Ectocarpus

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

Occurrence

It is a marine alga found throughout the world, particularly abundant along the Atlantic coast. A few species occur in fresh waters. The plant grows attached to rocks and stones along coasts. Some species are epiphytes on other algae. *Ectocarpus fasciculatus* grows on the fins of certain fishes. *Ectocarpus dermonemcnis* is endophytic.

Structure of thallus

The thallus consists of profusely branched uniseriate filaments.
Ectocarpus shows heterotrichous habit, consisting of a prostrate and erect system. The filaments of the erect system arise from the filaments of prostrate system.

Prostate system: The prostrate system consists of creeping, irregularly branched filaments. These filaments are attached to the substratum with the help of rhizoids. Prostrate system is poorly developed in free floating species.

Erect system: The erect 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 erect system are uniseriate. 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.

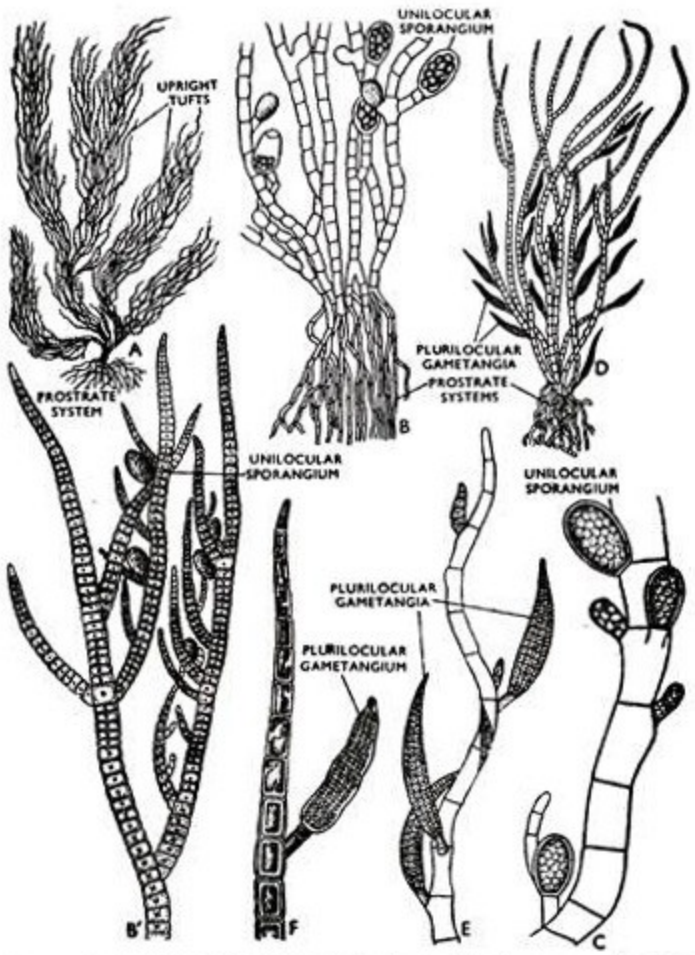

Fig. 102. *Ectocarpus* sp. A. Habit. B–C. Filaments bearing unilocular sporangia. D–E. Filaments bearing plurilocular gametangia. F. Portion of a filament showing plurilocular gametangium.

Cell Structure

Cells are cylindrical or rectangular and uninucleate. Cell wall is thick, composed of three layers of pectin and cellulose. Algin and fucoidan are also present in the cell wall. These are characteristic gelatinous substances present in the brown algae.

The chromatophores may be ribbon-like with irregular outline or disc-shaped. The dominant pigment is **fucoxanthin.** It gives this algae

golden brown colour. The other photosynthetic pigments are chlorophyll a, c, beta-carotene and other xanthophylls.

Growth :

In erect system growth is trichothallic. Intercalary meristem is present at the base of the hair. It is called trichothallic meristem. It increases the length of the terminal hair and vegetative cell of the branch. The growth in the prostrate system is apical.

Reproduction :

Ectocarpus reproduces by both asexual and sexual methods.

(i) Asexual Reproduction in Ectocarpus:

The asexual reproduction takes places with the help of biflagellate zoospores. These zoospores are produced in **unilocular** and **plurilocular sporangia.** These two types of zoosporangia may be produced on the same plant or on different plants. The unilocular zoosporangia form haploid zoospores and the plurilocular sprogania form diploid zoospores.

Unilocular Sporangia:

The unilocular sporangia develop singly on tips of small branchlets. The terminal cell of the branchlet gradually increases in size and becomes ellipsoidal. This cell functions as sporangial initial. The nucleus of sporangial cell first divides by meiotic division followed by many equational divisions. This results in formation of 32-64 haploid nuclei.

The nuclear divisions are not followed by wall formation and the sporangium remains unilocular. Each nucleus of the sporganiuin gets surrounded by protoplast segment and ultimately transforms into 32-64

zoospores. Each zoospore is pyriform, uninucleate with two laterally inserted unequal flagella.The anterior flagellum is longer, pantonematic and directed forward while the posterior is shorter, acronematic and directed backward.

The zoospores discharge en-masse in gelatinous matrix through a terminal pore in sporangium. The zoospores after being discharged remain in spherical mass at the apex of sporangium. These zoospores then become free and swim in water. These zoospores are haploid, they withdraw flagella and attach to the substratum by their anterior ends. The zoospores germinate within 2-3 hours to produce a new Ectocarpus plant which is similar to sporophytic plant in structure. These plants are called gametophytic plants because on maturity they bear plurilocular gametangia and produce gametes.

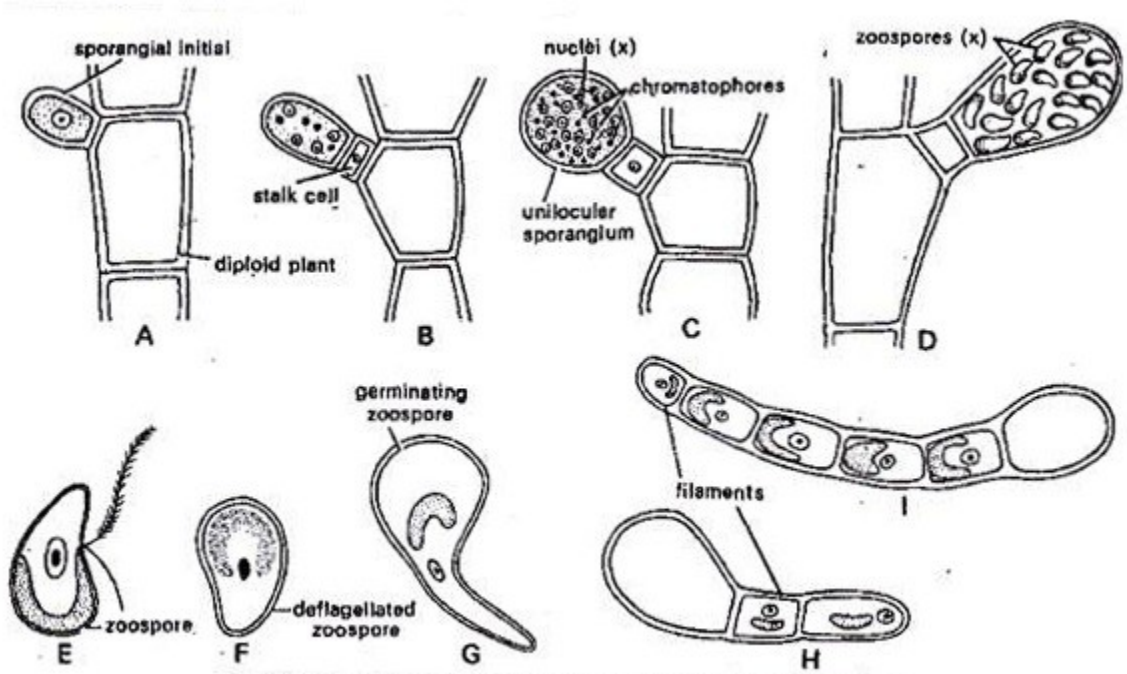

Fig. 2 (A–H). *Ectocarpus*. Development of unilocular sporangium.

Plurilocular Sporangia:

Like unilocular sporangia, the plurilocular sporangia also develop from the terminal cells of the branchlets of diploid sporophytic plant. The cell which functions as sporangial initial enlarges in size and becomes

spherical or elongated structure. It repeatedly undergoes transverse divisions to form a row of 5-12 cells. Then Many transverse and vertical divisions result in formation of cubical cells arranged in 20-40 transverse tiers. The cells are arranged in regular rows. This multicellular structure is called plurilocular sporangium.

The protoplast of each diploid uninucleate cell of the sporangium is transformed into a single biflagellate zoospore. The zoospores of plurilocular and unilocular sporangia are identical in structure but zoospores of plurilocular sporangia are diploid and zoospores of unilocular sporangia are haploid.

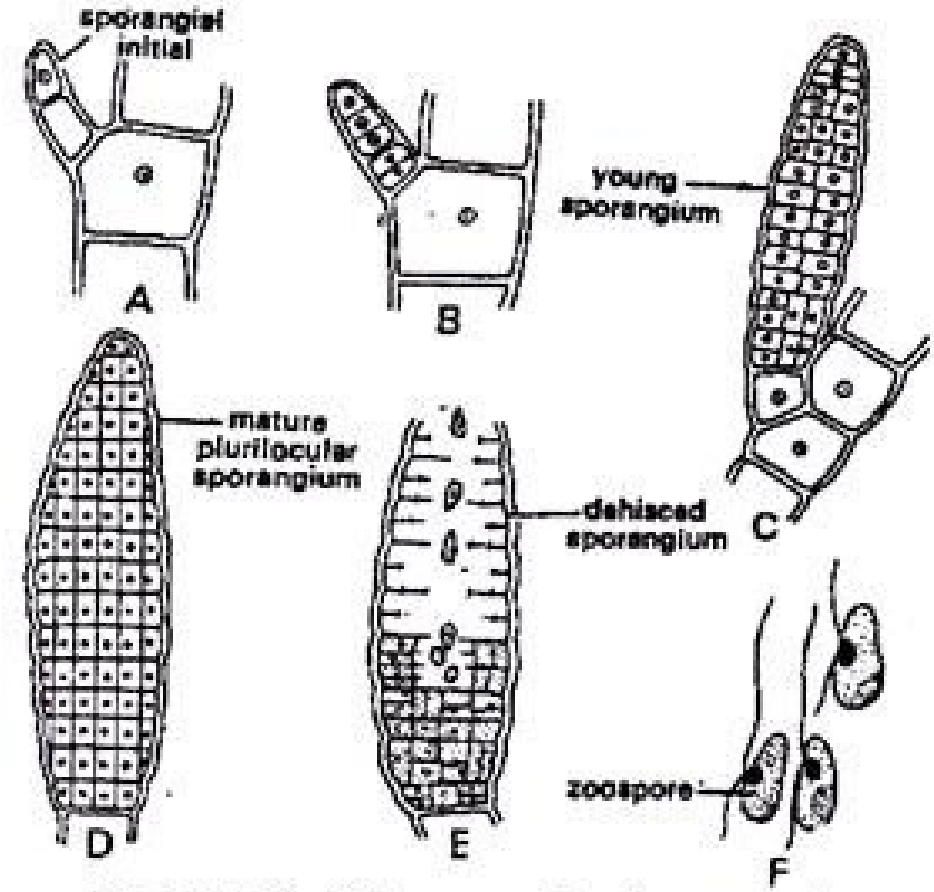

Fig. 3 (A–H). *Ectocarpus*. Development of Plurilocular Sporangia

The mature zoospores are liberated from the sporangium through apical or lateral pores. The zoospores remain motile for 4-5 hours and then

germinate into diploid thallus which later on bears unilocular and plurilocular sporangia.

These diploid zoospores multiply only sporophytic plants and they do not play any role in alternation of generation. The formation of unilocular and plurilocular sporangia is affected by environmental conditions like temperature and salinity of water. E. siliculosus produces unilocular sporangia at 13°C, plurilocular at 19°C and both unilocular and plurilocular at 16°C.

Sexual Reproduction

Sexual reproduction in Ectocarpus takes place by isogamy or 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 conical structures. Gametangia are produced on the haploid plants developing from the meiozoospores. The development of gametangia is similar to that of plurilocular sporangia.

1. These develop from terminal cell of a lateral branch. The gametangial initial gets inflated. It divides mitotically by repeated transverse divisions. It produces a vertical row of flat cells.

2. These cells undergo repeated vertical and transverse divisions. They form many hundred small cubical cells. These cells are arranged in 24-40 transverse rows.
3. The protoplast of each cell metatmorphoses into a single, pyriform, biflagellate, haploid gamete. The flagella are laterally attached. The zoospores and the gametes are similar in structure. But the gametes are relatively smaller in size.
4. The gametes are liberated through an apical pore formed in the gametangium .

Forms of sexual reproductions

a. Isogamy: Isogamous species are *E. pusilus* and E. *globifer* etc. In these species, the fusion takes place between alike gametes. These gametes belong to the same plant or even to toe same gametangium.

b. Physiological anisogamy : It occurs in species like *E. siliculosus*. The fusing gametes are identical morphologically. But they show different sexual behaviour. One is less active and is called **female gamete.** The other is more active and is called **male gamete.** The female gamete soon comes to rest. It settles on a substratum. It becomes surrounded by active male gametes. The male gametes attach themselves to the female gamete through their anterior flagella. The anchoring flagellum contracts, the body of one of the male gametes comes in contact with that of the female gamete and the fusion takes place. This phenomenon is called **clump formation.**

c. Morphological Anisogamy: It occurs in species like *E. secundus*. In this case, the two fusing gametes are dissimilar in size. They are produced in different gametangia: The smaller ones are produced in **microgametangia.** The larger ones are produced in **megagametangia.**

Fertilization:
Fertilization occurs and diploid zygote is formed. There is no zygotic meiosis. The zygote germinates into a diploid sporophyte.

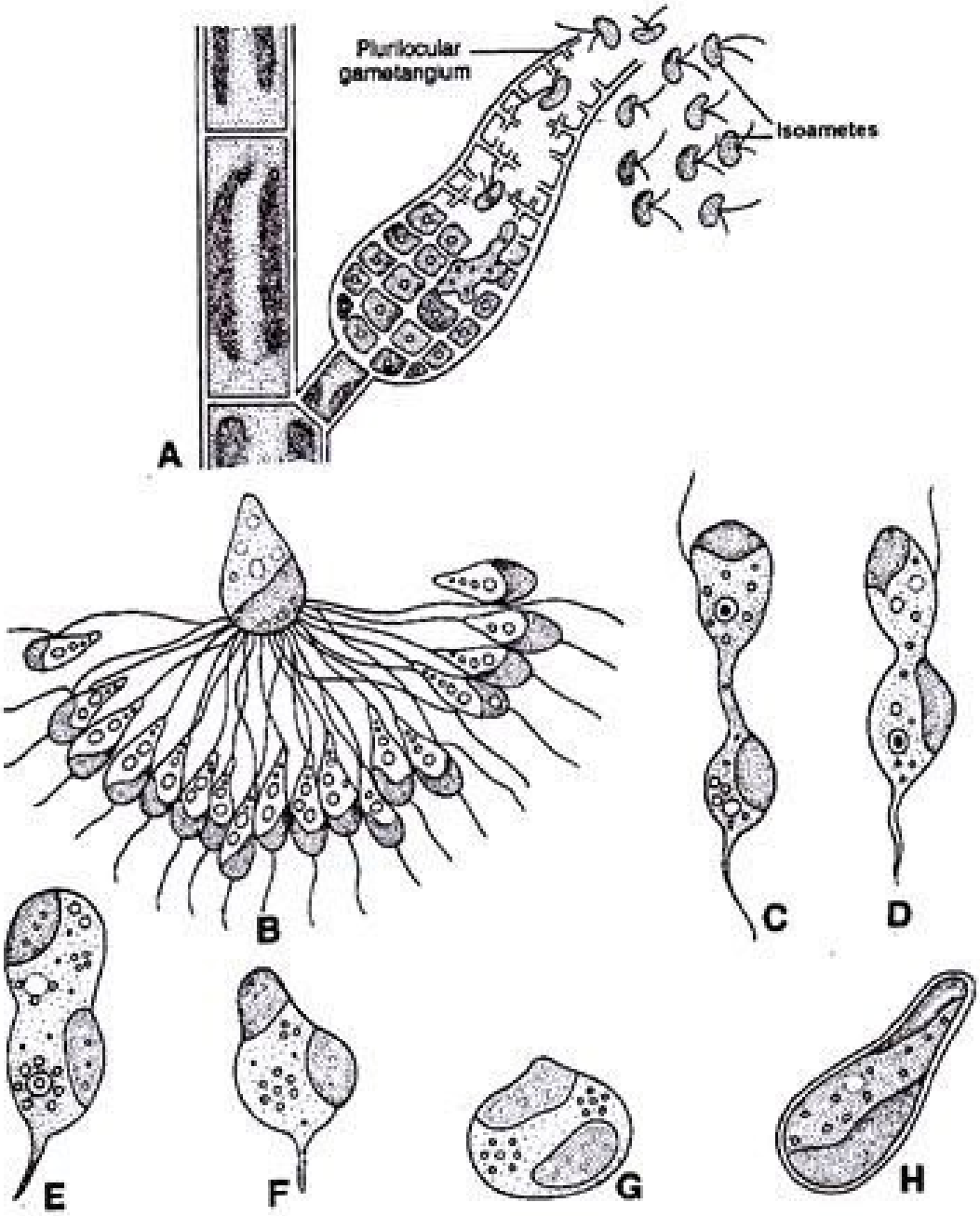

Fig. 4 (A–H). *Ectocarpus*. A. Plurilocular gametangium, B. Clump formation, C–H. Fusion stages and zygote.

Alternation of Generations

Ectocarpus shows isomorphic alternation of generations. There is alternation of morphologically similar gametophytic (haploid) and sporophytic (diploid) generations in its life cycle.

(**Sporophyte:** The sporophyte is diploid. It develops two types of sporangia. Zoospores are produced in these sporangia. Zoospores are produced by mitosis (mitozoospores) in plurilocular sporangia. The zoospores in unilocular sporangia are produced meiotically (meiozoospores).
The **mitozoospores** germinate into a diploid sporophyte. These spores cause reduplication of sporophyte generation. The **meiozoospores** germinate to give rise a haploid **gametophyte** plant.

Gametophyte: It develops plurilocular gametangia. These gametophytes are similar to the sporophyte in morphology. Haploid gametes are produced in the gametangia. These gametes fuse to form a diploid zygote. Zygote germinates into a diploid **sporophyte** plant. In some species the gametophyte generation is also reduplicated by the **parthenogenesis.** In this case, the gametes from plurilocular sporangia form new gametophyte generation.)

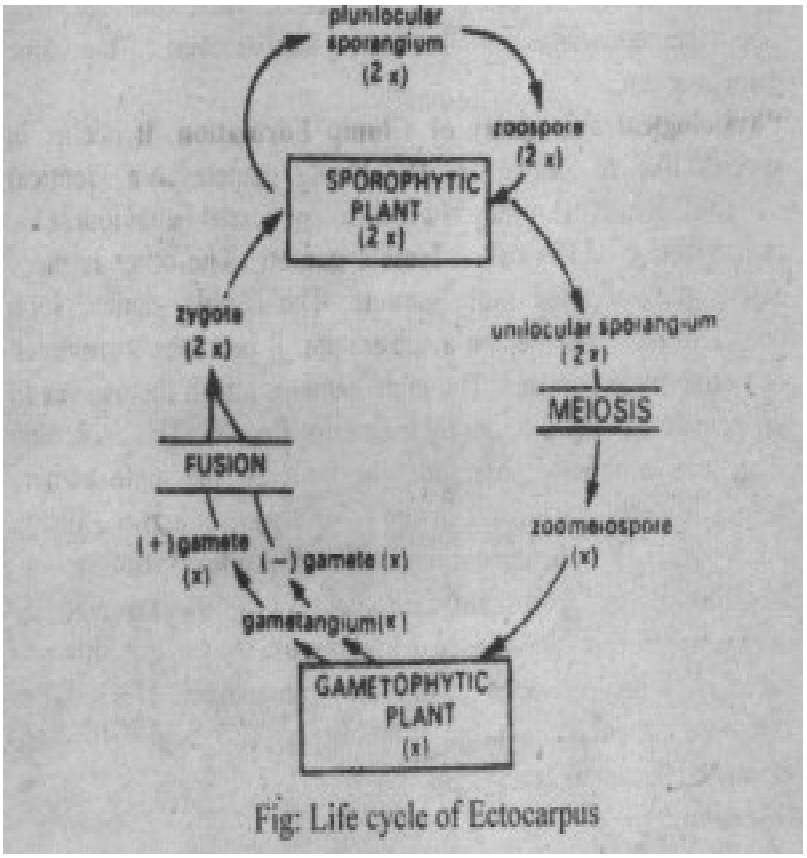

Fig: Life cycle of Ectocarpus