PLANT KINGDOM

SYSTEM OF CLASSIFICATION

1. **Artificial system of classification : (Given by Linnaeus)**
    - It is based on gross morphological characters (androecium structure size of leaf, shape of leaf etc.).
    - Related organisms are separated into different groups.

    Drawback :
    - Vegetative and sexual characteristic are given equal weightage.
2. **Natural system of classification : (Given by Bentham and Hooker)**
    - Consider many character like embryology, anatomy, cell structure, morphology.
    - Related organisms come in same groups.
3. **Phylogenetic classification system :**
    - Two organisms in single taxa (category) having common ancestor.
    - This system need information from evolutionary relationship.
    - Fossils help in phylogenetic system.

    (a) **Numerical taxanomy** – computer based method.
    Characters are given code/number.
    Large number of characters are considered.

    (b) **Cytotaxonomy** – based on cytological information like chromosome number, structure, behaviour.

    (c) **Chemotaxonomy** – uses the chemical constituents of the plant.

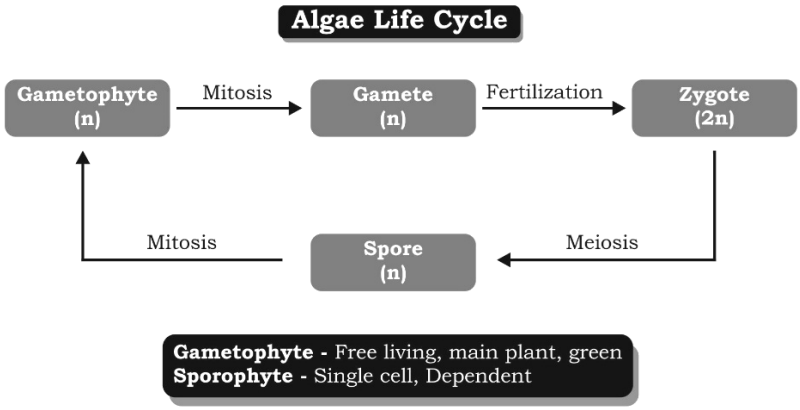
Comparison between different groups of Plant Kingdom

Feature	Algae	Bryophyte	Pteridophyte	Gymnosperm	Angiosperm
Embryophytes	No	Present	Present	Present	Present
Tracheophyta	No vascular bundle	No V.B.	Present	Present	Present
Spermetophyta	No seed	No seed	No seed	Seed-naked	Seed-covered
Dominant phase	Gametophyte	Gametophyte	Sporophyte	Sporophyte	Sporophyte
Main Plant body	Haploid	Haploid	Diploid	Diploid	Diploid
Spore	Homosporus	Homosporus	Mostly homosporus, Heterosporus (*Salvinia* and *Selaginella*)	Heterosporus	Heterosporus
Sex organ	Haploid oogonium (Female sex organ) Antheridium (male sex organ)	Haploid – Archegonium – Antheridium	Diploid – Sporangia (Antheridium) Archegonium develop on prothallus	Diploid sporangia – Microsporangia – Megasporangia (Female cone) bears two or more **archegonia**	Diploid sporangia – Microsporangia (In Anther) – Megasporangia (In pistil)

ALGAE

Classification of Algae			
Characters	**Chlorophyceae**	**Phaeophyceae**	**Rhodophyceae**
Common name	Green algae	Brown algae	Red algae
Habitat	Fresh water & marine water	Mainly marine water	Mainly marine water
Structure	**Filamentous –** *Ulothrix, Spirogyra Cladophora* **Unicellular –** *Chlamydomonas* (Motile) *Chlorella* (Non-motile) **Colonial –** *Volvox*	Filamentous less and more branched – massive Three parts – (a) Frond Main photosynthetic (b)Stipe (c)Holdfast-attachment	Filamentous – Branched
Pigment	Chl. a, b, Xanthophyll and Carotene	Fucoxanthin Chl. a, c and carotenoids	Chl. a & d r-phycoerythrin
Cell wall	Cellulose + Pectin-outer	Cellulose +outer Algin	Cellulose + carrageen + pectin + polysulphate ester

Reserve food	Starch	Laminarin, Mannitol	Floridean Starch
Flagella	2-8, Apical equal in zoospore and gamete	2 unequal, lateral in gamete and zoospore	Absent
Asexual reproduction	Fragmentation, zoospore (2-8 flagella apical)	Fragmentation zoospore (2 flagella unequal lateral)	Fragmentation Aplanospore - non-motile
Sexual reproduction	Isogamous motile – • *Chlamydomonas* • *Cladophora* • *Ulothrix* Isogamous non- motile – • *Spirogyra* Anisogamous– • *Eudorina* Oogamous – • *Volvox*	Isogamous Anisogamous Oogamous • *Fucus*	Only Oogamous



- **Economic Importance of Algae:**
  - At least a half of the total carbon dioxide fixation on earth is carried out by algae through photosynthesis.
  - Increase the level of dissolved oxygen in their immediate environment.
  - Species of *Porphyra*, *Laminaria* and *Sargassum* are among the 70 species of marine algae used as food.

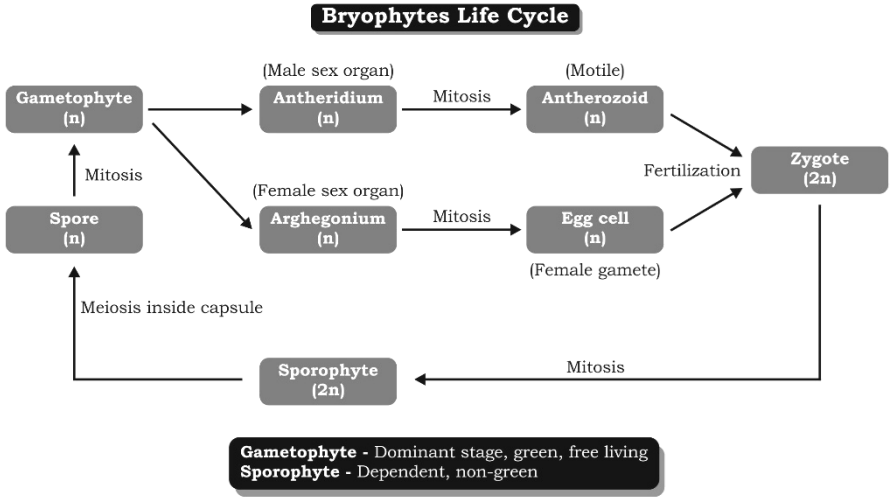
- Certain brown and red algae produce large amounts of hydrocolloids (water holding substances)-algin (brown algae) and carrageen (red algae).
- Agar, obtained from *Gelidium* and *Gracilaria* - used to grow microbes and in preparations of **ice-creams** and **jellies**.
- *Chlorella* used as food supplement even by **space travellers**.

BRYOPHYTES

- Commonly called as **plant amphibian**.
- **Alternation of generation** is observed.
- Vascular tissues are **absent**.
- They lack true stem, leaves and roots.
- Gametophyte is enchored (attached) by **rhizoids**.
- **Sporophyte (sporogonium) is dependent** on gametophyte for nutrition.
- Spores are produced by the sporophyte in a **spore capsule**.
- **Water** is essential for fertilization.
- Sex organs are **multicellular.**
- Fertilization produced an embryo inside the archegonium. Embryo grow into a sporophyte.
- **Protonema** is the juvenile gametophyte.
- Zygote and spores are the first cell of sporophytic and gametophytic generation respectively.
- Life cycle of Moss Plant—*Funaria*.
  - ❖ Commonly called as cord moss or fire moss.
  - ❖ Vegetative reproduction by fragmentation and gemmae.
  - ❖ Sexual reproduction by syngamy.
  - ❖ Archegonium attract sperm by sucrose present in their mucilage.
  - ❖ Sporophyte consists of three parts-foot, seta and capsule.
  - ❖ Funaria is **monoecious**
  - ❖ Fossilised Sphagnum produces peat which is used as fuel as well as manure.

Comparison between Liverwort and Mosses

Feature	Liverwort	Moss
Habitat	Moist soil, bank of river, deep wood	Moist soil
Dominant stage	Gametophyte is horizontal, flat, creeping thallus, Few are leafy with two row of leaf Unicellular rhizoids	Gametophyte, Leafy stage, spiral leaf Multicellular rhizoids on base of stem Non-green foot seta capsule
Sporophyte stage	Non-green- dependent foot, seta, capsule (three part)	Non-green, dependent foot, seta, capsule (more elaborate
Sex organ	Develop on gametophyte on one thallus or on different thallus (*Marchantia*) Antheridium – male sex organ Archegonium – Female sex organ	Develop on gametophyte on same or different thallus Antheridium and Archegonium present on thallus (develop on tip of branch)
Asexual reproduction	Fragmentation, Gemma cup having Asexual haploid bud-Gemmae bud, green multicellular (*Marchantia*)	Fragmentation Budding in Protonema
Spore develops into	Gametophyte stage by mitosis	Spore form protonema (green filamentous, multicellular) And protonema in leafy stage by budding
Special Spore dispersal mechanisms	Absent	Present



PTERIDOPHYTES OR FERNS

Shady, and cool place, some grow in sandy soil, Some medicinal and some are ornamental, Haplodiplontic and Diploid plants

Example –

Pteropsida – Ferns – *Pteris*, *Dryopteris*, *Adiantum*, *Salvinia*, *Azolla*

Lycopsida – *Lycopodium*, *Selaginella*

Sphenopsida – *Equisetum*

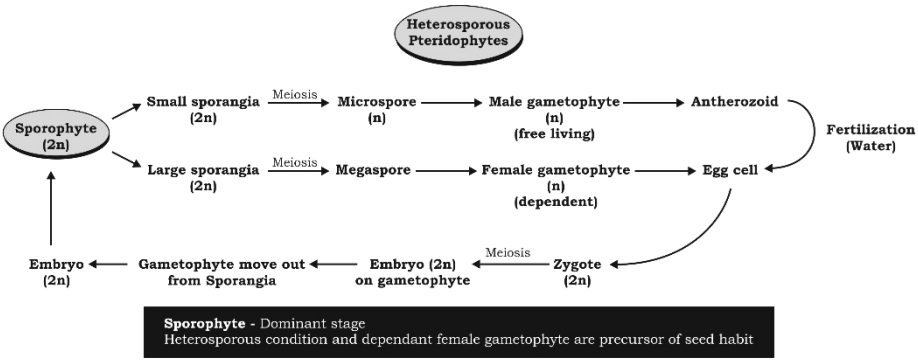
Psilopsida – *Psilotum*

Life cycle – Homosporous pteridophyte-most pteridophyte

Life cycle – Heterosporous pteridophytes – few (*Selaginella*)

Feature	**Pteridophyte**
Main plant or dominant stage	Sporophyte-Green and photosynthetic, free living
Well develop - root stem leaf	Present
Vascular bundle	Present (First time)
Gametophyte	Free living • Photosynthetic • Saprophytic Inconspicuous Short lived, Require shade

Sex organ	Antheridium, Archegonium (Both on same gametophyte) in homosporus
Sporophyte structure	Root, stem, leaf (Microphyll – *Selaginella*) (Macrophyll – *Fern*)
Sporangia	Develop on sporophyll Without cone – *Fern* In form of cone – *Selaginella* and *Equisetum*
Spore	Majority are homosporous except *Selaginella* and *Salvinia* which are heterosporous (produces two kinds of spores – micro and macro)



GYMNOSPERMS

- Feature – Dominant stage- Sporophyte, Shurb, and tree (Medium and large size)
- Example – *Pinus*, *Cedrus*, *Cycas*, *Ginkgo*, *Sequoia* (Red wood, tree, - tallest tree)
- Vascular plants with **naked seeds**.
- Perennial plant of colder region. Annual and herbaceous forms absent.
- Sporophyll produces strobili or cones. Flowers are absent.
- Female gametophyte develops archegonia
- Vessel absent
- Albuminous cell and sieve cell

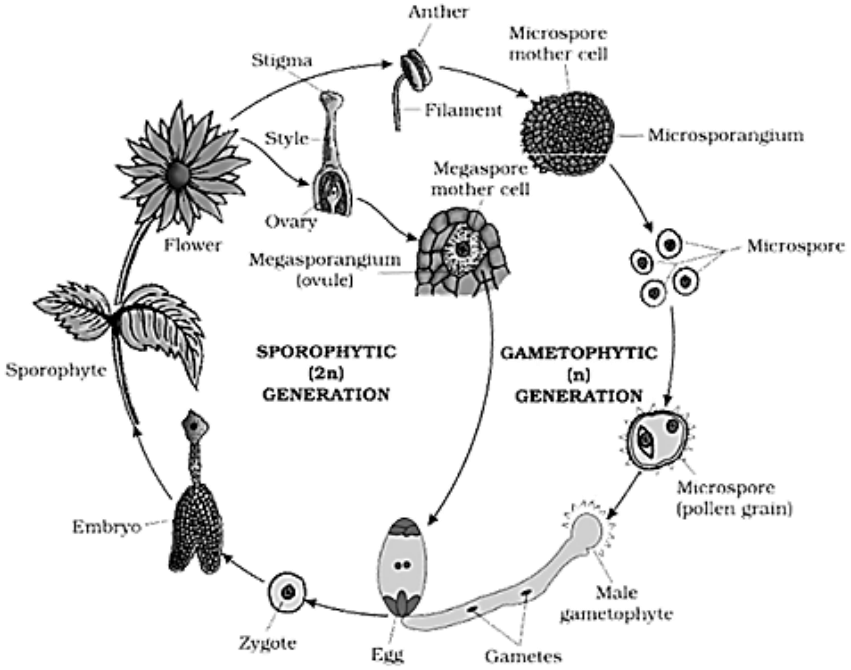
- Secondary growth occur in stem and root Last two condition not present in Pteridophyte, so precursor of seed habit
- Wind pollinated (wing pollen- pinus)
- Double fertilization – Absent
- Haploid endosperm

Comparison between Pinus and Cycas

	Pinus (Conifers)	**Cycas**
Stem	Branched	Unbranched
Leaf	Needle shape Have xerophytic adaptation (thick cuticle sunken stomata)	Pinnate compound Persist for few years
Root	Mycorrhizae present	Coralloid root have cyanobacteria
Cone	Male cone and female cone on same tree (Monoecious)	Male cone on one tree Megasporophyll on other

ANGIOSPERM

- In angiosperms, the seeds are enclosed in fruits, the pollen grains and ovules are developed in specialized structures called flowers.
- Highly evolved plants group.
- Sporophylls are aggregated to form flowers. Therefore, angiosperms are also called flowering plants.
- Both microsporophylls and megasporophylls are specialised. A microsporophyll or stamen consists of a filament and an anther. A megasporophyll or carpel consists of a stigma, style and ovary containing ovules.
- Female gametophyte or embryo sac develops, upto 8-nucleate state prior to fertilization.
- Archegonia are absent. Instead, there is one oosphere surrounded by two specialised synergid cells that attract the pollen tube. The latter brings two naked non-flagellate male gametes.



Life cycle of an angiosperm

Difference between Gymnosperm and Angiosperm

Gymnosperm	**Angiosperm**
Male cone and female cone	Flower present
Pollination by wind	Pollination by both biotic and abiotic
No double fertilization	Double fertilization
Endosperm haploid	Endosperm triploid
Seed naked	Seed cover inside ovary mainly in fruit
Orthotropous	Anatropous
Multicellular female gametophyte with 2 or more Archegonium	7- cell female gametophyte with 3-cell egg Apparatus

Difference between Dicots and Monocots

S.N.	Dictos	Monocots
1.	There are usually two cotyledons.	The seeds contain one cotyledon.
2.	Leaves possess reticulate venation.	The leaves possess parallel venation with a few exceptions.
3.	Primary root often long lived forming tap root system. Adventitious roots occur in some cases.	Primary root is short-lived. Tap root is absent. Instead, adventitious roots are found.
4.	Vascular bundles of the stem possess cambium (vascular bundles open), so that secondary growth is possible.	A cambium is absent (vascular bundle closed).
5.	In root, a pith is absent or small. The vascular bundles are few (8 or less).	In root, a pith is always present. Vascular bundles are many (more than 8).