

# Exercise 2

**Aim:** To identify and study the morphology of representative types of bacteria, fungi and different plant groups.

**Principle:** Morphology is the study of the characteristic features of the species. It could be a study of external or internal features. Morphological studies help in identification and classification of organisms.

**Requirement:** Permanent slides, hand section/photograph of bacteria, *Oscillatoria*, *Spirogyra*, *Rhizopus*, Yeast, preserved/fresh specimens of mushroom, lichens, *Funaria*, *Marchantia*, *Dryopteris*/fern, *Pinus*, angiospermic plants (one monocotyledonous plant like maize plant and one dicotyledonous plant like pea/sun flower).

## Procedure

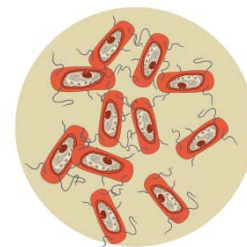
Procedure for the study of organisms vary from one organism to the other depending upon their shape and size.

- Microscopic organisms like bacteria, algae, fungi can be studied with the help of microscope only. Observe the permanent slides under a microscope and note down the characters.
- Large-sized specimen (fresh or preserved) can be examined directly with naked eye or with the help of a hand lens.
- Compare your observations with the characteristics given below.

## Observation

### **BACTERIA**

- (i) Bacteria (*sing.* : bacterium) are unicellular (Fig. 2.1).
- (ii) Cell wall is present.
- (iii) Absence of membrane bound organelles like mitochondria, nucleus, golgi bodies, plastids, etc.
- (iv) Mesosomes are present.



**Fig. 2.1** Bacteria (rod-shaped)

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- (v) Bacteria exist in different shapes like globular (coccus), rod-shaped (bacillus), spiral (spirillum) and comma-shaped (vibrio).

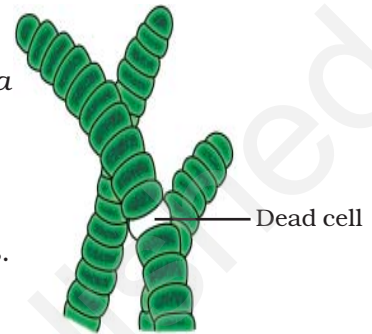
### Systematic position

Kingdom – Monera  
Class – Eubacteria

#### *OSCILLATORIA*

The features given below are useful in identifying *Oscillatoria* (Fig. 2.2).

- (i) It is a blue-green algae of fresh water bodies.
- (ii) Thallus is filamentous, unbranched, multicellular.
- (iii) The cells are arranged one above the other like a pack of cards.
- (iv) Each cell has a definite cell wall.
- (v) Some cells of the filament may be dead and appear as blank spaces in the filament.
- (vi) Fresh specimen of the filaments show oscillatory movements and hence the name *Oscillatoria*.



**Fig. 2.2** *Oscillatoria*

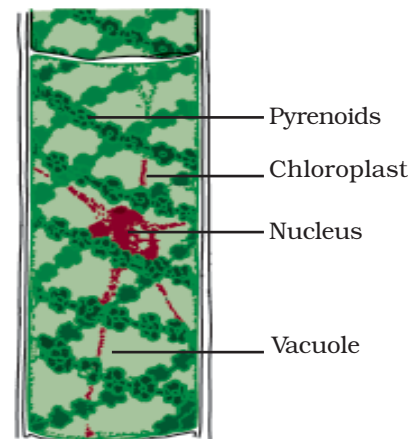
### Systematic position

Kingdom – Monera  
Division – Cyanobacteria  
Class – Cyanophyceae

#### *SPIROGYRA*

Observe the following features:

- (i) *Spirogyra* is a green-coloured algae commonly found in stagnant fresh water bodies.
- (ii) It is unbranched, filamentous and slimy to touch.
- (iii) The filament is composed of large number of long, cylindrical cells placed one above the other in a single row.
- (iv) The cells are characterised by long spiral ribbon-shaped chloroplasts with several pyrenoids (Fig. 2.3).
- (v) There is a single large vacuole in each cell.



**Fig. 2.3** *Spirogyra*

**Note :** *Spirogyra* can be collected from a pond. It is silky, slippery, green-coloured scum (floating in water). It can also be preserved in the FAA (Formalin, Acetic acid, Alcohol mixture).

- (vi) Conjugation tubes formed between the cells of two different filaments may also be found when in reproductive phase.

### Systematic position

Kingdom – Plantae  
 Division – Thallophyta  
 Class – Chlorophyceae

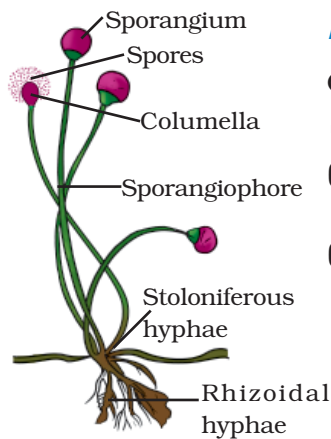


Fig. 2.4 *Rhizopus*

### *RHIZOPUS*

Observe the following features:

- (i) Thallus is an interwoven mass of hyphae called mycelium.
- (ii) Hyphae are tubular, multinucleate and without any septa (**coenocytic**) (Fig.2.4).
- (iii) Some hyphae are horizontal and grow parallel on the surface of the substratum. These are called stoloniferous hyphae. Some hyphae grow down into the substratum, and are called rhizoidal hyphae. Erect vertically growing hyphae are called **sporangiophores**.
  - Sporangiphore bears the capsule or sporangium, which is globular in outline.
  - A dome-shaped **columella** is found inside the cavity of sporangium.
  - Numerous black spores fill the cavity between columella and the sporangial wall.

**Note :** *Rhizopus* can be grown on moist piece of bread covered under a glass jar or kept in a petridish for a few days in dark. The fungus appears as a white cotton like mass.

### Systematic position

Kingdom – Fungi  
 Division – Eumycota  
 Class – Zygomycetes

### *AGARICUS* (COMMON EDIBLE MUSHROOM)

Observe the following features in the specimen:

- (i) Common edible mushroom is the fruiting body or basidiocarp of *Agaricus*.
- (ii) The fungus is a saprophyte that grows in soil rich in humus and with thick layer of semi-decomposed organic matter.
- (iii) The thallus consists of an underground, highly interwoven mass of thick colourless hyphae.

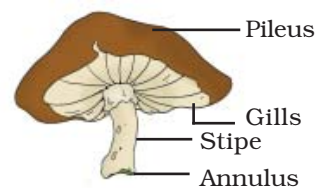


Fig. 2.5 *Agaricus*

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- (iv) A young fruiting body is a white, spherical, button like structure. A mature fruiting body can be distinguished into two parts (Fig. 2.5).
  - (a) An erect stalk or **stipe** composed of mass of vertically arranged hyphae, and
  - (b) An umbrella like **pileus** attached ventrally at the centre to the stalk. At the base of the stipe is collar like ring known as **annulus**, which is a remnant of the covering of young **basidiocarp**.
- (v) There are radiating plate like structures called gills on the under surface of pileus, which radiate from the centre to the periphery. The gills bear basidia and basidiospores.

**Note:** Fungus is very soft, one has to handle it carefully. Avoid inhaling spores. Use forceps to take out basidia which contain black spores.

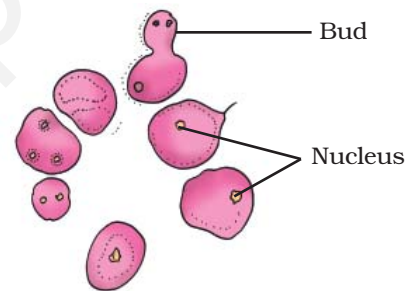
### Systematic position

- Kingdom – Fungi
- Division – Eumycota
- Class – Basidiomycetes

### SACCHAROMYCES (YEAST)

Observe the following features (Fig. 2.6):

- (i) Cells are oval or spherical in shape, and colourless.
- (ii) Cells form chains of buds that help in propagation.
- (iii) Each cell has one vacuole.
- (iv) Single nucleus is present in each cell.



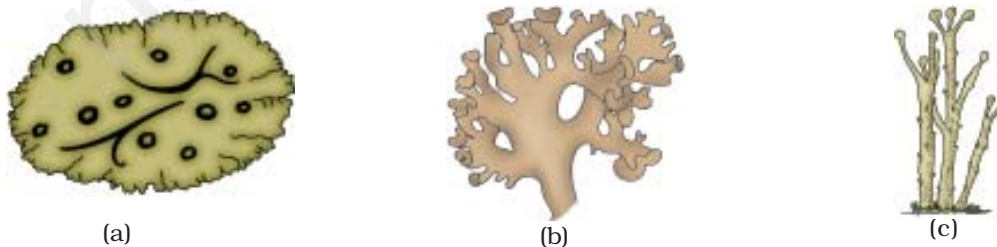
**Fig. 2.6** Yeast

### Systematic position

- Kingdom – Fungi
- Division – Eumycota
- Class – Saccharomycetes

### LICHENS

- (i) The body of lichen is a thallus, which is grey or greyish in colour. Yellow, red, orange or brown segments may be present in some species (Fig. 2.7).



**Fig. 2.7** Lichen : (a) Crustose; (b) Foliose; (c) Fruticose

- (ii) There are different forms of thallus. Three main categories of thalli are recognised on the basis of their general growth, form and nature of attachment to the substratum. These are as follows:

**(a) Crustose**

- These are encrusting lichens with thin, flat, inconspicuous thallus without lobes.
- The thallus appears as a thin layer or crust, closely attached by its whole of the lower surface to stones, rocks, barks of wood trees, etc.

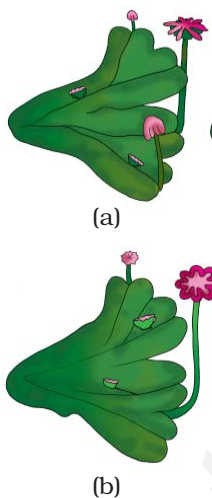
**(b) Foliose**

- Foliose lichens are leafy lichens with flat lobed and horizontally spreading thalli.
- These are attached to the substratum by rhizoid like structures.

**(c) Fruticose**

- These are shrubby lichens with cylindrical, flat or ribbon like upright, generally branched and pendulous thalli.
- These are attached to the substratum by disc like structures at their bases.

**MARCHANTIA (LIVERWORT)**



**Fig. 2.8** *Marchantia* bearing

(a) antheridiophore  
(b) archegoniophore

- (i) *Marchantia* thallus is dorsiventrally flat, thalloid structure that grows flat on the surface of the soil substratum (Fig. 2.8).
- (ii) Thallus is dichotomously lobed, with an apical notch in each lobe.
- (iii) There is a dark median furrow called mid-rib on the dorsal side that extends into each lobe.
- (iv) Small cup-like structures called gemma cups are borne on the dorsal surface of the thallus. They contain the vegetative propagules called gemmae.
- (v) Ventral side of the thallus bears colourless, unicellular rhizoids which are of two types- (a) smooth walled, and (b) tuberculate rhizoids. The rhizoids help in anchorage and absorption of water through their capillary action.
- (vi) Reproductive organs are borne on antheridiophores and archegoniophores that arise from the apical notches of male and female thalli respectively.
- (vii) The antheridiophore has a flattened, more or less convex head or receptacle which bears antheridia.
- (ix) The archegoniophores are umbrella shaped structure, with outwardly projected ribs. Between the ribs are the archegonia.

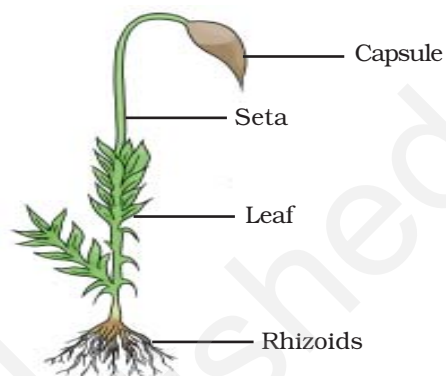
**Systematic position**

- Kingdom – Plantae  
Division – Bryophyta  
Class – Hepaticopsida

## Exercise 2

### *FUNARIA* (MOSS)

- (i) The thallus of *Funaria* consists of small upright, 'stem' that bears, small, ovate and leaf-like structures which are without midrib (Fig. 2.9).
- (ii) The leaves are green and are spirally arranged on the stem-like portion.
- (iii) The thallus is attached to the substratum by a cluster of rhizoids.
- (iv) Rhizoids are long, colourless, septate and intertwined.
- (v) Reproductive organs are borne on separate branches of the same thallus.
- (vi) The flattened apex of the male branch bears the antheridia which are club shaped, while the flattened receptacle of the female branch bears archegonia which are flask shaped.
- (vii) A mature *Funaria* plant bears (on female branches) the sporophyte which consists of a prominent conical capsule raised on a long stalk known as seta and a foot which is embedded into the tissues of the gametophyte.



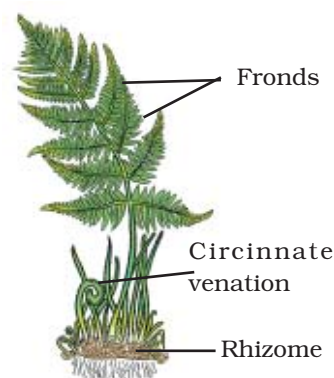
**Fig. 2.9** Moss

### Systematic position

Kingdom – Plantae  
Division – Bryophyta  
Class – Musci/Bryopsida

### *DRYOPTERIS* (FERN)

- (i) *Dryopteris* is a fern (Pteridophyta) with obliquely growing, subterranean rhizome (Fig. 2.10).
- (ii) Rhizome is short, thick and is covered with scale leaves, remnants of leaf bases and cluster of adventitious roots.
- (iii) The aerial shoot consist of several large compound leaves called fronds.
- (iv) Each compound leaf arises from a bud. The young leaf has circinnate venation. The leaf is rolled from apex downwards like a watch spring and petiole has dense covering of brown hair like structures called ramenta.
- (v) Leaves are long, upto 1.0-1.5 m length, compound with leaflets arranged on either side of mid-rib called rachis. Rachis is the extended part of the petiole.
- (vi) Petiole is long, cylindrical and covered with hairs when young.



**Fig. 2.10** *Dryopteris*

- (vii) Leaflets or pinnules have wavy margin, and are sub sessile.
- (viii) Large number of greenish (when young) or black (when mature) sac like structures are borne on the ventral side of the pinnule at the point of bifurcation of each vein. These are called as sori (single: sorus).
- (ix) Each sorus contains a cluster of sporangia bearing spores.

### Systematic position

- Kingdom – Plantae
- Division – Pteridophyta
- Class – Filicopsida

### *Pinus*

- (i) *Pinus* is a cone-shaped tall tree (Fig.2.11).
- (ii) Stem is hard, woody, cylindrical, rough and branched.
- (iii) Branches are of two types- (a) branches of unlimited growth, and (b) branches of limited growth.
- (iv) Both types of branches bear large number of brown, membranous scaly leaves.
- (v) Branches of limited growth are borne in the axil of **scale** leaves. They are 2-3 cm long and bear a cluster of long, needle like leaves.
- (vi) The needle like green leaves are called acicular leaves.
- (vii) The dwarf branch with its needles is known as spur shoot.
- (viii) Reproductive organs are borne in male and female cones in the same plant.
- (ix) Male cones are borne in large clusters (8-40). They are small, green, conical and composed of central axis surrounded by large number of green and small microsporophylls which are compactly arranged .
- (x) Micro sporophylls bear two elongated sac like structures at the base on the ventral side. These are called pollen sacs. Pollen grains are winged.
- (xi) Female cones are large, 10-30cm in length consisting of megasporophylls. Megasporophylls are compact when young but spread apart when mature. Each megasporophyll has (a) bract scale and (b) ovuliferous scale which bears 2 ovules on the ventral side.



**Fig. 2.11** *Pinus* tree

### Systematic position

- Kingdom – Plantae
- Division – Gymnosperm
- Class – Coniferopsida

## Exercise 2

### DICOTYLEDONOUS PLANT

- (i) Plant body is differentiated into roots, stems and leaves (Fig. 2.12).
- (ii) Taproot system.
- (iii) Leaves simple or compound, with reticulate venation.
- (iv) Flowers tetramerous or pentamerous, either solitary or in clusters forming inflorescence.
- (v) Reproductive organs are stamens and carpels. Within the carpels ovules are present.
- (vi) Seeds have two cotyledons.

*Example: Hibiscus, pea, gram, lady's finger, ground nut.*



**Fig. 2.12** Pea plant

### Systematic position

Kingdom – Plantae  
Division – Angiosperm  
Class – Dicotyledonae

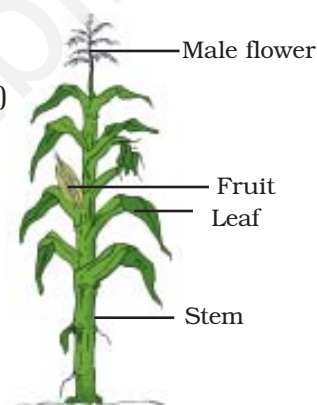
### MONOCOTYLEDONOUS PLANT

- (i) Plant body differentiated into roots, stems, and leaves (Fig. 2.13)
- (ii) Fibrous root system.
- (iii) Leaves simple or compound with parallel venation.
- (iv) Flower trimerous.
- (v) Ovules situated inside the carpels.
- (vi) Seed has one cotyledon

*Example: maize, wheat, sugarcane, paddy*

### Systematic position

Kingdom – Plantae  
Division – Angiosperm  
Class – Monocotyledonae



**Fig. 2.13** Maize plant

## Questions

1. An unlabelled slide shows filamentous structures with linearly arranged cells and blank spaces occurring intermittently. Name the specimen.
2. What is the structure bearing capsules in a moss called as – a sporophyte/gametophyte?
3. What type of leaves are found in ferns?
4. What are the similarities and differences observed in gymnosperms and angiosperms?
5. Given only flowers of some plants, how would you classify them as monocots and dicots?