Lichens

Lichens are small group of curious plant .They are made up of algal and fungal components, living together in an intimate symbiotic relationship. The algal component is known as Phycobiont (Phykos-alga, bios-life) and the fungal components as mycobiont (mykes-fungus, bios –life).The plant body of lichens neither resembles algae nor fungi.

Distribution: Lichens are cosmopolitan in distribution. There are about 400 genera and 16000 species of lichens all over the world. The lichens occur from arctic region to deserts and to evergreen forests to deciduous forests.

Classification of Lichens: There is no natural system of classification of lichens most of the scientists classify them on the basis of nature of fungal component and habitat and forms.

Classification based on the basis of nature of fungal partner: On the basis of nature of fungal partner lichens are classified into two groups such as: Ascolichens and Basidiolichens.

1. **Ascolichens:** The lichens in which the fungal components belong to the ascomycetes called ascolichens.The ascolichens are subdivided in to two sub classes: Gymnocarpeae and Pyrenocarpeae.

i. **Gymnocarpeae:** In which the ascocarp is disc like ex.Parmelia.

ii. **Pyrenocarpeae:** In which the ascocarp is flask shaped ex.Physcia

2. **Basidiolichens:** A group of lichens in which the fungal component belongs to the basidiomycetes is called basidiolichens ex. Cora, Corella

Classification based on Habitat: According to habitat the lichens are classified into three categories: Saxicolous Lichens, Corticolous lichens and Terricolous lichens.

i. **Saxicolous lichens :** The saxicolous grow on firm substratum of cold regions

ii. **Corticolous lichens :** The corticolous are commonly grow on barks of the trees

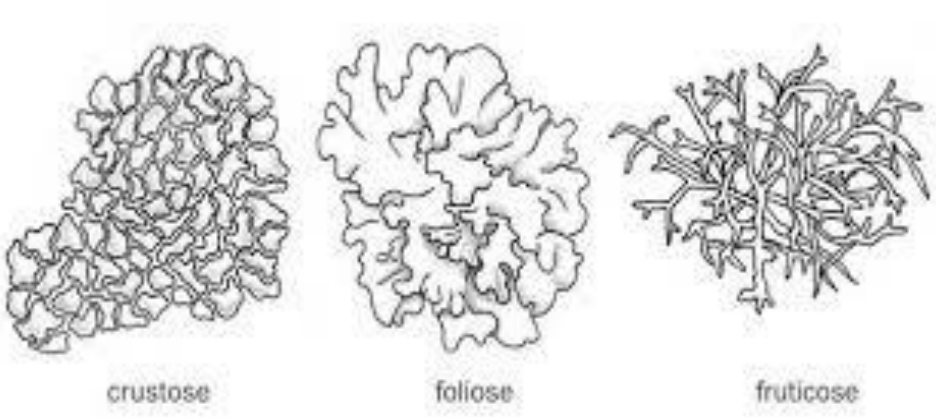
iii. **Terricolous lichens:** The Terricolous are terrestrial and commonly grow on soil of hot areas with scanty rains.

Classification based on forms of lichen thallus: On the basis of forms and nature of attachment to the substratum, the lichens are classified into three groups: Crustose, Foliose and Fruticose Lichen.

i. **Crustose lichens:** The thallus is insignificant size. It is flat, thin and closely attached to the substratum. It is just like a thin layer or crust closely attached to the stones, rocks or bark of trees. It is wholly or partially embedded in the substratum and in the latter case only fruiting bodies are visible above the surface of the substratum. Ex. Graphics,Rhizocarpon, Strigula etc.,,

ii. **Foliose Lichens:** These lichens are flat with leaf like and lobed thallus. They attached to the substratum with the help of rhizoid –like Rhizines. Ex. Parmelia, Physcia etc..,

iii. **Fruticose Lichen**: These are shrubby lichens with well developed shrub –like cylindrical and branched thallus. They grow erect or hang from the substratum. The plant body is attached to the substratum with the help of a basal mucilaginous disc. Ex. Usnea etc.,



RELATIONSHIP BETWEEN ALGA AND FUNGUS IN LICHENS: According to different author, the relationship between the two is either parasitic or symbiotic.

Some consider that fungi in lichens are mildly parasitic upon the algal cells, which they surround and from which they obtain food. The haustoria or appresoria of fungi that penetrate the algal cell wall and protoplasts prove this theory.

There are some authors that believe in mutualism or symbiosis of both the partners in lichens. The fungal partner gets the food synthesized by algae. The algal partner receives water absorbed by the fungi from the substratum or from moist air. It has been observed that the algal component of lichen can grow without fungal partner but fungal component cannot survive without algal component. Such type of symbiotic relationship as it exists at the expense of one of the partners (algae).

Internal structure of Lichen Thallus:

The internal structure of lichen thallus is very complex. The thallus composed of algal and fungal components. Such type of thallus is known as Consortium. In Advanced foliose lichen the following four distinct regions can be recognized in a vertical section.

1. **Upper cortex:** It is the outermost thick and protective zone of the thallus, composed of compactly interwoven fungal hyphae.The hyphae are arranged at right angle to the surface of the thallus. There are usually no intercellular spaces between the hyphae if there are they

are filled with gelatinous substances. In some lichens (e.g.Parmelia) there are many irregular arranged breathing pores on the outer surface. These pores help in gaseous exchange.

2. **Algal Layer:** The algal layer occurs just below the upper cortex. This layer is also Known as gonidial layer (Gonidium cells are reproductive cells of alga).The algal cells remain embedded in between the tangled network of loosely interwoven hyphae. In some species (e.g.Collema, Leptogium) algal cells and fungal hyphae are distributed more or less uniformly throughout the thallus. Such species is known as Homoisomerous. On the other hand in members like Parmelia and Physcia the algal cells form a distinct layer within the thallus. These species is known as heteromerous.Some common green and blue green algae found in the lichens are the species of Pleurococcus, Cladophora, Nostoc and Rivularia.
3. **Medulla:** It is the central part of the thallus comprised of loosely interwoven fungal hyphae with large spaces between them.
4. **Lower Cortex:** This zone is composed of compactly arranged hyphae which run parallel or perpendicular to the surface of the thallus. Some of these hyphae become specialized and extend downward from the lower surface of the cortex and help in the attachment in the thallus of substratum. These specialized hyphae are known as rhizines.

An internal structure of crustose lichens is also more or less similar to foliose lichens. The lower cortex does not occur in the fruticose lichens due to their cylindrical structures and medulla forms the central part of the axis.

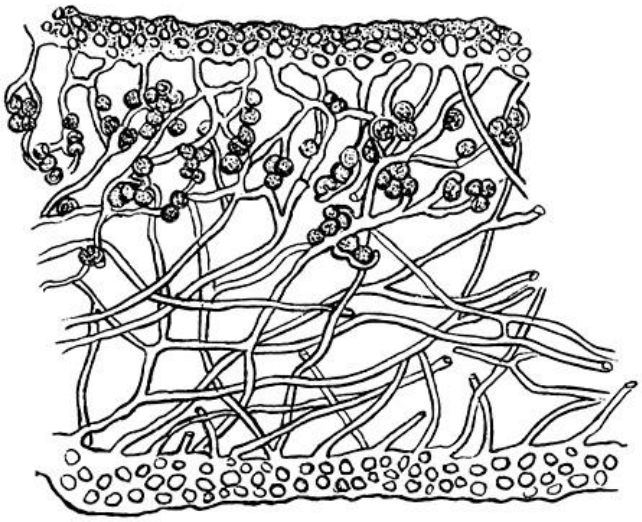
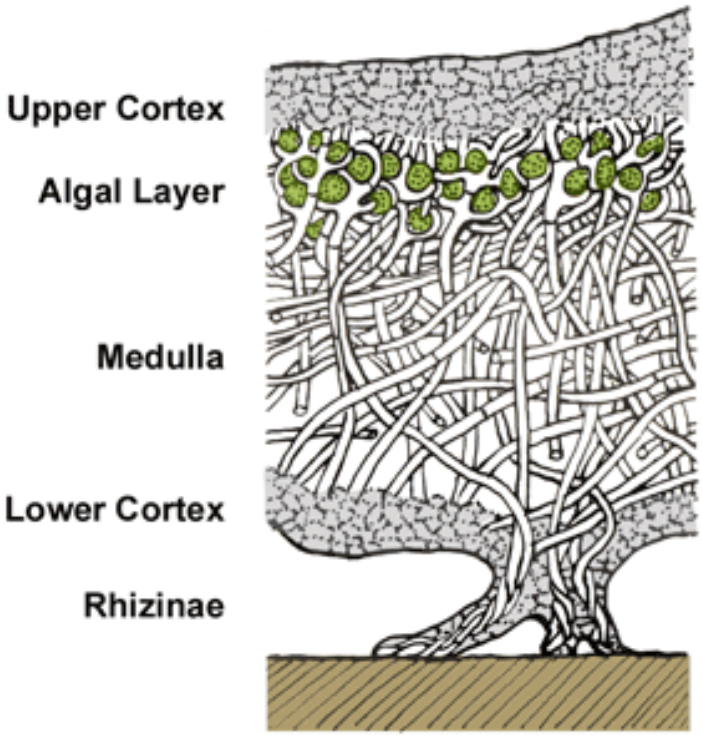


Fig. 8. *Physcia parietina* De Not. Vertical section of thallus obtained by synthetic culture × 130 (after Bonnier).



REPRODUCTION: Lichens reproduce vegetatively, asexually and sexually.

Vegetative reproduction: It takes place by:

Fragmentation: It may be due to death of older parts or by breaking.

By formation of vegetative structures:

Soredia: They are separable, noncorticated clumps of few algal cells closely enveloped by hyphae. Several soredia fuse together forming granular masses. Soredia originate in the medulla and algal layer. It shows overgrowth of algae. They come out through the pores and cracks in the cortex.

Soralia: Delimited masses of emerged soredia are called sorelia. Soralia are marginal or laminal. It may be granular or farinose. They are common in foliose lichens.

Hormocysts: These are algal structures which originate in apothecia like hormocystangia. They are found in gelatinous lichens. E. g. - *Lempholemma.*

Isidia: They are cylindrical, finger like outgrowths of the upper cortex in which algal and fungal tissues are continuously incorporated. They are fragile and produced on the upper surface without any pattern.

Lobules: These are marginally produced, dorsiventral outgrowths of foliose lichens. E. g. - *Parmelia* , *Peltigera* , etc.

Asexual reproduction: It takes place by the formation of various types of asexual spores such as oidia, condia or pycniospores produced within pycnidia by the fungal partners (ascolichens).The spores get dispersed and germinate in favourable conditions. They produce hyphae in all the directions. When these hyphae meet with suitable algal partners, grow further and form new lichen thallus.

Sexual reproduction: It has been studied in very few of the Ascolichens. The male reproductive structures are called **spermogonia** and are flask shaped. They produce numerous small male cells called **spermatia.** The female sex organs are called **ascogonia** or **carpogonia**. They develop in the medulla of the thallus. Each carpogonium is filamentous with basal coiled portion, **archicarp** and elongated, multicellular **trichogyne**. One of the cells of archicarps gets

converted to **oogonium**. A spermatium falls on the tip of the trichogyne. The walls of both dissolve at the point of contact. The male nuclei and the cytoplasm run into the oogonium. Plasmogamy is followed by the formation of many ascogenous hyphae. Either terminal or penultimate cell develops **binucleate asci**. Within the asci, the two nuclei fuse and undergo meiosis followed by mitosis to form eight ascospores. In between the asci, there are many sterile hyphae called **paraphyses**. Both, asci and paraphyses are formed in a saucer shaped fruiting body called **Apothecia** e. g. - *Parmelia , Usnea.*

If the fruiting body is closed with an aperture at the tip, it is called **perithecium** e. g. - *Peltigera*. In this, asci are at the base and paraphyses are present above.

ECONOMIC IMPORTANCE:

1. **Food for animals:** In the winter season, in Arctic region, lichens like *Cladonia*, *Cetraria* are used by reindeer and caribou, sheep, land snails, slugs, etc.
2. **Food for man:** Lichens such as *Umbilicaria, Cetraria*, etc. are used as salad or fried in deep fat and used as food in countries like Japan, Iceland, etc.
3. **Medicines:**
    a) *Lobelia pulmonaria*-for lung diseases.
    b) *Palmeria sulcata*-for Cranial maladies.
    c) *Peltigera Canina*-for Hydrophbia
    d) *Usnea, Cetraria islandica, Peltigera canina*-folk medicine.
    e) Antibiotics- Many lichens.
    f) Usnic acid- used for treating plant diseases.
4. **Dyes:** Lichens such as *Rocella, Parmelia, Evernia, Ochrolechia* are used for extracting dyes from them. These dyes are used for colouring wool, fabrics, etc. *Rocella* gives a dye that acts as acid- base indicator-litmus paper.
5. **Brewry:** Some lichens are used in the synthesis of beer for fermentation.
6. **Essential oil:** Species like *Parmelia, Evernia* yield essential oils that are used in perfumery.
7. **Skin diseases:** Lichens such as Usnea, Evernia, etc. are responsible for skin diseases and allergy.
8. **Pollution indicators:** Lichens act as pollution indicators especially for sulphur pollution.