

CHAPTER : 3 PLANT KINGDOM

ATTEMPTS OF CLASSIFICATION :

1st Attempt

- Superficial features used by biologists
- Morphological features were basis of classification –
 - Colour
 - Number
 - Leaf shape
 - Habitat

2nd Attempt

- Considered as artificial classification system
- Vegetative characters were basis of classification
- Many closely related plants came under same division
- Characters affected by environmental changes

3rd Attempt

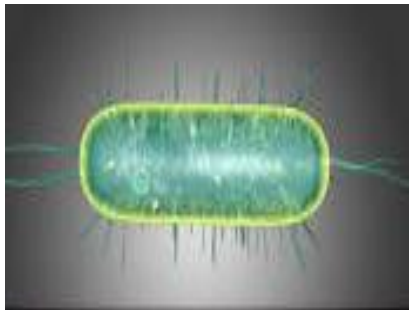
- Considered as natural classification system
- External & internal features of plants were considered

4th Attempt

- Phylogenetic classification
- Evolutionary relationship is the basis of classification
- Plants under one category are considered to have common ancestor
- Many classification issues got solved by this method

WHITTAKER'S 5 KINGDOM CLASSIFICATION :

Monera



Protista



Fungi



Plantae



Animalia



LIFE CYCLE OF PLANTS :

ALTERNATION OF GENERATIONS :

Rotation between the sporophyte & gametophyte generations

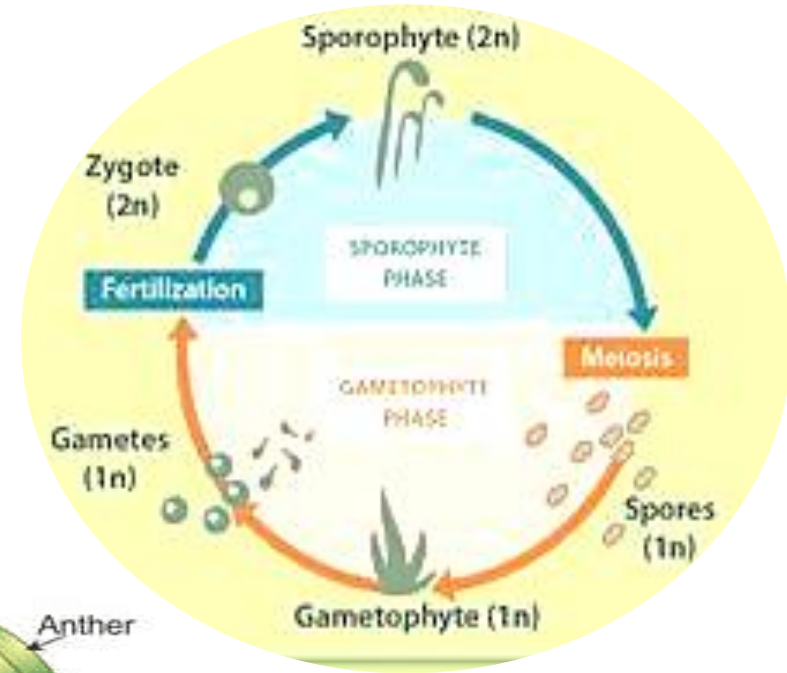
Sporophyte: Diploid plant (2 sets of chromosomes)

Gametophyte: Haploid plant (1 set of chromosome)

Mitosis: Production of haploid gametes by gametophytes

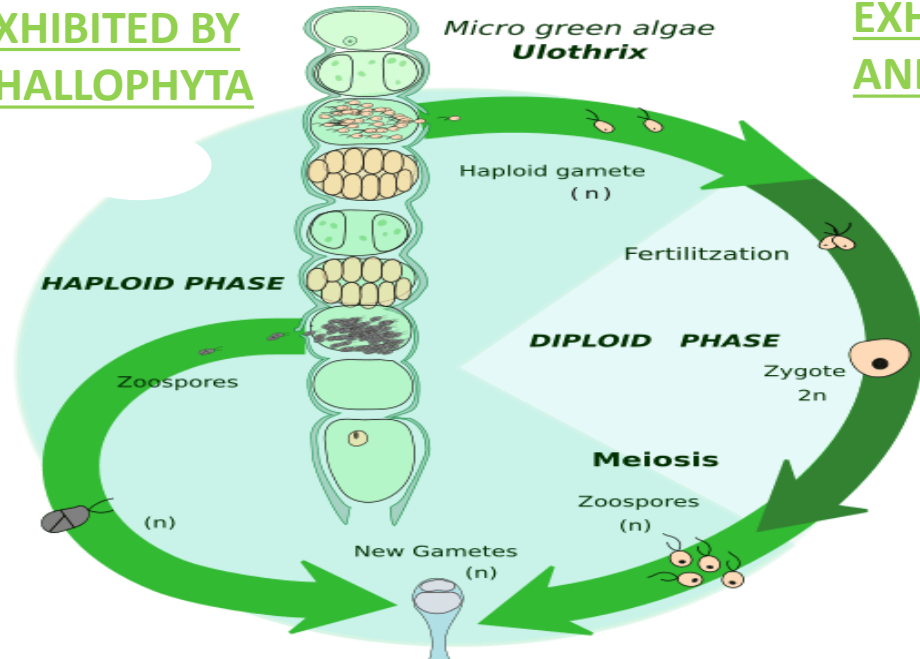
Meiosis: Production of haploid spores by sporophytes

Fertilization: Fusion of male & female gametes to form diploid zygote



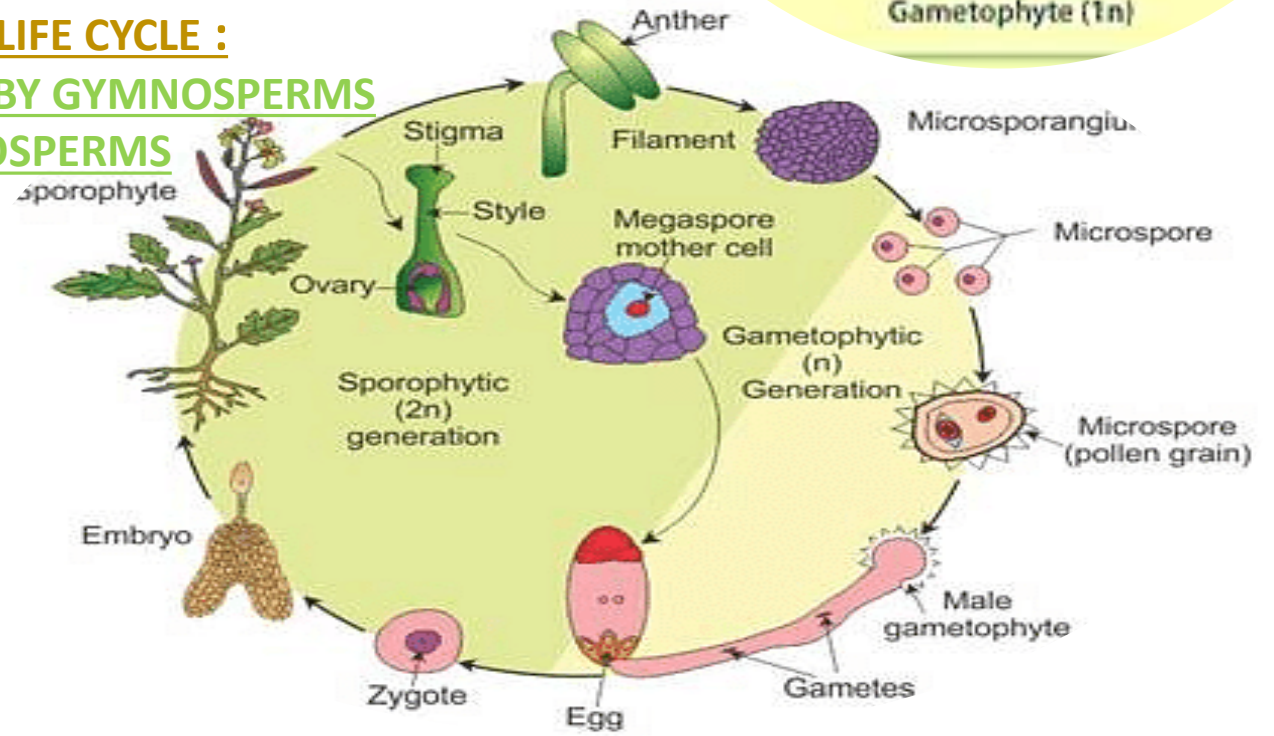
HAPLONTIC LIFE CYCLE :

EXHIBITED BY THALLOPHYTA



DIPLONTIC LIFE CYCLE :

EXHIBITED BY GYMNOSPERMS AND ANGIOSPERMS



THALLOPHYTA :

Alternation of Generations

- They consist of various types of algae
- Possess thallus-like body design which is undifferentiated
- Chlorophyll containing unicellular or multicellular autotrophs
- Simplest forms of producers in food chain
- Life cycle: Haplontic life cycle
- Habitats: Freshwater, marine water, moist stones, wood & soil
- Lichen: Mutual association between fungi & algae

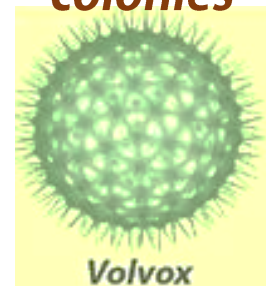


FORMS OF EXISTENCE :

colonies

unicellular

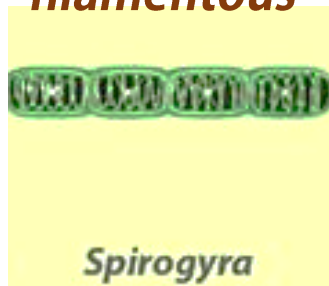
filamentous



Volvox



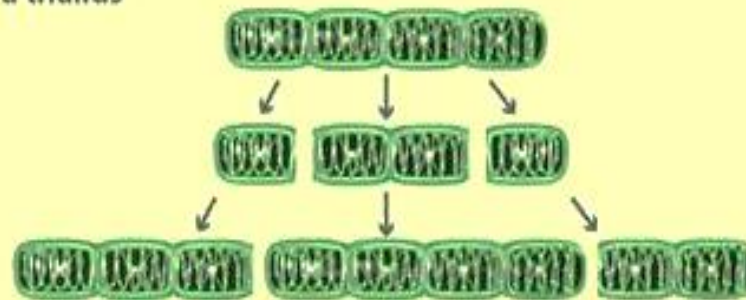
Chlamydomonas



Spirogyra

Unique Features

- Length: Microscopic to upto 60 m
- Can perform photosynthesis
- Reproduction: Vegetative, asexual & sexual
 - Vegetative reproduction: Each fragment develops into a thallus

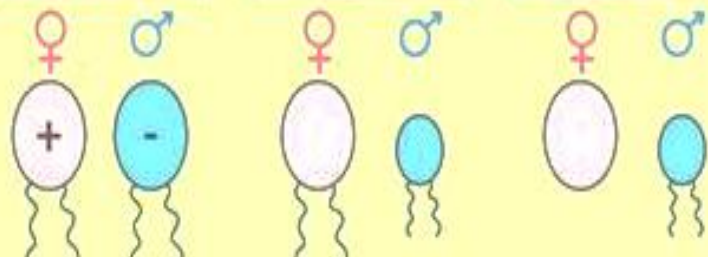


- Asexual reproduction: Occurs using flagellated zoospores
- Sexual reproduction: Size & gametes vary

Isogamous

Anisogamous

Oogamous



Classification

Chlorophyceae

Phaeophyceae

Rhodophyceae

Importance

- Produce half of the earth's oxygen
- Source of crude oil
- Algal biofuels can replace fossil fuel
- Keep atmospheric carbon dioxide stable & use it efficiently
- *Gelidium* and *Gracilaria* are source of agar that is used in making jellies & ice-creams



- *Chlorella* & *Spirulina* are superfood:

Spirulina products



BRYOPHYTA :

- Amphibians of plant kingdom
- Grow in terrestrial environment but depend on water for reproduction
- Grow in moist & shady areas
- Responsible for plant succession on bare rocks
- **Habitat:** Arid forests, rainforests, apart from the alpine habitats
- Grow on rocks, soil, tree trunks, bones, rotting wood etc.



UNIQUE FEATURES :

- **Length:** Few millimetre to 1 m
 - Partially differentiated body, lacking true roots, leaves & stem
 - Root-like structure called rhizoid present, body is more thallus-like & haploid
- Spore producing, non-vascular plants
 - Exhibit haplo-diplontic life cycle

Importance

- Have the ability to initiate soil formation in barren lands as they survive on bare rocks
- Maintain soil moisture & replenish nutrients in forest vegetation
- Peat mosses act as biofuel & are economically useful



- Used as packing material for shipment of living material as they can retain water

Classification

Liverworts

e.g.: *Marchantia*



Mosses

e.g.: *Sphagnum*



- **Reproduction:** Sex organs are multicellular. Antheridium is the male sex organ while archegonium is the female sex organ
 - Antheridium produces antherozoids with 2 flagella & archegonium produces single egg
 - **Reproduction procedure:**
 - (i) Antherozoids released in water come in contact with archegonium
 - (ii) Male & female gametes fuse to form zygote which remains in archegonium for some time
 - (iii) Mitosis of zygote forms embryonic sporophyte that is covered & protected by calyptra
 - (iv) Meiosis occurs in sporophyte to produce haploid spores which germinate to produce gametophyte
 - Gametophyte supply nutrients & gametophore supply water & minerals to embryo

PTERIDOPHYTA :

- Family of ferns & horsetails
- Called cryptogams as they don't bear flowers & seeds
- First group of terrestrial vascular plants
- Found in damp and shady places



horsetails



ferns



Pteridophytes



Psilopsida

UNIQUE FEATURES :

- **Length:** Mostly short but few grow tall upto few metres
- Plant body is differentiated into true roots, leaves & stems
- Leaves can be small (**microphylls**) or large (**megaphylls**)

• **Reproduction procedure:**

- i. Antherozoids are released in water and come in contact with archegonia
- ii. Gametes fuse in the archegonium to produce zygote
- iii. Zygote produces sporophyte after division

• Spores: Homosporous or heterosporous

- Sporangia bear leaf-like appendages - **Sporophyll**
- Sporophylls form compact structures called **cones** or **strobili** in some plants
- **Reproduction:** Show true alternation of generation

→ In heterosporous plants, microspore & megaspore give rise to male & female gametophyte respectively

CLASSIFICATION:

Psilopsida
Lycopsida
Sphenopsida
pteropsida



Lycopsida



Sphenopsida

- Dominant sporophyte produce spores by meiosis & gametophyte produces gametes by mitosis
- Sporangia produce spores in the spore mother cells that germinate to give gametophytes
- Gametophytes are free-living, multicellular, photosynthetic – **Prothallus**
- Male sex organ antheridia produce antherozoids & female sex organ is archegonia

GYMNOSPERMS:

- Consist of pines & deodars
- Gymno – naked; Sperma – seed
- Plants with naked seeds that do not bear flowers & fruits
- Seeds are visible as cones & develop on surface of reproductive structures



Cone



Pine

UNIQUE FEATURES :

- Wind is the major source of pollination
- **Length:** Medium to large trees & few are shrubs
- Vascular & complete differentiation into leaves, stems & roots
- **Leaves:** Needle-like with thick cuticle & sunken stomata
- **Roots:**
 - Taproot system
 - Some form mycorrhiza (e.g.: *Pinus*)
 - Some form specialized roots called coralloid roots (e.g.: *Cycas*)
- **Reproduction:**
 - Male & female cones can be on same (e.g.: *Pinus*) or different (e.g.: *Cycas*) plants
 - Heterosporous plants that produce haploid microspores & megaspores
 - **Male cones:** Contain microsporophyll, few of which develop into pollen grains & rest degenerate
 - **Female cones:** Several megasporophyll cluster to form female cone
 - Female cone bears ovule with megasporangium & give rise to haploid megaspores & a megaspore mother cell.



Leaves



cycas



Taproot

CLASSIFICATION:

- *Pinophyta*
- *Cycadophyta*
- *Ginkgophyta*
- *Gnetophyta*

ANGIOSPERMS:

- The family of flowering plants
- Vascular flora dominating across the globe
- Called phanerogams due to the presence of flowers
- Seeds (ovules) are enclosed inside hollow ovary (which forms the fruit)

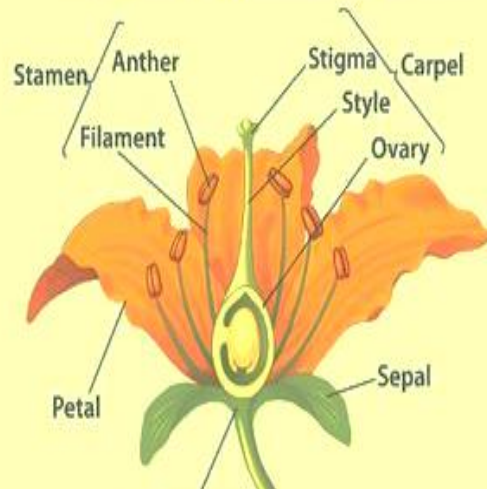


UNIQUE FEATURES :

- Well differentiated plant body with fully developed root & shoot system
- Survive in various habitats
- **Length:** Microscopic *Wolffia* to >100 m tall *Eucalyptus*
- Vast diversity including woody trees, shrubs & herbs
- Leaves, stems & roots are adapted as per habitat
- **Reproduction:**
 - + Flower is the reproductive structure – can be unisexual or bisexual



Structure of an idealized flower



- **Alternation of generation** - haploid gametophyte alternates with the diploid sporophyte
- **Double fertilization** is characteristic to Angiosperms – Syngamy & triple fusion
- **Post-fertilization** ovary forms the fruit & ovules form the seeds & remaining parts wither off



Classification

- 1 cotyledon
- Adventitious roots
- Simple leaves with parallel venation
- Trimerous flowers
- More vascular bundles that are closed

Monocot



Banana

Dicot



Sunflower

- 2 cotyledons
- Taproot system
- Flowers can be tetramerous or pentamerous
- 2-6 vascular bundles arranged in ring form