Lecture No. B1MIC P1U4.4

Structure, Reproduction and Economic Aspects of Lichens

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INTRODUCTION

Lichens are dual organisms or entities which contain a permanent association of a fungus or mycobiont and an alga or phycobiont.

The fungal partner is usually an Ascomycota and sometimes, a basidiomycete. The algal partner is mostly a green alga or a cyanobacterium (blue-green alga).

The term lichen was coined by Theophrastus (370-285 B.C.).

Lichens cannot tolerate air pollution, especially due to sulphur dioxide. Lichens are perennial. Their growth is slow.

Structure of Lichens:

According to shape, the lichens are of three types:

(i) Crustose:

Crust-like closely appressed to the substratum and attached to it at several places, e.g., Graphis, Lecanora, Rhizocarpon, Haematoma.

(ii) Foliose:

The body of the lichen is flat, broad, lobed and leaf-like which is attached to the substratum at one or a few places, e.g., Parmelia, Peltigera. Foliose lichen Cora (= Dictyonema) pavonia resembles bracket fungi in appearance.

(iii) Fruticose:

The lichen is branched like a bush and attached to the substratum by means of disc, e.g., Cladonia, Usnea, Evernia..

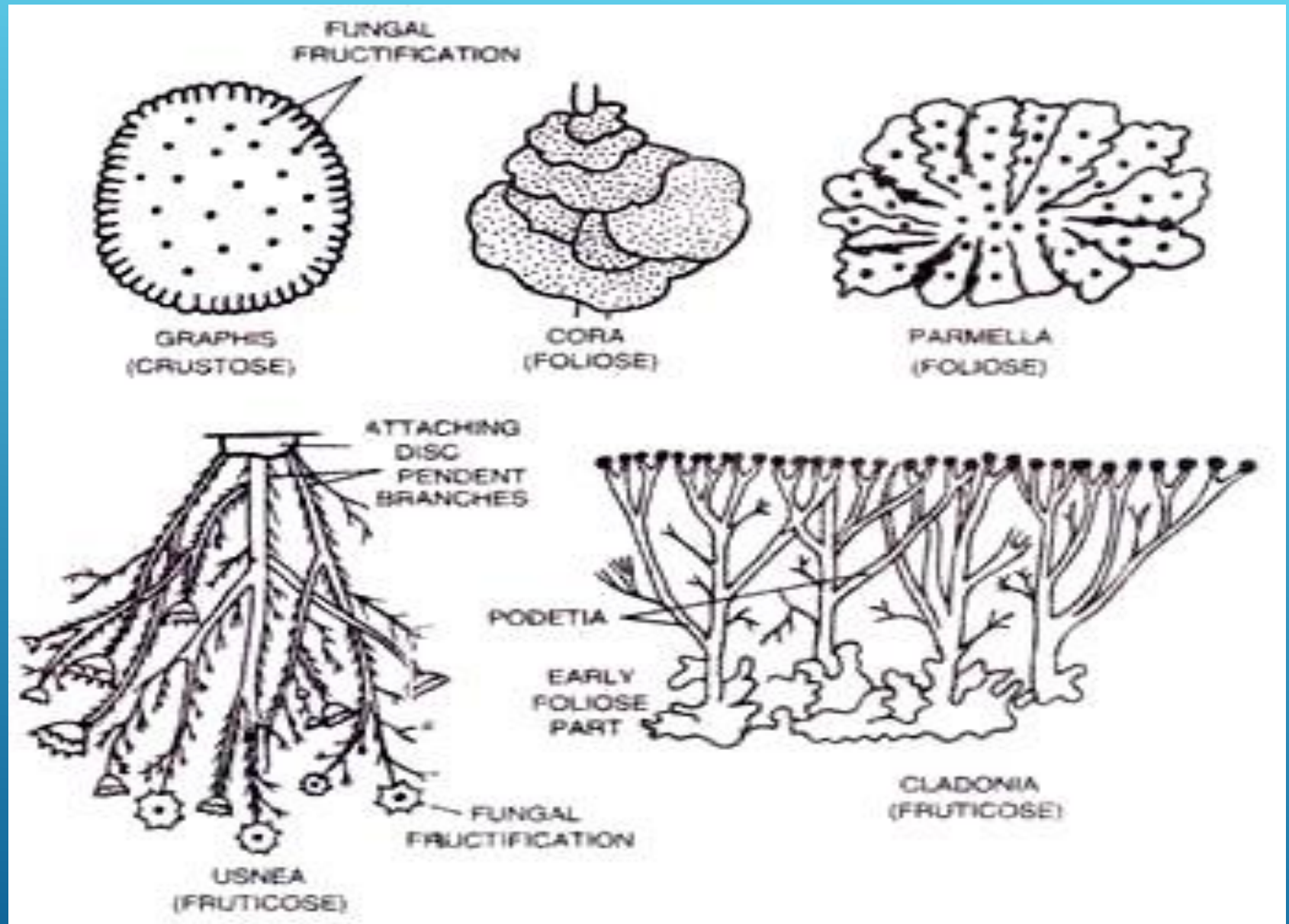

Fig. 2.54. Forms of Lichens.

On the basis of internal structure of thallus, the lichens are divided into two groups, namely, homoiomerous and heteromerous lichens.

1. Structure of Homoiomerous Lichen Thallus:

In the gelatinous lichen thalli such as Collema and Leptogium, the thallus shows a simple structure with little differentiation. It consists of a loosely interwoven mass of fungal hyphae with algal cells equally distributed throughout.

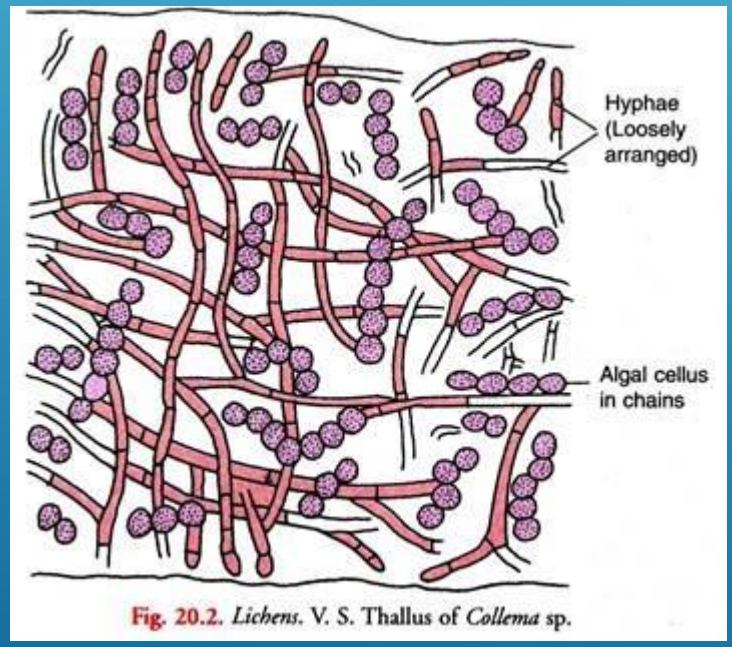

Fig. 20.2. *Lichens*. V. S. Thallus of *Collema* sp.

Structure of Heteromerous Lichen Thallus:

They exhibit considerable differentiation and layered structure. The algal component in a heteromerous thallus is restricted to a specific zone or layer.

A vertical section through the foliose thallus such as that of Parmelia or Xanthoria reveals the following four distinct zones:

(a) Upper Cortex:

It forms the upper surface which is generally thick and protective. The fungal hyphae in this region grow more or less vertically and are compactly interwoven to produce a tissue-like layer (Plectenchyma or pseudoparenchyma) called the upper cortex.

(b) Algal Zone:

It is the blue-green or the green zone which lies immediately beneath the upper cortex. It consists of a tangled network of loosely interwoven fungal hyphae with the algal cells of a green alga (in Xanthoria) or of a blue-green alga (in Peltigera canina) intermixed with the fungal hyphae.

c) Medulla:

It forms the central core of the thallus . It is less compact and consists of loosely interwoven hyphae with large spaces between them in certain regions. The fungal hyphae in this region are scattered and usually have thick walls.

(d) Lower Cortex:

It forms the lower surface of the thallus and is composed of densely compacted hyphae. They may run perpendicular to the surface of the thallus or parallel to it. Bundles of hyphae (rhizinae) often arise from the surface of the, lower cortex and penetrate the substratum to function as anchoring organs.

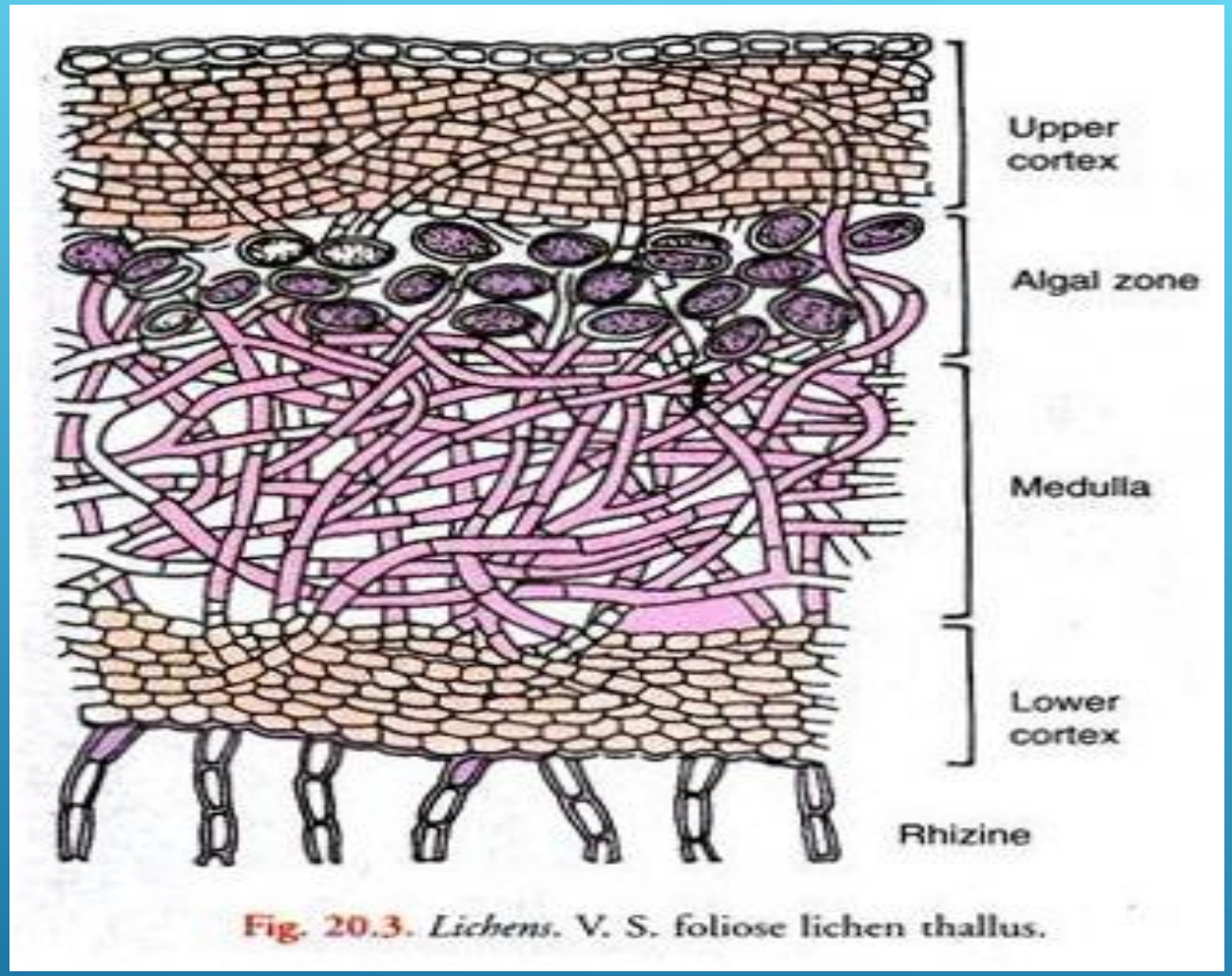

Fig. 20.3. *Lichens*. V. S. foliose lichen thallus.

Reproduction of Lichens:

1.BY Fragmentation

(i) Progressive death and decay resulting in the separation of a lichen into two or more parts,

(ii) Fragmentation caused by mechanical injury due to wind, trampling or animal bites,

2. By Propagules

(1) Isidia are superficial outgrowths of the lichens which are primarily meant for increasing surface area and photosynthetic activity. At times, they are broken off. Each isidium is capable of forming new lichen because it has a core of algal cells surrounded by a sheath of fungal hyphae.

(2) Soredia. They are microscopic lichen propagules which are produced in large numbers inside sori called pustules. Soredia are dispersed by air currents. After falling on a suitable substratum each soredium gives rise to a lichen because it has a few algal cells surrounded incompletely by a weft of fungus.

3. By sexual reproduction

By ascospore in suitable conditions germinate to produce a fungal hyphae which it comes in contact with a proper algae , develops into a new Lichen.

Economic Aspects of Lichens

(a) Ecological significance:

(i) Pioneer colonizers:
Lichens are said to be the pioneers in establishing vegetation on bare rocky areas (lithosere). They are the first members to colonize the barren rocky area. During development they bring about the disintegration of rock stones (biological weathering) by forming acids e.g., oxalic acid, carbonic acid etc. Thus, they **play an important role in nature in the formation of soil (a phenomenon called pedogenesis).**

(ii) Role in environmental pollution:
Lichens are very sensitive to atmospheric pollutants such as sulphur dioxide. They are unable to grow in towns, cities and around industrial sites such as oil refineries and brickworks. So, the lichens can be **used as reliable biological indicators of pollution**. By studying lichens on trees, a qualitative scale has been devised for the estimation of mean SO_2 level in a given season. Thus lichens are used as pollution monitors.

(b) Food and Fodder:

The lichens **serve as important source of food for invertebrates**. A large number of animals for example, mites, caterpillars, termites, snails, slugs etc. feed partly or completely on lichens. Lichens as food have also been used by man during famines. They are rich in polysaccharides, certain enzymes and some vitamins.

Cetraria islandica (Iceland moss) is taken as food in Sweden, Norway, Scandinavian countries, Iceland etc. Lecanora esculenta is used as food in Israel and Umbilicaria esculenta in Japan.

Species of Parmelia are used as curry powder in India. In France the lichens are used in confectionary for making chocolates and pastries.

Cladonia rangiferina (Reindeer moss) is the main food for reindeers (a kind of deer) in polar countries. Cetraria islandica is also used as fooder for horses. Species of Stereocaulon, Evernia, Parmelia and Lecanora are also used as fodder.

Source of Medicines:

Since very early times the lichens are used to cure jaundice, fever, diarrhoea, epilepsy, hydrophobia and various skin diseases**. Various lichens are of great medicinal**
A yellow substance usnic acid is obtained from species of Usnea and Cladonia. It is a broad spectrum antibiotic and is used in the treatment of various infections. It is effective against gram positive bacteria. **Some lichen compounds e.g., lichenin, isolichenin have anti-tumour properties.**

Protolichesterinic acid, a compound obtained from some lichens, is used in preparation of anti-cancer drugs.
Erythrin obtained from Roccella montagnei, is used to cure angina.

Many antiseptic creams such as Usno and Evosin are available in the market and are well known for their antitumour, spasmolytic and antiviral activities.

In Industry:

(i) Tanning and dyeing:

Some lichens are used in leather industry. Cetraria islandica and Lobaria pulmortaria show the astringent property. This **astringent substance is extracted from the thallus and is used in tannin industry.**

Lichens are also used in preparing natural dyes. Orchil, **a blue dye obtained from Roccella and Leconara, is used to dye woollen articles and silk fabrics.**

It is purified as orcum and used as a a biological stain. A brown dye is obtained from Parmelia spp. whereas Ochrolechia spp. yield a red dye.

Litmus used as a acid-base indicator, is also a dye and is obtained from Roccella tinctoria and Lasallia pustulata.

(ii) Cosmetics and perfumes:

Evernia, Ramalina, Pseudorina are reported to **have perfumed volatile oils.** Due to the aromatic substances present in the thallus, the lichens are **used in the preparation of various cosmetic articles, perfumery goods, dhoop, hawan samagris** etc.

Brewing and distillation:

Some species of lichen for example, **Cetraria islandica contain carbohydrates in the form of lichenin. In Sweden and Russia alcohol is produced from these lichens**. These lichens are also used in confectionary.

(iv) Minerals:

Lecanora esculenta is found in lime stone deserts and yields large amount of calcium oxalate crystals. These are 60% of its dry weight.

References

1. Vashishtha B.R., Sinha A.K. , Anil kumar,Botany for degree students , fungi Revised edition,647-667.
2. Stucture of Lichen with diagram by Savitha