

Algae: *Ectocarpus*

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Ectocarpus

Fritsch (1945)

Class-Phaeophyceae; Order-Ectocarpales; Family-Ectocarpaceae; Genus – *Ectocarpus*

Lee (1999)

Phylum-Phaeophyta; Class-Phaeophyceae; Order-Ectocarpales; Family- Ectocarpaceae;
Genus - *Ectocarpus*

Occurrence

- *Ectocarpus* is a brown alga. It is abundantly found throughout the world in cold waters. A few species occur in fresh waters. The plant grows attached to rocks and stones along coasts. Some species are epiphytes on other algae like members of Fucales and *Laminaria*. *Ectocarpus fasciculatus* grows on the fins of certain fish (epizoic) in Sweden. *Ectocarpus dermonemcnis* is endophytic. *Ectocarpus carver* and *Ectocarpus spongiosus* are free-floating.

Indian spp.

E. filife

E. enhali

E. coniger

E. rhodochortonoides

Plant Body

- Genetically the thalli may be **haploid or diploid**. But both the types are **morphologically alike**. The thallus consists of profusely branched uniseriate filaments. It shows **heterotrichous habit**. There are two systems of filaments. These are prostrate and projecting system. The filaments of the projecting system arise from the filaments of prostrate system
- **a) Prostrate system:** The prostrate system consists of creeping, leptate, irregularly branched filaments. These filaments are attached to the substratum with the help of rhizoids. This system enters the host tissues in epiphytic conditions. Prostrate system is poorly developed in free floating species.
- **b) Projecting system:** The projecting system arises from the prostrate system. It consists of well branched filaments. Each branch arises beneath the septa. The main axis and the branches of the projecting system are **uniseriate**. In this case, rans are Joined end to end in a single series. The branches terminate into an acute point to form a **hair**. In some species the older portions of main axis are **ensheathed**(corticated). This sheath is formed of a layer of descending rhizoidal branches.

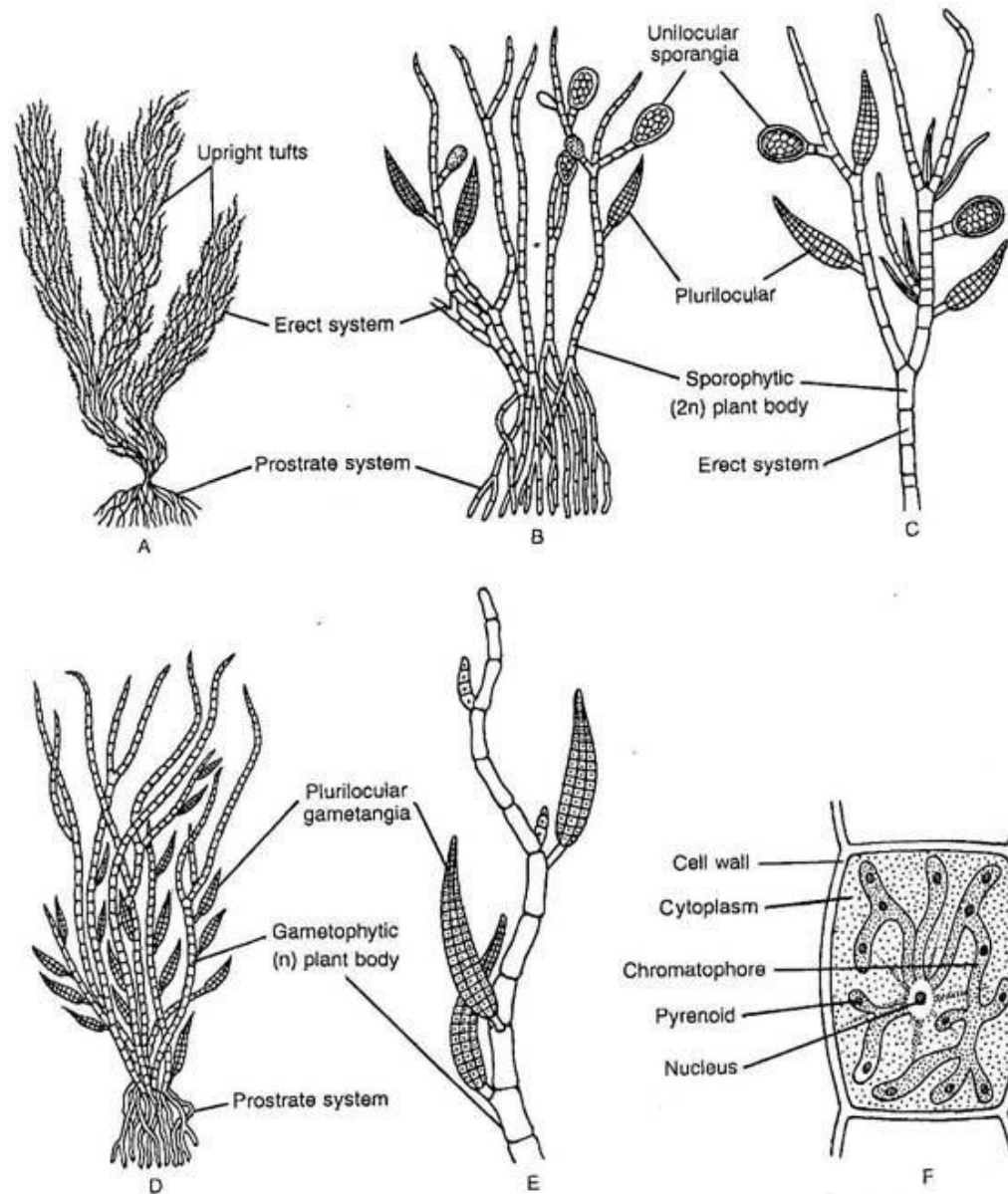


Fig. 3.110 : *Ectocarpus* sp. : A. Habit, B. Sporophytic (2n) plant body with both erect and prostrate system bearing unilocular and plurilocular sporangia, C. Portion of erect filament of sporophytic (2n) plant, D. Gametophytic (n) plant with both erect and prostrate system bearing plurilocular gametangia, E. Portion of erect filament of gametophytic (n) plant and F. Cell structure

Cell Structure

- The cells are small. They are cylindrical or rectangular and uni-nucleate.
- the cell wall is thick. It is composed of three layers composed of pectic-cellulose. **Algin and fucoidan** are also present in the cell wall. These are characteristic gelatinous substances of the walls of brown algae.
- The chromatophores may ribbon-like with irregular outline or disc-shaped. The dominant of Ectocarpus is **fucoxanthin**. It gives this algae golden brown colour. The other photosynthetic pigments are chlorophyll-a, -c, beta -carotene and other xanthophylls. vacuoles present.
- "yrenoid-like bodies-are associated with the chromatophores.
- **All** other eukaryotic organelle are present. **Growth** the growth of filaments in projecting system may be **intercalary** or **apical**
- **a) Intercalary:** In some species, an intercalary meristem is present in the base of the hair. It is called **trichothallic meristem**. It increases the length of the terminal hair and vegetative cell of the branch. This growth is called trichothallic growth.
- **b)**The growth in the prostrate system is **apical**

Reproduction

- Ectocarpus reproduces by both asexual and sexual methods.
- **Asexual reproduction**
- The asexual reproduction takes place by the formation of biflagellate **zoospores**. These zoospores may be haploid produced in one-celled **unilocular sporangia**. Or they may be diploid formed in many-celled **plurilocular sporangia**. Both kinds of sporangia are present on the same diploid **sporophyte** plant. The sporangia are borne terminally and singly on lateral branches.

Uni-locular sporangia

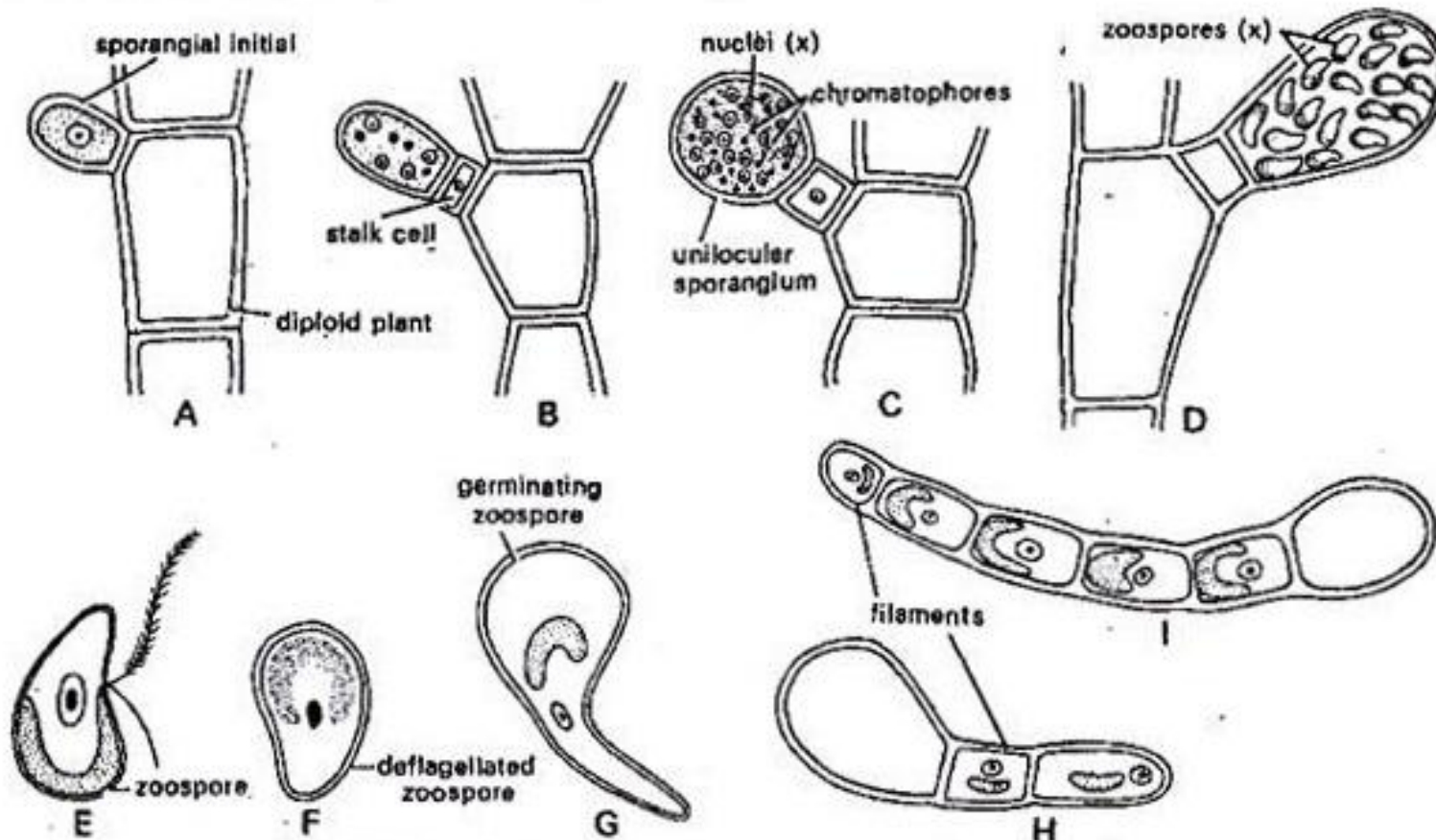


Fig. 2 (A-H). *Ectocarpus*. Development of unilocular sporangium.

Plurilocular sporangia

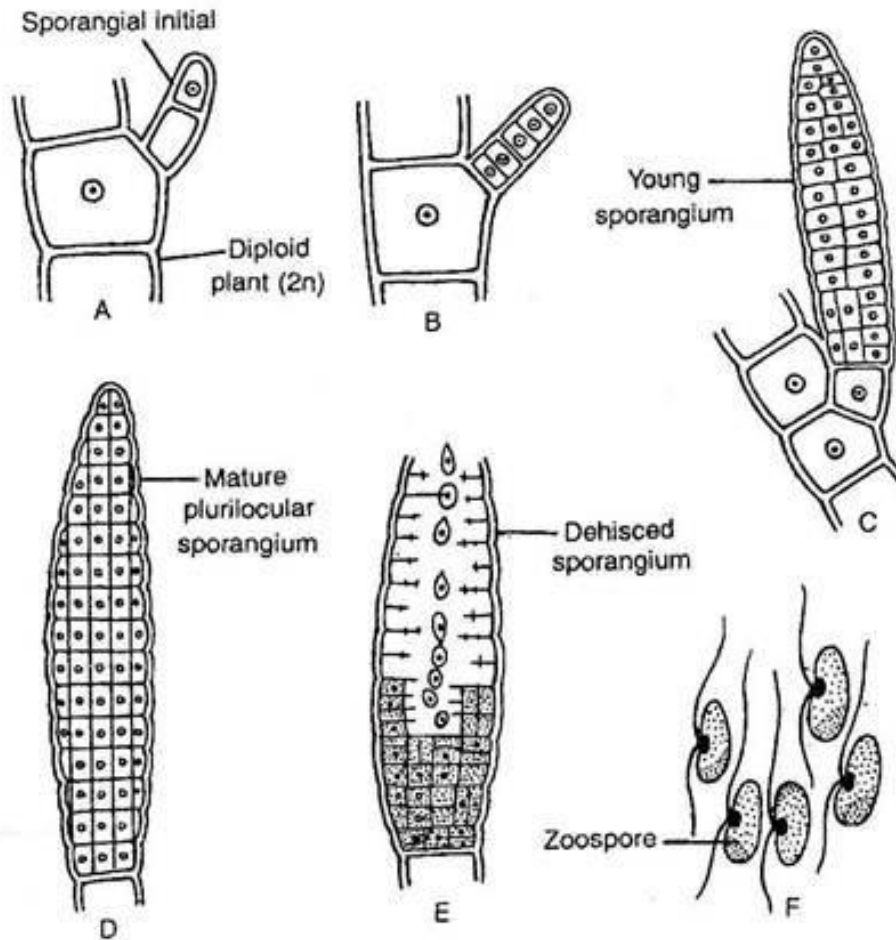


Fig. 3.112 : *Ectocarpus* sp.: A-D. Development of multilocular sporangium, E. Liberation of zoospores from sporangium, and F. Zoospores

Sexual Reproduction

- Sexual reproduction takes place by **isogamy** and **anisogamy**. Majority of the species are isogamous and homothallic. Some species are anisogamous. *Ectocarpus secundus* is heterothallic and anisogamous. The gametes are produced in **plurilocular gametangia**. These gametangia are many-celled, elongated, and sessile or shortly stalked conidial structures.

Fertilization

- During fertilization, many male gametes encircle the female gamete and get entangled by the anterior large flagellum. This stage is called clump formation. Out of many, only one male gamete fuses with the female gamete and the remaining gametes go astray and gradually get destroyed.
- The uniting gametes then form zygote, through plasmogamy and karyogamy

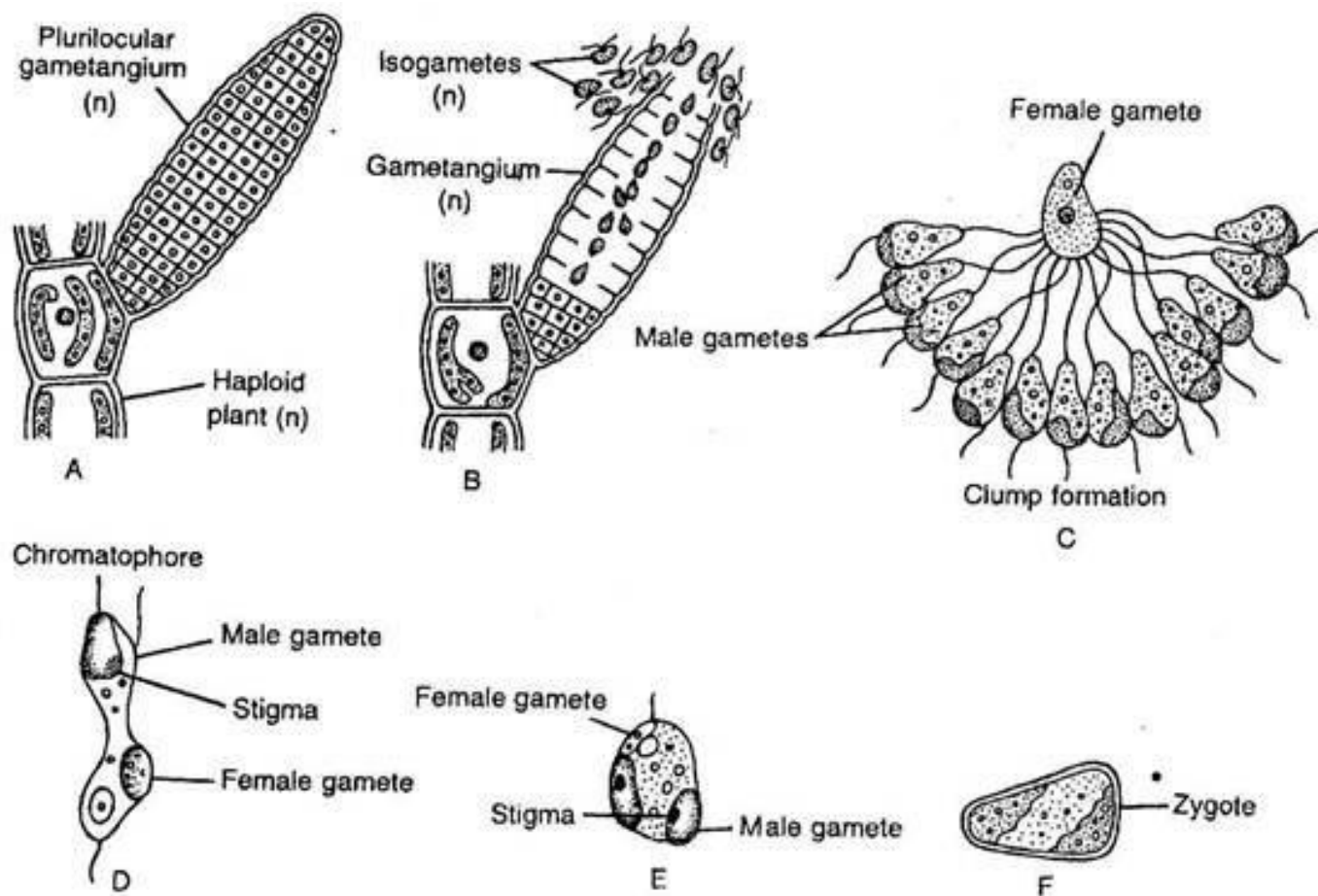


Fig. 3.113 : *Ectocarpus* sp. : A. Portion of gametophytic (n) plant with plurilocular gametangium, B. Liberation of gametes from gametangium, C. Male gametes around a female gamete before fertilisation (clump formation), D-E. Fusion of male and female gametes and F. Zygotes

Alternation of Generations

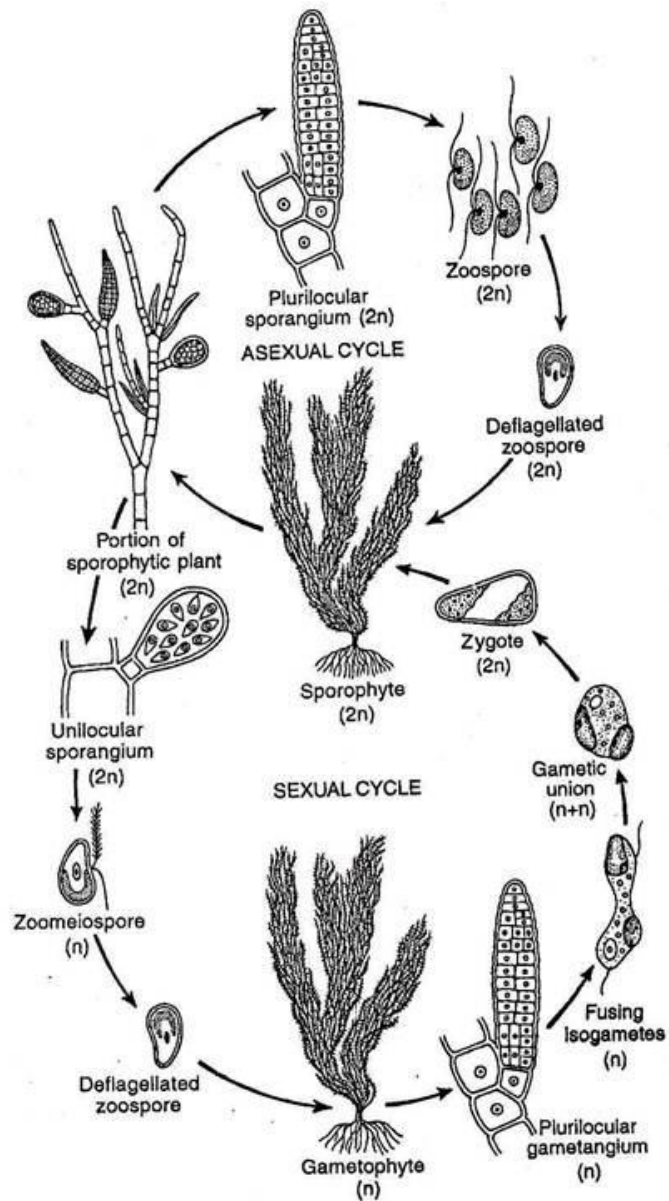


Fig. 3.114 : Life cycle of *Ectocarpus* sp.



Rhodophyta

Polysiphonia

Fritsch (1945)

Class-Rhodophyceae; Order-Ceramiales; Family-Rhodomelaceae; Genus – *Polysiphonia*

Lee (1999)

Phylum-Rhodophyta; Class-Rhodophyceae; Order-Ceramiales; Family- Rhodomelaceae;
Genus - *Polysiphonia*

Occurrence

- Polysiphonia is a large genus with about 150 species (Bold & Wynne, 1978) 6,000 species ([Encyclopædia Britannica, 2017](#)). The genus is represented in India by about 16 species found is southern and western coasts of India. Some common Indian species are *P. ferulacea*, *P. urceolata* and *P. variegata*.

Most of the species are **lithophytes** i.e., found growing on rocks. Some species are **epiphytic**, found growing on other plants and algae e.g., *P. ferulacea* grows on *Gelidium pusillum*. *P. variegata* grows on the roots of mangroves. Some species are **semi parasitic** e.g., *P. fastigiata* is semiparasite on *Ascophyllum nodosum* and *Fucus*.

Thallus Structure of *Polysiphonia*

- The thallus is filamentous, red or purple red in colour. The thallus is multi-axial and all cells are connected by pit connections hence, the name given is *Polysiphonia*. Due to continuous branching and re-branching the thallus has feathery appearance (Fig. 1A). The thalli may reach the length of about 30 cm.
- The thallus is heterotrichous and is differentiated into a **basal prostrate** system and **erect aerial system**.

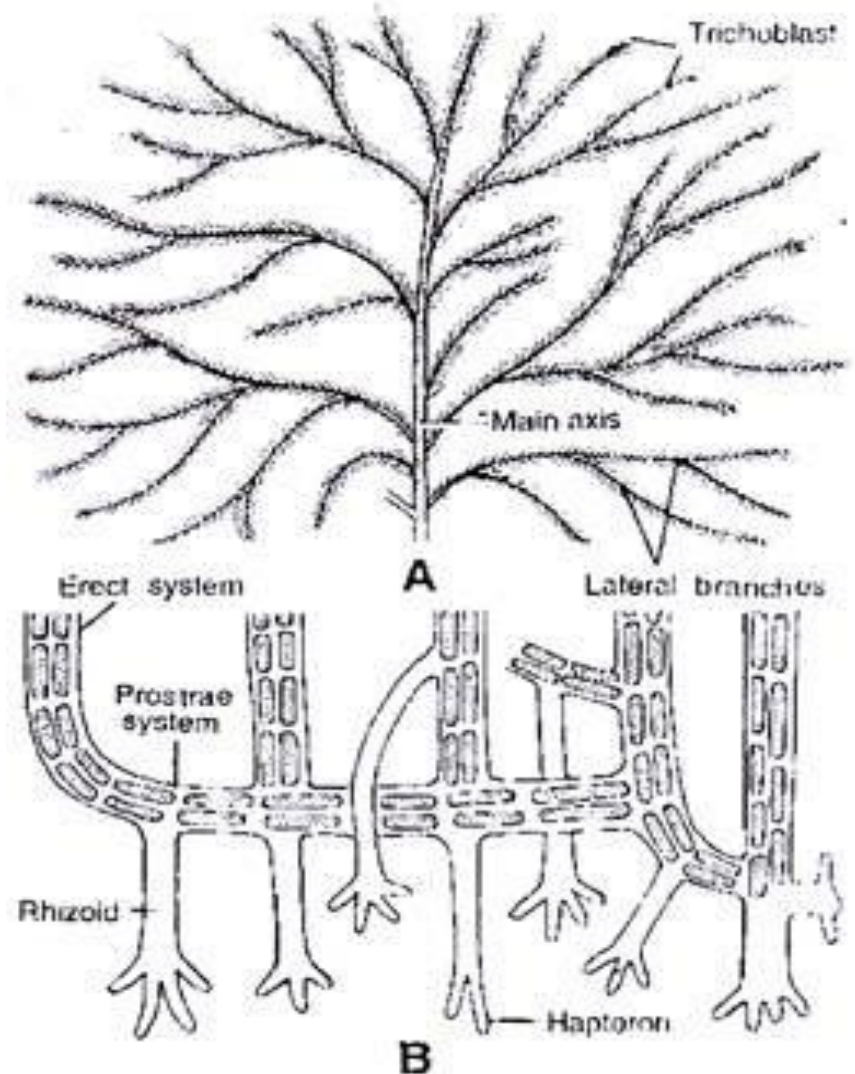


Fig. 1 (A, B). *Polysiphonia*. External features.
(A) Habit, (B) Prostrate and erect system

Branching

The thallus of Polysiphonia bears two types of branches (a) **Short branches** (b) **Long branches**. The branches are lateral and monopodial. The branching starts from the cell lying 2-5 cells below the apical cell.

- **(A) Short Branches or Trichoblasts:**
- The short branches or trichoblasts are branches of limited growth. These are uni-axial in structure and lack pericentral siphons. The cells are connected to each other by pit connections. These branches arise on main axis and on long branches in spiral manner. Their cells contain very few chromatophores.
- These branches are deciduous, perennial species shed these branches before winter and develop again in spring season. The basal cell of the last trichoblast is retained as scar cell by the pericentral siphon.

Development of Trichoblast

- The trichoblast initial is differentiated from a cell 2-5 cells below the apical cell (Fig. 3 A, B). It starts as a small cell and divides repeatedly to form dichotomously branched, uniseriate multicellular hair like trichoblast (Fig. 4 C, D). The trichoblast may bear male and female reproductive structures or remain sterile.

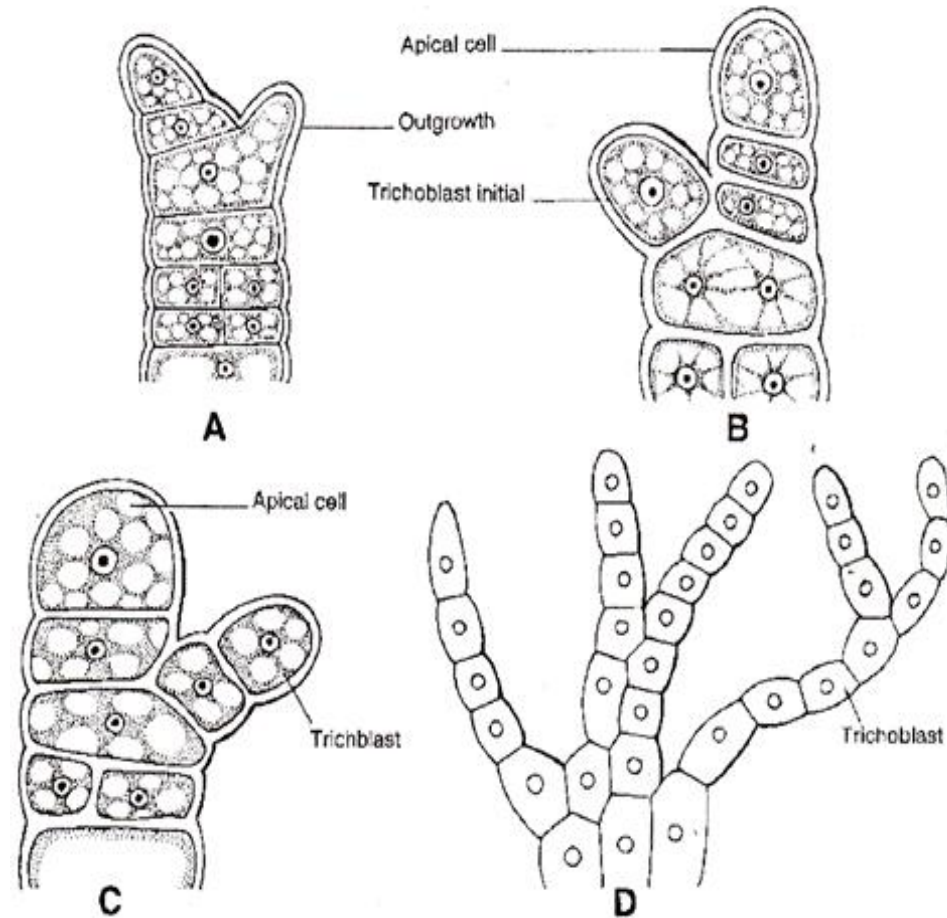


Fig. 3 (A-D). *Polysiphonia*. Development of trichoblast.

(B) Long Lateral Branches

- The long lateral branches are branches of unlimited growth are polysiphonous at the base and monosiphonous in terminal parts.
- Long Branch which after repeated division forms the central siphon. The central siphon later on develops peripheral siphons(4-20). In species like *P. elongata* the long branches arise directly from the main axis. The outgrowth develops from a cell 2-5 cells below the apical cell. The outgrowth forms central siphon and later pericentral siphon in normal way.

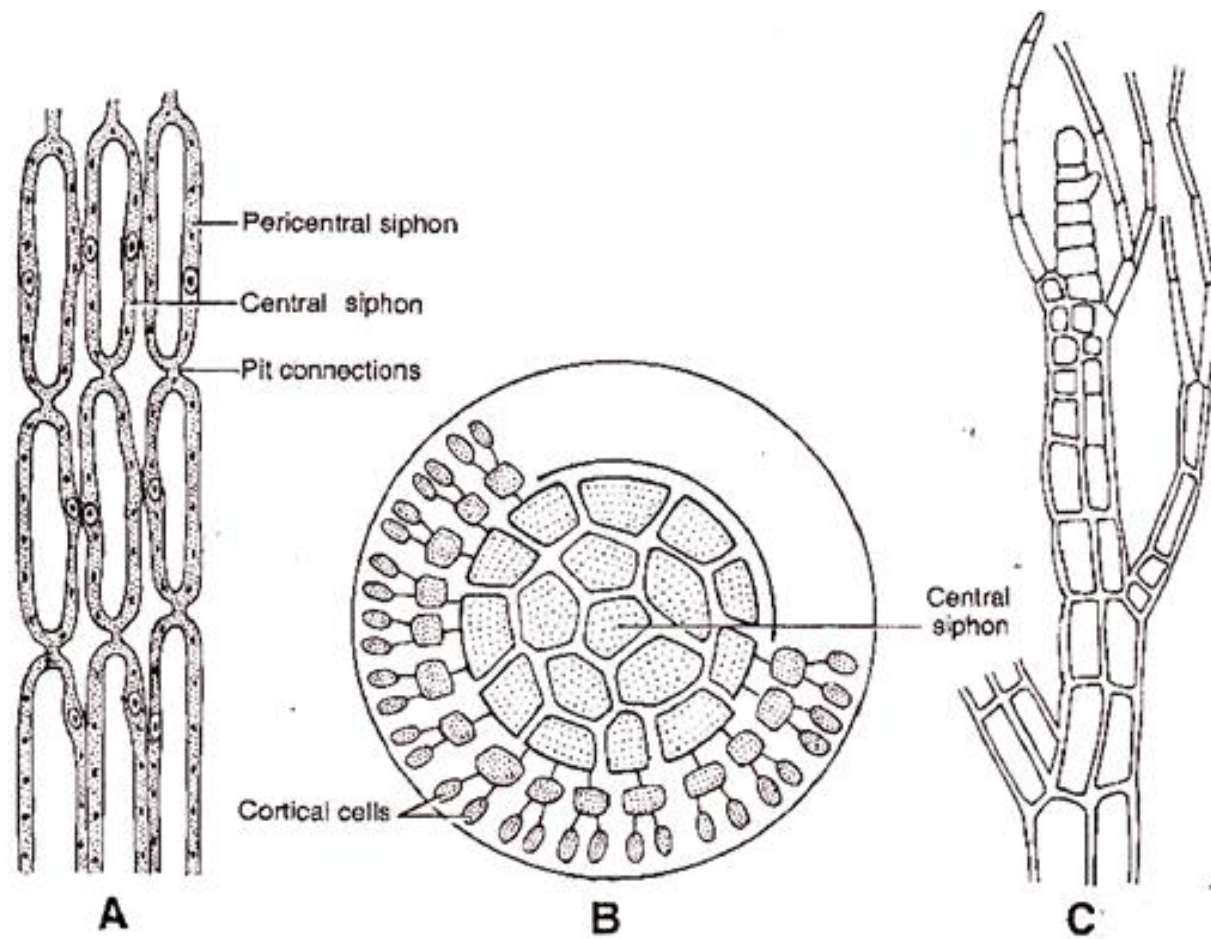


Fig. 2 (A-C). *Polysiphonia*. Thallus structure. (A) Part of aerial branch, (B) T.S. of aerial axis, (C) Vertical section of main axis.

Cell Structure of Polysiphonia

- The cells of central and pericentral siphons are cylindrical and elongated. The cell wall is differentiated into outer pectic and inner cellulosic layer. The cell contains a large central vacuole which is delimited by a membrane tonoplast. The cytoplasm is present between the cell wall and the central vacuole. The cell contains a number of red discoid chromatophores which lack pyrenoids.
- The chromatophores contain pigments chlorophyll a, chlorophyll d, and carotene, (3 carotene, r-phycoerythrin and r-phyococyanin. The chromatophores are parietal in position. The central siphon cells and pericentral siphon cells possess single peripheral nucleus. The cytoplasm contains granules of **floridean starch as food reserve**.

Reproduction in Polysiphonia

- In life cycle of Polysiphonia both asexual and sexual reproduction takes place. The life cycle is example of triphasic alternation of generation.
- **Polysiphonia is mainly heterothallic. In the life cycle of Polysiphonia three kinds of thalli are found. These are:**
 - (a) The **gametophytic thalli** which are haploid free living and dioecious. The male sex organs spermatangia are formed on male gametophytic plant and the female sex organs carpogonia are formed on female gametophytic plant.
 - (b) The **carposporophytes** are diploid, depend upon the female gametophyte. They develop after fertilization from zygote and later bear carposporangia. The carposporangia form diploid carpospores.
 - (c) The **tetrasporophytic plant** which is formed by germination of diploid carpospores is diploid and independent. Then plant bears tetrasporangia which form four haploid tetraspores which again give rise to male and female gametophytic plants.

Sexual Reproduction:

- Sexual reproduction is oogamous type and plants are dioecious i.e., male and female sex organs are produced on different male and female gametophytic plants.

Male Gametophyte

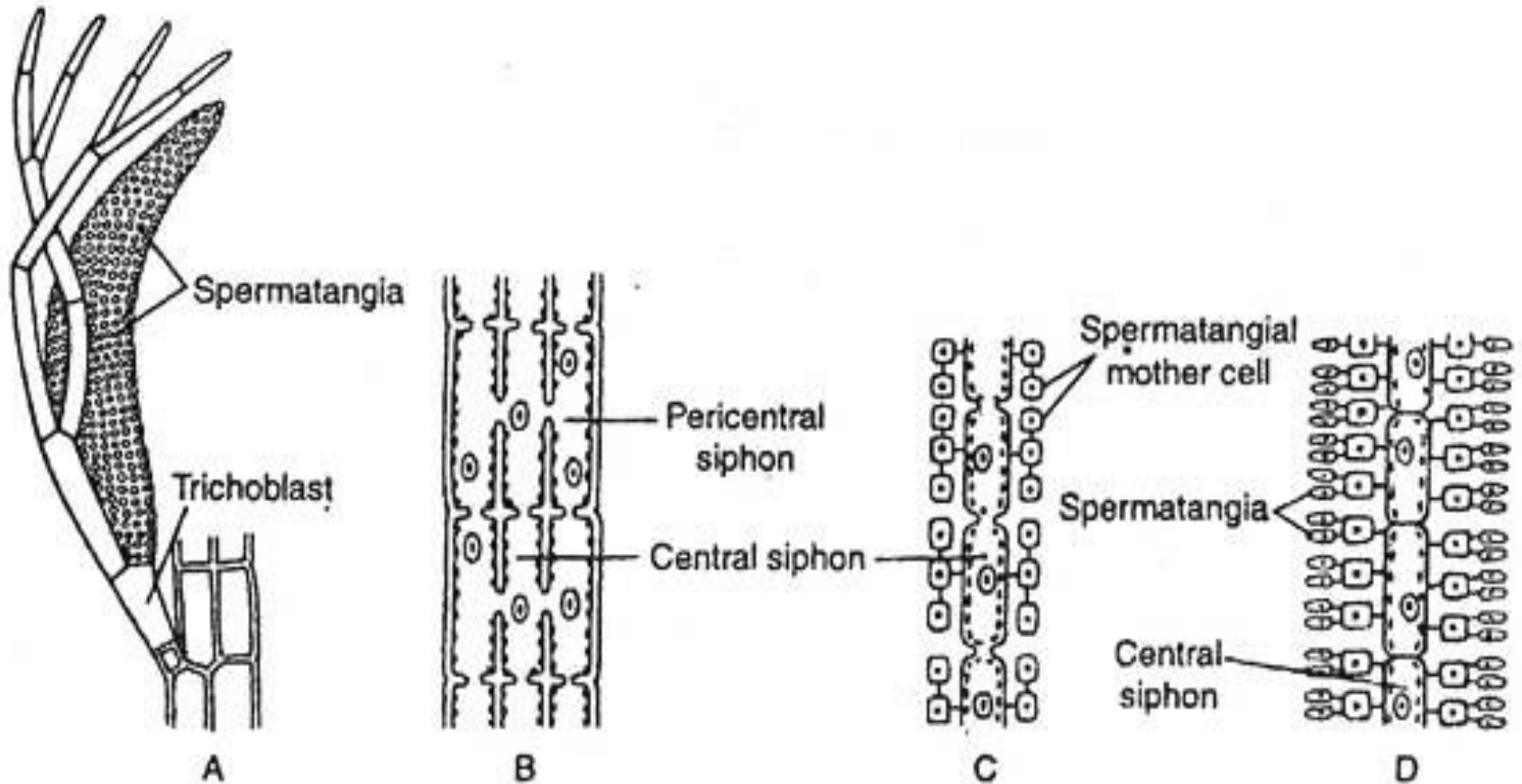


Fig. 3.134 : *Polysiphonia* sp. : Development of male reproductive organ. A. Portion of thallus with antheridial branch, and B-D. Sequential development of spermatangia

Female Gametophyte

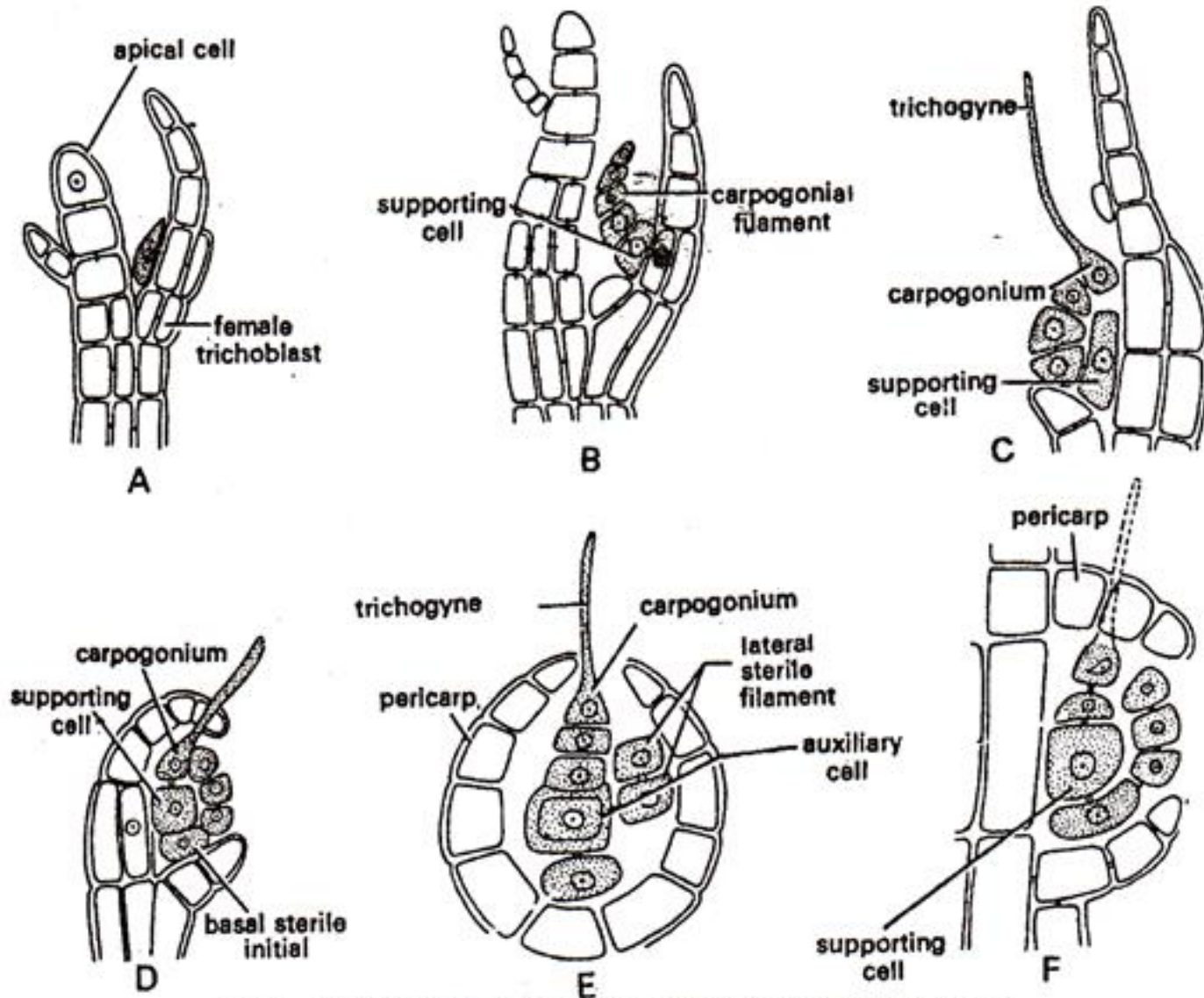


Fig. 5. (A-F). *Polysiphonia*. Development of female gametophyte.

Post fertilization changes

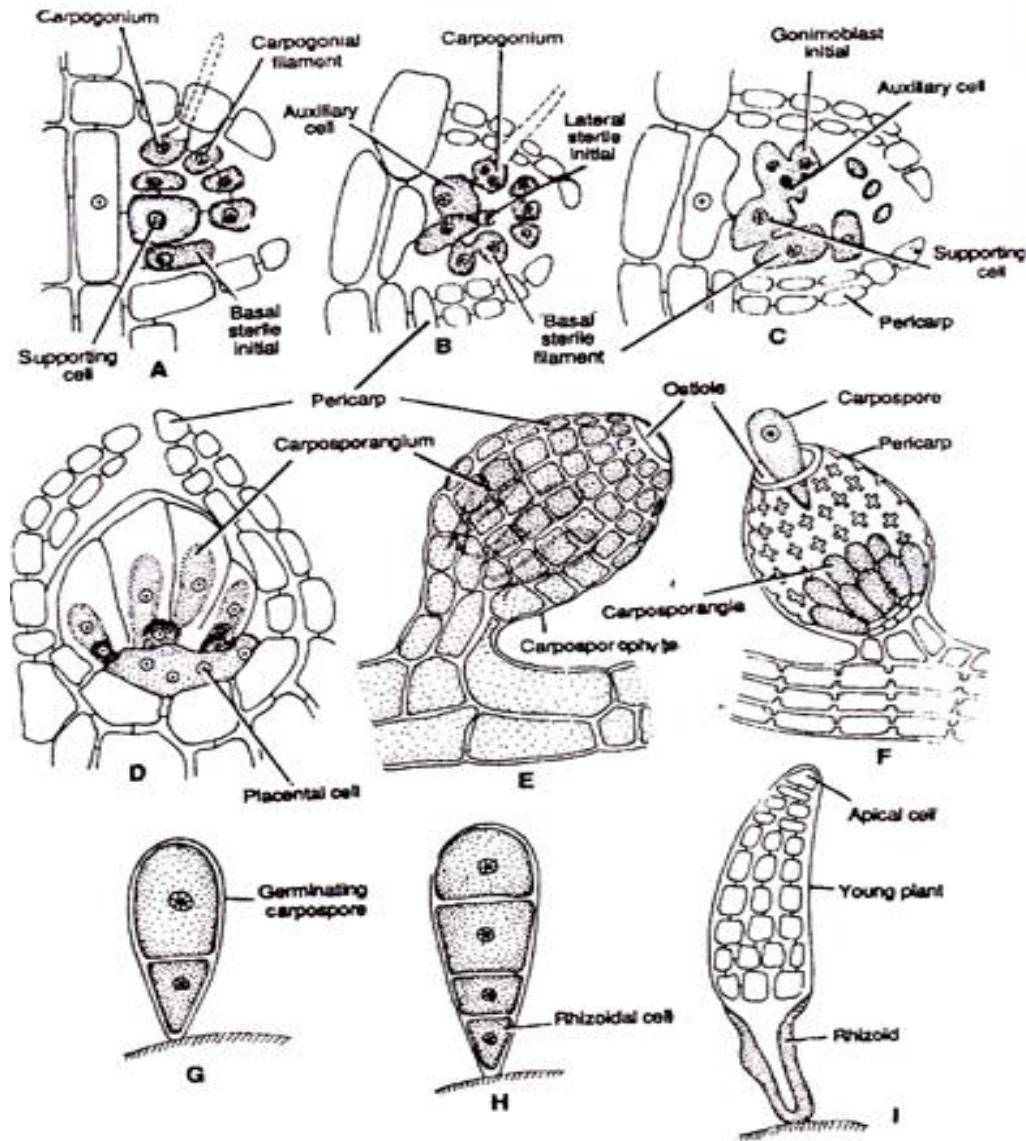
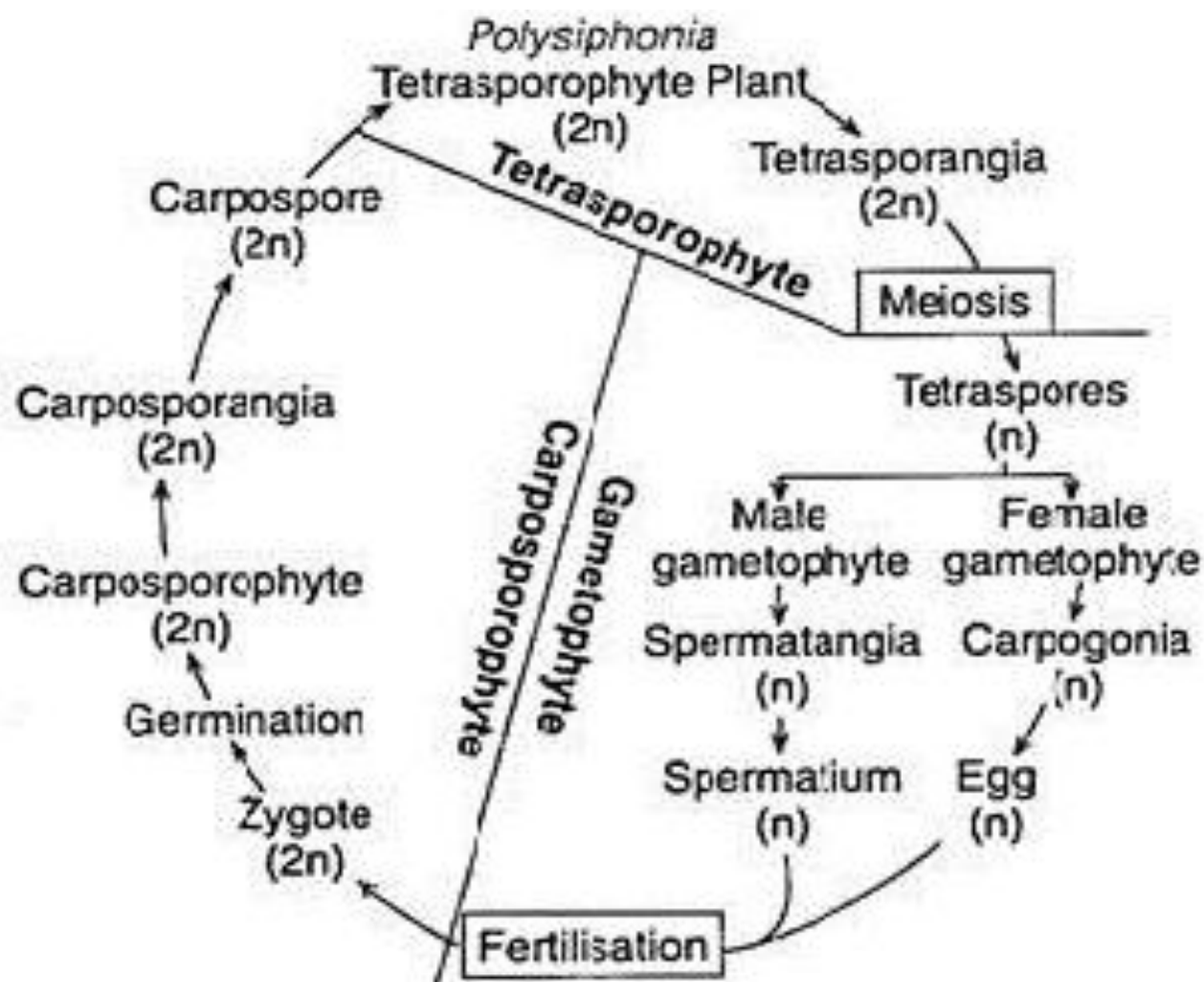


Fig. 6. (A-I). *Polysiphonia*. Post fertilization changes



B

Diplobiontic type (*Polysiphonia*)

Thanks

Economic Importance of Algae

Food:

- 1) *Chlorella*
- 2) *Chondrus crispus* (irish moss) – popular dish *Blancmanges*
- 3) *Codium* and *Ulva* – salad in japan
- 4) *Porphyra* – use as food having 30-35% protein and vitamin B & C
- 5) *Laminaria*- kombu food in japan (57-60% carbohydrate rich)
- 6) *Rhodomenia*- dulse food
- 7) *Monostroma* – use as aonori in Japan
- 8) *Spirulina*- having 60% protein
- 9) *Scenedesmus*- equivalent to skimmed milk
- 10) *Nostoc* – soup for China
- 11) *Spirogyra*- in south India

Fodder

Fucus , *Laminaria*, *Sargassum*, *Alaria*, *Ascophyllum*,
Macrocystis.

Agar-agar

Gelidium nudifrons

Gracilaria verucosa

Alginic Acid

Ascophyllum

Fucus

Macrocystis

Laminaria

Lassonia

Medicine

Tse-ko-Tsoi prepared from *Digenia sp*

Chlorellin

Funori a gum produce from *Gloiopeltis sp*

Vitamin

Vit-C from *Rhodomela sp*

Vit- A from *Porphyra lacinata*

Fucus , *Laminaria* good source of **iodine**

Minerals

Bromine found from *Polysiphonia sp*

Other than that Cu, Bo, Fe, Zn, Van, Cr, Co, Mn

Diatomite

Produce from Diatom