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SYSTEMATICS OF DIVISION ASCOMYCOTA 3 (LICHENIZED FUNGI)

Lichens are associations that arise from algae or cyanobacteria (photobiont) living among filaments of multiple fungi (mycobiont) in a mutualistic relationship. Lichens are regarded as a special group of fungi which is also known as lichenized fungi. Lichens are very common on earth and about 13500 species are exist and they cover approximately 6% of Earth's land surface. Some of them grow on the bark of temperate trees or as epiphytes on the leaves of trees in tropical rain forests. Others occupy some of the most inhospitable environments on earth, growing on cooled lava flows and bare rock surfaces, where they help in the process of soil formation, and on desert sands where they help to stabilize the surface and enrich it with nutrients. Some other types of lichen grow abundantly on tundra soils, providing a vital winter food source for animals in arctic and sub-arctic regions. Lichens are considered to be among the oldest living things and they are among the first living things to grow on a fresh rock exposed after an event such as a landslide. The long life-span and slow and regular growth rate of some lichens can be used to date events.

Lichens grow in a wide range of shapes and forms. Vegetative body parts of a lichen are called the thallus. Lichens are grouped by thallus type. There are three major morphological types of thallus (Foliose, Fruticose, and Crustose). Foliose lichens have a flat, leaf-like structure. Foliose lichens are leaflike in both appearance and structure. They adhere to their substrate loosely. Crustose lichens are crust-like and they are tightly attached to or embedded in their substrate and have no lower cortex. They are consist of about 75 percent of all lichens on earth. Fruticose lichens have no distinct top and bottom and are often round in crosssection. Their thalli may be upright, shrubby, or of pendulous strands.

Reproduction in lichens may be either sexual or vegetative (asexual). In asexual reproduction, fragments of the thallus containing both the photobiont and the mycobiont separate and form into a new lichen. This may happen when a piece of the thallus is accidentally broken off, but specialized structures that have evolved in lichens, namely isidia and soredia, usually carry out this type of reproduction. In most lichens undergoing sexual reproduction, tiny spores are produced within an ascus. The asci form inside of structures called ascomata.

The most common type of ascoma, called an apothecium, is shaped like an open disc. In sexual reproduction, only the fungal partner is reproduced. The spores that germinate must find the appropriate photobiont in order to form a new lichen. Since this is an undependable type of reproduction, vegetative reproduction is very important. The term “mycobiont” is the fungal component of a lichen and it could be a member of Ascomycete or Basidiomycete. The associated lichens are called either ascolichens or basidiolichens, respectively.

Lichen associations may be examples of mutualism, commensalism or even parasitism, depending on the species. There is evidence to suggest that the lichen symbiosis is parasitic or commensalistic, rather than mutualistic. The photosynthetic partner can exist in nature independently of the fungal partner, but not vice versa. Photobiont cells are routinely destroyed in the course of nutrient exchange. The association is able to continue because reproduction of the photobiont cells matches the rate at which they are destroyed. The fungus surrounds the algal cells, often enclosing them within complex fungal tissues unique to lichen associations. In many species the fungus penetrates the algal cell wall, forming penetration pegs (haustoria) similar to those produced by pathogenic fungi that feed on a host. Cyanobacteria in laboratory settings can grow faster when they are alone rather than when they are part of a lichen.

Lichens are pioneer species, among the first living things to grow on bare rock or areas denuded of life by a disaster. Lichens may have to compete with plants for access to sunlight, but because of their small size and slow growth, they thrive in places where higher plants have difficulty growing. Lichens are often the first to settle in places lacking soil, constituting the sole vegetation in some extreme environments such as those found at high mountain elevations and at high latitudes. Some survive in the tough conditions of deserts, and others on frozen soil of the Arctic regions.

A major ecophysiological advantage of lichens is that they are poikilohydric (poikilo- variable, hydric- relating to water), meaning that though they have little control over the status of their hydration, they can tolerate irregular and extended periods of severe desiccation. Like some mosses, liverworts, ferns, and a few "resurrection plants", upon desiccation, lichens enter a metabolic suspension or stasis (known as cryptobiosis) in which the cells of the lichen symbionts are dehydrated to a degree that halts most biochemical activity. In this cryptobiotic state, lichens can survive wider extremes of temperature, radiation and drought in the harsh environments they often inhabit.

Lichens do not have roots and do not need to tap continuous reservoirs of water like most higher plants, thus they can grow in locations impossible for most plants, such as bare rock, sterile soil or sand, and various artificial structures such as walls, roofs and monuments. Many lichens also grow as epiphytes (epi- on the surface, phyte- plant) on plants, particularly on the trunks and branches of trees. When growing on plants, lichens are not parasites; they do not consume any part of the plant nor poison it. Lichens produce allelopathic chemicals that inhibit the growth of mosses. Some ground-dwelling lichens, such as members of the subgenus Cladina (reindeer lichens), produce allelopathic chemicals that leach into the soil and inhibit the germination of seeds, spruce and other plants. Stability (that is, longevity) of their substrate is a major factor of lichen habitats. Most lichens grow on stable rock surfaces

or the bark of old trees, but many others grow on soil and sand. In these latter cases, lichens are often an important part of soil stabilization; indeed, in some desert ecosystems, vascular (higher) plant seeds cannot become established except in places where lichen crusts stabilize the sand and help retain water.

Lichens may be eaten by some animals, such as reindeer, living in arctic regions. The larvae of a number of Lepidoptera species feed exclusively on lichens. These include Common Footman and Marbled Beauty. However, lichens are very low in protein and high in carbohydrates, making them unsuitable for some animals. Lichens are also used by the Northern Flying Squirrel for nesting, food, and a water source during winter.

Group: Lichenized Ascomycete Fungi

Division: *Ascomycota*

Subdivision: *Pezizomycotina*

Class: *Arthoniomycetes*

Order: *Arthoniales*

Family: *Chrysothricaceae*

Family: *Arthoniaceae*

Family: *Roccellaceae*

Class: *Dothideomycetes*

Order: *Capnodiales*

Family: *Antennulariaceae*

Order: *Patellariales*

Family: *Patellariaceae*

Order: *Trypetheliales*

Family: *Trypetheliaceae*

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Family: *Arthopyreniaceae*

Family: *Dacampiaceae*

Family: *Lichenotheliaceae*

Family: *Mycoporaceae*

Family: *Naetrocymbaceae*

Class: *Eurotiomycetes*

Order: *Pyrenulales*

Family: *Celotheliaceae*

Family: *Pyrenulaceae*

Order: *Verrucariales*

Family: *Adelococcaceae*

Family: *Verrucariaceae*

Order: *Mycocalicales*

Family: *Mycocaliciaceae*

Family: *Sphinctrinaceae*

Class: *Lichinomycetes*

Order: *Lichinales*

Family: *Gloeoheppiaceae*

Family: *Heppiaceae*

Family: *Lichinaceae*

Family: *Peltulaceae*

Class: *Lecanoromycetes*

Order: *Acarosporales*

Family: *Acarosporaceae*

Order: *Candelariales*

Family: *Candelariaceae*

Order: *Rhizocarpales*

Family: *Rhizocarpaceae*

Order: *Lecideales*

Family: *Lecideaceae*

Order: *Peltigerales*

Family: *Collematineae*

Family: *Coccocarpiaceae*

Family: *Collemataceae*

Family: *Placynthiaceae*

Family: *Pannariaceae*

Family: *Peltigerineae*

Family: *Peltigeraceae*

Family: *Lobariaceae*

Family: *Nephromataceae*

Family: *Massalongiaceae*

Family: *Vahliellaceae*

Order: *Lecanorales*

Family: *Catillariaceae*

Family: *Psoraceae*

Family: *Gypsoplacaceae*

Family: *Pilocarpaceae*

Family: *Cladoniaceae*

Family: *Stereocaulaceae*

Family*: Sphaerophoraceae*

Family: *Calycidiaceae*

Family: *Mycoblastaceae*

Family: *Ramalinaceae*

Family: *Scoliciosporaceae*

Family: *Haematommataceae*

Family: *Lecanoraceae*

Family: *Parmeliaceae*

Family: *Dactylosporaceae*

Family: *Miltideaceae*

Family: *Pachyascaceae*

Order: *Teloschistales*

Family: *Physciineae*

Family: *Physciaceae*

Family: *Teloschistineae*

Family: *Brigantiaeaceae*

Family: *Letrouitiaceae*

Family: *Teloschistaceae*

Family: *Megalosporaceae*

Order: *Sarrameanales*

Family: *Sarrameanaceae*

Order: *Pertusariales*

Family: *Agyriaceae*

Family: Coccotremataceae

Family: *Icmadophilaceae*

Family: *Megasporaceae*

Family: *Ochrolechiaceae*

Family: *Pertusariaceae*

Order: *Baeomycetales*

Family: *Anamylopsoraceae*

Family: *Baeomycetaceae*

Order: *Trapeliales*

Family: *Trapeliaceae*

Order: *Ostropales*

Family: *Odontotremataceae*

Family: *Stictidaceae*

Family: *Coenogoniaceae*

Family: *Porinaceae*

Family: *Sagiolechiaceae*

Family: *Gyalectaceae*

Family: *Phlyctidaceae*

Family: *Gomphillaceae*

Family: *Solorinellaceae*

Family: *Graphidaceae*

Family: *Thelotremataceae*

Family: *Myeloconidaceae*

Family: *Phaneromycetaceae*

Family: *Arthrorhaphidaceae*

Family: *Hymeneliaceae*

Family: *Protothelenellaceae*

Family: *Fissurinaceae*

Family: *Thelenellaceae*

Family: *Fuscideaceae*

Family: *Ophioparmaceae*

Family: *Umbilicariaceae*

Family: *Lopadiaceae*

Family: *Aphanopsidaceae*

Family: *Biatorellaceae*

Family: *Coniocybaceae*

Family: *Microcaliciaceae*

Family: *Epigloeaceae*

Family: *Lyrommataceae*

Family: *Melaspileaceae*

Family: *Monoblastiaceae*

Family: *Sarcopyreniaceae*

Family: *Strigulaceae*

Family: *Thelocarpaceae*

Family: *Vezdaeaceae*

Family: *Xanthopyreniaceae*

Division: *Basidiomycota*

Subdivision: *Agaricomycotina*

Class *Agaricomycetes*

Order: *Agaricales*

Family: *Hygrophoraceae*

Order: *Cantharellales*

Family: *Clavulinaceae*

Order: *Corticiales*

Family: *Lepidostromataceae*

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