahilar depression, smooth, with a thickened, stramineous wall, and usually containing a single large guttule. Basidia 23-30 x 6-9 µm, clavate, with four sterigmata up to 5 µm long. Lamella-edge heteromorphous to sterile with crowded cheilocystidia. Cheilocystidia 32-45 x 13-16 µm, mucronate-clavate to vesiculose-clavate with a long tapering apical projection, hyaline, thin-walled, with few contents. Pleurocystidia frequent, 45-90 x 15-25 µm, subcylindric, fusoid ventricose or clavate-mucronate, hyaline, thin-walled, often with refringent oleaginous contents. Hymenophoral trama inverse, hyaline, with converging hyphae, 4-6 µm diam., inflated to 20 µm diam., also numerous laticiferous elements present. Subhymenial layer 10-20 µm wide, pseudoparenchymatous with large elements.

Pileal surface a repent epicutis of radially parallel, non-gelatinized and non-agglutinated hyphae, 6-25 µm diam., unbranched, containing a brown pigment.

34. POLYPORACEAE Fr. ex Corda 1839
Polyporales : Basdiomycota

Coriolopsis, Dochomitus, Earliella, Echinochaeta, Favolus, Fomes ,Hexagonia, Lentinus, Lenzites, Microporellus, Microporus, Navisporus, Nigroporus, Oxyporus, Perenniporia, Polyporus, Pycnoporus, Pyrofomes, Royoporus, Trametes s, Lenzites, Fomes, Nogroporus, Polyporus, Trametes and *Trichaptum* are the significant genera of this family. Members of this family are cosmopolitan in distribution. Many of them cause economic damage to timber and decay of living hardwoods.

Coriolopsis occidentalis (Klotzsch) Murrill, *Bull. Torrey bot. Club* 32(7): 358

Coriolopsis occidentalis is widely distributed in semi-evergreen to evergreen forests of the State and occurs in imbricate clusters on decaying logs.

Fruit bodies small to medium sized, annual, effused reflexed to dimidiate, corky, narrowly attached to the substratum. Pileus dull, smooth, soft, velvety, tomentose, 7-8 x 3.8-4.2 x 1 cm, grayish orange. Pore surface grayish orange, pores visible, round to angular, regular, 2-3 per mm, 5 mm deep, concolorous to pore surface; margin thin, smooth. Context pale yellow, 5 mm thick, duplexed, upper soft corky and lower thick, non-xanthochroic. Hyphal system trimitic. Generative hyphae thin-walled, hyaline, branched, septate with clamps, 2.5-3 µm wide; skeletal hyphae thick-walled, pale yellow, 4.5-5.5 µm, short branches at tip region; binding hyphae slightly thick-walled, pale yellow, more at dissepiments, 3-4.5 µm wide. Basidia 18-21 x 5-6 µm. clavate, thin-walled, hyaline with 4 sterigmata. Spores hyaline, broadly ellipsoid, thin-walled, smooth, 5-7 x 2.5-3.5 µm.

Fomes pseudosenex (Murrill) Sacc. & Trotter, *Syll. fung.* (Abellini) 21: 292 (1912)

Fomes pseudosenex is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs on decaying branches and on main trunk, associated with heart rot. Dimitic hyphal system with simple septate generative hyphae, xanthochroic reaction with KOH, poroid hymenium, globose, smooth spores are key characters of the species.

Fruit bodies perennial, hard, woody, dimidiate, ungulate. Pileus dark brownish grey (11F2), dimidiate, dull, concentrically sulcate, glabrous, rimose, radially cracking, concentrically ridged, crusty. Pore surface dark brown, pores round, regular, smooth, not visible, pores stratified, thin layer of context present in between, 6-8 per mm, pore tubes 1 mm deep. Margin thick, sharp, smooth, sterile, 5 mm thick. Pore dimension 75-100 x 75-90 µm. Dissepiments 35-75 µm thick. Context brown, homogenous, xanthochroic, 4 mm thick. Hyphal system dimitic. Generative hyphae hyaline to pale yellow, simple septate, branched, thin-walled 2.5-3 µm wide; skeletal hyphae dark brown, thick-walled with narrow lumen, septation present at tip region, 3.5-4.5 µm diam., and cell wall 1-2 µm thick. Basidia not observed. Spores pale yellow, globose, smooth, thin walled, 4-5 x 4-5 µm, bitunicate, no reaction with Melzer's reagent.

Hexagonia apiaria (Pers.) Fr., *Epicr. syst. mycol.* (Upsaliae): 497 (1838) [1836-1838]

Hexagonia apiaria is distributed in moist-deciduous to semievergreen forests of the State and occurs on decaying branches and twigs. Blackish brown pileus covered with stiff black dichotomously branched hairs, large hexagonal pores (2-4 /cm), trimitic hyphal system, colored vegetative hyphae, and presence of hyphal pegs are distinguishing characters of this species.

Fruit bodies small to large sized, annual, dimidiate, reniform, to semicircular, hard, corky, sessile, attached narrowly to the substratum. Pileus 9.5-17 x 6-9 x 0.6 cm, dark brownish grey, dull, surface covered with antler like black stiff hairs, concentrically arranged, 3-7 mm long. Margin thin, sterile, 3 mm wide. Pore surface pale brown to dark brown; pores large, angular to hexagonal, 2-4 per cm, pore tubes 4 mm deep. Pore dimension: 2.3-4 x 1.35-2.5 mm. Dissepiments 250-450 µm thick. Context dark brown, homogenous, xanthochroic. Hyphal system trimitic. Generative hyphae pale yellow to yellowish brown, septate, branched, 5-7 µm wide. Skeletal hyphae thick-walled, brown, unbranched, 5-6 µm wide. Binding hyphae yellowish brown, thick-walled, branched, 2-5 µm wide. Basidiole hyaline, smooth, thin-walled, inclusion present, 25-34 x 7-8 µm. Spores not found. Hyphal pegs present 80-150 x 40-70 µm.

Lentinus dicholamellatus Manim., in Manimohan, Divya, Kumar, Vrinda & Pradeep, *Mycotaxon* 90(2): 312 (2004)

Lentinus dicholamellatus is widely distributed in moist-deciduous forests and homesteads of the State and occurs growing scattered or in small to large clusters on decaying wood.

Fruit bodies medium to large sized, robust. Pileus 3-14 cm diam., initially convex with a depressed centre, becoming deeply infundibuliform; surface initially pale yellow, changing through grayish orange, brownish orange or grayish brown and finally becoming dark brown , finely radially fibrillose-striate, densely dotted with very fine appressed or erect squamules; margin incurved and remaining so, entire becoming undulate or lobate. Context pale yellow, up to 1 mm wide. Lamellae deeply decurrent, crowded, yellowish white, up to 1.5 mm wide; lamellulae very few or even absent but lamellae often repeatedly furcated at several levels; edge finely fimbriate. Stipe 1.5-10 cm x 3-20 mm, central or excentric, almost equal or slightly tapering towards base, terete, solid; surface yellowish white (4A2) to grayish brown or brown , tomentose, sometimes dotted with erect pointed squamules; base not attached to a pseudo- or true sclerotium.

Spores 5-8 x 3-4 µm, oblong-ellipsoid to subcylindric, ellipsoid or cylindric, hyaline, thin-walled, smooth, inamyloid. Basidia 20-28 x 3-7 µm, clavate to cylindro-clavate, 4-spored; sterigmata up to 3 µm long. Lamella-edge sterile. Cheilocystidia 20-37 x 3-6 µm, sinuous-cylindric, rarely nodulose, thick-walled, with a dark brown wall pigment, often with basal clamp connection. Pleurocystidia absent. Hyphal pegs scattered on the hymenium, 29-35 x 18-40 µm, projecting up to 150 µm, beyond the hymenial surface, conic to somewhat cylindric, composed of thin-walled hyphae. Lamellar trama irregular, of radiate construction; dimitic, composed predominantly of skeleto-ligative hyphae, 2-6 µm wide, with a thick wall up to 1.5 µm wide, hyaline,

with gradually tapering branches; generative hyphae 2-6 µm wide, thin-to slightly thick-walled, septate, branched, with prominent clamp-connections. Pileal trama interwoven, dimitic; hyphae similar to those of lamellar trama. Pileipellis a cutis of thick-walled generative hyphae frequently disrupted by bundles of loosely aggregated erect hyphae or ascending or erect bundles of cystidioid end-cells similar to cheilocystidia; hyphae 2-6 µm wide, thick-walled, with a pale yellowish to dark yellowish brown wall and sometimes with dark brown encrustations, with clamp-connections. Stipitipellis a trichodermium composed of 1.5-7 µm wide, thin- to slightly thick-walled, pale yellowish to yellow brown generative hyphae with frequent clamp connections; squamules of the stipe surface composed of ascending or erect, long bundles of 1.5-3.5 µm wide, slightly thick-walled, dark brown hyphae.

Lentinus sajor-caju (Fr.) Fr., *Epicr. syst. mycol.* (Upsaliae): 393 (1838) [1836-1838]

Lentinus sajor-caju is widely distributed in moist-deciduous to evergreen forests and homesteads of the State and occurs growing scattered or in small to large clusters on decaying wood.

Fruit bodies small to medium sized. Pileus 3-8 cm diam., soft coriaceous drying hard and rigid, convex with a deeply umbilicate centre then cyathiform to infundibuliform, or excentric and flabelliform; surface very variable in colour, at first whitish and often mottled grey, cream colour, pale ochraceous, more or less fuliginous, or umbrinous, dry glabrous and smooth or sometimes with small, appressed, darker squamules especially towards the centre, often finely radially striate, rimose in old specimens; margin initially incurved to involute soon straight, very thin, smooth, undulating and lobed. Lamellae deeply decurrent, not furcate, whitish, concolorous with the pileus or becoming darker towards the edge, often darkening on drying, narrow to sub-linear, 0.3-3 mm broad, densely crowded, with lamellulae of 4-6 lengths; edge entire or finely denticulate. Stipe central, excentric or lateral, short, 0.8-2.5 x 0.5-1.2 cm. cylindric with an abrupt base, solid; surface concolorous with the pileus, at times blackening especially towards the base. Annulus present, attached towards stipe apex, firm, white to fulvous, well formed. Context up to 8 mm thick at the centre but very thin over the hymenophore, tough and pliant drying hard and horney, white, consisting of a very tightly woven, dimitic hyphal system with skeleto-ligative hyphae. Generative hyphae 2-5µm diam., narrow, not inflated, very thin-walled, frequently branching, with clamp-connections. Skeletoligative hyphae dominant, 2-8 µm diam., hyaline or pale yellowish, with a thick- wall and often a very narrow lumen, comprising a skeletal element, 100-400 µm long. bearing two to several tapering ligative branches, up to 400 µm long, which are themselves often dichotomously dividend, sometimes the branches are very short, numerous, and nodulose to coralloid appearance. Spores 5-8 x 2-3 µm, narrowly cylindric, often curved, hyaline, thin-walled, with few contents. Basidia 20-25 x 4-5 µm, very narrow, clavate cylindric, bearing 4 sterigmata. Lamella-edge a broad sterile zone, with scattered or clustered cheilocystidia and numerous. emergent skeleto-ligative branches. Cheilocystidia 18-23 x 3-5 µm, clavate, often sinuous or nodulose, hyaline, thin-walled. Hyphal pegs abundant, 25-50 x 7-22 µm, truncate cylindric, consisting of fascicles of up to 50, narrow, hyaline hyphae, extending up to 80 µm, beyond the basidia. Hymenophoral trama irregular, hyaline. broad, of radiate construction, very compactly interwoven with few inter-hyphal spaces, and ligative branches frequently penetrating the hymenium. Subhymenial layer often indefinite or indistinct, becoming

pseudo-parenchymatous when well developed. Pileipellis an epicutis, 15-20 µm thick, of agglutinated, radiating generative hyphae, often with a brown encrustation and sometimes a brown membrane pigment.

Lenzites elegans (Spreng.) Pat., *Essai Tax. Hyménomyc.* (Lons-le-Saunier): 89 (1900)

Lenzites elegans is distributed in evergreen and shola forests of the State and occurs on decaying wood and stumps. *Lenzites elegans* is distributed world-wide in the tropics and sub-temperate zones; North America, Africa, India, Sri Lanka, South-East Asia, Australia and New Zealand. This species is close to *L. vespaceae* and is separated by small pores and a smooth pileus, which is finely asperulate in *L vespaceae*.

Fruit bodies annual, sessile, attached laterally, corky, flabelliform to dimidiate. Pileus off white, glabrous, smooth to concentrically ridged, 7.2 x 9.5 x 1cm. Pore surface pale orange, deadaloid, lamellate near margin, 2-3 per mm, 3 mm deep at middle, pore tubes cream. Margin thin, rounded, wavy. Context off white, homogenous, non-xanthochroic, 4 mm thick at middle. Hyphal system trimitic. Generative hyphae hyaline, thin-walled, septate with clamps, 2.5 µm wide. Skeletal hyphae hyaline, thick-walled, 3-6 µm wide, branched at tip. Binding hyphae hyaline, branched, lumen not visible, 2-3.5 µm wide. Basidia 15-28 x 4-6 µm, clavate, hyaline, thin-walled, with 4 sterigmata. Basidioles 14-17 x 4-5, clavate, thin-walled. Spores cylindric, hyaline, smooth, thin- walled, 6-8 x 3µm, Cystidioles: skeletal hyphae project in to the hymenium, 3-6 µm wide.

Microporellus violaceocinerascens (Petch) A. David & Rajchenb., *Mycotaxon*

Microporellus violaceocinerascens is widely distributed in moist-deciduous to evergreen forests of the State and occurs solitary or in small groups on soil on buried decaying wood.

Fruit bodies annual, central to laterally stipitate, corky, hard. Pileus 1.9-5.5 x 1.5-4 cm, brown, grayish brown to brownish orange, dull to shiny, smooth, glabrous with concentric zonation. Stipe central to lateral, 4-6.5 x 2-7 mm wide, pale to dark brown, tomentose; Pores 2-4 per mm, off white to brownish orange to dark brown, 1-4 mm deep. Context yellowish white to dark brown, homogenous, 1-2 mm thick. Spores 6-8 x 4-6 µm. Cystidia smooth to encrusted, hyaline, 25-40 x 5.5-14 µm. Basidia 22-30 x 5.5-7 µm, clavate, hyaline with 2 sterigmata.

Microporus xanthopus (Fr.) Kuntze, *Revis. gen. pl.* (Leipzig) 3(2): 494 (1898)

Microporus xanthopus is widely distributed in moist-deciduous to evergreen forsts of the State and occurs solitary or in large clusters on decaying wood, branches and twigs. Infundibuliform basidiome, glossy and shiny strongly banded pileus, yellowish glabrous stipe, minute pores, trimitic hyphal system, presence or coralloid elements in dissepiments are the key characters of this species.
Fruit bodies annual, centrally of laterally stipitate, usually infundibuliform, thin leathery. Pileus 4-9 cm wide, dark brown, violet brown at disk, brownish orange towards margin, shiny, concentrically sulcate, radially fibrillose, with concentric zonation. Margin thin, wavy. Pore surface off white, becomes brownish orange, pores

6-8 per mm, not visible, round, smooth, shiny. Pore dimension 75-160 x 50-150 µm. Dissepiments 25-100 µm thick. Margin thin. Stipe central to excentric, yellowish white, round, glabrous, covered with a thin cuticle, slightly expanded upwards and expanded to a disk like base, 4-10 x 2-6 mm. Context off white, homogenous, non-xanthochroic, very thin. Hyphal system trimitic. Generative hyphae hyaline, thin-walled, branched, septate with clamps, 2.5-3.5 µm wide. Skeletal hyphae thick-walled, hyaline, 3-7.5 µm wide. Binding hyphae hyaline, thick-walled 3-4 µm wide. Spores hyaline, smooth, oblong, ellipsoid, thin-walled, 5-9 x 2-6 µm, no reaction with Melzer's reagent. Basidia 9-13 x 4-5 µm, clavate, hyaline with 4 sterigmata.

Nigroporus durus (Jungh.) Murrill, *Bull. Torrey bot. Club* 34: 471 (1907)

Nigroporus durus is widely distributed in semi-evergreen to evergreen forets and sacred groves of the State and occurs on decaying wood of standing trees. Grayish blue to blackish coloured basidiome, dark ruby to violet brown spore surface, very hard consistency and almost invisible pores are the characteristic features of this species.

Fruit bodies perennial, hard woody, corky, dimidiate, applanate, corky, broadly attached to substratum. Pileus dark brown, violet brown, dark violet, olive brown, dull, glabrous, concentrically sulcate, concentrically ridged, 7-45 x 9-20 x 2.5-4 cm. Pore surface grayish brown, dark ruby to violet brown; pores not visible, shiny, 6-10 per mm, pore tube 4-19 mm deep. Pore dimension 70-225 x 70-140 µm. Dissepiments 25-180 µm. Margin sharp, acute. Context violet brown, grayish brown, dark Magenta (13F3), homogenous, bone hard, 5 mm thick. Hyphal system dimitic; generative hyphae hyaline to pale brown, simple septate, thin- to thick-walled, 2.5-5 µm wide; skeletal hyphae brown, thick-walled, 2.5-7.5 µm. Spores subglobose, lunate to elliptic, hyaline to pale brown, 3-6.5 x 1.5-4.5 µm. Basidiole clavate, 9-15 x 4-6.5 µm. Basidia clavate, 6.5-14.5 x 2-7.5 µm with 4 sterigmata.

Nigroporus vinosus (Berk.) Murrill, *Bull. Torrey bot. Club* 32(7): 361 (1905)

Nigroporus vinosus is distributed in moist-deciduous to evergreen forests of the State and occurs on decaying wood, branches and twigs. Dark vinaceous pileus surface and minute pores are the distinguishing features.

Fruit bodies annual, flabelliform to spathulate, sometime semicircular, dimidiate, imbricate, thin, corky, attached narrowly to the substratum. Pileus violet brown, becomes grayish brown, reddish brown to dark brown, concentrically sulcate, glabrous, and dull to shiny, concentrically zoned, 3-7.5 x 1.9-4.3 x 0.2-0.5 cm. Pore surface violet brown when fresh, becomes grayish brown, reddish brown to dark brown; pores round to angular, not visible, smooth, 5-9 per mm, pores 0.5-2 mm deep. Margin thin, sterile, wavy, and smooth. Context grayish brown to dark brown, homogenous, xanthochroic, 0.5-1 mm thick. Hyphal system dimitic; generative hyphae hyaline, thin-walled, smooth, branched, 2.5-5 µm wide; skeletal hyphae pale brown, thick- walled, 3.5-5.5 µm. Spores smooth, thin-walled, hyaline, oblong ellipsoid to allantoid, 3-4(7) x 1.5-2 (4) µm. Basidia clavate, smooth, hyaline, 11.5-15 x 4-5 µm with 4 sterigmata.

Oxyporus cervinogilvus (Jungh.) Ryvarden [as '*cervin-ogilvus*'], *Norw. Jl Bot.* 20: 3 (1973)

Oxyporus cervinogilvus is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs on decaying wood of standing trees and on logs. Brownish tomentose pileus surface, large pores, monomitic hyphal system and oblong ellipsoid spores are the characteristic features of this species.

Fruit bodies annual, resupinate, effused reflexed becomes dimidiate, thin, leathery, radially wrinkled, and tomentose. Pileus yellowish brown to brownish orange, tomentose, concentrically zoned, radially sulcate, dull. Pore surface grayish yellow, yellowish brown to brownish orange; pores visible, angular, 1-3 per mm, pore tubes 1 mm deep. Margin thin, wavy. Pore dimension 200-975 x 120-575 µm. Dissepiments 75-175 µm thick. Context pale brown to yellowish brown, homogenous, xanthochroic, 0.5 mm, thick. Hyphal system monomitic; generative hyphae hyaline, pale yellow to yellowish brown, simple septate, branched, 3-6 µm wide, minute sand like encrustation present in some specimens. Spores cylindric, hyaline, smooth, thin-walled 5-9 x 2-5 µm. Cystidia thick- walled, encrusted, 25-40 x 5-12 µm; smooth cystidia also present, 19-37.5 x 6.5-12 µm. Basidia clavate, smooth, hyaline, 26-30 x 4-6.5 µm with 4 sterigmata. Basidiole clavate, 13-32 x 3-6 µm.

Panus similis (Berk. & Broome) T.W. May & A.E. Wood, *Mycotaxon* 54: 148 (1995)

Panus similis is widely distributed in moist-deciduous to evergreen forests of the State and occurs growing scattered or in small to large clusters on decaying wood.

Fruit bodies small to large sized. Pileus 3-15 cm diam., thin, coriaceous, deeply infundibuliform expanding to cyathiform; surface cinnamon brown to dark chestnut brown, often with violaceous or purplish tints especially when young, finely velutinate at the centre, soon glabrescent elsewhere, radially plicate-sulcate with the striae extending almost to the centre, without concentric zoning; margin curved downwards, at times radially incised, ciliate. Lamellae decurrent, neither furcate nor anastomosing, ochraceous buff, darkening at maturity, sometimes with a purplish flush especially towards the edge, narrow, 0.5-2 mm broad, moderately spaced but with lamellulae of 5 lengths; edge entire. Stipe central, excentric or sublateral, 2-12 cm x 2-12 mm, cylindric, slightly expanded at the base, solid; surface concolorous with the pileus, uniformly velutinate or compressed tomentose and felt-like, usually but not always arising from a pseudosclerotium. Pseudosclerotium often large, 2.5-14 x 2.5-7 cm, lenticular or irregular. Context 1-2 mm thick at the centre, white, coriaceous, consisting of a dimitic hyphal system with skeletal hyphae. Generative hyphae 2-3.5 µm diam., not inflating, very thin-walled, sparsely to frequently branching, with clamp-connections. Skeletal hyphae 2-4 µm diam., sinuous cylindric, with a thickened, hyaline or pale brown wall, unbranched. Spores 5-6 x 2.5-3µm, elongate ellipsoid to oblong cylindric, hyaline, thin-walled, with few contents. Basidia 18-28 x 4-5 µm. clavate cylindric, bearing 4 sterigmata. Lamella-edge sterile, with small cheilocystidia, soon collapsing. Cheilocystidia crowded, 17-25 x 3-5.5 µm, nodulose-clavate, irregular, hyaline, thin-walled. Sclerocystidia very abundant, often appearing crowded, 20-40 x 4-9 µm, elongate, irregularly fusoid, with a thick, hyaline or brownish wall, scarcely projecting beyond the basidia. Hymenophoral trama irregular of radiate construction, hyaline, similar in structure to the context.

Subhymenial layer little developed. Pileipellis an epicutis, up to 110 µm thick, of more or less repent hyphae giving rise to erect, loose fascicles of unbranched, brownish generative hyphae, up to 150 µm long, 4-8 µm diam., with a thickened wall. Stipitipellis similar to pileipellis.

Polyporus arcularius (Batsch) Fr., *Syst. mycol.* (Lundae) 1: 342 (1821)

Polyporus arcularius is widely distributed in moist-deciduous to evergreen forests of the State and occurs solitary or in small clusters on decaying wood and also on soil from buried decaying wood. Small infundibuliform pileus with cilia along the margin and relatively large radially elongated pores are the distinguishing features of this species.

Fruit bodies annual, stipitate, pileus rounded, depressed to infundibuliform, thin, and leathery. Pileus surface brownish orange, grayish orange to brown, glabrous, dull, smooth, brittle and fragile when dry, 0.8-2.7 cm. Pore surface brownish orange, brown, pale yellow to off white; pores angular, radially elongated, 1-4 per mm, pore tubes 1-1.5 mm deep. Pore dimension 225-325 x 175-225 µm. Dissepiments 50-175 µm. Margin inrolled, ciliated. Stipe brownish orange, brown, off white, central to excentric, fibrillose, to squamulose, 1.3-2.5 x 0.1-0.3, equal. Context off white, non-xanthochroic, 1 mm thick. Hyphal system dimitic; generative hyphae thin- to thick-walled, hyaline, septate with clamp, branched 2.5-5.5 µm; binding hyphae hyaline to pale brown, branched, 3-5.5 µm wide. Spores cylindrical, smooth, hyaline, thin-walled, 6-9(11) x 2.5-5 µm, no reaction with Melzer's reagent. Basidia clavate, hyaline, thin-walled, 14-24 x 4.5-6.5 µm.

Polyporus grammocephalus Berk., *Hooker's J. Bot.* 1: 1184 (1842) [1840]

Polyporus grammocephalus is widely distributed in moist-deciduous to evergreen forests of the State and occurs solitary or in small to large clusters on decaying wood, branches and twigs.

Fruit bodies annual, flabelliform, thin leathery. Pileus light brown to dark brown, at margin grayish orange, dull, yellowish brown, smooth, glabrous, radially striated, sometimes rough (asperulate) at base, 5-8.5 x 4.1-12 x 0.2-0.3 cm. Pore surface pale orange, light orange at base, dark brown; pores round to radially elongated 3-5 per mm, pore tubes 1 mm deep. Pore dimension 160-370 x 15.-250 µm. Dissepiments 30-200 µm. Margin thin, wavy, and incurved. Stipe lateral, brown, solid, 0.5-1 x 0.3-0.6 cm. Context yellowish white, to grayish orange, homogenous, non-xanthochroic, 3 mm thick at middle, 9 mm thick at base. Hyphal system dimitic; generative hyphae hyaline, thin-walled, septate with clamp, branched, multiple clamps present, 2-4 µm wide; binding hyphae hyaline, branched, thin- to thick-walled, branched, 2-5 µm wide. Spores ellipsoid, to cylindric, hyaline, smooth thin- walled, 7-10 x 2-4 µm. Cystidiole smooth, thin-walled, thick at top, ventricose, 15-27x 4-7. Basidiole smooth, thin, hyaline, 14-18 x 5-6 µm.

Pycnoporus sanguineus (L.) Murrill, *Bull. Torrey bot. Club* 31(8): 421 (1904)

Pycnoporus sanguineus is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs in small to clusters on decaying logs.

Fruit bodies annual, dimidiate, thin, leathery, sessile to stipitate. Pileus orange red to brick red, dull, glabrous, sulcate, concentrically ridged, radially wrinkled, 4-6.5 x 1.5-5.3 x 0.1-0.3 cm. Pore surface orange red to brownish red; pores round to angular, 4-6 per mm, pore tubes 1-4 mm deep. Pore dimension 150-300 x 100-190 µm. Dissepiments 25-150 µm thick. Margin thin round, incurved wavy. Stipe pastel red to orange red, lateral to eccentric, 5-5.5 x 9-10 mm. Context orange red, homogenous, xanthochroic, 4 mm thick. Hyphal system trimitic; generative hyphae hyaline, thin-walled, septate with clamp, pale pink in KOH, 1.5-4 µm wide; skeletal hyphae pale red to pale brown in KOH, 4-6 µm wide, thick-walled; binding hyphae pale grayish brown, in KOH, 3-8 µm, wide. Spores subglobose, hyaline, smooth, thin-walled, 4-6 x 3-4 µm. Basidiole 9-10 x 3.5-4.5 µm. Basidia clavate, thin-walled, 10-18 x 3-6 µm.

Pyrofomes albomarginatus (Zipp. ex Lév.) Ryvarden [as '*albo-marginatus*'], *Norw. Jl Bot.* 19: 236 (1972)

Pyrofomes albomarginatus is widely distributed in moist-deciduous to evergreen forests and sacred groves of the State. This species causes heart rot of standing trees and occurs on decaying wood and logs. Nodose septate generative hphae, brick red tissue in KOH is the distinguishing features of this species.

Fruit bodies annual to perennial, resupinate, effused reflexed to dimidiate, hard woody, corky, sessile. Pileus yellowish brown, brownish orange, reddish brown to brown, dull glabrous, sulcate, radially ridged, 7.5-15.5 x 2.1-11.3 x 0.1-3.5 cm. Margin pale yellowish grey with red tint, thin. Pore surface grayish orange to grayish red margin reddish white, pores not visible, round shiny, 2-6 per mm, pore tubes 2-4 mm deep, up to 3 strata with context hyphae in between, mature tubes become filled with white hyphae. Pore dimension 130-220 x 110-200 µm. Dissepiments 40-170 µm thick. Margin thin, pale yellowish grey with red tint. Context brownish orange to reddish brown, homogenous, xanthochroic, 3-5 mm thick. Hyphal system trimitic; generative hyphae hyaline to pale red, septate with clamp, branched, surrounded by a thin sheath; skeletal hyphae thick-walled, brick red to red in KOH, 4-7.5 µm wide, rarely branched, sheath like covering present; binding hyphae pale red, branched, slightly thick-walled, 3-4 µm. Hyphal pegs present, 26-35 x 2-11µm. Basidiole clavate, 10-13 x 3-3.5µm; spores not observed.

Trametes pubescens (Schumach.) Pilát, in Kavina & Pilát, *Atlas Champ. l'Europe* (Praha) **3**: 268 (1939)

Trametes pubescens is widely distributed in moist-deciduous to evergreen and shola forests of the State and occurs on decaying wood and logs. Fruit bodies annual, dimidiate, thin, leathery, tomentose with concentric zonation. Pileus grayish orange to brownish orange, dark brown at base. Pore surface grayish orange; pores round to angular, pore tubes concolourous, 2-4 per mm, pore tubes 2 mm deep. Margin thin, incurved, wavy. Context orange white, homogenous, non-xanthochroic, 1-2 mm thick. Hyphal system trimitic; generative hyphae thin-walled, smooth, hyaline, branched, septate with clamp, 2-3 µm wide; skeletal hyphae thick-walled, hyaline, solid, 4-7 µm wide; binding hyphae hyaline, 3-3.5 µm wide, lumen not visible. Spores cylindric, hyaline, smooth, thin-walled 6-7.5 x 2.5-3 µm. Basidia clavate, thin-walled, 15-19 x 5-7 µm with 4 sterigmata.

Trichaptum biforme (Fr.) Ryvarden [as *'biformis'*], *Norw. Jl Bot.* 19(3-4): 237 (1972)

Trichaptum biforme is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs on decaying logs and stumps. Fruit bodies annual, thin, leathery, flabelliform, dimidiate, stipitate or attached with a broad base. Pileus grayish brown, brownish orange, adpressed tomentose, radially striated, concentrically zoned, 2.6-4.6 x 2.7-4 x 0.5 cm. Pore surface light brown to brownish orange; pores radially elongated, irregular, 2-5 per mm, pore tubes 0.5-1 mm deep; dissepiments irregular, sinuate to toothed. Pore dimension 125-450 x 100-290 µm. Dissepiments 40-230 µm thick. Margin thin wavy. Stipe grayish brown, lateral, 3-10 x 3 mm. Context off white to pale brownish orange, 1 mm thick, homogenous to non-xanthochroic. Hyphal system dimitic to trimitic; generative hyphae hyaline, thin- to slightly thick-walled, septate, with clamp, branched, 2-7.5 µm wide; skeletal hyphae thick-walled, hyaline, 2-6 µm wide; binding hyphae rarely found, hyaline, branched, 3-4 µm wide. Spores ellipsoid, hyaline, smooth, thin- walled, 5-6 x 2-3 µm. Cystidia thick-walled, hyaline, smooth, rarely encrusted, 11-25 x 3-5 µm, subulate. Basidia clavate, thin-walled, 11-17.5 x 3.5-5µm.

35. PSATHYRELLACEAE Vilgalys, Monclavo & Redhead 2001

Agaricales : Basidiomycota

The members of Psathyrellaceae are dark-spored agarics that generally have rather soft, fragile fruiting bodies, and are characterized by black or dark brown, rarely reddish, or even pastel colored spore-prints. About 50 per cent of the members produce fruiting bodies that dissolve into ink-like ooze when the spores are mature via autodigestion. *Cystoagaricus, Coprinopsis, Parasola,* and *Psathyrella* are the significant genera of this family. Members are mostly saprobes, widely distributed in different ecosystems and occur on decaying vegetation, humus, rotting wood, and dung of herbivorous animals. Many of these fungi have traditionally been classified in the Coprinaceae, but the type species of *Coprinus* has been demonstrated to be distantly related to most of the other species in that genus and is now placed in the Agaricaceae. The Bolbitiaceae is the most closely related family to this group. The genus *Psathyrella* contains more than 400 species (Kirk *et al.*, 2008). So far, 11 species of *Psathyrella* have been reported from Kerala. *Psathyrella candolleana, P. candolleana* var. *candolleana, P. efflorescens, P. lithocarpi, P. lucipeta* and *P.myceniformis* are all recently reported species (Mohanan, 2011).

Cystoagaricus trisulphuratus (Berk.) Singer, *Mycologia* 39(1): 87 (1947)

Cystoagaricus trisulphuratus is widely distributed in grasslands, moist-deciduous forests, and canopy open up areas in semi-evergreen forests of the State and occurs solitary or in small groups on soil amongst decaying forest litter, especially in bamboo stands. C. *trisulphuratus* is very closely related to *Agaricus crocopeplus*. Fruit bodies small to medium sized. Pileus 2-4.5 cm diam., globoso-campanulate then convex with a subumbonate centre; surface covered by a thick pulverulent veil, yellowish orange to orange chrome, more or less concentrically arranged; margin at first involute, floccose, appendiculate with velar remnants. Lamellae free, pale pinkish becoming

dark vinaceous brown, ventricose, up to 5 mm broad, thin, moderately crowded. Stipe 3-6 cm x 4-7 mm, equal, cylindric, sometimes with a rooting base, solid then fistulose; surface below the annulus concolorous with the pileus and similarly covered by the pulverulent veil. Annulus superior, attached close to the stipe apex, thin, floccose, fragile, fugacious. Context thin, up to 3 mm thick at the disk, pale vinaceous, made up of interwoven, thin-walled hyphae, 2-6 µm diam., inflated to 15 µm diam. Spores 4.5-7 x 3-4.5 µm, ovoid to ellipsoid, to phaseoliform in profile, fairly thick-walled with the episporium strongly developed at the apex. Basidia 12-18 x 4.5-6 µm, clavate, bearing four short sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 20-40 x 6-14 µm, subcylindric to inflated clavate, hyaline or with a pale yellowish wall, and few contents. Pleurocystidia absent. Hymenophoral trama subregular, hyaline or pale yellowish, with thin-walled, strongly inflated hyphae, 3-12 µm diam. Subhymenial layer pseudoparenchymatous, 7-12 µm, wide. Pileal surface covered by a thick deciduous velar layer composed of loosely interwoven, uninflated, branching, septate hyphae, 2-8 µm, thin-walled, sometimes with a fine, asperulate encrustation. All hyphae lacking clamp-connections.

Psathyrella lithocarpi A.H. Sm., *Mem. N. Y. bot. Gdn* 24: 305 (1972)

Psathyrella lithocarpi is distributed in semi-evergreen to evergreen forests and occurs scattered in small groups on soil. Fruit bodies small sized. Pileus 3-6 cm diam., convex; surface pubescent, dark brown at disk, light grey towards margin; margin striate, veil absent. Lamellae adnate, up to 3 mm wide, yellowish brown. Stipe 4-8 cm x 3-5 mm, cylindrical, hollow; surface pubescent, white; veil absent. Spore-print black. Spores 6.5-8 x 3-4.5 µm, ellipsoid, thick-walled, smooth, pale brown, with apical truncate germ-pore. Basidia 15-22 x 5-7.5 µm, 2- or 4-spored, mostly 4-spored, sterigmata up to 2 µm long. Cheilocystidia 26-33 x 6-13 µm, clavate to fusoid ventricose, thin-walled, hyaline. Pleurocystidia 15-20 x 7-10 µm, clavate, apex rounded, thin-walled, hyaline. Hymenophoral trama regular, hyphae thin-walled, hyaline, 3-9 µm diam. Context thin, white. Pileal surface an epithelium, made up of clavate cells, 3-5 layers, thin-walled, hyaline. Stipe tissue consisting of parallel hyphae, 3-14 µm diam.; caulocystidia 35-60 x 10-20 µm, variable in shape, clavate, cylindric, subcapitate, thin- walled, hyaline. All hyphae with clamp-connections.

36. PYRONEMATACEAE Corda 1842

Pezizales : Ascomycota
Pyronemataceae is the largest family of Pezizales, encompassing 75 genera (Eriksson, 2006) and approximately 500 species (Kirk et al., 2008). *Aleuria, Sowerbyella* and *Scuttellina* are significant genera of this family and members are cosmopolitan in distribution, saprobic on soil, dung or rotten wood or sometimes form ectomycorrhizal association with tree species. *Aleuria* and *Sowerbyella* species are commonly known as 'orange peel fungus' due its brightly coloured orange peel like ascomata are widely distributed in Northern Hemisphere and Europe.

Aleuria aurantia (Pers.) Fuckel, *Jb. nassau. Ver. Naturk.* 23-24: 325 (1870) [1869-70]

Aleuria aurantia, commonly known as 'orange peel fungus, is distributed in shola forests of the State and occurs scattered in small clusters on rotting branches and logs.

Ascocarp cup-shaped, often becoming flattened or irregularly shaped as a result of the clustered growth habit, 2-6 cm diam., bright orange to yellowish orange in colour, upper surface smooth, lower surface yellowish white, smooth. Asci eight spored, 220-260 x 12-15 um; ascospores 18-24 x 9-11 um, elliptical, guttulate and with prominent apiculum at each end, becoming warted and reticulate by maturity. Paraphyses with swollen and rounded ends with yellowish orange contents.

Aleuria rubra L.R. Batra, *Mycologia 52: 526 (1960)*

Aleuria rubra is distributed in shola forests of the State and occurs scattered in small clusters on rotting branches and logs. Ascomata flattened or cup-shaped, irregularly shaped reaching 8 cm in diam., bright reddish orange, purple to yellowish orange with purplish tints; upper surface smooth, lower surface yellowish white, smooth. Asci eight spored, 220-260 x 12-15 um; ascospores 18-24 x 9-11 um, elliptical, guttulate and with prominent apiculum at each end, becoming warted and reticulate by maturity. Paraphyses with swollen and rounded ends with yellowish orange contents.

Sowerbyella rhenana (Fuckel) J. Moravec, *Mycol. helv.* 2(1): 96 (1986)

Sowerbyella rhenana, commonly known as 'orange peel fungus, is distributed in shola forests of the State and occurs scattered in small clusters on rotting branches; also occurs on soil amongst decaying forest litter. Ascomata flattened or cup-shaped, irregularly shaped reaching 8 cm in diam., bright yellow. Upper surface smooth, lower surface pale yellowish to yellowish white, smooth. Asci eight spored, 220-260 x 12-15 um; ascospores 18-24 x 9-11 um, elliptical, guttulate and with prominent apiculum at each end, becoming warted and reticulate by maturity. Paraphyses with swollen and rounded ends with yellowish orange contents.

Scutellinia setosa (Nees) Kuntze, *Revis. gen. pl.* (Leipzig) 2: 869 (1891)

Scutellinia setosa is widely distributed in evergreen and shola forests of the State and occurs gregariously or scattered in clusters on rotting logs. Apothecia cup-shaped, 2-3 mm diam., fertile surface dull orange to yellowish orange, smooth, with a fringe of dark brown to blackish brown hairs around the margin; sterile surface pale brownish orange covered with tiny pale brown hairs, without stalk, flesh thin. Asci 8-spored. Spores 15-21 x 9-12 µm, elliptical, smooth ; mature spores prominently sculpted with warts and ribs, with oil guttules. Paraphyses with swollen tips. Marginal hairs 380-1400 x 18-40 µm , brown, thick-walled.

37. RUSSULACEAE Lotsy 1907

Russullales : Basidiomycota

The family Russulaceae contains about 1243 species (Kirk *et al.*, 2008). The family is dominated by the two well-known genera *Russula* and *Lactarius*. Members are widespread from Arctic and Antarctic regions through to the tropics, both Old World and New World. The genus *Russula* sometimes known as 'brittle gills', comprises about 750 species, the majority of which are quite difficult to identify. They have

splitting gills and do not exude a milky substance at cut surfaces, contrarily to the genus *Lactarius*. There are several edible species, while a few are toxic, especially red caped species like *R. emetica, R. sordonia, R. nobilis, etc*. Most of the species form ectomycorrhizal association with native trees. *Russula aciculocystis, R. adusta, R. atropurpurea, R. cinerella, R. congoana, R. delicula, R. hygrophytica, R. luteotacta, R. mariae, R. martinica, R. michiganensis* and *R. periglypta* are recently recorded species from Kerala (Mohanan, 2011).

The genus *Lactarius* or 'milk caps' is a large genus of ectomycorrhizal fungi, characterized by caps and stalks that exude a milky latex when cut; this liquid may be white, yellow, orange, red, or lilac, and may develop its final colour only after exposure to air. Most of the species form ectomycorrhizal association with native tree species. A few are edible. *Lactarius ignifluus*, a salmon coloured latex exuding species and *L. nebulosus,* a white coloured latex exuding species, have recently been recorded from Kerala (Mohanan, 2011).

Lactarius ignifluus K.B. Vrinda & C.K. Pradeep, in Vrinda, Pradeep, Mathew & Abraham, *Persoonia* 18 (1): 129 (2002)

Lactarius ignifluus, salmon pink coloured latex exuding species, is widely distributed in semi-evergreen to evergreen forests of the State and occurs scattered in small to large clusters on soil and on basal part of the stem of living trees. This species forms ectomycorrhizal association with *Hopea ponga, Vateria indica* trees.

Fruit bodies small sized. Pileus 5-40 mm diam., convex, becoming applanate with an acute umbo, scarlet to pastel red or grayish red turning bright scarlet when cut or bruised. Context thin, pale reddish. Lamellae decurrent; pale pink turning scarlet when bruised, subdistant. Stipe central, 1.5-4 cm x 1-3 mm, cylindrical, equal, becoming hollow, concolorous with the pileus pale pink to white at base with abundant aborted, small basidiomes. Latex scarlet, watery, pleasant. Spore-print white. Basidia clavate 35-45 x 6-8.5 µm, 4-spored. Spores globose to sub-globose, 8-10 x 6-8 µm, amyloid with ornamentation of ridges and verrucae forming sub-complete reticulum. Cheilocystidia thin-walled, clavate, 33-42 x 5-7 µm, with dense granular contents. Pleurocystidia clavate, 65-90 x 5-6 µm with dense granular contents. Hymenophoral trama hyaline to pale pinkish, heteromerous, of narrow hyphae, 5-20 µm diam., intermixed with numerous sphaerocytes and laticiferous hyphae. Subhymenial layer well-developed, pseudoparenchymatous. Pileipellis a dense and continuous trichodermial palisade, 25-40 µm thick, of erect or semi-erect, thin-walled, sinuous-cylindric hairs 20-40 x 3-5 µm, with an obtusely rounded apex, pale pinkish granular contents, occasional laticiferous hyphae present.

Lactarius nebulosus Pegler, in Pegler & Fiard, *Kew Bull.* 33(4): 610 (1979)

Lactarius nebulosus, a white coloured latex exuding species, is widely distributed in semi-evergreen to evergreen forests of the State and occurs solitary or scattered in small clusters on soil. Fruit bodies small to medium sized. Pileus 2.5-4.5 cm diam., fleshy, at first convex with a more or less umbilicate centre than applanate or slightly depressed; surface whitish with broad pale grayish brown with grayish brown areas, azonate, dry, glabrous to subvelutinate, often somewhat rugose; margin horizontal, acute, undulate, not striate. Lamellae adnato-decurrent, white, staining pale brown or

bruising, up to 4 mm wide, rather distant, with numerous lamellulae and frequently furcate especially near the margin. Stipe 2-4 cm x 7-12 mm, often very short, cylindric, equal, firm, solid; surface pure white, bruising cinnamon brown, subpruinose, glabrescent. Context up to 5 mm thick at the disk, firm, pure white, discolouring brown on exposure, heteromerous, of thin-walled hyphae, 2-5 µm diam., interwoven with groups of sphaerocytes, 9-20 µm diam., and abundant, hyaline, refractive laticiferous hyphae, 3-10 µm diam.. Latex abundant, aqueous, white.

Spores 9-11 x 8-10 µm, subglobose, ovoid or short ellipsoid, hyaline, with a strongly amyloid ornamentation of isolated, hemispherical verrucae, 0.6-1.5 x 0.4-1.5 µm, suprahilar plage inamyloid although a small, central amyloid spot often visible; hilar appendix 1.5-2 x 1-1.5 µm. Basidia 35-42 x 10-13 µm, elongate clavate, hyaline, bearing 2 or 4 sterigmata; sterigmata up to 5 µm long. Lamella-edge fertile or heteromorphous, with scattered pseudocystidia. Pseudocystidia very abundant, 35-45 x 11-15 µm, lanceolate-fusoid, with an acute, constricted or mucronate apex, thin-walled, hyaline, with oleaginous to granular, refractive contents, projecting beyond the basidia. Hymenophoral trama hyaline, heteromerous, of narrow hyphae intermixed with numerous sphaerocytes and laticiferous hyphae. Subhymenial layer well-developed pseudoparenchymatous. Pileipellis a dense and continuous trichodermial palisade, 30-60 µm thick, of erect or semi-erect, thin-walled, sinuous-cylindric hairs 30-50 x 2.5-5 µm, with an obtusely rounded apex, hyaline or occasionally with grayish vacuolar contents, occasional laticiferous hyphae present.

Russula atropurpurea (Krombh.) Britzelm., *Bot. Zbl.* 54: 99 (1893)

Russula atropurpurea is distributed in moist-deciduous to evergreen forests and sacred groves of the State. This species occurs solitary or scattered in large groups on soil under *Vateria indica, Hopea parviflora* stands.

Fruit bodies small to medium sized. Pileus 3-8 cm diam., subglobose to convex, finally depressed, often lobed; surface bluish red (12A7) to vivid red (11B6), yellowish red at the centre, weakly viscid when moist, shiny, smooth, not striate. Lamellae adnexed to adnate, white to pale pinkish, moderately crowded, with lamellulae, occasionally furcated. Stipe 2-5.5 cm x 8-16 mm, firm, cylindric, solid surface white with pinkish tints or grayish when moist. Context thick and firm white containing groups of large sphaerocytes; taste more or less acrid.

Spores 6-8 x 5.5-6 µm obovoid, hyaline, amyloid with fairly large verrucae connected by an incomplete, fine reticulum; suprahilar plage amyloid, often poorly defined. Basidia 24-28 x 9-11 µm, clavate, bearing 4 sterigmata. Lamella-edge heteromorphous, with macrocystidia. Macrocystidia 40-48 x 8-15 µm, fusoid, often mucronate, rarely clavate, hyaline, thin-walled, with granular oleaginous contents. Hymenophoral trama irregular and intermixed, hyaline, with thin-walled hyphae, 2-6 µm diam., and sphaerocytes. Subhymenial layer interwoven 5-8 µm wide. Pileal surface a loose trichodermium of erect, thin-walled hyphae, together with clavate or mucronate dermatocystidia, 30-80 x 5-7 µm with pigmented contents.

Russula mariae Peck, *Trans. & Proc. Roy. Soc. S. Australia* 43: 275 (1919))

Russula mariae is distributed in moist-deciduous to evergreen forests of the

State. This beautiful red coloured species occurs solitary or scattered in small groups on soil under *Hopea ponga, H. parviflora, Hopea* sp. *Vateria indica,* and *Diospyros malabarica* forming ectomycorrhizal association.

Fruit bodies small to medium sized. Pileus 4.5-6.5 cm diam., convex becoming depressed; surface grayish brown at centre, brownish violet (11D8) to red (11A3) at the margin, uniformly becoming paler when old, smooth; margin radially striate. Lamellae adnate, crowded, often dichotomously branched, yellowish white (2A2), thick, without lamellulae. Context whitish to cream, unchanging when cut, heteromerous, with thin-walled hyphae, 1.5-5 µm diam., and groups of sphaerocytes. Stipe 2.5-7 cm x 5-10 mm, central, cylindric, solid becoming hollow; surface pink with pale red tints, smooth.

Spores 8-9 x 6-7 µm, globose to subglobose, strongly amyloid, consisting of irregular large verrucae, joined by connective to form a partial to complete reticulum, hilar appendix non-amyloid. Basidia 28-31 x 10-12 µm, clavate bearing four sterigmata. Lamella-edge sterile, cheilocystidia crowded 35-45 x 10-11 µm, ventricose-fusoid, usually with acutely pointed or mucronate apex, thin-walled, hyaline. Pleurocystidia scattered, 78-90 x 15-20 µm, ventricose-rostrate or fusoid-cylindric, thin-walled, hyaline. Hymenophoral trama intermixed, sphaerocytes and connective hyphae without laticifers. Subhymenium pseudoparenchymatous. Pileal cuticle a trichodermium of erect to semi-erect hyphae that terminate as short chains of inflated cells, terminal cells up to 54 µm long, lanceolate, obclavate, often rostrate or narrowly to broadly lageniform, constituting the dermatocystidia. Stipitipellis a trichodermium, similar to pileus cuticle, caulocystidia 45-60 x 5-7.5 µm, aciculate, lanceolate, subulate or fusoid-ventricose, thin-walled, hyaline. All hyphae lacking clamp-connections.

38. SARCOSYPHACEAE Le Gal ex Eckblad 1968

Pezizales : Ascomycota

The family Sarcoscyphaceae contains 13 genera and 102 species (Kirk *et al.*, 2008) and are cosmopolitan in distribution, being found both in temperate and tropical regions (Cannon and Kirk, 2007). *Cookeina* and *Sarcoscypha* are the genera encountered in the forests of Kerala. *Cookeina* species are distributed in tropical and subtropical regions of the world and occur on fallen branches and on forest litter. *Cookeina indica*, *C. speciosa* and *C. tricholoma* are the species reported from Kerala (Mohanan, 2011). *Sarcoscypha*, one of the best known genera of Sarcoscyphaceae is a bright red, epixylous discomycete, commonly known as 'scarlet cup fungus' or 'scarlet elf cap'. Members of this genus are difficult to distinguish one another because there are a few discrete macroscopic characters. *Sarcoscypha occidentalis* is a newly record species from Kerala (Mohanan, 2011).

Cookeina speciosa (Fr.) Dennis, *Mycotaxon* 51: 239 (1994)

Cookeina speciosa is widely distributed in semi-evergreen to shola forests of the State and occurs scattered to gregarious groups on rotting branches, wood, forest litter, etc.

This species is close to *Cookeina tricholoma* and differs in having evenly distributed hairs arising from medullar excipulum.

Stromata funnel-shaped, 9-22 mm diam., stalk 10-45 mm long, hairs short, up to 2 mm long, forming ring towards the margin. Hymenial surface smooth, yellowish orange (4A8), grayish brown (6E3) to pale chocolate brown (6F4), highly hygrophanous, becoming pastel yellow to brownish yellow on drying. Outer surface paler than hymenium. Hairs composed of bundles of septate and thick-walled hyphae. Ectal excipulum of textura angularis, outer cells globose, with thickened, hyaline, to pale brown walls. Medullary excipulum of textura inricata. Subhymenium textura intricata. Paraphyses branched and net-like, exceeding the asci level. Asci cylindrical, 300-370 x 16-20 µm. Ascospores 24-33 x 11-16 µm, ellipsoid, thick-walled, surface with longitudinal ridges, biguttulate, at times with a large and small oil drops.

Cookeina tricholoma (Mont.) Kuntze, *Revis. gen. pl.* (Leipzig) 2: 849 (1891)

Cookeina tricholoma is widely distributed in moist-deciduous to evergreen shola forests of the State and occurs scattered to gregarious groups on rotting branches, wood, forest litter, etc. This species is very close to *C. sinensis* with the colour range and hairs of apothecia.

Stromata deeply cup-shaped to funnel-shaped, gregarious, 6-16 mm diam., pale orange to scarlet to grayish beige (4C2), clothed with long prominent up to 5 mm long, whitish hairs, sparse but more close around the margin, extended up to the stalk. Hairs composed of an aggregation of elongate cells, thick-walled, arising from medullary excipulum. Ectal excipulum 35-60 µm thick, of textura angularis, cells up to 20 µm diam., medullary excipulum of textura intricate, up to 250 µm thick; subhymenium of textura intricate. Paraphyses much branched, net-like. Asci cylindrical, 290-340 x 12-18 µm. Ascospores 20-32 x 10-14 µm, pointed ellipsoid, surface with fine longitudinal ridges, thick-walled, biguttulate with several small oil droplets.

Sarcoscypha occidentalis (Schwein.) Sacc., *Syll. fung.* (Abellini) 8: 154 (1889)

Sarcoscypha occidentalis is widely distributed in evergreen to shola forests of the State and occurs solitary or scattered in small clusters on rotting wood and forest litter. Fruiting bodies appear under damp weather.
Stromata cup-shaped, saucer-shaped or funnel-shaped, stipitate, 1.5-2 cm diam., hymenial surface scarlet red, fading with age, smooth; outer surface pale pinkish red, smooth. Stipe 1-3 cm x 1.5-2.5 mm, pale pinkish red, base with hairy white mycelium. Asci 8-spored, cylindrical, 150-220 x 13-15 µm; paraphyses present, filiform. Ascospores ellipsoid, smooth, 18-25 x 9-12 µm, uniseriate, hyaline, not sheathed, with two or more guttules, pseudodextrinoid.

39. SCHIZOPHYLLACEAE Quel. 1888
Agaricales : Basidiomycota

Schizophyllum is the significant genus of this family and members are widespread in distribution. Most species are saprobes on rotten wood, bamboos etc. *Schizophyllum*

commune has been used extensively as a model organism for physiological and genetic studies. It is also used for food, either directly or following fermentation to produce a cheese-like substance.

Schizophyllum commune Fr. [as '*Schizophyllus communis*'], *Observ. mycol.* (Havniae) 1: 103 (1815)

Schizophyllum commune is widely distributed and reported to be occur everywhere except Antarctica. The gills split when the basidiome mature and dries out, hence the common name 'split gill'. This fungus does not appear to be very closely related to the other gilled mushrooms and most researchers place it in its own order Schizophyllales. This fungus exhibits great adaptability to various climatic conditions. Unlike other mushrooms, the mycelium produce only one set of basidiome per year, which dries out and rehydrate and keep functioning. *Schizophyllum* commune has been used extensively as a model organism for physiological and genetic studies. The genome of *S. commune* has been sequenced in 2010 (Robin *et al.*, 1010). The fungus causes white rot in bamboo culms, logs, braches and twigs.

Fruit bodies small sized. Pileus 1-5 cm diam., thin, flabelliform, laterally attached by a small base; surface pale to dark grayish brown, villose; margin lobed, often deeply incised. Hymenophore falsely lamellate, separating along the lamella-edge in dry conditions so that the two surfaces become recurved. Stipe absent, sometimes attachment by a lateral extension of the pileal margin. Context thin, up to 1.5 mm thick, brownish, non-gelatinized, of thick-walled, uninflated hyphae, 2.5-6 µm diam., with clamp-connections. Spore print white, although salmon pink and glutinous in culture. Spores 3-6 x 1.2-2 µm, allantoid, cylindric, hyaline, thin-walled, smooth. Basidia 15-20 x 4-6 µm, narrowly clavate, bearing four sterigmata. Cystidia absent. Subhymenial layer interwoven, up to 10 µm wide. Pileipellis a trichodermium of hyaline to brownish hairs, 3-4 µm diam., with thickened walls, often encrusted with granules.

Schizophyllum commune is widely distributed in deciduous to evergreen shola forests and occurs in small clusters on decaying logs, branches and twig, decaying bamboo culms, etc. More common in highly disturbed and fire burnt forest areas.

40. SCLERODERMATACEAE Corda 1842

Boletales : Basidiomycota

The family Sclerodermataceae contains two important ectomycorrhizal fungi, *Pisolithus* and *Scleroderma. Pisolithus* and *Scleroderma* have worldwide distribution and have proven to be very efficient in enhancing tree growth under certain circumstances (Marx *et al.*, 1977; Mohanan, 2002, 2003). *Pisolithus* forms ectomycorrhizal association with a variety of angiosperms and gymnosperms. Isolates of *Pisolithus* have been used extensively in forestry inoculation programmes over the past 35 years, with growth enhancement reported for several species of *Eucalyptus, Acacia* and pines (Marx *et al.*, 1977; Duponnois and Ba, 1999; Mohanan, 2002, 2003). Recent molecular analyses have revealed considerable genetic variation within the species, suggesting that *P. tinctorius* group worldwide comprises a

complex of several species. In Kerala, *Pisolithus* species are widespread, although mostly found in *Eucalyptus*, *Casuarina* and *Acacia* plantations. It seems likely *Pisolithus* species have been introduced to Kerala with the eucalypt seedlings from Australia as has been shown to have occurred through eucalypts introduction in other parts of the world (Martin *et al.*, 1988). Earier, this fungus has been reported as *P. tinctorius* from *Eucalyptus, Acacia* and *Casuarina* plantations in the State. Artificial mycorrhization of seedlings of various forestry species with '*P. tinctorius*' isolates has been attempted (Mohanan, 2002, 2003, 2006).

Scleroderma citrinum, S. geaster and *S. verrucosum* have earlier been reported from Kerala, forming ectomycorrhizal association with *Acacia auriculiformis, A. mangium, Eucalyptus grandis* and *E. tereticornis* (Mohanan, 2003). Improvement of tree seedlings, employing artificial mycorrhization with *S. citrinum* and *S. verrucosum* have been attempted (Mohanan, 2002). *Scleroderma areolatum, Scleroderma bovista* and *Scleroderma polyrhizum* are newly recorded species from Kerala (Mohanan, 2011).

Pisolithus albus (Cooke & Massee) Priest,: 122 (1998)

Pisolithus albus is widely distributed in moist-deciduous to semi-evergreen forests and in *Eucalyptus tereticornis, Acacia auriculiformis, A. mangium* and *Casuarina equisetifolia* plantations of the State and occurs solitary or scattered in small groups on soil. This species forms ectomycorrhizae with eucalypts, acacia, casuarinas and many indigenous host plants. Fruit bodies irregularly club-shaped or capitate, up to 18 cm tall, 6-10 broad, yellowish or olivaceous brown, the lower thick stalk or root-like part immersed in soil often with chrome yellow markings and sand-grain incrustations; wall thin, becoming brittle, disintegrate at maturity to expose the gleba. Gleba composed at first of numerous yellowish brown, peal-shaped peridioles which break down to form grayish brown powdery mass of spores when ripe. There is no true capillitium, just some septate, hyaline hyphae. Spores spherical, 8-12 µm diam., ochraceous to cinnamon brown, warted to spiny, each with one guttule.

Scleroderma citrinum Pers., *Syn. meth. fung.* (Göttingen) 1: 153 (1801)

Scleroderma citrinum is widely distributed in moist-deciduous to evergreen forests and forest plantations, especially *Eucalyptus tereticornis, E. grandis, E. deglupta, Acacia mangium, A. auriculiformis* and pine plantations. This species forms ectomycorrhizal association with *Vateria indica*, eucalypts, acasia and pines. Fruit bodies often gregarious, subspherical, almost sessile, 3-12 cm diam., usually lemon yellow or pale chrome, sometimes ochraceous, coarsely scaly; wall tough and very thick up to 4-6 mm, eventually breaking open irregularly at apex. Hyphae with clamp-connections. Gleba purplish black, marbled by white tramal plates. Spores spherical, brown, 9-12 µm diam., without their ornamentation which consists of spines up to 1.5 µm high, joined at their bases to form a network.

Scleroderma verrucosum (Bull.) Pers., *Syn. meth. fung.* (Göttingen) **1**: 154 (1801)

Scleroderma verrucosum is widely distributed in moist-deciduous to evergreen forests and forest plantations, especially *Eucalyptus tereticornis, E. grandis, E. deglupta,*

Acacia mangium, A. auriculiformis and pine plantations. This species forms ectomycorrhizal association with *Vateria indica*, eucalypts, acasia and pines.

Fruit bodies 3-7 cm diam., tapered below into a thick, grooved, stem-like base about 5 cm long, rather reddish brown when young, becoming brownish yellow; wall rather thin and brittle, at first smooth, then cracked except at the apex to form irregular scales sometimes with raised edges but never surrounded by areolar or rings. Hyphae without clamp-connections. Gleba olivaceous brown. Spores spherical, dark brown, 8-11 µm diam., without their ornamentation, spines separate, 10-11.5 µm long,

41. STEREACEAE Pilat 1930

Russulales: Basidiomycota

The family Stereaceae contains 22 genera and 125 species (Kirk *et al.*, 2008). *Stereum* is the significant genus of this family. Members are widely distributed in temperate and tropical zones; lignicolous or terrestrial (in leaf litter) and typically saprobic; a few members are pathogens causing rot in living trees.

Stereum hirsutum (Willd.) Pers., *Observ. mycol.* (Lipsiae) 2: 90 (1800) [1799]

Stereum hirsutum is widely distributed in moist-deciduous to evergreen forests of the State and occurs on decaying wood, logs and stumps.

Fruit bodies annual, thin, leathery, dimidiate, flabelliform to spathulate to tomentose, concentrically zoned. Pileus brownish orange, dark brown, 2.4-14.5 x 3-10 x 0.1-0.2 cm. Pores surface stereoid, smooth, pale orange, orange grey to yellowish grey. Margin thin, wavy. Context homogenous, xanthochroic; a thin black zone present below the tomentum, orange white to yellowish brown. Hyphal system dimitic; generative hyphae pale yellowish, simple septate, branched, thin- to slightly thick-walled, 2-5 µm wide; skeletal hyphae pale brown, thick-walled, unbranched, 5-7.5 µm wide, occasionally septate at young parts. Acanthophyses hyaline, pseudo-acanthophyses also present, 15-33 x 2-4 µm. Spores 4-8x2.5-4 µm, hyaline, ellipsoid, smooth, thin-walled, no reaction with Melzer's reagent. Cystidia smooth, thick-walled; skeletal hyphae project into the hymenium, 22.5-45 x 5-7.5 µm. Cystidiole 19-22.5 x 2-2.5 µm, hyaline, thin-walled, pointed towards apex. Basidia 17.5-36 x 3-6 µm, hyaline, clavate with 2 sterigmata. Basidiole 14-24 x 4-5 µm, hyaline, clavate, smooth.

42. STROPHARIACEAE Singer & A.H. Sm. 1946

Agaricales: Basidiomycota

The family Strophariaceae contains 8 genera and about 1316 species (Kirk *et al.*, 2008). Ecologically, all the members in the family are saprotrophs, growing on various kinds of decaying organic matters, including dung of herbivorous animals. *Agrocybe, Galerina, Gymnpilus, Hypholoma, Pholiota, Psilocybe* and *Stropharia* are the significant genera of this family. The genus *Agrocybe* has a world-wide

distribution and contains about 100 species. From Kerala, so far, eight species of *Agrocybe* have been reported and most of them occur on elephant dung (Mohanan, 2011). The genus *Galerina* contains more than 300 species and is distributed throughout the world. This genus is most noted for toxic species and many species contain alpha-amanitin and other amatoxins. Ecologically all *Galerina* species are saprobic growing in habitats like rotting wood or among moss. The genus *Gymnopilus* contains about 200 species (Kirk *et al.*, 2008) formerly divided among *Pholiota* and the defunct genus *Flammula*. A total of 11 species of *Gymnopilus* have been reported from Kerala; of these, *Gymnopilus crocias*, *G. chrysopellus, G. hispidellus, G. lateritius, G. junonius* and *G. subbellulus* are recently reported by the author (Mohanan, 2011). Of these, *G. junonius* is reported to contain psilocybin. The genus *Pholiota* has a widespread distribution, especially in temperate regions, and contains about 150 species (Kirk *et al.*, 2008). Most of the species are liginicolous. Earlier, *Pholiota bambusina* and *P. ealaensis* have been reported from Kerala (Joseph *et al.*, 1995; Thomas and Manimohan, 2001). *Pholiota gregariiformis* and *P. squarrosa* are recently recorded ones (Mohanan, 2011). The genus *Psilocybe* is best known for its species with psychedelic or hallucinogenic properties, widely known as 'magic mushrooms' though, the majority of the species do not contain hallucinogenic compounds. Psilocybin and its derivative psilocin- present in many *Psylocybe* species. Oxidation turns psilocin into a blue pigment, which is an indicator for the presence of psilocin, though not all blue colour are oxidized psilocin. So far, 15 species of *Psilocybe* have been reported from Kerala, including the recently reported *Psilocybe aztecorum, P. inquilina, P. plutonia, P. samuiensis* and *P. squarrosipes* (mohanan, 2011). Members of *Stropharia* are mostly coprophilous or occur on decaying woody debris.

Agrocybe pediades (Fr.) Fayod, *Annls Sci. Nat.*, Bot., sér. 7 9: 358 (1889)

Agrocybe pediades is distributed in semi-evergreen to evergreen forests and grasslands and occurs solitary or scattered in small groups on dung of elephant and cattle. This species is very close to *Agrocybe semiorbicularis* (Bull.) Fayod but the species is predominantly bisporic, and has yellowish brown pileus and larger spores. *A. pediades* is characterized by a pale coloured convex pileus with white powdery velar remnants towards margin when young, non-annulate stipe, large spores with truncate germ-pores, 4-spored basidia, lageniform to somewhat tibiiform cystidia and clamped hyphae.

Fruit bodies small sized. Pileus 2-3 cm diam., hemispherical to convex, becoming plano-convex to plane, sometimes with an indistinct umbo or a small depression at the disk. Pileal surface brownish orange to pale orange or light orange at the centre, orange white towards margin, glabrous, sometimes with white powdery velar remnants towards margin especially when young, non-hygrophanous dull, slightly sticky when moist; margin initially incurved, becoming decurved and finally plane, initially entire, at times becoming fissile. Context up to 3 mm thick at centre, whitish or orange white. Lamellae adnate to adnate-adnexed, light brown to grayish brown, crowded to subcrowded, with lamellulae of 3 lengths, up to 8 mm wide; edge pale, finely scalloped. Stipe 3-6 cm x 1.5-2 mm, central, terete, almost equal or broader towards both ends with a bulbous base, solid turning to fistulose; surface brownish orange or orange white, initially coated with velar remnants, later glabrescent, without an annulus; base with a few rhizoids. Odour not distinctive. Spore-print dark brown.

Spores 12-14 x 6-9 µm, lenticular, ovoid in face-view, ellipsoid in side-view, cinnamon brown, smooth, thick-walled, apically truncated by a germ-pore up to 1 µm wide. Basidia 20-36 x 8-12 µm, cylindro-clavate, frequently with a slight medium constriction, 4-spored; sterigmata up to 4 µm long. Lamella-edge sterile to heteromorphous. Cheilocystidia 25-31 x 7-9 µm, lageniform or rarely somewhat tibiiform, sometimes distal end capped with a resinous substance, thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama regular; hyphae 2-16 µm wide, thin-walled, hyaline. Pileal trama loosely interwoven; hyphae 2-16 µm wide, thin-walled, hyaline to yellowish. Pileipellis hymeniform, sometimes covered with a poorly developed gelatinous layer, elements 8-30 x 6-12 µm, pedicillate-clavate, thin-walled hyaline towards distal end, yellowish towards base. Hypodermium composed of 2-8 µm wide, thin-walled hyphae with pale yellowish brown encrustation. Stipe trama composed of 2-12 µm wide hyphae, thin-walled, hyaline or with a pale yellow wall pigment. Stipitipellis a cutis; hyphae 2-4 µm wide, thin to slightly thick-walled, pale yellowish brown. Caulocystidia 15-40 x 5-10 µm, narrowly lageniform to almost tibiiform, apex capped with a resinous substance, thin-walled, hyaline, restricted to upper part of the stipe. Clamp-connections present.

Agrocybe wayanadensis K.A. Thomas & Manim., *Mycotaxon* 86: 326 (2003)

Agrocybe wyanadensis is widely distributed in semi-evergreen to evergreen forests of the State and occurs in small caespitose groups on soil or decaying logs or humus. This species is characterized by the medium to very large sized pale coloured basidiome growing in clusters on the substrata, well developed superior annulus, and exudation of a colorless liquid when stipe is bruised, large spores with an indistinct germ-pore.

Fruit bodies medium to large sized, robust. Pileus 4-10 cm diam., convex to applanate, frequently becoming depressed at the centre; surface pale orange or greyish orange with bluish tints at the centre, fading towards margin to orange white, not striate, moist, glabrous, smooth or sometimes irregularly pitted; margin incurved when young, turning to plane and finally becoming slightly upturned, almost entire to slightly eroded. Context fleshy, white up to 12 mm thick at the centre. Lamellae adnate to adnexed, grayish orange, orange grey or light brown, sub-crowded, up to 8 mm wide, with lamellulae of 3 lengths; edge pale almost entire, serrate or slightly eroded. Stipe 4-15 cm x 5-14 mm, central, terete, almost equal or tapered at the base, solid, with a well-developed, persistent, striate, superior annulus. Stipe surface pale orange to orange white; fibrillose-striate, base deeply immersed in the substratum. A colourless liquid oozing out from fresh stipes when bruised. Odour not distinctive. Spore-print brown.

Spores 9-10 x 5-7 µm, ellipsoid. ellipsoid-oblong, subreniform or somewhat cylindric occasionally with a constriction, smooth. with a thickened yellowish brown wall and an apical germ-pore up to 1.5 µm wide. Basidia 20-26 x 5-7 µm. cylindric, sometimes with a median constriction, 2- to 4-spored; sterigmata up to 6 µm long. Lamella-edge sterile with cheilocystidia. Cheilocystidia 17-19 x 5-8 µm, versiform, clavate, fusoid cylindric or utriform, sometimes mucronate or with a subcapitate apex, crowded, hyaline to pale yellowish brown pigmented wall. Pleurocystidia 22-27 x 9-13 µm clavate-mucronate, scattered. thin-wailed, hyaline. Hymenophoral trama regular;

hyphae 3-20 µm wide, thin-walled, hyaline to pale yellowish brown. Pileal trama loosely interwoven; hyphae 2-18 µm wide, thin-walled, hyaline to pale yellowish brown. Pileipellis hymeniform; elements 16-40 x 11-30 µm, hyaline to pale yellowish brown. Pileocystidia 15-42 x 8-16 µm, similar to cheilocystidia in shape, scattered, hyaline. Stipe trama composed of 20-30 µm wide, parallel, thin- to slightly thick-walled hyphae with a yellowish brown wall. Stipitipellis a cutis; hyphae 2-12 µm wide, thin- to slightly thick-walled with a yellowish brown wall, faintly encrusted. Caulocystidia 15-62 x 4-12 µm similar to cheilocystidia in shape, thin-walled, hyaline to yellowish brown. All hyphae with clamp-connections.

Galerina vittiformis (Fr.) Singer, *Acta Inst. bot. Komarov. Acad. Sci.*, Pl. Crypt, ser. 2 6: 472 (1950)

Galerina vittiformis is distributed in semi-evergreen to evergreen forests of the State and occurs solitary or in small groups on soil. Fruit bodies small sized. Pileus 1-2 cm diam., convex to campanulate, rarely expanding; surface orange to brownish orange, orange white to cream elsewhere, hygrophanous, drying to cream from the centre, glabrous, radially striate. Lamellae adnate, ascending, pale ochraceous to grayish orange, ventricose, with lamellulae of two lengths. Stipe 2-4 cm x 0.5-1.5 mm, cylindric, flexuous, hollow; surface yellowish brown becoming more fulvous below, pruinose, glabrescent; veil none. Context very thin, brown, aqueous, of interwoven hyphae, 5-20 µm diam., with clamp-connections. Spores 7-9.5 x 4-5.5 µm, ovoid to amygdaliform, rugulose to verruculose, with a smooth suprahilar plage. Basidia 25-30 x 7-9 µm, clavate, with 4 rarely 2 sterigmata. Lamella-edge heteromorphous, with crowded cheilocystidia. Cheilocystidia 40-68 x 7-16 µm ventricose below, cylindric or tapering above, hyaline, thin-walled. Pleurocystidia present, similar to the cheilocystidia. Hymenophoral trama regular, with parallel, hyaline hyphae, 3-12 µm diam., Subhymenial layer interwoven. Pileipellis an undifferentiated epicutis of hyaline hyphae, 3-8 µm diam., overlying a thin hypodermium with brown, encrusted hyphae.

Gymnopilus crocias (Berk. & Broome) Singer, *Sydowia* 9(1-6): 412 (1955)

Gymnopilus crocias is widely distributed in moist-deciduous to evergreen forests of the State and occurs scattered in clusters on rotting logs. Fruit bodies small to medium sized. Pileus 3-7.5 cm diam., convex, umbonate, surface yellowish orange to deep orange, covered with small, erect, dark rusty brown to grayish ruby, pointed radially arranged squamules, more concentrated towards the centre. Lamellae adnate, dark orange, 4-7 mm broad, moderately crowded, with lamellulae of two lengths. Stipe 3-8 cm x 3-9 mm, cylindric or slightly tapering towards the base; surface grayish Magenta, paler at apex, coarsely fibrillose. Veil reduced to a faint cortinoid zone on upper stipe. Context fairly thick, pale, consisting of inflated, thin-walled hyphae, 3-15 µm diam., with clamp-connections. Spores 7.5-8 x 4.5-5 µm, ellipsoid to subamygdaliform, with a suprahilar depression, yellowish brown, with a thickened wall, and a finely verruculose ornamentation. Basidia 21-24 x 5-6 µm, clavate, bearing four sterigmata. Lamella-edge heteromorphous to sterile, with scattered to crowded cheilocystidia. Cheilocystidia 21-24 x 7.5-9 µm, utriform to lageniform, with a ventricose base and a short to elongate neck with a subcapitate apex, 2.5-3.5 µm diam. Hymenophoral trama regular, hyaline, of parallel hyphae, 2-6 µm diam. Subhymenial layer poorly developed, 7-9 µm wide, interwoven. Pileipellis a disrupted

repent epicutis of radially parallel, brown, thin-walled hyphae, 6-12 µm diam., with transverse bands of a finely granular encrusting pigment, often aggregated into semi-agglutinated fascicles.

Gymnopilus terricola K.A. Thomas, Guzm.-Dáv. & Manim., *Mycotaxon* 85: 302 (2003)

Gymnopilus terricola is distributed in grasslands and lawns and occurs scattered in clusters on soil among grass. Fruit bodies small sized. Pileus 1.5-4 cm diam., hemispherical to convex; surface yellowish orange or reddish-brown at the disc, light orange or grayish orange towards margin, dry, tomentose when young, then fibrils joining to form erect to suberect squamules, especially at the disk; fibrils violet brown to purplish; margin decurved, entire, sometimes fissile, occasionally appendiculate. Context pale orange, less than 1mm at the disc. Lamellae sinuate to adnexed, light orange when young, becoming orange or grayish-orange when mature, subdistant, ventricose, up to 5 mm wide, with lamellulae of 2-3 lengths; edge concolorous with the sides, entire to slightly wavy, lamellae exceeding pileus margin. Stipe 2-4 cm x 4-6 mm, central, terete, almost equal, hollow; surface grayish red to golden yellow towards apex, grayish-orange or faintly bluish-grey towards base, fibrillose apically. Veil fibrillose, evanescent, in some cases forming a superior annular zone with flaps fibrils. Spore-print brown.

Basidiospores 7-8 x 5-6 µm, broadly ellipsoid to ellipsoid, occasionally subamygdaliform, with obtuse or subacute apex, sub-thick-walled, verrucose, without plage or with a vey poorly developed one, without germ-pore, orange-brown, dextrinoid, not metachromatic with large oil guttule. Basidia 24-27 x 6-7 µm, clavate to cylindric-clavate, sometimes with a median constriction, hyaline, with orange-brown contents, 4- spored; sterigmata up to 5 µm long. Basidioles 12-30 x 5-8 µm, clavate to narrowly clavate, hyaline, or with yellowish-brown or orange-brown granulose content, scattered on the edge and sides of lamellae. Lamella-edge heteromorphous with scattered or occasionally crowded cheilocystidia. Cheilocystidia 17-22 x 5-8 µm, apex 2-3.5 µm wide, fusoid, narrowly utriform, cylindric-sub-ventricose to lageniform, with obtuse or subcapitate apex, thin-walled, hyaline or with yellowish content. Pleurocystidia absent. Hymenophoral trama subregular; hyphae 2-16 µm wide, thin-walled, with yellow to orange-yellow content. Subhymenium rimose. Pileal trama radial; hyphae 3-16 µm wide, with a thin, orange-brown wall, encrusted in bands with an orange-brown pigment, often aggregating into erect fascicles with clavate, clavate-mucronate, or fusoid end-cells. Stipe trama composed of 2-16 µm wide hyphae, thin-walled, with a light yellow pigment. Stipitipellis a cutis, hyphae 3-12 µm wide, thin-walled, light yellowish brown, at times faintly encrusted. Caulocystidia 17-36 x 4-8 µm apex 3-8 µm wide, cylindric, clavate or lageniform, with obtuse, subcapitate or rostrate apex, hyaline, with or without yellow or orange-brown granulose content, thin-walled, in tufts at the apex and middle of the stipe. Clamp-connections present in all parts of the basidiome.

Hypholoma subviride (Berk. & M.A. Curtis) Dennis, *Kew Bull.* 15 (1): 134 (1961)

Hypholoma subviride is widely distributed in moist-deciduous to evergreen forests and occurs in caespitose clusters on decaying wood and stumps.

Fruit bodies small sized. Pileus 0.5-2 cm diam., hemispherical then convex to umbonate or sometimes papillate; surface pale sulphur yellow with a greenish tint towards the margin to deeply yellow or reddish brown at the centre, bruising brown, dry glabrous, smooth, non-striate. Lamellae adnexo-adnate to subdecurrent, arcuate, dull greenish yellow darkening to purplish brown, narrow, 1-2 mm wide, very crowded, with lamellulae of three lengths. Stipe 1-3 cm x 0.5-3 mm, curved, cylindric, fistulose to hollow; surface concolourous with the pileus, smooth. Veil forming neither a persistent annulus nor a Cortina. Context 2-3 mm thick at disk, pale lemon yellow, firm consisting of thin-walled, inflated hyphae, 3-26 µm diam., Spores 6-8 x 3-4 µm, ellipsoid, smooth, with a thickened, fuscous brown wall, apically truncated by a broad germ-pore. Basidia 15-18 x 4-6 µm, narrowly clavate, bearing 4 sterigmata, sterigmata up to 4 µm long. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 18-23 x 5-8 µm, lageniform, hyaline, thin-walled. Chrysocystida 32-42 x 8-12 µm, clavate to ovoid often constricted or with a mucronate apex, containing yellowish pigment. Hymenophoral trama regular, hyaline with inflated hyphae, 3-22 µm diam. Subhymenial layer 8-10 µm wide, pseudoparenchymatous. Pileipellis an epicutis of repent, non-gelatinized, thin-walled hyphae, 3-10 µm diam., overlying a pseudoparenchymatous hypodermium, 12-16 µm thick.

Hypholoma trinitense (Dennis) Pegler [as '*trinitensis*'], *Kew Bull.*, Addit. Ser. 9: 509 (1983)

Hypholoma trinitense is widely distributed in moist-deciduous to evergreen forests and occurs in caespitose clusters on decaying logs and stumps.

Fruit bodies small sized. Pileus 2-4.5 cm diam., convex, applanate or umbonate; surface hygrophanous, yellowish brown, somewhat translucent when moist, paler at the margin, minutely furfuraceous-squamulose, glabrescent; margin with appendiculate, white, velar remnants. Lamellae broadly adnate, pale yellowish grey or with a greenish tint darkening to brown, up to 4 mm wide, moderately crowded, with lamellulae of three lengths. Stipe 3-6 cm x 5-8 mm, cylindric and expanded above, solid to fistulose; surface off white to pale grayish yellow, glabrous, striate, arising from white, rhizomorphic mycelial strands. Partial veil cream coloured, fibrillose floccose, at first forming an indistinct annular zone on the upper stipe, fugacious. Context thin, 3 mm thick at the disk, dark brown, aqueous, of much inflated, thin-walled hyphae, 3-28 µm diam., with prominent clamp-connections; odour farinaceous or of potato. Spore print dark maroon. Spores 5-7 x 3.5-5 µm, ovoid to ellipsoid, occasionally reniform, fuscous brown, smooth, with a minute apical germ-pore. Basidia 26-30 x 5-7 µm, clavate, bearing four sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 26-38 x 9-15 µm, globose to pyriform, hyaline, thin-walled. Chrysocystidia numerous, 32-38 x 10-15 µm, vesiculose, ventricose or lageniform, thin-walled, with pale yellowish, amorphous contents. Hymenophoral trama subregular, pale brown, with inflated hyphae, 4-20 µm diam. Subhymenial layer 8-12 µm wide, interwoven. Pileipellis a non-gelatinized, repent epicutis of hyaline hyphae, 8-16 µm diam., overlying a hypodermium of inflated elements. 2-16 µm diam., with brown vacuolar pigment. All hyphae with clamp-connections.

Pholiota gregariiformis (Murrill) A.H. Sm. & Hesler, *The North American species of Pholiota*: 304 (1968)

Pholiota gregariiformis is distributed in pine stands in Munnar and Peermedu Forest Divisions and occurs on decaying forest litter.

Fruit bodies small sized. Pileus 2.5-3 cm diam., convex to planoconvex; surface smooth, brown when young, brownish orange at maturity; margin incurved. Lamellae adnate, 4 mm wide, reddish yellow, turns brown in age; lamellulae of 3 lengths. Stipe up to 3-6 cm x 2-3 mm, hollow; surface hairy, light orange, tufts of hyphae present at the base. Spore-print colour yellowish brown. Spores 11.5-13 x 5-6.5 µm, ovoid to ellipsoid, smooth, with oil guttules, without germ-pore. Basidia 28-32 x 7-8.5 µm, 4- spored, sterigmata up to 4 µm long. Lamella-edge sterile with cheilocystidia. Cheilocystidia 30-40 x 5-7.5 µm, thin walled, clavate to versiform, hyaline. Pleurocystidia 40-46 x 18-23 µm, narrowly fusoid, apex obtuse, thin-walled, hyaline, with central amorphous body. Hymenophoral trama regular, hyphae thin-walled, hyaline, 3-8 µm diam. Context thin, hyphae 3-14 µm diam., inflated up to 28 µm diam.; subhymenial layer gelatinous at maturity, hyphae 3-4 µm diam. Pileal surface a gelatinous layer, hyphae smooth to encrusted, 3-6 µm diam., hypodermial region of floccose yellowish brown hyphae, walls encrusted, 3-12 µm diam. Stipe tissue consisting of sub-parallel hyphae, 3-8 µm diam., inflated up to 16 µm diam.; caulocystidia not observed. All hyphae with clamp- connections.

Psilocybe cubensis (Earle) Singer, *Sydowia* 2(1-6): 37 (1948)

Psilocybe cubensis is widely distributed in grasslands, semi-evergreen to evergreen forests of the State. This mushroom contains Type 4 toxins, psilocybin and psilocin, which affect the central nervous system and results in moderate to strong hallucinogenic reactions. This mushroom occurs gregarious to scattered on humus rich soil or on dung of herbivorous animals. Fruit bodies small sized. Pileus 1-6 cm diam., convex to plano-convex; surface smooth, yellowish brown (5D8) to deep orange (5A8) to grayish orange at the centre, paler at the margin; margin regular, smooth. Lamellae adnate, grayish brown (5E3), up to 6 mm wide. Stipe up to 8-14 cm x 4-12 mm, cylindrical with bulbous base; surface hairy, white to yellowish white (4A2), paler at apex, turns blue on bruising. Annulus well developed, median, white. Spore-print colour dark brown. Spores 11-16 x 7-10 µm, ellipsoid, thick walled, with apical truncate germ pore, smooth. Basidia 21-30 x 8-10 µm, 2- or 4- spored, mostly 4- spored, sterigmata up to 6 µm long. Cheilocystidia 28-30 x 8-11 µm, lecythiform, capitellum up to 6 µm diam., thin-walled, hyaline. Pleurocystidia 34-42 x 13-15 µm, broadly clavate, hyaline, thin-walled. Hymenophoral trama regular, hyphae thin-walled, hyaline, 3-7 µm diam. Context thin, white, bluing on bruising, made up of interwoven, hyaline, thin- walled hyphae, 2-5 µm diam. Stipe tissue consisting of parallel hyphae, 3-14 µm diam.; caulocystidia 12-23 x 7 -8 µm, clavate, thin-walled, hyaline. All hyphae with clamp-connections.

Psilocybe wayanadensis K.A. Thomas, Manim. & Guzmán, in Thomas, Manimohan, Guzmán, Tapia & Ramírez-Guillén, *Mycotaxon* 83: 198 (2002)

Psilocybe wayanadensis is distributed in semi-evergreen to evergreen forests of the State and occurs gregarious to scattered on humus rich soil or dung.

Fruit bodies small sized. Pileus 2-4.5 cm diam., convex. becoming applanate to slightly depressed, with a small acute umbo at the centre, smooth, glabrous, slightly sticky when moist, translucent-striate towards margin, initially-brownish grey (5C2) or grayish brown (5D3), uniformly turning to grayish brown with brownish grey umbo (5F2, 6F2), pale yellow or grayish yellow towards margin, hygrophanous; margin decurved becoming plane, entire, sometimes becoming eroded or fissile. Context up to 4 mm thick, whitish or concolorous with the pileus surface. Lamellae adnexed to sinuate, initially grayish yellow (4B3), orange grey (5B2) or brownish orange (5C3), becoming grayish brown (6D3) to brown, close, up to 6 mm wide; edge pale entire. Stipe 3-9 cm x 4-8 mm, central, terete, hollow, off white or grayish yellow, smooth, with a superior, membranous, white annulus; base enlarged, with strigose basal mycelium. Stipe and pileus turning blue on bruising or aging. Odour distinctive and unpleasant. Spore-print dark brown.

Spores 10-11 x 5-7.5 µm, lenticular, sub-rhomboidal in face-view, ellipsoid in side-view, pale brownish or pale violet brown, smooth, thick-walled, apically truncated by a germ-pore. Basidia 17.5-19 x 4.5-6 µm, sub-ventricose or cylindric to clavate, hyaline, 4- spored; sterigmata up to 4 µm long. Lamella-edge sterile. Cheilocystidia 30-36 x 5-9.5 µm, clavate to sub-ventricose, ventricose-fusoid or sub-lageniform, thin-walled, hyaline, often with a sub-gelatinous secretion at the apex. Pleurocystidia not observed. Hymenophoral trama regular to subregular; hyphae 2-20 µm wide, thin-walled, hyaline to pale brownish. Context pale brownish, with interwoven hyphae 2-12 µm wide. Pileipellis an ixocutis; hyphae 2-12 µm wide, thin-walled with faint hyaline encrustations. Stipitipellis a repent cutis, with 1.514 µm wide, thin-wailed, hyaline or pale bluish hyphae. Caulocystidia 14-26 x 6-11 µm, similar to cheilocystidia in shape, restricted to the extreme tip of the stipe, either in clusters or scattered, often with a sub-gelatinous secretion at the apex. All hyphae with clamp-connections.

Stropharia semiglobata (Batsch) Quél., *Mém. Soc. Émul. Montbéliard*, Sér. 2 5: 143 (1872)

Stropharia semiglobata is widely distributed in semi-evergreen to evergreen forests and occurs solitary or in small groups on elephant dung.

Fruit bodies small to medium sized. Pileus up to 2-3 cm diam., hemispherical to convex, surface smooth, viscid, reddish yellow when young, light yellow at maturity, margin regular, with velar remnants. Lamellae adnate, up to 4 mm wide, grayish white, with lamellulae of 3 lengths. Stipe up to 5-9 cm x 4-5 mm, cylindrical, surface pubescent, yellowish white, velar remnants forming a cobweb-like annulus. Spore print colour grayish brown. Spores 12-15 x 7-11 µm, ellipsoid, thick walled, smooth, with a truncate germ pore. Basidia 24-30 x 10-13 µm, 2 or 4 spored, mostly 4 spored, sterigmata up to 4 µm long. Lamella-edge sterile with abundant cheilocystidia. Cheilocystidia 28-40 x 6-9 µm, lageniform, thin walled, hyaline. Pleurocystidia in the form of chrysocystidia, 23-52 x 8-12 µm, clavate-mucronate, thin walled, with hyaline to yellow contents. Hymenophoral trama regular, hyphae thin-walled, hyaline, 3-8 µm diam. Context up to 3 mm thick, of thin walled hyphae, 3-7 µm diam. Pileal surface a strongly gelatinized epicutis with hyaline hyphae, 2-4 µm diam., subtended

by an underlying hypodermium of pigmented, encrusted hyphae. Stipe tissue consisting of parallel to sub-parallel hyphae, 3-11µm diam.; caulocystidia in clusters, 20-42 x 5-11 µm, lageniform, thin walled, hyaline. All hyphae with clamp-connections.

43. SUILLACEAE Besl & Bresinstay 1997
Boletales : Basidiomycota

The family Suillaceae contains 54 species (Kirk *et al.,* 2008). *Suillus* is the significant genus of this family and members are widespread in distribution, mainly in the north temperate area but also known from tropical Africa; perhaps introduced (with pines) in the southern hemisphere. Some species are edible and eaten by animals, including man; others are toxigenic. Members form ectomycorrhizal association, typically associated with confers.

Suillus brevipes (Peck) Kuntze, *Revis. gen. pl.* (Leipzig) 3(2): 535 (1898)

Suillus brevipus is distributed in pine stands of the State and occurs solitary or scattered in small groups on soil around *pines.* This species possibly forms ectomycorrhizal association with pines. Fruit bodies broadly convex when young, becoming almost applanate in age, 2.5-5 cm diam., surface glabrous, viscid to glutinous, pale yellowish brown, pale brown towards margin. Context whitish to off white, unchanging on bruising. Tubes 4-11 mm deep, adnate to subdecurrent. Pores boletenoid, round, minute, 1-2 per mm, yellow to pale yellowish brown. Stipe 2-3 cm x 0.6- 2 cm, equal, dry, solid, pale brown, becoming yellowish brown in age, without glandular dots. Veil absent.

Spore mass pale brown, spores 8-10 x 4-5 µm, ellipsoid to subfusoid, hyaline, inamyloid. Basidia 20-23 x 6.5-7.5 µm, clavate, 4-spored, hyaline. Cheilocystidia 25-28 x 5-7.5 µm, narrowly clavate, sometimes capitates, with yellowish brown amorphous incrusting pigments. Pleurocystidia 35-40 x 8-11 µm, subcylindric to clavate, with dark yellowish brown amorphous incrusting pigments. Tube trama bilateral, divergent, composed of gelatinous hyphae; pileus cutis composed of interwoven gelatinous hyphae, 3-8 µm diam., yellowish brown in KOH. Stipe cutis composed of parallel, gelatinized hyphae, compactly arranged, clamp-connections absent in all hyphae.

44. TREMELLACEAE Fr. 1821
Tremellaes : Basidomycota

The family Tremellaceae contains 18 genera and around 250 valid species. Members are cosmopolitan in distribution and contains both telomorphic and anamorphic genera, most of the latter being yeasts. Members of this family are widely distributed in tropical and temperate zones and usually growing on wood substrata. Some of the larger species are cultivated and eaten, especially in the East. Most of the species are parasitic on other fungi and produce anamorphic yeast state. *Tremella foliacea, Tremella mesenterica* and *Tremella reticulata* are the newly recorded species by the author (Mohanan, 2011).

Tremella foliacea Pers., *Observ. mycol.* (Lipsiae) 2: 98 (1800) [1799]

Tremella foliacea is widely distributed in moist-deciduous to evergreen forests of the State and occurs in small to large clusters on decaying wood, logs, branches and twigs during rainy season.

Fruit bodies tufted and made up of a number of broad, leafy lobes 3-7 cm long and 0.8-1.4 cm wide, soft, gelatinous, yellowish brown to reddish brown, conspicuous when moist, drying to form a horny mass. Hymenium amphigenous, hyphae thin-walled, with clamps, 2.5-3 µm diam. Basidia sessile with basal clamps, globose to ovate, 2 to 4 celled, longitudinally cruciate-septate, 20-26 x 19-21 µm; sterigmata 10-45 x 3.5-5 µm. Spores hyaline, one celled, smooth, apiculate, subglobose to broadly ovate, depressed on one side, 14-15 x 9-10 µm, germinating by repetition.

Tremella mesenterica Schaeff., *Fung. Bavar. Palat.* 4: tab. 168 (1774)

Tremella mesenterica is distributed in moist-deciduous to evergreen forests of the State and occurs in small clusters on decaying wood, logs, branches and twigs; appears in crevices in bark during rainy season.

Fruit bodies mostly solitary, cerebriform or lobed, gelatinous, bright golden yellow to reddish orange and very conspicuous during wet weather, 3-6 cm wide and up to 4 cm high; the basidiome becomes greasy or slimy during the wet weather. Basidia 12-30 x 10-22 µm, with clamps, sterigmata 124-145 x 2,5-4 µm. Spores hyaline, one celled, smooth, apiculate, broadly ellipsoid to subspherical, 10-15 x 4-6 µm.

Tremella reticulata (Berk.) Farl., (1908)

Tremella reticulata is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs solitary or in small to large clusters on decaying wood, logs and forest litter. Large clusters of the fungus were collected from decaying stacked logs of *Eucalyptus tereticornis*. This species has been claimed to be edible.

Fruit bodies sessile, tough gelatinous to cartilaginous when young and soft gelatinous at maturity, heterogeneous, consisting of tough gelatinous outer layer with a fleshy mucous core, tuberculate, caespitose, irregularly multiple branched with leaf-like coalescing, erect, hollow, elongated lobes, 4-12 x 2-3 cm, glossy white, conspicuous when moist, drying to form a horny mass. Hymenium amphigenous, hyphae thin-walled, with clamps, 2.5-3 µm diam. Basidia sessile with basal clamps, globose, ovate to clavate-cylindrical, 2 to 4 celled, predominantly 2-celled, longitudinally cruciate-septate, 8-15 x 5-8 µm; epibasidia slender, tapering into a sterigmata, 2-7 µm in length. Spores hyaline, one celled, smooth, apiculate, subglobose to broadly ovate, 6-8 x 3-4 µm, germinating by repetition.

45. TRICHOLOMATACEAE R. Heim ex Pouzar 1983
Agaricales : Basidiomycota

Tricholomataceae is a large family and contains 78 genera and about 1020 species (Kirk *et al.*, 2008). *Clitocybe, Collybia, Lepista, Macrocybe, Tricholoma* and

Tricholomopsis are the significant genera of this family. Members are cosmopolitan in distribution, more prominent in temperate areas. Many species of this family are edible, The genus *Clitocybe* contains both edible and poisonous mushrooms. *Clitocybe dealbata* and many small species contains the toxin 'muscarine' in deadly amounts. *Clitocybe dealbata* and *C. minuta* reported herein are new records for the State. The genus *Lepista* contains about 50 species (Kirk *et al.*, 2008). Earlier, *Lepista hyalodes* and *L. indica* have been reported from Kerala (Sathe and Daniel, 1980; Manimohan and Leelavathy, 1989). *Lepista sordida*, a greyish lilac to violaceous coloured widely distributed mushroom is a recently reported one by the author (Mohanan, 2011).

The genus *Macrocybe* contains seven species and are widely distributed in the tropical regions (Kirk *et al.*, 2008). *Macrocybe lobayensis* and *M. pachymeres* have recently been reported by Mohanan (2011). The genus *Tricholoma* contains a large number of fairly fleshy edible as well as poisonous mushrooms which are widely distributed in both temperate and tropical regions. Many species form ectomycorrhizal association with both conifers and broad-leaved trees. Some of the well known species are the East Asian *Tricholoma matsutake* also known as 'matsutake' and North American species, *T. magnivelare* or 'American matsutake'. Many species originally described within the genus *Tricholoma* have been shifted to other genera like *Calocybe*, *Clitocybe*, *Macrocybe*, among others. *Tricholoma ceriniceps, T. rimosoides* and *T. subrimosum* have ben reported by Mohanan (2011). The genus *Tricholomopsis* contains about 30 species (Kirk *et al.*, 2008). *Tricholomopsis crocobapha* and *T. tropica* have been reported by Mohanan (2011).

Clitocybe dealbata (Sowerby) Gillet, *Les Hyménomycètes ou description de tous les champignons (fungi) qui croissent en France* (Alençon): 152 (1874)

Clitocybe dealbata is widely distributed in semi-evergreen to evergreen forests of the State and occurs in small clusters on decaying wood and rotting stumps. This lignicolous species is very close to *Clitocybe hydrophora.*

Fruit bodies small to medium sized. Pileus 3-7 cm diam., convex soon expanded, deeply umbilicate, off white at the disk, white towards the margin. Margin thin, straight, fimbriate. Lamellae decurrent, arcuate, white to pale cream, subdistant, with a few lamellulae; edge entire, concolorous. Stipe 4-7 cm x 3-9 mm, attenuated towards the base, cylindric, smooth, hollow, concolorous with the pileus, rather tough, growing from a small, basal, white mycelial disk. Context thin, white, 3 mm wide, inamyloid. Spores 5-7.5 x 2.5-4.5 µm, ellipsoid to ellipsoid-amygdaliform, hyaline, thin-walled inamyloid, usually containing small oil-guttules. Spore-print pure white, Basidia 25-35 x 5-7.5 µm clavate cylindric, bearing 4 short sterigmata. Lamella-edge sterile with cheilocystidia. Cheilocystidia 25-33 x 6.5-9 µm, broadly clavate, thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama subregular, of the Clitocybe-subtype with the outermost hyphae diverging toward the subhymenial layer; hyphae hyaline, 2-5 µm diam., thin-walled, oleiferous ducts occasionally present in the context of the pileus. Pileal surface an epicutis of repent hyphae, though often fragmented and then the hyphae becoming curved to form a trichodermium. The hyphae are 3-8 µm diam., thin-walled, branched, septate with clamp-connections, sometimes containing a pale brownish vacuolar pigment. Pileocystidia present,

scattered, 12-35 x 5-10 µm, smooth, resembling the cheilocystidia, though at times bifurcate. Caulocystidia absent. All hyphae with clamp-connections.

Clitocybe minuta Mohanan

Clitocybe minuta is distributed in semi-evergreen to swamp forests of the State and occurs scattered in small groups on humus rich soil. This very small terrestrial species of *Clitocybe* is different from the so far, reported *Clitocybe* species.

Fruit bodies small sized. Pileus 2-2.5 cm diam., convexo-umbilicate; surface off white, smooth, glabrous, radially innately fibrillose; margin undulate. Lamellae adnato-decurrent, white with a pinkish bloom, up to 2 mm wide, subdistant, with lamellulae of 2 lengths, and some interveining. Stipe 2-2.5 cm x 1.5-2 mm, cylindric or tapering below, solid then fistulose; surface concolorous with the pileal surface, glabrous. Context about 1 mm thick at the disk, pale pinkish buff, of thin-walled hyphae, 3-10 µm, with clamp-connections. Spores 5-6 x 4-4.5 µm , subglobose to pyriform with a pronounced hilar appendix, hyaline, inamyloid, smooth, thin-walled. Basidia 17-21 x 6-7 µm, clavate, bearing 4 sterigmata. Lamella-edge fertile. Hymenophoral trama regular, hyaline, of parallel to slightly diverging hyphae, 2-10 µm diam. Subhymenial layer interwoven. Pileipellis a repent epicutis of radial parallel hyphae, 4-8 µm diam.

Collybia chrysoropha Berk. & Broome, *Saccardo's Syll. fung.* V: 213; XII:

Collybia chrysoropha is widely distributed in moist-deciduous to evergreen forests of the State and occurs in dense clusters on decaying forest litter.

Fruit bodies small sized. Pileus 8-16 mm diam., convex; surface pale yellowish brown, striate, finely pruinose; margin straight, entire. Lamellae adnate, dull white; subdistant with lamellulae of 2 lengths; edge smooth. Stipe 1.5-2.5 cm x 1.5-2 mm thick, central, cylindric, hollow; surface cinnamon brown, densely pruinose. Spore-print white. Spores 6-9 x 3-4 µm, pip-shaped, hyaline, inamyloid, thin-walled, smooth. Basidia 20-23 x 5-7 µm, clavate bearing 4 sterigmata up to 4 µm long. Lamella-edge sterile. Cheilocystidia 23-25 x 11-12 µm, clavate, hyaline, thin-walled. Pleurocystidia absent. Hymenophoral trama regular, inamyloid, context white, inamyloid, hyphae thin-walled. Pileipellis a disrupted trichodermium of elongate pileocystidia arising from narrow repent hyphae. Pileocystidia 30-60 x 8-12 µm, clavate, hyaline, thin-walled, erect or ascedent. Stipe tissue inamyloid; hyphae thin-walled. All hyphae with clamp-connections.

Collybia multijuga (Berk. & Broome) Sacc., *Syll. fung.* (Abellini) 5: 231 (1887)

Collybia multijuga is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs scattered in large caespitose clusters on humus rich soil. Fruit bodies small-sized. Pileus 3-4 cm diam., convex and umbonate, later depressed and umbilicate; surface dark brown at umbo, pale brown elsewhere, fibrillose; margin straight, entire. Lamellae adnato-decurrent, off white, up to 3 mm wide, subdistant, with lamellulae; edge smooth. Context thin, white, 2 mm thick at disk, of thin-walled hyphae, inamyloid. Stipe 6-8 cm x 2-4 mm thick, central, cylindric, equal, hollow; surface pale brown, off white at apex, fibrous. Spore-print white.

Spores 8-10 x 4-5 µm, ellipsoid to pip-shaped, hyaline, inamyloid, thin-walled, smooth. Basidia 25-26 x 5-6 µm, cylindro-clavate, bearing 4 sterigmata. Lamella-edge sterile with cheilocystidia. Cheilocystidia 20-26 x 6.5-7 µm, clavate, thin-walled, hyaline. Pleurocystidia rare, 27-33 x 7.5-10 µm, clavate-ventricose, thin-walled, hyaline. Hymenophoral trama regular, inamyloid; hyphae inflated, 2-18 µm diam., hyaline, thin-walled. Pileipellis a repent epicutis of narrow radially parallel hyphae 3-6 µm diam., thin-walled with dark brown encrusting pigment. All hyphae with clamp-connections.

Lepista hyalodes (Berk. & Broome) Pegler, *Kew Bull.*, Addit. Ser. 12: 79 (1986)

Lepista hyalodes is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs solitary or scattered in small clusters on humus rich soil.

Fruit bodies small to medium sized. Pileus 5-6.5 cm diam., thin, brittle, convex to umbonate becoming depressed to cyathiform on expansion; surface white to cream colour, sometimes with yellowish white tints at the centre, dry, smooth, glabrous, not striate; margin incurved then straight, undulate. Lamellae sinuato-decurrent, whitish then greyish orange (5B3), narrow, 3 mm wide, moderately crowded, with lamellulae of 2 lengths; edge often irregular. Stipe 5-9 cm x 7-10 mm, equal, cylindric or fusoid with a tapering base, solid then fistulose; surface white, fibrillose striate, often cracking longitudinally, with a whitish tomentose base. Context variable, up to 6 mm thick at the umbo, white, unchanging, of much inflated, thin-walled hyphae, 5-16 µm diam., with clamp-connections. Spore-print pale pink. Spores 5-6.5 x 3-4.5 µm, ovoid to ellipsoid, subhyaline, thin-walled, with a fine but distinct verruculose ornamentation. Basidia 30-35 x 6-6.5 µm clavate, bearing four sterigmata. Lamella-edge fertile. Hymenophoral trama regular, hyaline, of parallel hyphae, 3-15 µm diam. Subhymenial layer 6-9 µm wide, pseudoparenchymatous. Pileipellis a poorly differentiated epicutis of hyaline, woven hyphae, 3-8 µm diam.

Lepista sordida (Schumach.) Singer, *Lilloa* 22: 193 (1951) [1949]

Lepista sordida is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs scattered in small to large caespitose clusters on humus rich soil. This species is usually found beneath the bamboo (*Bambusa bambos, Dendrocalamus strictus*) clumps.

Fruit bodies small to medium sized. Pileus 2-7.5 cm diam., broadly conico-campanulate soon expanding and depressed, umbonate; surface hygrophanous, greyish lilac to violaceous, discolouring pale greyish brown at centre, drying ash-grey, glabrous and smooth; margin incurved then expanded and finally lobate, striate when moist. Lamellae sinuato-adnate, lilaceous to pale greyish brown, up to 6 mm broad, much narrower, rather crowded, with lamellulae of 2 lengths. Stipe 3-7 cm x 4-9 mm, often curved, equal or slightly tapering towards the apex, solid or fistulose; surface concolorous with pileus, often with brown streaks, longitudinally fibrillose, with a tomentose base. Context thin, up to 2 mm thick at centre, aqueous, lilac or greyish brown, of thin-walled, inflated hyphae, 3-16 µm diam., with clamp-connexions. Spores 6-7 x 3.5-4 µm, oblong ellipsoid, hyaline, thin-walled, with a fine but distinct ruguloso-verruculose ornamentation. Basidia 20-24 x 5-6 µm, clavate, bearing four

sterigmata. Lamella-edge fertile. Hymenophoral trama regular, hyaline, with parallel, inflated hyphae, 2-20 µm diam. Subhymenial layer 6-10 µm diam., pseudoparenchymatous. Pileipellis a repent epicutis of radially parallel hyphae, 4-8 µm diam., hyaline, thin-walled.

Macrocybe lobayensis (R. Heim) Pegler & Lodge, in Pegler, Lodge & Nakasone, *Mycologia* 90(3): 498 (1998)

Mcrocybe lobayensis is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs scattered in large caespitose clusters on humus rich soil.

Fruit bodies medium to large sized. Pileus 8-25 cm diam., fleshy, convex to applanate, surface white with pale greyish tints, glabrous, smooth, non-striate, margin lobed, inrolled. Lamellae adnate to sinuate, cream colour with pale pink tints, narrow up to 2 mm broad, moderately crowded, with lamellulae of 5 lengths, edge entire. Stipe 10-30 x 2-2.5 cm, cylindrical with a swollen base, solid, finally fistulose; surface white to pale greyish, fibrillose, rugose to glabrous, arising from a buried pseudosclerotium. Context up to 2 cm thick, white, colour unchanging, firm, fibrillose, consisted of very thin-walled hyphae, 2-5 µm diam., inflated to 12 µm diam. with clamp- connections. Odour of bitter almonds. Spore-print white. Basidiospores 6-8 x 4-5 µm, ovoid to broadly ellipsoid, hyaline, thin-walled, containing single large refractive guttule. Basidia 28-35 x 4-6 µm, narrowly clavate, bearing 4 sterigmata with a basal clamp connection. Lamella-edge heteromorphous. Cheilocystidia rare, 23-32 x 5-7 µm, clavate-cylindrical with granular contents. Caulocystidia 40-45 x 5-8 µm, clavate, thin-walled, hyaline. Hymenophoral trama regular, hyaline with thin-walled hyphae 2-8 µm diam. Pileipellis a thick cutis of closely interwoven hyphae, 2-4 µm diam., thin-walled, much branched with oleaginous contents and clamp-connections.

Macrocybe pachymeres (Berk. & Broome) Pegler & Lodge, in Pegler, Lodge & Nakasone, *Mycologia* 90 (3): 498 (1998)

Macrocybe pachymeres is widely distributed in moist-deciduous to semi-evergreen forests and homesteads (coconut garden) of the State and occurs scattered in small groups on humus rich soil and decaying forest litter. This large, fleshy, edible species is of pantropical distribution and originally described from Sri Lanka.

Fruit bodies large sized. Pileus 8-22 cm diam., fleshy, hemispherical to convex; surface pale yellowish brown becoming paler towards the margin, at first covered by a white tomentum, soon glabrescent, dry, finally tessellate; margin inrolled, projecting beyond the lamellae. Lamella sinuato-adnexed, greyish yellow (2B3) with pale pinkish tint, up to 11 mm wide, very crowded, with lamellulae of 2 lengths. Stipe 6-9 cm x 2-5 cm, stout, cylindric or swollen either at the base or the centre, solid; surface off white, covered with numerous, greyish brown, recurved fibrillose squamules, slowly bruising dark brown. Context 3 cm thick, pure white, tough, of narrow, thin-walled hyphae, 4-8 µm diam., with clamp-connections; odour faint, pleasant, taste not distinctive. Spores 5-7 x 4-6 µm, subglobose to ovoid, hyaline, inamyloid, with a large guttule. Basidia 38-63 x 8-10 µm, clavate, guttulate, bearing four sterigmata. Lamella-edge sterile. Cheilocystidia rare, 31-40 x 8-8 µm, clavate, thin-walled, with granular contents. Hymenophoral trama regular, hyaline, broad, of parallel hyphae,

2.5-6 µm diam. Subhymenial layer narrow, interwoven. Pileipellis a repent epicutis of tightly woven, narrow hyphae, 3-6 µm diam.

Tricholoma ceriniceps Pegler, *Kew Bull.*, Addit. Ser. **9**: 112 (1983)

Tricholoma ceriniceps is widely distributed in moist-deciduous to semi-evergreen forests of the State and occurs scattered in small groups on soil around tree species like *Xylia xylocarpa, Terminalia paniculata*, among others. Fruit bodies small to medium sized. Pileus 6-8 cm diam., at first hemispherical to broadly convex becoming umbonate, occasionally depressed; surface uniformly greyish brown margin reddish white, smooth, dry, glabrous; margin inrolled and pruinose. Lamellae adnate to sinuate, white, 7-10 mm wide, densely crowded with lamellulae of 4 lengths. Stipe 4-6 x 4-16 mm, cylindric expanding, sometimes abruptly to 3 cm diam. at the base, hollow; surface whitish, pruinose, with small, scattered reflexed reddish white squamules towards the base. Context 8 mm thick, whitish, unchanging, firm of inflated hyphae, 3-12 µm diam., lacking clamp-connections; odour farinaceous; taste extremely bitter. Spores 6-7 x 4-5 µm, ellipsoid, hyaline, inamyloid, thin-walled. Basidia 25-30 x 4-6 µm, narrowly clavate, bearing 4 sterigmata. Lamella-edge fertile. Hymenophoral trama regular, hyaline, of parallel hyphae, 2-12 µm diam. Subhymenium narrow, interwoven. Pileipellis an epicutis of tightly interwoven, narrow, thin-walled hyphae, 2-3 µm diam.

Tricholomopsis tropica Dennis, *Trans. Br. mycol. Soc.* 34(4): 475 (1951)

Tricholomopsis tropica is widely distributed in moist-deciduous to semi-evergreen forests and bamboo stands of the State and occurs scattered in small groups on soil and decaying forest litter. This species is usually found associated with bamboo clumps (*Bambusa bambos*). Fruit bodies small sized. Pileus 3-5.5 cm diam., convex expanding, slightly depressed at the disk; surface pale yellow, covered by a tomentum of erect, downy hairs disrupting into dark brown crowded squamules. Lamellae sinuato-adnate, yellow, narrow up to 2 mm wide, crowded, with lamellulae of two lengths; edge denticulate. Stipe 3-4 cm x 4-7 mm, cylindric, hollow; surface yellow, paler at top, longitudinally striate, with faint zones of yellowish brown, fibrillose squamules. Context pale yellowish, of thin-walled hyphae, 3-14 µm diam., with clamp-connections. Spores 5-6 x 4-5 µm, subglobose, hyaline, inamyloid, thin--walled, with a large oil guttule. Basidia 24-30 x 6-7 µm, clavate, bearing four sterigmata. Lamella-edge sterile, with crowded cheilocystidia. Cheilocystidia 25-30 x 7-8 µm, pyriform, inflated clavate to sub-pedicillate, hyaline, thin-walled. Hymenophoral trama regular, hyaline, with parallel thin-walled hyphae and refractive gloeoelements. Subhymenial layer interwoven. Pileipellis a disrupted of loosely woven hyphae, 3-6 µm diam., with a thickened brown wall.

46. XYLARIACEAE Tul. & C. Tul. 1861
Xylariales : Ascomycota

The family Xylariaceae contains about 73 genera. It is one of the most commonly encountered groups of ascomycetes and is found throughout the temperate and tropical regions of the world. Members are typically found on wood, seeds, fruits,

pods, plant debris, some even associated with termite nests. Among the 73 genera, *Daldinia* and *Xylaria* are the most significant ones. *Daldinia concentrica* is known by several common names, including 'King Alfred's Cake', 'cramp balls', and 'coal fungus'. This species is widely distributed in deciduous to evergreen forests, especially in disturbed and fire-prone forest areas. *D. concentrica* contains several unique compounds, including a purple pigment from a perylene quinone and a metabolite called concentricol, which is oxidized squalene. Many types of insects and other small animals make their home inside the stromata of this fungus. So far, no *Daldinia* species has been reported from Kerala. *Daldinia concentrica* is a new record for Kerala.

The genus *Xylaria* contains about 100 species of cosmopolitan fungi. *Xylaria polymorpha*, commonly known as dead man's fingers, is a plant pathogen. *X. polymorpha* and *symplocosii* are common in moist-deciduous to evergreen forests, usually growing from the bases of roots or injured tree stumps and decaying roots and wood. *Xylaria hypoxylon* commonly known as the 'candlestick fungus', the 'candlesnuff fungus', 'carbon antlers', or the 'stag's horn fungus', occurs on rotting wood, and also colonize on substrates like woody legume pods, and herbaceous stems, and forest litter. The stromata are characterized by erect, elongated black branches with whitened tips, typically grow in clusters on decaying substrata. *Xylaria escharoidea* and *Xylaria nigripes* are found associated with inactive termite nests and mounts.

Daldinia concentrica (Bolton) Ces. & De Not., *Comm. Soc. crittog. Ital.* 1(no. 4): 197 (1863)

Daldinia concentrica is widely distributed in dry deciduous to evergreen forest ecosystems of the State and occurs scattered in small clusters on decaying trunks and rotting logs, especially in fire-prone areas.

Fruit bodies appear as hard hemispherical to variously shaped cushions up to 4.5 cm diam., annual, reddish brown to purplish brown, soon changes to black. The outer surface smooth, somewhat shiny, dotted with minute pores formed by the ostiole of the perithecia. In a vertical section, stromata show distinct concentric zoning of its fibrous hyphal tissues caused by the regions of thick-walled hyphae alternating with less thick regions. Perithecia crowded in a single layer just below the outer crust, immersed in stromatal tissue, possess a conical neck. Asci within the perithecium immersed in mucilage, cylindrical, 80-150 x 8-12 µm, with long stalk. Ascospores uniseriate, elliptical to inequilateral, opaque at maturity, 12-16.5 x 6-9.5 µm; conidia ovate to ellipsoid, olive green, 6-8 x 4-5 µm.

Xylaria longipes Nitschke, *Pyrenomycetes Germanici* 1: 14 (1867)

Xylaria longipes is distributed in moist-deciduous to evergreen forests of the State and occurs solitary or in small groups on decaying wood and logs. Fruit bodies cylindrical to clavate to flattened irregular, solitary or several arising from a common base, unbranched or occasionally branched, with rounded fertile apices, with long, short or obsolete stipe, 2-6 x 0.4-1.1 cm. Immature stromatal surface grayish white to brown, becoming black with age, somewhat rugose, often with fine cracks, or more or less smooth; stromatal context white. Perithecia 0.5-1 mm diam. Asci 8-spored, long

stipitate, 130-200 µm total length x 8 um diam., spore bearing part 85-100 µm long. Ascus apical ring inverted hat-shaped, bluing in Melzer's reagent. Ascospores brown to blackish brown, smooth, one-celled, ellipsoid-inequilateral, with a long germ-slit which is spiral around the spore in such a manner that a portion of the slit is usually visible on the lateral wall, 13-15 x 5-6.5 µm. Immature hyaline ascospores with a cellular appendage which disappear as spores attain their mature colour.

Xylaria symplocosii Pande, Waingankar, Punekar & Randive, *Ind. J. For.* 28(3): 267-269 (2005)

Xylaria symplocosii is distributed in semi-evergreen forests of the State and occurs solitary or scattered in small groups on soil around large trees with wilting or die-back symptoms. This species is very close to *Xylaria gigantea*. This species is very distinctive in emerging out through the roots of wilt affected trees.

Fruit bodies erect, mostly straight, solitary, smooth, cylindrical, apex rounded, or rarely notched in upper part, surface pale yellow to yellowish green, with black dots of ostioles spread over entire surface, interior white, 20-25 cm x 4-5 cm. Stipe concolourous, slightly narrow, cylindrical, 2-5 cm long, 2-3 cm diam. Stromatal surface becomes black and wrinkled on drying. Perithecia numerous, innate, in one layer below the surface of stromata, ostiole punctuate or slightly papillate; perithecia 700-790 x 310-450 µm. Asci numerous, cylindrical, stipitate, 8-spored, paraphysate, 95-135 x 10-12 µm; pedicel 25-35 x 3-4 µm. Ascospores light brown to brown, one celled, navicular or fusoid, slightly pinched at both tips, 12-16 x 4-6 µm, with germ-slits straight, running entire length.

CONCLUSIONS

The three years inventory data reveal that Western Ghats of Kerala State is endowed with a remarkably rich macrofungal flora. A total of 550 species of macrofungi belonging to 166 genera falling in 51 fungal families of Basidiomycota and Ascomycota were encountered in different forest ecosystems of the State. Each forest ecosystem supports unique assemblage of macrofungal communities and their occurrence, abundance and species composition, depend largely on the prevailing microclimatic conditions and level of anthropogenic disturbances. Among the forest ecosystems studied, moist-deciduous and semi-evergreen forests support maximum number of macrofungi, followed by evergreen and shola forests. The grassland ecosystem supports only a few macromycetes, while Myristica swamp forests harbour an array of different interesting groups of macrofungi. Macrofungal species assemblage, species abundance and frequency are very characteristic in the shola forests. Among the macrofungi encountered, terricolous, humicolous and lignicolous form the major groups, while coprophilous or macrofungi inhabiting on dung of herbivores are the insignificant group. Of the 550 species of macrofungi reported herein, more than 360 species are new record for Kerala, more than 300 species are new record for the country and 15 are hitherto unrecorded species.

SELECTED REFERENCES

Abraham, T.K, Vrinda, KB., Pradeep, C.K and Vijaya Joseph, A. 1995. Edible Cantherelle from Southern India. *Mushroom Res.* 4: 73-76.

Aim, M.C., Vilgalys, R. and Miller, O.K. 2005. The *Crepidotaceae* (*Basidiomycota, Agaricales*): Phylogeny and taxonomy of the genera and revision of the family based on molecular evidence. *Am. J. Bot.* 92: 74-82.

Anjali Roy and De, A.B. 1996. Polyporaceae of India. International Book Distributors, Dehra Dun, 309 p.

Ammirati, J.F. Traquair, J.A. and Horgen, P.A. 1986. Poisonus mushrooms of the Northern United States and Canada (Minneapolis): 396p.

Antonin, V., Halling, R.E. Noordeloos, M.E. 1997. Generic concepts within the groups of *Marasmius* and *Collybia sensu lato. Mycotaxon* 63: 359-368.

Bakshi, B.K. 1971. Indian Polyporaceae (on timber and Trees). Indian Council of Agricultural Research, New Delhi, 246 pp.

Bandoni, R.and Ginns, J. 1999. Notes on *Tremella mesenterica* and allied species. *Cn. J. Bot.* 76: 1544-1557.

Baroni, T.J. and Horak, E. 1994. *Entolomataceae* in North America III: new taxa, new combinations and notes on species of *Rhodocybe. Mycologia* 86: 138-145.

Bas, C. 1990. Tricholomataceae R.Heim ex Pouz. In: Flora *Agaricina Neerlandica* 2:65.

Baseia, I.G. 2003. Contribution to the study of the genus *Calvatia* (*Lycoperdaceae)* in Brazil. *Mycotaxon* 88: 107-112.

Bateman, G. L. and Nabb, S. 2000. *Volvariella speciosa* in arable fields. *Mycologist* 14: 16.

Bessette, A.E., Bessette A. R. and Fischer, D.W. 1997.Mushrooms of Northeastern North America. Syracause University Press, 582 pp.

Bhavani Devi, S., Nair, M.C. and Menon, D.M.R.1980. *Termitomyces robustus* - an addition to Indian edible mushrooms. *Kavaka* 8: 53-54.

Binder, M and Bresinsky, A. 2002. Derivation of a polymorphic lineage of gasteromycetes from boletoid ancestors. *Mycologia* 94: 85-98.

Binder, M. and Hibbett, D.S. 2002. Higher-level phylogenetic relationships of homobasidiomycetes (mushroom-forming fungi) inferred from four rDNA regions. *Mol. Phylogen. Evol.* 22:76-90.

Binder, M. and Hibbett, D.S. 2006. Molecular systematics and biological diversification of Boletales. *Mycologia* 98 (6): 971-981.

Boa, E.R.2004. Wild Edible Fungi: a Global Overview of Their Use and Importance to People, Food and Agriculture Org. Rome.

Bodensteiner, P., Binder, M., Moncalvo, J.M., Agerer, R. Hibbett, D.S. 2004. Phylogenetic relationships of cyphelloid homobasidiomycetes. *Mol. Phylogen. Evol.* 33: 501-515.

Bougher, N.L. and Young, A.M. 1997. *Hygrophoraceae* of Western Australia. *Mycotaxon* 63: 25-35.

Callan, B.E., Rogers, J.D. 1993. A synoptic key to *Xylaria* species from continental United States and Canada based on cultural and anamorphic features. *Mycotaxon* 46: 141-154.

Cannon, P.F. and Kirk, P.M. 2007. Fungal Families of the World. Wallingford: CAB International, Wallingford, UK, 456 pp.

Corner, E.J.H. 1950. A monograph of *Clavaria* and allied genera. *Ann. Bot.Mem.* 1: 1-740.

Diez, J. Anta, B., Manjon, J.L. and Honrubia, M. 2001. Genetic variability of *Pisolithus* isolates associated with native hosts and exotic eucalyptus in the western Mediterranean region. *New Phytol.* 149: 577-587.

Ding, M.R. and Wen, H.A. 2003. Studies on *Suillus* from southwest China. *Nova Hedwigia* 76: 459-464.

Drehmel, D., Moncalvo, J.M. and Vilgalys, R. 1999. Molecular phylogeny of *Amanita* based on large-subunit ribosomal DNA sequences: implications for taxonomy and character evolution. *Mycologia* 91: 610-618.

Ellis, M.B. and Ellis, J.P. 1990. Fungi without Gills (Hymenomycetes and Gasteromycetes) : An Identification Handbook. Chapman and Hall, London, New York, Tokyo, Madras, 329p.

Gilbertson, R.L. and Ryvarden, L. 1986. North American Polypores. Fungiflora, Oslo, Norway, 433 pp.

Gonzalez, F.S.M. and Rogers, J.D. 1989. Preliminary account of *Xylaria* of Mexico. *Mycotaxon* 34: 283-373.

Gottlieb, A.M. Ferrer, E. and Wright, J.E. 2000. rDNA analyses as an aid to the taxonomy of species of *Ganoderma. Mycol. Res.* 104: 1033-1045.

Harrington, F.A. 1998. Relationships among *Sarcoscypha* species. Evidence from molecular and morphological characters. *Mycologia* 90: 235-243.

Harrison, K.A. and Grund, D.W. 1987. Differences in European and North American stipitate hydnums. *Mycotaxon* 28: 427-435.

Hawksworth, D.L. 2001. The magnitude of fungal diversity: the 1.5.million species estimate revisited. *Mycol. Res.* 105(2): 1422-1432.

Heinemann, P. and Leelavathy, K.M. 1991. The genus *Micropsalliota* (Agaricaceae) in Kerala State, India. *Mycol. Res.* 95(3): 341-346.

Hosaka, K., *et al.* 2006. Molecular phylogenetics of the gomphoid-phalloid fungi with an establishment of the new subclass *Phallomycetidae* and two new orders". *Mycologia* 98 (6): 955.

Hughes, K.W. and Petersen, R.H. 1998. Relationships among *Omphalotus* species (*Paxillaceae*) based on restriction sites in the ribosomal ITS1-5.8 S-1TS2 region. *Pl. Syst. Evol.* 211: 231-237.

Iyengar, M.O.P. and Krishnamurthy, V. 1954. A note on *Aseroe rubra* (La Bill) Fries var. *zeylanica* (Berk.) Ed. Fischer from South India. *Lloydia* 17: 257-262.

Johnston, P.R., and Nuchanan, P.K. 1995. The geneus *Psilocybe(Agaricales)* in New Zeland. *N.Z. J. Bot.* 33: 379-388.

Joseph, A.V. and Manimohan, P. 1998. Rediscovery of two rare agaricoid asidiomycetes. *Mycol. Res.* 102(4): 476-478 .

Joseph, A.V., Abraham, T.K., Vrinda, K.B. and Pradeep, C.K. 1995. New Agarics from India. *Mushroom Res.* 4: 1-6.

Kirk, P.M., Cannon, P.F. and Minter, D.W., Stalpers, J.A. (eds.) 2008. Ainsworth & Bisby's Dictionary of the Fungi. Tenth Edition, CAB Internationall, Wallingford, UK, 771 pp.

Kruger, D., Binder, M., Fischer, M. and Kreisel, H. 2001. The *Lycoperdales.* A molecular approach to the systematics of some gasteroid mushrooms. *Mycologia* 93: 947-957.

Lakhanpal, T.N. 1996. Mushrooms of India: Boletaceae, A.P.H. PUBLISHING Corporation, New Delhi.

Largent, D.L. 1985. The Agaricales of California 5: Hygrophoraceae. Eureka, CA: Mad River Press.

Leelavathy, K.M. and Sr. Little Flower 1981. Additions to South Indian Agaricales-I. *Kavaka* 9:31-33.

Leelavathy, K.M. and Sr. Little Flower 1986. The genus *Micropsalliota* in India. *Kavaka* 14(1,2):17-23.

Leelavathy, K.M. and Ganesh, P.N. 2000. Polypores of Kerala. Daya Publishing House, New Delhi. 166p.

Leelavathy, K.M., Manimohan, P. and Arnolds, E.J.M. 2006. *Hygrocybe* in Kerala State, India. *Persoonia* 19(1): 101-151. 2006.

Manimohan, P. and Thomas, K.A. 1998. A new species of *Gloiocephala* from India. *Mycotaxon* 69:87-91.

Manimohan, P. Joseph, A.V. and Leelavathy, K.M. 1995. The genus *Entoloma* in Kerala State, India. *Mycol. Res.* 99: 1083-1097.

Manimohan, P., Leelavathy, K.M. and Noordeloos, M.E. 2002. Three new species of *Entoloma* from Kerala State, India. *Persoonia* 17(4):625-630.

Manimohan, P., Noordeloos, M.E. and A.M. Dhanya, A.M. 2006. Studies on the genus *Entoloma* (Basidiomycetes, Agaricales) in Kerala State, India. Persoonia 19(1): 45-93.

Manimohan, P., Vrinda, K.B. and Leelavathy, K.M. 1988. Rare agarics from Southern India. *Kavaka* 16(1,2): 50-56.

Marren, P. 1995. Stinkhorns, earth stars and fungal flowers: the strange world of gasteromycete fungi. *British Wildlife* 6: 366-376.

McNabb, R.F.R. 1965. Taxonomic studies on *Dacrymycetaceae* II. *Calocera* (Fries) *N.Z. J. Bot.* 3: 31-58.

Miller, S. L. Steven L. Miller, Terry M. McClean, John F. Walker and Bart Buycket al. 2001. A molecular phylogeny of the Russulales including agaricoid, gasteroid and pleurotoid taxa. *Mycologia* 93: 344-354.

Mohanan, C. 1997. Diseases of Bamboos in Asia: An Illustrated Manual.International Network for Bamboo and Rattan, Beijing, Eindhoven, New Delhi, 228 pp.

Mohanan, C. 1994. Decay of standing trees in natural forest. Kerala Forest Research Institute Research Report No. 97, Kerala Forest Research Institute, Peechi, Kerala.

Mohanan, C 2003. Mycorrhizae in forest plantations: Association, Diversity and Exploitation in planting stock improvement. Kerala Forest Research Institute Research Report No. 252. Kerala Forest Research Institute, Peechi, Kerala.

Mohanan, C. 2007. Prevalence of decay and decay fungi in natural forests of Kerala, India. *Journal of Tropical Forestry* 23: 39-47.

Mohanan, C. and Jayaraman, K. 2007. Identification of heart rot in commercial tree species in natural forests of Kerala, India by the use of decay indicators. *Journal of Tropical Forestry* 22: 30-42.

Mohanan, C. and Rajeshkumar, K.C. 2008. *Ganoderma* root and butt rot of *Acacia mangium* plantations in Kerala, India. *Ind. J. Forestry* 31 (3): 375-378.

Mohanan, C., Sumesh, P.M., Rajesh, P. and Anila, K.B. 2010. Biodiversity of macrofungi in the Western Ghats of Kerala. *Proc. 22nd Kerala Science Congress*, 28-31 January 2010, Peechi, Kerala, 673-674.

Moncalvo, J.M. Lutzoni, F.M. Rehner, S.A., Johnson, J. Vilgalys, R. 2000. Phylogenetic relationships of agaric fungi based on nuclear large subunit ribosomal DNA sequences. *Syst. Biol.* 49: 278-305.

Moncalvo, J.M., Vilgalys, R., Redhead, S.A., Johnson, J.E., James, T.Y., Aime, M.C., Hofstetter, V., Verduin, S.J.W., Larsson, E., Baroni, T.J., Thorn, R.G., Jacobsson, S., Clemencon, H., and Miller, O.K. 2002. One hundred and seventeen clades of euagarics. *Mol. Phylogen. Evol.* 23: 357-400.

Mueller, G.M. 1997. Distribution and species composition of *Laccaria (Agaricales)* in tropical and subtropical America. *Revta Biol. trop.* 44: 131–5.

Murrill, W. 1903. A historical review of the genera of the polyporaceae. *The Journal of Mycology* 9(2): 87-102.

Natarajan, K and Raman, N. 1983. South Indian Agaricales. *J Cramer* FL-9490 Vaduz, Germany: 203p.

Noordeloos, M.E. 1987. *Entoloma (Agaricales)* in Europe. Synopsis and keys to all species and a monograph of the subgenera *Trichopilus, Inocephalus, Alboleptonia, Leptonia, Paraleptonia,* and *Omphaliopsis. Beih. Nova Hedwigia* 91: 419p.

Nordstein, S. 1990. The genus *Crepidotus* (*Basidiomycotina, Agaricales*) in Norway. *Syn. Fung.* (Oslo)2: 1-115.

Pande, A. 1978. Contributions to the Xylariaceae of Western India - XI. *Indian Phytopath.* 31: 106-107.

Pande, A. Waingankar, V., Punekar, S. and Randive, K. 2005. A new Xylaria from Western Ghats of India. *Ind. J. Forstry* 28(3): 267-269.

Pegler, D.N. 1977. A Preliminary Agaric Flora of East Africa. *Kew Bull.* Addit. Ser. 6: 615 pp.

Pegler, D.N. 1983. Agaric Flora of the Lesser Antilles. *Kew Bull.* Addit. Ser. 19: 666 p.

Pegler, D.N. 1986. Agaric Flora of Sri Lanka. *Kew Bull.* Addit. Ser. 12:519 p.

Pegler, D.N., Lessoe, T. and Spooner, B.M. 1995. *British Puffballs. Earthstars and Stinkhorns.* An Account of the British Gasteroid Fungi (Kew): 255p.

Peintener, U., Moser, M.M., Thomas, K.A., and Manimohan, P. 2003. First records of ectomycorrhizal *Cortinarius* species from tropical India and their phylogenetic position based on rDNA ITS sequences. *Mycol. Res.* 107: 485-494.

Petersen, R.H. 1985. Notes on clavarioid fungi. XX. New taxa and distributional records in *Clavulina* and *Ramaria. Mycologia* 77: 903-919.

Pradeep, C.K. and Vrinda, K.B. 2006. New and noteworthy species of *Pluteus* (Pluteaceae, Agaricales) from Kerala State, India. *Persoonia* 19(1): 95-99.

Rattan, S.S. 1977. The Resupinate Aphyllophorales of the North Western Himalayas. Bibliotheca Mycologica, J. Cramer, FL-9490 Vaduz, 427 pp.

Reid, D.A. 1974. A monograph of the British *Dacrymycetales. Trans. Br. Mycol. Soc.* 62: 433-494.

Rogers,J.D., Yu-Ming Ju, Lehmann, J. 2005. Some Xylaria species on termite nests. Mycologia 97 (4): 914-923.

Ryvarden, L., and Johansen, I. 1980. A Preliminary Polypore Flora of East Africa. Fungiflora, Oslo, Norway, 636 pp.

Ryvarden, L. 2004. Studies in Neotropical polypores 19. Two wood-inhabiting *Amauroderma* species. *Syn. Fung.* (Oslo) 18: 57-61.

Sathe, A.V. and Daniel, J. 1980. Agaricales (Mushrooms) of Kerala State. MACS Monograph No.1: 75-108.

Shaffer, R. L. 1957. *Volvariella* in North America. *Mycologia* 49: 545-579.

Sims, K.P. Watling, R. Jeffries, P. 1995. A revised key to the genus *Scleroderma. Mycotaxon* 56: 403-420.

Singer, R. and Hausknecht, A. 1988. Notes on *Conocybe (Bolbitiaceae). Pl. Syst. Evol.* 159: 107-121.

Singer, Rolf 1986. *The Agaricales in Modern Taxonomy.* Koenigstein: Koeltz Scientific Books, 981p.

Stijve, T. 1997. Close encounters with *Clathrus rubber,* the latticed stinkhorn. *Australas. Mycol. Newsl.* 16: 11-35.

Thomas, K.A. and Manimohan, P: 2003. The genus, *Agrocybe* in Kerala State, India. *Mycotaxon* 86: 317- 333

Thomas, K.A., Guzman-Davlos, L. and Manimohan, P. 2003. A new species and new records of *Gymnopilus* from India. *Mycotaxon* 85: 297-305.

Thomas, K.A., Manimohan, P., Guzman, G., Tapia, F. and Ramirez-Guillen, F. 2002b. The genus *Psilocybe* in Kerala State, India. *Mycotaxon* 83: 195-207

Thomas, K.A., Ursula Peintner, Moser, M.M. and Manimohan, P. 2002a. *Analmika,* a new mycorrhizal genus of Cortinariaceae from India and its phylogenetic position based on ITS and LSU sequences. *Mycol. Res.* 106(2): 245-251.

Thorn, R.G., Moncalvo, J.M., Reddy, C.A. and Vilgalys R. 2000. Phylogenetic analyses and the distribution of nematophagy support a monophyletic *Pleurotaceae* within the polyphyletic pleurotoid-lentinoid fungi. *Mycologia* 92: 241-252.

Vellinga, E.C., de Kok, R.P.J. and Bruns, T.D. 2003. Phylogeny and taxonomy of *Macrolepiota (Agaricaceae). Mycologia* 95: 442-456.

Vrinda, K.B, Pradeep, C.K., Mathew, S. and Abraham, T.K. 1999b. Agricales from Western Ghats - VII. *Mushroom Res.* 8(2): 9-12.

Vrinda, K.B. and Leelavathy, KM. 1996. New records of Agaricus from India. *J. Econ. Taxon. Bot.* 20(2): 345-349.

Vrinda, K.B., Pradeep, C.K and Abraham, T.K. 2000. A large bolete from the Western Ghats. *Mushroom Res.* 9(2): 113-115.

Vrinda, K.B., Pradeep, C.K. and Abraham, T.K 2001. Additions to Indian mushroom flora. *Mushroom Res.* 10(1): 1-4.

Vrinda, K.B., Pradeep, C.K. and Abraham, T.K. 1997c. A new species of *Russula* from Kerala, India. *Mycotaxon* 62: 389-393.

Vrinda, K.B., Pradeep, C.K., Pradeep, N.S and Abraham, T.K 1996a. Agaricales from Western Ghats - 1. J. *Mycopathol. Res.* 34(2); 119-123.

Weinstein, R.N., Iturriaga, T. 2002. A phylogenetic study of the genus *Cookeina. Mycologia* 94: 673-682.

Weiss, M. and Oberwinkler, F. 2001. Phylogenetic relationships in *Auriculariales* and related groups – hypoteses derived from nuclear ribosomal DNA sequences. *Mycol. Res.* 105: 403-415.

Young, A.M. and Mills, A.K. 2002. The *Hygrophoraceae* of Tasmania. *Muelleria* 16: 3-28.

Zhang, L.F., Yang, J.B. and Yang, Z.I. 2004. Molecular phylogeny of eastern Asian species of *Amanita(Agaricales, Basidiomycota)*: taxonomic and biogeographic implications. *Fungal Diversity* 17: 219-238.

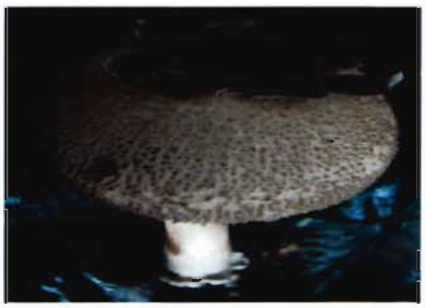
Agaricus endoxanthus

Agaricus endoxanthus

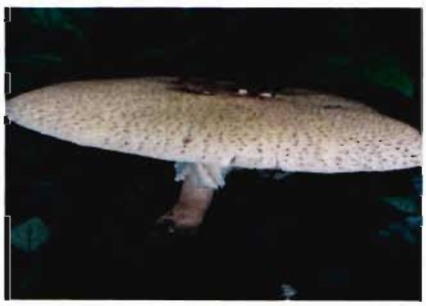
Agaricus silvaticus

Chlorophyllum rachodes

Chlorophyllum molybdits



Clarkeinda trachodes



Clarkeinda trachodes

Coprinus comatus

Coprinus comatus

Coprinus disseminatus

Lepiota clypeolaria

Lepiota xanthophylla

Leucoagaricus leucothites

Leucoagaricus rubrotinctus

Leucoagaricus birnbaumii

Leucocoprinus cepistipes

Leucocoprinus zeylanicus

Macrolepiota dolichaula

Macrolepiota dolichaula

Macrolepiota procera

Macrolepiota procera

Amanita angustilamellata

Amanita bisporigera

Amanita griseofarinosa

Amanita hemibaha

Amanita hemibaha

Amanita muscaria

Limacella guttata

Auricularia auricula-judae

Auricularia auricula-judae

Bolbitius fissus

Conocybe ochracea

Conocybe zeylanica

Copelandia wayanadensis

Panaeolina foenisecii

Panaeolus antillarum

Panaeolus cyanescens

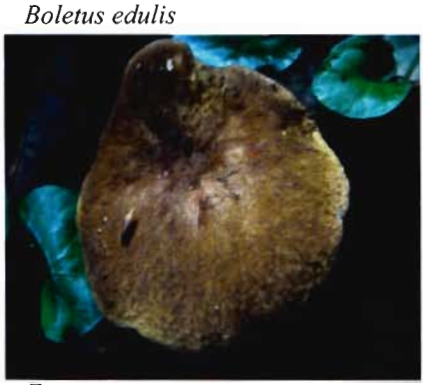
Astroboletus garcilis

Boletus alutaceus

Boletus edulis

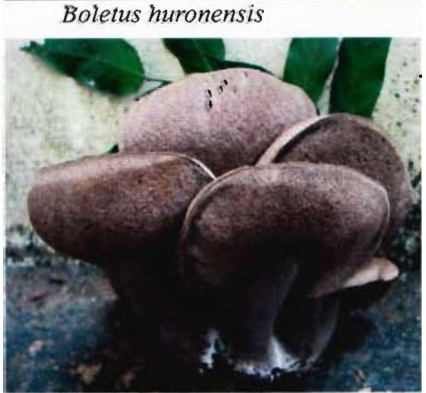
Boletus hongae

Boletus huronensis



Gyroporus castaneus

Gyroporus castaneus



Rubinoboletus caespitosus

Strobilomyces mollis

Strobilomyces strobilaceus

Boletinellus merulioide

Boletinellus merulioide

Phlebopus protensous

Bulgariaceae indica

Cantharellus cibarius

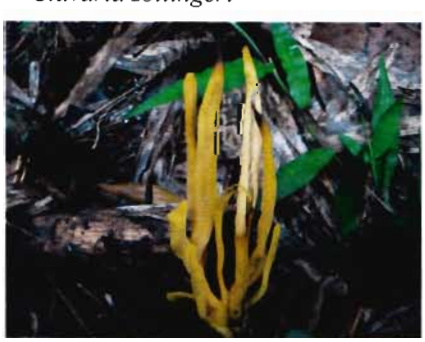
Cantharellus cibarius

Cantharellus lateritus

Clavaria zollingeri

Clavulina cristata

Clavulinopsis aurantiocinnabarina



Clavulinopsis fuciformis

Clavulinopsis luteoalba

Ramariopsis pulchella

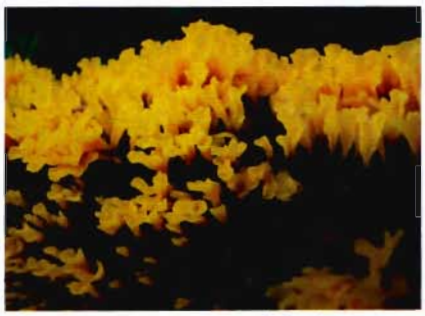
Ramariopsis kunzei

Anamica indica

Cortinarius pholideus

Crepidotus reversus

Crepidotus uber



Dacryopinax spathularia

Entoloma brihadam

Entoloma niranjanum

Entoloma rugosopruinatum

Entoloma theekshnagandhum

Rhodocybe retroflexa

Ganoderma conjunctum

Ganoderma fuscoporia

Ganoderma applantum

Ganoderma colossum

Ganoderma lucidum

Geastrum saccatum

Geastrum triplex

Ghompus clavatus

Ramaria apiculata

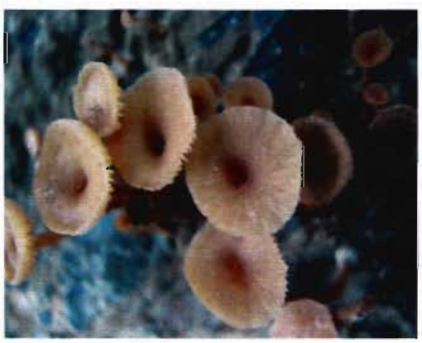
Romaria formosa

Ramaria versatilis

Hydnum rufescens

Hydnum rufescens

Laccaria fraterna



Laccaria laccata

Camerophyllus umbrinus

Hygrocybe alwisii

Hygrocybe aurantioal

Hygrocybe firma

Coltricia sp.

Cyclomyces tabacinus

Hymenochaete rubiginosa

Inonotus nothofagi

Phellinus adamantinus

Phellinus wahlbergii

Inocybe petchii

Inocybe virosa

Lycoperdon decipines

Lycoperdon perlatum

Termitomyces clypeatus

Thermitomyces microcarpus

Gymnopus tenu

Hydropus sphaerosporus

Marasmius haematocephalus

Lactocollybia epia

Marasmiellus stenophyllus

Marasmius haematocephalus

Marasmius hakgalensis

Omphalotus olearis

Trogia infundilbuliformis

Rigidoporus microporus

Irpex lacteus

Podoscybha venustula

Cyathus striatus

Aseroe rubra var. zeylanica

Clathrus archeri

Clathrus pusilus

Dictyophora cinnabarina

Ileodictyon gracile

Lysurus wayanadensis

Mutins caninus

Phallus anamudii

Phallus indusiatus

Armillaria mellea

Cyptotrama asprata

Xerula radicata

Oudemansiella canarii

Hohenbuehelis testudo

Pleurotus flabellatus

Pleurotus ostratus

Plutes agaleotheles

Pluteus conizates

Volvariella cubensis

Volvariella volvaceae

Fomes pseudosenex

Heaxagonia apiaria

Coriolopsis occidentalis

Lentinus acuta

Lentinus dicholamellatus

Lentinus sajor -caju

Microporellus violaceocinerescens

Microporus xanthopus

Nigroporus durus

Nigroporus venosus

Oxyporus cevinogilvus

Panus similis

Polyporus arcularis

Polyporus grammocephalus

Pycnoporus sanguineus

Pyrroformes albomarginatus

Trametes pubescens

Trichaptum biforme

Cystoagaricus trisulphuratus

Psathyrella lithocarpi

Aleuria aurantia

Aleuria rubra

Scutellinia setosa

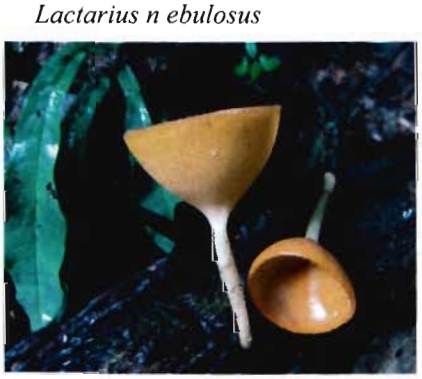
Sowerbyella rhenana1

Lactarius ignifluus

Lactarius n ebulosus

Russula atropurpurea

Ruslula mariae2



Cookenia speciosa

Cookenia tricholoma

Sarcosypha occidentalis

Schizophyllum commune

Schizophyllum commune

Pisolithus albus

Scleroderma verrucosum

Stereum hirsutum

Agrocybe pediades

Agrocybe wayanadensis

Psilocybe samuiensis

Galerina vittiformis

Gymnopilus crocias

Gymnopilus terricola

Hypholoma subviride

Hypholoma trintensis

Pholiota gregariformis

Psilocybe cubensis

Psilocybe wayanadensis

Stropharia semiglobata

Suillus brevipes

Tremella foliacea

Tremella mesenterica

Tremella reticulata

Clitocybe dealbata

Clitocybe minuta

Collybia chrysoropha

Collybia multijuga

Lepista hyalodes

Lepista sordida

Macrocybe pachymeres

Macrocybe lobayensis

Tricholoma ceriniceps

Tricholomopsis tropica

Daldinia concentrica

Xylaria longipes

Xylaria symplocosii

Daedalea flavida

Fomitopsis feei

Daedalia dochmius

Laetiporus sulphureus

PART-III

1. Recommendation including remedial measures relevant to the environmental problems studied under the project.

Large-scale removal of litter from the forest floor, especially from the semi-evergreen forests, is one of the factors adversely affecting the macrofungal diversity. Heavy inflow of eco-tourists, unauthorised tracking in evergreen and shola forests, human-induced forest fire in moist-deciduous and semi-evergreen forests are also affecting the macrofungal diversity. Erratic rainfall and climate change are the other possible adverse factors affecting the macrofungal diversity. The human induced activities in the forests should be minimized for maintaining the health and productivity of the forests as well as biodiversity of macrofungi.

2.Utility of the findings of the project for industry/other organizations (pl. also specify the manner in which these could be utilized)

The study brought out information on occurrence of various groups of macrofungi and their distribution in different forest ecosystems of the State. The data generated will be useful for biodiversity inventories, studies related to litter decomposition, nutrient cycling, ectomycorrhizal association, stand health and productivity and also studies on ecosystem dynamics. Of the 550 species of macrofungi recorded from the Kerala part of the Western Ghats, a large number belong to potential edible and medicinal mushrooms, while a few are highly toxic and hallucinogenic. There is lot of scope for commercial exploitation of these groups of fungi for isolation of industrially important enzymes as well as commercial cultivation for trade. The outcome of the project is a systematic account of the macrofungi of the Western Ghats, Kerala and this will be useful to students, teachers and researchers in mycology and fungal biodiversity.

3.Whether any Patents have been filed or are likely to be filed on the basis of the project work: No.

4. List of research papers published/accepted on the work done under the project (two copies of the reprints/accepted/submitted paper also to be enclosed)

Mohanan, C., Sumesh, P.M., Rajesh, P. and Anila, K.B. 2010. Biodiversity of macrofungi in the Western Ghats of Kerala. Proceedings of 22nd Kerala Science Congress, 28-31 January 2010, Kerala Forest Research Institute, Peechi, pp. 673-674.

5. Whether any research fellow associated with the project has been awarded Ph.D. etc. or any other higher degree and if so, name of the fellow and title of the thesis may be given:

Sri. Sumesh, P.M. has registered for Ph.D. in Cochin University of Science & Technology (CUSAT), Kerala under the research guidance of the Principal Investigator. He has completed his research work on 'Biodiversity of Polypores in Kerala State" and the Thesis will be submitted within two months.