



**Chaudhary Mahadeo Prasad Degree College**  
(A Constituent Postgraduate College of Central University of Allahabad)

# E-learning module

## Lichens

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# E learning B.Sc. I

## Lichens- I



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# Lichen history

- ▶ Theophrastus first gave the term Lichen in 371–284 BC
- ▶ 1699: **Morrison** called them **Musco Fungus**
- ▶ 1700: **Turnfort** called them Plants with shallow cup like fruits but lack flowers
- ▶ **Dellenius** 1741: called **Lichenoids** for all the lichen like plants
- ▶ **Weber** 1780: lichens are independent group of plants
- ▶ **Acharius** 1798: classified lichen into a separate group of families. He is the **Father of Lichenology**
- ▶ **Schwender** 1867: proposed the dual component of Lichen
- ▶ **Stahl** 1877: proposed that algae and fungus are of different origin
- ▶ **Crombie** 1885: described the association as **Romance of Lichenology–Helotism–** Mycobiont is Tyrant Master and Phyco Biont is Damsel (master slave relationship)
- ▶ **Reineke** 1872: Association of Algae and Fungus as Consortium where both have mutual growth and interdependence.
- ▶ **De Barry** 1879: Proposed the term **Symbiosis** for the association of Algae and Fungus

# Different names of lichens on the basis of substrate

- ▶ A Crustose lichen that grows on rock is called a saxicolous lichen.
- ▶ Crustose lichens that grow on the rock are epilithic, and those that grow immersed inside rock, growing between the crystals with only their fruiting bodies exposed to the air, are called endolithic lichens.
- ▶ A Crustose lichen that grows on bark is called a corticolous lichen.
- ▶ A lichen that grows on wood from which the bark has been stripped is called a lignicolous lichen.
- ▶ Lichens that grow immersed inside plant tissues are called endophloidic lichens or endophloidal lichens.
- ▶ Lichens that use leaves as substrates, whether the leaf is still on the tree or on the ground, are called epiphyllous or foliicolous.
- ▶ A terricolous lichen grows on the soil as a substrate.
- ▶ Many squamulose lichens are **terricolous**.
- ▶ Umbilicate lichens are foliose lichens that are attached to the substrate at only one point.
- ▶ A vagrant lichen is not attached to a substrate at all, and lives its life being blown around by the wind.

# Examples of some lichens

- ▶ Aquatic lichen– Grow in sea water –*Peltigra* sp.
- ▶ Tundra region– Reindeer Moss–*Cladonia rangiferina*
- ▶ Colour of the lichens is due to the algal pigments
- ▶ White lichens: *Gyrophora*

# Symbiotic association of lichens

## Mycobiont

- Fungal component
- Protects the algae
- Provides attachment to the substratum

## Phycobiont

- Algal component
- Provides food
- Gives colour

# Mycobiont

- ▶ Fungal component of the lichen belong to Ascomycotina or Basidiomycotina
- ▶ Eg of ascomycotina lichens: Peltigra , Parmelia, Graphis
- ▶ Only 4 genera of lichens belong to basidiomycotina: Cora, Corella, Dictyonema

# Phycobiont

- ▶ Algal component mostly belongs to
- ▶ Cyanophyta e.g. *Gleocapsa*, *Nostoc*, *Scytonema*, *Rivularia*
- ▶ *Chlorophyta*: e.g. *Coccomyxa*, *Trebouxia*, *Cladophora*
- ▶ *Xanthophyta*
- ▶ *Phaeophyta*



# Hole 1967 divided lichens to 3 classes

- ▶ Lichens are grouped into 3 classes based on the participating fungal component
- ▶ 1. **ASCOLICHENS**, in which the fungal component belongs to Ascomycetes. All the three forms of lichens are in this group
- ▶ 2. **BASIDIOLICHENS**, in which the fungal component belongs to Basidiomycetes.e.g. *Cora*
- ▶ 3. **LICHENS IMPERFECTI**, in which the fungal component belongs to Duteromycetes. e.g. *Crocynia, Lepraria*

# Classification of Lichen

I: Based on habitat

1. Saxicolous
2. Corticolous
3. Terricolous
4. Lignicolous

II: Based on the group of fungal partner

1. Ascolichen
2. Basidiolichen

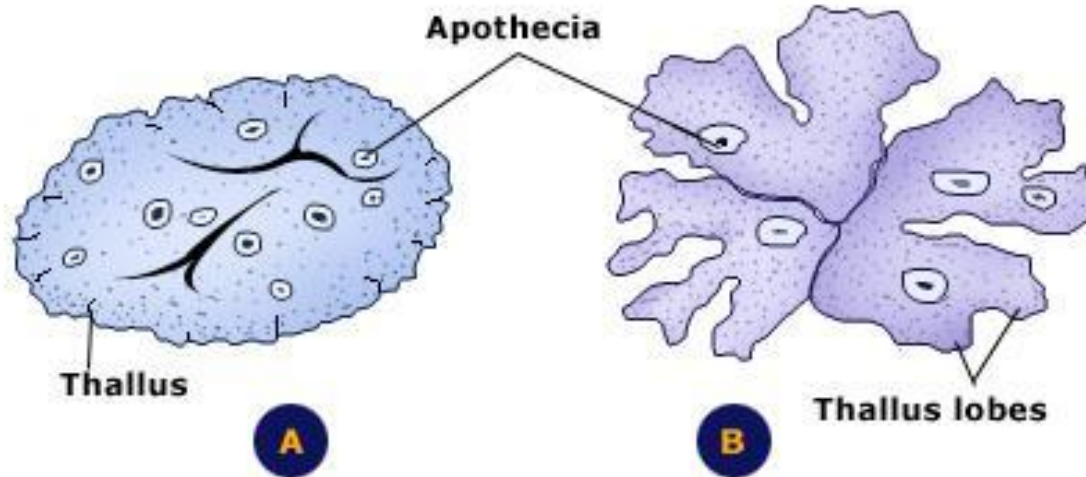
III: Based on thallus structure

1. Leprose lichen
2. Crustose
3. Foliose
4. Fruticose

IV: Based on distribution of algal and fungal component in the thallus

1. Homoisomerous thalli
2. Heteromerous thalli

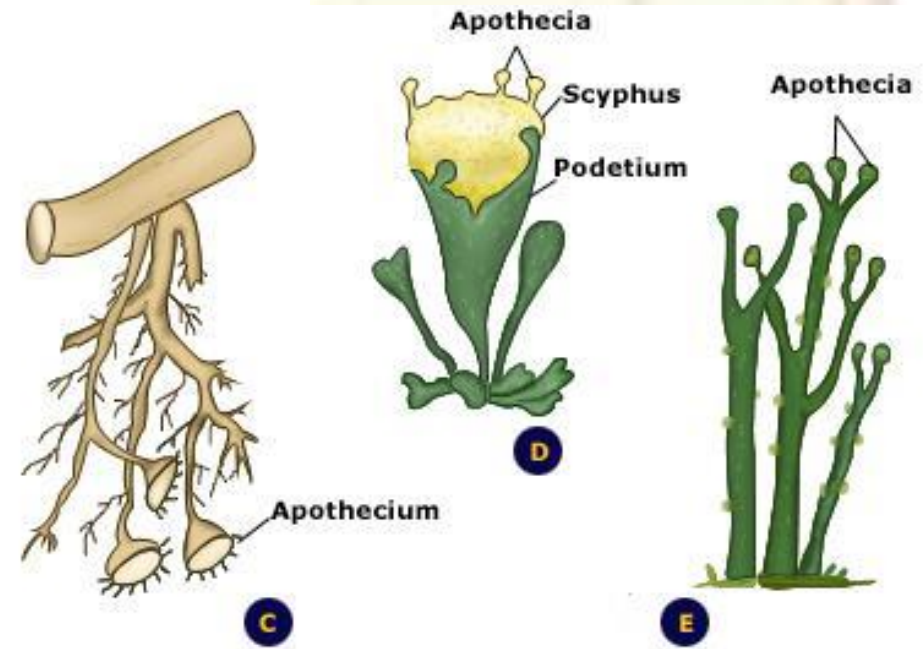
# Forms of lichens



e.g. Foliose lichen:  
Parmelia, Peltigra  
Physcia

e.g. Crustose lichen:  
Graaphis  
Lecanora and Rhixocarpon

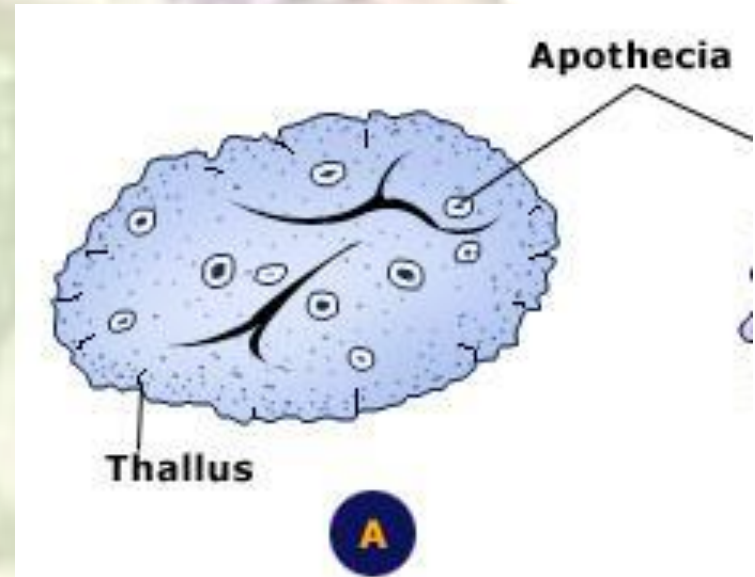
e.g. Fruticose lichen:  
Usnea and Cladonia sp



A. Crustose; B. Foliose; C-E. Fruticose

# Crustose lichen

- Thallus is flat dorsiventral.
- Closely attached to the bark of trees like a crust.
- Thalli may be partially or completely embedded in the substratum.
- Fruiting body is seen above the surface.



e.g. Crustose lichens

*Caloplaca thallincola*,



*Graphis*

*Lecanora muralis*

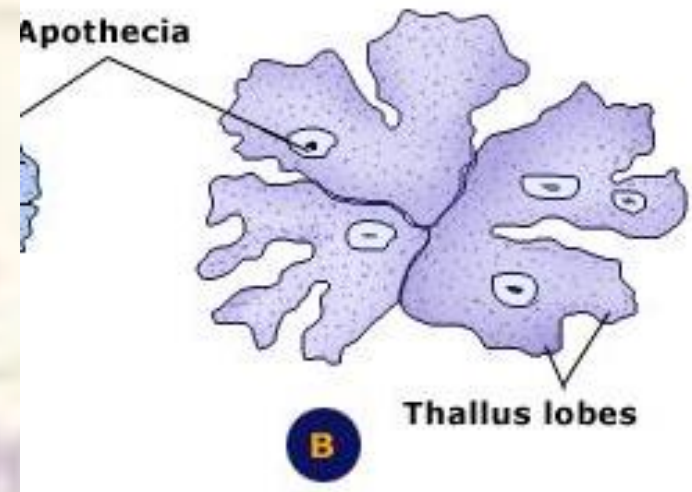


*Lepraria*



# Foliose lichen

- ▶ Flat dorsiventral thallus, leaf like appearance with irregular margins.
- ▶ Looks like dried up thallus of Bryophytes
- ▶ Thallus is attached to the substratum by means of rhizoid like structure Rhizines which are fungal origin



e.g. Foliose lichens



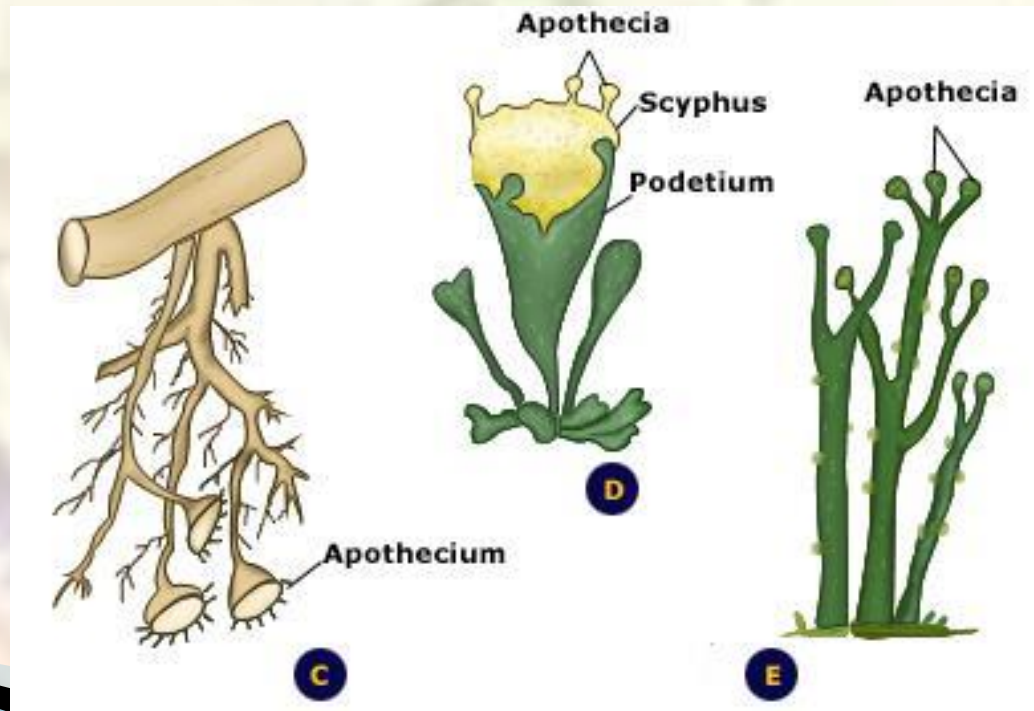
*Xanthoria parietina*



*Peltigera membranacea*

# Fruticose lichens

- ▶ Thallus is cylindrical, branched, bushy in appearance
- ▶ May be erect or pendant hanging from the branches of the trees
- ▶ Attached to the substratum by means of basal part





# e.g. Fruticose lichens



*Usnea subfloridana*

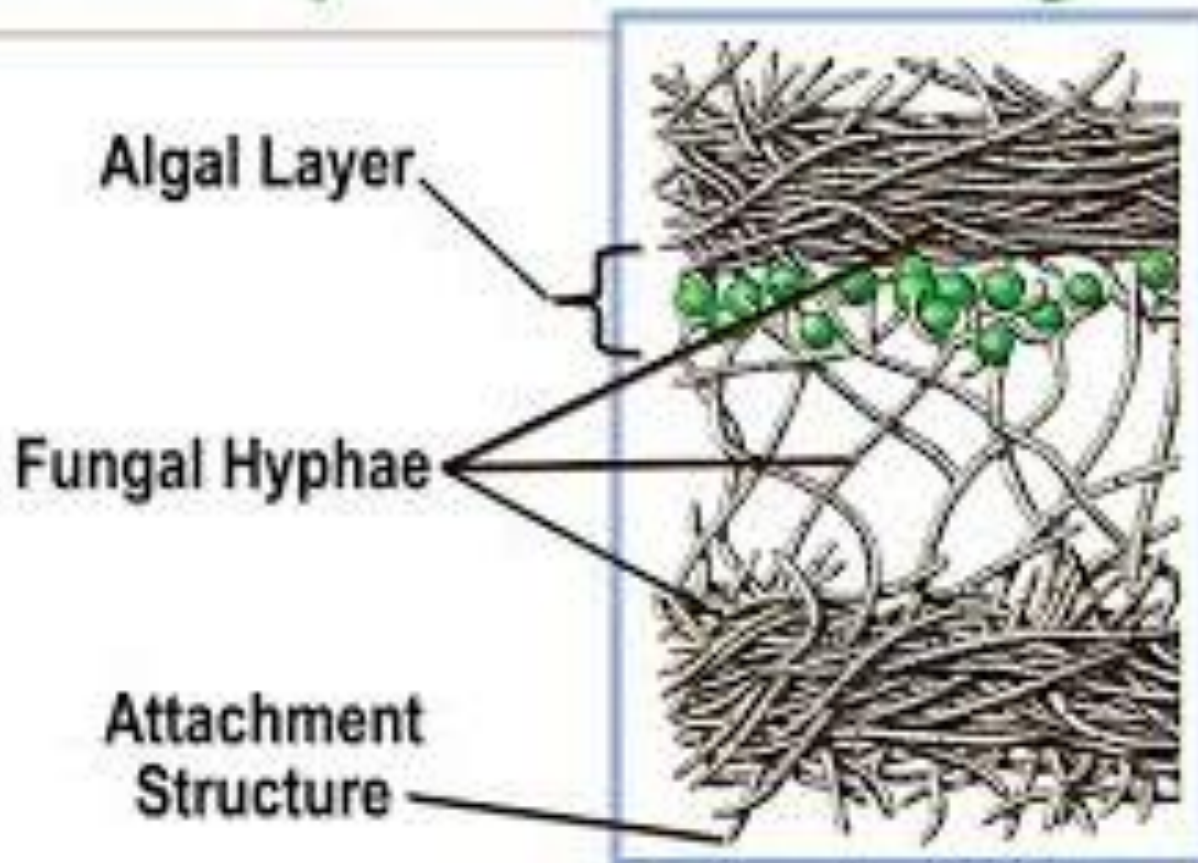
*Roccella phycopsis*



*Ramalina polymorpha*

# Internal morphology of lichen thallus

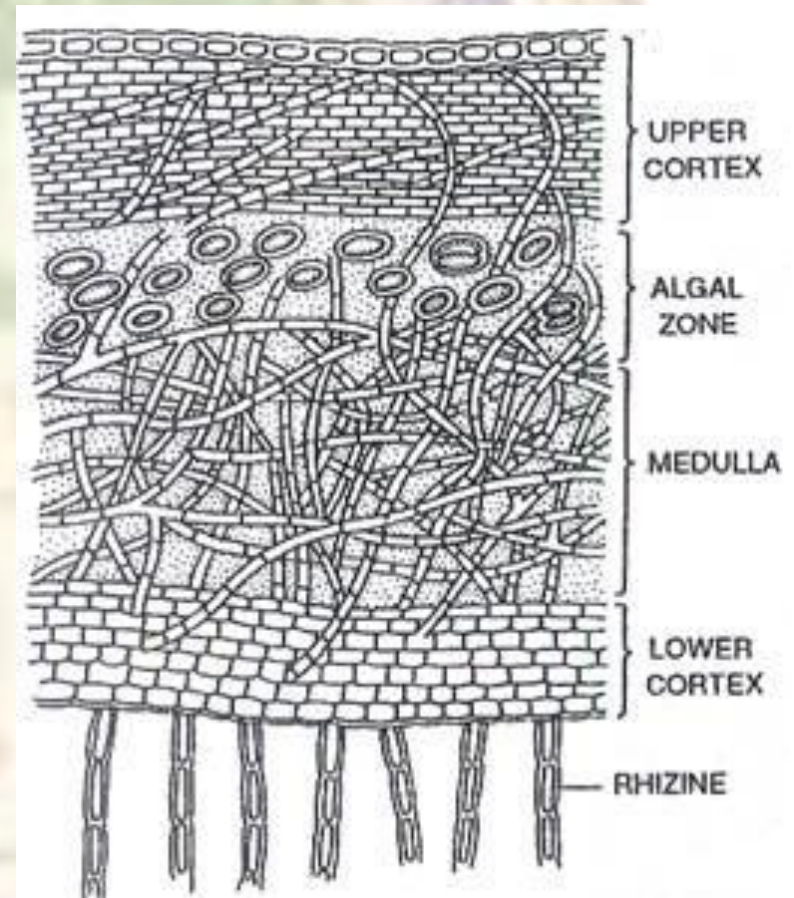
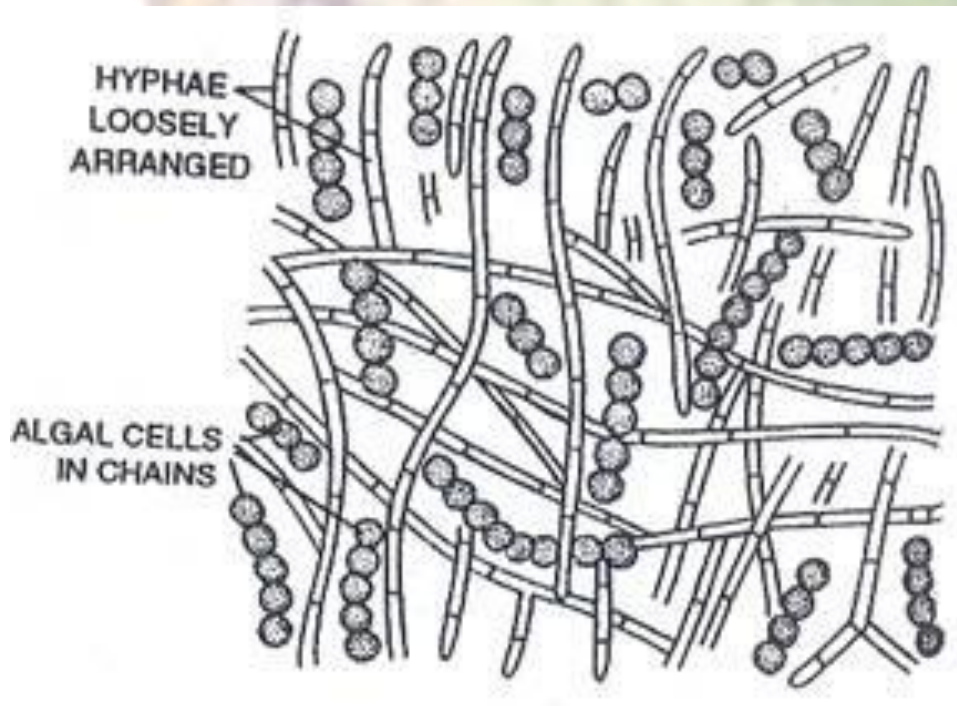
## Lichens: Symbiotic Partnerships



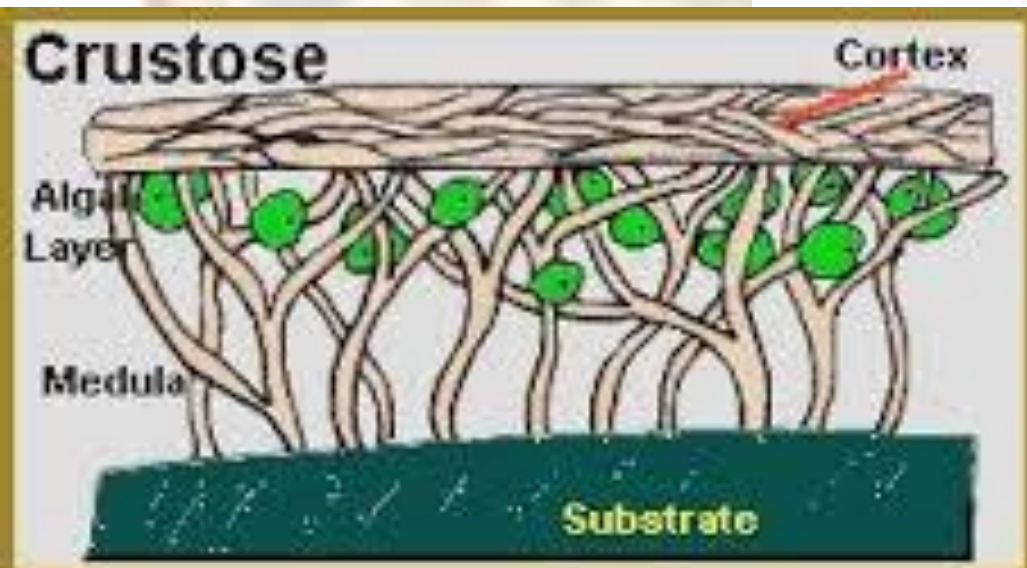
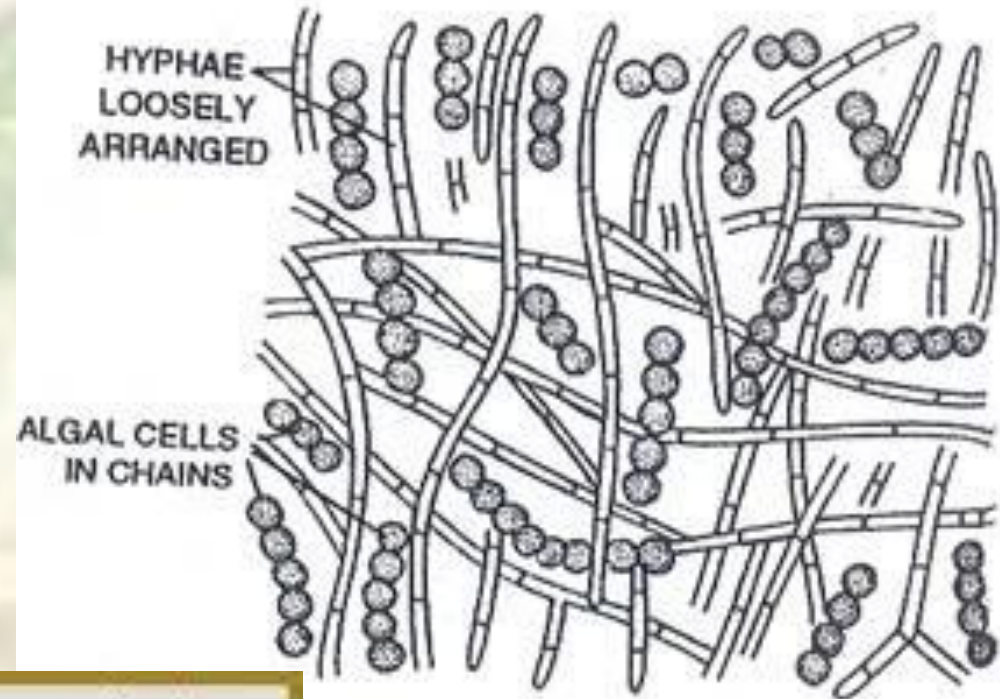
# Internal structure : thallus is

Heteroimerous

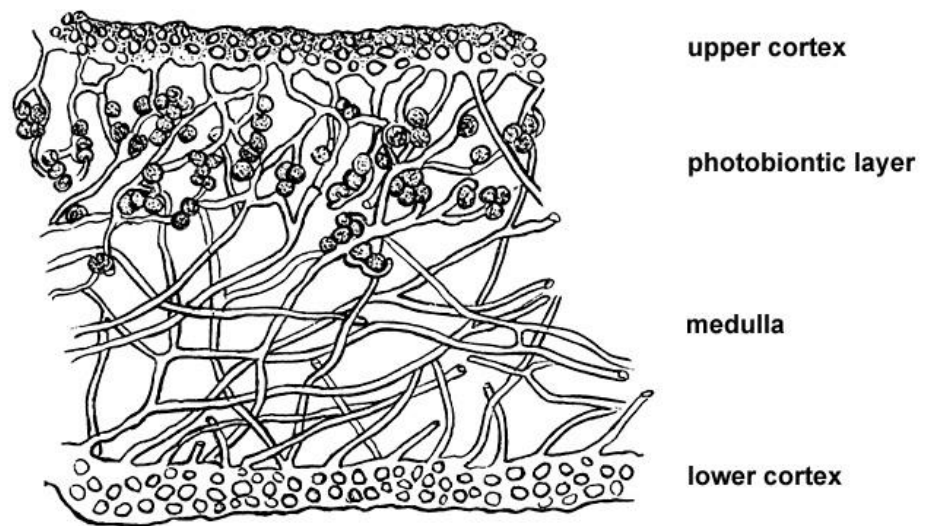
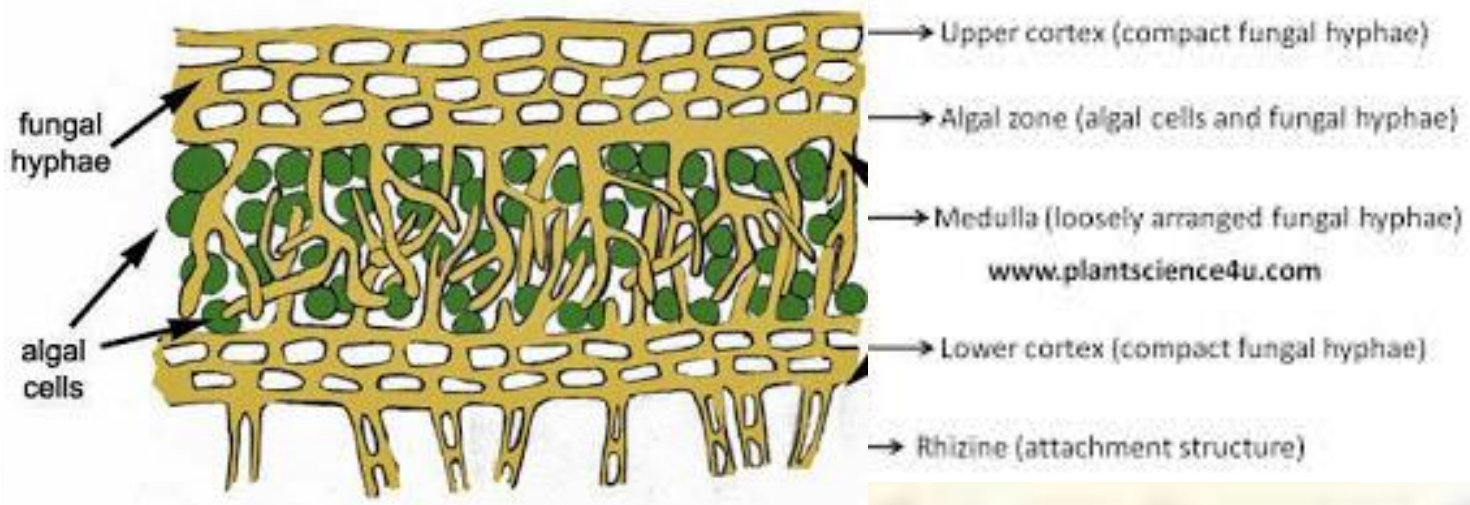
Homoimerous



# Crustose lichen Homoiomeroous type

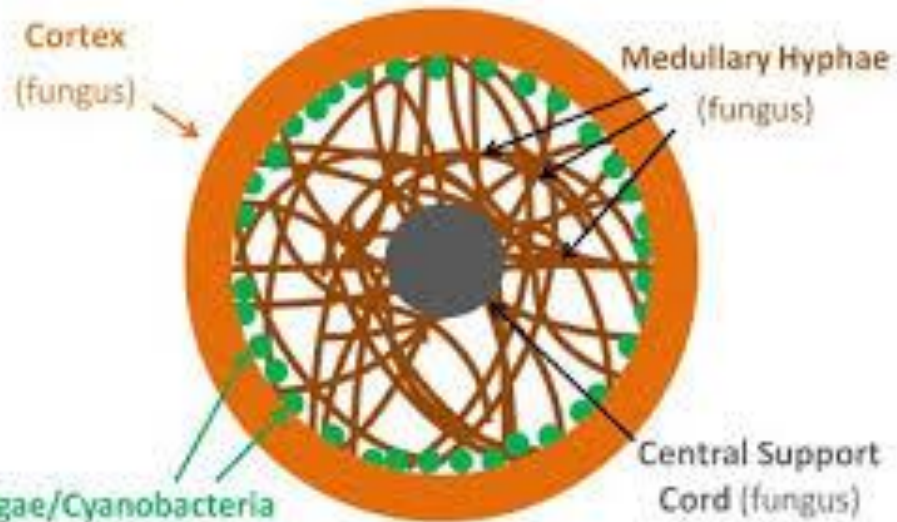


# Foliose lichen: Heteroiomerous type



# fruticose lichens–Heteroiomerous type

**Fruticose Lichen Structure**  
*(Cross-section)*



Upper Cortex

Algal Layer

Medulla

Lower Cortex

Rhizinae



# Reproduction in Lichen

Vegetative

1. Fragmentation

2. Isidia

3. Soredia

[www.plantscience4u.com](http://www.plantscience4u.com)

Asexual

1. Oidia

2. Conidia

3. Pycniospores

Sexual

By fungal partner  
Male sex organ: Spermgonia or pycnia  
Female sex organs: carpogonia (ascogonia)  
Fruiting body : Apothecium or perithecium

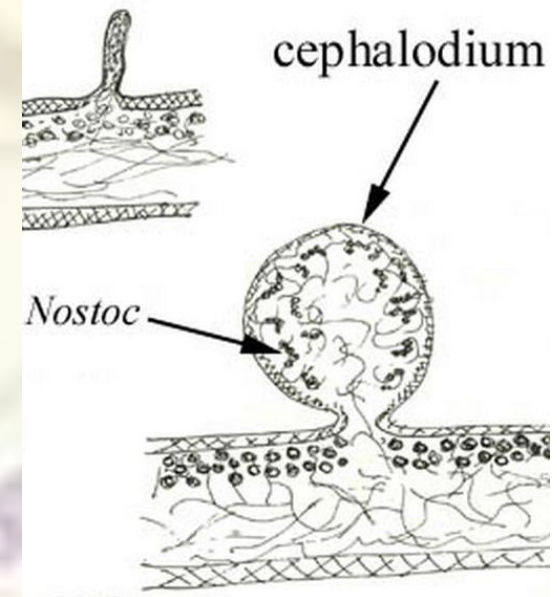
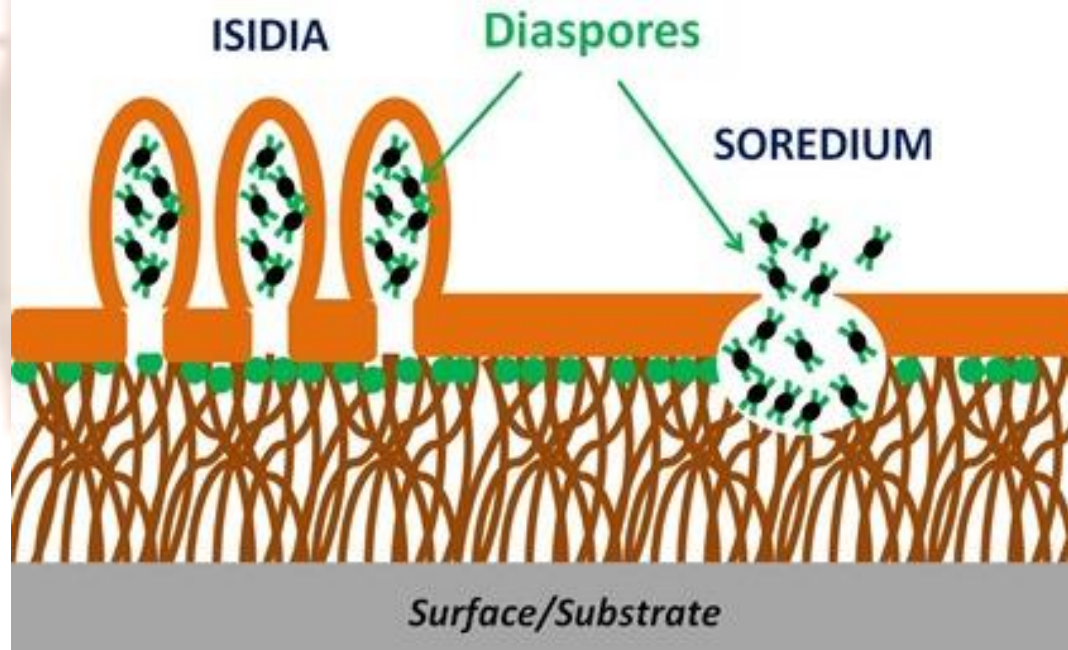
# Asexual reproduction

- ▶ Many lichens reproduce asexually, either by a piece breaking off and growing on its own vegetative reproduction
- ▶ Diaspore: through the dispersal of diaspores containing a few algal cells surrounded by fungal cells.
- ▶ Because of the relative lack of differentiation in the thallus, the line between diaspore formation and vegetative reproduction is often blurred.
- ▶ **Fragmentation:** Fruticose lichens can easily fragment, and new lichens can grow from the fragment vegetative reproduction.
- ▶ Many lichens break up into fragments when they dry, dispersing themselves by wind action, to resume growth when moisture returns.



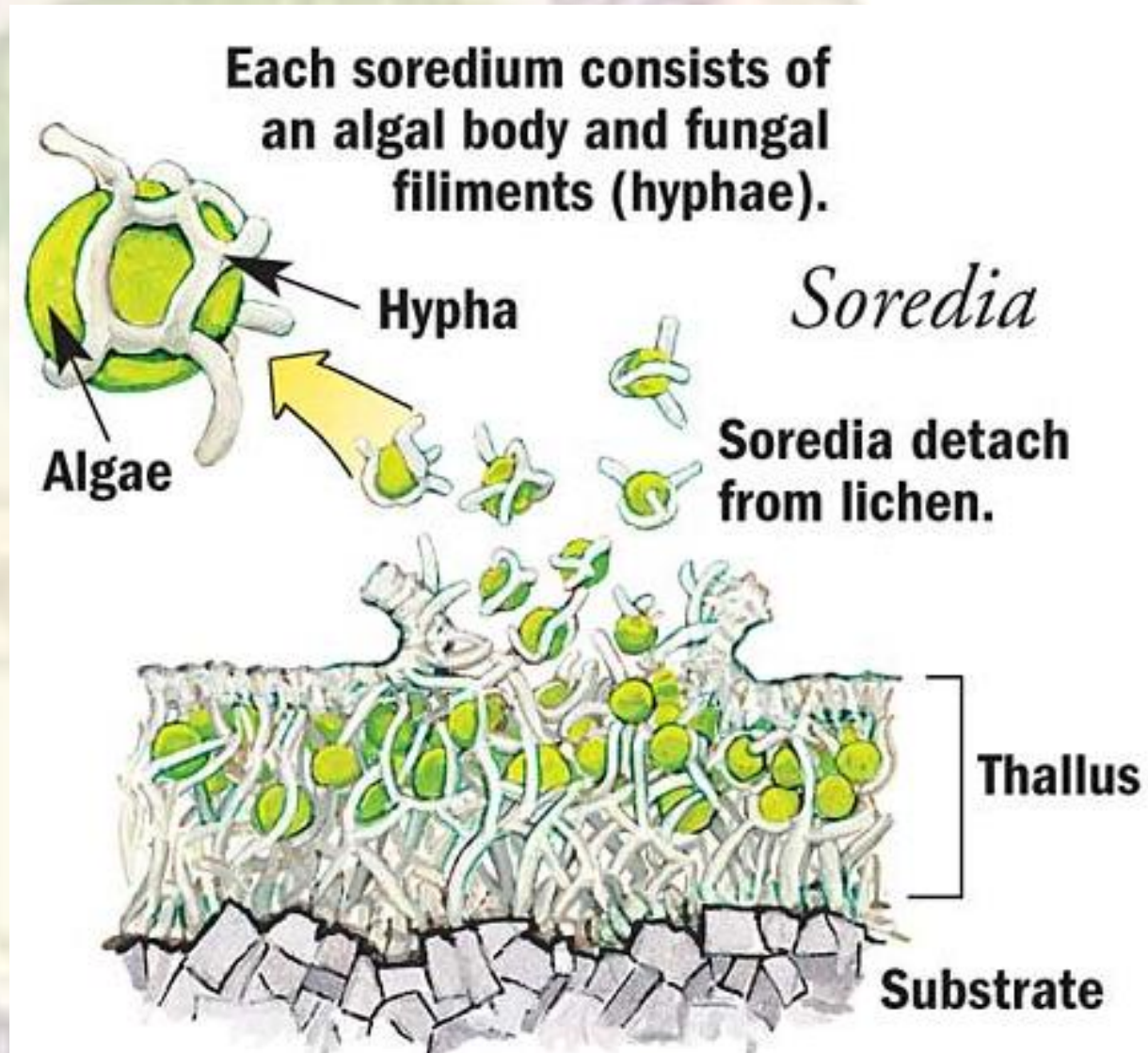
# Special vegetative structures in Lichens

## Lichen Asexual Reproduction



# Soredia

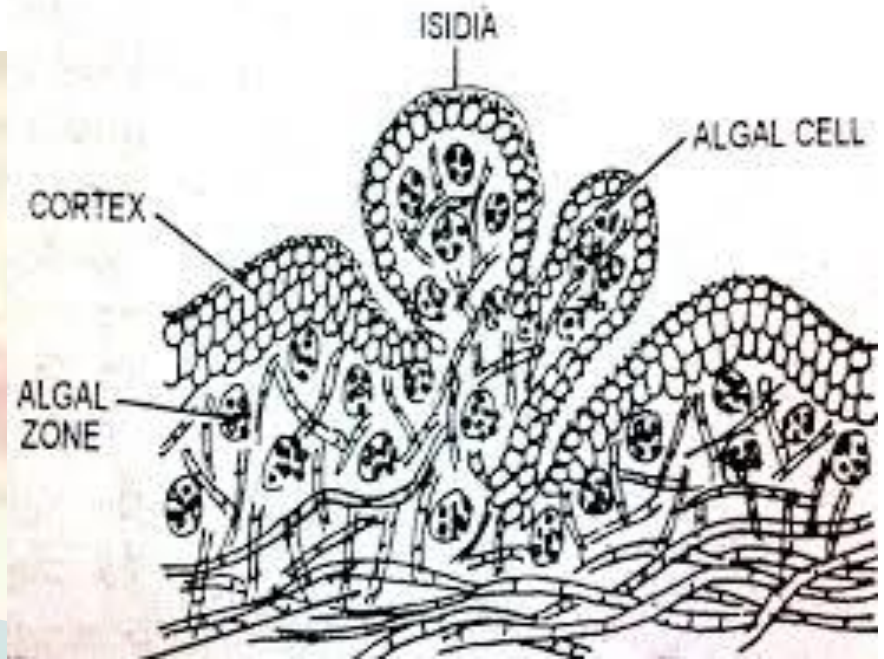
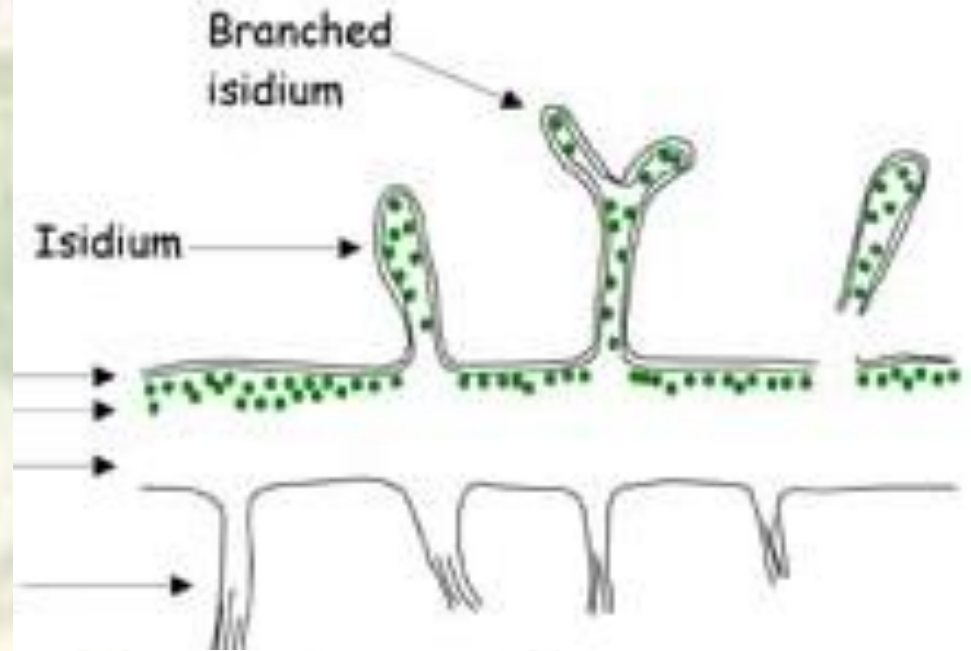
**Soredia** (singular "soredium") are small groups of algal cells surrounded by fungal filaments that form in structures called soralia, from which the soredia can be dispersed by wind



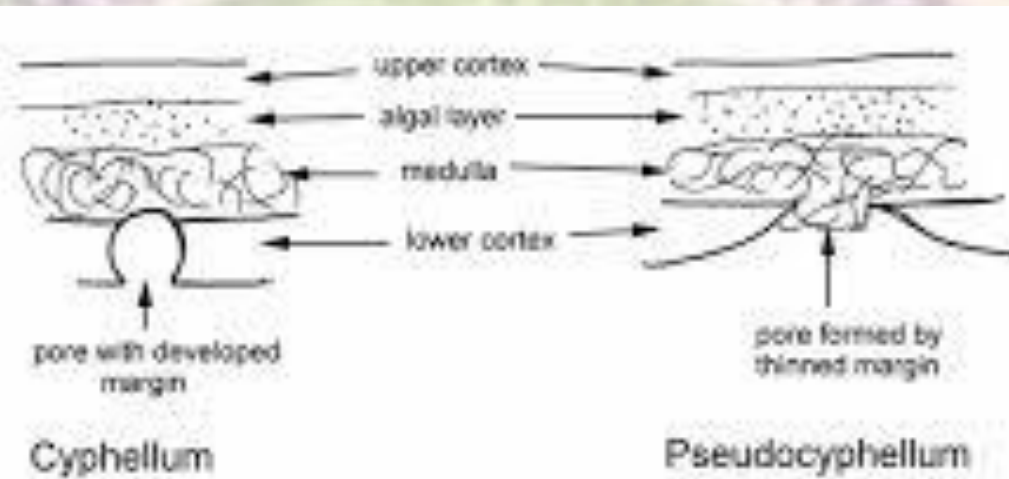
# Isidia

**Isidia** (singular "isidium") are branched, spiny, elongated, outgrowths from the thallus that break off for mechanical dispersal.

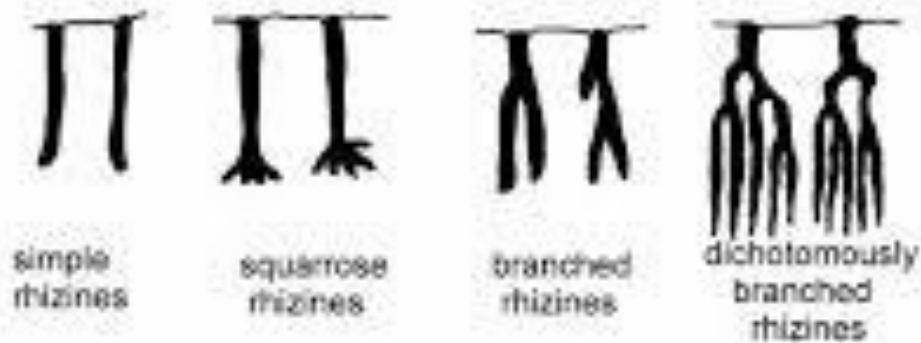
Lichen propagules (diaspores) typically contain cells from both partners, although the fungal components of so-called "fringe species" rely instead on algal cells dispersed by the "core species".



# Cyphelle and pseudocyphelle



## Rhizines



# Sexual reproduction

- ▶ Only the fungal partner in a lichen reproduces sexually.
- ▶ Lichens that are in Basidiomycetes produce mushroom like reproductive structures.
- ▶ Structures involved in reproduction often appear as discs, bumps, or squiggly lines on the surface of the thallus.
- ▶ Many lichen fungi reproduce sexually like other fungi, producing spores formed by meiosis and fusion of gametes. Following dispersal, such fungal spores must meet with a compatible algal partner before a functional lichen can form.
- ▶ This may be a common form of reproduction in basidiolichens, which form fruiting bodies resembling their non lichenized relatives.

# Lichen Sexual Reproduction

APOTHECIUM

PERITHECIUM

Ascospores

Ascospores

Surface/Substrate

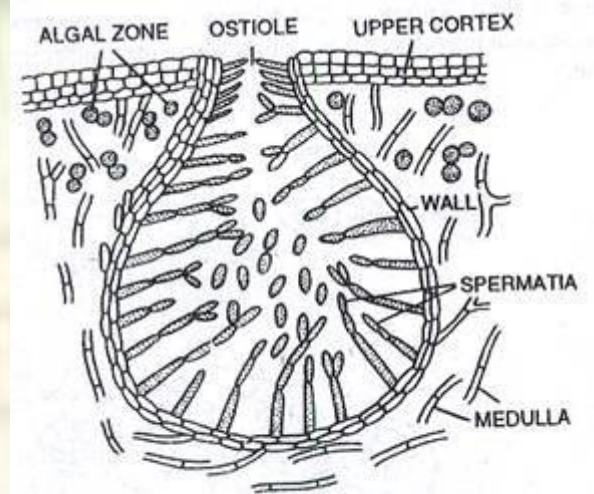


Fig. 18.13. Diagrammatic representation of spermatogonium (pycnium) of *Physcia*.

# Economic importance of lichens

- ▶ Food:
- ▶ **Iceland moss** (*Cetraria islandica*) an important human food in northern Europe, cooked as a bread, porridge, pudding, soup, or salad.
- ▶ **Wila** (*Bryoria fremontii*) was an important food in parts of North America, where it was usually pit cooked.
- ▶ Northern peoples in North America and Siberia traditionally eat the partially digested Reindeer Lichen (*Cladonia* spp.)
- ▶ Rock tripe (*Umbilicaria* spp. and *Lasalia* spp.) is a lichen that has frequently been used as an emergency food in North America, and one species,
- ▶ *Umbilicaria esculenta* is used in a variety of traditional Korean and Japanese foods.

# Lichenometry

- ▶ Lichenometry is a technique used to determine the age of exposed rock surfaces based on the size of lichen thalli.
- ▶ Introduced by Beschel in the 1950s the technique has found many applications.
- ▶ it is used in archaeology, palaeontology, and geomorphology. Lichenometry is especially useful for dating surfaces less than 500 years old, as radiocarbon dating techniques are less accurate over this period
- ▶ The lichens most commonly used for lichenometry are those of the genera *Rhizocarpon* (e.g. the species *Rhizocarpon geographicum* and *Xanthoria*



# Lichens as Dyes

- ▶ The pH indicator (indicated acidic or basic) in the litmus test is a dye extracted from the lichen *Rocella tinctoria* by boiling.
- ▶ the orange *Xanthoria parietina* and the grey foliaceous *Parmelia saxatilis* common on rocks known as "crottle"
- ▶ Lichens belonging to the family Roccellaceae, commonly called orchella weed or orchil used to make chromosome dye Orcin

# Ethnolichenology

- ▶ Historically in Europe, *Lobaria pulmonaria* was collected in large quantities as "Lungwort", due to its lung-like appearance
- ▶ Similarly *Peltigera leucophlebia* was used as a supposed cure for thrush due to the resemblance of its cephalodia to the appearance of the disease
- ▶ *Peltigra canina* used in Dog bites

# Disease and lichens

- ▶ **Usnic acid** is the most commonly studied metabolite produced by lichens and has been associated with the suppression of tuberculosis

# Air pollution

- ▶ If lichens are exposed to air pollutants at all times, without any deciduous parts, they are unable to avoid **the accumulation of pollutants**.
- ▶ Also lacking stomata and a cuticle, lichens may **absorb aerosols** and gases over the entire thallus surface from which they may readily diffuse to the **photobiont layer**.
- ▶ Because lichens do not possess roots, their primary source of most elements is the air, and therefore elemental levels in lichens often reflect the accumulated composition of ambient air.
- ▶ The processes by which atmospheric deposition occurs include fog and dew, gaseous absorption, and dry deposition.
- ▶ Consequently, many environmental studies with lichens emphasize their feasibility as effective **biomonitors** of atmospheric quality