INTRODUCTION

Lesson Aim

To select and cultivate appropriate varieties of mushrooms in different situations, with particular emphasis on the genus *Agaricus*.

To classify different varieties of fungi which are commonly eaten.

INTRODUCTION

The following notes are designed to give you a broad, general understanding of mushroom culture.

Mushrooms are living things and as such are somewhat unpredictable and variable. The way you treat a mushroom is different from place to place, time to time and according to what you are trying to get from the mushroom.

You need to adapt what you read to your situation. When referring to a book or magazine article, always look at where it was written and who it was written by (e.g. experts write from their own experience, and that experience may present a different bias according to their own background). There can be great variations over relatively small distances in such things as climate, culture and marketing considerations.

There are always different ways of tackling any job; and often each one just as valid as the next.

Never consider that a particular technique is the only way of doing something! You should try to be aware of the advantages and disadvantages of all of the alternatives. All have their advantages and disadvantages; and it is up to your own preferences as to which way you choose to do something.

This course aims to teach mushroom growing in a way which will be relevant to any place in the world. It puts aside regional techniques and tries to teach you principles and concepts which can be applied to anywhere.

- Keep this in mind as you study.
- Interpret the principles.
- Don’t simply seek facts, because facts change according to where and when you do something!

UNDERSTANDING SCIENTIFIC NAMES

Fungi Names

All mushrooms are given two different types of names:

- Common Names - These are English language names usually given to plants by amateur gardeners as a descriptive, easy to remember tag. Many plants have more than one common name, and sometimes the same common name can be given to several quite different plants. This along with the fact that there is no real control over common names makes them inaccurate and unreliable for plant identification.
- Scientific Names - Based on Latin language, these names often seem more complex than common names at first glance; however, they have a system to them which can make plant identification much easier. The system of scientific naming is strictly controlled and coordinated by life scientists throughout the world. Scientific names should always be used in preference to common names.

In the scientific system, mushrooms are classified by dividing them into groups which have similar characteristics. These groups are then divided into smaller groups with similar characteristics. These are divided again and so the division of group to sub group and sub group to further sub groups goes on, until you finally have only one type of plant in each group.

There are many different levels of division, although the main ones which we use are just a couple at the bottom end of the scale.

The plant names which you see in books or on plant labels in a nursery will usually consist of two words:

- The first word is the “genus name” of the plant.
- The second word is the “species name” of the plant.

The main levels of division are as follows:

All life is divided into KINGDOMS

All fungi are divided into PHYLA

Phyla are divided into CLASSES

Classes are divided into ORDERS

Orders are divided into FAMILIES

Families are divided into GENERA (singular: Genus)

Genera are divided into SPECIES

Species are sometimes divided into VARIETIES.

There are Five Kingdoms of living things. Fungi make up one of these five kingdoms. Other Kingdoms include Animals, Plants, Bacteria and Protocists.

The Kingdom Fungi is characterized by the following facts:

- Fungi lack chlorophyll (chlorophyll is what enables plants to capture and use light energy from the sun it also gives plants their green colour). Therefore, they must get their energy from other sources, such as decomposing materials: parts of plants like fallen leaves, bark, trunks, twigs, or animal remains.
- The vegetative stage of the fungi is mainly filaments (i.e. microscopic threads of cells growing amongst organic material a living or dead organism). The visible part of some fungi is the fruiting body (mushroom).

The Fungi Kingdom is divided into three Phyla:

- ZYGOMYCOTA – Simplest types, generally a mass of microscopic filaments, frequently feeding on dead tissues of plants or animals, lacking cross walls except for separations in between reproductive structures
- BASIDIOMYCOTA – Distinguished by a microscopic reproductive structure (Basidium). Includes mushrooms. The mushroom we eat is a reproductive structure that contains many basidia on the underside of the cap.
- ASCOMYCOTA – Differentiated from other fungi by a microscopic reproductive structure called an ascus. These include Truffles, Yeasts, Blue Green moulds and Lichens.

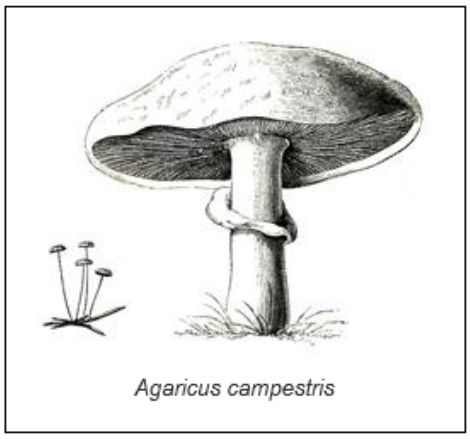
Phyla are divided into smaller groups, which are further divided into even smaller groups etc., until you reach the level of family. Fungi which belong to the same family have a lot of similar characteristics.

The families are divided up into further groups called genera (singular = genus). Genera are then divided into species.

The genus of the common field mushroom (which grows wild throughout the world) is "***Agaricus***"

The species of the common field mushroom is "***campestris***".

We write the scientific name of the common field mushroom as follows: ***Agaricus campestris***



It is possible to find fungi of the same species which vary in some way, one from another (e.g. one might be more tolerant to cold, or one might have a lighter coloured surface). These different strains are called "varieties" of the same species. Often they are given a special name to distinguish them, and that name is written after the species, hence three words are written instead of two, to designate the fungi name.

The Most Commonly Cultivated Mushroom

Agaricus bisporus is the most commonly cultivated mushroom. It is also known as the “Champignon”.

This species may also be known, in some areas, by other species names. *Agaricus brunnescens* is a former name for *A. bisporus*, and some references may still use this name. *Agaricus hortensis* is a synonym that is applied to pure white forms of *A. bisporus*

The species "*Agaricus bitorquis*", has some characteristics which make it more desirable than *Agaricus bisporus* (i.e.: longer shelf life, virus resistance and resists bruising). These characteristics have led to the species *Agaricus bitorquis* being used in breeding programs aimed at producing crops more suited to the fresh market.

There are a range of other edible fungi which are often referred to as mushrooms. Cultivation of these fungi is still a developing industry in many countries, and there is certainly scope for commercial production of specialty mushrooms. Some are already economic crops in some countries.

Other Fungi with Commercial Potential

Coprinus fimetarius

Suited to freezing, canning and drying. It has excellent flavour and potential as a novelty vegetable. Whilst many species of *Coprinus* are highly ephemeral (they have an extremely short shelf life), *C. fimentarius* has the potential as a cultivated mushroom. It is easy to grow and can quickly produce good commercial yields.

Flammulina velutipes

This fungus is commonly known by names such as ‘Winter Mushroom’, ‘Velvet Stem’ and ‘Velvet Foot’. Cultivated Japanese varieties are known as Enoki and Enokitake, but bear little resemblance to wild populations. Whereas wild ones are dark in colour, the cultivated Japanese varieties are grown in low-light conditions and have pale flesh and skin.

This mushroom fruits in cold conditions. Fruiting bodies are small, but delicious. This mushroom has been eaten for centuries in parts of Asia. It grows naturally on wood and can be cultivated on sawdust.

Lentinus edodes

Lentinus edodes, the Shiitake mushroom, is the most important cultivated mushroom in Japan. It is grown on logs of Fagaceae trees (e.g. Oaks) and various other trees. The shiitake mushroom is said to possess many health benefits, including the presence of many polysaccharides and polysaccharide-protein complexes that have been isolated and utilised for therapeutic purposes (it has been reported as promoting health due to immunity stimulating properties against cancer, viral infection and high cholesterol). This mushroom is usually sold fresh or dried. There is potential for commercial shiitake mushroom cultivation, although many markets have

high quality standards that must be met.

Pleurotus

Several species of this genus are edible and have the potential for cultivation commercially. *Pleurotus ostreatus* is perhaps the most commonly cultivated species, known as the oyster mushroom, due to its appearance. The oyster mushroom naturally grows on dead wood, but can be cultivated on any cellulose material.

Wood shavings, cellulose fibre, and waste hulls from agriculture are commonly used. This mushroom can even be cultivated on toilet rolls!

Stropharia rugoso-annulata

This species of mushroom, sometimes known as the 'Garden Giant' has been grown commercially in Germany, and grows wild in parts of Europe. It is cheap and easy to grow, but yields are variable.

It is not generally suited to commercial production, but is well suited to outdoor culture in the home garden. Indoor fruitings are possible but the King Stropharia requires an unsterile casing to stimulate mushroom development and is slow to fruit.

Volvariella volvacea

The edible Straw Mushroom originates from the tropics and sub-tropics, and has been cultivated and eaten for centuries in China and other Asian countries. This mushroom is traditionally cultivated on fermented rice straw. Due to the nature of traditional cultivation, yields have typically been low and variable. Modern cultivation practices utilising industrial waste from cotton processing have allowed increased yields and further development of the Straw Mushroom industry.

Auricularia auricula

This is one of the 'jelly fungus,' and bears the common name 'Judas' Ear', based on a myth that it grew, as a result of a curse, on the tree that Judas hung himself on. It was eaten in ancient China, and cultivated on logs throughout Asia. Species of *Auricularia* mushroom can commonly be found dried in Asian stores.

There are many other cultivated fungi throughout the world. Further details can be supplied by the school if you require them.

Synonymous Names

Naming of fungi are generally controlled by the International Botanical Congress; however, when changes occur, the new name can often take many years to come into use, hence the same fungi may be referred to by two different names for a period of time (e.g. *Psallatia* and *Agaricus* have both been used as the genus of the common field mushroom).

Naming of fungi is also controlled by a (some would say) rival organisation called the International Horticultural Congress. This organisation like the Botanical Congress is made up of equally well qualified and reputable academics.

The two congresses do generally agree, but occasionally may have different rulings, which explains why sometimes plants, algae and fungi may have two different current names being given to it by two equally respected academics.

IDENTIFYING EDIBLE MUSHROOMS

There is no certain method of knowing whether a fungus is edible or not, apart from developing a broad and in depth knowledge of the correct identification methods, and a knowledge of the poisonous species which grow in the locality you are concerned with.

Generally, you should avoid the following:

- *Amantia* (though not all species are poisonous)
- Species of *Agaricus* which become yellow when broken
- *Inocybe* many species, not all

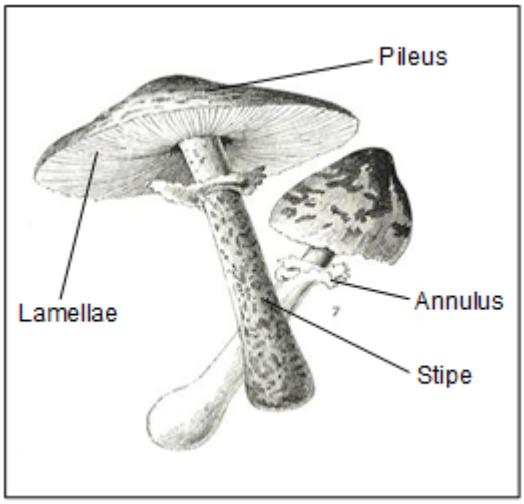
- *Psilocybe* most species

STRUCTURE

Mushrooms and toadstools (Basidiomycota), which produce umbrella like fruiting bodies, are together called the "gill fungi".

The fruiting part of the gill fungi is composed of the following:

- The cap (also called the **pileus**)
- The stalk which supports the cap (called the **stipe**)
- The gills on the under surface of the cap (called the **lamellae**)
- On some species; a ring on the stalk (called the **annulus**). The ring is the remains of a veil which covered the gills earlier. It is a thin flap of tissue encircling the stalk near the top of the stalk.



The structure of Basidiomycota fruiting body. Here Macrolepiota sin Agaricus procerus, the Parasol mushroom.

Tell-Tale Characteristics

These are things which will tell an expert what species of gill fungi is being dealt with:

The cap

The surface structure can be either filamentous (made up of microscopic strands), or cellular (made up of congregations of cells).

The gill

- The shape and thickness of the cystidia (which bear the spores)
- The arrangement of hyphae (i.e.: filaments) on the gill. These may be irregular, regular or in some other way characteristic of the species.

Characteristics of the Agaricaceae family

- The cap can usually be readily removed from the stalk.
- Stalk joins the cap in the centre of the cap.
- Gills are free or almost free of each other (not joined together)
- Spores are dark brown to black in colour, when dropped.
- Typically there is a ring (i.e.: annulus)

The Agaricus genus

There are 32 species of *Agaricus* worldwide, according to Singer (1975). Other "experts" have listed more, some up to 100.

Assignment 1

Question 1

How does the botanical definition of a mushroom compare with more common definitions for a "Mushroom"? Write a paragraph or two.

Question 2

Explain the classification, to genus level, of ten different commercially grown edible fungi.

Question 3

Produce a labelled illustration showing the parts (morphological characteristics) which are common to different edible fungi of the genus *Agaricus*.

Question 4

Compare the physical characteristics (in a sentence for each) of different commercially cultivated edible fungi.

Question 5

How can you distinguish edible Agaricus mushrooms from similar, inedible fungal fruiting bodies?

Don't forget to submit samples from your resource file.

Congratulations on finishing this

Now start the next section on the next page