CYANOPHYCEAE

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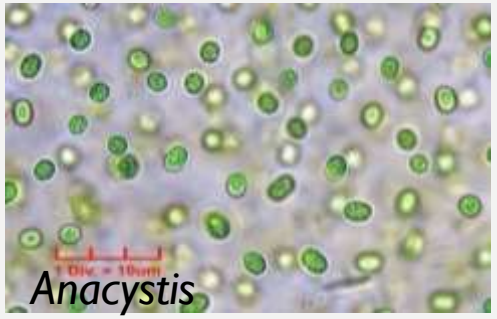
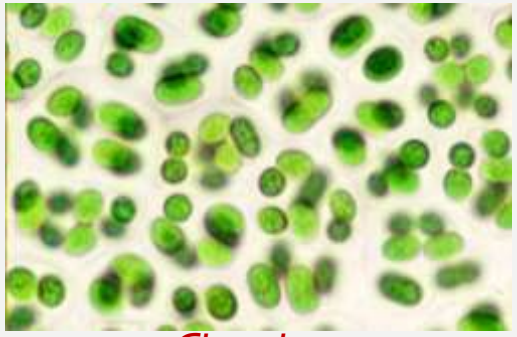
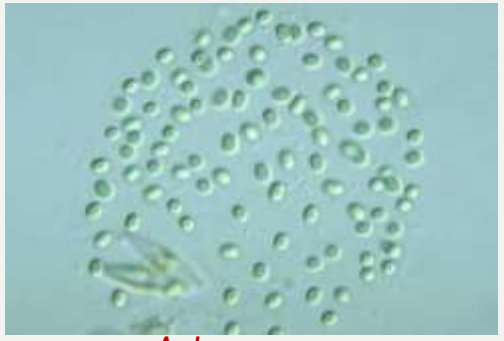
MORPHOLOGY

- Non-filamentous, coccoid and palmelloid form to filamentous ones
- Non- filamentous forms
  - single cells (*Chroococcus, Synechococcus, Anacystis, Gleocapsa*) or
  - grouped in palmelloid colonies (*Gloeothece , Aphanocapsa*)





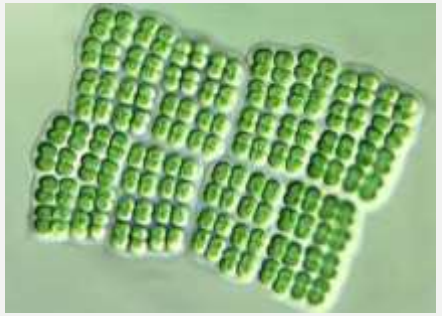


MORPHOLOGY

- coccoid forms
  - spherical or sometimes cylindrical or fusiform,
  - multiplying in one/two/three directions
  - form daughter cells which may readily separate out or may remain aggregated
  - microscopic or macroscopic
  - cubical/spherical/square/irregular

MORPHOLOGY

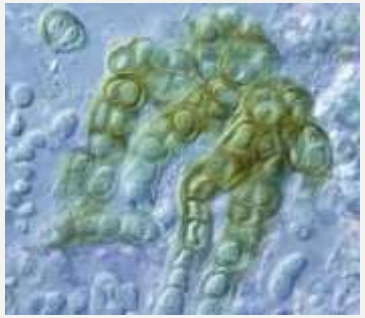
- *Merismopedia* and *Holopedia* - tubular or cubical
- *Chamaesiphon* - base and apex differentiation
- *Pleurocapsa* and *Hyella* - heterotrichous organization



Merismopedia

Chamaesiphon

Pleurocapsa



Hyella

MORPHOLOGY

- Filamentous form - frequent cell divisions in one plane and in a single direction
- Cells in the trichome are held tighter by separation walls or a common gelatinous sheath

- Trichome may be straight – *Oscillatoria*; spirally coiled – *Spirulina*; whiplike – *Rivularia*; tapers towards both the ends – *Aphanizomenon*; single trichome – *Oscillatoria* and *Lyngbya*; several trichomes – *Microcoleus* and *Hydrocoleus*

MORPHOLOGY

Special Cells

- Akinetes
  - asexual resting state, resist harsh environments and germinate to form new cells
  - larger than vegetative cells
  - thickened extra cellular envelope
  - enlarged and filled with food reserves
  - contain glycogen & proteins (cyanophycin)
  - uphold low level of metabolic activities

MORPHOLOGY

Special Cells

- Heterocysts
  - nitrogen fixation, found in the members of Nostocales and Stigonematales
  - thick outer wall, multi-layered envelop outside the cell wall
  - outer fibrous layer - uniformly thick, middle (homogenous) and inner (thin lamellar) layer - thicker at the polar ends
  - terminal – *Gloeotricha*, intercalary - *Nostoc* and *Scytonema*, lateral - *Nostochopsis*

MORPHOLOGY

Special Cells

- Heterocysts
  - solitary or in pairs (*Anabaena*)
  - contain mostly carotenoids, Chl a present, phycobiliprotein absent
  - Thylakoids (lamellae) tightly packed, concentrated near the periphery
  - lamellae contain two lipids, glycolipids and acyl lipids

MORPHOLOGY

Special Cells

- Hormogonia
  - short, non-heterocystous filaments of cells
  - smaller than the cells of the vegetative trichome
  - *Nostoc*, *Oscillatoria* and *Cylindrospermum*
  - possess gliding motility, produce gas vacuole giving them buoyancy
  - transient morphological form

REPRODUCTION

- Vegetative and asexual mode
  - Vegetative - cell division (unicellular), fragmentation and hormogonia formation (multicellular)
  - Asexual - Exospores and endospores – *chamaesiphonales* and *pleurocapsales*
  - Smaller than the cells of the vegetative trichome
  - Sexual reproduction is absent (Sex organs, gametes and flagellated zoospores are altogether absent)
  - Genetic recombination (*Anabaena* , *Nostoc* , *Synechoccus* and *Cylindrospermum*)

REPRODUCTION

- Endospores
  - protoplasm of the heterocyst divides successively
  - thin walled, cannot be regarded as resting spores
  - Disintegration of the capsule wall – liberation
  - Germinate to form new trichomes

CHLOROPHYCEAE

GENERAL CHARACTERS

- Oxygenic photosynthetic eukaryotes
- Presence of chloroplast with a double- membrane envelope, chlorophyll a and b , stacked thylakoids and interplastidial starch
- Thalloid plant body
- More than 7,500 species growing in a variety of habitats.

OCCURRENCE

- Aquatic and are predominantly freshwater (river streams, lakes, ponds, puddles, ditches and other kinds of freshwater bodies)
- *Spirogyra* and *Hydrodictyon* frequently form noticeable but harmless blooms; *Chlamydomonas, Volvox* and *Chlorella* are frequently found in freshwaters
- Only about 10 % are marine
- Some are terrestrial

OCCURRENCE

- Terrestrial forms grow on moist aerated soils, rocks and cliffs
- *Fritschiella* – acidic soils
- *Stichococcus, Hormidium, Chlorella* – loam cultivated soils
- *Ulothrix* and *Zygogonium* - form of sheets on damp soil
- *Trentepohlia* - orange-red growths on moist rocks or cliff faces

OCCURRENCE

- Members of Caulerpales are predominantly marine
- Macroscopic growths in near shore marine environments - *Ulva* (sea lettuce), *Codium* (dead man's fingers), *Enteromorpha, Cladophora*.

OCCURRENCE

Specialized habitats

- *Protococcus* and *Trentepohlia* - epiphytic on sea weeds or on the bark of trees
- *Chlorella* – endophytic
- *Cephaleuros* and *Rhodochytrium* – parasitic
- *Chlamydomonas nivalis* - cryophilic

THALLUS ORGANISATION

- Heterogenous group
- Motile unicellular forms, multicellular flagellated or non flagellated colonies,
- Palmelloid forms, dendroid forms,
- Filamentous forms, heterotrichous forms, siphonous forms,
- Well developed parenchymatous thalli
- Thallus with well differentiated tissues which bear leaf and stem like structures and resemble land plants

THALLUS ORGANISATION

- Unicellular motile – Chlamydomonas
- Unicellular non-motile – Chlorella
- Coenobium – Motile (Volvox), Non-motile (Hydrodictyon)
- Palmelloid – Temporary (Chlamydomonas), Permanent (Tetraspora)
- Dendroid – Ecballocystis

THALLUS ORGANISATION

- Filamentous unbranched – Oedogonium
- Filamentous branched – Chladophora
- Heterotrichous – Coleochaete
- Siphonaceous – Codium
- Parenchymatous – Ulva
- Complex forms – Chara

CELL STRUCTURE

Cell wall

- Cellulose is the main structural polysaccharide with additional xylans and mannans,
- Cellulose microfibrils (30–200 Å wide) – two or three layers thick

Mucilage

- Contain rhamnose, galactan sulphate and uronic acid
- Some yield galactose, mannose and arabinose on hydrolysis

CELL STRUCTURE

Flagella

- One to four - equal length - anterior or apical end - whiplash type - basal body or blepharoplast
- Axoneme consists of 11 (9 peripheral + 2 central) microtubules

Nucleus

- Uni/multinucleate

CELL STRUCTURE

- Mitochondria, Golgi Bodies, Endoplasmic Reticulum and Contractile Vacuoles present

Chloroplast

- Thylakoids are much larger than those of higher plants – various shapes – cup, stellate, laminate, girdle, reticulate, spiral

CELL STRUCTURE

Pyrenoid

- Proteinaceous body - central granular core surrounded by tightly packed starch plates – diminish during starvation
- Component of the carbon concentrating mechanism (CCM)
- Contains large amount of enzyme RuBisCO

Eyespot

- Photoreceptive organ - consists of a curved pigment plate and a biconvex hyaline lens – contains huge accumulation of carotenoids

REPRODUCTION

- Vegetative, asexual and sexual
- Vegetative – fragmentation, binary fission
- Asexual – Zoospores (*Ulothrix, Chlorococcum*), Aplanospores, Hypnospores, Autospores (*Chlorococcales*), Palmella stage
- Sexual - Isogamy, Anisogamy, Oogamy

ASEXUAL REPRODUCTION

Zoospore formation (Chlamydomonas)

- Formed during the night
- Parent cell comes to rest, withdraws its flagella, contractile vacuoles disappear and the protoplast withdraws from the cell wall
- Cell divides longitudinally into two daughter protoplasts - second division - right angles - 4, 8 or 16 uninucleate protoplasts - successive mitotic divisions

ASEXUAL REPRODUCTION

Zoospore formation (Chlamydomonas)

- Each daughter protoplast secretes a new cell wall, develops flagella, and contractile vacuoles
- Daughter cells – smaller in size
- Parent cell wall ruptures or gelatinizes - liberated zoospores - produce new zoospores after 24 h

ASEXUAL REPRODUCTION

Zoospore formation (Ulothrix)

- Favourable conditions – any cell – zoosporangium - 2, 4, 8, 16 or 32 daughter protoplasts – longitudinal division
- Macro (bigger, oval and quadriflagellate, 2-8 nos.) and microzoospores (smaller, pear shaped, and bi- or quadriflagellate, 8-32 nos.)
- Hypnospores - lack flagella and eyespot – have thick cell wall

ASEXUAL REPRODUCTION

Aplanospore formation (Chlamydomonas)

- Unfavourable conditions such as drought - cells come to rest and withdraw their flagella
- Protoplast rounds up - divides into daughter protoplasts - secretes thin wall - aplanospore germinates into a new individual
- Severe drought - thick walled resting spore - hypnospore

ASEXUAL REPRODUCTION

Palmella stage (Chlamydomonas)

- Unsuitable conditions – cell division - 4–8 daughter cells - non-motile cells – clustered in mucilaginous matrix
- Temporary perennating stage - presence of water - develop flagella - escape out - mature into large vegetative cells

ASEXUAL REPRODUCTION

Gonidia (Volvox)

- Reproductive cell – posterior part – immotile – longitudinal division – perpendicular to first division – hollow ball of cells
- Flagella – anterior end – inversion – phialopore – daughter colony – released into water

ASEXUAL REPRODUCTION

Autospore (Chlorella)

- Non-motile - 2, 4, 8 or 16 daughter protoplasts – autospore - rupture of the parent cell wall – new individual
- No sexual phase
- No distinct alternation of generations

SEXUAL REPRODUCTION

- Sexual - largely controlled by environmental factors such as light, temperature and nutrition
- Depletion of nitrogen/ammonium results in the formation of sexual gametes
- Rise in temperature increases the proportion of gametes (*Chlamydomonas*)
- Light acts through photosynthetic assimilation leading to the depletion of the available nitrogen
- Absence or deficiency of nutritional substances
- High CO2 concentration and presence of Calcium

SEXUAL REPRODUCTION

Isogamy (Chlamydomonas)

- Primitive type – similarity in size, form and structure between the fusing gametes - Morphologically similar but functionally different
- Protoplast division - 8, 16, 32 or 64 daughter protoplasts - biflagellate gamete – naked – smaller than zoospores
- Gametes swim in water – flagellar linear glycoprotein - agglutinins

SEXUAL REPRODUCTION

Isogamy (Chlamydomonas)

- Homothallic (*C. debaryanum* , *C. longistigma* , *C. media*)
- Heterothallic (*C. reinhardtii* , *C. moewusii*)
- Isogametes fuse to form zygote - motile for few hours to several days - secretes a primary and a secondary wall – zygospore – accumulates fats and reserve food materials and turns orange red

SEXUAL REPRODUCTION

Isogamy (Chlamydomonas)

- Zygospore – favourable condition – meiosis - four to eight haploid nuclei - biflagellate meiozoospore - secretes a cell wall
- Inner wall of the zygospore gets dissolved and the outer wall splits open, liberating the meiozoospores – develops into mature cell

SEXUAL REPRODUCTION

Anisogamy (Chlamydomonas)

- Fusion takes place between dissimilar gametes
- Physiological anisogamy - morphologically identical but different in their behavior i.e., one gamete may be more active than the other (*C. monoica*)
- Morphological anisogamy - fusing gametes (male and female) differ noticeably in size e.g., *C. braunii* .

SEXUAL REPRODUCTION

Anisogamy (Chlamydomonas)

- Gametangia - male gamete is small and active, whereas the female gamete is large and passive
- External fertilization – water – zygote - heterothallic or dioecious

SEXUAL REPRODUCTION

Oogamy (Chlamydomonas)

- Advanced - *C. coccifera*, *C. ooganum* - Distinct male and female sex organs
- Female mother cell - single globose macrogamete – non-motile
- Male parent cell – 4 divisions - 16 spherical biflagellate microgametes – released in water
- Plasmogamy and karyogamy - non-motile zygote

SEXUAL REPRODUCTION

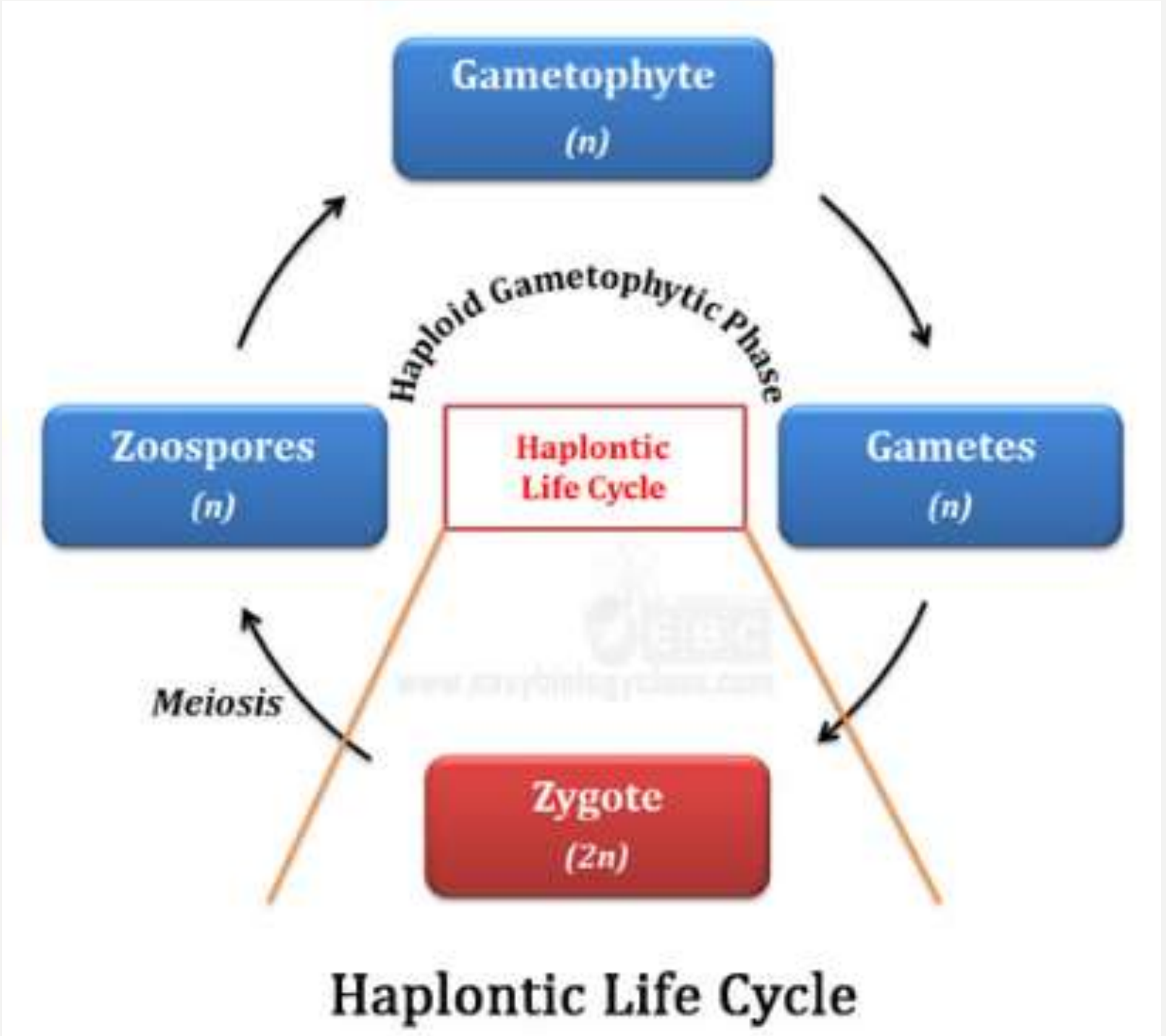
Oogamy (*Volvox*)

- Nitrogen starvation and high temperature
- One or a few colonies induce male gametes - pheromone, a glycoprotein – diffuse through
- Gonidia exposed to pheromone - a single egg cell or 16–64 small, pale, biflagellate antherozoids

REPRODUCTION

Oogamy (*Volvox*)

- Antherozoids fertilize the egg – zygote – spiny wall – haematochrome – carotenoid
- Zygote – meiosis - one meiotic product survives – mitosis - coenobium



Haplontic Life Cycle

LIFE CYCLE

Anisogamy (*Ulva*)

- Ulva thalli: (i) haploid gametophytic or sexual plants and
- (ii) diploid sporophytic or asexual plants.
- Gametophytic plants produce haploid gametes by mitosis
- Ulva is heterothallic or dioecious and gametes from plants of different mating types fuse with each other.

LIFE CYCLE

Anisogamy (*Ulva*)

- Gametes are biflagellate, pyriform and are produced in the marginal cells of the thallus
- Male gametes are narrower and smaller and possess a yellowish green chloroplast with an indistinguishable pyrenoid
- Female gametes are larger and possess a green chloroplast with a distinct pyrenoid

LIFE CYCLE

Anisogamy (*Ulva*)

- Gametes escape through an apical aperture
- Fusion takes place in water - diploid quadriflagellate zygote
- Zygote develops into diploid sporophytic thallus of Ulva.
- Diploid plants resembles exactly with the haploid gametophytic plants - isomorphic alternation of generations

LIFE CYCLE

Anisogamy (*Ulva*)

- Sporophytic plants produce many haploid quadriflagellate zoomeiospores by meiosis
- Zoomeiospores develop into haploid gametophytic thalli
- Life cycle is thus Haplodiplontic

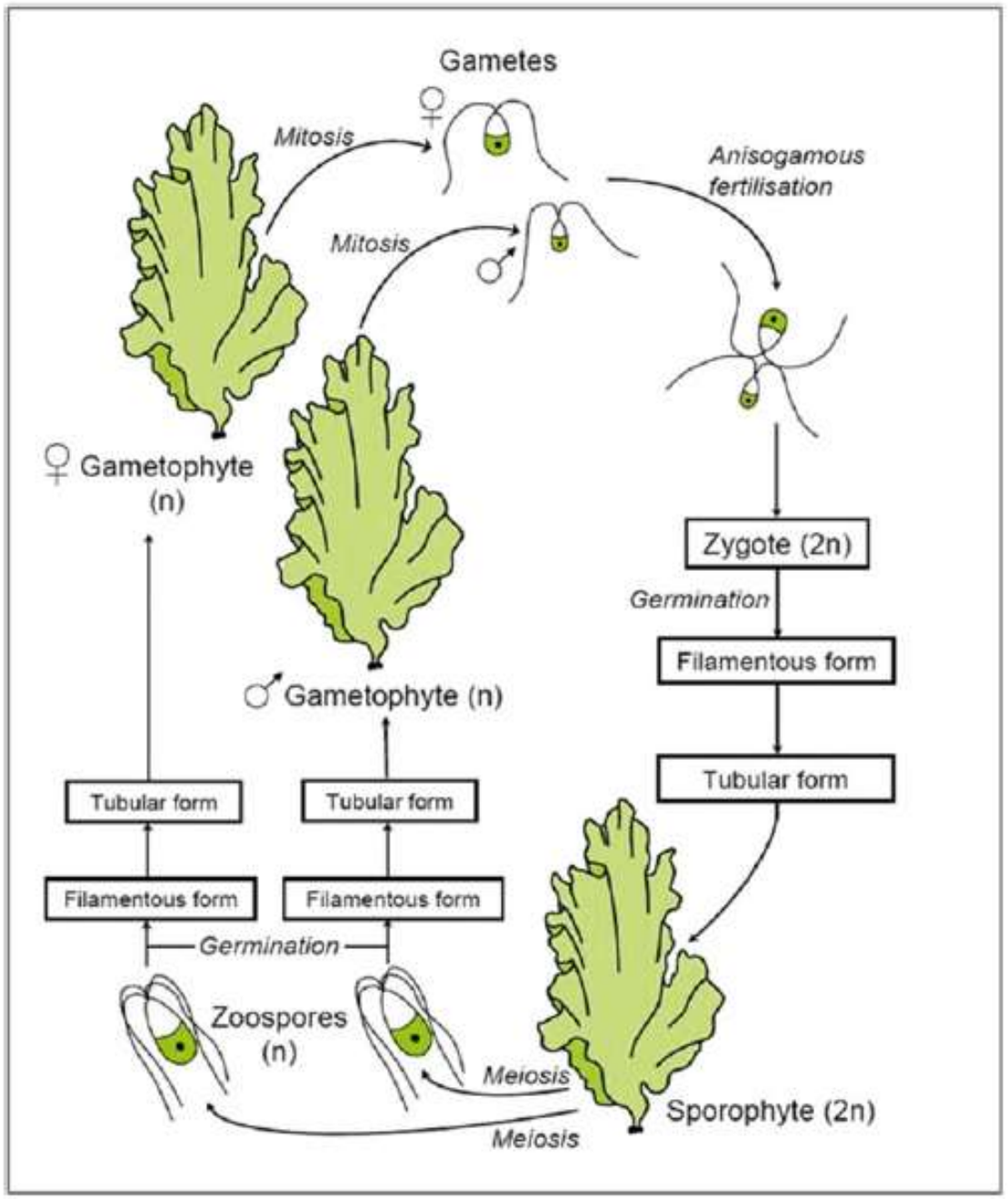


Fig. 16 Life cycle of *Ulva* (Picture courtesy: Dr. Christopher Skilbeck)

LIFE CYCLE

Isogamy (*Acetabularia*)

- Unicellular plant body of Acetabularia is composed of three parts:
- a lobed rhizoidal holdfast
- a middle upright tubular stalk; and
- a cap at the top

LIFE CYCLE

Isogamy (*Acetabularia*)

- Mature plant body forms many gametangial rays
- On maturity, single diploid nucleus located in the rhizoidal lobe enlarges in size, undergoes meiosis and forms many small secondary nuclei
- Nuclei reach the gametangial rays by cytoplasmic streaming

LIFE CYCLE

Isogamy (*Acetabularia*)

- Formation of bright green cysts – cyst has biflagellate gametes of only one strain
- Gametes of + or − strains (from the same thallus) fuse to form the zygote
- Zygote germinates to make a diploid uninucleate sporophyte – diplontic life cycle

RHODOPHYCEAE

OCCURRENCE

- Aquatic forms, terrestrial forms, epiphytic and parasitic forms.
- Freshwater - flowing streams (*Lemanea*) – stagnant water (*Compsopogon*) – brackish water (*Gracilaria*) – Marine (*Kappaphycus*)
- Grow in the intertidal and sublittoral regions.
- Moist soil (*Porphyridium*) - simple mode of reproduction

OCCURRENCE

- Exhibit a high degree of epiphytism and parasitism
- Parasitic species show a great reduction in their form and pigmentation (*Polysiphonia, Ceramium*)

THALLUS ORGANISATION

- Unicellular (*Porphyridium*) to complex multiaxial form
- Multicellular, filamentous (*Polysiphonia*) or non-filamentous, cylindrical or flattened or foliaceous, branched or unbranched
- Filamentous thalli - uni- or multiseriate, often heterotrichous
- Parenchymatous (*Porphyra*), Pseudoparenchymatous (*Gracilaria*), multiaxial or fountain type, (*Kappaphycus*)
- Growth is intercalary or apical

CELL STRUCTURE

- Eukaryotic
- Thick cell walls that have microfi brils arranged in three regions –
  - (1) the innermost electron-dense,
  - (2) middle electron-translucent and
  - (3) outermost electron dense regions
- Microfibrils are parallelly arranged

CELL STRUCTURE

- Cells connected through distinct pit-connections
- Cytoplasm show large starch grains
- Extracellular matrix consists of cellulose, galactans, and mucilage
- Mucilages -polymers of D-xylose, glucose, glucoronic acid and galactose
- Cellulose absent (*Porphyra*), Calcium (*Corallina*)

CELL STRUCTURE

- Chloroplast contains pigments r-phycoerythrin and r-phycocyanin
- Unstacked, evenly spaced thylakoid - stellate to discoid to highly lobed structure
- Uninucleate and multinucleate
- Pit-connection is one of the most distinguished features of the red algae

CELL STRUCTURE

- Absence of flagellated motile stages.
- Storage products are in the form of floridean starch, floridoside and mannoglycerate.

REPRODUCTION

- Vegetative, asexual and sexual
- Vegetative – unicellular members of Porphyridiales
- Asexual reproduction – Endospores – monosporangia, bisporangia, tetrasporangia and polysporangia.
- Haploid spores (monospore, bispore, neutral spore, carpospores, tetraspore and polyspores) produced on diploid thalli

REPRODUCTION

- Sexual – oogamous
- Male gamete 'spermatium' is nonflagellate
- Female cells 'carpogonium' is a flask shaped cell with a neck like protuberance called trichogyne - near the apices of the branches
- Carpogonial branch – two celled – carpogonium cell having trichogyne – lateral hypogonous cell

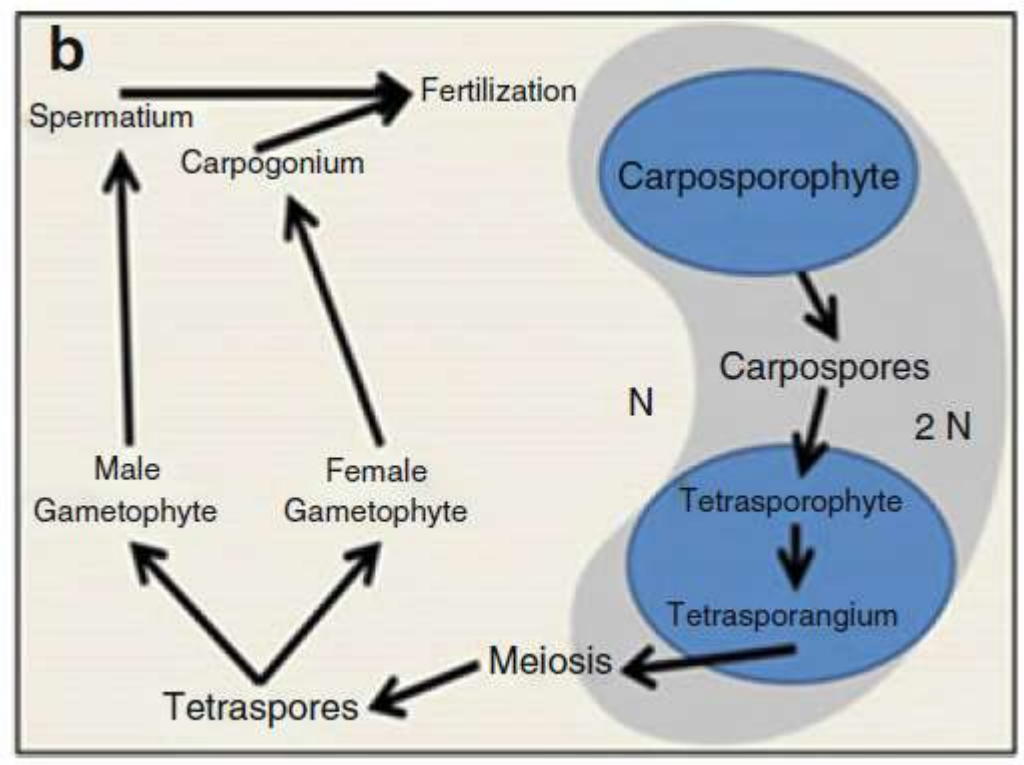
REPRODUCTION

- Carpogonium – sessile or stalked
- Spermatangial conceptacle - irregularly ovoid - thick mucilaginous covering
- Water – fertilisation – fusion between male and female nucleus – zygote
- Zygote produces gonimoblast filaments

REPRODUCTION

- Terminal cell of gonimoblast filament – Carposporangia – single carpospores
- Gonimoblast protected by compact cellular wall, the "Pericarp" - Cystocarp

LIFE CYCLE



- **Carposporophyte is always dependent on the gametophyte**
- **Tetrasporophyte is quite independent**
- **Gametophyte and tetrasporophyte are morphological identical**

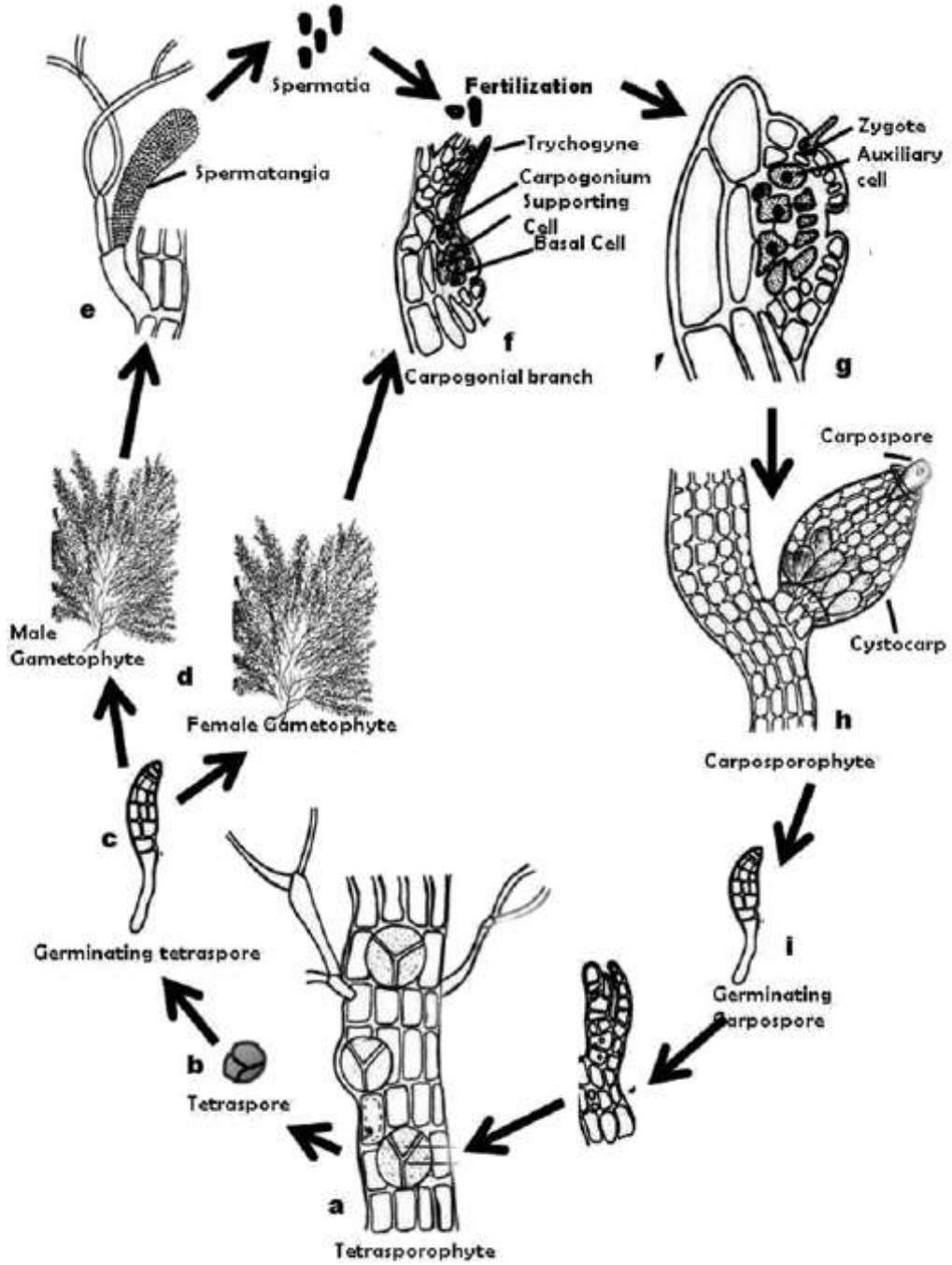


Fig. 15 *Polysiphonia* life history illustrating different stages of development

LIFE CYCLE - POLYSIPHONIA

- Gametophyte alternating with carposporophyte and tetrasporophyte – diplobiontic - isomorphic alternation of generation.
- Sexual reproduction in Polysiphonia is oogamous.
- Male and the female gametophytes are morphologically similar
- Male reproductive structure is known as spermatangia or antheridia

LIFE CYCLE - POLYSIPHONIA

- Spermatangia or antheridia develop on fertile trichoblasts present on tips of male gametophytic plant.
- The male trichoblast when only 2-3 celled divides dichotomously.
- In most of the species one branch remains sterile and the other bears spermatangia, in some specie both branches become fertile.

LIFE CYCLE - POLYSIPHONIA

- The cells of the trichoblast except the two lowermost cells of the fertile branch divide periclinally to form pericentral cells
- The pericentral cells form spermatangial mother cells on outer-side

LIFE CYCLE - POLYSIPHONIA

- Each spermatangial mother cell produce two or four spermatangia so that a cluster of spermatangia get compactly arranged to give a cone like appearance.
- Spermtangium is a minute uninucleate one-celled structure

LIFE CYCLE - POLYSIPHONIA

- Spermatangium - spherical in shape and is rich in protoplasm - three layered wall - contains a single non- motile spermatium.
- Spermatium floats in water and fertilizes the egg if it comes in contact with a carpogonium.

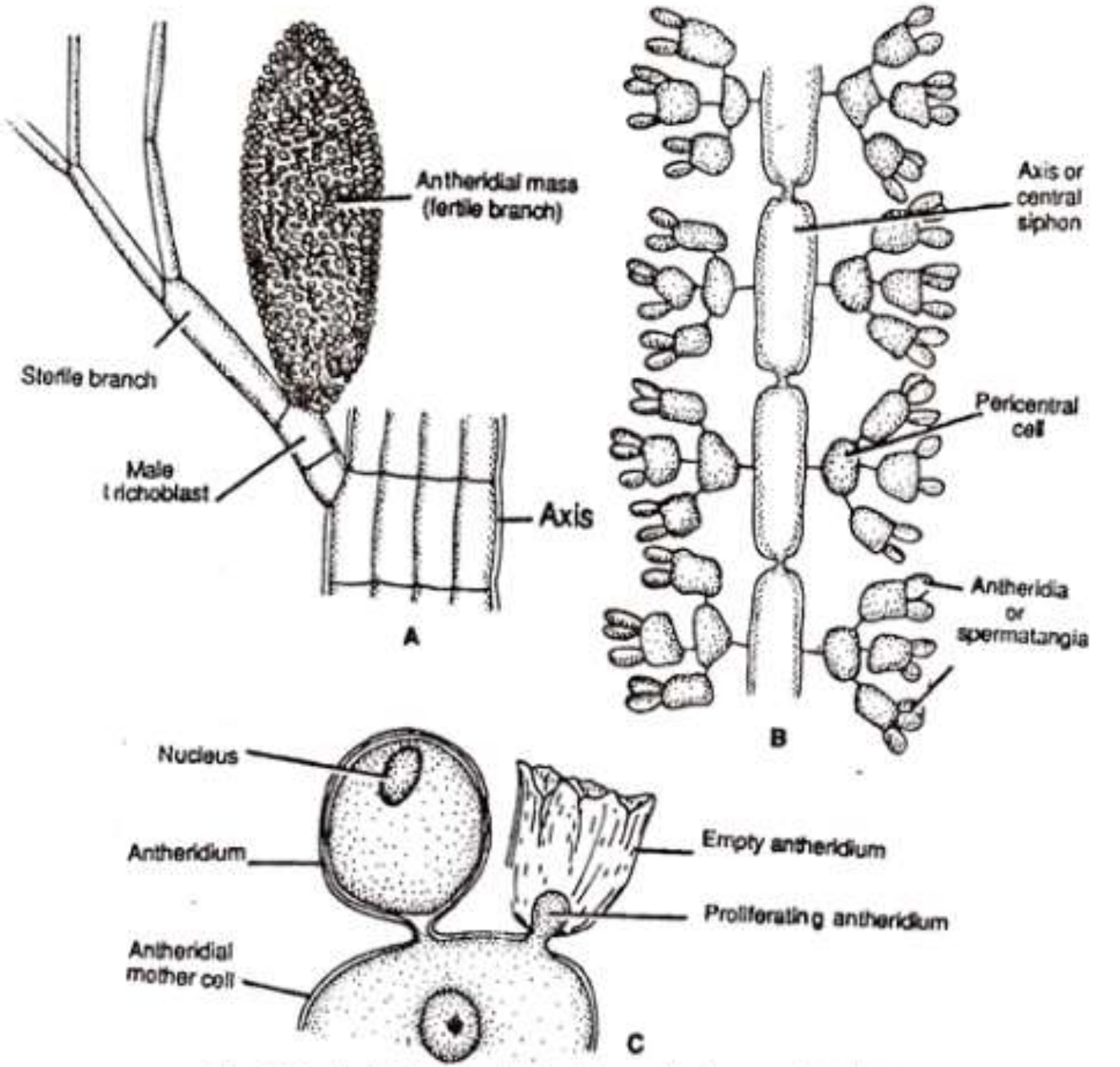


Fig. 4 (A–C). *Polysiphonia*. Development of spermatangium.

LIFE CYCLE - POLYSIPHONIA

- The female sex organ – carpogonium - trichoblast on female gametophyte - 5-7-celled
- The lowermost two cells of the female trichoblast - a ring of pericentral cells - One of the pericentral cells on the adaxial side - a supporting cell

LIFE CYCLE - POLYSIPHONIA

- Supporting cell cuts off a small initial cell which divides to produce a four-celled carpogonial filament
- The uppermost cell – carpogonium - flask-shaped structure - swollen egg containing a basal part and a tubular elongated trichogyne

LIFE CYCLE - POLYSIPHONIA

- Supporting cell - basal sterile filament initial and a lateral sterile filament initial.
- The lateral sterile initial - a two- celled lateral sterile filament.
- Pericentral cells – sheath - pericarp

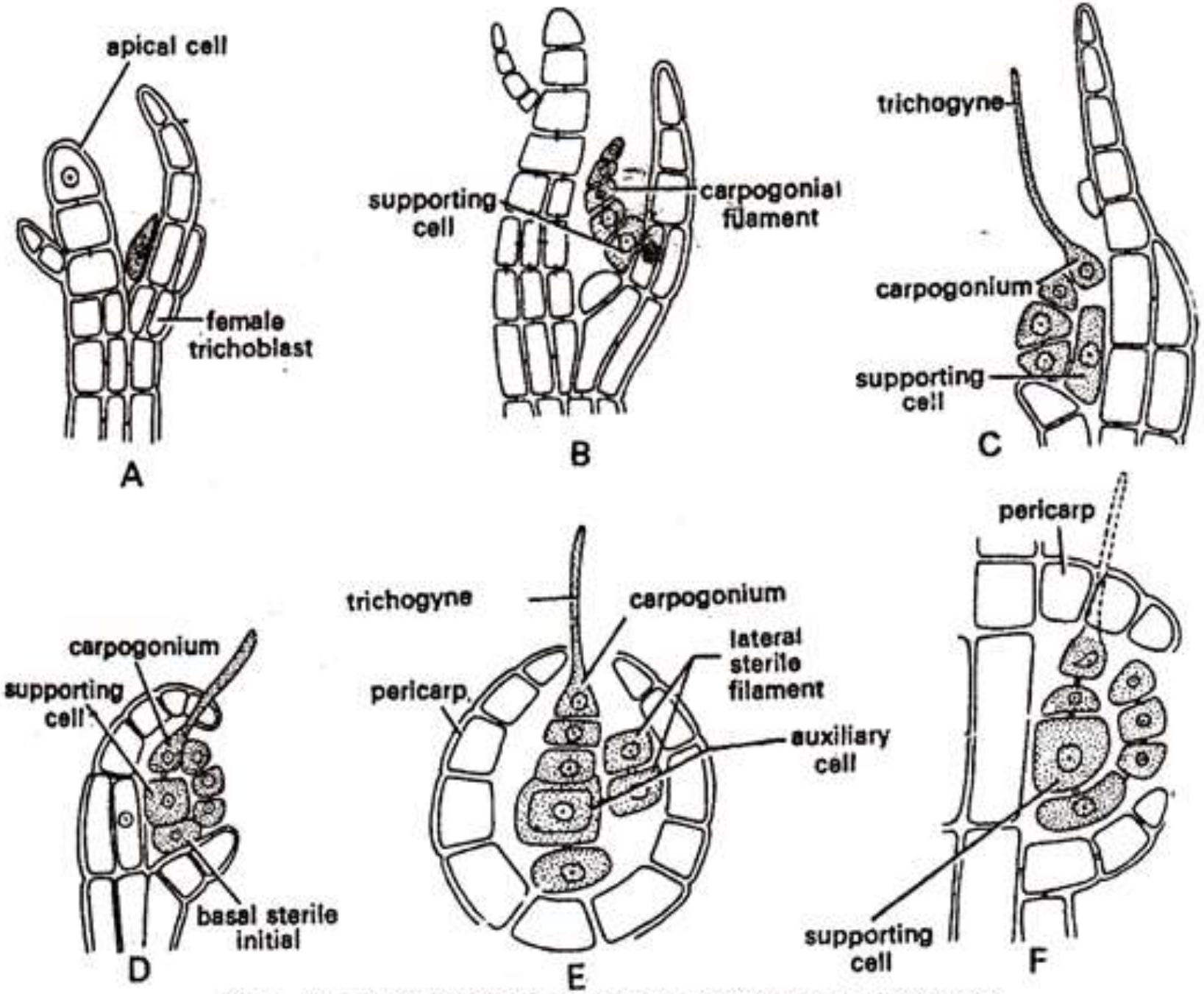


Fig. 5. (A–F). *Polysiphonia*. Development of female gametophyte.

LIFE CYCLE - POLYSIPHONIA

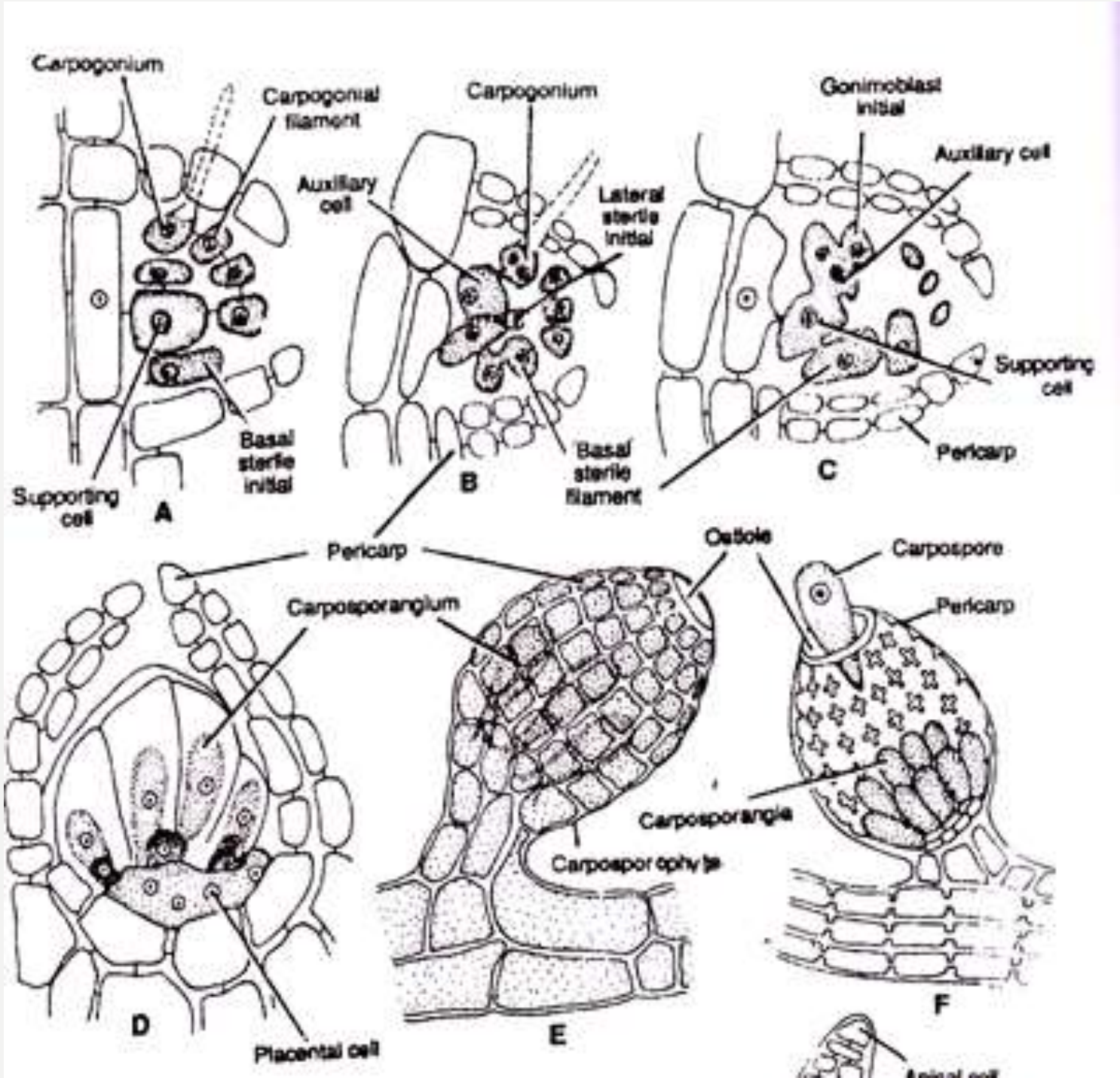
- The trichogyne – receives spermatium – walls dissolve - fuse - a diploid zygote
- Basal sterile initial - basal sterile filaments – 2-4 cells
- Lateral sterile initials - lateral sterile filaments - 4- 10 cells

LIFE CYCLE - POLYSIPHONIA

- Supporting cell – transverse division - auxiliary cell – protoplasmic connection – carpogonium
- Zygote nucleus – mitosis – two – one migrates to auxiliary cell
- Carpogonium, auxiliary cell and supporting cell fuse and form irregular shaped placental cell

LIFE CYCLE - POLYSIPHONIA

- Gonimoblast initials arise from the placental cell - two celled gonimoblast filament or gonimalobe - compact mass – Carposporophyte
- Terminal cell – carposporangia - a single diploid carpospores
- Pericentral cells – pericarp with an ostiole at the tip


Carpogonium
Carpogonial filament
Supporting cell
Basal sterile initial
A
Carpogonium
Auxiliary cell
Lateral sterile initial
Basal sterile filament
B
Gonimoblast initial
Auxiliary cell
Supporting cell
Pericarp
C
Pericarp
Carposporangium
Placental cell
D
Ostiole
Carpospore
Pericarp
Carposporangia
Carposporophyte
E
F

LIFE CYCLE - POLYSIPHONIA

- Cystocarp - diploid portion – carposporophyte
- Carpospore – release – germinate – unequal mitosis – smaller lower cell (rhizoidal cell) - a larger upper cell - four-celled filament
- Central siphons – tetrasporophyte – resemble gametophyte

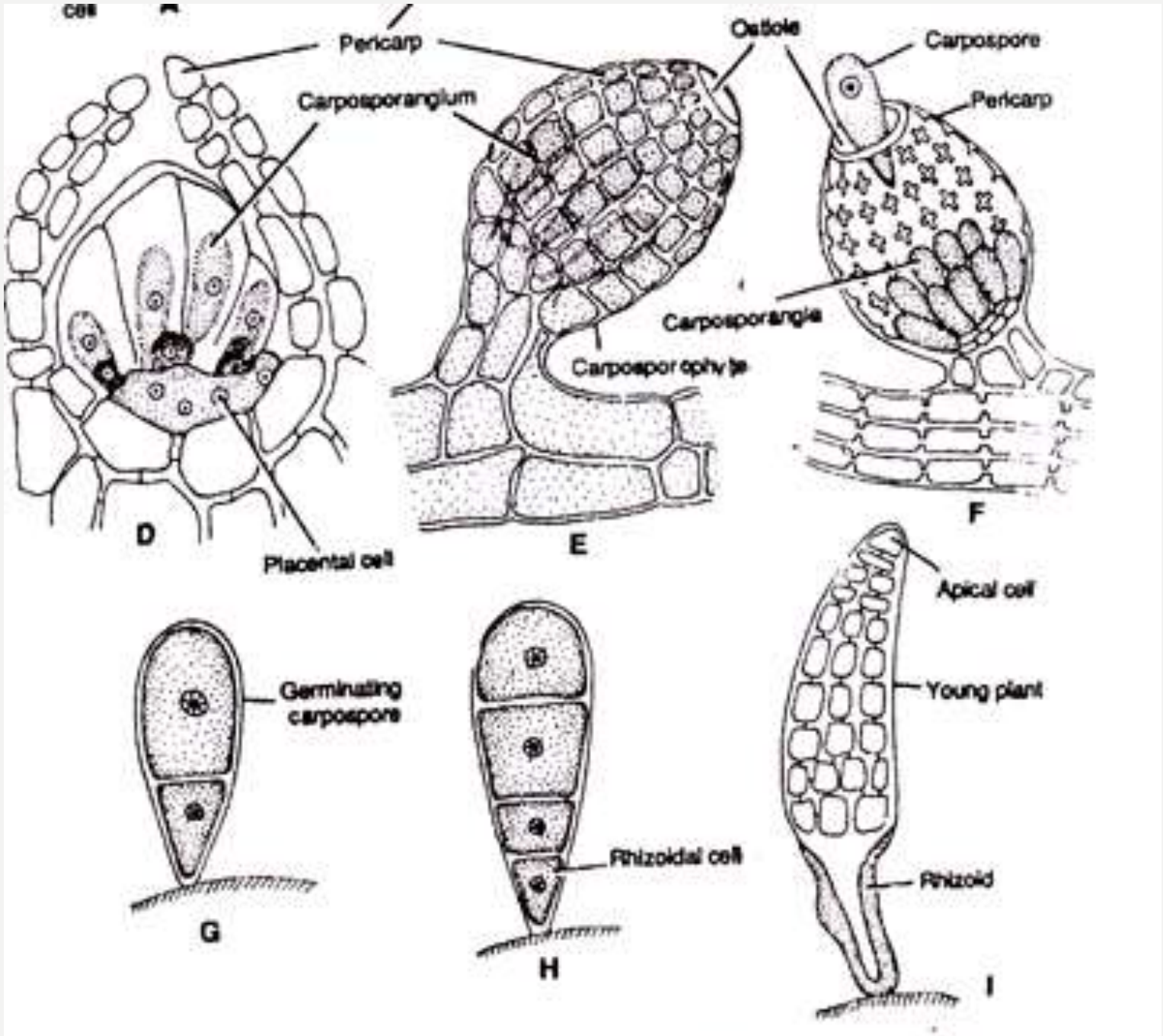


Fig. 6. (A–I). *Polysiphonia*. Post fertilization changes

LIFE CYCLE - POLYSIPHONIA

- Pericentral cells of tetrasporophytic plant function as tetra sporangial initials – vertical division - outer cover cell - inner sporangial mother cell
- Sporangial mother cell - transverse division - lower stalk cell - upper sporangial cell - tetra sporangium

LIFE CYCLE - POLYSIPHONIA

- Tetra sporangium – meiosis – tetraspores - germinate to make haploid male and female gametophyte

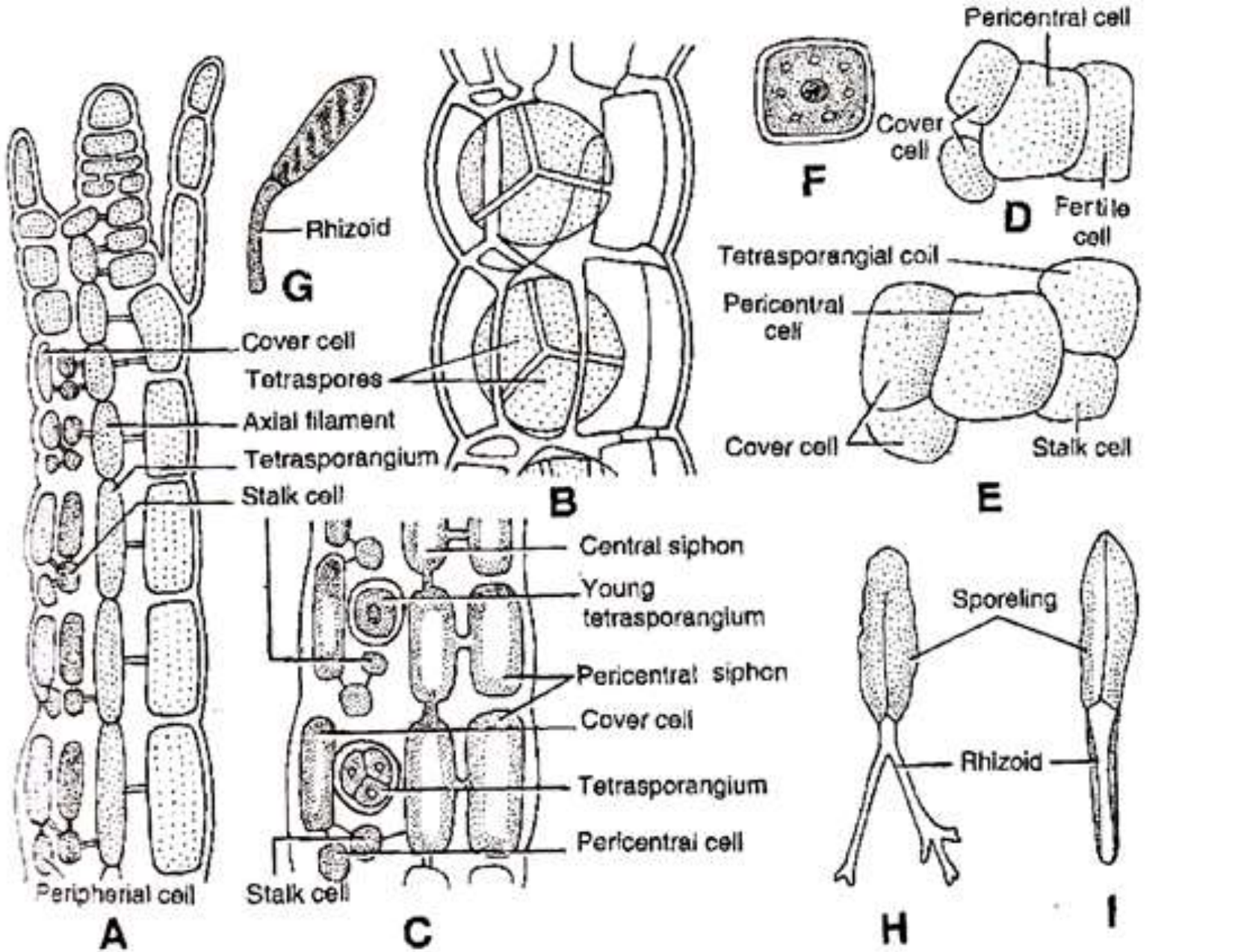


Fig. 7 (A–I). *Polysiphonia* Tetrasporophyte. (A, C). A part of stichidium showing development of tetrasporangia. (B) A part of stichidium with tetrasporangia. (D, E). Development of tetrasporangium from pericentral cell. (F) A tetraspore, (G–I). Development of new gametophytic thallus.

PHAEOPHYCEAE

OCCURRENCE

- Multicellular organisms - marine habitats - brackish waters
- Sub-polar area to equator yet temperate areas shows significant diversity
- No reports of unicellular or colonial organisms found so far
- 285 genera and 1800 species
- Contain Carotenoid pigment, fucoxanthin

THALLUS ORGANISATION

- Mostly lithophytes, filamentous, smaller species – epiphytes
- Unicellular, colonial and unbranched filaments absent
- Small filamentous forms (*Ectocarpus*), largest seaweed known *Macrocystis pyrifera*
- Higher morphological and anatomical differentiation

CELL STRUCTURE

- Cell walls – gelatinous – two layered – Algin, Fucoidin, Fucin, Cellulose
- Alginic acid - with stand long desiccation periods
- *Padina* - deposition of calcium carbonates
- Plasmodesmeta or pores are present in cell walls and are bounded by plasmalemma.

CELL STRUCTURE

- Chloroplasts have chlorophylls a , c1, and c2, β-carotene, violaxanthin, diatoxanthin and large amounts of fucoxanthin.
- Pyrenoid is stalked and protrudes from the chloroplast
- Laminarin - stored in endoplasmic reticulum
- D-mannitol - accumulated through photosynthesis

CELL STRUCTURE

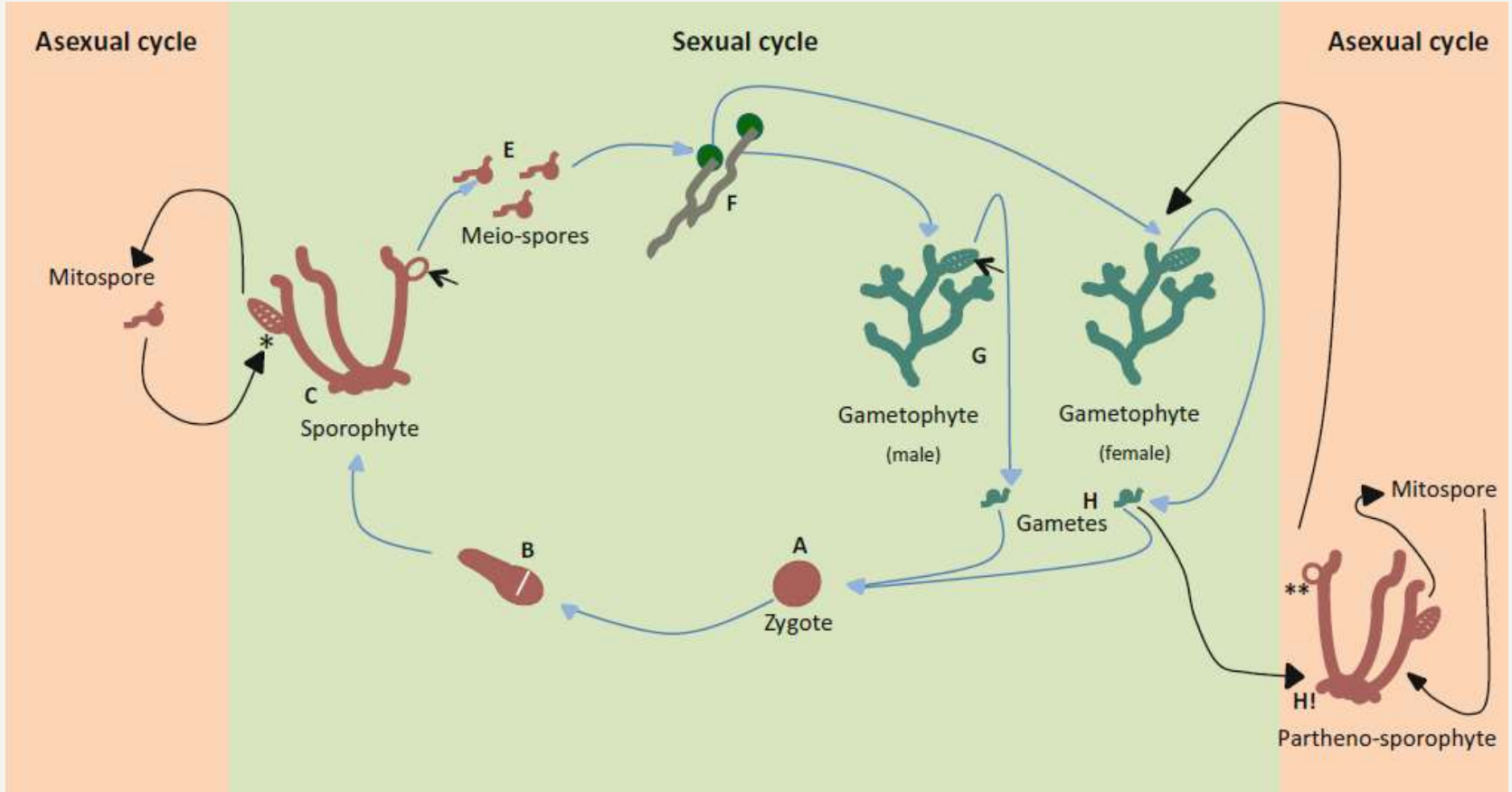
- Presence of Physodes (fucosan granules) - characteristic features of brown algae - colourless vesicles with highly refractive acidic fluid – store phlorotannins - eadily oxidizes in air forming phycophaein, a black pigment
- Discourages grazing; absorb ultraviolet radiation, serving as a component of cell walls, and as antifoulants

REPRODUCTION

- Vegetative, asexual and sexual
- Vegetative reproduction via fragmentation
- Asexual reproduction - biflagellate zoospores - sporangia - unilocular or plurilocular
- Asexual reproduction is absent in Laminaria
- Sexual reproduction - formation of flagellate gametes - gametangia

REPRODUCTION

- Sexual reproduction – isogamy, anisogamy, oogamy – isomorphic (Ectcarpus) – heteromorphic (Laminaria) – Diplontic



REPRODUCTION

- Gametophyte and sporophyte are multicellular – indistinguishable in field
- Under culture conditions - gametophyte - free floating – sporophytes form compact thalli – attached to substratum
- Sexual life cycle - diploid zygote - bipolar germination – sporophyte - prostrate and upright filaments

REPRODUCTION

- Upright filaments – plurilocular (mitospores) and unilocular (meiospores) sporangia
- Meiospores - bipolar germination – asymmetric – gametophyte – upright filament - plurilocular gametangia - male and female gametes

REPRODUCTION

- Ectocarpus can also reproduce asexually using various methods:
- (1) Gametes that fail to find a suitable partner develop asexually into partheno-sporophytes
- A mature partheno-sporophyte produces unilocular and plurilocular sporangia.
- (2) Mitotic events in plurilocular sporangium forms mito-spores that forms ‘clones’ of sporophytes

REPRODUCTION

- (3) Sometimes, meio-spores released from unilocular sporangia can change their fate to develop into sporophytes.
- This particular phenomenon where a meio-spore develops into sporophytes is called heteroblasty