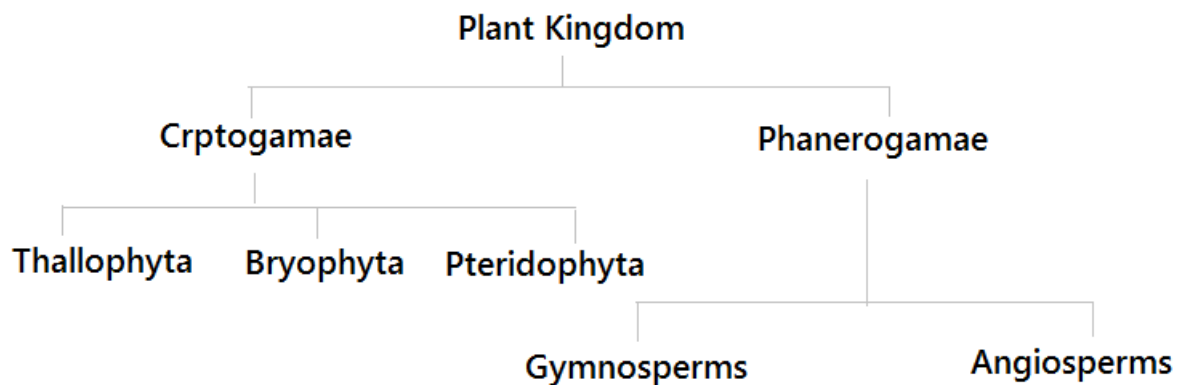


Plant Kingdom

Kingdom Plantae includes green, brown and red algae, liverworts, mosses, ferns and seed plants with or without flowers. They have the following characters:-

- (1) Multicellular organisms with walled and frequently vacuolate eukaryotic cells.
- (2) They contain photosynthetic pigment in plastids.
- (3) Principle mode of nutrition is photosynthesis but number of plants has become absorptive.
- (4) Primarily non-motile, living anchored to a substrate.
- (5) Structural differentiation leading towards organs of photosynthesis, anchorage and support and in higher forms towards specialized photosynthetic, vascular and covering tissues.
- (6) Reproduction is primarily asexual or sexual. The reproductive organs are multicellular.
- (7) A multicellular embryo is formed during development from the zygote. Algae lack embryo stage. Life cycle consists of alternating haploid gametophyte and diploid sporophyte generation. This phenomenon is called alternation of generation.



Thallophyta

Algae

- (1) The branch of botany dealing with the study of algae is called as phycology or algology.
- (2) It is derived from the Greek word Phykos which means 'alga' or 'sea weed'.
- (3) They are simple, autotrophic non-vascular plants having unicelled sex organs and no embryo formation.
- (4) According to Fritsch, (1935) the designation alga must include all holophytic organisms.
- (5) Specialized habitats

(a) **Cryophytes:** Plants growing on snow or ice are called as cryophytes.

(b) **Thermophytes:** Plants growing in hot water are called as thermophytes

(c) **Epiphytes:** Several algal forms grow on other plants (algae, angiosperms) as epiphytes. e.g., Oedogonium, Cladophora, Vaucheria etc.

(d) **Endophytes:** Some blue-green algae grows as endophytes inside other plants e.g., Anabaena growing inside the leaf of Azolla (fern)

(e) **Epizoic:** Algae growing on the bodies of animals are described as epizoic. e.g., Cladophora crispata grows on snail shell.

(f) **Endozoic:** Algae growing inside the body of animals. e.g., Chlorella grows with in the tissue of Hydra.

(g) **Symbiotic forms:** Some algae like Chlorella, Nostoc etc. growing in symbiotic relationship with members of Ascomycetes and Basidiomycetes (Fungi) constitute the lichen.

(6) **Parasites:** The alga Cephaleuros virescens grows a parasite on the tea leaves.

(7) **Thallus organization:** The algae show a considerable variation in the organization of the thallus.

(i) **Unicellular forms:** Several members of algae are unicelled. They may be motile (Chlamydomonas) or non-motile (diatoms).

(ii) **Multicellular forms:** The multicelled algae show a considerable range in their organization.

(a) **Colonial:** A colony consists of independent organisms. While the colony of Volvox is motile, that of Hydrodictyon is fixed.

(b) **Planeloid:** Here the vegetative cells of the alga get surrounded by a mucilagenous matrix e.g., Tetraspora.

(c) **Dendroid:** Here the colony appears like a microscopic tree. There is secretion of mucilage from the polar end e.g., Ectocarpus.

(d) **Filamentous:** The filaments may be uniseriate or multiseriate, free floating or attached, unbranched (Ulothrix) or branched (Cladophora).

(e) **Siphonous:** An aseptate, multinucleate (coenocytic) condition of a filament or thallus constitutes the siphonous habit e.g., Vaucheria.

(f) **Parenchymatous:** Parenchymatous organization of the thallus has been observed in many members of brown algae (Sargassum, Laminaria), red algae (Gracillaria, Porphyra) and a few green algae (Chara, Ulva) etc.

(8) **Classification:** Linnaeus (1754) differentiated a group of plant and called as 'algae' where he included lichens and liverworts also. Fritsch (1935) classified algae into 11 classes as under :

(i) Chlorophyceae (Green algae)

(ii) Xanthophyceae (Yellow-green algae)

(iii) Chrysophyceae

(iv) Bacillariophyceae (Diatoms)

(v) Cryptophyceae

- (vi) Dinophyceae (Dinoflagellates)
- (vii) Chloromonadineae
- (viii) Euglenineae (Euglenoids)
- (ix) Phaeophyceae (Brown algae)
- (x) Rhodophyceae (Red algae)
- (xi) Myxophyceae or Cyanophyceae (Blue green algae)

Salient features of some selected classes

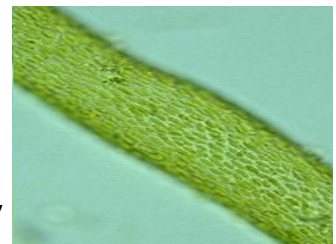
(i) Chlorophyceae

- (a) Plants fresh water or marine.
- (b) Forms unicelled to parenchymatous.
- (c) Cells showing eukaryotic organization.
- (d) **Chief pigments** – Chlorophyll a, b; a, b, g- carotenes, lycopene, lutein, violaxanthin.
- (e) **Reserve food** – Starch and oils.
- (f) Zoospore formation occurs.
- (g) Male gametes flagellate.
- (h) Flagella identical.
- (i) **Sexual reproduction** – Isogamous, anisogamous or oogamous.



(ii) Xanthophyceae

- (a) Plants generally fresh water.
- (b) Forms unicelled to siphonous.
- (c) Cells showing eukaryotic organization.
- (d) **Chief pigments** – Chlorophyll a,e and beta-carotene, violaxanthin, neoxanthin.
- (e) **Reserve food** – Chrysolaminarin and oils.
- (f) Zoospore formation occurs.
- (g) Male gametes flagellate.
- (h) Flagella non-identical (unequal).
- (i) **Sexual reproduction** – Isogamous, anisogamous or oogamous.



(iii) Phaeophyceae

- (a) Plants marine
- (b) Forms unicelled to parenchymatous
- (c) Cells showing eukaryotic organization
- (d) **Chief pigments** – Chlorophyll a, c; beta-carotene, fucoxanthin, lutein, violaxanthin, diatoxanthin.
- (e) **Reserve food** – Laminarin, mannitol and oils.
- (f) Zoospore formation occurs.
- (g) Male gametes flagellate.
- (h) Flagella unequal.
- (i) **Sexual reproduction** – Isogamous , anisogamous or oogamous.



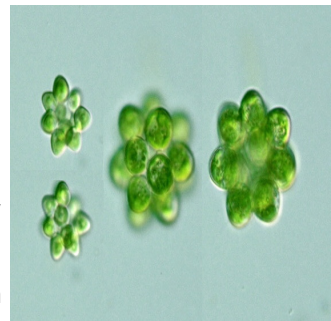
(iv) Rhodophyceae

- (a) Plants generally marine.
- (b) Forms filamentous to parenchymatous.
- (c) Cells showing eukaryotic organization.
- (d) **Chief pigments** – Chlorophyll a, d is present but chlorophyll c is absent; a, b-carotene, lutein, violaxanthin, fucoxanthin, myxoxanthin, g-phycoerythrin, g-phyocyanin and allophyocyanin.
- (e) **Reserve food** – Floridean starch, galactan -SO₄ polymers.
- (f) No zoospore formation.
- (g) Male gametes non-flagellate.
- (h) Sexual reproduction by specialized type of oogamy.
- (i) Life cycle haplobiontic or diplobiontic.



(v) Myxophyceae (Cyanophyceae)

- (a) Plants generally fresh water, a few forms marine.
- (b) Forms unicelled to filamentous.
- (c) Cells showing prokaryotic organization.
- (d) **Chief pigments** – Chlorophyll a; b-carotene; luteins, myxoxanthin, oscillaxanthin, c-phyocyanin, c-phycoerythrin, allophyocyanin.
- (e) **Reserve food** – Cyanophycean starch (glycogen) and cyanophycin (protein).
- (f) No zoospore formation.
- (g) No flagellate bodies.



(h) No sexual reproduction.

Bryophyta

(1) Bryophyta (Gk: Bryon = moss; phyton = plants) includes the simplest and primitive land plants.

(2) Due to peculiar type of their habitats, they are regarded as 'the amphibians of the plant kingdom'.

(3) **Habitat:** Bryophytes usually grow in moist and shady places.

(4) **Specialized habitats:** Some bryophytes grow in diverse habitats such as –

(a) Aquatic (e.g., *Riccia fluitans*, *Ricciocarpus natans*, *Riella*), epiphytes (e.g., *Dendroceros*, *Radula protensa* and many mosses), saprophytes (e.g., *Buxbaumia aphylla*, *Cryptothallus mirabilis*)

(b) Dry habitats such as dry heaths (e.g., *Polytrichum juniperinum*), deserts (e.g., *Tortula desertorum*) and dry rocks (e.g., *Porella platyphylla*).

(5) Sexual reproduction: The male sex organ is called as antheridium and the female as archegonium.

(6) Salient features of classes

(i) **Hepaticopsida:** The latin word Hepatica means liver. Thus the members of hepaticopsida are popularly known as liverworts.

(ii) **Anthocerotopsida:** This class is characterized by the following characters –

(a) Gametophyte is thalloid. Thalli are lobed, dorsiventral, and internally homogenous without any differentiation of tissues.

(b) Air chambers and air pores are absent but mucilage cavities may be present.

(c) Rhizoids are only smooth walled.

(d) Scales are absent.

(e) Each cell possesses single (some times more) large chloroplast with central pyrenoid.

(f) Oil bodies are absent.

(g) Antheridia are endogenous in origin, borne singly or in groups inside the closed cavities.

(h) Sporogonium is differentiated into foot, meristematic zone and capsule (the seta is absent).

(i) Capsule has central sterile columella.

(iii) **Bryopsida:** The members of bryopsida are commonly known as mosses. The class is characterised by the following characters –

(a) Gametophyte is differentiated into two stages – prostrate protonema and erect radial leafy shoot.

(b) Leaf-like appendages are spirally arranged on stem – like axis.

(c) Rhizoids are multicellular with oblique septa.

(d) Sex organs develop from superficial cells.

(e) Sporogonium is differentiated into foot, seta and capsule.

- (f) Wall of capsule is several layered with stomata on epidermis.
- (g) The capsule has central columella.
- (h) Elaters are absent.

Pteridophyta

- (1) The pteridophytes (Gk. Pteron = feather and phyton = plants ; means plants with feather like fronds or ferns). They are flowerless, seedless, spore producing vascular plants which have successfully invaded the land.
- (2) **Habitat:** The plants of pteridophytes are mostly terrestrial. They prefer shady habitats.
- (3) They have Sporophytic plant body
- (4) **Apical growth:** The pteridophyte generally possesses a single apical cell with three cutting faces in the shoot apex.
- (5) Salient features of sub-phyla

(i) Sub-phylum: Psilopsida

- (a) These are the oldest known vascular plants; most of them (except Psilotum and Tmesipteris) are fossils.
- (b) Plant body is relatively less differentiated.
- (c) Roots are absent; instead dichotomously branched rhizome is present.
- (d) Aerial axis is either naked or have small spirally arranged leaves.
- (e) Sporangia are cauline (i.e., directly borne on the axis or stem); they are lateral or terminal in position. e.g., Psilotum, Tmesipteris.

(ii) Sub-Phylum: Lycopsidea

- (a) Plant body is differentiated into root, stem and leaves.
- (b) Leaves small (i.e., microphyllous) with a single unbranched vein.
- (c) Sporangia develop in the axil of the sporophylls.
- (d) Sporophylls generally form compact strobili. e.g., Lycopodium, Selaginella, etc.

(iii) Sub-Phylum: Sphenopsida

- (a) Stem differentiated into nodes and internodes.
- (b) Leaves microphyllous, present in whorls at each node.
- (c) Sporangia are borne on the sporangiophores which form compact cones at the apex of the fertile branches. e.g., Equisetum.

(iv) Sub-Phylum: Pteropsida

- (a) Plant body well differentiated into root, stem and leaves.

(b) Leaves megaphyllous, pinnately compound.

(c) Sporangia develop on the ventral surface of the sporophylls, usually aggregated into sori. e.g., Dryopteris, Pteris, Pteridium, Polypodium, etc.

Angiosperms

(1) The angiosperms, or flowering plants, constitute the most dominant and ubiquitous vascular plants of present day flora which changed the green and yellow melancholy of the earth's vegetation by the colourful brightness and fragrance of their flower.

(2) The term angiosperm means 'enclosed seed' because the ovules or potential seeds are enclosed within a hollow ovary.

(3) **Classification:** The plants of Angiosperms divided into two major groups as – Dicotyledons and Monocotyledons.

(i) Dicotyledons :

They are show following distinguished characteristics.

(a) Tap roots found in the members of this group.

(b) The leaves in members of these class exhibit reticulate (net like) venation.

(c) The flowers are tetramerous or pentamerous having four or five members in the various floral whorls, respectively.

(d) The vascular bundles arranged in a ring, numbering 2–6, open and with cambium.

(e) The seeds of dicotyledons are with two cotyledons as the name indicate.

(ii) Monocotyledons:

They are show following distinguished characteristics:

(a) Adventitious roots found in the members of this group.

(b) The leaves are simple with parallel venation.

(c) The flowers are trimerous having three members in each floral whorl.

(d) The vascular bundles scattered in the ground tissue, many in number, closed and without cambium.

(e) The seeds of monocotyledons are with one cotyledon as the name indicates. e.g., Cereals, bamboos, sugarcane, palms, banana, lilies and orchids.

Gymnosperms

(1) Living gymnosperms are mostly perennials, xerophytic, evergreen, arboreal and woody plants.

(2) They grow as wood trees, bushy shrubs or rarely as climbers (e.g., Gnetales).

(3) None of them are herbs or annuals.

(4) External features:

- (i) The plant body is sporophyte and differentiated into root, stem and leaves.
- (ii) The plant possesses well developed tap root system. In some cases the roots are symbiotically associated with algae (e.g., Coralloid roots of *Cycas*) or with fungi (e.g., Mycorrhizal roots of *Pinus*).
- (iii) The stem is erect, aerial, solid, woody and branched (unbranched in *Cycadales*) but almost tuberous in *Zamia*.
- (iv) The leaves may be microphyllous or megaphyllous.

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