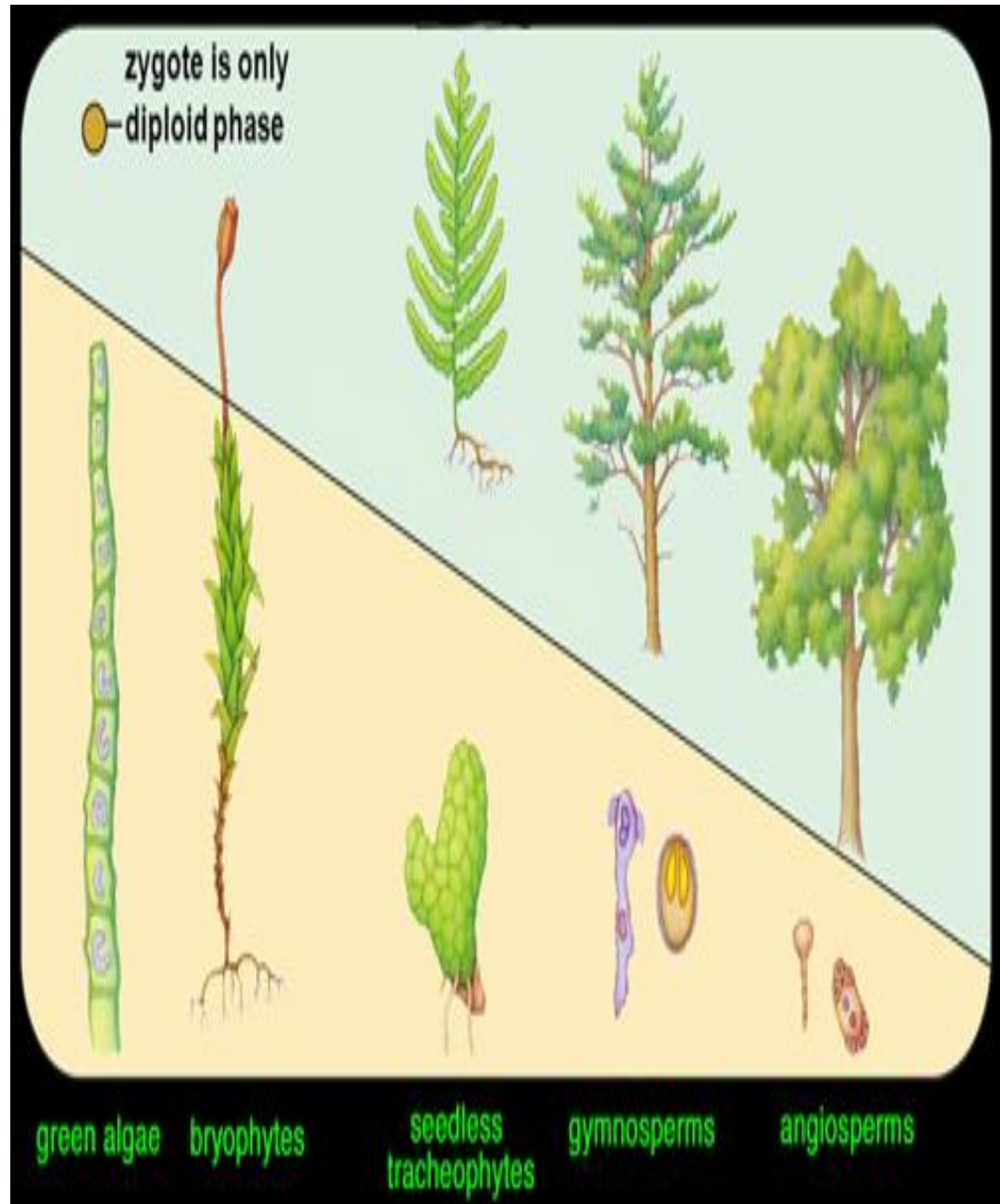


# Subject- Botany

Production of Courseware –  
Content for UG course

Paper – Plant Life and  
Utilization- I

Module- Introduction To  
Plant Kingdom



# **Chapter -1**

## **Introduction To Plant Kingdom**

**Plant Life and Utilization –I**

**Paper -I, Sem- I**

**FYBSc**

**By**

**Dr Shilpa M Jagtap**

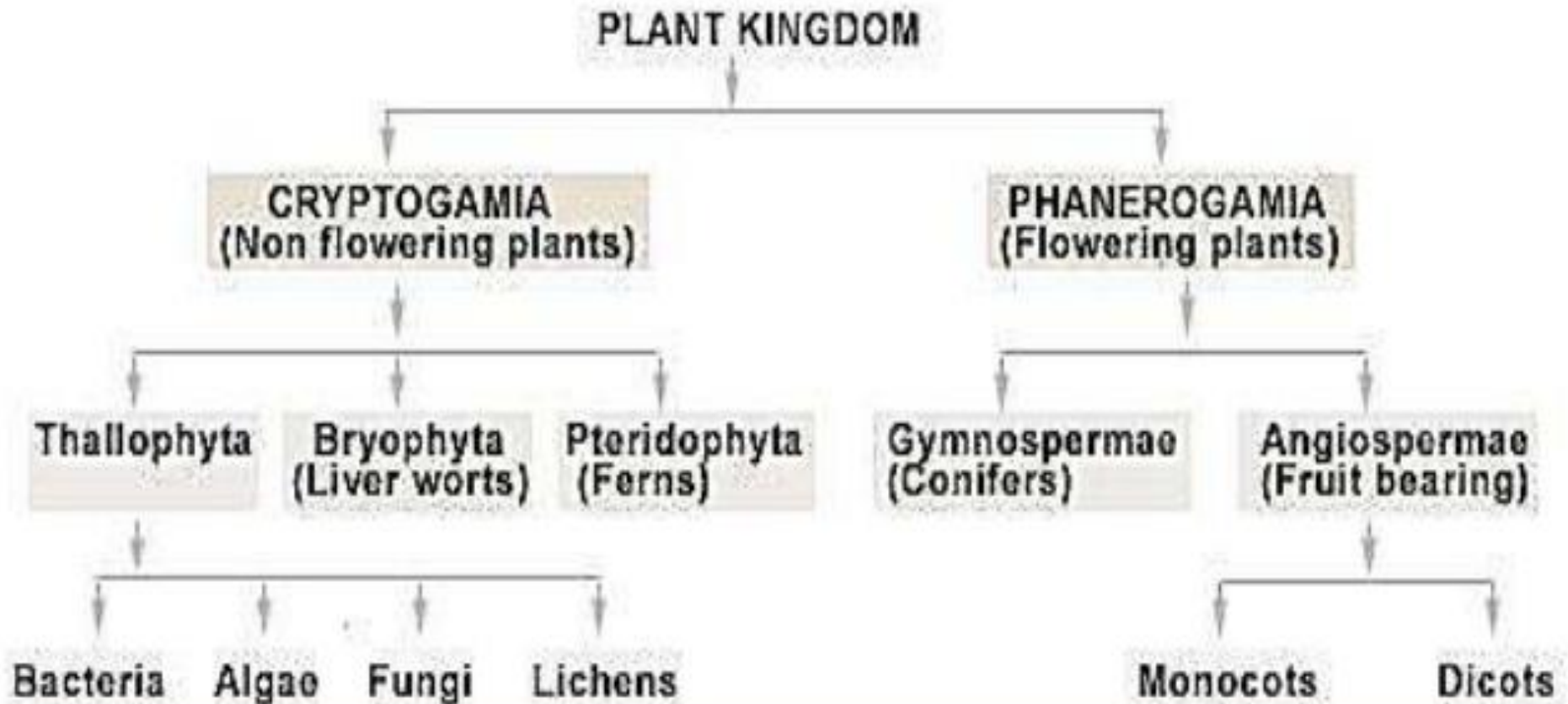
# Learning Objectives

- 1.1 Introduction
- 1.2 General outline of plant kingdom (**Lower Cryptogams:** Thallophytes- Algae, Fungi & Lichens;  
**Higher Cryptogams:** Bryophytes and Pteridophytes;  
**Phanerogams:** Gymnosperms and Angiosperms- Dicotyledons and Monocotyledons).
- 1.3 Distinguishing characters of these groups and mention few common examples from each.

# 1.1. Introduction to Plant Kingdom

- Plant classification system is based on form or habit were introduced by the Greeks and, by many subsequent workers and continued up to the time of Carl Linnaeus (1707-1778).
- Linnaeus in 1737 introduced artificial system of classification based on number of sex organs and presence or absence of flower so it is also called as sexual system.
- Linnaeus grouped all plant under 24 classes out of that 23 are flowering plant class and in one (24<sup>th</sup>) class he included all nonflowering plant and this group is called as Cryptogams.
- The kingdom plantae on the basis of thallus structure or plant body, mode of nutrition and nature of reproduction is divided into two divisions i.e. Cryptogams and Phanerogams.
- The outline of the classification of Kingdom plantae is as follows:

## 1.2 General outline of plant Kingdom



# Lower Cryptogams- Thallophyta

- **General character of Cryptogams:**

- A cryptogam (scientific name Cryptogamae) is a plant that reproduces by spores, without flowers or seeds. "Cryptogamae" (Greek word kryptos means "hidden" and gameein means "to marry") means "hidden reproduction", referring to the fact that no seed is produced, thus cryptogams represent the non-seed bearing plants.

- **Lower Cryptogams- Thallophyta:**

Plant body is thalloid, not differentiated into root, stem and leaves. It include:

- 1. Algae,
- 2. Fungi,
- 3. Lichen

# 1. Algae

- Plant body may be unicellular e.g. *Chlorella* (*non-motile*), *Chlamydomonas* (*motile*) or multicellular unbranched filamentous like *Spirogyra* and *Ulothrix*, or branched filamentous like *Chara* or colonial forms like *Volvox*
- Some are huge macroscopic such as sea weeds which measure more than 60 meters in length. e.g. *Sargassum*. Algae are represented by over 7,175 species in 66 genera.
- Variation in Habit , Habitat, Size, form and reproduction.
- Thalloid plant body, Prokaryotic and Eukaryotic, unicellular or multicellular.
- Autotrophic mode of nutrition.
- Chlorophyll bearing plant body is autotrophic, thalloid.
- Prokaryotic or Eukaryotic
- Mostly aquatic, marine or fresh water, some are terrestrial
- Both generation (Saprophytic and Gamatophytic) are independent.
- Common examples are *Volvox*, *Fucus*, *Spirogyra*, *Chara*, *Polysiphonia*, *Ulothrix*, etc.

**Algae showing their diversity of shape and growth form (multicellular, unicellular, and colonial)**





## 2. Fungi

- The fungi ( sing. Fungus; L., a mushroom) are heterotrophic organisms of very diverse form, size, physiology and mode of reproduction.
- Definition- Fungi are achlorophyllous, heterotrophic, eukaryotic and spore bearing organism whose cell wall is made up of chitin or cellulose or both, which reproduce by asexual and sexual spores.
- The study of fungi is known as Mycology (Gr. mykes, a mushroom and logos, discourse)
- There are about 5100 genera and 250000 species of fungi.
- Filamentous plant body is called as mycelium.
- Hyphae: single filament is called as hypha (Pl. Hyphae), group or web of hypha is called as mycelium.

- Cross wall in between two adjacent cell is called septum (pl. Septa). hypha with septum is called septate hyphae and without septum is called as aseptate hyphae.
- Coenocytic hypha: hyphae without septum is called as coenocytic hypha.
- Mode of nutrition is heterotrophic-Heterotrophy - 'other food'
- Saprophytes or saprobes - feed on dead tissues or organic waste (decomposers)
- Symbionts - mutually beneficial relationship between a fungus and another organism
- Parasites - feeding on living tissue of a host. Parasites that cause disease are called pathogens.

- Reserve food material is glycogen and oil drops.
- Reproduction :-Usually there are two broadly recognizable types of reproduction; asexual and sexual
- Asexual Reproduction by means of asexual spore , flagellated spore are called as zoospores and nonflagellated spores are called as sporangiospore and conidia.
- Sexual spores are Ascospores and Basidiospores produced in ascus and basidium respectively. In deuteromycetes sexual reproduction is absent so these fungi is called as imperfect fungi.,
- Common examples are yeast,*Penicillium notatum*,*Agaricua*,*Albugo* etc.

**Phycomycetes  
(Lower Fungi)**

- Saprolegnia
- Rhizopus
- Mucor
- Albugo
- Pythium

**Ascomycetes  
(Sac Fungi)**

- Yeast
- Aspergillus
- Pencillium
- Neurospora
- Peziza

**Basidiomycetes  
(Club Fungi)**

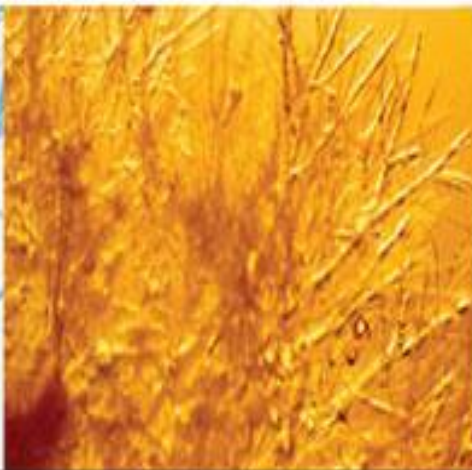
- Agaricus
- Polyporus
- Puccinia
- Ustilago
- Lycoperdon

**Deuteromycetes  
(Fungi imperfecti)**

- Cercospora
- Collectotrichum
- Trichoderma
- Pyricularia
- Fusarium



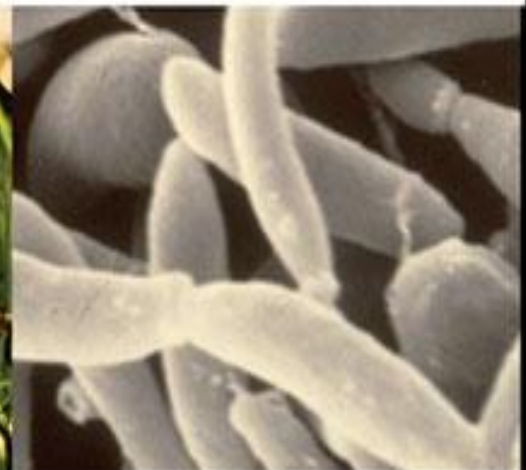
Rhizopus



Neurospora



Agaricus



Fusarium

### 3. Lichen

- A Lichen is an intimate association of a fungus and an algae in which both the organism intertwine to form a single thallus.
- Algal partner is called phycobiont and is from cyanophyceae or Chlorophyceae. Mycobiont (fungal partner) from Ascomycetes are called Ascolichen and if it is from Basidiomycetes it is called as Basidiolichen.
- Lichen are widely distributed on every convenient and in varied habitat.
- Lichen are found growing on the leaves, the bark of tree, on decaying wood, on rock and on soil.
- Lichen can survive in extremes of heat, cold and drought.
- Lichen are of many different forms and colours. They are commonly form thin thalli.
- Morphologically lichen are classified into three types, crustose lichen, Foliose lichen and Fructiose lichen.
- Common examples are *Parmelia*, *Usnea*, *Graphis*.

The three types of lichens are shown here. (a) crustose lichen (b) foliose lichen (c) fruticose lichen



(a)



(b)



(c)

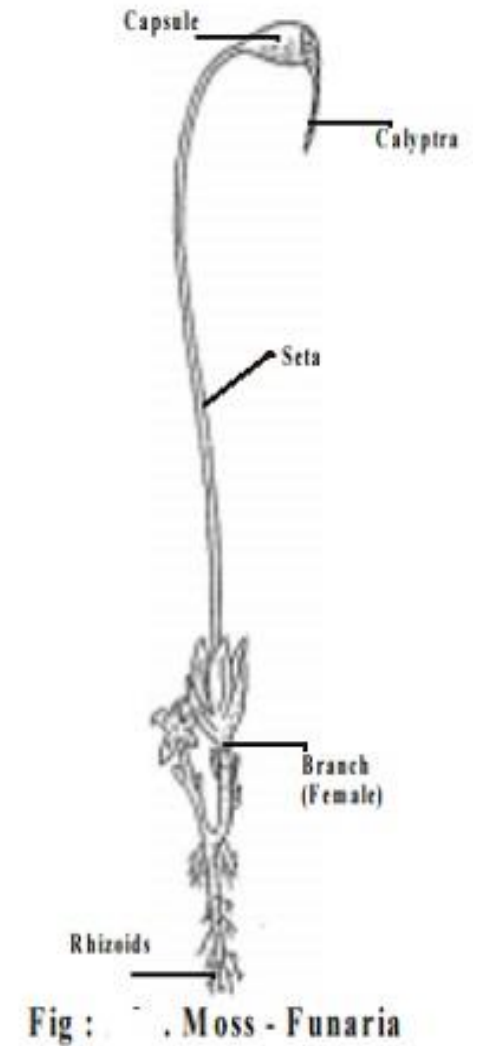
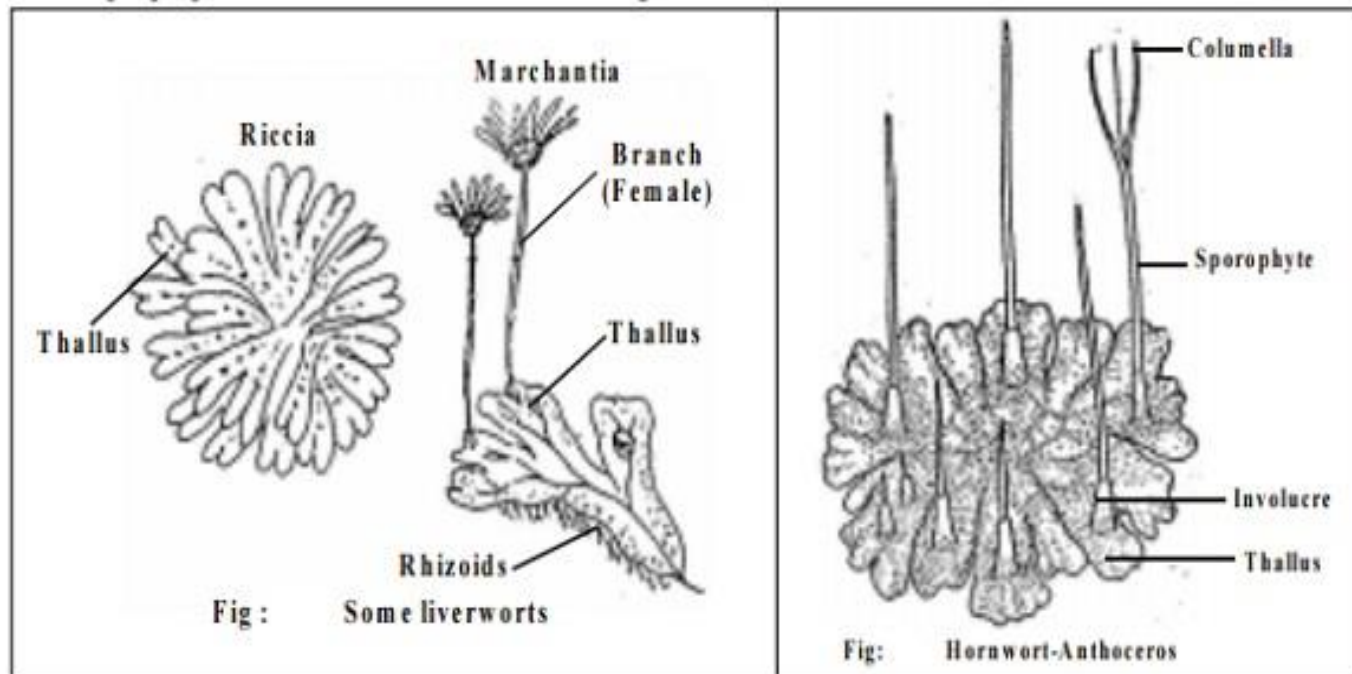
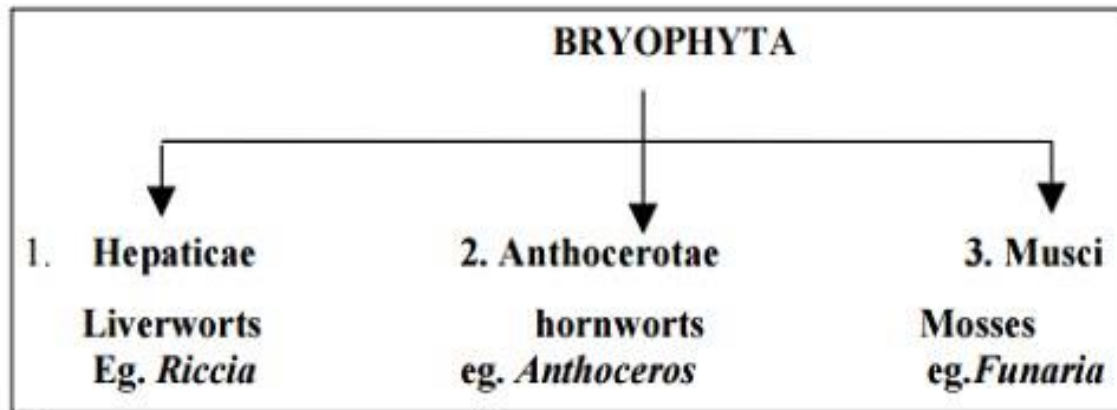
# Higher Cryptogams-Bryophytes and Pteridophytes

## Bryophytes:

- Plant body is thalloid i.e. not differentiated into root stem and leaves
- The plants usually grow in moist and shady places.
- Plant body simple in lower forms (liverworts and hornworts) attached to substratum by unbranched, unicellular hair like structure called rhizoid and higher forms are erect, foliose with stem and leaf like structure
- Internal tissue are homogenous or differentiated paranchymatous.
- Bryophytes reproduce by Vegetative and sexual reproduction method
- Vegetative reproduction: Fragmentation , adventitious branches, tubers (*Riccia*), gemmae (*Marchantia*)
- Sexual reproduction is always Oogamous type.
- The sex organ are protected by complex multicellular jacket layer

- The male reproductive organs are antheridia and female reproductive organs are archegonia.
- Water is essential for fertilization. After fusion of antherozoid and egg nucleus zygote is formed and this is the end of gametophytic phase.
- Zygote is the first cell of sporophytic generation, Zygote undergo repeated division and produce multicellular embryo.
- The embryo develops into a sporophyte which is called as sporogonium. The sporogonium developing plant body is called as the sporophyte.
- Sporophyte is dependent on gametophyte for nutrition and it divides into foot, seta and capsule. Capsule produces meiospore.
- Meiospore under suitable conditions produces gametophytic plant.
- Life cycle of bryophytes shows two alternate generations, gametophytic phase is independent and sporophytic phase is dependent on gametophytic phase.
- Some of the common examples are *Riccia*, *Marchantia*, *Funaria*, *Sphagnum*, *Antheoceros*, etc.





# Pteridophytes

- Pteridophyta (Gr, Pteron = feather, phyton = plant), the name was originally given to those groups of plants which have well developed pinnate or frond like leaves. Pteridophytes are cryptogams (Gr. kruptos = hidden, and Gamos = wedded) which have well developed vascular tissue.
- Plant body is sporophytic and can be differentiated into root, stem and leaves.
- Vascular tissue is present in stem and root. It consists of xylem and phloem. Xylem consists of tracheids only and phloem has only sieve tubes.
- Reproduction takes place by means of spores which are produced inside sporangia.
- Spores on germination give rise to multicellular gametophytic bodies called prothalli (sing. Prothallus).
- Antheridia and archegonia are developed on prothalli. Antheridium is surrounded by a single layered sterile jacket.
- Archegonium consists of four vertical rows of neck cells, 1-2 neck canal cells, ventral canal cell and egg.
- Antherozoids are unicellular, biflagellate (e.g., Selaginella) or multiflagellate (e.g., Equisetum and ferns) and motile.

- Antherozoids are attracted towards the neck of the archegonium chemotactically by certain substances like malic acid) present in the mucilaginous substance formed by the degeneration of neck canal cells and venter canal cell.
- Water is essential for fertilization (zooidogamous). Therefore, Pteridophytes are also known as amphibians of the plant kingdom.
- Fertilization results in the formation of zygote or oospore, which ultimately develops into well-developed sporophyte.
- The fertilized egg divides transversely or vertically. Another cross wall forms a quadrant stage producing stem, leaf, foot and root.
- Plants show heteromorphic alternation of generation. The main plant body is sporophytic and forms a dominant phase in the life cycle.
- Some of the common examples are *Nephrolepis*, *Selaginella*, *Equisetum*, *Pteris*, etc.

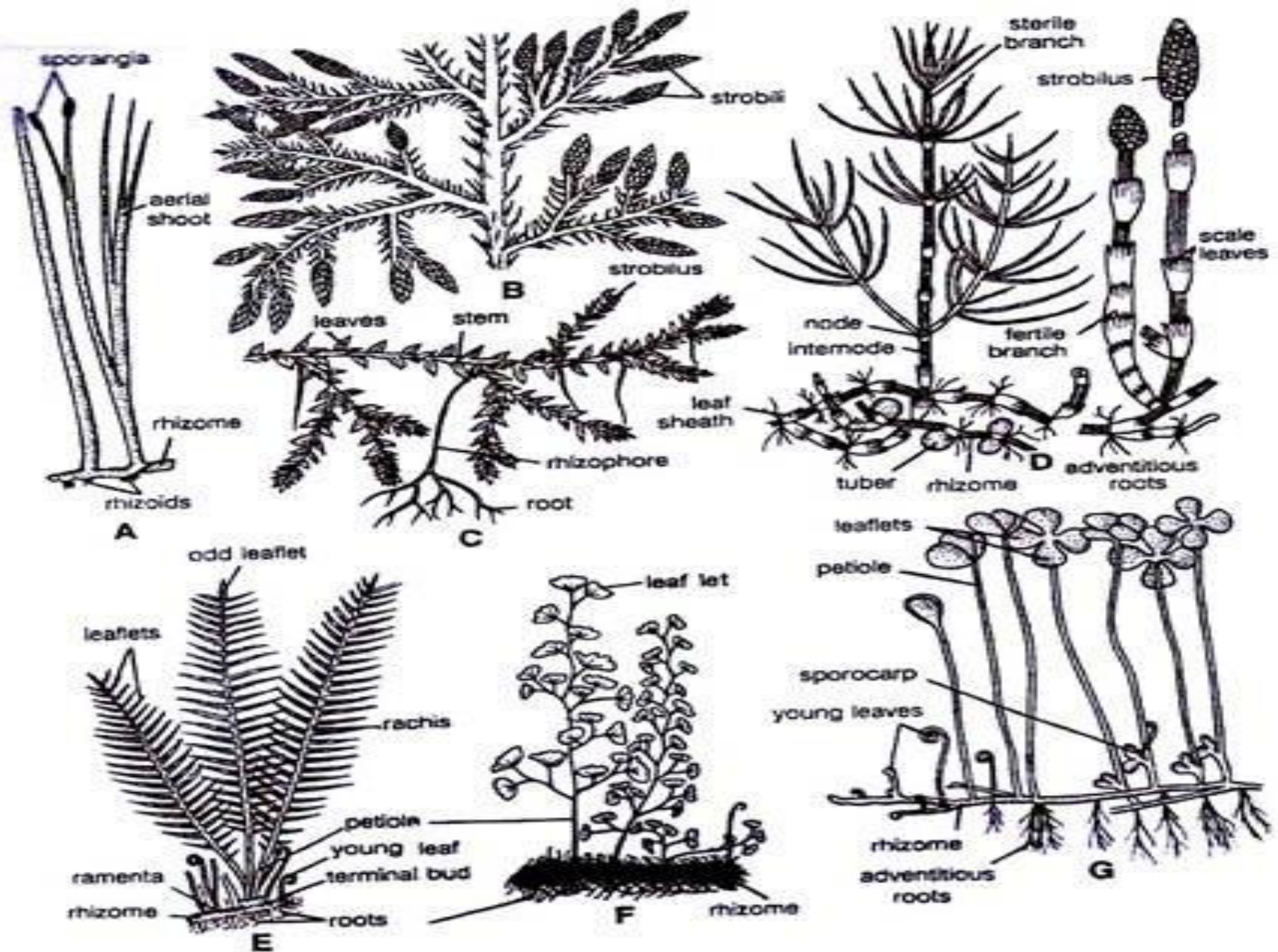


Fig 1 (A–G). Different forms of Pteridophytes A. *Rhynia*, B. *Lycopodium*, C. *Selaginella*, D. *Equisetum* E. *Pteris*, F. *Adiantum*, G. *Marsilea*

# Phanerogams:

Gymnosperms and Angiosperms-  
(Dicotyledons and Monocotyledons).

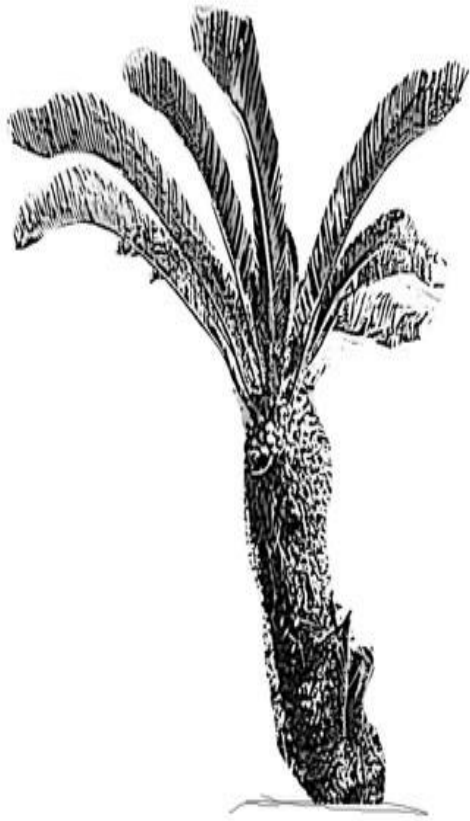
**Phanerogams:** These are seed bearing vascular plants so called as spermatophytes. Phanerogams are further divided into two divisions viz: Gymnosperms and Angiosperms.

## Gymnosperms

- The dominant plant body is sporophyte ( $2n$ ) which may be dioecious or monoecious. Gametophytes are inconspicuous and endosporic i.e. develop with the spores.
- Sporophyte differentiated into — root, stem and leaves.
- Tap root system is exarch and diarch to polyarch. Besides tap root, coralloid roots (in cycads) and mycorrhizal root (in coniferals) present.
- Stem: Erect, generally branched (Cycas is un-branched)
- Leaves- Dimorphic i.e. 2 types, foliage and scale leaves.
- Xylem: Composed of xylem parenchyma and tracheids with bordered pits. Vessels are absent (except in Gnetales).
- Phloem: Composed of sieve cells and phloem parenchyma but companion cells absent.

- Heterospory: The gymnosperms are heterosporous, means 2 types of spores produced i.e. haploid microspores and megaspores. Microspores produced within microsporangia while megaspores produce within megasporangia (nucellus) of ovules. Both types of sporangia are formed on special leaf-like structures called sporophylls (microsporophylls and megasporophylls).
- Cones or Strobili: Sporophylls are spirally arranged along an axis to form compact cone or strobili i.e. male or pollen cones and female or seed cones but in *Cycas* female cone is loosely arranged called lax.
- Ovules: Naked, sessile, generally orthotropous, and unitegmic or bitegmic (in *Gnetum*).
- Pollination is anemophilous i.e. by wind.
- Fertilization is siphonogamous i.e. male gametes carried to female gametes by means of a pollen tube. Double fertilization, a feature unique to angiosperms, is absent in gymnosperms, but found in *Ephedra*. After fertilization, Zygote develops into embryo and ovules become seed.
- Some of the common examples of gymnosperms are *Cycas*, *Pinus*, *Ephedra*, etc.

# Different types of Gymnosperms



**Cycas**



**Pinus**



**Ginkgo**

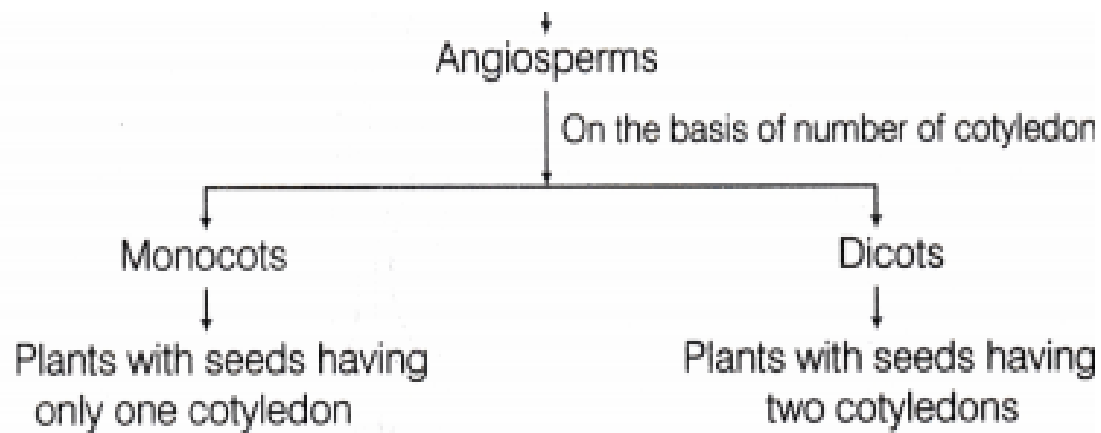


**Zamia**

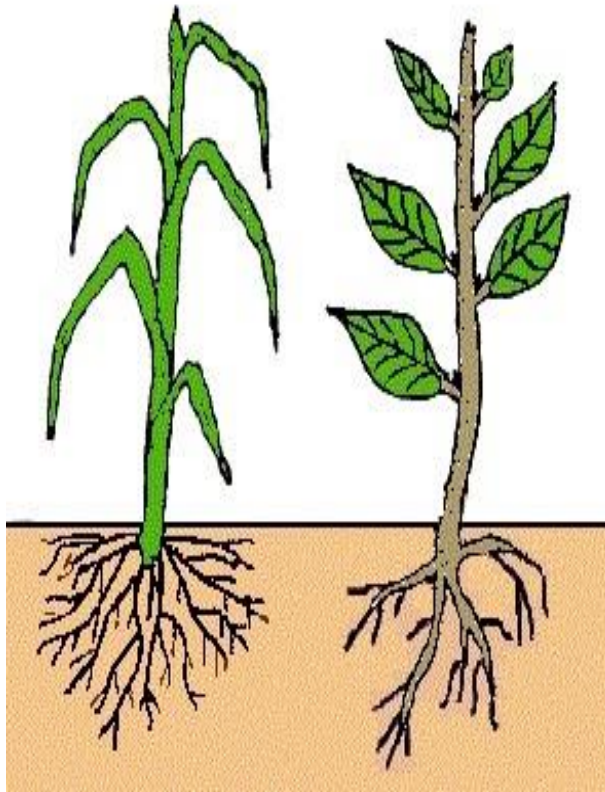
# Angiosperms



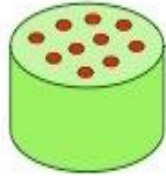
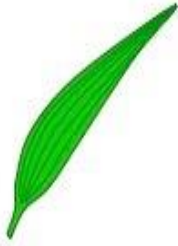



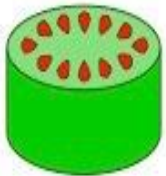


- The sporophyte which is the dominant plant in the life-cycle is differentiated into roots, stem and leaves.
- The highest degree of perfection of the vascular system with true vessels in the xylem and companion cells in the phloem.
- The organisation of the microsporophyll's (stamens) and megasporophylls (carpels) into a structure called the flower, which is typical only of the angiosperms.
- The seed or seeds remain enclosed in the ripened ovary called the fruit.
- The phenomenon of double fertilization or triple fusion is the characteristic of the angiosperms.
- The endosperm develops after fertilization. It is triploid.





MONOCOT PLANTS	DICOT PLANTS
<p>(i) The seeds have only one cotyledon.</p> <p>(ii) Leaves usually show parallel venation.</p> <p>(iii) They have fibrous root system.</p> <p>(iv) The flowers are <u>trimerous</u> (have three or multiple of three petals).</p> <p>(v) There is no <u>secondary</u> growth.</p> <p>(vi) Stem contains scattered vascular bundles.</p> <p>e.g., Maize, Rice, Grass, Wheat, etc.</p>	<p>(i) The seeds have two cotyledons.</p> <p>(ii) Leaves have reticulate venation (network of veins).</p> <p>(iii) They have taproot system.</p> <p>(iv) The flowers are <u>pentamerous</u> (have five or multiple of five petals).</p> <p>(v) Secondary growth is present.</p> <p>(vi) Stem contains ring of vascular bundles.</p> <p>e.g., Sunflower, Pea, Rose, <u>Neem</u>, etc.</p>



	Seed	Root	Vascular	Leaf	Flower
Monocot					
	One cotyledon	Fibrous roots	Scattered	Parallel veins	Multiples of 3
Dicot					
	Two cotyledon	Tap roots	Ringed	Net-like veins	4 or 5

# Summary

- Kingdom Plantae includes all the plants. They are eukaryotic, multicellular and autotrophic organisms. The plant cell contains a rigid cell wall. Plants have chloroplast and chlorophyll pigment, which is required for the photosynthesis.
- Thallophytes lack a well-differentiated body structure and the plant body is thallus like.
- Thallophyta includes plants with primitive and simple body structure. The plant body is thallus, they may be filamentous, colonial, branched or unbranched. Examples include green algae, red algae and brown algae. Algae are represented by over 7,175 species in 66 genera. Common examples are *Volvox*, *Fucus*, *Spirogyra*, *Chara*, *Polysiphonia*, *Ulothrix*, etc.
- Fungi are achlorophyllous, heterotrophic, eukaryotic and spore bearing organism whose cell wall is made up of chitin or cellulose or both, which reproduce by asexual and sexual spores. Mode of nutrition is heterotrophic-Heterotrophy - 'other food'. There are about 5100 genera and 250000 species of fungi. Common examples are *Penicillium notatum*, *yeast*, *Agaricua*, *Albugo* etc
- A Lichen is an intimate association of a fungus and an algae in which both the organism intertwine to form a single thallus. Mycobiont from Ascomycetes are called Ascolichen and if it is from Basidiomycetes it is called as Basidiolichen. Algal partner is called phycobiont and is from cyanophyceae or Chlorophyceae. Common examples are *Parmelia*, *Usnea*, *Graphis*.

- Bryophytes do not have vascular tissues. The plant body has root-like, stem-like and leaf-like structures. Bryophytes are terrestrial plants but known as “amphibians of the plant kingdom” as they require water for sexual reproduction. They are present in moist and shady places. Bryophyta includes mosses, hornworts and liverworts. Some of the common examples are *Riccia*, *Marchantia*, *Funaria*, *Sphagnum*, *Antheoceros*, etc.
- Pteridophytes have a well-differentiated plant body into root, stem and leaves. They have a vascular system for conduction of water and other substances. Some of the common examples are *Nephrolepis*, *Selaginella*, *Equisetum*, *Pteris*, etc.
- Gymnosperms have a well-differentiated plant body and vascular tissues. They bear naked seeds, i.e. seeds are not enclosed within a fruit. Some of the common examples of gymnosperms are *Cycas*, *Pinus*, *Ephedra*, etc.
- Angiosperms are seed-bearing vascular plants with well-differentiated plant body. The seeds of angiosperms are enclosed within the fruits. Angiosperms are widely distributed and vary greatly in size, e.g. *Wolffia* is small measuring about 0.1 cm and Eucalyptus trees are around 100 m tall. Angiosperms are further divided into monocotyledons and dicotyledons according to the number of cotyledons present in the seeds. Some of the common examples are mango, rose, tomato, onion, wheat, maize, etc.

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