

## **Ascomycetes or “sac” fungi**

This large group of fungi account for over 75% of described fungal species. It includes most of the fungi that combine with algae to form lichens, and the majority of fungi that lack morphological evidence of sexual reproduction, the latter reproducing from conidia in an asexual form of the fungus.

Of the fungi that reproduce sexually, the spores are produced inside a club shaped or cylindrical structure, an ascus, from the Greek “wine skin”.

Usually 8 spores are produced in each ascus, but there can be more or less spores.

### **Conidia & asexual spores**

Some fungi reproduce by asexual spores on conidia. These spores are produced quickly and are usually short lived but they can be spread readily by air currents. The sexual form of the fungus is usually an ascomycete, but it can be a basidiomycete.

In many cases the sexual form is not known or has been lost in evolution.

The conidial form is then classified in the Subdivision Deuteromycotina, and sometimes referred to as “Fungi Imperfecti”

### **Anamorph and Telemorph**

Anamorph is a term used for the asexual form, and telemorph for the sexual form.

As the structures are produced in each of these forms of the fungi at different times, frequently it is impossible to tell if the two forms belong to a particular fungus.

Some progress is being made by DNA analysis to find a connection between an anamorph and its telemorph. This fungus can then be considered as a holomorph. Some fungi have lost the sexual form of reproduction and exist only as the anamorph.

### **Asexual Reproduction**

Non motile spores are formed on ends of specialized hyphae called conidiophores.

They are formed by mitosis, (cell division).

Asexual spores are formed on conidia. These spores are genetically identical to the mycelium from which they are derived., can be dispersed by wind, insects or in “honeydew” that is spread by insects or gravity to other plants etc. and then germinate on a suitable host or substrate.

### **Anamorphic fungal species**

(Asexual spores produced on conidia)

The following fungi have frequently been observed in SFSGI field studies.

They have been classified thus:-

Division Eumycota

Subdivision Deuteromycotina

Class Hyphomycetes

Note: Hyphomycetes is an obsolete class of fungi in the equally obsolete phylum Deuteromycotina that lack fruiting bodies. Most hyphomycetes have now been assigned to the Ascomycota, mainly as a result of DNA sequencing, but many remain unassigned.

### ***Nomuraea atypicola***

Division Eumycota Subdivision Deuteromycotina Class Hyphomycetes

**Fruit body.** This fungus is parasitic on the body of the brown trap door spider, and the pallid stem bearing the asexual spores or conidia, protrudes through the funnel shaped burrow, this specimen was found at Coachwood Glen.

### ***Isaria cicadae aka Paecilomyces cicadae***

Division Eumycota Subdivision Deuteromycotina Class Hyphomycetes

**Fruit body.** White, 5-7 cm high, the terminal branches covered with powdery conidia.

**Habitat.** Parasitic on cicada nymph, emergent from soil surface. Found at Mt Wilson.

### ***Isaria tenuipes aka Paecilomyces tenuipes***

Division Eumycota Subdivision Deuteromycotina Class Hyphomycetes

**Fruit body.** Conidial stage of ascomycotic infection of a moth within a pupal case . The branches were 40-50 mm high and covered with the powdery asexual spores. Found at Mill Creek.

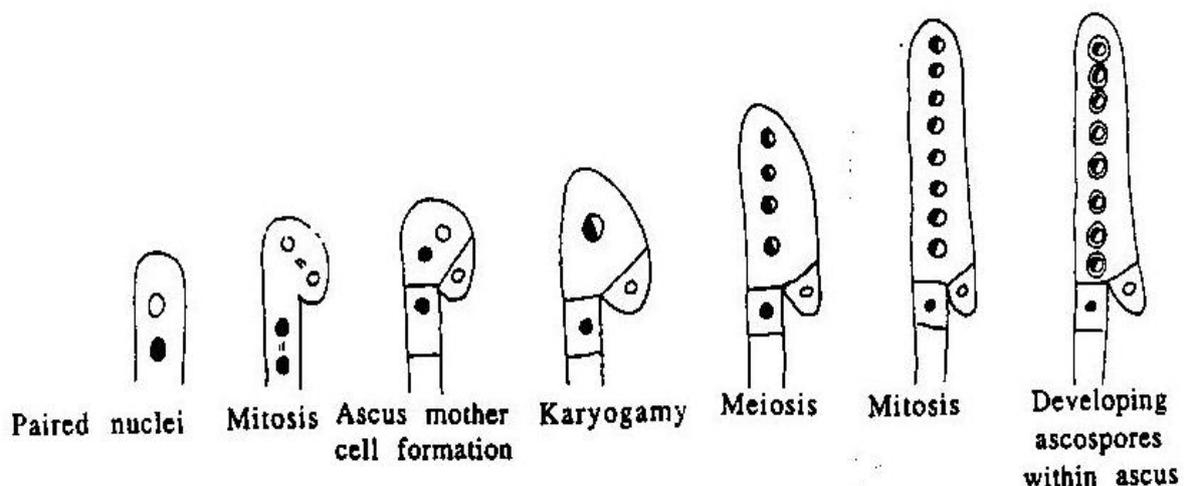
### **Sexual reproduction.**

Mycelium comes in contact with a compatible mycelium of same species. The mycelia form hyphae:- ascogonia & antheridia.

The male antheridium, enters a specialized hypha, the ascogonium ( female sex organ), through a pore or a hair like hypha called a trichogyne. There is now a dikaryophase with two genetically distinct nuclei in ascogenic hyphae.

Asci with eight spores (typically) are then formed by a process of meiosis and mitosis.

### **Ascus development**



From J. F. Brown

1. Simultaneous division of male & female nuclei
2. tip of ascogenous hypha forms crozier, and 2 septa are laid down.
3. Karyogamy (nuclear union),

4. Meiosis ( 2 nuclear divisions in which the chromosome number is reduced by half), into 4 nuclei.
5. Further mitosis or occurs resulting in 8 haploid spores.
6. Ascospores in ascus.

#### **Ascus formation and development**

At the same time as the asci are forming, the ascogonium and hyphal cells below it are stimulated into forming a wall around the developing asci, and this forms the fruiting body or **ascocarp**.

#### **Perithecium & Apothecium Ascocarps.**

The hymenium, ( spore bearing layer) develops on the inner surface of the perithecium. There is a small apical ostiole through which the spores from the asci are ejected from a perithecium. Spore release from perithecium may be due to increasing osmotic pressures. The hymenium develops on the surface of the apothecium and spores are ejected from the asci on this surface. Increasing pressure within the asci may also cause the release of the spores from the asci in an apothecium.

This explosive rupture is apparently caused by increasing osmotic pressure in the asci, when the complex polysaccharides in the epiplasm are converted into simple sugars as the ascospores mature, and draw fluid from the basal hyphae

#### **Cleistothecium**

In the closed cleistothecium the spores may be released when the ascocarp wall disintegrates or ruptures and dispersal of the spores may be dependent on insects or animals

#### **Naked Asci ( no ascocarp).**

Naked asci have no formed ascocarp, and are mostly present in plant diseases. There is a mycelium present intracellularly in the leaf, and the asci form on the leaf surface.

#### ***Cordyceps cranstounii***

Division Eumycota Subdivision Ascomycotina Class Pyrenomycetes Order Clavicipitales

**Fruit body.** Cream, club shaped, with visible ostioles.

**Stem.** lacelike filaments, connecting to the parasitised caterpillar.

**Habitat.** Emergent from its host in the soil.

#### ***Cordyceps gunnii***

##### **vegetable caterpillar, a parasitic fungus**

Division Eumycota Subdivision Ascomycotina Class Pyrenomycetes Order Clavicipitales

**Fruit body.** 6-10 cm long, dark olive green, club shaped fertile head.

**Stem.** Yellow, emerging from body of host caterpillar and grading into the fertile head.

**Habitat.** The fungal spores infect moth larvae, consuming the soft tissues whilst in the soil. The fruiting body emerges from behind the head of the caterpillar with the fertile head and stem above the soil.

***Ophiocordyceps robertsii* prev. *Cordyceps robertsii***

Division Eumycota Subdivision Ascomycotina Class Pyrenomycetes Order Clavicipitales

**Fruit body.** Long thin, 12 cm, with a distinct fertile dark brown head, and lighter stem.

**Habitat.** Parasitic on a larva of a moth and emerging through the soil.

***Ophiocordyceps robertsii* parasitized by *Cordyceps cranstounii***

Division Eumycota Subdivision Ascomycotina Class Pyrenomycetes Order Clavicipitales

The white outgrowth often seen on *Cordyceps robertsii* is *Codyceps cranstounii*.

***Daldinia concentric***

Division Eumycota Subdivision Ascomycotina Class Pyrenomycetes Order Sphaeriales

**Fruit bodies.** Spherical, hard, brittle to 4-5 cm diameter, purplish brown with small ostioles. Interior has concentric growth rings.

**Habitat.** Dead wood in rainforest

***Xylaria polymorpha***

Division Eumycota Subdivision Ascomycotina Class Pyrenomycetes Order Sphaeriales

**Ascocarp.** Hard, carbonaceous, with small ostioles, cylindrical to club shaped.

**Habitat.** On old wood.

***Xylaria hypoxylon***

Division Eumycota Subdivision Ascomycotina Class Pyrenomycetes Order Sphaeriales

**Fruitbody.** Carbonaceous, covered with filmy conidia when young, club-shaped and branching.

**Habitat** On dead or buried wood in damp areas.

***Biscogniauxia capnodes* (*Hypoxylon bovei*)**

Division Eumycota Subdivision Ascomycotina Class Pyrenomycetes Order Sphaeriales

**Fruit body.** A thin black crust over decaying wood. Small papillae with the ostioles of the spore chambers evident on surface. Feathery conidial tufts seen emergent from immature fruit bodies

**Habitat.** Dead wood.

***Ascocoryne sarcoides***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Helotiales

**Fruitbody.** Disc to 20 mm with tapered base, smooth firm gelatinous surface, lobed edge. Purplish colour

**Habitat.** Saphrotrophic, on dead wood.

***Banksiomyces macrocarpus***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Helotiales

**Fruit body.** Small irregular shaped discs to 1.5 cm, growing on the cones of *Banksia spinulosa*.

**Spores.** Colourless.

**Habitat.** On moist *Banksia spinulosa* cones.

***Bisporella citrine***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Helotiales

**Fruit body.** Small disc shaped fungi to 3 mm diameter. Bright lemon yellow, smooth slightly convex to flattened, tapering to a small base.

**Spore print.** Colorless.

**Habitat.** On old wood.

***Chlorociboria sp***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Helotiales

**Fruit body.** Disc to tongue shaped, 0.3 -1.1 mm dia, slightly stipitate, spores colourless

**Habitat.** On moist old wood.

***Microglossum viride***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Helotiales

**Fruit body.** Green tongue-like fungi slightly flattened and grooved, growing to about 5 cm.

**Habitat.** On damp soil

***Mollisia sp***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Helotiales

**Fruit body.** White to greyish disc. 0.2 -5mm wide, broadly attached or less often very shortly stipitate.

**Habitat.** On old moist wood.

***Trichoglossum walteri***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Helotiales

**Fruit body.** Tongue-like fertile head tapering into a slender stem. Dark brown to near black. Bristle-like hairs are on the head and stem. A very similar species is *Trichoglossum hirsutum*, but this has longer 15 septate spores, 113-140µm whereas *Trichoglossum walteri* has 7 septate spores 90-95µm.

**Habitat.** On soil.

***Geoglossum sp (Photo © Gayle Drady)***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Helotiales

**Fruit body.** Black smooth tongue-like fertile head and slender stem, no hairs or bristles.

**Habitat.** On soil.

***Leotia lubrica***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Pezizales  
**Fruit body.** Dia. To 2.5 cm. Irregular spherical head with a rubbery jelly-like consistency, yellow to greenish.  
**Stem.** Long, slender, viscid, granular .  
**Spores.** Colourless.  
**Habitat.** In wet forest on leaf litter.

***Aleuria rhenana***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Pezizales  
**Fruit body.** Cup to disc shaped fungus, bright orange, smooth with a mealy white undersurface, growing up to 2.5 cm diameter.  
**Stem.** Short, central, white, similar to the under surface.  
**Spores.** White.  
**Habitat.** On soil.

***Aleuria aurantia***

orange peel fungus

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Pezizales  
**Fruit body.** Cup to disc shaped becoming undulate, bright orange, smooth, growing caepitosely up to 5-7cm diameter.  
**Stem.** No stem.  
**Spores.** White.  
**Habitat.** On soil.

***Aleurina ferruginea***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Pezizales  
**Fruit body.** Cup to saucer shaped fungus with a distinct rim, to 2 cm dia. Dull orange to olive brown. The inner surface of the cup is smooth and glistening, the outer surface has small raised warts. No obvious stem.  
**Habitat.** Crowded on damp soil.

***Discinella terrestris***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Pezizales  
**Fruit body.** Cup shaped to 1cm, yellow-orange discs growing on soil, slightly flattened to undulate.  
**Habitat.** On damp soil, often amongst moss.

***Helvella chinensis***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Pezizales

**Fruit body.** A stalked disc fungus, height to 6 cm, outer surface of the disc and stem villous, dia. to 5cm.

Inner surface grey, smooth.

**Habitat.** Soil, saprotropic.

**Cup fungus**

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Pezizales

**Fruit body.** Cup shaped to 1 cm dia., pale orange, smooth, no marginal hairs, small white stem, 1 mm dia., 2-3 mm long.

**Habitat.** On moist dead wood.

***Plectania campylospora***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Pezizales

**Fruit body.** Dark brown bowl shaped, inner surface smooth and outer surface glandular.

**Habitat.** On rotten logs.

***Scutellinia scutellata.***

Division Eumycota Subdivision Ascomycotina Class Discomycetes Order Pezizales

**Fruit body.** Shallow, cup shaped disc. Inner hymenial surface is bright orange, outside beige and velvety. The margin of the disc is covered with dark brown hairs.

**Stem.** Absent.

**Habitat.** On old decaying wood