Ministry of Agriculture and Forests
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Semtokha

FUNGI OF BHUTAN

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FOREWORD

Mushrooms or macroscopic fungi are spore-bearing fleshy fruit-bodies of fungi growing above the ground on soil or on its food source like dead wood. About 20,000 species of mushroom of the estimated 53,000 to 110,000 fungal species globally have been described. Ecologically there are three different types of fungi or mushroom which are mycorrhizal, saprophytic and parasitic, all of which play an important role in the ecosystem. For culinary purposes, mushrooms are classified as edible, inedible and poisonous. Culturally, humans have used also mushroom as a source of medicines including in Bhutan.

Bhutan with its different ecological zones, pristine and largely intact forest harbours large diversity of mushrooms that are both edible and poisonous. The country is home to expensive mushroom *Cordyceps sinensus*, the culinary delights Matsutake (*Tricholoma matsutake*), Chanterelle, and some of the most poisonous mushroom among *Amanita* and other genera. However, the true diversity of the existence of mushroom in the country is not known.

Every year, farmers and urban dwellers make purposeful journey to the forest to collect this delectable commodity for home consumption and to sell in the market to earn additional income. For many dwellers in rural Bhutan particularly where agricultural activities are limited mushroom collection is contributing to most of their annual income. Except for the few experts, many collectors are not able to differentiate between edible and poisonous mushroom. There are many reported cases of mushroom poisoning. It is also observed that many collectors have little regard for long term sustainability of the mushroom.

The book on mushroom, which is first of its kind and publications hopes to provide information on the diversity of mushroom that are identified and classified in Bhutan to general public, students, health workers and academia. It is also expected that collectors are educated on edible and poisonous mushroom and also sincerely hope that the knowledge shared through this book will ensure long term sustainability of mushroom diversity in the country.

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This is the first book on wild mushrooms of Bhutan. The identification of mushrooms in the forest of Bhutan has been initiated over a few decades but has gained impetus in the last couple of years when we could collaborate with experts from other parts of the world espically with Costa Rica in South-South projects.The compilation of information was undertaken with the help of many diverse sources such as books, internet web pages and mycologists from different parts of the world. Therefore, our heartiest appreciation goes to all the authors listed in the bibliography. Very special thanks to mycologists who had contributed directly to this book by giving their time and expertise in identification and photographing of the mushrooms and suggestions on the manuscript of the book: Mr. Eduardo Alvarado, Costa Rica, Ms. Enia Navarro Valverde of Instituto Nacional de Biodiversidad (INBio) Costa Rica, Dr. Thomas Laessoe, Associate Professor at the University of Copenhagen, Denmark, Dr. Morten Christensen, Senior Consultant with Grontmij, Denmark, Dr. Nigel L. Hywel-Jones, Senior Scientist at Bhutan Pharmaceuticals Private Limited (who contributed the part on insect fungi) and all the staff of the National Mushroom Centre. We also like to acknowledge the continued support received from the Department of Agriculture and the Ministry of Agriculture and Forests. DP gives especial appreciation to Professor Gilberto Govi and Professor Alessandra Zambonelli of the University of Bologna who initiated him in the fungal world and supported him throughout his stay at the university and later in his work in Bhutan.

CONTENTS

I. INTRODUCTION 1

1. What are fungi? 1

2. Importance of Fungi in Nature 2

3. Edible Fungi 2

4. Hallucinogenic Fungi 4

5. Poisonous Fungi 4

Table 1. Symptomatic diagnosis of mushoom poisonings. 5

6. Medicinal Fungi 6

7. Fungi in Industry 7

8. Fungi that Cause Diseases to Human Beings 7

9. Fungi that Cause Diseases to Plants and Animals 7

II. CLASSIFICATION OF THE KINGDOM FUNGI 8

1 Ascomycota 8

2 Basidiomycota 8

3 Chytridiomycota 8

4 Zygomycota 9

III. MACROFUNGI 9

1. Morphology 9

2. Growth Habit 10

3. Substrate 10

IV. COLLECTION, DESCRIPTION AND PRESERVATION OF MACROFUNGI 11

1. Collection 11

2. Description 12

2.1 Spore Print or Spore Deposit 12
2.2. Macroscopic Description 13
2.2.1. Pileus/Cap 13
2.2.2. Hymenophore or Fertile Surface 20
2.2.3. Stipe/Stem 22
2.2.4. Growth Habit 26
2.2.5 Substrate 26
2.2.6. Macro Chemical Tests 26
2.2.7 Number of fruit body 27

3. Preservation 28
V. Notes for the macroscopic description of "Wood ears" type macrofungi 29
VI. Notes for the macroscopic description of fruit bodies different from "umbrella" or "Wood ear" type of macrofungi 30
VII. Mushroom species and descriptions 31
VIII. INSECT FUNGI1 278
INTRODUCTION 279
IX. Insect fungi species and descriptions 281
GLOSSARY 302
BIBLIOGRAPHY 311
Genus and Species Index 314

I. INTRODUCTION

Fungi are a group of living beings that are different from plants or animals. For this reason, they are classified into a separate kingdom called Fungi. With high adaptability, they can grow on many surfaces, both in the nature and in cities. They play an important role as decomposers, since they transform organic matter into simpler substances that can be assimilated by other living beings. They are also important in medicine, industry and food.

Although the number of species is not known with accuracy, so far about 100,000 fungi have been described worldwide. However, once tropical forests have been studied thoroughly, this figure may increase to 1.5 million. In Costa Rica there are about 2,000 known species, but it is assumed that from 40,000 to 70,000 species might be living in its territory. In Bhutan about 350 species have been identified either with scientific names or local names through traditional use of knowledge in the survey done based in some part of Thimphu, Paro, Bumthang, Tashiyangtse, Punakha and Sarpang dzongkha. But the vast majority is not identified or unaccounted for. It could be speculated that Bhutan's mycoflora could be much larger due to its diverse climatic and geographical conditions.

1. What are fungi?

Fungi have very specific characteristics which differentiate them from plants. They do not produce their own food through photosynthesis like green plants, but live at the expense of other living or dead organisms. They also differ from animals because they do not possess the ability to move in the environment or on the surface or in which they grow.

There are microscopic fungi (microfungi), which are not visible to the naked eye, and macroscopic (macrofungi), whose fruit body can be seen easily. The science that studies them is Mycology (from the Greek = Mykes = Fungi and Logos = study).

Fungi may be formed by one cell (unicellular) or many cells (multi-cellular). Since they lack the substances required to carry out photosynthesis, such as chlorophyll, they feed mainly by absorption and have adapted to live as saprobes (on decaying matter), parasites (on living beings, causing them diseases or death) or in symbiosis (associated with other living beings for their mutual benefit).

Fungi can live in almost any environment, from the seabed to deserts and from polar regions to tropical rain forests. They can grow on cloth, leather, plastic, rubber, metals, glass, paper, coal, food or any other substance or waste. They can also be very destructive, for example to stored food, fruits or crops of high economic value.

2. Importance of Fungi in Nature

Fungi play a very important role within their natural habitats, since they are decomposing organisms which recycle a great deal of organic waste. They are able to transform dead matter and return minerals and other substances into the environment, which can be assimilated by other living beings such as plants and animals. This allows the flow of energy and nutrients through natural ecosystems.

The fungi form associations for mutual benefit (symbiosis) with the roots of some plants, which are called mycorrhiza. The fungus receives carbohydrates from the roots, and the plant in return gets minerals from the fungus, such as nitrogen and phosphorus needed for their growth. The association helps to increase the surface area of absorption of the roots. Among algae and a few species of fungi, there is another type of symbiotic association: lichens, which are organisms that are totally different from plants and fungi. Some fungi regulate the increase or decrease of both animal and plant populations, such as those that are parasitic to plants and insects, thus provoking their death.

3. Edible Fungi

Fungi can be as nutritious as many plant or animal food source, because in addition to a great amount of water, they contain proteins, vitamins, minerals and other substances. They also have many health

benefits because of its low cholesterol and many medicinal properties.

In Bhutan the collection and consumption of edible wild mushrooms is very popular, as it is in some places of Europe, Asia and North America. Collection of wild edible mushroom during the monsoon season has always been a common activity in Bhutanese tradition. In olden times mushrooms were mostly collected by cattle herders for home consumption. Since the last decade or so mushroom collection has become increasingly popular across the country, from east to west and north to south ranging from 300 to over 3000 masl because of the commercial interest. However mushroom is normally collected by the poorer section of the society, both in the rural and urban situations. Some of the very popular wild edible mushrooms in Bhutan include: *matsutake* mushroom, *Chanterelle* sp., *Rozites* spp., *Lentilunulla* spp., *Pleurotus* spp., *Auricularia* spp., *Tremella* spp., *Lyophyllum* spp. *Ramaria* spp. and *Termitomyces* spp in the south.

Wild Mushroom sold on roadside markets

4. Hallucinogenic Fungi

This is another interesting group of fungi that have been studied mostly in Mexico, because they play an important role in the religion and medicine among native cultures. These fungi can cause changes to the auditory, visual, and tactile senses, mainly because they contain active substances such as psilocybin and psilocin, but there are also others such as baeocystin and norbaeocystin. The most common ones are: *Psilocybe* spp, *Panaeolus* spp. and *Amanita muscaria*: The last one is hallucinogenic at first but becomes toxic later.

5. Poisonous Fungi

Toxic fungi may cause stomach discomfort (vomiting, diarrhoea, and abdominal cramps), drowsiness, fever, tachycardia and in some cases death - if the person does not get prompt medical assistance, depending on the species they have ingested. Among the substances that cause intoxication, there are amanitins, orellanine, muscimol/ibotenic acid, psilocybin, muscarine, and gyromitrins. A few examples of poisonous mushrooms are: *Amanita phalloides, A. virosa, A. verna, A. muscaria, A. pantherina, Galerina autumnalis, Clitocybe* spp., *Inocybe* spp., *Naematoloma fasciculare/ Hypholoma fasciculare, Lepiota cristata, Cortinarius orellanus, Coprinus atramentarius, Gyromitra esculenta* etc. Although a lot of mushrooms are being consumed by the Bhutanese people and there is adequate traditional knowledge on edible mushrooms, mushroom poisoning cases are happening in Bhutan almost every year with casualties once in a while. During the mushroom season it is advisable to consinder possibility of mushroom poisoning during medical diagnosis when similar symptom are encountered.

Table 1. Symptomatic diagnosis of mushoom poisonings.

Onset Rapid (15 min-2 h after ingestion)		
Symptoms	Cause	Prognosis
Nausea and abdominal discomfort, sometimes with diarrhoea and vomiting	Unknown toxins from numerous genera	Rapid and complete recovery, serious cases may last 2-3 days and require fluid replacement
Excessive sweating, lacrimation, salivation beginning 15-30 min after ingestion	Muscarine from *Clitocybe* or *Inocybe* spp.	Complete recovery within approximately 2 h
Inebriation or hallucinations without drowsiness or sleep	Psilocybin from *Psilocybe*, *Paneolus*, *Gymnopilus*, *Conocybe*, or *Pluteus* spp.	Complete and spontaneous recovery within 5-10 h, may take up to 24 h with large doses
Delirium with sleepiness or coma developing within 1 or 2h after ingestion	Ibotenic acid/ muscimol from *Amanita muscaria* or *A. pantherina*	alternating periods of drowsiness and excitement for several h, followed by total recovery
Onset Delayed (6 h-3 days after ingestion)		
Symptoms	Cause	Prognosis
Feeling of abdominal fullness and severe headache about 6 h after ingestion, vomiting but no diarrhoea	Gyromitrin and related hydrazones from *Gyromitra esculenta* and its relatives	Complete recovery within 2-6 days, may require correction of metabolic acidosis, some deaths have occurred due to liver failure

Persistent and violent vomiting, abdominal pain, profuse, watery diarrhoea beginning around 12 h after ingestion	alpha-, beta-, and gamma-amanitins from *Amanita phalloides* and its relatives, *Galerina autumnalis* and its relatives, or *Lepiota josserandii* and its relatives	Apparent recovery a few hours after onset of symptoms, followed by a symptom-free period of 3-5 days, which precedes a period of jaundice, loss of strength, coma, and often death
Intense, burning thirst and frequent urination beginning 3-14 days after ingestion, followed by gastrointestinal disturbances, headache, pain in the limbs, spasms, and loss of consciousness	Orellanine from *Cortinarius orellanus*	Recovery (including recovery of renal function) may require several months in less severe cases, death from kidney failure may occur in severe cases
Onset Conditional (within 72 h of ingestion)		
Symptoms	Cause	Prognosis
Flushing, palpitations, rapid heartbeat, rapid, laboured breathing occur within 1/2 to 2 h after consuming alcohol, if alcohol was consumed within 72 h of mushroom ingestion	Coprine in *Coprinus atramentarius*	Recovery is spontaneous and complete within a few to several hours after onset of symptoms

Source: Internet

6. Medicinal Fungi

There are many fungi that provide great benefits to human health. One of them is *Penicillium chrysogenum*, previously known as *Penicillium notatum*, a microfungus from which the antibiotic penicillin is extracted. There are also species that have active anticancer/ antitumour substances. Currently, many fungi are being studied, in an effort to find the cure for AIDS. Many macrofungi of relevance

that are under study in other countries can be found in the forests of Bhutan, such as: Shiitake, *Hericium*, Matsutake, *Auricularia*, *Lepista nuda, Trametes versicolor, Schizophyllum commune* and *Ganoderma* spp. such as *G. lucidum* and *G. applanatum*. A few mushrooms are mentioned in the book on Traditional Tibetan Medicine being of use in medicine: *Calvatia cyathiformis, Boletus* spp., *Agaricus* spp., *Russula sanguiflus, Albatrellus* spp. and *Coprinus* spp.

7. Fungi in Industry

Many fungi - mainly microscopic fungi - have great importance in various industrial processes worldwide. Yeasts of the *Torula* and *Sacharomyces* genus are used in the elaboration of bread and beer, respectively, while some species of the *Penicillium* genus, such as *P. camemberti* and *P. roqueforti,* are used in the elaboration of cheese.

8. Fungi that Cause Diseases to Human Beings

Human beings might be attacked by some kind of mycosis, which are diseases caused by various parasite microfungi. For instance, *Aspergillus fumigatus* produces aspergillosis, a respiratory disease that sometimes can be fatal. The so called "tinea" or "athlete's foot" is caused by a micro fungus called *Trichophyton interdigitales*. There are also fungi that grow on the scalp, skin, nails and genitals, and among other parts of the body.

9. Fungi that Cause Diseases to Plants and Animals

Some fungi, especially microfungi, may cause diseases and in some cases even death of plants and animals. Many crops or plants of great economic value are sometimes invaded by parasitic fungi, leading to considerable losses. This is the case of coffee leaf rust (*Hemileia vastatrix*) and corn smut (*Ustilago maydis*). Others attack cereal and other vegetable crops, as well as fruits, either packed or stored. Insects can also be attacked by parasitic microfungi and macrofungi, which in many cases leads to their death. Many species of the *Cordyceps* genus infect larvae of flies, butterflies, ants and beetles.

II. CLASSIFICATION OF THE KINGDOM FUNGI

This kingdom has approximately 103 orders, 484 families, 4,979 genus and about 100,000 species described to date. It is divided into four groups or phyla: *Ascomycota*, *Basidiomycota*, *Chytridiomycota* and *Zygomycota* (Hawksworth *et al*., 1995).

1 Ascomycota

It constitutes the largest taxonomic group. Its fungi have varied shapes, such as cups, buttons, hives and fingers. It groups a large amount of pathogenic fungi to plants and animals, and those that grow on food, in addition to some that can be found on leather, fabric, paper, glass, camera lenses, walls, etc. Their main characteristic, in addition to their shape, is the presence of microscopic reproductive structures called an ascus, which originate spores. Asci (the plural of ascus) are formed by a specialized sac-like cell in which spores are formed, usually in groups of eight or multiples of eight. Asci form meiotic spores called ascospores.

2 Basidiomycota

It comprises those fungi with the shape of umbrellas, corals, wood ears, jelly, and puffballs while some are single-celled yeasts. Some of them have powdery or stained impressions and grow on various structures of plants (flowers, fruits, leaves, stems or roots). Some have economic importance, such as the rust and smut mentioned above. At a microscopic level, their main feature is the presence of specialized reproductive structures called basidia, which give rise to the spores – externally -, usually in groups of four; although in some species two to six spores per basidium can be found. Spores are known as basidiospores.

3 Chytridiomycota

This group is made up of mainly microscopic aquatic fungi, although some of them can grow on organic decaying matter or living organisms such as worms, insects, plants and other fungi. In this case, the spores, called “zoospores”, have flagellae that allow them to move in liquid media.

4 Zygomycota

This group is comprised mainly of microscopic fungi that can grow on organic decaying matter, although they can also be found in the digestive tract of some species of arthropods, such as insects.

III. MACROFUNGI

The term macrofungi – also known as mushroom or champignon - is used to refer to the reproductive structure or fruit body of a fungus. Actually, the fungus itself is comprised of a series of filaments that are not generally visible to the human eye individually called mycelium. Mycelium are under surface structure of fungi and the fruit body which we see on the ground, sprouting out of tree barks or decaying woods are fruit of the fungi. Macrofungi grow on the surface of substrart (soil, wood, manure, etc.) when environmental conditions (such as light, acidity of soil, humidity) are appropriate.

Most macrofungi belong to the *Basidiomycota* group, however, many fungi of the *Ascomycota* group -that are appealing because of their shape or colour- are also considered macrofungi. In short, macrofungi are all those fungi that are generally fleshy and that because of their size, colour and shape can be seen with the naked eye.

1. Morphology

Macrofungi have different shapes. The most common ones are umbrella type, bracket, ear, star, coral, shelf crust, or trumpet which belong to the *Basidiomycota* group. Those that belong to the *Ascomycota* group have cup, finger, hive and other shapes. However, although the shapes vary from one group to another widely, their role is always the same: to perpetuate the species through the dispersal of spores. Their appearance or consistency is variable, as they may be gelatinous, cartilaginous, spongy, fleshy and milky or even cork-like. There may also be variation in size.

The most common fruit bodies are the fleshy ones, mostly formed by a cap or upper part called **pileus**. The tissue, generally fertile and

located below the pileus, or attached to its surface is called **fertile layer,** in the case of the **Ascomycota** group, or **hymenophore,** in the case **Basidiomycota**. This fertile layer or hymenophore may be either smooth or entirely consist of lamellae (gills), venations, wrinkles, teeth, pores, etc., which are covered or wrapped by specialized reproductive structures (asci and basidia) that produce spores. In addition, they have a stem or stalk that is called **stem** or **stipe**. In some species the stem can be missing (in which case they are sessile) or be very small. The inner part of the pileus and the stem is called context.

The **spores** are specialized cells that are part of the reproductive stage of the fungus. Wind and water are the main dispersers of the spores, taking them to various places and substrates. When the environmental conditions are appropriate, they germinate and produce the mycelium. The **mycelium** is a mass that generally is not visible to the naked eye and is formed by microscopic filaments **(hyphae)**, which can develop in different habitats: terrestrial, lignicolous, coprophilous, fungicolous, as parasites or associated to roots of some types of trees, forming a mycorrhiza.

2. Growth Habit

This is the manner in which a macrofungus grows. The habit can be **solitary** when it grows alone, **scattered** when several grow in the same area, **gregarious**, when they grow together, but not intertwined, **caespitose**, where they grow together as in the form of clusters and have a common base.

The most important climatic factors for the spores to germinate and form **fruit bodies** are humidity and temperature. The majority of macrofungi need a relative humidity of above 70% and a temperature ranging from 10 to 25 °C, although it is important to note that many others are able to thrive in extreme conditions of both humidity and temperature outside this range.

3. Substrate

It is the surface where macrofungi grow. It can be **terrestrial** (on the

soil), **coprophilous** (on manure), **lignicolous** (on wood), **fungicolous** (on other fungi). They can also grow in a parasitic manner on other living beings (such as plants and even insects). Some fungi even grow on other bigger fungi which will then produce conidia and not the spores.

IV. COLLECTION, DESCRIPTION AND PRESERVATION OF MACROFUNGI

The techniques to collect fungi in the field vary according to their type of **fruit body.** Particularly, in the case of fleshy fruiting bodies, it is very important to know the appropriate collection, description and preservation procedures, since further taxonomic study and potential scientific value of the specimens depend on it.

1. Collection

For mushroom collections to have scientific value, it is essential to carry out the procedures below:

- Take note of the substrate, and whenever possible record data on vegetation surrounding the specimen.
- Take photographs of the specimens.
- Use a blade or stick to remove the fungus. It is necessary to insert the blade a few centimetres down from the base of the mushroom, in order not to cut the stem when it is present.
- Remove the mushroom with a small portion of substrate on its base.
- Collect both young and mature specimens, and as many as possible, provided you leave some fruit bodies on the substrate.
- Place the removed specimens on wax paper or aluminium foil (never in plastic bags), in such a way that the edges can be closed without damaging the samples.
- Place the collections within a suitable basket (never inside backpacks, plastic or paper bags) for transportation to the laboratory or work place.

2. Description

The macroscopic description should be performed in the lab or at the work place as soon as possible, since most of them lose moisture in a short time and therefore changes of size and colour may occur, which are very important characteristics for taxonomic purposes. For that reason, it is advisable to collect the specimens in the morning and to describe them in the afternoon, following the steps below:

2.1 Spore Print or Spore Deposit

Spore Print of *Agaricus bisporus*

The spore print is the aggregate or mass of spores that fall off the fertile surface of a fungus. **Spore print** is taken by placing the whole cap (if there are enough specimens) or a part of it (in the case of only one or two specimens available) with the fertile surface (lamellae, pores, teeth, venations etc.) facing down on a white surface for black spores and on black surface for white spore fungi. Leave for a few hours until the spores fall off or over night for some fungi. The colour of the spores in mass is noted when fresh and later when the spore print is dry. In some cases, when collections from higher elevations are moved to lower elevations or vice versa, it is advisable to take the s**pore print** in the field and carefully move it inside the basket.

Spore prints in sterile petri dishes are useful to obtain spores for germination on culture media. In this case, a section of the cap or the whole cap in the case of pileated specimens; or a section including the fertile part in the case of not pileated specimens are adhered with petroleum jelly to the lid of the petri dish, in such way that the spores are deposited on the bottom part of the petri dish. The dish is sealed with parafilm and it is left standing for a few minutes or hours. When

the spores are deposited, the lid containing the adhered section of the fungus is replaced by another fully sterilized lid and the dish, along with the deposit of spores is sealed again with parafilm to be brought to the lab, where the dilutions with sterile water are done.

2.2. Macroscopic Description

The description of the macroscopic characteristics is performed only with specimens that are fresh or have been collected recently. It is very important to take 2 or 3 photographs of the specimens before the description, in case photographs were not taken in the field.

Many fruit bodies of the collected fungi may be divided into three parts (cap/pileus, hymenium or hymenophore and stem/stipe), however, one of them may not be present, or it could be a totally different fruit body depending on the fungus group that has been collected. In this case, the description is done noting all the traits of the parts present, or describing carefully all the characteristics that are evident to the eye or by using a magnifying glass.

Generally, the steps to perform a macroscopic description of a macrofungus with the umbrella shape is as follows:

2.2.1. Pileus/Cap

It is the upper part or top of a fruit body.

a. Size

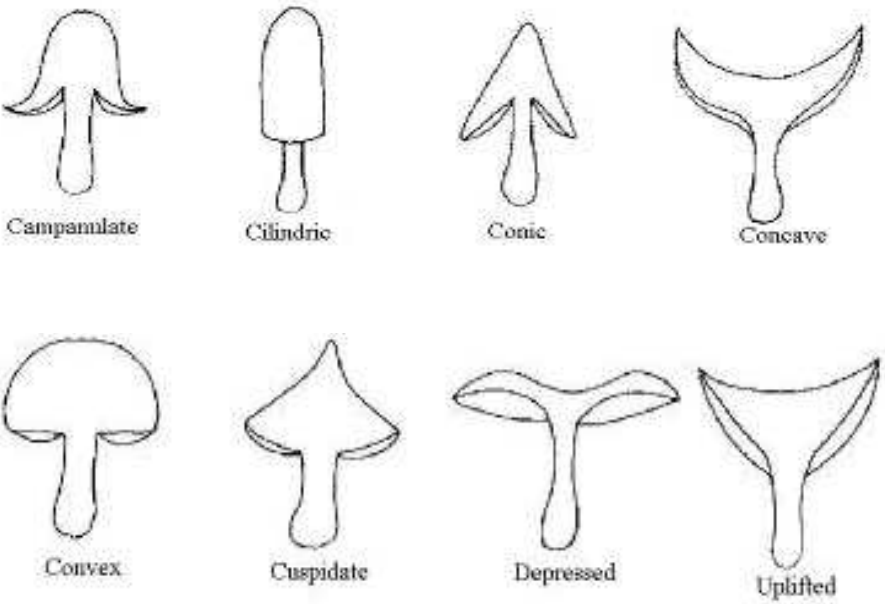
The diameter is measured if it is circular, or the length and width if it is not, with a ruler calibrated in mm or cm. It is advisable to cut the specimen lengthwise to facilitate measuring. When the collection is comprised of over two specimens, a range is established taking into account from the smallest to the largest.

b. Shape

Take note of the cap in both young and mature fruit bodies. It is advisable to take into account all shapes present and to note the ranges. Among these shapes, there are cylindrical, conical, concave, convex,

cuspidate, depressed, uplifted, infundibuliform, campanulate, ovoid, parabolic, plane, umbilicate, umbonate, etc.

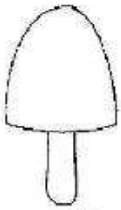
There are other shapes of cap when the specimen is adhered to wood and lacks a well-shaped stem. They can be applanate, applanate with umbo, convex, dimidiate, effused-reflexed, elongated, spathulate, flabelliform, imbricate, petaloid, resupinate, semicircular, ungulate, etc.as shown below.



Infundibuliform

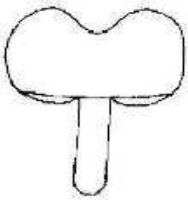
Papillate

Ovoid



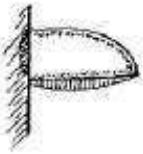
Parabolic

Plane

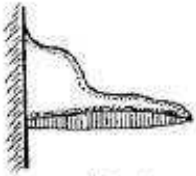


Umbilicate

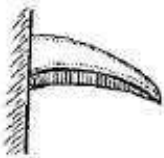
Umbonate



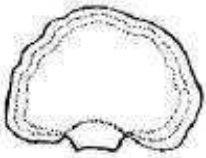
Applanate



Applanate with umbo

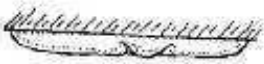


Convex



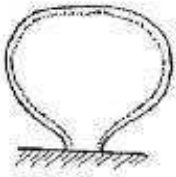
Dimidiate

Effussed-reflexed



Elongated

Spathulate

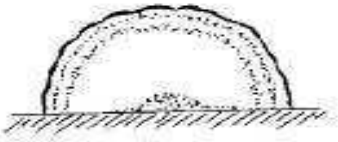


Flabelliform

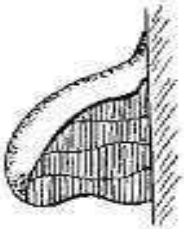
Imbricate

Petaloid

Resupinate



Semicircular



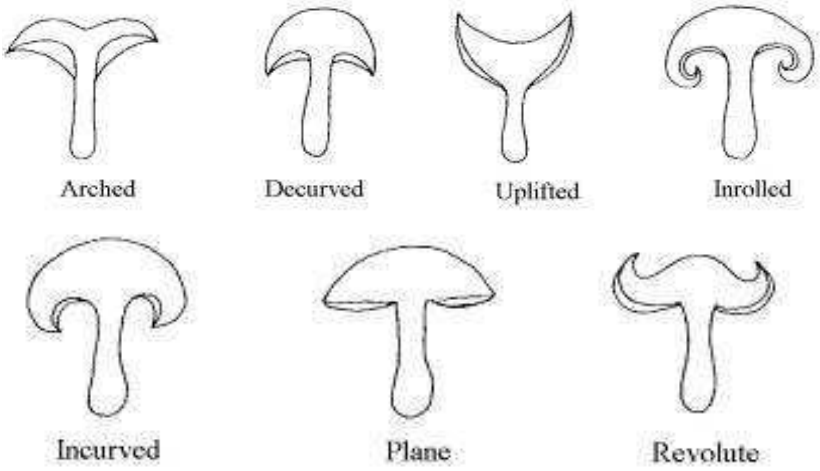
Ungulate

c. Colour

The colour of the cap should be noted, taking into account both young and mature specimens, since some of them may change with age. It is very important to note the colour of the disc or central area of the cap, or any other observation of colours in other parts of the cap, if it is different. In addition, it is important to note the colour of the margin. It is also important to describe if there is a change in colour when the mushroom is touched. All described colours should be supported by a standard colour code.

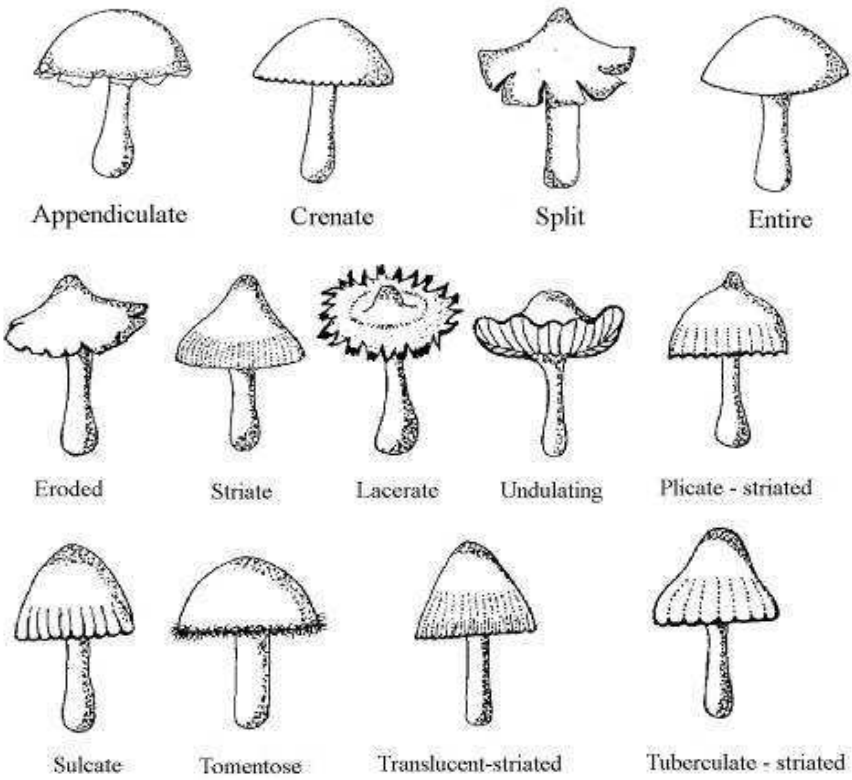
d. Margin

The margin of the cap of a mushroom may vary according to the degree of expansion it has reached. It is advisable to cut the fruit body lengthwise to describe the type of margin, which may be; arched, incurved, decurved, involute, straight, uplifted, and revolute, etc.as shown below.



The texture of the margin of the cap is another characteristic that must be noted. The margin may be:

- *Striate*: with grooves lifted over the margin.
- *Virgate-streaked*: with bulges over the grooves.
- *Plicate-striated*: with very evident pleats and grooves.
- *Translucent-striated*: the lamellae are visible through translucent lines through the pileus.
- *Sulcate*: when the margin lines form slots or furrows.
- *Entire*: with a totally smooth margin.
- *Eroded*: with the margin uneven, nibbled or gnawed.
- *Appendiculate*: with attachments or parts. When a portion of the partial veil that hangs from the edge of the pileus when it expands is also called appendicute margin.
- *Lacerate*: with the margin torn or with deep fissures.
- *Split*: with the margin cut or divided in sections.
- *Tomentose/hairy*: with filaments or hairs that can be simple or branched, usually close together and intertwined.
- *Undulating*: with waves on the margin.
- *Crenate*: the margin is ornamented with very fine undulating shaped as rounded teeth.



e. Surface

Texture and ornamenting of the surface often vary with age, environmental conditions, etc. Therefore, it is very important to describe the surface of the cap in every specimen of a collection, which may be:

e.1. Shiny or dull surface

e.2. Dry surface:

- *Fibrillose*: with fine threads intertwined.
- *Fibrillose appressed*: with threads arranged sort of radially.
- *Squamose*: filaments are arranged in groups or fascicules.

- *Squamose fibrillose recurve*: fascicules of recurved scales.
- *Squarrose*: straight scales close to the centre of the pileus.
- *Pulverulent or pruinose*: texture like flour.
- *Tomentose*: woolly surface with soft hairs.
- *Velutinous*: compact surface with short, fine and soft hairs.
- *Glabrous*: smooth, without threads.
- *Rivulose*: with deep channels or depressions called alveolas.
- *Lacunose*: with deep holes surrounded by crests.
- *Areolate*: the cuticle of the pileus seems to be cracked.
- *Rugulose*: with very fine wrinkles arranged in a regular way.
- *Rugose*: with deep wrinkles arranged irregularly.
- *Granulose*: the surface seems to be covered by salt granules.
- *Pubescent*: compact surface with short hairs.
- *Villose*: surface with long and fragile hairs.
- *Hirsute*: surface with stiff and shaggy hairs.
- *Hispid*: with stiff straight hairs.
- *Strigose*: coarse with pointed hairs.

e.3. Moist surface

- Hygrophanous: change in colour occurs when the fungus loses moisture.

- Viscid or viscous: gelatinous or sticky.
- Glutinous: extremely viscous and very sticky.
- Lubricous: oily.

f. Context

It is the inner fleshy tissue that is part of the cap or the overall fruit body. Take note of the following:

- Colour and changes in colour when touched.
- Width in mm or cm
- Smell
- Taste

- Presence or absence of secretions:
  - Taste of the secretion.
  - Colour and changes in colour.

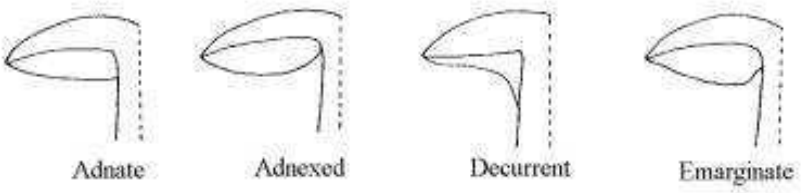
2.2.2. Hymenophore or Fertile Surface

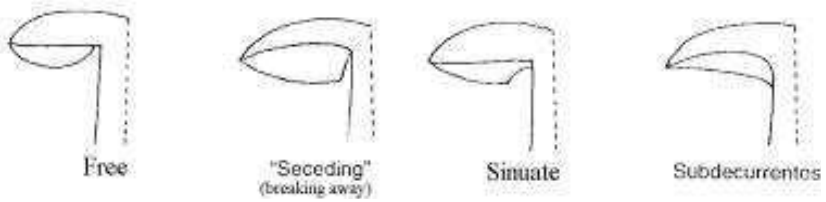
It refers to the surface of the hymenium or the fertile surface of the mushroom, which may be smooth, porous, lamellate, dentate, verrucose, reticulate, with venations, etc. It is generally covered by microscopic reproductive structures, such as sporangia, asci, basidia, conidia, cystidia, paraphyses, spores, etc.

When the said surface is made up of pores and tubes, they must be described taking note of the pores and changes in colour that may occur, in addition to the number of pores per mm that are observed, using a magnifying lens. Regarding the tubes, in order for them to be seen, the cap must be cut lengthwise, take note of the colour and changes in colour and then measure the length of said tubes with a ruler calibrated in mm. If the hymenophore is made of teeth, colour changes and colour must be noted, in addition to the length of the teeth. If the hymenophore is formed by lamellae, the following must be noted:

a. Type of attachment (to the stipe)

It varies according to the age of the specimen; therefore variations within a collection must be noted. The type of junction may be: adnate, adnexed, decurrent, emarginate, free, seceding, sinuate, sub-decurrent, etc. as shown below.



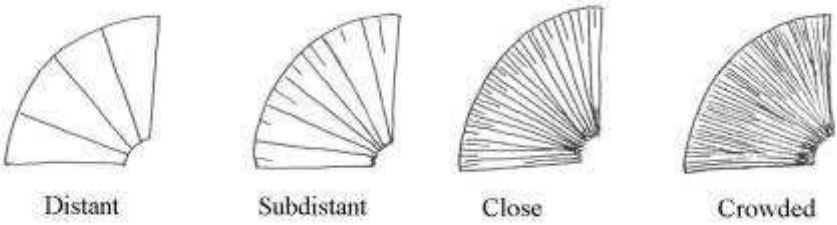


b. Colour

Take note of colour and changes in colour if observed, both in young and mature specimens.

c. Spacing

This refers to the space between one lamella and another, which may be: distant, sub-distant, close, crowded, etc. as shown below.



d. Thickness

Note if the lamellae are narrow, wide, moderately narrow or wide, etc. It is important to measure the width of lamellae in mm.

e. Margin

Observe and note if the margin of the lamella is smooth, dentate, eroded, serrate, serrulate, it has slots, or it is marginate (when the margin has a colour different from the rest of the lamella and in such case the colour must be noted), etc.

f. Lamellulae

Very small lamellae that do not reach the stem or the union point of the substrate, in cases of missing stem. In this case, only the presence or absence of lamellulae is noted.

2.2.3. Stipe/Stem

It is the base that holds the cap of a fruit body. Notes should be made of the following character:

a. Size

- Length (it is measured in mm or cm from the base to the apex).
- Width (generally measured in the apex, it is advisable to cut the specimen lengthwise).

b. Shape

The stem may be; tapering, equal or uniform, marginate, bulbous, abruptly bulbous, clavate, sub-clavate, radicating, ventricose, etc. as shown below.

Tapering

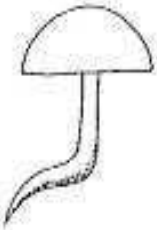
Equal

Marginate

Abruptly bulbous

Bulbous

Clavate



Radicating

Sub - clavate

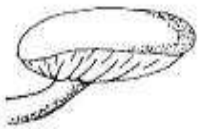
Ventricose

c. Position

Note if the stem is; central, lateral or eccentric.

Central

Lateral



Eccentric

d. Colour

Note of colour and changes in colour both in young and mature specimens.

e. Surface

It may be *moist*, *dry*, or *viscid*. The same characteristics noted above for the surface of the cap may be used for the surface of the stem.

f. Context (interior)

The inner tissue of the stem can be:

- Solid: stuffed and uniform interior.
- Semi-stuffed: Non homogeneous, with a central channel or with holes.
- Hollow.

g. Ring

The rings are remnants of a partial veil that covers the mushroom in early development stages. In other fungal species it is also possible to find an annulus area, formed by remnants of a fibrillose cortina that also covers the mushroom in early development stages. When both the ring and the annulus area are present, they must be described as follows:

- Position: may be apical, basal or central.
- Type: may be adhered or movable.
- Structure: it can be made of one or two layers, membranous or fibrillose.
- Colour: make a note of the colour of the ring or the cortina, and/or changes in colour when it is manipulated.

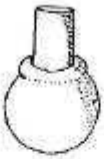
h. Volva

The volva represents remnants of the universal veil that covers the mushroom in the early development stages. If it is present, it must be described as follows:

★ **Shape:** volvas can be found in shapes such as:

- Sheathing
- Collar
- Saccate
- Friable(or disappearing)
- Granular
- Cleft
- Marginate – depressed
- Concentric scales

Sheating



Collar

Saccate

Friable
(disappearing)

Granular

Cleft

Marginate - depressed

★ **Texture:**

- Membranous
- Fibrillose
- Cottony

★ **Colour:** Note the colour of the volva and/or changes in colour when touched.

i. Other Characteristics

- Mycelium at the base of the stem (Write colour and abundance).
- Projection of stem on the substrate.
- Presence of rhizomorphs (resembling small roots that spread on the substrate, make note of colour and abundance).

j. Spore Print

It is important to note as part of the macroscopic description- the colour of the spore print both fresh and dry. The spore print that is obtained on

paper must be kept within the corresponding dry collection; therefore it must have a prior identification with the collection number, date, place and identification whenever possible.

2.2.4. Growth Habit

It is the manner in which macrofungi grow on the substrate.

- Solitary: growing alone.
- Scattered: several growing within the same area.
- Gregarious: they grow together, but not intertwined.
- Caespitose: they grow together as in the form of clusters and have a common base.

2.2.5 Substrate

It is the surface on which macrofungi grow and produce their fruit bodies.

- Terrestrial: on the soil.
- Coprophilous: on manure.
- Lignicolous: on wood
- Fungicolous: on fungi.

In addition, macrofungi can be found growing as parasite over other living beings.

2.2.6. Macro Chemical Tests

Observe and make note of the colour or changes in colour according to the different groups (chemical tests are not performed to every mushroom), when adding chemical reagents to the surface of the cap, context and fertile surface of the stem, or on the surface or context of cap with other fruit body forms. Observe and check in about 15-

20 minutes. The reagents to be used may be one or several of the following:

I. Aqueous ferrous sulphate at 10%

II. Aqueous sodium hydroxide at 10%

III. Aqueous ammonium hydroxide at 10%

IV. Aqueous phenol at 2%

V. Aqueous formaldehyde at 40%

VI. Sulphuric, hydrochloric, or nitric acid etc.

The reaction of the fungi with the chemical should be noted.

2.2.7 Number of fruit body

At the end of each description, make note of the number of collected fruit bodies used while describing the specimen.

3. Preservation

Once the specimens have been described, some of them must be cut lengthwise to allow faster drying and further microscopic study. Once cut, they are placed over a heat source (it is recommended to use a food dehydrator (dryer), because it has an airflow that goes through the fruit bodies thus providing appropriate drying). The specimens must be dried slowly at temperatures not exceeding 65 ºC, although for fruit bodies of very small and fragile fungi lower temperature is needed. Drying time may range from a few minutes to many hours, depending on the type of mushroom. For instance, for large fleshy fungus drying time may be up to 24 hours.

"**Mushrooms should never be dried or preserved between newspapers or plant presses**". Once the specimens have dried totally, they are placed in plastic bags, taking them directly from the dehydrator (dryer), in such a way that they do not absorb moisture again (there should be some air in the bag, but never blow in it when there are dry specimens are inside). In very humid regions, it is advisable to add a small amount of desiccant (such as self-indicating silica gel) in the plastic bag, to protect the collection from moisture and growth of mould.

V. Notes for the macroscopic description of "Wood ears" type macrofungi.

Fungi that are known as "wood ears" show a great variety of shapes of the cap/pileus**.** It is even possible to find several caps merged or joined to one another, forming a single fruit body. Furthermore, some of them present a well shaped stipe/stem, in others it may be reduced (very small), and in others it is completely absent. When the stem is present, it can have a central, eccentric or lateral position.

When a description of this type of fungus is performed, it is important to take note of the **length** and **width** (or **diameter) measurements** of the **cap,** the **shape** and **texture** of the surface, colour and **changes in** colour (when observed), **type, texture** and **colour** of the **margin.** The description of the **context** includes thickness**,** colour and changes in colour and the end of the fungus must be cut lengthwise, in such a way that the context is exposed to note the colour changes when exposed.

The **hymenophore (hymenium)** or the **fertile surface** is described according to what is observed, if the surface looks **smooth** (using a magnifying glass) take note only of colour and changes in colour while if the surface has pores, take note of colour and changes in colour of the **tubes** (make a cut of the fruit body lengthwise), as well as their **length**. In addition, take note of the colour of the **pores** and their **number** per **linear millimetre.** If the fertile surface has **teeth** measure their **length** and **colour** (or changes in colour). When the fertile surface has any other shape, one should describe as best as possible what is observe with naked eye or using a magnifying glass.

If the fruit body has a **stem,** it is described taking into account its **length, width, shape, position** (centred, eccentric or lateral), **surface (texture),** colour and changes in colour **context** (colour or changes in colour) and other characteristics that are normally described for any other type of mushroom with a well defined stem. All remaining characteristics such as **habit, substrate,** and **number** of fruit bodies are also noted for this group.

VI. Notes for the macroscopic description of fruit bodies different from "umbrella" or "Wood ear" type of macrofungi.

In case some collected fungi do not fit into the description done earlier ("umbrellas" or "wood ears"), they can be described using ones own words and using comparisons that are considered as most appropriate. It is very important to note the shape of the fruit body that is being described. In such cases, it is also important to note the measurements of these fruit bodies; such as **length, width**, or **diameter**, and particularly measurements that are considered appropriate for a specific shape.

Notes on the texture of the surfaces, colour and changes in colour and about context, thickness are also very important. Another relevant aspect is the number of fruit bodies collected from which the macroscopic description was obtained, in addition to the substrate where they were collected from and their growth habit.

For every collection, there must be a reference label that should include the following information:

- Collection Number/Description number
- Genus, species
- Date
- Place of collection
- Information about substrate
- Collector

VII. MUSHROOM SPECIES AND DESCRIPTIONS.









Agaricus cf. ***augustus*** **(Fr.)**
(The Prince)

Local name: No local name known

Edibility: Edible; *Agaricus augustus* has been accused of specifically bioaccumulating the metal cadmium. The same is true for other edible species of *Agaricus*, namely *A. arvensis*, *A. macrosporus* and *A. silvicola* though quantities may vary greatly.

Habitat: Solitary or sometimes gregarious and terrestrial.

Description: Cap: 2-7 cm in diameter, has brownish fibrillose scales on white background, feels rough due to the presence of scales on the cap surface, convex slowly expanding to plane and context of the cap is 0.1-0.5 cm thick. **Hymenophore:** Grey-purplish gills when young which turn dark brown at maturity, crowded when young and close as it matures. **Stem:** 3.4-4.5 cm long, 0.8 cm at the apex, 1.1 cm in the middle and 0.6 cm at the base of the stem, white scaly and white powdery on the surface of the stem. **Flesh:** Whitish flesh which turns brownish when exposed to the air. **Spore Print:** Rusty brown to blackish.

Comments: It has brown fibrils or scales, a prominent annulus, chocolate-brown spores and a shaggy stem which is usually hidden in the ground. The poisonous *A. praeclaresquamosus* is often found in the same habitats but has greyer cap fibrils, a smoother stem and smells like phenol.

Agrocybe* cf. *praecox (Pers : Fr.) Fayod

Local Name: No local name known

Edibility: Edible but the edible mushrooms species in this genus are not easy to identify and it is safer to avoid the entire genus when mushroom hunting for consumption.

Habitat: Terrestrial and scattered.

Description: Cap: 3-5 cm in diameter, parabolic when young, umbilicate when mature and cream-coloured cap, decurved margin when young and arched when mature and surface cracks at the margin or else smooth and dry. **Hymenophore:** Free gills, rusty brown in colour sub-distant, up to 1 mm width, irregular margin and presence of lamellulae. **Stem:** 5 -10 cm long, sub-clavate in shape, central in position and white in colour, smooth surface and solid. White, apical and small ring present but it is not visible in mature specimen. Mycelium present at the base. **Spore Print:** Grey.

Comments: *Agrocybe praecox* has brown spore prints, whitish to yellowish brown caps and partial veils that often leaves fragments hanging from the cap margins and fragile rings on the stems. The mushrooms range from small to medium in size and are often found near settlements though some species occur in the woods as well.

Albatrellus caeruleoporus (Peck) Pouzar

Local name: Chhenpa Shamong

Edibility: Edible.

Habitat: Terrestrial and solitary or in groups of few.

Description: Cap: 3-16 cm in diameter, circular to slightly convex to irregular. It surface is dry and finely velvety, sometimes scaly and colour is blue to bluish-grey becoming greyish-brown to dull orange with age. **Hymenophore:** 2-3 pores per mm, angular, pale blue to grey, descending to the stem, greyish-brown to orange with age. **Stem:** 5-7 cm long and up to 2.5 cm wide, sub-bulbous, surface smooth to rough and blue-brown to greyish. **Flesh:** White. **Spore Print:** White.

Comments: *A. caeruleoporus* is reported as an edible mushroom in Bhutan. The change of their bright fall colours to pale brown are important features to recognize this species in the field. There is another species, *A. fletti* which is blue to brownish grey but the pores of this species are white, while *A. caeruleoporus* has blue to bluish-grey pores.

Aleuria aurantia (Pers.) Fuckel

(Orange Peel Fungus)

Local name: No local name known

Edibility: Edible if thoroughly cooked but it is not particularly tasty.

Habitat: Terrestrial and gregarious to clustered, often on soil or disturbed areas.

Description: Fruit body: Disc-shaped or cup-shaped, globose in very early stages of development and gradually expand until 3-5 cm in diameter. The external surface is pale orange, pruinose and under surface is smooth, usually bright orange and sometimes becoming reddish-orange. **Flesh:** Thin and bright orange. **Spore Print :** White to creamy.

Comments: This species is considered edible and is easy to recognize by the bright orange colour and grows mostly on disturbed areas. It has little flavour with thin and fragile flesh. This is not an important item for cooking in Bhutan but is used raw in salads in some countries because it gives an attractive colour. Species of *Sarcoscypha* is a similar species to *A. aurantia*. However *Sarcoscypha* spp. has a bright red internal surface, grows on wood and is tough, while *A. aurantia* is usually bright orange, grows on soil and is fragile.

Amanita* cf. *caesarea (Scop.: Fr.) Pers.

(Caesar's Mushroom)

Local Name: Gongsay Shamong

Edibility: Edible; However, many mycologists try to caution the mushroom collectors as it can be easily confused with other deadly members of the *Amanita* (*A.phalloides*)

Habitat: Terrestrial and solitary to gregarious.

Description: Cap: 5-19 cm indiameter, bright orange-red to a duller orange, often becoming more or less paler at maturity, hemispherical then plano-convex, smooth, shiny and somewhat viscid with a rather short-striate margin. **Hymenophore:** Free gills, close, yellow, sometimes forked at the margin and with a subflocculose margin. **Stem:** 6-13 cm long and 1-3 cm wide, cylindrical or enlarging downward, yellow, smooth below the ring and slightly striated above. **Ring :** Is ample, thick, membranous, yellow and slightly striated on the upper side and felted on the lower side. **Volva:** Up to 6 cm tall, connected to the stem only at the base, membranous, white on the outer surface, white or tinted orange on the inner surface except at the point of contact with the stem where it is yellow. **Flesh:** White; yellow just below the cap skin and 20 mm thick above the stem. **Spore Print:** Creamy white.

Comments: *Amanita caesarea* and its relatives *Amanita hemibapha* and *Amanita jacksonii* are among the relatively few widely-consumed edible *Amanita* species. The genus *Amanita* is better known for its poisonous members like the death angels (*Amanita virosa, A. bisporigera, A. verna*) the destroying angel or death cap (*A. phalloides*) and the hallucinogenic and toxic fly agaric (*A. muscaria*).

Amanita* cf. *flavoconia (G.F. Atk.)

(Yellow Patches or yellow wart)

Local name: No local name known

Edibility: Poisonous / Suspect.

Habitat: Terrestrial and solitary to scattered.

Description: Cap: 2-7 cm in diameter, sub-oval to convex when young, becoming plane with age, surface bright yellow to orange to pale with age and with small bright yellow warts loosely spread over the surface that disappears easily. **Hymenophore:** Free to slightly adnexed gills, close, white and sometimes with yellow edges. **Stem:** 5-10 cm long and 0.5-1 cm wide, equal, surface smooth to slightly scaly, with a persistent annulus, whitish to yellow in colour and with fragile yellow remains of the volva at the base. **Flesh:** Thin and white. **Spore Print:** White.

Comments: This species is reported as poisonous but its effects have been little studied. Symptoms of poisoning are similar to other poisonous *Amanita* species such as vomiting, dizziness and nausea. These symptoms can occur several hours after ingestion. *A. flavoconia* is sometimes confused with the yellow *A. muscaria* but *A. flavoconia* has no concentric rings at the base of the stem but have yellow patches that are remnants of the volva.

Amanita hemibapha (Berk. & Broome) Sacc.
(Half-Dyed Slender Caesar)

Local name: Gongsay Shamong

Edibility: Edible.

Habitat: Terrestrial and scattered to gregarious.

Description: Cap: 5-10 cm in diameter, hemispheric, convex to campanulate and then plane, sometimes umbonate, surface bright tomato red when young, becomes opaque orange in the disc and yellow in the margin with age, striated margin. **Hymenophore:** Free gills, crowded, whitish when young to light yellow with age. **Stem:** 5-20 cm long and a cm wide, equal and yellow to orange yellow. **Annulus:** Yellow, striated and membranous. **Volva:** Saccate, membranous and white. **Flesh:** White. **Spore Print**: White.

Comments: *Amanita hemibapha* and *A. hemibapha* var. *ochracea*, belongs to *Amanita caesarea* by their macroscopic features and they are known as "chicken egg". This name is derived because in the early stages of development the fruit bodies are covered by the universal veil and appear like egg yolks which is also true for the local name "Gongsay", but always shows part of the colour of the cap. It differs from *A. hemibapha* var. *ochracea* by the red to bright orange colour of the fruit bodies while the fruit bodies of *A. hemibapha* var. *ochracea* are yellow ochre.

Amanita hemibapha var. ochracea Zhu L. Yang

(Ochraceous Half-Dyed Slender Caesar)

Local name: Gongsay Shamong

Edibility: Edible.

Habitat: Terrestrial and scattered to gregarious.

Description: Cap: Up to 20 cm in diameter, convex to plano-convex, umbonate, brown over the disc and ochraceous to yellow towards the margin. The cap margin is tuberculate-striate and the context is white. **Hymenophore:** Free gills, crowded, white, with yellowish brown edges. **Stem:** 10-18 cm long and 1-2 cm wide, tapering towards the apex, surface whitish to yellowish and with yellowish brown to yellowish squamules. **Annulus:** Yellowish and membranous. **Volva:** Saccate and membranous and whitish. **Flesh:** Whitish. **Spore Print:** White.

Comments: *Amanita hemibapha* var. *ochracea* belongs to the *Amanita caesarea* group by their macroscopic features and is known as "chicken egg". This name was given because in the early stages of development it is egg-shaped and is covered by a white membrane which is also true for the local name "Gongsay", but shows part of the colour of the cap. It differs from *A. hemibapha* by the yellow ochre of the fruiting body.

Amanita pantherina (Gonn. & Rabenh.) Gilbert
(Panther Cap)

Local name: No local name known

Edibility: Poisonous; The European Panther contains ibotenic acid and muscimol. It is used as an entheogen much less often than the related *Amanita muscaria* because of the extremely high levels of these compounds found in the mushroom.

Habitat: Terrestrial and solitary or in a groups of few.

Description: Cap: Up to 10 cm in diameter, convex to plano-convex, deep brown to hazel-brown to pale ochraceous brown. The warts are pure white to sordid cream, finely verrucose and floccose and removable. Viscid when wet with a striate margin. **Hymenophore:** Free gills, close to crowded, white becoming greyish. **Stem:** 5-15 cm long and 0.5-2 cm wide, sub-cylindrical, white, becoming slightly light brown in age, stuffed then hollow, minutely floccose becoming smooth above the ring and with small appressed squamules or cream floccose material below. **Ring:** Small, thin and white and sometimes movable. **Volva:** White becoming grey with age, forming one or two narrow hoop-like rings above the bulbous base. **Flesh:** White and unchanging when damaged. **Spore Print:** White.

Comments: Very toxic, symptoms include psychomotor excitation, convulsions, delirium, dizziness, hallucinations and vomiting, due to their high content of toxins similar to *Amanita muscaria* which are concentrated in the cuticle of the cap. It is more toxic than *A. muscaria*. The features of the stem base and volva of *A. pantherina* are clearly differentiated from other species of *Amanita*.

Amanita rubrovolvata S. Imai

(Red Volva Amanita)

Local name: No local name known

Edibility: Although considered poisonous, the edibility of this species is still doubted. Neither edibility nor toxicity has been established, but it is suspected to be associated with neurological anomalies.

Habitat: Terrestrial and scattered to gregarious.

Description: **Cap:** 2-5 cm in diameter, convex, campanulate to applanate, sometimes umbonate, surface bright red to orange becoming yellowish-orange at margin with reddish-orange to yellow remnants of universal veil and striated margin. **Hymenophore:** Free gills, crowded and white to pale yellow. **Stem:** 5-10 cm long and 0.5-1 cm wide, sub-bulbous, surface pale yellow above the annulus and yellowish below and upper part covered with red-orange or yellow scales. **Annulus:** Membranous, fragile, with upper surface white and lower surface yellowish and a reddish-orange edge. **Volva:** Bulb-like, white and covered by red scales. **Flesh:** White. **Spore Print:** White.

Comments: This species is easily recognized in the field by medium-sized to small fruit bodies, cap bright red to orange, stem yellowish with membranous annulus and white to yellowish to reddish-orange and red powdery at the stem base.

Amanita vaginata (Bull., Fr.) (Schaeff.) Gill.
(Grisette)

Local name: No local name known

Edibility: Edible but can be confused with other poisonous species of *Amanita*.

Habitat: Solitary to gregarious and terrestrial.

Description: Cap: 5-10 cm in diameter ovoid at first, expanding to almost flat with a low umbo and a distinctly grooved margin, grey-brown, slightly paler towards the margin and smooth, slightly sticky when moist. **Hymenophore:** Free gills, close, broad and white to creamy. **Stem:** 5-15 cm long, slender, hollow, quite fragile, tapering towards the apex, white tinged with orange-brown and very fine white hairs, no ring and no basal bulb. **Volva:** White tinged and orange-brown in colour. **Flesh:** White. **Spore Print:** White.

Comments: It has grey-brown cap, white gills, absence of a ring, and membranous sack or bag at the base. The group is especially complex, where a number of forms with white to grey or brown caps are common in pine forests. Although an edible species of *Amanita,* extra care should be taken to identify the right species.

Armillaria* cf. *mellea (Vahl) P. Kumm.

(Honey Mushroom)

Local name: No local name known

Edibility: Edible.

Habitat: On decayed parts of wood mostly at the base of the tree and is gregarious to caespitose.

Description: Cap: 5-10 cm in diameter, convex to flat, sometimes depressed or wavy, surface smooth, variable in colour, honey yellow, yellow ochre and tawny to dark brown often with a few dark scales near the centre. **Hymenophore:** Sub-decurrent gills, attached or slightly descending, close to nearly distant, whitish to yellow and then brownish with age. **Stem:** 5-15 cm long and 0.5-1 cm wide, tapering towards the base, surface tough and fibrous, yellow to reddish-brown at the base and pale near apex. **Ring:** Thick, whitish to yellow and cottony. **Flesh:** White. **Spore Print:** White to cream colour.

Comments: *A. mellea* is a very common species, edible when cooked, but is best eaten in small quantities because it has been reported to cause stomach problems. This species spreads by long black cords (rhizomorphs) in the soil and they can travel large distances to infect other trees. This is one of the most dangerous parasites of trees, causing diseases and ultimately death.

Astraeus hygrometricus (Pers.) Morgan
(Hygroscopic Earthstar)

Local name: No local name known

Edibility: Inedible.

Habitat: On dry sandy soil or under conifer trees and other different woods, scattered to gregarious.

Description: Fruit body: 2-5 cm in diameter when young, globose which opens to take star like form, 5-8 cm in diameter and forming 4-20 rays of 2-4 cm long and with dirty white or grey to brown surface. **Outer surface:** Exoperidium is beige brown, dry and cracks easily. **Inner surface:** Endoperidium, gleba that is exposed after the fruit body opens is 2-3 cm in diameter, is dirty white to brownish and has a hole in the apical part from where the spores are released. **Spore Print:** Brownish.

Comments: *A. hygrometricus* is easily recognized in the field by its hygroscopic rays. They open and close in response to humidity levels in environment; opens when the humidity is high and closes when the humidity is low. This feature is very important for the mushroom because it can disperse the spores when the humidity is optimal and this ensures the conservation of the species.

Aureoboletus thibetanus (Pat.) Hongo & Nagas.

Local name: No local name known

Edibility: Inedible.

Habitat: Terrestrial and scattered to solitary.

Description: Cap: 2-5 cm in diameter, convex to flat, surface strongly viscid when wet, reticulate, reddish brown, orange-brown to pale brown, margin appendiculate with remnants of the veil, strongly gelatinized, hyaline and then pale yellow. **Hymenophore:** 1-2 pores per mm, depressed around the stem and pale yellow when wet to greenish yellow with age. **Stem:** 4-5 cm long and 0.5-1 cm wide, sub-cylindrical, surface fibrillose, viscid when young, whitish around the apex, cream-pink tones in the middle and cream coloured at the base. **Flesh:** Whitish-yellow. **Spore Print:** Light olive brown.

Comments: There is not much documentation done on this species although it is very unique by its characteristics. The characteristics that allow this to be easily recognized are their small size, bright colour of the cap, surface strongly viscid and reticulate and margin appendiculate of gelatinous consistency.

Auricularia auricula-judae (L.) Underw.

(Wood Ear)

Local name: Bjili Namcho

Edibility: Edible.

Habitat: On dead logs, branches and stumps and solitary to gregarious.

Description: Fruit body: Ear-shaped, 5-15 cm in diameter. **Upper surface (sterile):** Often veined with fine downy hair, pale brown to brown-pink and blackish when dried. **Lower surface (fertile):** Concolorous with the upper surface and slightly velvety and rarely has mild venations. **Flesh:** Thin, rubbery and pale brown to brown-pink. **Spore Print:** Creamy white.

Comments: *Auricularia auricula-judae* is an edible species and widely consumed in China where they sell the dried fruit bodies in the supermarkets. Because of its appearance it can be confused with some cup-shaped mushrooms but usually *A. auricula-judae* grows attached laterally to the wood and has no stem. The cup-shaped mushrooms are more fragile and brittle, while *A. auricula-judae* has consistency like rubber and is hard to break when fresh. Besides being an edible species, *A. auricula-judae* is supposed to have many medicinal properties.

Auriscalpium vulgare Grey
(Ear Pick Fungus)

Local name: No local name known

Edibility: Inedible.

Habitat: On rotting cones of conifers and humus and solitary to scattered.

Description: Cap: 1-3 cm in diameter, kidney-shaped or almost circular in outline, in some cases convex to plane, surface hairy like dense fibrils when young to smooth with age and reddish-brown to dark-brown. **Hymenophore:** Spines 1-2 mm long, crowded, white at first, pinkish and then brownish. **Stem:** 2-5 cm long and up to 3 mm wide, lateral, slender, surface tough, densely hairy and brownish-orange to dark brown. **Flesh:** Thin and white to pale brown. **Spore Print:** White.

Comments: The small size of *A. vulgare* makes it difficult to find in the field, however once observed, it is easy to identify because it mainly grows on decaying conifer cones and it has hairy textured, elongated lateral stem and hymenophore consists of crowded teeth.

Bolbitius* cf. *vitellinus (Pers.: Fr.)

(Sunny Side Up)

Local name: No local name known

Edibility: Edible, but too small and fragile to be of any interest. But www.rogersmushrooms.com considers it as "Poisonous/ Suspect".

Habitat: Gregarious on the lawns among grasses.

Description: Cap: 1-2 cm in diameter, conical to convex shape and sometimes becomes flat when matured fully, yellowish with light brown centre when young and slowly fades away to become whitish at maturity. The surface of the cap is translucent-striated and tears apart when opened fully. Surface viscid when moist, the margin is decurved in young specimens and plane when it matures. **Hymenophore:** Adnexed gills, close when young and becoming sub-distant when fully matured. Yellowish when very young, turns brownish as the spores are released and whitish when all the spores are released into the air. The margin of the gills is smooth with no lamellulae present. **Stem:** 2 -5 cm long, 1-2 cm wide, hollow, smooth, yellowish towards the apex and whitish at the base, sub-clavate shape, positioned to the centre, context cream-coloured and fibrillose texture. **Flesh:** White and stringy. **Spore Print**: Brown

Comments: This fragile mushroom varies greatly in size, shape, and habitat but can generally be recognized by its viscid, yellow, striated cap plus its rusty-coloured gills and soft fragile texture. Other species include *B. coprophilus*, with a greyish- pinkish cinnamon coloured cap in age, usually found on dung and *B. lacteus* with a small whitish cap.

Boletellus* cf. *emodensis (Berk.) Singer
(Shaggy Top or Hairy-cap Mushroom)

Local name: No local name known

Edibility: Edible.

Habitat: Terrestrial and solitary to scattered.

Description: Cap: 5-10 cm in diameter, round at first and then convex, surface scaly, the scales large and uplifted, some scales appressed, pinkish when young or darker red to purplish red, fading with age, margin fibrillose-scaly, appendiculate and uplifted. **Hymenophore:** Free pores, a pore per mm, bright yellow when young, discolouring reddish brown to brown with age and bruising blue when handled. **Stem:** 5-10 cm long and 1-2 cm wide, more or less equal to sub-bulbous, surface fibrillose to smooth and red to pale red. **Flesh:** Whitish to yellowish and staining greenish-blue on exposure. **Spore Print:** Olive-brown.

Comments: This species can be identified easily by the scaly-uplifted appearance on the cap, the lengthened sterile margin covering the hymenophore in early stages of development of the fruit bodies. This species is macroscopically similar to *B. ananas*, however *B. emodensis* has a red stem, dull red to pinkish red and *B. ananas* has pinkish brown stem.

Boletus* cf. *edulis Bull.: Fr.
(King Bolete)

Local name: Phap Shamong

Edibility: Edible.

Habitat: Terrestrial and solitary to scattered and sometimes gregarious.

Description: Cap: 5–25 cm in diameter slightly sticky to touch, convex when young and flattens with age. The colour is generally reddish-brown fading to white in areas near the margin and continues to darken as it matures, dull when dry and smooth with dents some parts of the cap. **Stem:** 10–15 cm long and up to 5 cm thick, it is club-shaped, or bulges out in the middle. It is finely reticulate on the upper portion but smooth or irregularly ridged on the lower part. **Hymenophore:** The under surface of the cap is made of thin tubes. They are up to 2 cm deep and 4 tubes per mm and whitish in colour when young, but mature to a lemon-yellow. The pores are angular and do not stain when bruised. **Flesh:** White, thick and firm when young but becomes somewhat spongy with age. **Spore Print:** Olive brown.

Comments: *Boletus edulis* is considered one of the safest wild mushrooms to pick for the table as there are no poisonous species that closely resemble it. The most similar mushroom may be the Devil's bolete (*Boletus satanas*) which has a similar shape, but has a red stem and stains blue on bruising. The Bhutanese has not yet developed the taste for this mushroom.This mushroom is much appreciated in europen countries especially in the dry form. It is popularly known as Porcini or cepe mushroom.

Boletus ornatipes Peck

(Ornate-Stalked Bolete)

Local name: No local name known

Edibility: Edible but some authors say that it is very bitter.

Habitat: Solitary, scattered to gregarious and terrestrial.

Description: Cap: 5-10 cm in diameter, convex, becoming broadly convex or nearly flat as it matures, pale grey to yellow brown or olive brown and becomes darker when bruised. **Hymenophore:** Bright yellow pores, not bruising, 2-3 round pores per mm and the tubes are 10 mm deep. **Stem:** 5-11 cm long, 1-2 cm thick, more or less equal, little tapered towards the apex, bright yellow becomes brownish with age or on handling, solid and yellow mycelium at the base. **Flesh:** Yellow and not staining blue on exposure. **Spore Print:** Brownish.

Comments: It is easily identified by its yellow pores and flesh and its beautifully patterned golden-yellow stem. The cap colour varies considerably but is usually some shade of grey, olive or yellow- olive. *B. ornatipes* has bitter taste. *B. auriflammeus* is similar but has a brownish-orange to brilliant golden cap and creamy or pink tinged flesh. It stains the fingers yellow when handled.

Bondarzewia* cf. *monticola (Quel.) Sing.

Local name: Kou Shamong

Edibility: Edible.

Habitat: Solitary to gregarious and terrestrial.

Description: Fruit body: 20-30 cm in diameter, consisting of one to five caps arising from a single gnarled stem. **Cap:** 5-20 cm across, kidney-shaped or irregular in outline, loosely convex, flat, or with a central depression, dry, velvety or leathery, sometimes radically wrinkled and has semi-concentric zones on the cap. Whitish to cream-coloured or pale tan and it does not bruise. **Hymenophore:** Decurrent pores, whitish, bruising very faintly brownish pores, angular, 0.5-2 mm across and the tubes are 1 cm deep. **Stem:** 4-8 cm long, 3-5 cm wide, central or somewhat off-centred, yellowish to pale brownish, dry and tough. **Flesh:** White and thick, not bruising. **Spore Print:** White.

Comments: It is easy to identify due to its white pores and their unique structure. There is no very close resemblance to this mushroom but since it is an edible mushroom, consumers have to be sure of the identification before taking it home.

Calocera viscosa (Pers., Fries.) Fr.
(Yellow Stags-horn Fungus)

Local name: No local name known

Edibility: Unknown.

Habitat: Caespitose and lignicolous on dead logs and stumps.

Description: Fruit body: 5-10 cm long, yellow when moist, orange-yellow when dry, variable in shape, upper branches often forked and smooth. **Flesh:** Yellow and gelatinous and rubbery, it does not break apart like coral fungi.

Comments: Its tough and gelatinous texture distinguishes it from coral fungi which are brittle and easily broken.

Calvatia gigantea (Batsch: Pers.) Lloyd
(Giant Puff Ball)

Local name: Pang toe

Edibility: All members of the true puffball family are considered edible when immnature except a few that can cause digestive upset if the spores have matured.

Habitat: Terrestrial and scattered to gregarious in grasses.

Description: Fruit body: Shaped like a ball or nearly so, up to 20 cm or more across, white when fresh, becoming greyish as it matures then finally yellowish or olive brown before it ruptures to throw out its spores, finely velvety when young, but soon smooth and soft. **Interior:** White and fleshy becoming yellowish or greyish yellow with dusty spores which are then blown by wind.

Comments: The deadly *Amanitas* have a volva or "universal veil" that completely envelops the young mushrooms. Before bursting from the volva, they look like little round puffball. Additionally, puffballs resemble the earth ball (*Scleroderma citrinum*). The latter are distinguished by a much firmer, elastic fruiting body and as an interior that becomes dark purplish-black with white reticulation.

Cantharellus* cf.*cibarius Fries

(Yellow Chanterelle)

Local name: Sese Shamong

Edibility: Edible.

Habitat: Terrestrial and scattered to gregarious.

Description: **Cap:** 3-10 cm in diameter, plane-convex when young to funnel-shaped with age, surface smooth, bright orange, bright yellow to pale yellow, margin undulate and sometimes enrolled. **Hymenophore:** Venations similar to gills, thick, sub-distant, decurrent and light orange to orange-yellowish. **Stem:** 2-7 cm long and 0.5-2.5 cm wide, plug-shaped, equal, surface smooth and orange-yellow to whitish. **Flesh:** White to yellowish. **Spore Print:** Creamy white.

Comments: *C. cibarius* is the most popular edible species of the *Cantharellus* genus. The most important features to identify *C. cibarius* in the field are the appearance of the hymenophore with very prominent venations resembling decurrent light orange gills and fragrant odour. It is a very common mushroom found in the market particularly in western Bhutan during the summer season and one of the most popular mushrooms in Bhutan. It can be recognised by it characteristic unique odour.

Catathelasma imperiale (Fr.) Sing.

Local name: Chhagoey Shamong

Edibility: Edible.

Habitat: Terrestrial and solitary to scattered and sometimes gregarious.

Description: Cap: 10-30 cm in diameter, convex becoming nearly flat when matured, sticky when young (but soon dry). Grey to dirty white coloured cap. The cap can be peeled easily like the leathery thin skin. **Hymenophore:** Sub-decurrent gills, close, whitish and sometimes discolouring greyish with age. **Stem:** Up to 8 cm long and sometimes up to 8 cm wide, tapering to the base and usually rooting somewhat, sometimes almost completely underground, whitish above the ring and brownish below with soil attached. **Flesh:** White and not changing on exposure. **Spore Print**: White.

Comments: *Catathelasma imperiale* is a conifer-loving species defined by its large size, decurrent gills white spore print, short, thick and rooting stem with a tapered base, sticky cap and mealy odour. *Catathelasma ventricosum* is very similar. *Tricholoma magnivelare* as well as its close relatives *Tricholoma caligatum* are likely to be confused with *C. imperiale* but neither of these species have gills that run down the stem.

Chlorociboria aeruginascens (Nyl.) Kanouse ex C.S.

(Green Wood Cup)

Local name: No local name known

Edibility: Inedible.

Habitat: On decayed hardwood logs and sticks and scattered to gregarious.

Description: Fruit body: Cup-shaped at first to disc-shaped with age and up to 1 cm in diameter, **Upper surface:** Smooth and bluish-green to turquoise bluish-green. **Lower surface:** Lighter bluish-green. **Stem:** Sometimes has a small stem, nearly up to 1 cm long of the same colour as the sterile surface. **Flesh:** Bluish-green to turquoise. **Spore Print:** Creamy white.

Comments: *C. aeruginascens* is easily recognizable in the field, due to the bluish-green or turquoise-green colour of the fruit body and the blue colouring of the wood by the mycelium. It can often be identified by the turquoise colouring of the wood where it has been growing, even in the absence of fruit bodies.

Clavariadelphus* cf. *pistillaris (Linn.: Fr.) Donk syn**. *Clavaria pistillaris***

(Common Club Coral)

Local name: No local name known

Edibility: Edible mediocre or inedible.

Habitat: Solitary to gregarious and terrestrial under hard woods and in mixed woods.

Description: Fruit body: 5-20 cm long, 1-4 cm wide, light yellow to deep ochre, with a purplish-lavender bloom over the stem, dry, smooth with longitudinal wrinkles on the lower part of the club and never branching. **Flesh:** Firm then soft and spongy, white and bruising brownish. **Spore Print:** Whitish.

Comments: The ochre-brown to flesh-coloured, club-shaped fruiting body that stains brown when handled is characteristic of this club coral. Its apex is sometimes quite broad, but not as flagrantly flattened as that of *C. truncatus*. Another species, *C. subfastigiatus* is a brownish–orange species which does not discolour as much when handled.

Clitocybe gibba (Pers: Fr.) Kummer
(Common Funnel Cap)

Local name: No local name known

Edibility: Edible.

Habitat: Solitary, scattered or gregariously growing on litter or terrestrial.

Description: Cap: 4-9 cm in diameter, depressed when young which then develops to concave or funnel shape with maturation, smooth but with brown pubescent on light brown or yellowish surface and wavy margin. **Hymenophore:** Strongly decurrent gills**,** cream white and close to crowded. **Stem:** 3-10 cm long, up to 1 cm thick, equal, fairly smooth, light yellowish and white mycelium at the base. **Flesh:** Thin and white. **Spore Print:** White.

Comments: The pale yellowish-tan cap which is funnel shaped and the crowded, whitish and decurrent gills and pallid slender stem make this species distinct and easy to identify.

Clitocybe odora (Bull.: Fr.) Kummer
(Blue-green Anise Mushroom)

Local name: No local name known

Edibility: Edible; but best used as flavouring agent due to the strong taste. Mushroom hunters should be sure to pick mature ones, mainly because the younger ones can be confused with similar poisonous ones that grow along with this mushroom.

Habitat: Growing scattered or gregarious on litter or terrestrial.

Description: Cap: 5-10 cm in diameter, convex with an enrolled margin when young, becoming flat as it matures, smooth and blue to greenish-colour. **Hymenophore:** Slightly decurrent gills, close to crowded, whitish to pinkish buff. **Stem:** 5-10 cm long up to 2 cm thick, more or less equal, covered with thin white hairs which disappear with frequent handling and appears brownish with white mycelium at the base. **Flesh:** Thin and whitish. **Spore Print:** Pinkish.

Comments: The blue-green to dull greenish colour helps to identify this species immediately in the field. The other anise-scented *Clitocybe* is never blue-green. *C. aeruginosa* has a greenish cap, but has white spores and does not smell like anise.

Clitopilus prunulus (Ccop.: Fr.)
(Sweetbread Mushroom)

Local name: No local name known

Edibility: Edible.

Habitat: Solitary to scattered, or gregarious in grassy areas and open woods.

Description: Cap: 5-10 cm in diameter, convex with a somewhat enrolled margin, becoming flat or irregular as it matures, often with a wavy margin and white to greyish in colour. **Hymenophore:** Decurrent gills, close to distant, whitish at first then becomes pinkish as the spores are released. **Stem:** 5-8 cm long and up to 1.5 cm thick, central but sometimes off-centred, equal, solid, smooth and white or pale greyish. **Flesh:** Fairly firm and white. **Spore Print:** Pink.

Comments: The pinkish spores, decurrent gills, white to greyish cap and strong mealy odour are the distinct features of this fungus. The poisonous *Clitocybe dealbata* closely resembles it but is somewhat smaller and has white spores. *Clitocybe subconnexa* and its close relatives have pinkish spores but grow in clusters and are more robust.

Conocybe* cf. *tenera (Schaeff.) Fayod

(Brown Dunce Cap)

Local name: No local name known

Edibility: Inedible, likely to be poisonous.

Habitat: Terrestrial in parks, gardens, fields, solitary to scattered.

Description: Cap: 1-3 cm in diameter, conic to campanulate, surface smooth and slightly sulcate at the margin, brown to cinnamon-brown fading with age to brown-yellowish. **Hymenophore:** Gills are annexed to free, close and cinnamon-brown to rusty-brown. **Stem:** 5-8 cm long, equal, surface smooth to fibrillose and concolorous with the cap. **Flesh:** Thin and brown. **Spore Print:** Rusty-brown.

Comments: It is relatively small, fragile, brown-coloured, usually appears solitary to scattered in disturbed soils, parks, gardens, along trails, etc. It is better not to consume it because a related species, *Conocybe filaris* contains toxins similar to *Amanita phalloides*.

Coprinus comatus (Müll.:Fr.)
(Shaggy Ink Cap)

Local name: Lueki Shamong

Edibility: The young mushrooms, before the gills start to turn black, are edible.

Habitat: Terrestrial on the road side and disturbed soil, solitary to gregarious.

Description: Cap: 5-15 cm long, 3-6 cm in diameter, cylindrical to ovoid-elongate when young and elongate-campanulate with age, surface fibrillose-scaly, uplifted, white to pinkish-beige towards the margin when young, turning blackish with age. **Hymenophore:** Free and crowded gills, white when young and turns blackish-brown with age. **Stem:** 5-18 cm long, 1-2 cm wide, equal with tapering to the apex, surface fibrillose, white to pinkish white and turns light brown when handled. **Ring:** In the midsection of the stem, movable, fibrillose and white. **Flesh:** White. **Spore Print**: Blackish.

Comments: This species is easily recognized by the shape of the fruit body with cylindrical cap, elongate when young, turning campanulate with a revolute margin at maturity and finally becoming deliquescent (a process that occurs when the cap tissue, including the hymenophore in mature specimens digests itself and melts into a dense liquid like black ink.

Cortinarius* cf. *violaceus (L.: Fr.) Fr.

(Violet Cortinarius)

Local name: No local name known

Edibility: Inedible.

Habitat: Terrestrial and scattered to gregarious.

Description: Cap: 5-15 cm in diameter with an incurved margin, convex when young, umbonate or flat as it matures. Dark violet/purple to blue-black, covered with fine, downy scales. **Hymenophore:** Dark violet gills, changing to a purplish-brown with age, adnate, becoming adnexed and are fairly well-spaced. **Stem:** 5-10 cm long, 1-2 cm thick, the base of the stem can sometimes be as wide as 4 cm thick, concolorous with the cap and covered in woolly whitish fibrils. **Flesh:** Violet. **Spore Print:** Rusty brown.

Comments: Of the many violet-coloured *Cortinarius species, C. violaceus* is the most deeply coloured. It is sometimes so dark that it is almost black, making it difficult to notice in the woods. The only other mushrooms with a comparable colour are certain *Leptonia* species, including *L. carnea* and *L. nigroviolacea*. The *Leptonia* species are easily differentiated due to their pink spore print.

Craterellus cornucopioides (Pers.) Quél.
(Horn of plenty)

Local name: No local name known

Edibility: Edible.

Habitat: Terrestrial and scattered to gregarious.

Description: Cap: 2-5 cm in diameter, deeply depressed, scaly surface, not viscid, black in colour when wet but becoming dark grey when dried, wavy margin and sometimes torn. **Hymenophore:** Fold like pseudo gills which fork near the cap margin, well spaced and shallow and bluish black which becomes greyish or paler due to spore dust. **Stem:** 2-8 cm long, equal or tapering at the base, central or off-centred, tough, hollow except at the base and concolorous with the hymenophore. **Flesh:** Thin, tough and concolorous with the cap. **Spore Print:** Whitish.

Comments: This fungus usually occurs in large groups. It is hard to locate it in the dim forest but once one piece is found it is sure to find more in the same area. *Craterellus cinereus* (black chantherelle) is somewhat similar but it has primitive gills. *Polyozellus multiplex* (blue chanterelle) is also similar but is dark blue or violet-tinted. Several Ascomycetes are black but not trumpet-shaped. *Thelephora terrestris* is sometimes funnel-shaped but is thinner, smaller and purple-brown rather than grey or black.

Crucibulum leave (Huds ex Relh.)

(Common Bird's Nest Fungus)

Local name: No local name known

Edibility: Unknown.

Habitat: Solitary to densely gregarious on wood debris.

Description: Fruit body: Up to 1 cm long and 15 mm across, at first cushion-shaped and closed, later becoming cup-shaped and the lid disappears. **Outer surface:** Yellowish at first and darkening to nearly brown when mature and velvety or fairly smooth. **Inner surface:** Smooth, shiny and whitish to pale cinnamon-coloured. **Eggs:** Up to 2 mm wide, shaped like flattened circles or ellipses, tough, attached to the nest by tiny cords and pale in colour.

Comments: This attractive little fungus is easily identified by its whitish eggs that are initially attached to the nest by thin cords. It lacks the sticky mucilage and the eggs are never black as in *Cyathus*. Another species, *Crucibulum parvulum* is similar but has a white to greyish or buff exterior.

Cyathus striatus Willd.: Pers.

(Fluted Bird's Nest)

Local name: No local name known

Edibility: Unknown.

Habitat: Scattered or gregarious on dead wood or vegetative debris in open woods.

Description: Fruit body: 1-2 cm long and 6-8 mm wide but variable in size. **Outer surface:** Greyish buff to dark brown and shaggy to woolly with tufts of hairs. **Inner surface:** Distinctly grooved or lined, smooth and shiny. **Eggs:** Initially concealed by a whitish membrane across the mouth of the cup that withers at maturity and it is up to 2 mm wide, often roughly triangular, enclosed and attached to the nest by cords.

Comments: The combination of a shaggy outer surface and a conspicuously striate inner surface make it unlikely to confuse *Cyathus striatus* with any other bird's nest. *Cyathus olla* and *C. stercoreus* resemble it but lack the striated feature on inner surface.

Cyptotrama asprata (Berk.) Redhead & Ginns

(Golden-scruffy Collybia)

Local name: No local name known

Edibility: Inedible.

Habitat: On decaying wood, solitary to scattered.

Description: Cap: 1-4 cm in diameter, convex, surface fibrillose-scaly, uplifted, with pointed or pyramid-shaped scales, yellowish orange at the disc and light yellow toward the margin. **Hymenophore:** Adnate, sub-distant and white gills. **Stem:** 2-5 cm long and 0.2-0.5 cm wide, equal, with a slightly widened base, surface fibrillose-scaly and light yellow in colour. **Flesh:** Yellowish. **Spore Print**: White.

Comments: Despite its small size, this species is easily recognized by the characteristic cap surface and the stem which has pointed or pyramid-shaped scales that detach easily when the fruit bodies are handled. It can also be identified by its orange and yellow colour of the fruit bodies and pure white gills.

Cystoderma granulosum (Batsch: Fr.)

Local name: No local name known

Edibility: Inedible.

Habitat: Growing scattered and terrestrial.

Description: Cap: 1-5 cm in diameter, dry, convex with an enrolled margin, densely covered with conical granules and warts, broadly convex or flat as it matures and tawny brown to brick red-colour. **Hymenophore:** Free gills, close, lamellate and white-colour. **Stem:** 2-5 cm long, equal or somewhat tapering at the base, solid, covered with granules and scales and is concolorous with the cap. **Flesh:** Whitish and not bruising. **Spore Print:** White.

Comments: The colour of this species are extremely variable but in most collections the cap and stem are tawny brown to brick red-or paler when faded by sunlight. Like other species of *Cystoderma, Cystoderma granulosum* has a cap densely covered with granules which as the mushroom matures may begin to separate or wear away. There is no true ring on the stem. The lack of a ring and the inamyloid spores will help to separate *Cystoderma granulosum* from other species in the genus.

Dacrymyces* cf. *palmatus (Schw.) Burt.

(Orange Jelly fungus)

Local name: No local name known

Edibility: Edible.

Habitat: Scattered to clustered and growing on wood cracks or cut down stump.

Description: Fruit body: Sessile to sub-stipitate, at first sub-globose, to cushion-shaped, soon deeply wrinkled. When fully mature it is up to 8 cm broad, narrow and pallid at the attachment point, surface viscid, yellow-orange, drying reddish-orange to reddish-brown and forming a tough membranous film on the substrate. **Context:** Gelatinous, concolorous with the cap, up to 2 cm thick and tending to liquify with age.

Comments: *Dacrymyces palmatus* is a yellow-orange jelly fungus that closely resembles yellow *Tremella* species, the common Witch's Butter. The two taxa are best told apart in the field by differences in habitat and substrate. *Tremella aurantia* typically fruits on hardwoods usually with intact bark. In contrast, *Dacrymyces palmatus* occurs on decorticated conifer wood and is not associated with *Stereum* species. *Tremella aurantia* has basidia that are longitudinally septate and ovate spores while *Dacrymyces palmatus* has tuning-fork shaped basidia and multi-septate and curved-oblong spores.

Descolea flavoannulata (L. Vassilieva) Horak

Local name: No local name known

Edibility: Unknown.

Habitat: Scattered and terrestrial.

Description: Cap: 1-5 cm in diameter, convex when young and plane when mature. The colour of the cap surface is brown with greenish tinge at the centre and appears wrinkled with substance which falls off as it matures. **Hymenophore:** Adnexed, close and brown gills with lamellulea. **Stem:** The stipe is 4-9 cm long and up to 0.5 cm wide with rather bulbous base. **Ring:** Central and movable ring. It is membranous with farrows on the upper surface. **Flesh:** Very thin and greenish brown. **Spore Print:** Brownish.

Comments: This species was spotted in the lower part of Royal Botanical Park by a group of Danish mycologists. It is distinguisted from others similar fungi by it membranous farrowed and thick ring.

Entoloma conferendum (Britzelmayr) Noordeloos

Local name: No local name known

Edibility: Unknown.

Habitat: Scattered and terrestrial.

Description: Cap: 4-7 cm in diameter, conic to cuspidate cap with oppressed fibrillose on the surface and is greyish-coloured. The cap is sometimes umbonated. **Hymenophore:** The gills are emarginated to sinuate. It is grey when young and pinkish when mature. **Stem:** 6-9 cm long and 2-5 mm wide. The stipe is fragile and hollow. It is grey with white tiny hairs. The basal part of the stipe has mycelium which collects and binds the leaf letters around it. **Flesh:** Very thin, fragile and greyish brown in colour. **Spore Print:** Pinkish.

Comments: They are tall umbrella with grey cap and pinkish gills due to spore deposit. The fruit bodies are very fraglie and grow on the ground among grass and moss in pine forests.

Favolaschia calocera (R. Heim)

(Orange Pore Fungus)

Local name: No local name known

Edibility: Unknown.

Habitat: On woods among mosses and lichens and is gregarious.

Description: Fruit body: 1-3 cm in diameter. The fungus appears as a bright orange stalked fan. **Upper surface:** Bright orange to yellowish with a relatively bumpy surface, smooth with no hairs or scales, **Under surface:** With prominent pores looking like honeycomb, wide and well spaced, more like holes, concolorous with the upper surface. **Stem:** Very short, 3-5 mm tall, laterally joined to cap. **Spore Print:** White.

Comments: It is a very unique mushroom which is easy to identify due to its large pores and bright orange colour. It does not have a close resemblance to other mushrooms and is thus easy to identify. Handling this fungus will result in orange staining of the hand.

Fistulina* cf. *hepatica (Schaeff.:Fr.)

(Beefsteak Fungus)

Local name: Che' Shamong

Edibility: Edible but it has strong sour taste which some may not like.

Habitat: Solitary to gregarious on woods**.**

Description: Fruit body: Bracket 5-15 (25) cm across and up to 4 cm thick, tongue-shaped or semicircular. **Upper surface:** Red-pinkish to orange-red in colour and jelly like when young and wet, rough with rudimentary pores especially toward the margin. **Hymenophore:** Tubes up to 1.5 cm deep, free but adhering in maturity and whitish in colour. Three circular pores per mm which are whitish at first then bruising to reddish brown in maturity or when bruised. **Stem:** Sometimes rudimentary or short, thick and blood red. **Flesh:** Thick and succulent with dark flesh-pink and lighter veining with blood-like sap. **Spore Print:** Pinkish.

Comments: It looks like a piece of red meat when sliced and blood-red liquid oozes out. Its flesh is not tough like in other polypores and bracket fungi. The similar species are *Pseudo-fistulina radicata* but this has greyish to pale red cap and its stem is longer and rooting.

Fomes fomentarius (L. Fr.) Kickx

Local name: No local name known

Edibility: Inedible.

Habitat: Solitary and grows on dead woods or from wounds in living rees.

Description: Fruit body: 8-14 cm in diameter and 2-8 cm thick. Ungulate shaped and broadly attached to the tree. The upper surface of the fruit body is smooth to feel but with bumpy zoned surface which is grey to blackish. **Hymenophore:** It has tiny pores of 2-3 pores/mm which are 4-8 mm long. The pore surface is whitish which turns brown when bruised. **Flesh:** The flesh is cinnamon brown and smooth but the flesh at the basal part is granular. The tubes are brown but the walls of the tubes are white. **Spore Print:** White.

Comments: It is said to cause white rot to the plant host and kills the host by rotting the heart of the tree. Although the fruit body is 4-8 cm thick, when cut open it has layers of tubes arranged on top of one another are visilbe. The flesh is just a cm thick with hard outer surface covering.

Fomitopsis* cf. *pinicola (Fr.) Karst.

Local name: No local name known

Edibility: Inedible due to its woody texture.

Habitat: On dead stumps and logs and occasionally on living trees and growing alone or gregariously.

Description: Fruit body: Up to 30 cm across, 15 cm thick, semi-circular or fan-shaped or hoof-shaped, smooth, becoming wrinkled with age, red to dark brownish red or brown to black toward the point of attachment, with white to yellow marginal area, hard and woody. **Hymenophore:** Cream-coloured pores, not bruising, with 3-6 round pores per mm, tube layers usually fairly distinct and the tubes are up to 8 mm deep. **Flesh:** Up to 12 cm thick, corky, hard, woody and cream to buff. **Spore Print:** Whitish.

Comments: It might be confused with *Ganoderma tsugae* but it is perennial and much harder and denser. It has a bracket to shelf-like or irregularly knobby fruiting bodies. The cap is usually brown to greyish brown with a pallid growing margin, but is sometimes reddish-brown and its flesh does not redden in KOH. It is a frequent parasite of conifers and usually grows at the base of the trunk or from its roots.

Gloeophyllum* cf. *sepiarium (Wulf.: Fr.) Karst.

Local name: No local name known

Edibility: Inedible.

Habitat: Solitary or gregarious or sometimes caespitose and growing on dead woods.

Description: Fruit body: 2-5 cm wide, 5-10cm across, up t 1cm thick and fan shaped. **Upper surface:** Yellow to reddish brown with white hairs near the margin. Concentrically ridged and radially wrinkled. **Hymenophore:** Golden-brown, mostly tough gill-like elongated pores. **Flesh:** Woody or leathery hard. **Spore Print:** Brownish yellow.

Comments: *Gloeophyllum sepiarium* is easily recognized since its cap is more or less orange. But as it matures the brown colours replace the orange from the centre outwards. The underside of this polypore features gills which is a bit odd since other polypores have pores rather than gills.

Gomphus* cf. *clavatus Pers.: S.F. Grey

(Pig's Ears)

Local name: Tai Namcho (Translation: horse ear)

Edibility: Although edible consumption may cause gastro-intestinal distress in susceptible individuals.

Habitat: Scattered to gregarious and terrestrial.

Description: Fruit body: Two or more irregularly shaped caps arising from a shared stem and often fusing together at their edges. Up to 17 cm high and 20 cm across, individual caps with wavy and irregular margins, somewhat centrally depressed at maturity. **Upper Surface:** Pale brown to light or dark violet, often fading to creamy tan or paler and smooth or with very tiny scattered scales. **Hymenophore:** Wrinkled, dirty whitish or purple when young but often fading to pale lilac, decurrent. **Stem:** 3-5 cm long and 1-3 cm wide, whitish below and violet near the hymenophore, sometimes bruising reddish brown and fairly smooth above but with a somewhat velvety base. **Flesh:** Whitish to pinkish or pale lilac. **Spore Print:** Brownish.

Comments: Also known as *Cantharellus clavatus*, this northern conifers-lover is easily distinguished by its overall shape, dull purplish veined hymenophore and growth habit in clusters.

Gomphus floccossus (Schw.) Sing.
(Scaly Chanterelle)

Local name: Ting Shamong

Edibility: Considered edible by some in Bhutan but consumption generally not advisable due to possibility of gastrointestinal upset. The compound norcaperatic acid has been isolated from this species (Miyata et al., 1966; Henry and Sullivan, 1969), and it is known to cause similar delayed gastrointestinal effects.

Habitat: Terrestrial and scattered or gregarious.

Description: Fruit body: Vase-shaped and fleshy, developing a deep central depression, 2-12 cm across and 6-15 cm long. **Upper Surface:** Cinnamon to pale orange or reddish orange to orange covered with soft, darker scales that become more prominent as the mushroom matures. **Hymenophore:** Shallow and deeply wrinkled cream colour or darker, often yellow near the cap edge when young and decurrent. **Stem:** 1-3 cm wide, not distinctly separate from the cap and concolorous to the under surface. **Flesh:** White, sometimes bruising and discolouring to brownish. **Spore Print:** Cinnamon to pale brownish yellow.

Comments: This striking mushroom and its close relatives are easily recognised by their vase-shaped fruiting body with a reddish–orange to orange-buff scaly cap and pallid veined exterior. The name *G. bonari* has been given to the western variety with milky white hymenophore. It has a tendency to grow in clusters and is paler or more cinnamon-coloured cap.

Gymnopus* cf. *dryophilus (Bull.) Murrill

Local Name: No local name known

Edibility: It is generally considered edible, although it does not taste good.

Habitat: Scattered to gregarious and on the ground among the pine leaves.

Description: Cap: 2-8 cm in diameter, papillate when young, up-lifted-umbilicate when mature, the margin is rolled upwards. Coffee-coloured when young then turns to light brown as it matures. **Hymenophore:** Adnexed gills when young and emarginated when mature, clean white when young and cream white as it matures, crowded, with eroded margin and lamellulae present. **Stem:** 3-10 cm long and 0.7-1.2 cm wide at the apex, pinkish in colour when moist and fading buff when drying and it is hollow. **Flesh:** White. **Spore Print:** White.

Comments: This honey-brown to buff-brown *Gymnopus* lives up to its species name, seldom venturing far from oaks and among pine niddles. A close cousin, *Rhodocollybia butyracea*, is similarly coloured but has a lubricous cap, gills with finely scalloped edges, a cream spore print with a hint of pink, and a faintly striated stem.

Gyromitra* cf. *infula (Schaeffer:Fr.) Quélet

(Hooded false morel or the elfin saddle)

Local name: No local name known

Edibility: Poisonous.

Habitat: Terrestrial and solitary to gregarious.

Description: Fruit body: 5-10 cm in diameter, occasionally cup-shaped when young, saddle-shaped to tri-corner hat-shaped with even or occasionally wrinkled surface. **Hymenophore:** Yellow-brown to orange-brown to cinnamon-brown, with margin free or sometimes attached to stem. Sometimes uplifted portions of margin are attached to each other. **Stem:** 2-9 cm long and 1-2 cm wide, equal or wider at base, surface pale pinkish-brown or sometimes whitish over the base or over the entire surface and sometimes compressed or slightly cleft with age. **Flesh:** Thin and brittle. **Spore Print:** Creamy white.

Comments: *G. infula* is characterized by uplifted, folded 2-3 times, more or less brown cap, with edges sometimes fused. *Gyromitra infula* is most likely to be confused with saddle-shaped species of *Helvella* with smooth stipes. It contains the toxic compound gyromitrin, which when digested is metabolized into monomethylhydrazine, a major component of rocket fuel. Although much of the gyromitrin may be removed by parboiling with generous volumes of water, consumption is not advisable due to possible long-term health effects—there is evidence that even small doses of gyromitrin may have a cumulative carcinogenic effect.

Helvella atra Koenig, Fr.
(Dark Elfin Saddle)

Local name: No local name known

Edibility: Unknown.

Habitat: Terrestrial among leaf litters and scattered to gregarious.

Description: Fruit body: 1-3 cm, loosely lobed, often forming two or three distinct lobes, smooth or somewhat wrinkled, dark brownish grey to black, the margin not typically rolled upwards. **Under surface:** Greyish to greyish brown and finely fuzzy. **Stem:** 1-5 cm long, up to 0.5 cm thick, dark grey or greyish brown, finely fuzzy. **Flesh:** Thin and brittle. **Spore Print:** White.

Comments: This species can be identified by its greyish-brown to brown mottled cap. It is reminiscent of *H. crispa* and *H. lacunosa,* but is darker than the former and paler than the latter. It might also be confused with *Gyromitra californica*, but is less fragile and lacks the strongly spreading or umbrella-like cap of that species. *H. fusa* is said to be quite similar, but has distinct ribs on the underside of the cap and lacks a flaring margin.

Helvella crispa (Scop.) Fr.
(Common White Saddle)

Local name: No local name known

Edibility: Although some guidebooks list this species as edible the genus is now regarded with suspicion by many. Research has established this species contains methylhydrazine, which can cause severe sporadic intoxications and may be carcinogenic.

Habitat: Terrestrial and solitary to gregarious.

Description: Fruit body: 1-5 cm long, irregularly lobed, looks like paper flower. **Upper surface: S**mooth or slightly wrinkled and creamy white to yellowish. **Under surface:** Finely hairy, concolorous with the upper surface or slightly darker, the margin often curled upwards and usually not fused with the stem where contact occurs. **Stem:** 3-10 cm long, 1-3 cm wide, white or slightly pinkish with cross-veins and with pockets like tiny windows. **Flesh:** Thin, brittle and often chambered in the stem. **Spore Print:** White.

Comments: The white to buff cap and deeply ribbed or fluted stalk are characteristic of this beautiful elfin saddle, which is the type species of the genus *Helvella*. The cap is not brown as in *H. maculatae*, nor grey or black as in *H. lacunosa*.

Helvella macropus (Pers.) P. Karst.

(Scurfy Elfin Cup)

Local name: No local name known

Edibility: Inedible.

Habitat: On litter under trees and scattered to gregarious.

Description: Cap: 2-5 cm in diameter, cup-shaped to disc-shaped when young, plane to up lifted with age, velvety and grey-brownish. **Hymenophore:** Smooth, greyish and sometimes with blackish spots. **Stem:** 2-6 cm long and 0.2-0.5 cm wide, equal, surface velvety and grey-brownish. **Flesh:** Thin and greyish-white. **Spore Print:** White.

Comments: *H. macropus* is characterized by an uplifted cap with a velvety to greyish-brown surface.

Hericium* cf. *erinaceus (Bull.: Fr.) Pers

(Old man's Beard)

Local name: Rapoe Jaw

Edibility: Edible

Habitat: Solitary on living trees or on the cut ends of recently felled logs.

Description: Fruit body: 8-20 cm, rounded to elongate, a mass of overlapping slender spines arising from a short rooted stalk, spines up to 2-6 cm long with pointed tips, pinkish when tender then white when fresh then becomes yellowish to yellowish-brown as it matures. **Flesh:** Whitish and tough. **Spore Print:** White.

Comments: Of the three *Hericiums, H. erinaceus* is the most recognizable with a rounded fruiting body composed of pendant, long, slender and white to creamy teeth. Close relatives include *Hericium abietis* which has a compact branching structure with shorter clustered teeth and *Hericium ramosum,* sparsely branched with short teeth that tend to be arranged in rows.

Humaria hemisphaerica (F H Wigg.: Fr.) Fuckel
(Hairy Fairy Cup)

Local name: No local name known

Edibility: Unknown.

Habitat: Grows on well-decayed wood or on the ground and solitary or gregarious.

Description: Fruit body: Goblet shaped when young, becoming more broadly cup-shaped and reaching widths of 2-3 cm when mature. **Upper surface:** White or pale bluish, fairly smooth. **Under surface:** Densely hairy with prominent hairs that extend above the margin of the cup, brown, without a stem. **Flesh:** Brownish or pale and brittle. **Spore Print:** Creamy white.

Comments: The combination of pallid fertile surface and brown hairy exterior make this an easy cup fungus to recognize. *Jafnea semitosta* is a large species with a creamy-white to tan or brown interior, a brown exterior clothed with scattered soft brown hairs, plus a short ribbed stalk. Other hairy species, *Trichophaea boudieri* and *T. bullata* have a pale grey to whitish interior and brown hairy exterior, but are much smaller and grow on wet soil under conifers.

Hydnellum peckii Banker

(Peck's hydnum or "bleeding tooth fungus")

Local name: No local name known

Edibility: Unknown but believed to have medicinal properties (Anticoagulant activity).

Habitat: Growing solitary, scattered or clustered together and is terrestrial.

Description: Fruit body: 4-10 cm, convex to flattened and sometimes slightly depressed in the centre. It is more or less uneven, somewhat round to irregular. **Upper surface:** Usually has a dense covering of "hairs". It is initially whitish, but later turns slightly brownish with irregular blotches of dark-brown to nearly black colour where it is bruised. In maturity, the surface is fibrous and tough, greyish-brown in the central part which is woody. **Hymenophore:** Cylindrical and tapering teeth, less than 5 mm, pinkish-white initially and greyish-brown as it matures. They are crowded together with 3-5 teeth per mm. **Stem:** Thick, short and often deformed. It becomes bulbous where it inserts into the ground, and may root into the ground for several centimetres. It is up to a cm wide, 2-3 cm tall above the ground. The upper part of the stem is covered with spines like the underside of the fruiting body, the lower part of the stem is hairy and often encases debris from the forest floor. **Flesh:** Pale pinkish-brown. **Spore Print:** Brown.

Comments: The bright red droplets that cling to the surface of the cap in moist weather make this a striking and easily identified mushroom. As in other *Hydnellums*, the cap varies considerably in colour and texture according to age and environmental conditions.

Hydnum repandum L.:Fr.
(Hedgehog Mushroom)

Local name: Chey Shamong

Edibility: Edible.

Habitat: Terrestrial and solitary to gregarious.

Description: Cap: 2-10 cm in diameter, convex to depressed, surface fibrillose, pale orange cream, margin smooth, enrolled to decurved. **Hymenophore:** The teeth are concolourous to the cap surface and up to 0.5 cm long. **Stem:** 2-10 cm long, 1-2 cm wide, equal, position central to eccentric, surface fibrillose concolourous to the cap surface. **Flesh:** Whitish-cream, sometimes discolouring yellowish when bruised. **Spore Print:** White.

Comments: The fleshy consistency and orange-cream colour of the fruit body and consisting of prominent teeth are diagnostic in identifying this species. *H. repandum* is a popular edible species but it is usually found in small quantity here in Bhutan and as such not very popular.

Hydropus nigrita (Berk. & Curt.) Sing.

Local name: No local name known

Edibility: Inedible.

Habitat: Lignicolous and gregarious.

Description: Cap: 2-5 cm in diameter, convex to plane with a low umbo, finely fibrillose surface, greyish-yellowish-brown but turning black when handled. **Hymenophore:** Gills are adnexed, crowded, white to yellow that turn black with handling. Watery secretion present on the gills. **Stem:** 1-5 cm long and up to 0.5 cm wide, equal, surface finely powdery to fibrillose, greyish to yellowish-grey but turns blackish when handled. It produces an abundant, colourless secretion when the fruit body is cut. **Flesh:** Thin and light grey. **Spore Print:** White.

Comments: *H. nigrita* is characterized by the black colour that appears on the cap, gills and stem when handled. And also by the abundant colourless secretion discharged primarily by the cap and gills when cut and which immediately turns black.

Hygrocybe cantharellus (Schw.:Fr.) Murrill
(Chanterelle waxy cap)

Local name: No local name known

Edibility: Inedible.

Habitat: Saprobe in hardwood forests and mixed woods on soil or in moss. Sometimes on rotting logs and growing gregariously.

Description: Cap: 2-5 cm in diameter, convex to campanulate, becoming plane to depressed, surface with fibrillose, red-orange, fading to yellow, margin plicate-striate. **Hymenophore:** Decurrent gills, distant to sub-distant and pale orange to light-yellow. **Stem:** 5-10 cm long and up to 0.5 cm wide, surface longitudinally fibrillose, orange red to orange yellow to whitish toward the base. **Flesh:** Thin and orange-yellow. **Spore Print:** White.

Comments: *H. cantharellus* is distinguished by the long, longitudinally fibrillose and yellow to orange stem, red orange cap that becomes yellow in age and distant, decurrent and very pale yellow gills.

Hygrocybe conica (Fr.) Kumm.
(Witch's Hat)

Local name: No local name known

Edibility: Inedible.

Habitat: Terrestrial under hardwoods or conifers, solitary to gregarious.

Description: Cap: 2-5 cm in diameter, conical to bell-shaped, surface fibrillose, red mostly on the disc to yellowish-red towards the margin. The colour varies in some cases to orange-yellow. **Hymenophore:** Gills free and close with yellowish white to greenish yellow in colour. **Stem:** 5-10 cm long and up to 1 cm wide, sub-clavate, surface fibrillose, yellowish-orange from the mid-section to the tip and greenish-yellow toward the base. Cap, stem and gills turn black with handling. **Flesh:** Reddish to orange-yellow. **Spore Print:** White to cream.

Comments: This species is relatively easy to identify by the conical shape of the cap and from bright red to orange-red, yellowish-orange and even greenish-yellow colours. However, the most important characteristic is that all parts of the fruit body bruise and discolour strongly black when bruised and as it ages.

Hygrophoropsis aurantiaca (Wulf.:Fr.) Maire
(False Chanterelle)

Local name: No local name known

Edibility: It has been described as edible (though not tasty) by some experts, but other authors describe it as poisonous.

Habitat: Terrestrial or occasionally on wood and solitary, scattered or gregarious.

Description: Cap: 5-10 cm in diameter, convex, plane-depressed, bright orange to orange-brown or yellowish-brown. **Hymenophore:** Decurrent and close gills, repeatedly forked and pale yellow to orange. **Stem:** 2-10 cm long and up to 1 cm wide, equal, sometimes curved, orange to light yellow with brownish shades. **Flesh:** Orange. **Spore Print:** Cream-coloured.

Comments: *H. aurantiaca* can be recognized by the bright orange to brownish colours of the fruiting bodies, the orange forked gills are a distinctive feature. This species sometimes is confused with *Cantharellus,* however, *H. aurantiaca* has true gills, rather than false gills and has soft flesh compared to the hard-flesh of the *Cantharellus*.

Hygrophorus* cf. *russula (Schaeff.: Fr.) Quel.

(Russula –Like Waxy Cap)

Local name: Eto Shomong

Edibility: Considered edible in Bhutan.

Habitat: Terrestrial and scattered or gregarious.

Description: Cap: 5-10 cm in diameter, convex when young, becoming flat as it matures, slimy but often drying out quickly, smooth or finely hairy in places, margin enrolled and soft or cottony, eventually unrolling, reddish to pinkish and often bruising yellow in places especially near the margin. **Hymenophore:** Gills are attached to the stem or beginning to run down, close, white when young, soon developing reddish spots or becoming pinkish overall. **Stem:** 3-7 cm long and 1-3 cm wide, more or less equal, white at first but soon developing the colours of the cap, smooth or finely hairy and solid. **Flesh:** White and flushed with pink, thick and soft. **Spore Print:** White.

Comments: Features defining *Hygrophorus russula* include the reddish spotting on the mature gills, the habitat under hardwoods and the fact that the cap and stem often feature streaks and spots of purplish pink shades. Several conifer-loving *Hygrophorus* species are very similar in appearance. *Hygrophorus russula* has a slimy cap but it soon dries out.

Hypholoma fasciculare (Huds.) P. Kumm
(Sulphur Tuft or clustered wood lover)

Local name: No local name known

Edibility: Poisonous; symptoms may be delayed for 5–10 hours after consumption, after which there may be diarrhoea, nausea, vomiting, proteinuria and collapse.

Habitat: On decaying logs and stumps of hardwoods and conifers and gregarious to caespitose.

Description: Cap: 0.5-5 cm in diameter, conical to convex, becoming plane-convex, surface smooth, in some cases with reddish-orange disc and greenish-yellow towards the margin. **Hymenophore:** Attached gills, close to crowded, sulphur yellow, becoming olive or greenish-yellow to brown-blackish. **Stem:** 3-9 cm long and up to 1 cm wide, equal, surface fibrillose and yellow to tawny with reddish-brown stains. **Flesh:** Thin and yellow. **Spore Print:** Brown-purplish.

Comments: The greenish-yellow gills, dark spores and clustered growth habit makes easy to identify *Hypholoma fasciculare* in the field. Clustered caps often assume a greyish tinge from a coating of spore dusts on maturity. *N. capnoides* has similar cap colours but the gills are never yellow and it grows only on conifers.

Laccaria amethystina Cooke

(Amethyst Deceiver)

Local name: No local name known

Edibility: Edible, though generally not considered a choice edible.

Habitat: Terrestrial and solitary to scattered or gregarious.

Description: Cap: 2-5 cm in diameter, convex to convex-umbilicate, surface occasionally translucent-striate, finely powdery to fibrillose, finely scaly when it loses moisture, greyish-purple when young and violet-yellow with age. **Hymenophore:** Gills are sinuate, distant to sub-distant and greyish-purple. **Stem:** 2-8 cm long and up to 1 cm wide, sub-clavate to bulbous, surface fibrillose, coarsely hairy or scaly of the same colour as the cap surface. **Flesh:** Violet. **Spore Print:** White.

Comments: This mushroom is easily recognized by the purple colour of the fruiting bodies. It has thick purple gills, white spore print and a small cap that is initially purplish but soon fades to buff or brownish. *L. amethystina* differs from the other species of purple *Laccaria* by the spacing of the gills.

Lactarius* cf. *deliciosus (L.: Fr.) S F Grey

(Saffron milk cap)

Local name: Om Shamong

Edibility: Edible.

Habitat: Scattered to gregarious and terrestrial.

Description: Cap: 4-10 cm in diameter, convex, margin enrolled when young, surface viscid when moist, banded concentrically with shades of orange, often developing green discolouration in age. **Hymenophore:** Gills decurrent, narrow, close to crowded, dull orange. **Stem:** 2-5 cm long and up to 2 cm wide, solid when young, hollow in age, equal to tapered at the base, surface smooth, dull orange-buff, bruising green where handled. **Flesh:** Thick and brittle. **Milk:** Bleeding dark orange latex when cut which turns green. **Spore Print:** White.

Comments: *Lactarius rubrilacteus* closely resembles *L. deliciosus* with orange to orange-red zoned, shallowly, infundibulate caps and tends to develop green discolouration in age but *Lactarius rubrilacteus* has dark reddish latex rather than carrot-orange.

Lactarius lignyotus Fr.

Local name: Om Shamong

Edibility: Inedible.

Habitat: Terrestrial and lignicolous solitary to sometimes scattered.

Description: Cap: 3-11 cm in diameter, convex when young and becoming depressed as it matures, often with a rugged or wrinkled surface, blackish when young turns brownish as it matures with the margin sometimes becoming ridged. **Hymenophore:** Gills decurrent and distant, whitish but stains reddish to pinkish when damaged. **Stem:** 5-11 cm long up to 1.5 cm wide, equal with slightly tapering at the base and concolorous with the cap except for a whitish base. **Flesh:** White which changes slowly to pinkish on exposure to air. **Milk:** White and drying to pinkish. **Spore Print:** Creamy white.

Comments: This species is easy to identify in the field due to its black colour with white latex but it has many varieties. This one has a rough cap surface and thick flesh of medium size but there are other larger varieties and smaller ones too.

Lactarius piperatus (Scop.: Fr.) S. F. Gray
(Peppery Milk Cap)

Local name: Om Shamong

Edibility: Edible when well cooked but it is not recommended. The milk has a very hot and acrid taste, which can be removed by cooking or drying.

Habitat: Terrestrial and scattered to gregarious.

Description: Cap: 5-15 cm in diameter, at first convex becoming flat with a shallow central depression, smooth or slightly wrinkled with whitish and sometimes yellowish tan and the margin is even. **Hymenophore:** The gills are attached to the stem or decurrend, crowded, many forked at the ends of the gills, white in colour becoming pale cream. **Stem:** 2-8 cm long up to 2 cm wide, white, more or less equal or tapering somewhat to the base, smooth and solid. **Flesh:** White and thick. **Milk:** White and sometimes drying greenish or yellowish. **Spore Print:** White.

Comments: The dull dry white cap and very crowded narrow gills, extremely peppery taste and copious white milk which form distinctive set characters. It looks similar to *Russula brevipes* and *Russula delica* but those species lack the latex. There are several similar, medium-sized to large whitish, acrid milk caps with white latex, including *L. neuhoffii*, with large spores and gills that are sometimes pale pinkish.

Lactarius torminosus (Schaeff.: Fr.) S.F. Gray
(Woolly Milk Cap or Bearded Milk Cap)

Local name: Om Shamong

Edibility: Not recommended.

Habitat: Terrestrial and scattered to gregarious.

Description: Cap: 3-8(15) cm in diameter, depressed cap with incurved margin. The colour is pinkish to light brown with darker hair. The hair is longer at the marginal edge than on surface **Hymenophore:** Adnate to subdecurrent gills, white which stains creamy by the milk, lamellulae present. **Stem:** Up to 5 cm long, light brown in colour, smooth with white mycelium at the base, semi-hollow, equal and centred positioned. **Flesh:** Whitish soft and thin. **Milk:** White which dries out to be creamy brown. **Spore Print:** Creamy white.

Comments: The peppery taste of this mushroom when raw can blister the tongue if sampled in sufficient quantity. Some authors have reported the species as poisonous or causing "mild to fatal gastroenteritis". *L. pubescens* is physically quite similar, but can be distinguished by its paler colour and smaller spores (6–8.5 by 5–6.5 µm.*)* *L. controversus* has a cap margin that is not as hairy and whitish to cream-coloured gills and larger spores measuring (7.5–10 by 6–7.5 µm.)

Lactarius* cf. *volemus (Fr.) Fr.

(Weeping Milk Cap)

Local name: Om Shamong

Edibility: Edible.

Habitat: Terrestrial among mosses and scattered to solitary.

Description: Cap: 5-13 cm wide, at first convex with an enrolled margin then becomes flat with a central depression as it matures, smooth or slightly wrinkled, brownish orange, or sometimes lighter, typically without distinct zones of colours but often darker towards the centre. The margin is even. **Hymenophore:** The gills are attached to the stem or running slightly down, close, creamy white then discolouring brown when bruished, often forking near the margin. **Stem:** 6-12 cm long, up to 2 cm wide, concolorous with the cap or paler, equal or tapering to the base, smooth, solid or hollowing somewhat. **Flesh:** White, eventually staining brown when cut. **Milk:** White, sometimes becoming brownish on exposure to air but always staining the tissues brown. **Spore Print:** White.

Comments: *Lactarius volemus* is an attractive mushroom, fairly easy to recognize by its brownish orange colourations. Its white milk stains paper, hands and everything in sight brown and has tendency to develop a fishy odour. Its cap is smooth or only slightly wrinkled, separating it from the similar *Lactarius corrugis* (which lacks the fishy odour). *Lactarius hygrophoroides* is similar in appearance but has distant gills and non-staining milk.

Laetiporus* cf. *cincinnatus (Morgan) Burdsall, Banik, & Volk
(White-pored Chicken of the woods)

Local name: Taa Shamong

Edibility: Edible but needs to be cooked well.

Habitat: Sometimes solitary but often in over lapping clusters on dead woods and on living trees as well. Sometimes growing as rosettes from roots of the tree and buried woods.

Description: Fruit body: 12–38 cm across, fan-shaped or irregularly semi circular, thick and fleshy, usually in large groups. **Upper surface:** Uneven, lumpy and wrinkled, lemon-yellow or yellow-orange with obtuse margin. **Hymenophore:** Dirty white to grey colour with tiny pores. **Flesh:** White. **Spore Print:** White.

Comment: There is another type of fungus which has a white pore surface and some authors recognize it as *Laetiporus sulphureus* var. *semialbinus* syn. *Laetiporus cincinnatus* but both are edible when cooked well. *Laetiporus sulphureus* has yellow pores in contrast to *Laetiporus cincinnatus*.

Leccinum* cf. *aurantiacum (Fr.) Gray syn. ***Boletus aurantiacus***

Local name: No local name known

Edibility: Edible.

Habitat: Terrestrial on leaf litter and scattered to solitary.

Description: Cap: 4-10 cm wide, at first hemispherical and later becomes flatter. The skin of the cap is light reddish brown to reddish orange-brown, smooth, dry but slimy when damp. **Hymenophore:** The pores are creamy white when young but greyish later. In older specimens the pores towards the margin are bulged out, while around the stem they dent in strongly. **Stem:** 4-14 cm long and up to 3cm wide, slim, with white and dark to black flakes and tapering at the apex. It has white mycelium at the base. **Flesh:** Whitish, later more grey-white and does not change colour when bruised. In young specimens it is relatively firm, but it very soon becomes spongy and holds water, especially in rainy weather. **Spore Print:** Dull brown**.**

Comments: There are several similarly coloured species that are best differentiated microscopically, but *L. montanum* can be distinguished by its different mycorrhizal host. *L. grisenigrum* is associated with birch. There are several species with a blackish to bluish-grey to dark brown cap. *L. snellii* also has a dark cap.

Leccinum* cf. *versipelle (Fr. et Hook) Snell
(Orange Birch Bolete)

Local name: No local name known

Edibility: Edible.

Habitat: Terrestrial among mosses and solitary to scattered.

Description: Cap: 8–15 cm in diameter, parabolic to convex, reddish orange with tiny black mole like structures all over the cap, slightly viscid with the margin overhanging the pores. **Hymenophore:** Tiny pores, whitish at first later developing greyish, white tubes bruised to chocolate brown when handled. **Stem:** 4-9 cm long, whitish-greyish covered with woolly brownish-black scales with white mycelium at the base. **Flesh:** White then dark brown but blue-green in stem base and finally blackish. **Spore Print:** Brownish.

Comments: *Leccinum scabrum* which occurs under birch has a brown cap; its stem flesh does not display a marked colour change when it is cut but turns darker very slowly. Although it is said to be edible care should be taken not to confuse with other similar species.

Leotia lubrica (Scop.) Pers., Fr.

(Jelly babies)

Local name: No local name known

Edibility: This species is not toxic but very tiny to be of any interest.

Habitat: Gregarious and terrestrial among mosses.

Description: Cap: 1-3 cm in diameter, variable in shape but more or less convex, convoluted with a smooth or slightly wrinkled surface, sticky or slimy when fresh, but sometimes drying out, the colour is buff brownish yellow or greenish yellow and the margin is enrolled. **Under side:** Yellowish and smooth. **Stem:** 2-8 cm long, up to 1 cm wide, smooth or finely roughened, more or less equal, sticky or slimy when fresh, concolorous with the cap or paler and hollow or filled with jelly. **Flesh:** Gelatinous when fresh. **Spore Print:** White.

Comments: Besides texture, *Leotia lubrica* is characterized by a yellowish, viscid (when moist) cap with an enrolled margin. The stem is concolorous with the cap but usually brighter and is finely scaled. Closely related are *Leotia viscosa*, which has an olive to dark-green cap and a yellowish to buff-coloured stem.

Lepista* cf. *nuda (Bull.: Fr.) Cooke

(Wood Blewit)

Local name: No local name known

Edibility: Wood blewits are generally regarded as a good edible but they are also known to cause allergic reactions in sensitive individuals. This is particularly likely if the mushroom is consumed raw, though allergic reactions are known even from cooked blewits.

Habitat: Terrestrial often growing in fairy rings.

Description: Cap: 6-15 cm in diameter and retains a slightly enrolled margin until the violet tinge on the cap fades and the surface turns buff brown. Old specimens sometimes develop wavy margins. **Hymenophore:** Gills are close, adnate to adnexed, purple or pale purple to bluish-purple or greyish-purple when young, fading to buff and pinkish-buff or brownish in age. **Stem:** 5-10 cm long and 1-2 cm wide, more or less equal and solid. **Flesh:** Thick, soft and purplish to lilac-buff. **Spore Print:** Pale pinkish-buff.

Comments: A similar species *Lepista saeva* lacks the violet tinge to the cap. Care should be taken to ensure that these edible mushrooms are not confused with some of the larger purple species of *Cortinarius*. All *Cortinarius* fungi have rusty brown spores and as such is fairly easy to distinguish them from *Lepista nuda*.

Leucoagaricus rubrotinctus (Peck) Singer

Local name: No local name known

Edibility: Inedible.

Habitat: Terrestrial or on wood and solitary to scattered.

Description: Cap: 3-7 cm in diameter, convex to plane-umbonate, surface fibrillose and scaly, with the fibrils arranged radially on the cap, brownish-red on a white background. **Hymenophore:** Gills are free, close, white and moderately broad. **Stem:** 6-13 cm long and up to 1 cm wide, equal to bulbous, surface fibrillose and bright white. **Ring:** Membranous and white with a reddish-orange margin. **Flesh:** White. **Spore Print:** White.

Comments: *L. rubrotinctus* is one of the more distinctive species, easy to recognize by a cap which has a reddish-brown disc, a surface that becomes fibrillose due to splitting of the cap, free white gills and a ring.

Lichenomphalia umbellifera (L.) Redhead, Lutzoni et Moncalvo

Local name: No local name known

Edibility: Too small to be of interest.

Habitat: Gregarious and growing as a lichen associate on decaying wood.

Description: Cap: Very small fungi with cap sized of 0.6-1.2 cm wide. Convex when young with depressed centre and uplifted when mature, it is lemon yellow with darker centre which dries out much paler. **Hymenophore:** The gills are decurrent, distant with lamellulae present. The gills are concolourous to the cap. **Stem:** 2-3 cm long and 1 mm wide, light brown in colour and slightly hollow with thicker base. **Flesh:** Very thin. **Spore Print:** White.

Comments: This is the fruit body formed by the lichen when they need to produce spores. It is a very tiny fruit body and grows on the ground covered with lichens or if there is hypha of lichen. Is also grows on wood covered with lichens.

Lycoperdon echinatum Pers., Pers.

(Spiny puffball)

Local name: No local name known

Edibility: Inedible.

Habitat: Terrestrial and gregarious but sometimes solitary.

Description: Fruit body: 3-5 cm across, 4-8 cm long, globe-shaped fruit body on a short stem, white when young, becomes yellowish brown when it matures. The soft spines are in sets of three or four that converge at the tips and looks like a pyramid. **Flesh:** White when young and greyish brown when it matures. **Spore Print:** Purple-brown.

Comments: *Lycoperdon pulcherrimum* closely resembles *L. echinatum,* but its spines are stouter and it does not turn brown with age and the surface of the fruit body underneath the spines is smooth, not pitted. Young specimens of *L. pedicellatum* may also be difficult to distinguish from *L. echinatum* but the former has a smooth outer surface when mature and has spores attached to a pedicel. *Lycoperdon compactum* also resembles *L. echinatum* in appearance but differs in having smaller spores.

Lycoperdon perlatum Pers.
(Common Puff Ball)

Local name: Fawang goti

Edibility: Edible when young.

Habitat: On plant debris and fertile soil solitary or scattered to gregarious.

Description: Fruit body: 2-6 cm wide and 3-8 cm long. Globose, white when very young and shaped like a pear with age, yellowish brown at maturity, some appearing elongated toward the base, The surface is ornamented with white conical spines which becomes brownish-yellow with age and which falls off in maturity leaving a scar surrounded by small warts, which together give a reticulated appearance. At maturity the fruit bodies develop a central perforation through which spores are liberated. **Flesh:** Solid and white when young, dusty and dark brown with age (due to the spores). **Spore Print:** Dark brown.

Comments: This species is reported as edible but only in early stages of development. The collectors should be careful as there are other similar puffballs that are not edible. Mature specimen of this species was reportedly used in west as a wound healing agent and was used for the same purpose here in Bhutan by the rural people and in traditional medicines.

Lyophyllum aggregatum (Schaeff.: Fr.) Kühner

Local name: Bjishi Ruru

Edibility: Edible.

Habitat: Terrestrial and caespitose.

Description: Cap: 1-6 cm in diameter, convex when young and grows to be depressed as it matures with decurved margin in young specimens becoming uplifted at maturity. Light brown to grey colour and viscid when wet. **Hymenophore:** Adnexed, white and close gills. Lamellulae present. **Stem:** 3-11 cm long up to 3 cm wide, equal with fused base, white, smooth and semi-stuffed stem. **Flesh:** White, no change in colour on exposure to air. **Spore Print:** White.

Comments: It can be confused with others of the same group, however all are edible. The only danger of confusion could be with the toxic *Entoloma lividum* which occurs individualy and does not aggregate. It is very prone to insect attack and is not advisable to take to far away market unless it is dried or stored in cold storage.

Lyophyllum shimeji (Kawam.) Hongo

Local name: Kashi Shamong

Edibility: Edible.

Habitat: Terrestrial and scattered to gregarious.

Description: Cap: 2-10 cm in diameter, convex, brown surface and decurved to plane margin with viscid surface. **Hymenophore:** Sub-decurrent, white and close gills. The margin of the gills is serrete with lamellulae. **Stem:** 2-7 cm long and up to 3 cm wide, equal to sub-clavate, central and fused base in some cases. It is white and semi-stuffed. **Flesh:** White and not changing colour when exposed to air. **Spore Print:** White.

Comments: *L. shimeji* should always be cooked. It is not good to serve raw due to a somewhat bitter taste. The bitterness disappears completely upon cooking. The cooked mushroom has a pleasant, firm, slightly crunchy texture and a slightly nutty flavour. This mushroom has the same problem as other *Lyophyllum* in being very prone to worms.

Microporous affinis (Blume & T. Nees)

Local name: No local name known

Edibility: Unknown.

Habitat: Gregarious and lignicolous.

Description: Cap: 1-5 cm in diameter. **Upper Surface:** 4-5 concentric lines, yellowish towards the stem and reddish and then whitish at the margin. **Under surface:** Tiny pores (3-5 pores per mm), cream to whitish which turns yellowish when bruised, with a smooth surface. **Stem:** Up to 2 cm long, hard and brownish to reddish-colour. **Flesh:** White and rubbery. **Spore Print:** White.

Comments: It looks like a tiny *Ganoderma* species but it has thinner context than *Ganoderma*. It is found to be growing gregariously and sometimes the caps are fused with eachother.

Mutinus caninus (Huds.: Pers.) Fr.

(Dog Stinkhorn)

Local name: No local name known

Edibility: The Dog Stinkhorn is probably edible at the 'egg' stage, but it is not recommended**.**

Habitat: Solitary to gregarious and terrestrial.

Description: Immature Fruit Body: Often partially submerged in the ground, appearing like a whitish to pinkish or purplish "egg" up to 4 cm long. When sliced reveals the stinkhorn-to-be encased in a gelatinous substance. **Mature Fruit Body:** 4-15 cm long and up to 1 cm wide, more or less equal, with a slightly swollen apex, sometimes whitish below with pinkish to orange red above. It has whitish volva remnants at the base. The slime quickly becoming foul smell and is often removed by insects.

Comments: *Phallus rubicundus* is very similar in appearance, but has a distinct head that hangs skirt-like from the tip of the stem.

Otidea* cf. *onotica (Pers.) Fuckel

(Donkey Ears)

Local name: No local name known

Edibility: Unknown.

Habitat: Terrestrial and solitary to gregarious.

Description: Fruit Body: Spoon-shaped, ear-shaped, or cup-like, with a cleft down one side, up to 10 cm high and 6 cm across. **Inner surface:** Yellowish to orange, often with rose or pink areas. **Outer surface:** Concolorous with the inner surface but lacking pink or rose shades, often finely fuzzy. **Stem:** If present whitish, small and rudimentary. **Flesh:** Pale yellowish and brittle. **Spore Print:** Creamy white.

Comments: The erect growth habit and ear-like fruiting body plus the orange to pinkish-tinged fertile surface separate this from most other cup fungi. The apex of the fruiting body is not broadly flattened or truncate as is typical of *O. alutacea*. Other species, *O. leporina* has yellowish-brown interior and brownish exterior but is otherwise quite similar. *O. concinna* and *O. cantharella* are both pale to bright yellow but often have a broadened or truncate apex.

Peziza vesiculosa Bull.

(Common Dung Cup)

Local name: No local name known

Edibility: Inedible.

Habitat: Terrestrial on manure and gregarious to caespitose.

Description: Cup: 3-8 cm across, cup-shaped often with a strongly enrolled margin, often in clusters and is sessile. **Inner surface:** Pale yellowish-buff and often wrinkled. **Outer surface:** Light buff and very scurfy. **Flesh:** Brittle and light buff. **Spore Print:** Creamy white.

Comments: Most obvious is its preference for fruiting in clusters on horse dung or decayed straw. While many other cup fungi also occur on dung, these are smaller, differently coloured or have hairs on the cup margin. *Peziza vesiculosa* is additionally distinguished by a wrinkled yellowish-brown hymenial inner surface and a pale tan outer surface.

Phallus impudicus L.: Pers.

(Common Stink Horn)

Local name: No local name known

Edibility: The 'egg' stage which lacks the disgusting smell is edible though not tasty.

Habitat: Scattered to gregarious on rotting wood in gardens and woodland.

Description: Immature fruit body: Initially semi-submerged and often covered by leaf-litter, egg-like, 3–5 cm across, attached to substrate. The outer wall of the egg is white to pinkish but there is a thick gelatinous middle layer held between the membranous inner and outer layers. **Mature fruit body:** The egg soon rupture as the white hollow stalk-like receptacle extends to 10–25 cm long. The pendulous or bell-shaped head is covered by dark olive slime which contains the spores. This slime has a strong sickly offensive smell which attracts flies from large distances to disperse the spores.

Comments: The stinkhorn is sometimes mistaken inexplicably for a morel, perhaps because of the pitted head and somewhat similar shape. However, the indiscreet odour and slimy spores mass leaves no doubt as to its identity. It is difficult to identify when it is at the egg stage.

Phylloporus bellus (Mass.) Corner

Local name: No local name known

Edibility: Unknown.

Habitat: Terrestrial and solitary.

Description: Cap: 3-5 cm in diameter, at first convex, with age it becomes plane, depressed or concave, dark brown to yellow orange. The surface is granular-fibrillose or scaly. **Hymenophore:** Decurrent gills, sub-close to distant, a few forked or simple. **Stem:** 1–5 cm long and up to 1 cm wide, mostly equal or sub-equal, solid. **Flesh:** White to pale yellow. **Spore Print:** Yellowish.

Comments: It is distinguished by its egg yellow colour and distant gills.

Phyllotopsis nidulans (Pers.:Fr.) Sing.

Local name: No local name known

Edibility: Inedible.

Habitat: Lignicolous and scattered to gregarious.

Description: Cap: 3-10 cm wide and 2-5 cm long, semicircular sometimes fan-shaped, surface finely velvety when young to wrinkled and prominently hairy with age, orange- yellow to dull orange. **Hymenophore:** Close gills, dull reddish-orange to light orange. **Stem:** Absent or poorly developed and attached laterally to the substrate. **Flesh:** Orange-yellow. **Spore Print:** Light pink.

Comments: This species can be recognized by the usually sessile form of the fruit body and the strong, unpleasant odour and taste. The cap surface is very conspicuous, with prominent hairs and its bright orange- yellow colour and dull orange gills, making it easy to see on the woods.

Pleurotus cornucopiae var. citrinopileatus Singer
(Golden Oyster Mushroom)

Local name: Sili Shamong

Edibility: Edible.

Habitat: Lignicolous and gregarious to caespitose.

Description: Cap: 2-6 cm in diameter, convex at first, funnel-shaped with age, surface fibrillose bright yellow to dull yellow. **Hymenophore:** Decurrent, sub-distant and white grills**. Stem:** 5-8 cm long and up to 2 cm wide, subclavate, surface fibrillose, white and it is often diverges from a single base. **Flesh:** White. **Spore Print:** White.

Comments: *P. citrinopileatus* is an excellent edible species growing in sub tropical regions of Bhutan. It grows in natural environments on dead trunks of trees and other plants in decomposition. This species degrades lignin and cellulose, which are the main components of wood.

Pleurotus ostreatus (Jacq.:Fr.) Kumm.
(Oyster Mushroom)

Local name: Naki Shamong (Changma Shamong for the white variety)

Edibility: Edible.

Habitat: Lignicolous and gregarious.

Description: Cap: 3-12 cm wide, convex, becoming fan-shaped or shell-shaped, sometimes semicircular or plane with a small depression at the centre, surface smooth and pale brown to dark brown. **Hymenophore:** Decurrent gills, close, whitish or with a grey tinge. **Stem:** Rudimentary or absent. **Flesh:** Thick and white. **Spore Print:** Whitish to greyish.

Comments: This is a very popular edible species that is often cultivated here in Bhutan and as is elsewhere in the world. It is easily identified by the white colour of the gills, the smooth pileus, white to greyish or brownish-grey, and soft, fleshy consistency of the fruit body, which is generally fan-shaped or shell-shaped.

Polyporus arcularius Batsch.: Fr.

(Spring Polypore)

Local Name: No local name known

Edibility: Unknown.

Habitat: Lignicolous and gregarious.

Description: Cap: 3-5 cm in diameter, uplifted-depressed. It is light brown with brownish scales, decurved when young and convex when mature. The texture of the contexts is leathery. **Hymenophore:** Pores like honey comb, decurrent, cream-coloured with 2-3 pores per mm. **Stem:** 2-3 cm long and 1-3mm in width, bulbous in shape central in position and concolorous with the cap, dry, white and solid. **Flesh:** White and very leathery. **Spore Print:** White.

Comments: Its small size and fairly large pores plus the typically central stem characterize this attractive polypore. *P. brumalis* has much smaller pores. *Microporellus dealbatus* has a concentrically zoned cap and a central stalk; *M. obovatus* has a whitish, unzoned cap and central to lateral stalk. None of these have the black or half-black stem of *P. elegans* and *P. badius*.

Polyporus varius Pers.: Fr.

(Varied Polypore)

Local name: Kou Shamong

Edibility: Edible but very leathery even after cooking.

Habitat: Lignicolous and solitary.

Description: Cap: 5–10 cm in diameter, irregularly kidney-shaped, depressed above the point of attachment to the stem, wavy and often lobed at the margin, ochre-brown with fine radial lines and turns brownish with age. **Hymenophore:** Decurrent pores which are white to cream-coloured, 4–7 pores per mm, circular, white becoming ochraceous-brown. **Stem:** Up to 3 cm long, lateral or eccentric, equal, often curving, dry, smooth or finely velvety, pale tan at the apex but black below and hard. **Flesh:** White when fresh, drying corky, cream-coloured, hard and leathery on maturity. **Spores Print:** White.

Comments: Typically fruiting on hardwood and decaying branches, this polypore is easily recognized by its whitish pore surface, and its black or half-black stem. It appears to vary somewhat in the colour and texture of its cap. Like many polypores it is rather tough, and can manage to "stay up" for quite a while in dry weather resulting in older specimens with faded, nearly white caps and brownish pore surfaces.

Pseudohydnum gelatinosum (Fr.) Karsten
(White Jelly Mushroom)

Local Name: No local name known

Edibility: Edible.

Habitat: Lignicolous and scattered to gregarious.

Description: Fruit Body: 1-5 cm long and 2-5 cm wide, flabelliform, semicircular and shell-shaped, surface smooth to very finely papillate, translucent white to greyish and sometimes brown or fairly dark brown **Hymenophore:** Teeth 0.2-0.5 cm long, running down the stem, translucent white or pale greyish. **Stem:** Up to 2 cm long and 1 cm wide, lateral, surface covered with fine hairs, denser at the base, white to greyish. **Flesh:** Rubbery-gelatinous and white to grey. **Spore Print:** White.

Comments: *P. gelatinosum* is a jelly fungus, easy to identify by the white teeth on the hymenophore and the somewhat gelatinous consistency of the fruiting body.

Pulveroboletus ravenelii (Berkeley & Curtis) Murrill

Local name: No local name known

Edibility: Unknown.

Habitat: Terrestrial and scattered to gregarious.

Description: Cap: 2-10 cm in diameter, convex becoming broadly convex, surface powdery when young with universal veil material, scaly, densely woolly between scales, red to reddish orange when young becoming yellow to sulphur yellow with reddish orange scales on maturity and slowly bruising greenish blue. **Hymenophore:** 1-3 pores per mm, at first covered with a bright yellow veil, round or angular pores, whitish at first, becoming yellow to yellowish brown or olive and bruising greenish blue. **Stem:** 3-10 cm long and up to1 cm wide, equal, surface powdery when young, then covered with long fibres from partial veil, veil remnants sulphur yellow, basal mycelium sulphur yellow too. **Ring:** Apical, membranous but not persistent, bright sulphur yellow. **Flesh:** White, often bruising blue when cut. **Spore Print:** Olive-coloured.

Comments: The yellow powdery covering over the young fruit bodies and odour strong of chlorine are distinctive features for *Pulveroboletus ravenelii*.

Pycnoporus cinnabarinus (Jacq., Fr.) Karst.

(Cinnabar Bracket)

Local name: No local name known

Edibility: Inedible.

Habitat: Lignicolous, solitary or caespitose.

Description: Fruit body: 5-12 cm wide and up to 1 cm thick. **Upper surface:** Reddish-orange, fading in age to whitish, wrinkled, with warts or smooth. **Hymenophore:** Orange-red, fading less than the cap surface with 2-4 pores per mm. **Spore Print:** White.

Comments: Another species, *P. sanguineus*, resembles *Pycnoporus cinnabarinus* but is thinner (up to 0.5 cm thick) and has a smaller cap.

Ramaria botrytis (Fr.) Ricken

(Pink Tipped Coral Fungus)

Local name: Bjichu Kangru

Edibility: Edible.

Habitat: Terrestrial and caespitose.

Description: Fruit body: Up to 20 cm high and 3-20 cm wide, stocky and repeatedly short-branched. **Branches:** Densely packed, basal branches thick, smooth, and whitish pink, terminal branches crowded, short, and pink to red tips; cauliflower-like especially when young. **Stem:** 3-4 cm long up to 4 cm wide, whitish pink and developing yellowish or brownish colours with maturity. **Flesh:** Whitish and firm. **Spore Print:** Yellowish brown.

Comments: It is distinguished by its large size and red to pinkish tips and tough gelatinous fleshy branches which fade in age. Close relatives include *Ramaria strasseri*, which also has a large massive base and longitudinally striate spores but it is more yellowish to tan in colour.

Ramaria violaceibrunnea* var. *asiatica
(R.H. Petersen & M. Zang) R.H. Petersen

Local name: Bjichu Kangru

Edibility: Edible.

Habitat: Terrestrial and solitary, scattered or gregarious

Description: Fruit body: Up to 21 cm high and 6-30 cm wide, stocky and short-branched. **Branches:** Densely packed, basal branches thick, smooth, and whitish, terminal branches crowded, short, purplish, tips, cauliflower-like, especially when young. **Stem:** 3-4 cm long and up to 6 cm wide, whitish with basal mycelium. **Flesh:** Whitish and firm. **Spore Print:** Light brown.

Comments: This *Ramaria* species is identified by its purple colour which makes it attractive to collect and it has pretty good taste but it needs to be cooked properly for safety.

Rozites caperata (Pers.: Fr.) Karst.

(Gypsy)

Local name: Dhungshing Shamong

Edibility: Edible.

Habitat: Terrestrial and solitary to gregarious.

Description: Cap: 5-10 cm in diameter, convex and becomes flat or somewhat bell-shaped as it matures, dry, usually wrinkled when young with a greyish to whitish coating of fibres, light brownish to purplish at first, but soon brownish, often with a paler margin. **Hymenophore:** Gills attached to the stem, close, pale at first, becoming brown or cinnamon brown. **Stem:** 5-13 cm long and up to 4 cm thick at the apex, equal or slightly swollen at the base, dry, usually rough or shaggy near the apex, whitish or pale tan. **Flesh:** Whitish-greyish, or pale lilac. **Spore Print:** Rusty brown.

Comments: It is another abundantly collected edible mushroom sold in the local market in Bhutan. It is similar to *Rozites emodensis* when mature. They are edible but care should be taken not to confuse with some of other brown *Cortinarius* species. In Bhutan *R.caperata* appears before other alpine mushrooms.

Rozites emodensis (Berk.) M.M. Moser
(Himalayan gypsy)

Local Name: Bjishi Dungshi (In Geney, Thimphu District)

Edibility: Edible.

Habitat: Terrestrial and solitary to gregarious.

Description: Cap: 2-10 cm in diameter, parabolic when young and umbonate as it matures. The colour of the cap is light purplish when young and turns to light brown with fading edges as it matures. Margin is eroded to uplift with dry and shiny surface when young and wrinkled surface as it ages. **Hymenophore:** Brownish to clay buff gills, close, adnexed to sinuate, smooth when young and eroded when mature with lamellulae. **Stem:** 5-10 cm long and up to 2 cm width, equal to sub-clavate, centrally positioned, dull white to yellowish, dry and solid. It has moveable ring the central position and white mycelium at the base of the stem. **Spore Print:** Brownish.

Comments: It does not cause much confusion as it has distinctly purplish cap when young and whitish stem but when mature it may look alike with *Rozites caperata* but there is no danger to the consumers as both the species are edible. These two can be confused with brownish *Cortinarius* species.

Russula compacta Frost

(Firm Russula)

Local name: No local name known

Edibility: Inedible.

Habitat: Terrestrial and solitary to scattered**.**

Description: Cap: 5-10 cm in diameter, concave when young, convex with a depressed disc with age, surface dry but viscid when wet, whitish developing orange brown pigments with age and exposure to light, staining brown when handled. **Hymenophore:** Adnate to sub-decurrent gills, close, occasionally forked and white to pale cream-yellow then brown when bruised. **Stem:** 5-10 cm long and up to 2 cm wide, equal or slightly wider below, surface cottony white, staining light brown to pale orange from handling. **Flesh:** White but slowly staining orange brown when exposed. **Spore Print:** White to cream.

Comments: *R. compacta* is a firm-fleshed mushroom that is dull tan at first but becomes brownish with age. It also stains brown when bruised. It has pungent fishy odour at first but becomes more strong with age and drying.

***Russula delica* Fr.**

(Short Stem Russula)

Local name: Gah Shamong

Edibility: This mushroom is edible, but of poor quality, having an unpleasant taste, leading some to classify it as inedible.

Habitat: Terrestrial and solitary to scattered and sometimes gregarious.

Description: Cap: 10-20 cm in diameter, convex with a central depression and an enrolled margin when young, later broadly convex with a central depression, the margin remaining somewhat enrolled, dry, smooth and sometimes becoming cracked in age. White to whitish or creamy at first developing brownish discolourations and the skin does not peel easily. **Hymenophore:** Gills are attached to the stem or running down it slightly, crowded or close, white at first, later creamy to pale yellow, sometimes spotting and discolouring brownish especially near the junction with the stem. **Stem:** 3-8 cm long and up to 4 cm thick, sturdy and solid, more or less equal, dry, smooth, whitish, sometimes discolouring and bruising brownish. **Flesh:** White but sometimes discolouring brownish. **Spore Print:** White to buff.

Comments: *Lactarius piperatus* is similar in appearance but it has very crowded gills and release white latex when they are damaged. Otherwise it is distinct from other coloured *Russula* species. Although it does not have pleasant taste when fresh, people in Bhutan dry and consume it during the off seasons.

Russula emetica (Schaeff., Fr.) S. F. Grey
(The Sickener)

Local name: No local name known

Edibility: Poisonous; the symptoms are mainly gastrointestinal in nature: diarrhoea, vomiting and abdominal cramps.

Habitat: Terrestrial and solitary to scattered.

Description: Cap: 5-10 cm in diameter. Bright red or cherry red in colour with finely ridged margins, sticky when young or moist. The cuticle can be easily peeled from the cap. It is initially convex, then later flat, or depressed. **Hymenophore:** White with close gills. **Stem:** Up to 7 cm long and 2 cm wide, cylindrical and white. **Flesh:** Brittle white and the taste peppery. **Spore Print:** White.

Comments: This attractive mushroom is easily recognized by its red cap, white stem and gills and hot taste. Other species in this group include *R. silvicola* with a red to pinkish-yellow cap and slightly smaller spores and *R. mairei* similar in colour to *R. emetica* but associated with hardwoods and with a firmer texture and smaller spores.

Russula fragrantissima Romagn

Local name: No local name known

Edibility: Unknown.

Habitat: Terrestrial and solitary to gregarious.

Description: Cap: 5-15 cm in diameter, convex becoming broadly convex to flat as it matures, with a shallow depression.It is very viscid when wet and shiny when dry. The skin peels away easily at the margin and sometime beyond half way to the center. **Hymenophore:** Gills attached to the stem, close or nearly distant, whitish to creamy and often discolouring yellowish brown to brownish with maturity. **Stem:** 4-15 cm long and up to 4 cm thick, white, discolouring brownish to yellowish or reddish near the base, dry and more or less smooth. **Flesh:** White. **Spore Print:** Creamy white.

Comments: Easily separated from most of the others in this group on the basis of its dull yellow colours, large size and sickly sweet odour. It lacks the orange colourations found in *Russula foetentula* and lacks the granules or scurf found on the caps of *Russula granulata* and *Russula pulverulenta*.

Russula nigricans (Bull.) Fr.

(Blackening Russula)

Local name: No local name known

Edibility: Edible but not good taste.

Habitat: Solitary to scattered and terrestrial.

Description: Cap: 5-20 cm in diameter, broadly convex when young, later flat with a central depression or shallowly vase-shaped, dry, more or less smooth but with a waxy feel, initially whitish but soon discolouring to brownish ashy grey or brown eventually almost black. The margin is not lined and the skin also does not peel easily. **Hymenophore:** Gills attached or running very slightly down the stem, thick, distant, white to cream, bruising and discolouring slowly reddish and then greyish to blackish. **Stem:** 3-8 cm long and up to 4 cm thick, whitish at first but soon darkening like the cap and bruising reddish then blackish and is fairly smooth. **Flesh:** White, hard and bruising promptly or slowly reddish on exposure then blackish. **Spore Print:** White

Comments: *Russula nigricans* has widely spaced gills and small spores while *Russula densifolia* has close or crowded gills and larger spores. *Russula anthracina* also known as *R. albonigra* has closer gills and is far less common.

Russula rosacea (Pers.) S. F. Grey

(Rose-Red Russula)

Local name: No local name known

Edibility: Inedible.

Habitat: Solitary, scattered, or gregarious and terrestrial.

Description: Cap: 2-10 cm in diameter, convex when young and becoming broadly convex to flat at maturity, sometimes with a shallow depression. It is sticky when fresh or wet, fairly smooth and dark to bright red but sometimes fading in age. The margin is not lined or merely slightly lined at maturity and the skin peels only at the margin. **Hymenophore:** Gills attached to the stem or running slightly down, close, white when young but soon creamy to yellowish. **Stem:** 2-8 cm long and up to 2 cm thick, firm, concolorous with the cap or paler or flushed red over a white base colour, dry and fairly smooth. **Flesh:** White and unchanging when sliced. **Spore Print:** Creamy to yellowish or orange-yellow.

Comments: *R. rosacea* is one of the prettiest mushroom in the forest. This Rosy russula is easy to identify by its red cap, rosy pink stem, brittle flesh, and acrid taste. *Russula silvicola* is similar but has a white stem and a white spore print.

Sarcodon scabrosus (Fr.) Bourd. et Galz
(Blue-footed Scaly-tooth)

Local name: No local name known

Edibility: Unknown.

Habitat: Terrestrial among the mosses, solitary to scattered**.**

Description: Cap: 3-10 cm in diameter, convex to broadly convex with a central depression, dry when young, hairy to sub-scaly in maturity developing well defined scales with darkened tips, reddish brown to purplish brown and the margin often enrolled. **Hymenophore:** Decurrent, crowded teeth which are 2-8 mm long, pale brown with whitish tips at first becoming darker brown with age. **Stem:** 5-10 cm long and up to 2 cm thick, often tapered to the base, which frequently extends into the ground like a root, dry, fairly smooth, pale or brownish, base with prominent white to pink basal mycelium. **Flesh:** Soft whitish to pinkish, grey to black or greenish stem base. **Spore Print:** Brown.

Comments: Recognized by its brown to reddish brown or purplish brown colours, its appressed cap scales which develop as the mushroom matures, its greenish to bluish or black stem base and its bitter taste.

Schizophyllum commune (Fr.) Fr.

(Split-Gill)

Local name: Tsintsiring Bamung in Eastern Bhutan.

Edibility: It is believed to have medicinal properties in oriental medicine. Considered edible in Bhutan.

Habitat: Gregarious and growing on decayed woods and twigs.

Description: Fruit body: 1-3 cm long and 1-4 cm wide, looks like the claws of the cat with short finger like margin. **Upper surface:** Woolly surface with short hairs, dirty white-grey with light purplish margin. **Hymenophore:** Highly decurrent, distant, smooth gills, purplish-brownish colour with short lamellulae present. **Stem:** Up to 2 cm or sessile sometimes, concolorous with the cap with eccentric position. **Flesh:** Leathery and greyish-coloured. **Spore Print:** Whitish.

Comments: *Schizophyllum commune* is easily recognized by its tiny fruiting bodies which lack stems and they attach themselves like tiny bracket fungi on the dead wood of deciduous trees. Unlike a bracket fungus however, *Schizophyllum commune* has what appear to be gills on its underside rather than pores or a simple flat surface.

Scutellinia scutellata (L.) Lamb syn. ***Patella scutellata*** (L.) Morgan

(Eyelash Pixie Cup)

Local name: No local name known

Edibility: Unknown.

Habitat: Lignicolous, growing gregariously or in clusters.

Description: Fruit body: At first spherical but soon opening to form a shallow cup and eventually disc like, up to 2 cm broad. **Upper surface:** Smooth, bright red to scarlet to orange, margin conspicuously fringed with dark brown to blackish hair. The hairs are up to 1 mm long. **Under surface:** Clotted with dark hairs on reddish to brown surface. **Flesh:** Thin and transparent. **Spore Print:** Creamy white to yellowish.

Comments: This brightly coloured cup fungus is tiny beauty of the forest which is difficult to locate due to its small size. It is recognized by the long, stiff and dark-coloured marginal cup hairs and a red to orange hymenophore. Other *Scutellinia* species have shorter hairs.

Sparassis crispa (Wulf.) Fr.
(Cauliflower Mushroom)

Local name: Meto Shamong

Edibility: Edible and believed to have many medicinal properties.

Habitat: On the wood debris and at the base of the trees and is caespitose.

Description: Fruit body: 15-50 cm broad and composed of multiple caps with many branches and a stem like structure. Each cap is 2-10 cm across, more or less fan-shaped, creamy to dirty white in colour and finely velvety with wavy margins. **Hymenophore:** Creamy when young and becoming dirty whitish to yellowish at maturity. **Stem:** Branched, whitish, tough and often off-centre. **Flesh:** Firm and white. **Spore Print:** White.

Comments: As its common name suggests, the densely branched fruit body of *Sparassis crispa* resembles a cauliflower. Initially creamy-buff in colour and the long-leaved fruiting bodies gradually darken in age especially along the edge of the branch. *Sparassis crispa* is believed to be parasitic on conifers. The size, colour and flattened branch structure of *Sparassis crispa* distinguish it from the members of the coral group.

Spathularia flavida Pers.: Fr.

(Yellow Earth Tongue)

Local name: No local name known

Edibility: The edibility of *Spathularia flavida* is variously described as untested, or edible.

Habitat: Scattered to gregarious and growing on humus or rotten wood.

Description: Fruit body: Roughly spatula-shaped with a flattened head portion at the top of a stem, usually running down the stem on either side of it. The head portion is up to 3 cm across, light yellow and fairly smooth. **Stem:** 5-10 cm long and up to 1 cm thick, whitish to yellowish with white to yellow basal mycelium. **Flesh:** Thin and whitish. **Spore Print:** Yellowish brown.

Comments: This spatula-shaped mushroom is separated from the similar *Spathulariopsis velutipes* by virtue of its smooth (rather than fuzzy) and yellowish (rather than brown) stem. Under the microscope, its longer spores also distinguish it. As with other members of the *Cudoniaceae* family, the spores are long and needle-like and are packed into the asci side by side.

Spathulariopsis velutipes Cooke et Farlow syn. ***Spathularia velutipes***

(Fairy Fan)

Local name: No local name known

Edibility: Inedible.

Habitat: Scattered to gregarious or even clustered, sometimes in line or circles and terrestrial, growing on humus.

Description: Fruit body: 3-10 cm long, the head portion is very compressed, 1-3 cm broad, decurrent, smooth and sometimes wrinkled, pallid when young becoming pale yellow to yellow as it matures. **Stem:** 2-8 cm long and up to 10 mm thick, often thicker or swollen at the base, sometimes hollow, smooth surface, yellowish to brownish with white to pale yellow mycelium at the base. **Flesh:** White and not gelatinous. **Spore Print:** Creamy white to yellowish.

Comments: Unlike *Spathularia flavida*, it has a minutely fuzzy, brownish stem with orange basal mycelium. In addition, its spores are shorter and it bears a veil-like covering when in the button stage, which leads mycologists to place it in its own genus *Spathulariopsis*.

Stropharia semiglobata (Batsch: Fr.) Quel.

(Dung Slime-head)

Local name: No local name known

Edibility: Inedible or questionable.

Habitat: Solitary to gregarious and terrestrial on animal dung and freshly manured grassland.

Description: Cap: 2-5 cm in diameter, hemispheric, expanding to convex, margin incurved then decurved, surface viscid when moist, glossy when dried and pale-yellow. **Hymenophore:** Gills adnexed, sub-distant, relatively broad, cream-coloured when young then greyish and then dark purple-brown in age. Lamellulae up to four series present. **Stem:** 5-10 cm long and up to 5 mm thick, slender, stuffed or hollow, equal to slightly enlarged at the base and partial veil pallid, thin, membranous with a glutinous coating forming a narrow superior annulus flattened to the stem soon blackened from spores or leaving fragments on the cap margin. **Flesh:** Soft and watery-cream-yellow. **Spore Print:** Purplish brown.

Comments: Fruits of *Stropharia semiglobata* in manure-rich grass can be confused with *Agrocybe pediades* and *Stropharia coronilla*. Both species have similar cream-coloured and sub-viscid caps. *Stropharia coronill*a however differs in possessing a non-viscid and striate-margined annulus while *Agrocybe pediade*s lacks a ring and has brown and not purple-brown gills and spores. *Bolbitius vitellinus* which occasionally fruits on dung, has a viscid, yellowish cap with a striate margin ochre-coloured gills and lacks a veil.

Suillus pictus (Peck) A. H. Smith et Thiers
(Painted Suillus)

Local name: Kesha Losha

Edibility: Edible.

Habitat: Terrestrial under pine, scattered to gregarious.

Description: Cap: 5-10 cm in diameter, cone-shaped or convex becoming flat, with an incurved margin often hung with veil remnants, red to reddish yellow with coarse scales, surface dry and sometimes viscid in wet young specimens. **Hymenophore:** Tubes adnate to decurrent and bright yellow. **Stem:** 5-10 cm long and up to 2 cm wide, solid, sometimes wider at the bottom yellow at the top above the ring, scaly and patchy below similar to the cap. White veil with pink patches, delicate, fibrous, leaving a dull coloured ring on the stem. **Flesh:** Downy yellow changing to dull pink or reddish if bruised. **Spore Print**: Olive brown.

Comments: It can often be found in large quantities in pine woods where it is frequently the dominant species. It starts decaying before it is fully mature thus collectors collect only the cap when it is not yet destroyed by tiny larva. Though it has bright red color to identify care should be taken when collecting mature specimens as the bright colour is usually fade on maturity.

Tarzetta catinus (Holmski.: Fr.) Korf et Rogers

Local name: No local name known

Edibility: Unknown.

Habitat: Terrestrial and solitary or sometimes gregarious.

Description: Fruit body: Cup-shaped from young to maturity and 2-5 cm across. **Inner surface:** Smooth and creamy to yellowish or occasionally olive-coloured. **Outer surface:** Hairy or granular, creamy to yellowish, the margin often densely hairy. **Stem:** Usually without a stem or have pseudo stem but occasionally with a pinched-together base. **Flesh:** Pale yellow. **Spore Print :** Pale.

Comments: This cup fungus is easily identified by its small and deeply cup-shaped fruiting bodies that often have finely scalloped margin**.** It is distinguished from *T. cupularis* by the wider spores and lobed paraphyses but some authors say it is synonym to *T. capularis*.

Trametes hirsuta (Wulfen) Lloyd

(Hairy Turkey Tail)

Local name: No local name known

Edibility: Inedible.

Habitat: Lignicolous and solitary to gregarious.

Description: Fruit body: 2-5 cm long and 5-10 cm wide and fan-shaped. **Upper surface:** White hairy/hirsuta surface when young with concentric lines of grey which becomes brownish with age. **Hymenophore:** 1-3 pores per mm, whitish when young which become cream-grey with age. **Flesh:** Tough and whitish to yellowish. **Spore Print:** White.

Comments: This species is quite common and is found growing on decaying wood. Recognized by its white hairy cap when young and grey-brown in maturity. *Trametes hirsuta* exhibits a good amount of variation in the appearance of the cap and pore surfaces creating confusion with other similar species.

Tremella fuciformis Berk.

(Snow fungus)

Local name: No local name known

Edibility: Edible, considered to have medicinal properties in oriental medicine(tuberculosis, high blood pressure and common cold).

Habitat: Lignicolous on decaying tree trunks and branches and is solitary to gregarious.

Description: Fruit body: Made up of lobed gelatinous patches which are 2-5 cm wide with whitish to translucent appearance. **Flesh:** Translucent to whitish**. Spore Print:** White.

Comments: With its gelatinous, transparent appearance, it is unlike any other mushroom of the same consistency. It grows on decaying wood and in high humidity. Reported mainly in Asia, it is supposed to decrease the levels of cholesterol, prevent cardiovascular problems and used as a tonic to nourish the stomach, kidneys and brain and for the treatment of problems associated with asthma and chronic bronchitis. It is also used in patients who have undergone chemotherapy or radiotherapy or in patients with chronic infections to enhance the immune system.

Trichaptum abietinum (Dicks Fr.) Ryv.

(Violet-Pored Bracket Fungus)

Local name: No local name known

Edibility: Inedible, leathery.

Habitat: Lignicolous and gregarious.

Description: Fruit body: 3-5 cm (up to 10 cm when fused together), lateral, attached to the decayed woods and has no stem. **Upper surface:** Concentric lines, pubescent surface, brownish with purplish towards the margin but green towards the base due to the presence of algae and have awavy margin. **Under surface:** Yellowish-purplish with elongated pores (0.5-2 mm long pores) the pores being longer at the base than at the margin, (1-2 pores per mm). **Flesh:** Tough leathery and greyish-coloured**. Spore Print:** Greyish white.

Comments: The white, hairy and zonate cap usually with a purplish margin when young and purple-tinged pores makes it easy to recognize although in age the pores may break down to form spines causing possible confusion with species of tooth fungi. Look-alikes include *Schizophyllum commune*, also with a whitish, hairy cap but distinguished by a "split gill" and *Fomitopsis cajanderi* a larger woody polypore that has a blackish-brown cap and pinkish pore surface.

Trichaptum biforme (Fr.) Ryv.

Local name: No local name known

Edibility: Inedible.

Habitat: Lignicolous on rotting wood and gregarious.

Description:Fruit Body: Up to 5 cm long and 6 cm wide, fan -shaped. The surface has fine downy hairs (ube scence) which becoms smooth at old age. Colour variable in concentric zonez; brownish-grey, brownish-yellow and violet towards the margins. **Hymenophore:** 2-3 pores per mm, resembling teeth up to 4 mm long, pinkish-violet to light pinkish-beige. **Flesh:** White. **Spore Print:** White.

Comments: The most important diagnostic feature of *T. biforme* is the hymenophore made up of elongate, robust pores resembling teeth, pinkish-violet in colour and also the colouring of the cap forming concentric lines with grey, violet and brown or beige tones.

Trichoglossum hirsutum (Pers.: Fr.) Boud. f. *hirsutum*
(Black Earth Tongue)

Local name: No local name known

Edibility: Unknown.

Habitat: Solitary to gregarious. Terrestrial on among moss and on rotting woods or leaf litter.

Description: Fruit body: Clavate and 4-7 cm long. **Head:** Oblong, flattened, often grooved, 1-3 cm long and up to 2 cm wide with black and velvety projecting hairs or spines. **Stem:** 3-8 cm long and up to 3 mm thick, round, equal, black and conspicuously pubescent.

Comments: *Trichoglossum hirsutum* is one of several black earth tongues. All require a microscope for positive identification. Velvety hairs on both the stem and fertile "head" are the primary distinguishing feature of *Trichoglossum* species. This character separates the genus from *Geoglossum*, whose species have a relatively smooth surface but are otherwise similar in appearance.

Tricholoma matsutake (S. Ito et Imai) Sing
(Pine Mushroom)

Local name: Sangay Shamong

Edibility: Edible.

Habitat: Terrestrial mainly in oak and spruce forest in Bhutan and scattered to gregarious.

Description: Cap: 5-20 cm in diameter, convex becomes convex or nearly flat with maturity, brownish with enrolled margin. The surface of the cap is sticky and fibrillose. **Hymenophore:** Gills attached to the stem, crowded, white, developing brown or reddish brown stains and spots with age. When young the margin of the cap is attached to the stem with veil. **Stem:** 4-15 cm long and up to 5 cm thick, more or less equal, or with a slightly tapered base and concolorous with the cap. The surface of stem is also sticky and fibrillose. **Flesh:** White, firm and not changing on exposure. **Spore Print:** White.

Comments: *Tricholoma matsutake* is very easy to identify and it is not easily confused with other mushrooms as it has a very distinct appearance and odour of its own. Some people find its smell pungent but some find it appetizing. In Bhutan it is found in abundance in Bumthang and Thimphu valley but is also found in Paro, Gasa (Laya, Lunana geog), Wangdue, and Haa districts. Its presence has also been reported in Tashigang (Yangneer) Eastern Bhutan.

Tricholoma* cf. *sejunctum (Sow.: Fr.) Quel.

(Deceiving Knight- Cap)

Local name: Sila Mu (Bumthang dialect in Central Bhutan)

Edibility: Edible, being consumed in Bhutan especially in Ura, Bumthang.

Habitat: Terrestrial and scattered to gregarious.

Description: Cap: 3-7 cm in diameter, broadly convex when young and becomes flat as it matures with a central knob. It is sticky when moist, yellowish at the margin and blackish on the cap with darker tinge at the centre. The margin is somewhat enrolled when young and remain so even when mature. **Hymenophore:** Gills are attached to the stem, close, white and developing yellow tinges near the cap margin in age. **Stem:** 5-10 cm long and up to 2 cm thick, equal and some what tapering at the base, smooth, dry and whitish or with yellow tinges. **Flesh:** White and not changing on exposure. **Spore Print:** White.

Comments: This species is common in Ura Bumthang and is distinguished by having a viscid yellowish pileus with dark fibrils. The pale yellow to buff lamellae of this species will distinguish it from similar species that have more rich and even yellow lamellae or species with pure white lamellae. Although listed an inedible species in literature the people of Ura consider it edible and is sold even in markets. There has been no complaint of poisoning so far from consumtion of this species in Bhutan.

Tricholomopsis rutilans (Schaeff., Fr.) Sing.

(Plums and Custard)

Local name: No local name known

Edibility: Considered edible by some but is not recommended.

Habitat: And most of the time it is found at the base of the trees or near the decayed logs where there is lots of fresh humus, solitary to gregarious.

Description: Cap: 4–10 cm in diameter
, convex to bell-shaped when young and expands often with a low broad umbo, yellow densely covered in reddish-purple downy scales, more densely covered at the centre. **Hymenophore:** Slightly decurrent gills, and egg-yellow in colour. **Stem:** 3-5 cm long, concolorous with the cap but to a much lesser extent. **Flesh:** Pale yellow or cream-coloured. **Spore Print:** White.

Comments: With its large stature, reddish-purple cap and contrasting yellow gills, *Tricholomopsis rutilans* is one of our most handsome mushrooms. Despite its inviting appearance, *Tricholomopsis rutilans* has no redeeming culinary value.

Xeromphalina campanella (Batsch: Fr.) Maire

Local name: No local name known

Edibility: Unknown.

Habitat: Lignicolous and gregarious.

Description: Cap: 2-5 cm in diameter, convex, becoming broadly convex with a central depression, smooth, brownish yellow, rusty yellowish, or orange and usually darker towards the centre. **Hymenophore:** Gills running down the stem, fairly distant, usually with many cross-veins and is pale yellow or orange. **Stem:** 1-5 cm long and up to 3 mm thick, more or less equal, smooth, yellowish above and darker below, smooth above and finely hairy at the base and is tough. **Flesh:** Fragile. **Spore Print:** White.

Comments: Its colouration, cap shape, decurrent gills, tough thin stem, absence of an annulus and its size distinguish this species.

Xerula hispida Halling et Mueller

Local name: No local name known

Edibility: Inedible.

Habitat: Terrestrial and solitary to scattered.

Description: Cap: Up to 5 cm in diameter, convex, sometimes with a conical umbo, surface densely tomentose, with numerous scattered long stiff hairs over the disc and the margin, dark brown at centre and appearing dull brown towards margin which may be due to the dense light brown hairs. **Hymenophore:** Gills are adnexed to adnate, close to sub-distant, white with margins having long stiff brown hairs. **Stem:** 5-18 cm long and up to 2 mm wide, equal with a long tapered base which is mostly in the substrate, surface densely covered with long, stiff, erect and dark golden brown hairs, pale creamy yellowish under hairs at apex and orange brown towards base. **Flesh:** Thin and white. **Spore Print:** White.

Comments: *X. hispida* is easily identfifed by the long, stiff, brown hairs that cover the pileus and stem and the long rooting stem which grows deep into the soil.

VIII. INSECT FUNGI

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INTRODUCTION

Yartsa Goenbub is the most famous insect fungus in Bhutan because of the high price it fetches and the income it generates for countless households in the mountains close to the Tibetan border. However, it is only one species amongst several hundred species of fungi that infect and kill insects around the World. Most fungi infect plants or grow on dead plant material. But the insect fungi have evolved to infect and grow inside insect hosts. They slowly deplete the insect of the nutrients it needs to grow. Eventually, the fungus (e.g. *Yartsa Goenbub*) will kill its insect host and then grow out to produce spores that can then infect the next generation of insects. Most of the insect fungi have developed a very close relationship with their hosts. They will be tied to the life-cycle of that insect and often infect only a particular stage in the insect's life-cycle. *Yartsa Goenbub* is an example of this group. It infects only the caterpillar – not the eggs, pupae or adults.

However, there are some species that have evolved so that they can infect a wide range of insects and at any stage of the life-cycle. The most common of these are *Beauveria bassiana* and *Metarhizium anisopliae*. In any agricultural system around the world these two species can be found killing insect pests. As such, they are considered to be 'friendly fungi'. But it was not always the case. *Beauveria bassiana* first came to the attention of scientists in the early nineteenth century when it was far from 'friendly'. It had become a serious problem in the French and Italian silkworm industry where it was killing the silkworms in large numbers.

Over the last one hundred years or so, both *Beauveria bassiana* and *Metarhizium anisopliae* have been investigated as potential biological control agents of insect pests. A few other species that can be grown easily in culture have also been tested as potential

biocontrol agents. There is still much research that needs to be done and currently there are few, if any, successful commercial biocontrol agents based on insect fungi.

While *Yartsa Goenbub* has a long history of usage in traditional Asian medicine it is only recently that it has attracted attention around the World. A close relative of *Yartsa Goenbub* is used in New Zealand by Maori people as a dye for their tattoos. Another species, *Cordyceps militaris* is also used in Chinese, Korean and Japanese traditional medicine. More recently, these fungi have also been investigated for novel metabolites that may be of benefit to man – chiefly pharmaceutical agents such as antibiotics, anti-cancer compounds etc.

Already, over 100 species of insect fungi (relatives of *Yartsa Goenbub*) have been recorded from Bhutan. Sixty of these have been named while there are several new species that need to be described and named. The following descriptions provide a brief introduction to the insect fungi of Bhutan.

IX. INSECT FUNGI SPECIES AND DESCRIPTIONS.

Akanthomyces arachnophilus (Petch) Samson & Evans

Local name: No local name known

Edibility: Too inconspicuous and rare for culinary purposes.

Habitat: On spiders (*Araneae*) attached to the underside of forest leaves.

Description: Stroma: Cream-yellow to white mycelium completely covering the host. **Synnemata:** Erect, simple, solitary (or multiple), cylindric up to 6 mm, *ca*. 50 μm diam., white, composed of parallel strands of hyphae. **Phialides:** In a monolayer, scattered or locally crowded, globose, smooth-walled, 3.0-4.3 μm diam. with a distinct neck, 1.0-2.0 long x 0.5 μm wide. **Conidia:** In long chains, single-celled, smooth-walled, hyaline, cymbiform, 3.5-6.0 x 1.0-1.5 μm.

Comments: This has been frequently recorded throughout the Indian Ocean region and has been reported from northern Australia and Thailand. In Bhutan it has been found below 2200 masl.

Beauveria bassiana (Bals.) Vuill.

Local name: No local name known

Edibility: Too inconspicuous for culinary purposes.

Habitat: On a wide variety of insect orders especially the following: *Coleoptera*, *Hemiptera* and *Lepidoptera*, loose in the leaf litter or slightly buried in soil – occasionally attached to the underside of leaves or other aerial vegetation.

Description: Stroma: Basal weft of woolly, white mycelium over host. **Phialides:** Body 2.5-4 x 2-3 μm across with zig-zag rachis up to 30 μm long bearing conidia on inconspicuous sterigmata. **Conidia:** Round, hyaline, 1.5-2.5 x 1.5 μm.

Comments: This is one of the most commonly collected insect fungi with a world-wide distribution as it has evolved from being a specific pathogen to an opportunist. Consequently, it is commonly found in agricultural ecosystems or gardens where it can infect a wide variety of pests. Throughout the last fifty plus years it has been the subject of investigation as a biological control agent for agricultural insect pests. It was the organism used by Agostino Bassi to demonstrate infection in silk worms in the early nineteenth century. Some thirty years later Louis Pasteur used Bassi's work as the basis for what is now known as the Germ Theory. When *Beauveria bassiana* was formally named, Bassi's name was used for the species epithet – hence *bassiana*.

Gibellula pulchra (Sacc.) Cavara

Local name: No local name known

Edibility: Too small and inconspicuous for culinary purposes.

Habitat: On hunting spiders (*Araneae*) attached to the underside of dicotyledonous leaves.

Description: Stroma: Basal weft of pale yellow mycelium over host. **Synnemata:** Several to many, cylindrical and tapering at tips, 5-10 mm, appearing purple with conidiophore heads. **Conidiophores:** Up to 500 μm long at base of synnemata, shorter (100-200 μm) towards tips, with a prominent Y or T shaped base Heads 50-60 μm diam., purple. **Metulae:** Obovate, 6-10 μm long by 4-6 μm across. **Phialides:** 6-10 μm long and up to 3 μm across. **Conidia:** In chains, purple, almond-shaped, 2-5 x 1-2 μm.

Comments: This appeared to be the most common species encountered and was also the most variable. However, a general feature was that the synnemata tended to be more numerous than the other *Gibellula* species, more crowded and stouter. *Gibellula pulchra* has a world-wide distribution and in Bhutan it has been found up to 2200 masl.

Isaria amoene-rosea P. Henn.

Local name: No local name known

Edibility: Too small and inconspicuous for culinary purposes.

Habitat: On beetle adults (*Coleoptera*) in the leaf litter or attached to aerial plant material (e.g. living leaves and branches).

Description: Synnemata: Red to reddish-pink, 2-10 mm long and up to 150 μm diam., solitary or multiple irregularly branched becoming white with conidia. **Conidiophores:** Smooth-walled, hyaline, with densely clustered phialides, up to 150 μm long x 2.5-4 μm wide. **Phialides:** 4-8 μm long x 1.5-3 μm wide. **Conidia:** Sub-globose to ellipsoideal, hyaline, smooth-walled, 2.5-4.5 μm long x 1.5-2.5 μm wide.

Comments: This species was first described from Brazil but has been recorded throughout the tropics. It has a wide but sparse distribution throughout Asia. It is found in forest up to 2200 masl in Bhutan.

Isaria tenuipes Peck

Local name: No local name known

Edibility: Too small and inconspicuous for culinary purposes, but see comments.

Habitat: On moth larvae and pupae (*Lepidoptera*) in the leaf litter.

Description: Synnemata: Conspicuous, lemon-yellow, 10-20(-50) mm long and up to 500 μm diam., solitary or multiple, irregularly branched becoming white with conidia. **Conidiophores:** Smooth-walled, hyaline, with densely clustered phialides, ca. 100 μm long x 2.5-4 μm wide. **Phialides:** 4.5-7 μm long x 2.5-3 μm wide. **Conidia:** Slightly curved (kidney-shaped), hyaline 2.0-8.0 μm long x 1-1.5 μm wide.

Comments: This species was first described from North America but has a wide distribution throughout Asia. It is found in forests up to 3500 masl in Bhutan. There is no record of this species having been used in Bhutanese Traditional Medicine. However, it is cultivated for use in Korean/Japanese Traditional Medicine.

Moelleriella raciborskii (Zimm.) P. Chaverri, M. Liu & K.T. Hodge

Local name: No local name known

Edibility: Too small and inconspicuous for culinary purposes.

Habitat: On scale insects (*Hemiptera*: *Aleyrodidae*) infesting the underside of (usually) dicotyledonous leaves.

Description: Stroma: Circular, usually surrounded by a thin mycelial membrane (hypothallus), white, pale-yellow, sometimes orange, up to 6 mm in diam. **Perithecia:** In tubercles (containing one perithecium each), solitary or aggregated, arising from the stroma, elongate flask-shaped, with a long neck, 300-450 μm long by 125-350 μm wide. **Asci:** Cylindrical, up to 450 μm long, *ca*. 7-15 μm wide, with a distinct, thickened hyaline cap. **Ascospores:** Divide into part-spores, cylindrical narrow-oval, ends rounded to obtuse, 14-16 μm long x 2.5-4.0 μm wide, occasionally slightly curved.

Comments: This species has a wide distribution throughout Asia. In Bhutan, it is found in forests up to 3500 masl. This species is very variable in gross morphology and is possibly a complex of related species. The asexual state is *Aschersonia placenta* and this is the more common state that is formed. Often, the *Aschersonia* will be found on the same stroma as the sexual state.

Moelleriella reineckiana (P. Henn.) P. Chaverri, M. Liu & K.T. Hodge

Local name: No local name known

Edibility: Too small and inconspicuous for culinary purposes.

Habitat: On scale insects (*Hemiptera*: *Coccoidea*) infesting the underside and upper side of (usually) dicotyledonous leaves especially along major veins and the petiole.

Description: Stroma: Hemispherical when mature but conico-pulvinate to pulvinate in immature specimens, up to 5 mm diam., *ca*. 1.0-2.5 mm high, moderately hard, orange to brownish orange when fresh. **Perithecia:** Scattered, ostioles slightly projecting and darker brown. **Asci:** Up to 200 μm long, containing 8 ascospores. **Ascospores:** Dividing into part-spores in the ascus. **Part-spores:** Cylindric 6-9 μm long x 1-1.5 μm wide.

Comments: This species has a wide distribution from the Indian Ocean as far west as Madagascar (but apparently not continental Africa) into the Pacific Ocean (north to Japan and east to Tahiti). It has also been recorded from Australia. In Bhutan it is found in sub-tropical forest below 2000 masl. Elsewhere (but not yet in Bhutan) this has also been recorded infesting scale insect pests of orchard crops – especially guava (*Psidium* spp.).

Ophiocordyceps myrmecophila (Ces.) G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora

Local name: No local name known

Edibility: Too rare and inconspicuous for culinary purposes.

Habitat: On formicine ants (*Hymenoptera*) loose in the leaf litter or slightly buried in soil.

Description: Stroma: Usually single (rarely multiple), cream yellow to yellow orange, 30-80 mm long, 200-300 μm across, expanding to 2-4 mm at terminal perithecial head. **Perithecia:** Immersed obliquely, hyaline-walled with a curved neck, up to 800 μm long x 150-200 μm wide. **Ostioles:** Concolorous, slightly projecting. **Asci:** Elongate-cylindric, up to 500 μm x 5-6 μm diam., 8-spored. **Ascospores:** Filiform, breaking easily into 64 part-spores (sometimes slightly fewer). **Part-spores:** Cylindric, ends blunt, 6-7.5 μm long x 1.5-2 μm wide.

Comments: This species was originally described from Italy and it has a wide distribution around the World. In Bhutan it has been found below 2000 masl.

Ophiocordyceps nutans (Pat.) G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora

Local name: No local name known

Edibility: Too inconspicuous and rare for culinary purposes.

Habitat: On stinks bugs (*Hemiptera*: *Pentatomoidea*) loose in the leaf litter or slightly buried in soil.

Description: Stroma: Usually solitary but multiple on large hosts, 25-100 mm long, 0.5-1.0 mm across, blackish brown, becoming pinkish red 5-10 mm below the perithecial head which is pinkish red to salmon pink or orange-yellow, 5-20 mm long x 3-5 mm wide. **Perithecia:** Immersed, hyaline-walled, oblique with a curved neck, 550-800 μm long x 150-200 μm wide. **Ostioles:** Visible as slightly darker dots, usually plane with the surface. **Asci:** Elongate-cylindric, up to 800 μm long x 7-8 μm diam., 8-spored. **Ascospores:** Breaking easily into 64 part-spores (sometimes slightly fewer). **Part-spores:** Cylindric or slightly barrel-shaped, ends blunt, 9.5-15 μm long x 1.5-2 μm wide.

Comments: This species has a wide distribution in east Asia and can be found in large numbers in Japan and South Korea. In tropical countries (including Bhutan) it is generally only found as solitary specimens. In Bhutan it is found in sub-tropical forests below 2200 masl.

Ophiocordyceps sinensis (Berk.) G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora

Local name: Yartsa Goenbub

Edibility: Popular in traditional Himalayan medicine.

Habitat: On larvae (*Lepidoptera*: *Hepialidae*) buried in soil.

Description: Stroma: Grey to grey-brown, usually solitary (rarely 2), up to 80 mm long, 1.0-1.5 mm across. **Perithecial head:** Sub-terminal, cylindrical, brown to blackish-brown up to 15 mm long x 3.5-4 mm across which is pinkish red to salmon pink or orange-yellow, 5-20 mm long x 3-5 mm wide. **Perithecia:** Superficial, ovoid, up to 450 μm long x 200-250 μm wide. **Ostioles:** Obscured. **Asci:** Cylindric, up to 300 μm long x 10-12 μm diam., 8-spored. **Ascospores:** Filiform, whole, hyaline, up to 90 μm long x 1.5-2 μm wide.

Comments: This is the most well-known insect fungus in Bhutan thanks to the high value it can command in markets. In Bhutan it is found above the tree-line (4000 masl) usually from 4300-4800 masl. It is commonly found throughout the Himalayan-Tibetan plateau region from Nepal through Sikkim and into Bhutan as well as north into Tibet. The immature specimens can appear from mid May onwards (depending on temperature) and collection is allowed throughout June. By the end of July the perithecial head begins to develop and the specimens lose value in the market place because of this. However, it is these specimens which when left in the ground and not picked will produce the spores that will infect the next generation of hepialid hosts.

Glossary with additional mycologist terms.

Acrid: Strong peppery taste.
Acute: An edge that forms a sharp angle at the apex.
Adaptation: The process whereby a living being adjusts to the environment in which it lives.
Adnate: Gills that are attached perpendicular to the stem.
Adnexed: Gills that are attached to the stem by a narrow point of contact.
Alveolate: Surface with deep pits or depressions (alveolae).
Anastomosed: Having a network of connections or joins among gills or lamellulae.
Anastomosis: Connections or fusions of lamellae or lamellulae.
Angular: A structure that is not rounded at the edge, but forms angles.
Annular: Ring-shaped.
Annulus: Fragments of the ruptured partial veil that remain attached to the top of the stem.
Apex: Top of the structure (as the stem) or of a specific fruit body.
Apical: Refers to the top, at the apex.
Appendiculate: A pileus margin that has fragments of the partial veil hanging from the edge of the expanding cap.
Appressed: Scales, fibres or hairs that lay flat against the surface of the cap or stem.
Aqueous: Watery consistency.
Arcuate: Gills that curve into an arch.
Areolate: Surface of the cap cracked into plates.
Arthropod: An invertebrate animal with a segmented body, having articulated appendages.
Ascomycota: A fungal group characterized by the presence of reproductive structures called ascus.
Ascus: Sac-like cell inside which spores are produced in members of the Ascomycota fungi (pl. **asci**).
Basidiomycota: A fungal group whose distinguishing characteristic is the presence of reproductive structures called basidia, covering the fertile surface of the fruit bodies.
Basidium: The specialized cell on which spores are formed externally, diagnostic for mushrooms of the Basidiomycota group.

Bulbous: A stem that bulges into an enlarged base.
Caespitose: Fruit bodies that grow in close groups or clusters, with stems joined together.
Campanulate: Bell-shaped.
Cartilaginous: Having the consistency of animal cartilage.
Cerebriform: Resembling a brain in certain species.
Chlorophyll: Substance present only in members of the Plant Kingdom, especially in plant stems and leaves. Essential in the processes of photosynthesis and carbon fixing.
Circular: In the shape of a circle.
Clavate: Club-shaped.
Close: Gills arranged very near to one another, but not crowded.
Clustered: Habit of fruit bodies growing very close together.
Columnar: Shaped like a pillar or column.
Concentric zonations: Bands of differing colours or textures those appear on the cap surface.
Concentric: In geometry, refers to several figures that have the same centre point.
Concolours: Having the same colour.
Conic: A cap higher than wider, with a pointed apex.
Context/Flesh: The fleshy tissue or insides of the fruit body on the cap and stem.
Convex: Rounded, higher in the middle than at the margin.
Coprophilous: A fungus that grows on dung or manure.
Crowded: Gills spaced very close together.
Crust: A fruit body that is attached in its entirety to the substrate.
Curved: Curved or folded downward.
Cyanescent: Turning dark blue.
Cylindric: Cylinder-shaped, a stem that has the same diameter from apex to base.
Decomposer: An organism that reduces organic matter to simpler materials that can be used by plants or primary producers. Examples include some insects, bacteria and fungi.
Decurrent: A type of gill attachment in which the gills run down the stem.
Decurved: Refers to a cap margin that appears to curve downward.
Deliquescence: Melting to liquid occurs when the gills of certain fruit bodies

digest themselves at maturity, releasing a dark substance of the same colour as the spores.

Depressed: A cap that has a central cavity or hollow, with the middle lower than the edge.

Dichotomously: A form of branching or forking in which the tip divides into matched pairs.

Dimidiate: Semicircular or shaped like a sea shell.

Disc: Central portion of the cap, also, circular plate at the base of the stem.

Discoid: Disc-shaped.

Distant: Gills which are separate from one another and spaced well apart.

Eccentric: A stem attached off centred of the pileus.

Ectomycorrhiza: A beneficial plant/fungus symbiotic association in which the mycelium of the mushroom forms a sheath around the short roots and enters the plant root where they form a network between the cells of the root. The association works to bring in water, nitrogen and other nutrients to the plant, while the mushroom obtains sugar from the plant.

Effused-reflexed: A growth pattern in which part of the mushroom fruit body takes the shape of a crust and the other part develops caps.

Elongate: A structure that is longer than it is wide.

Entire: A cap margin that is smooth and uninterrupted.

Equal: A stem having the same diameter throughout its length.

Eroded: A cap or gills with irregular jagged edges.

Eccentric: Having the stem attached off-centre, to one side of the fruit body.

Family: A classification group within the taxonomic system, made up of one or more related characters.

Farinaceous: Having a floury appearance and odour or taste, mealy.

Fertile surface: The surface on mushrooms where reproductive structures of the fruit body are located.

Fibrillose: Composed of delicate, very fine silky fibres.

Fimbriate: Fringed surface.

Flabelliform: Fan-shaped.

Flagellum: A moving filament attached to the spore, propelling it through water.

Forked: Dividing into two branches.

Free: Type of gill attachment in which the gills do not touch the apex of the stem.

Fruit body: The reproductive structure that the mushroom produces on the substrate, for the purpose of dispersing spores.
Fungicolous: Growing on other fungi as substrate.
Furfuraceous: Surface covered with tiny brain like scales, resembling dandruff.
Genus: A group of closely related species, the genus is expressed in upper case as the first word in the scientific name of all it's member species.
Glabrous: Without hairs or ornamentation of any kind.
Globose: Fully or nearly spherical in shape.
Granulose: A surface that appears to be covered with salt-like granules.
Gregarious: Fruit bodies cluster in close groups within a small area.
Habit: The characteristic external appearance of mushrooms, and the manner in which they grow.
Habitat: The environment where an animal or plant population naturally grows and develops.
Hallucinogen: Refers particularly to certain substances present in mushrooms, causing hallucinations.
Hexagonal: Having the shape of a six-sided polygon.
Hispid: Covered with stiff hairs.
Hymenium: The spore-bearing surface of the Basidiomycota group.
Hymenophore: Structure that bears the reproductive structures that make spores, covered by the hymenium.
Hypha: A filament which is the fundamental structural unit of most mushrooms (pl. **hyphae**).
Hypogeous: Developing fruit bodies underground.
Imbricate: Caps that grow one above the other.
Incurved: A cap margin curved inwards, forming a concave shape on the inner side.
Infundibuliform: Funnel-shaped.
Enrolled: A cap margin that rolls inward, pointing toward the gills.
Intervenose: Connected by joins or ridges between gills.
Lacerate: Parts of the fruit body in which the texture appears to have been irregularly torn.
Lamellae: A particular type of hymenophore composed of plate like structures which bear the fertile surface, located underneath the cap and containing the spores, gills.

Lamellula: A small lamella that does not reach to the stem (pl. **lamellulae**).
Lateral: Stem attached to the edge of the cap.
Latex: A milky liquid that oozes from certain mushroom species when they are cut or injured.
Lignicolous: Growing on a substrate of wood, whether alive or in decay.
Lobed: With rounded divisions on the margin.
Lobulate: Having rounded divisions or lobes on the edges.
Loculose: Having hollows or chambers where the reproductive structures are located.
Macrofungus: A fungus whose size, colour and shape make it easily visible to the naked eye (pl. **macrofungi**).
Margin: The edge of the cap or gill.
Microfungus: A fungus that cannot be observed without a magnifying glass (pl. **microfungi**).
Morphology: The study of the forms of living organisms.
Multipileate: A multi-capped fruit body.
Multistipitate: A multi-stemmed fruit body.
Mushrooms: Macro fungi with a distinctive fruit body, large enough to be seen with the naked eye and to be picked by hand.
Mycelium: Vegetative part of mushrooms consisting of a mass of hyphae growing through the substrate.
Mycology: The science of fungi.
Mycorrhiza: The symbiotic association of a fungus and the roots of certain types of trees, in which both organisms benefit. The fungus provides the roots with minerals, while the tree provides food (carbohydrates) to the fungus.
Order: A classification group consisting of one or more related families.
Organic matter: Constituent substances of the biological world that generate the entire biosphere (lipids, carbohydrates, proteins, alkaloids, nucleic acids, pigments, etc.).
Ostiole: Openings through which the fungi of certain groups release their spores.
Ovoid: Egg-shaped.
Papilla: A small bump that develops on a surface.
Papillate: Having papillae on a surface.
Parasite: An organism that lives at the expense of another living organism, in some cases causing death to the host.

Partial veil: Membrane covering the fertile surface of certain mushrooms during the early stages of development, located under the cap.
Pathogen: An organism that attacks another living organism and is able to cause disease.
Perithecia: Pear-shaped fruit bodies within which certain fungi (Ascomycota) produce spores.
Petaloid: Shaped like the petal of a flower.
Photosynthesis: A metabolic process in certain plant organisms, allowing them to synthesize and prepare their own organic nutrients from inorganic substances, using light energy.
Pileate: Having a cap, or pileus.
Pileus: The top part of a fruit body (pl. **pilei**) or cap.
Pleurotoid: A type of fruit body that has no stem and in most cases is attached laterally to the substrate.
Plicate: A folded or pleated surface.
Pores: The opening at the end of the tubes of the hymenophore.
Powdery: A surface covered with fine powder.
Primordium: The earliest or immature stage of development of a fruit body.
Protuberance: A bulge on a surface.
Pruinose: A surface covered with a frost-like dust, resembling flour.
Pubescent: A surface with short, downy hairs.
Pungent: Having a strong or penetrating odour.
Pyramidal: A structure with a polygonal base, which several faces join at the top in a point.
Radicating: A stem with a root like base.
Reniform: Kidney-shaped.
Resupinate: Fruit bodies that grow in the form of a crust, without a cap.
Reticulate: Veins, lines or edges in bas-relief, forming a weave that appears net-like.
Reticulum: Small net.
Revolute: A cap margin that is rolled up toward the cap face.
Rhizomorphs: Root-like bands of mycelia that sustain the fruit body.
Ring: Circular ring around the stem that is thinner and smaller than the annulus.
Rugose: Having deep wrinkles in an irregular formation.

Rugulose: Having fine wrinkles in an irregular formation.
Rust: The common name of a fungus that attacks the leaves of crop plants. Has a powdery, rust-coloured appearance.
Scabers: A specific type of a small pointed scale formed of aggregated hyphae. Typically found on stems.
Scabrous: A surface with scabers.
Scales: A type of ornamentation on the cap or stem of a mushroom formed from the surface tearing, from hyphae in the surface clumping together and becoming uplifted, or from fragments of the universal veil that remain attached to the surface of the cap or stem.
Scattered: Growth habitat of mushroom where it is separate or dispersed around a certain area
Sclerotium: A knot or a compact usually rounded mass of hyphae, hard to the touch and resistant to adverse environmental conditions.
Semicircular: In the shape of a half-circle.
Sessile: Fruit bodies that lack either a stem or extensions attaching it to the substrate (without a stem).
Shelf: A mushroom that attaches laterally to wood or other substrate.
Sinuate: Gills that have a small depression at the point of attachment to the stem.
Smooth: A surface that has no ornamentation.
Smuts: Fungi that attack plants, damaging leaves, roots, stems and flowers. Resemble small black pouches containing a black powder.
Solitary: The growth habit of mushrooms producing a single fruit body.
Spathulate: Shaped like a spatula.
Species: The smallest taxonomic group made up of individuals that have a single common ancestor.
Spore print: The spore mass formed by placing a mushroom cap on white paper and letting the spores accumulate. Used to tell spore colour for identifying many groups of mushrooms
Spores: Specialized cells produced by the fungus as part of its reproductive system, dispersed primarily by wind and water.
Squamules: Tiny scales.
Squamulose: A surface with very small scales.
Stem: The stalk on which the pileus rests, holding it above the substrate.
Striate: Surface markings consisting of parallel lines or grooves.

Strigose: A surface ornamented with stiff hairs.
Subbulbous: A somewhat bulbous stem.
Subcampanulate: A slightly bell shaped cap.
Subcerebriform: A slightly brain shaped fruit body.
Subclavate: A slightly club-shaped stem.
Subconic: A slightly conical cap.
Subdecurrent: Slightly decurrent gills.
Subdistant: Gill spacing which is slightly distant.
Subglobose: A somewhat spherical- shaped fruit body.
Subpruinose: A slightly powdery surface.
Subreticulate: A mildly reticulate surface.
Subrugulose: A slightly rugulose surface.
Subscabrous: A slightly scabrous surface.
Subsquamulous: A somewhat scaly surface.
Substrate (substratum): The surface through which the fungi grow; the material that a fungus digests and uses as food.
Subsulcate: A somewhat grooved surface.
Subtomentose: A surface with a somewhat dense layer of soft hairs.
Subumbonate: A slightly umbonate cap.
Subvelutinous: A somewhat velvety surface.
Sulcate: A grooved or furrowed surface.
Symbiotic association: A mutually beneficial relationship between two organisms.
Tapered: A stem that thins in diameter from the apex to the base.
Taxonomy: The science that names describes and classifies living organisms.
Teeth: Small pointed structures found in the hymenium, on the surface of which the basidia are formed.
Tesselate: A surface with a mosaic like appearance.
Tomentose: Having filaments or hairs, whether simple or branched.
Tomentum: A dense layer of simple or branched hairs, sometimes matted.
Toxic: Capable of causing poisoning.
Translucent: A surface that transmits light diffusely, through which thing can be seen clearly.
Tuberculate: Small wrinkles or low bumps that grow on the cap surface.
Tubes: A particular type of hymenophore comprised of cylindrical

structures, visible when the cap is cut lengthwise, where the spores develop.
Umbo: A bulge or knob at the centre of the cap.
Umbonate: A cap that has a bulge or raised knob at the centre.
Undulate: A wavy edge to the cap.
Ungulate: A horseshoe-shaped cap.
Uniform, equal: An evenly shaped stem, having the same diameter from base to apex.
Universal veil: A membrane that fully covers the fruit body of the mushroom in the early stages of development.
Uplifted: The growth pattern of the mushroom in which the margin of the cap turns upward
Vegetative phase: A stage in the life cycle of a mushroom, made up of very small microscopic filaments called hyphae, grouping together to form a filamentous mass called the mycelium, which spreads out on the substrate.
Veil remnants: Fragments of the partial or universal veil.
Velutinous: A surface covered with a compact layer of short, fine, soft hairs
Velvety: Refers to surfaces that are covered with fine hairs, having the consistency of velvet
Venations: A complex of veins (folds, lines or edges) on a surface.
Venose: A system of veins (pleats, lines or edges) on a surface.
Ventricose: A structure that is wider in the middle than at either end.
Verrucose: A surface containing wart-like growths.
Viscid: A cap or stem that has a slimy or viscous consistency.
Volva: A cup-like or sac-like structure that remains at the base of the stem as part of the universal veil.
Wart: A bulge or outgrowth found on the surface of the cap or stem.

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Genus and Species Index

A-B

Agaricus augustus 32
Agrocybe praecox 34
Akanthomyces arachnophilus 282
Albatrellus caeruleoporus 36
Aleuria aurantia 38
Amanita caesarea 40
Amanita flavoconia 42
Amanita hemibapha 44
Amanita hemibapha var. ochracea 46
Amanita pantherina 48
Amanita rubrovolvata 50
Amanita vaginata 52
Armillaria mellea 54
Astraeus hygrometricus 56
Aureoboletus thibetanus 58
Auricularia auricula-judae 60
Auriscalpium vulgare 62
Beauveria bassiana 284
Bolbitius vitellinus 64
Boletellus emodensis 66
Boletus edulis 68
Boletus ornatipes 70
Bondarzewia monticola 72

C-G

Calocera viscose 74
Calvatia gigantean 76
Cantharellus cibarius 78
Catathelasma imperiale 80
Chlorociboria aeruginascens 82
Clavariadelphus pistillaris 84
Clitocybe gibba 86
Clitocybe odora 88
Clitopilus prunulus 90
Conocybe tenera 92
Coprinus comatus 94
Cortinarius violaceus 96
Craterellus cornucopioides 98
Crucibulum leave 100
Cyathus striatus 102
Cyptotrama asprata 104
Cystoderma granulosum 106
Dacrymyces palmatus 108
Descolea flavoannulata 110
Entoloma conferendum 112
Favolaschia calocera 114
Fistulina hepatica 116
Fomes fomentarius 118
Fomitopsis cf. pinicola 120
Gibellula pulchra 286
Gloeophyllum sepiarium 122
Gomphus clavatus 124
Gomphus floccossus 126
Gymnopus dryophilus 128
Gyromitra cf. infula 130

H-L

Helvella atra 132
Helvella crispa 134
Helvella macropus 136
Hericium erinaceum 138
Humaria hemisphaerica 140
Hydnellum peckii 142
Hydnum repandum 144
Hydropus nigrita 146
Hygrocybe cantharellus 148
Hygrocybe conica 150
Hygrophoropsis aurantiaca 152
Hygrophorus russula 154
Hypholoma fasciculare 156
Isaria amoene-rosea 288
Isaria tenuipes 290
Laccaria amethystina 158
Lactarius deliciosus 160
Lactarius lignyotus 162
Lactarius piperatus 164
Lactarius torminosus 166
Lactarius volemus 168
Laetiporus Cincinnatus 170
Leccinum aurantiacum 172
Leccinum versipelle 174
Leotia lubrica 176
Lepista nuda 178
Leucoagaricus rubrotinctus 180
Lichenomphalia umbellifera 182
Lycoperdon echinatum 184
Lycoperdon perlatum 186
Lyophyllum aggregatum 188
Lyophyllum shimeji 190

M-S

Microporus affinis 192
Moelleriella raciborskii 292
Moelleriella reineckiana 295
Mutinus caninus 194
Ophiocordyceps myrmecophila 296
Ophiocordycees nutans 298
Ophiocordycees sinensis 300
Otidea onotica 196
Peziza vesiculosa 198
Phallus impudicus 200
Phylloporus bellus 202
Phyllotopsis nidulans 204
Pleurotus cornucopiae var. citrinopileatus 206
Pleurotus ostreatus 208
Polyporus arcularius 210
Polyporus varius 212
Pseudohydnum gelatinosum 214
Pulveroboletus ravenelii 216
Pycnoporus cinnabarinus 218
Ramaria botrytis 220
Ramaria violaceibrunnea var. asiatica 222
Rozites caperata 224
Rozites emodensis 226
Russula compacta 228
Russula delica 230
Russula emetica 232
Russula fragrantissima 234
Russula nigricans 236
Russula rosacea 238
Sarcodon scabrosus 240
Schizophyllum commune 242
Scutellinia scutellata 244
Sparassis crispa 246
Spathularia flavida 248
Spathulariopsis velutipes 250

T-X

Tarzetta catinus 256
Trametes hirsuta 258
Tremella fuciformis 260
Trichaptum abietinum 262
Trichaptum biforme 264
Trichoglossum hirsutum 266
Tricholoma matsutake 268
Tricholoma sejunctum 270
Tricholomopsis rutilans 272
Xeromphalina companella 274
Xerula hispida 276