Lichens

Introduction

Lichen Is such an association of an alga and a fungus In which two organism remain so closely associated with each other that they appear to be a single plant

Lichen has been defined as a stable self supporting association of a mycobiont and a phycobiont .The mycobiont is the fungal partner and phycobiont – photosynthetic partner in a lichen association

Components of lichen

- The mycobiont is usually a member of ascomycotina less commonly basidiomycotina and only rarely of deuteromycotina
- The phycobiont is usually a member of Green algae and blue green Algae
- Most of the fungal partner comes under class ascomycotina ,the lichens are graphidales ,,peltigerales,pertusariales and teloschistales
- Basidiomycotina – dictyonema,omphalina and Multiclavula

Wikipedia

Peltigerales - Wikipedia

Encyclopedia of Life

dictyonema lichen - Encyclopedia of Life

- Lichen forming green algae cephaleuros, Chlorella,phycopeltis ,trebouxia
- Blue green algae anabena,calothrix , Nostoc , scytonema

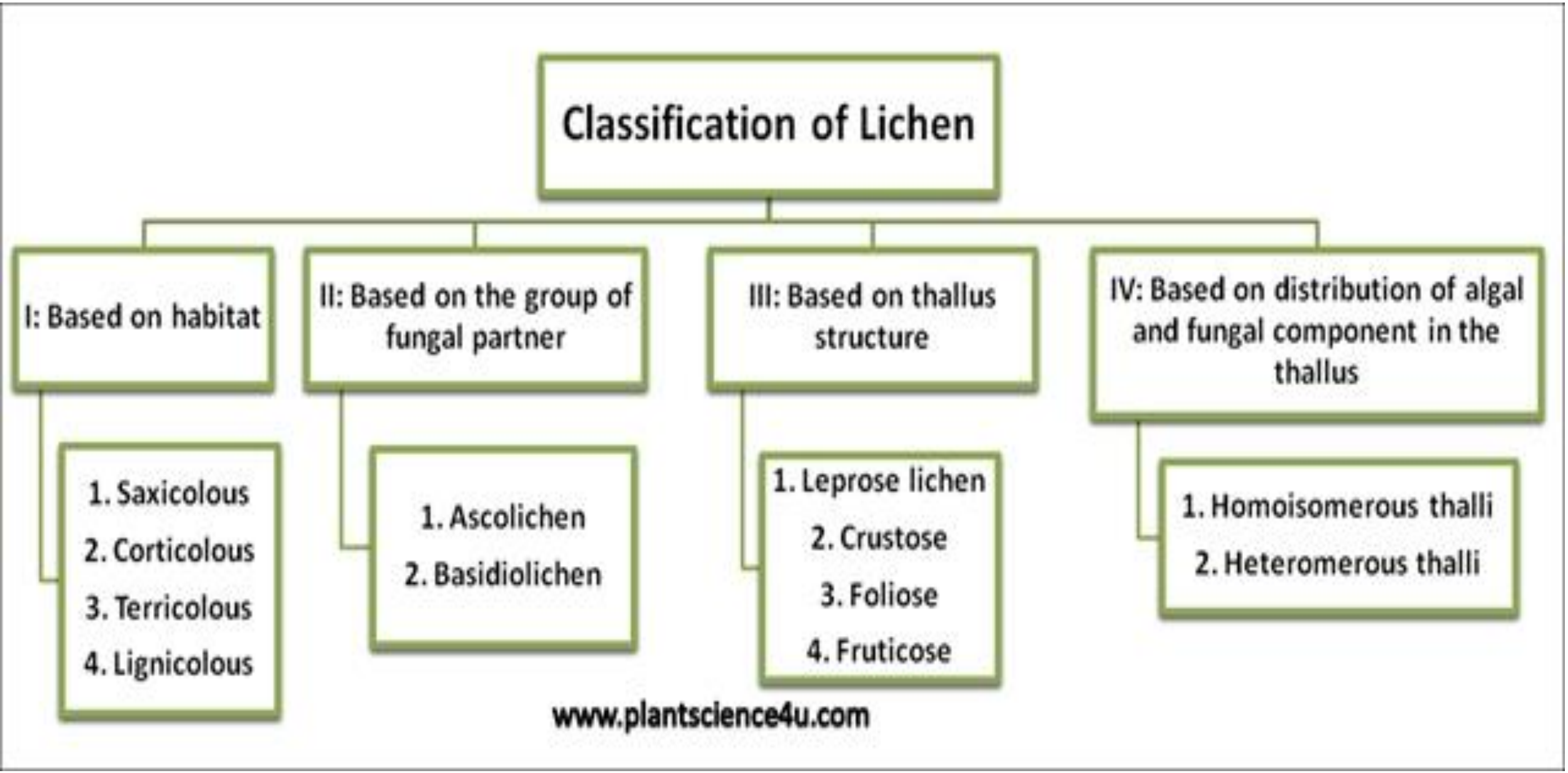
- Among the fungi ------- are the economically most useful group and Cladonia is ------ kind of a Lichen
- A) Basidomycetes, Ascolichen
- B) Zygomycetes, Basidiolichen
- C) Ascomycetes, Ascolichen
- D) Dueteromycetes, Ascolichen

- Identify the bio indicator of SO2 pollution from the following:

A) Orchids B) Water hyacinth

- C) Lichen D) Aloe vera

- What is meant by lichenometry?
- A) Study regarding the age of lichens.
- B) Study of the age of exposed rock surfaces based on the size of lichen thalli.
- C) Study regarding the calculation of the period in which lichens evolved.
- D) Study regarding the succession of various forms of lichens


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
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Based on the occurrence

- 1. Corticolous: lichen developing on bark of trees eg., Parmelia ,Usnea graphis
- Lignicolous : lichen developing directly on wood eg., Cyphelium
- Saxicoles : lichens developing on rock substrata eg., Verrucaria ,porina
- Terricolous : lichens growing on ground eg., Cladonia sps
- Marine : caloplaco marina ,caloplacentum marinae
- Fresh water : hymenlia lacustris

- Lichens living on rocks are called

A) Saxicolous B) Corticolous

C) Terricolous D) Halicolous

- Basidiolichens: fungal partner is an basidiomycotina
- Deuterolichens: sterile lichen that does not produce spores
- Ascolichens: fungal partner is a an ascomycotina Classified into
  1)Gymnocarpae : fruting body is an apothecium eg., Parmelia
  2)Pyrenocarpae : fruiting body is a perithecium eg., Dermatocarpon

- Pyrenolichens fall under

A) Discolichens
B) Ascolichens
- C) Basidiolichens
D) Deuterolichens

They are mainly classified on the basis of their morphology and size into 3 major categories namely:-

1. **Crustose**

- They are crust like.
- Tightly attached to the substrate.
- Have only upper surface.
- They are microlichens.

2. Foliose

- They are usually flat and leaf like and can be loosely to tightly attached.
- They have an upper and lower surface.
- They are called macrolichens.

3. Fruticose

- They are shrubby or bushy, sometimes they hang down.
- Most of them don`t have any upper and lower surface but are often round in cross section.
- They are also called macrolichens.

- Crustose lichen : Graphis , Haematomma, Lecanora , venucaria , Rhizocarpon
- Foliose lichen : xanthoria, Physcia , peltigera ,parmelia
- Fruticose lichen : Usnea, Cladonia ,evernia

- Lichen with a 3-dimensional branching, bushy appearance, like a leafless shrub is called
- A) Fruticose lichen B) Foliose lichen

C) Crustose lichen D) Anastomose lichen

- ---------- is a drooping pendant fruticose lichen

A) Physcia B) Cladonia

C) Usena D) Haematomma

- Cladonia verticillata is a:

A) Crustose lichen B) Foliose lichen

- C) Fruticose lichen. D) Moss

There are few intermediate categories of growth form:-

1. Squamulose- They are the intermediate between crustose and foliose. They are small and leafy with loose attachments to the substrate. They are composed of small and overlapping "scales" called squamule.
2. Leprose- It has powdery and granular surface. They don't have any cortex, only have a weak kind of medulla.
3. Dimorphic :- Single thallus has the characters of both foliose/ squamulose and fruticose lichens. They have leaf and erect stem like structure.
4. Placodioid:- Lichen thallus is closely attached to the substratum at the center , free at margin and lacking rhizines.

Internal structure

- The algal and fungal components of thallus are almostly uniformly distributed , without the formation distinct cellular layaers .this is called homomerous thallus
- Algal and fungal components are arranged in distinct cellular layers .this is called heterogeneous condition
- Structure of Crustose lichen
- Homomerous thallus
- Structure of Foliose lichen

Heteromerous thallus four layers – upper cortex ,algal layer, Medulla and the lower cortex

1. Cortex Layer

- It is band of compacted fungal hyphae.
- Coxtex serve as a protecting layer and consist of upper and lower cortex layer.
- It is 10-40µm thick with several layers of cells
- The upper cortex layer protect the tissues beneath and also supplies mechanical support to prevent the breaking of the thallus due to winds or other external forces.
- The lower cortex layer present in some ,is same as upper cortex layer and possess rhizoids.

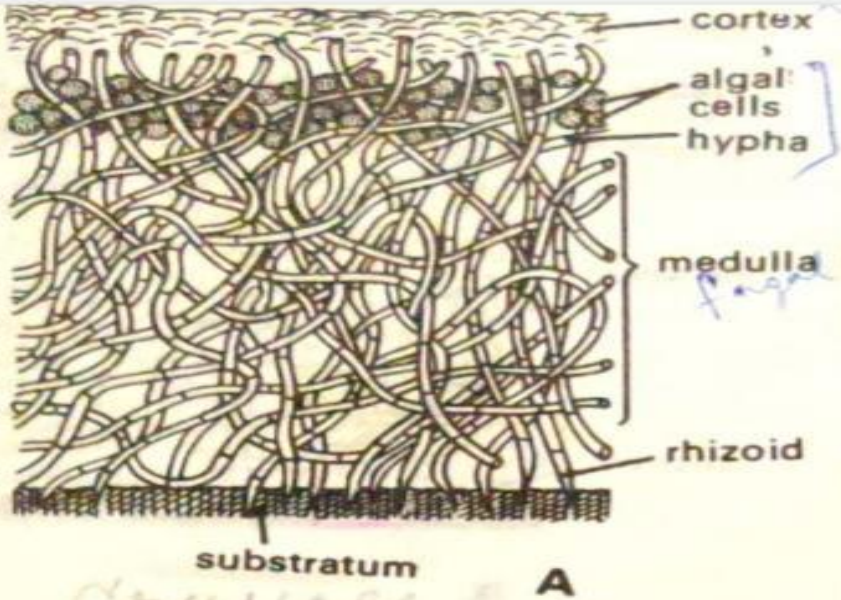
2. Algal Layer (Photobiont)

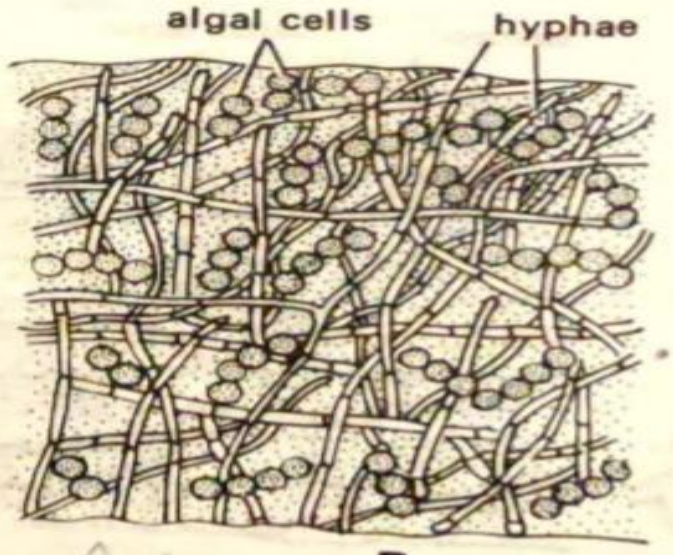
- Algal cells are present which are completely surrounded by fungal tissue.

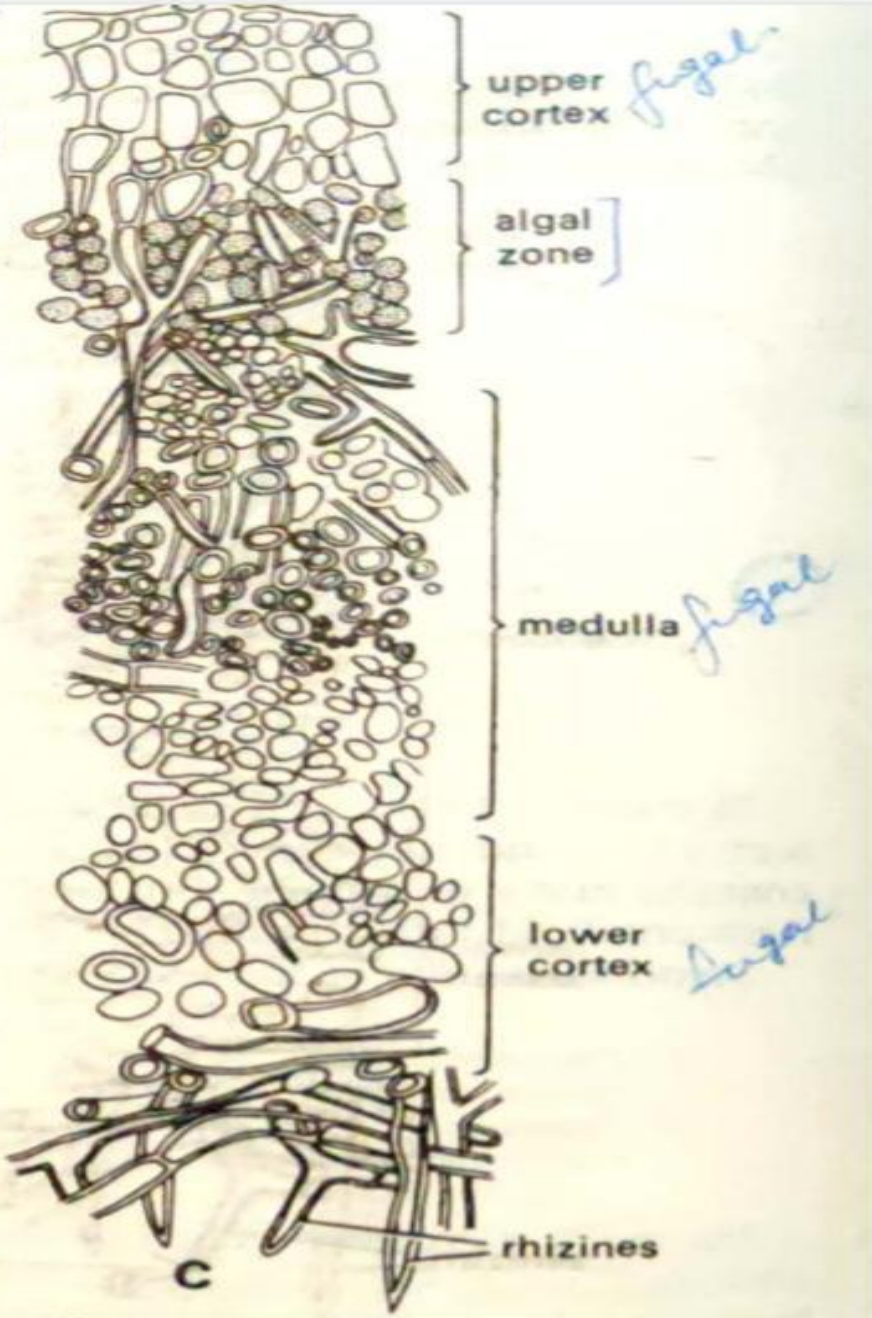
- This layer is responsible for by photosynthesis and providing food.
- It makes a great contribution in thallus colour.

3.Medulla

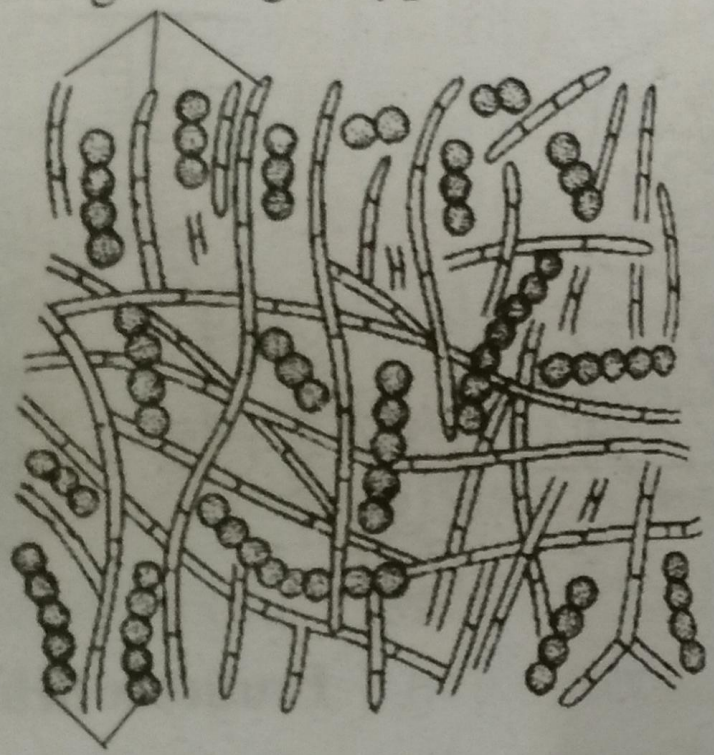
- It is a loose weave of fungal hyphae.
- Lichen thallus is majorly consist of medulla, may be 500µm thick.



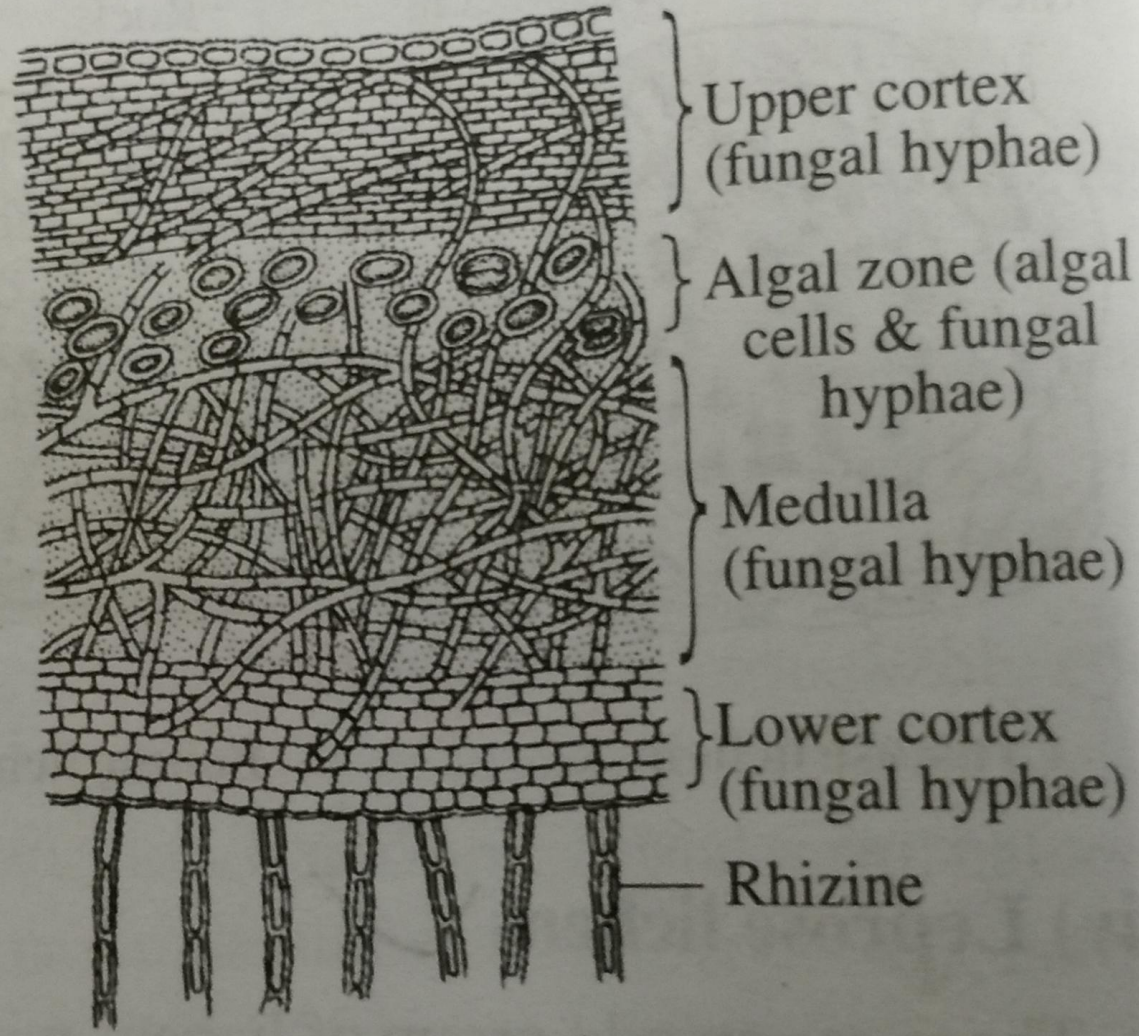




21.4 Internal organisation of lichens A, Crustose lichen; B, foliose (homoiomerous)lichen; C, foliose (heteromerous) lichen



Homomerous thallus



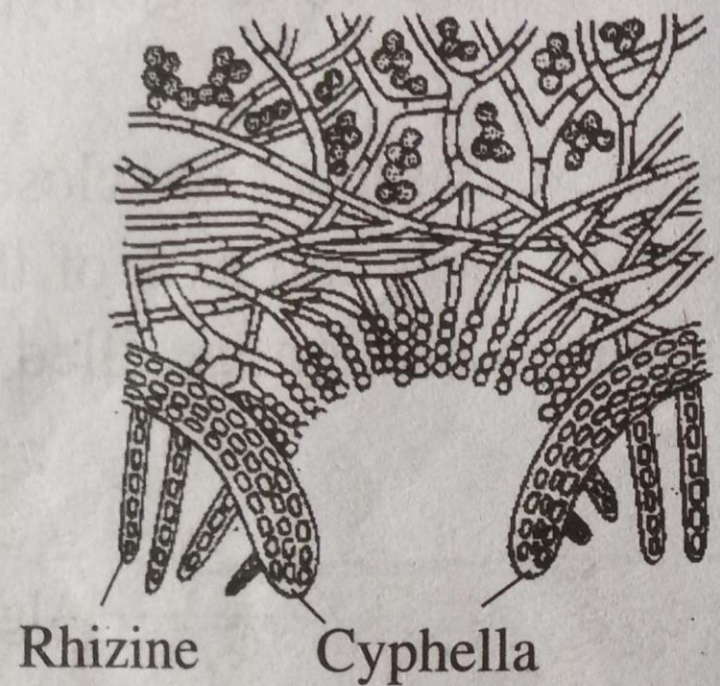
Hetromerous thallus

Propagules associated with lichen thallus

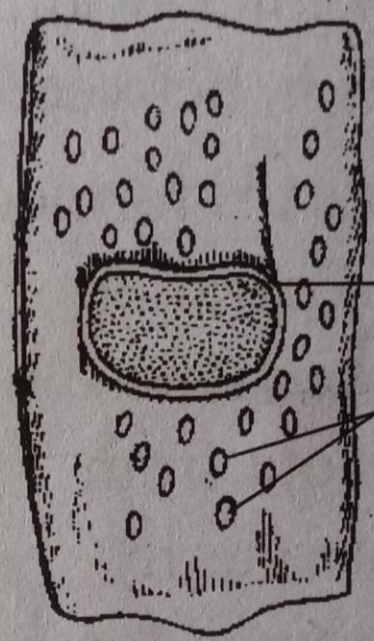
- Breathing pore: These are the areas in the Cortex where loosely interwoven hyphae are present.In Foliose lichen they develop only in the upper cortex. breathing Pores are supposed to function in gaseous exchange

- Cyphellae : These are the neat circular depression present only on the lower surface of certain lichen , function – gas exchange

- Pseudocyphellae : looser hyphal medullary tissue comes to the surface of the lichen thallus in the form of discrete . These are also present in lower cortex



Cyphella

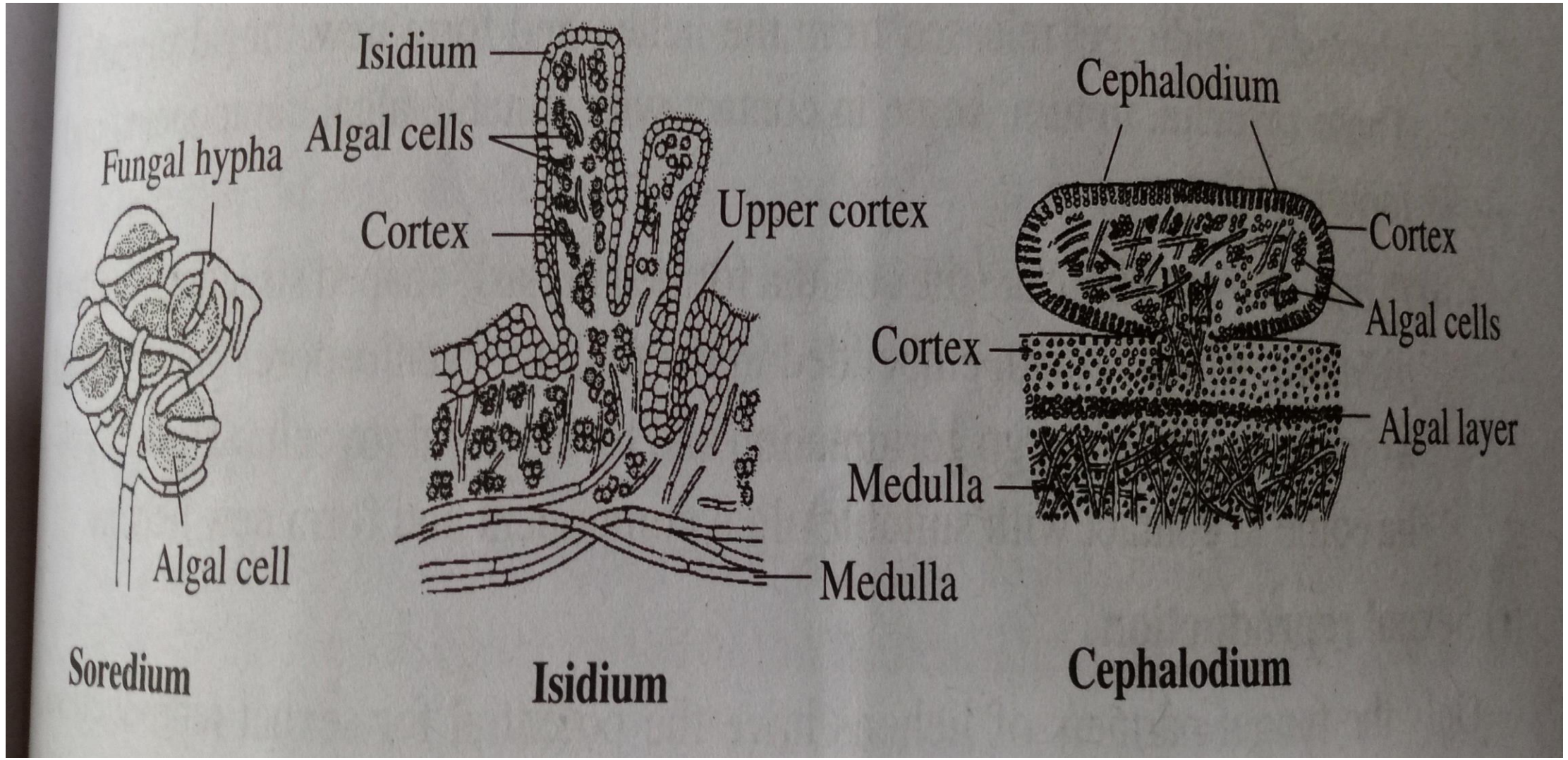


Breathing pores

- Cyphellae in lichens are analogous to ---------- in higher plants

A) Palisade tissue B) Epidermis

C) Bundle sheath D) Stomata


Fungal hypha
Algal cell
Soredium
Isidium
Algal cells
Cortex
Upper cortex
Medulla
Isidium
Cephalodium
Cortex
Algal cells
Cortex
Algal layer
Medulla
Cephalodium

- Cephalodia : some of the lichen have 2 phycobionts of which one is blue – green algae and other is green alga , it’s a 3 membered symbiosis
- Isidia : An isidium is a small and corticated outgrowth present on the upper surface of lichen thallus .it is made up of both fungal hyphae and algal cells
- Soredia: A soredium is a small but non – Corticated bud like outgrowth present on the upper surface of the lichen thallus .It is made up of only a few algal cells enclosed by only a few fungal hyphae

- In Lichens following special vegetative structure is formed as respiratory organs

A) Soredia B) Isdia

C) Cyphellae. D) Medulla

- Cyphellae, Cephalodia, Isidia and Soredia are certain specialized structures associated with thalli of:

A) Certain Alga

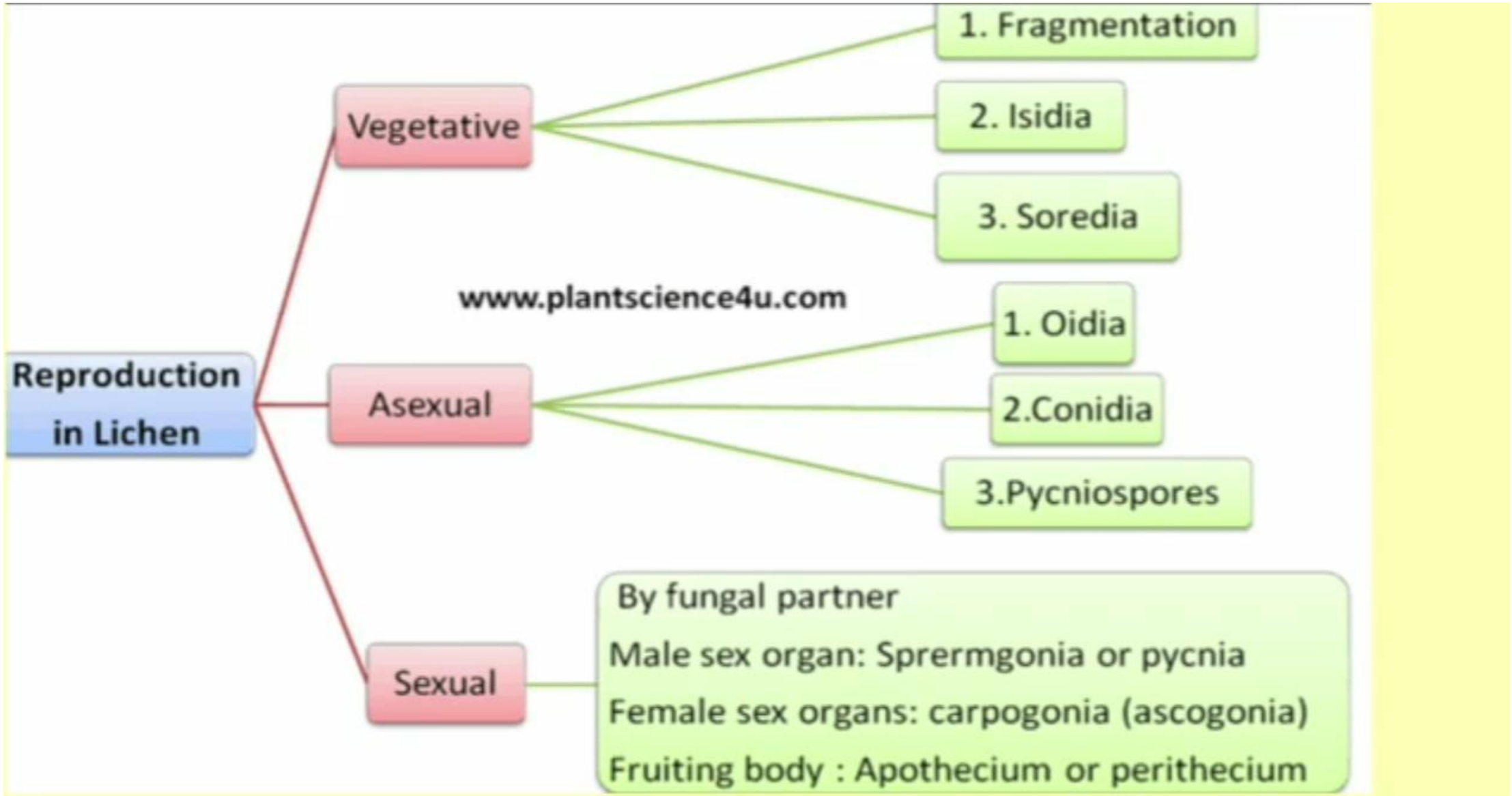
B) Some Fungi

C) Lichens

D) Certain Bryophytes

- In lichens that have both green algal and cyanobacterial symbionts, the cyanobacteria are restricted to structures called:

A) Cephalodia B) Isidia C) Soredia D) Soralia


Reproduction in Lichen
Vegetative
1. Fragmentation
2. Isidia
3. Soredia
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Asexual
1. Oidia
2.Conidia
3.Pycniospores
Sexual
By fungal partner
Male sex organ: Sprermgonia or pycnia
Female sex organs: carpogonia (ascogonia)
Fruiting body : Apothecium or perithecium

Vegetative reproduction

- Fragmentation
- Isdia
- Soridia

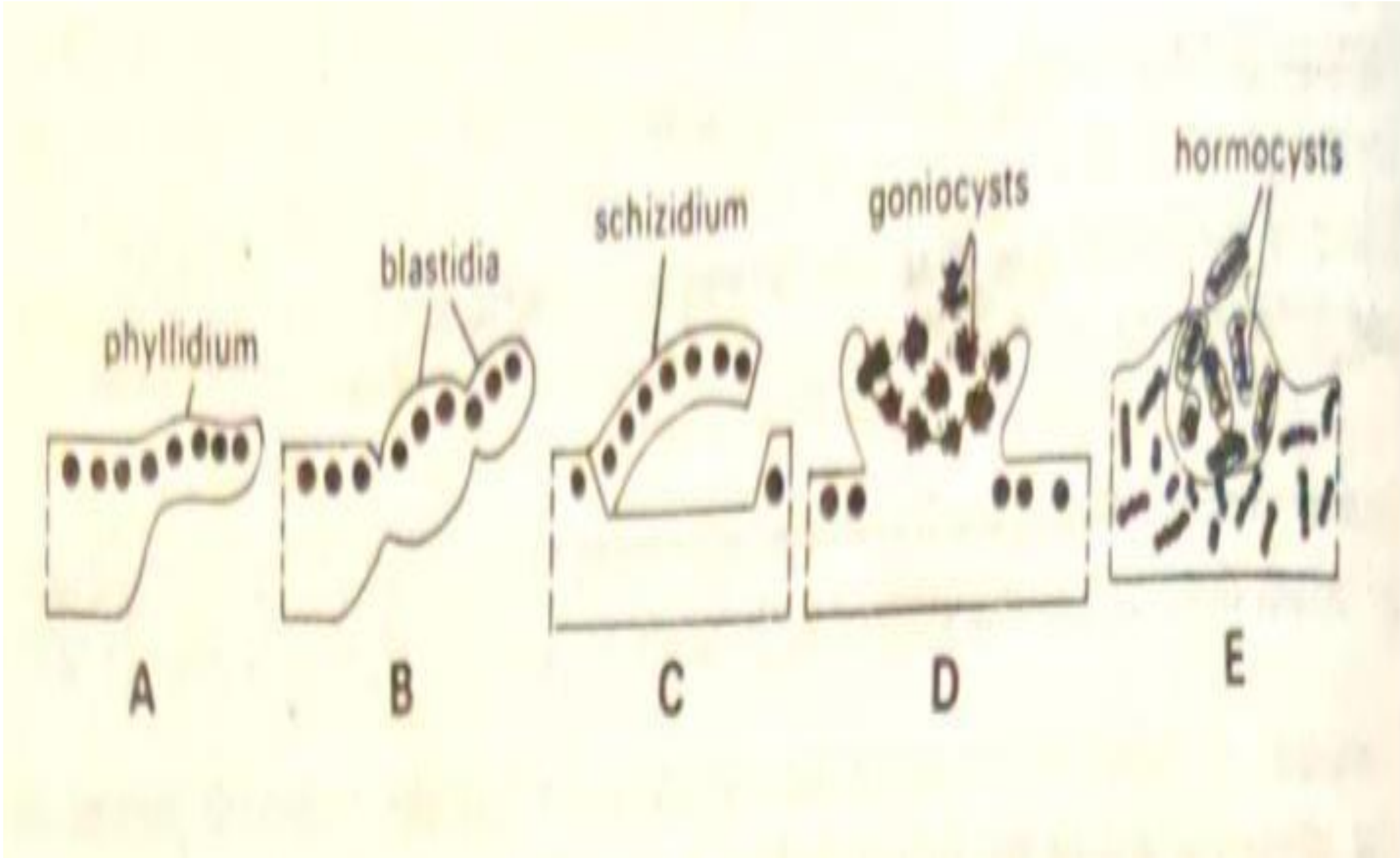
- Vegetative reproduction in lichens takes place by

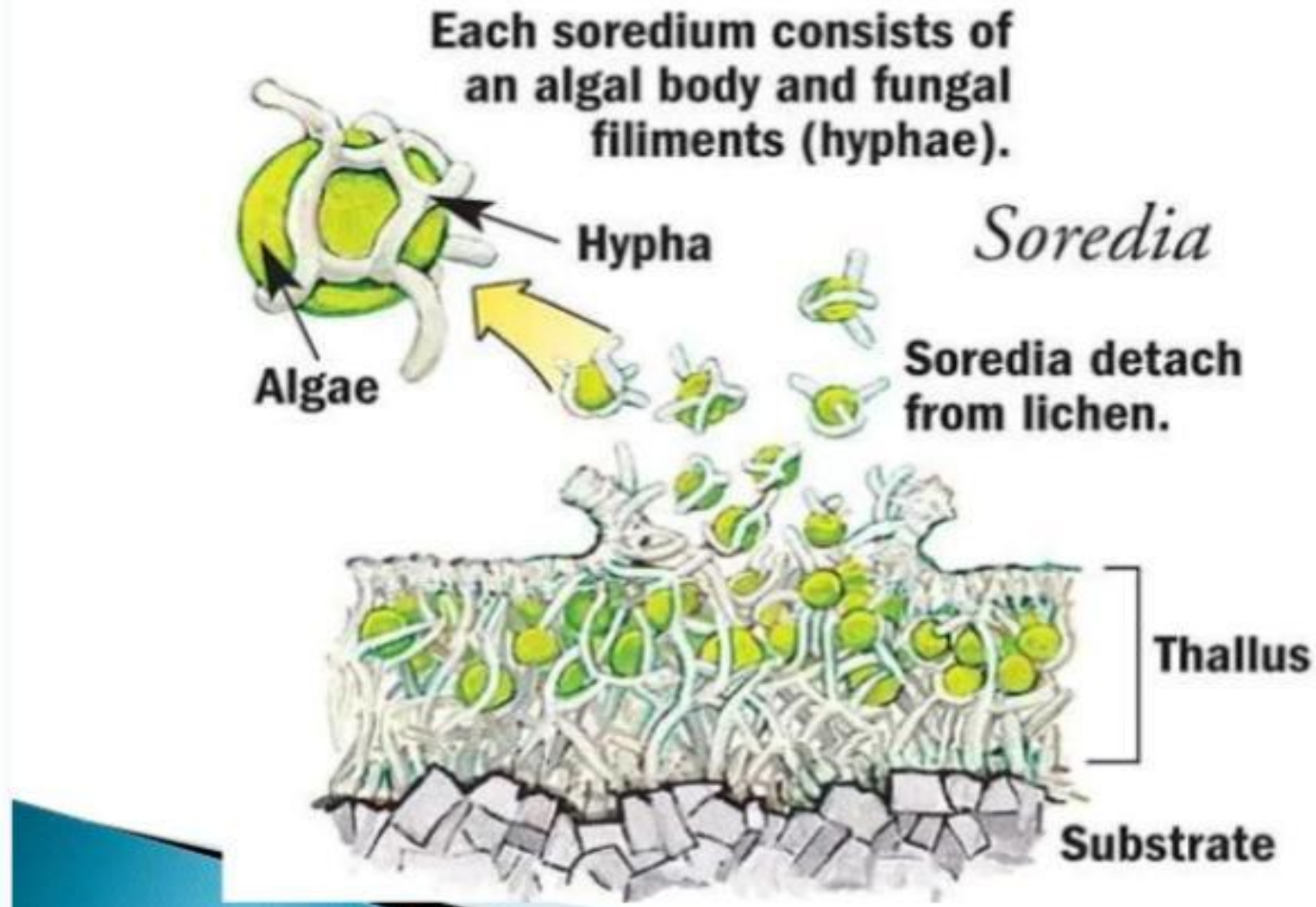
A) soredia B) Isidia

- C) fragmentation D) all the above

Some rare methods of vegetative reproduction

- Phyllidia – these are abstricted , leaf or scale like dorsoventral portion of the entire thallus of some Foliose lichen eg., Peltigera
- Blastidia- there are yeast like segment propagules eg., Physcia opuntiella
- Schizidia – these are the splitted scale like segment of some lichen (parmelia), made up of upper layer of the thallus
- Goniocysts- when an algal cells and it's derivatives remain wrapped in fungal hyphae in the form of an unsorallium like structure – goniocyst
- Hormocysts- when algal filament and fungal hyphae grow together in a chain like manner and break into clumps , these are called hormocysts


phyllidium
blastidia
schizidium
goniocysts
hormocysts
A
B
C
D
E


Each soredium consists of an algal body and fungal filiments (hyphae).
Hypha
Soredia
Algae
Soredia detach from lichen.
Thallus
Substrate

Asexual spores

- 1. Conidia

In several lichens ,the fungal component forms conidia on conidiophores .conidia get released from the lichen and form new fungal mycelia . These mycelia, in turn ,come in contact with suitable algal components and form new lichens

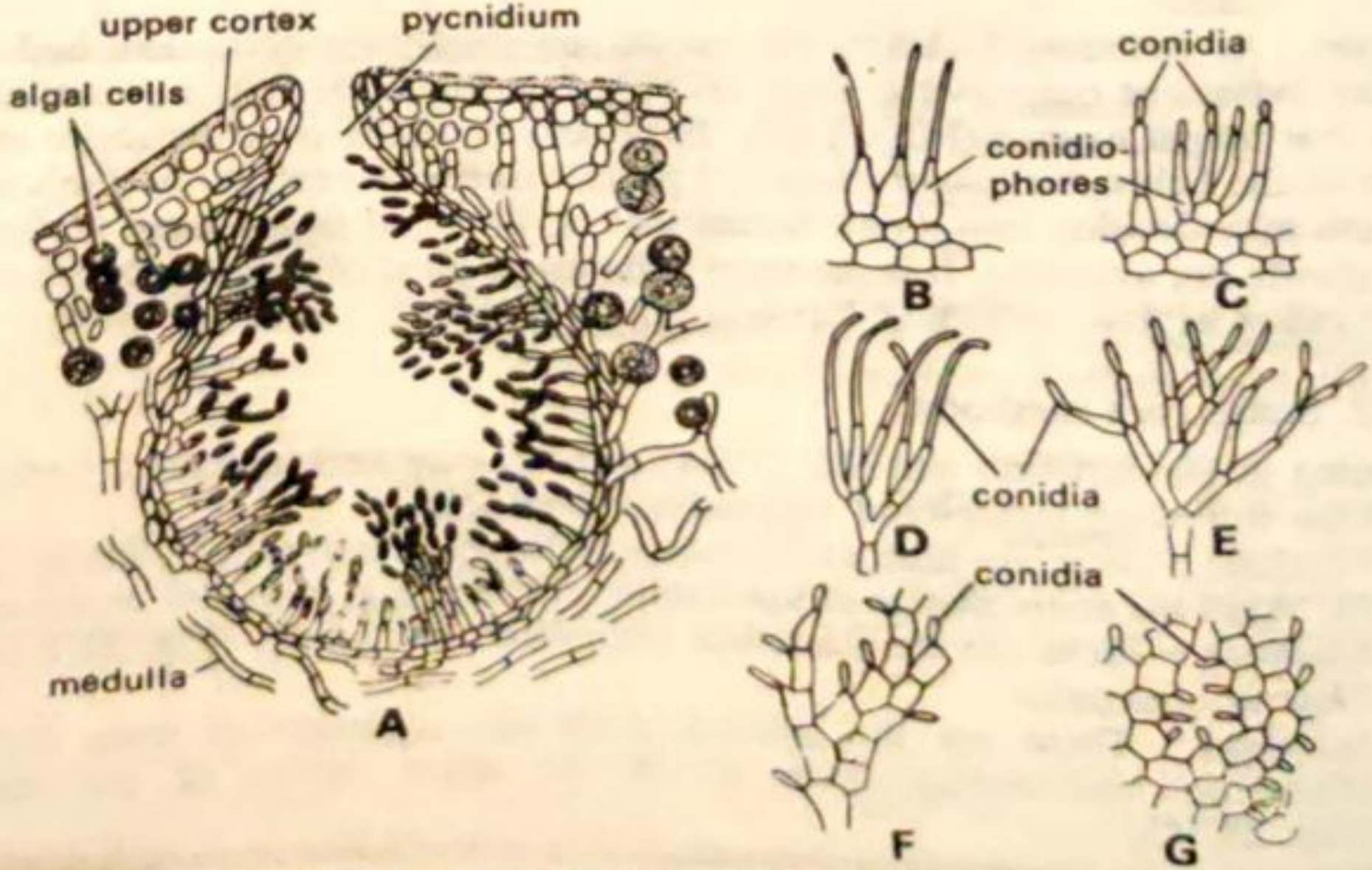


Fig. 21.8 *A*, V.S. of a pycnidium of *Physcia*; *B–G*, Conidia and conidiophores of *Arthonia* (*B*), *Peltigera* (*C*), *Roccella* (*D*), *Cladonia* (*E*), *Lobaria* (*F*) and *Xanthoria* (*G*)

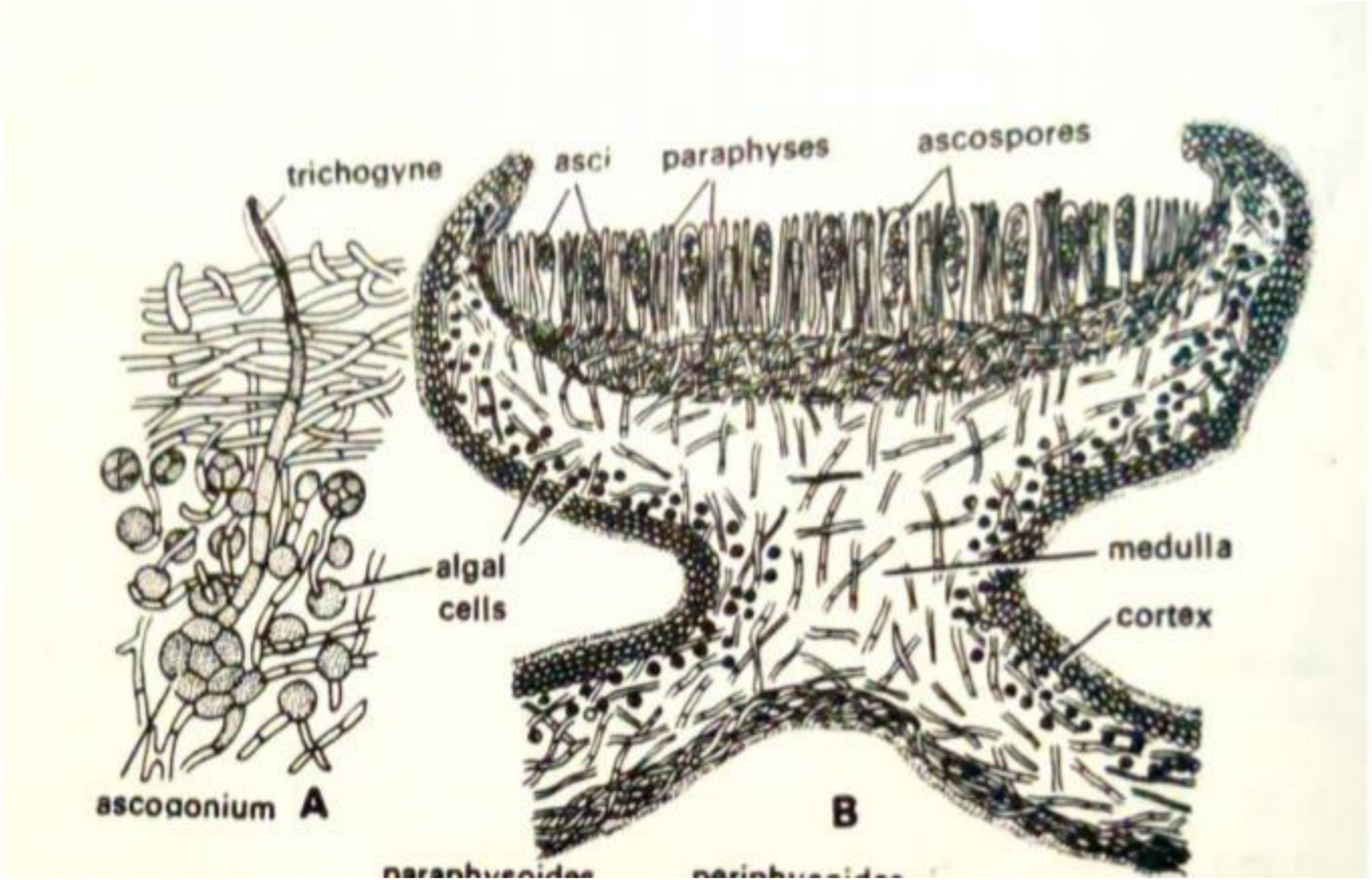
- Oidia : the hyphae of certain lichen break up into. Small bodies called oidia .The oidia may germinate into hyphae
- Pycniospores:These are the condia formed in flask – shaped structure ,called pycnidia ,which remain embedded in the thallus .pycniospores get liberated from the lichen Undergo germination and form fungal mycelia .These mycelia come in contact with suitable algal component and form new lichens

Sexual reproduction

- Ascolichens
- The male and female sex organs of Ascolichen are known as spermagonia and carpogonia (ascogonia)
- Ascogonium / carpogonia : carpogonium are the multicellular , elongated and basally coiled female sex organ ,lying lying embedded In the upper cortex Of the thallus .Their helically coiled basal portion is called oogonium and erect and extended terminal portion is called trichogyne . Oogonium contain the egg nucleus
- Spermatium : spermogonia are flask shaped ,lying embedded on the upper surface of the thallus . Having ostiole, spermogonia Cavity is filled with fertile and sterile hyphae.

- Spermatia are unicellular , uninucleate, non – motile ,colourlesa and walled male gametes produced. On large numbers in each spermagonium
- Disseminated by wind

- Fertilization: at time of fertilization many spermatia are lodged against the sticky tips of the trichogyne
- Fruting bodies may be. Apothecium or perithecium
- cupshaped fruting body flask shaped .eg,
- graphis verrucaria


trichogyne
asci
paraphyses
ascospores
algal cells
medulla
cortex
ascogonium
A
B

Reproduction in phycobiont

- Phycobiont belonging to blue green algae reproduce by akinetes , hormogonia ,heterocysts and cell division .The green algal phycobiont are known to multiply by vegetative cell division and formation of aplanospore and biflagellate zoospore the sexual reproduction in phycobiont has Not been observed

Economic importance

1) Biochemical weathering and pedogenesis

- The Crustose lichen affect the chemistry of the rock on which they grow – biological weathering
- Mycobiont → soluble organic acids like oxalic acid Secrete
- The process of formation of this new soil is called pedogenesis
- Thalli mix with soil and soil become fertile

Drugs from lichen

- 1 usnic acid – Produced from many lichen have antibiotic properties , they inhibit gram positive bacteria
- 2 antiseptic Creams – usno and evosin are available in market well known for tumor inhibitors
- 3) erythrin obtained from Roccella montagnei- Used for heart disease
- 4) protolichesterinic acid obtained from certain algae used as anticancer drug
- 5) components like lichenin isolichenin exhibit anti tumor properties
- 6) Lobaria pulmonaria and cetaria islandica in tuberculosis and lung disease
- 7) some lichen are used with tabacco for hallucinogenic effect

Consortium of North American Lichen Her...

CNALH - Roccella montagnei

Visit

Perfumes from lichens

- Pseudevernia furfuraceae and evernia prunastri are widely used in perfume industry , the lichen contains naphthalene, camphor ,geraniol and borneol

- Usnic acid, a dibenzofuran derivative has been utilized in medicine, perfumery and cosmetics This was isolated by the German scientist W. Knop in 1844. Name the lichen/s yield usnic acid

A) Usnea B) Cladonia C) Lecanora D) All the above

Dyes from lichen

- Red and Purple Dyes are obtained from ochrolechia androgyna and
  o. Tartaria
- Litmus paper used as an acid base indicater in the laborateries is prepared from lichen such as Roccella montagnei- ,Lasallia pustulata
- Colours : lecanoric acid , erythrin and gyrophoriv acid
- Brown dye – parmelia omphalodes used to dye wool and silk fiber

- Litmus is a dye obtained which lichen?

A) Lecanora B) Cladonia

C) PeltigerD. D) Roccella

- The pH indicator in the litmus test is a dye extracted from the lichen.

A) Umbilicaria esculenta B) Parmelia saxatilis

C) Roccella tinctoria D) Xanthoria parietina

O. Tartaria.

- Food from lichen : Cladonia rengiferina (reindeer moss) serve as common food in tundra region for many animals including reindeer and musk
- Sps of parmelia ,Lecanora ,cetraria are eaten by man , horses,cattle
- Poison – letharia vulpina (wolf moss) is used as a poison for Wolves ,
- Vulpinic acid is present in this lichen , which is responsible for its poison

- Oakmoss lichen – evernia prunustri: used as jelly and bread baking
- Cetraria islandica – Iceland moss
- Usnea – perfume industry

- Which lichen is known as “Reindeer moss?”

A) Cladonia rengiferina. B) Peltigera canina

C) Lobaria pulmonaria D) Rocella montaignei

- Which among the following lichen is/are used as a source of food?

1. Iceland moss (Cetraria islandica). 2. Wila (Bryoria fremontii)
- 3. Rock tripe (Umbilicaria esculenta)
- A) 1 & 3 B) 1 & 2 C) 2 & 3 D) 1, 2 & 3