ECTOCARPUS

SYSTEMATIC POSITION:

Division - Algae

Class - Phaeophyceae

Order - Ectocarpales

Family - Ectocarpaceae

Type - ***Ectocarpus* sp**

OCCURRENCE:

Ectocarpus is a multicellular, filamentous, branched, marine, brown alga. It occurs in colder seas of polar and temperate regions. It grows abundantly on sea shore attached to rocks and stones. Some species of *Ectocarpus* grow epiphytically on other algae. A very few species grow epizoically on the fins of fishes.

THALLUS STRUCTURE:

The plant body of *Ectocarpus* is a multicellular, filamentous, much branched, brown coloured thallus. The thallus is differentiated into two portions i.e.

i) Prostrate portion.

ii) Erect portion.

The prostrate portion is composed of many horizontal, branched filaments attached to the substratum by **rhizoids.**

The erect portion of thallus is composed of many erect, aerial,

delicate, much branched filaments in a **tuft**. The erect filaments are composed of a series of rectangular or cylindrical cells. The erect filaments bear many lateral branches and they have **tapering ends**. The lateral branches are developed from just beneath the septae

Ectocarpus plants are of two types i.e. (i) **Sporophytic or Diploid or Asexual plant** (ii) **Gametophytic or Haploid or Sexual plant.** Both types of the plants are similar morphologically and alternate regularly in the life cycle.

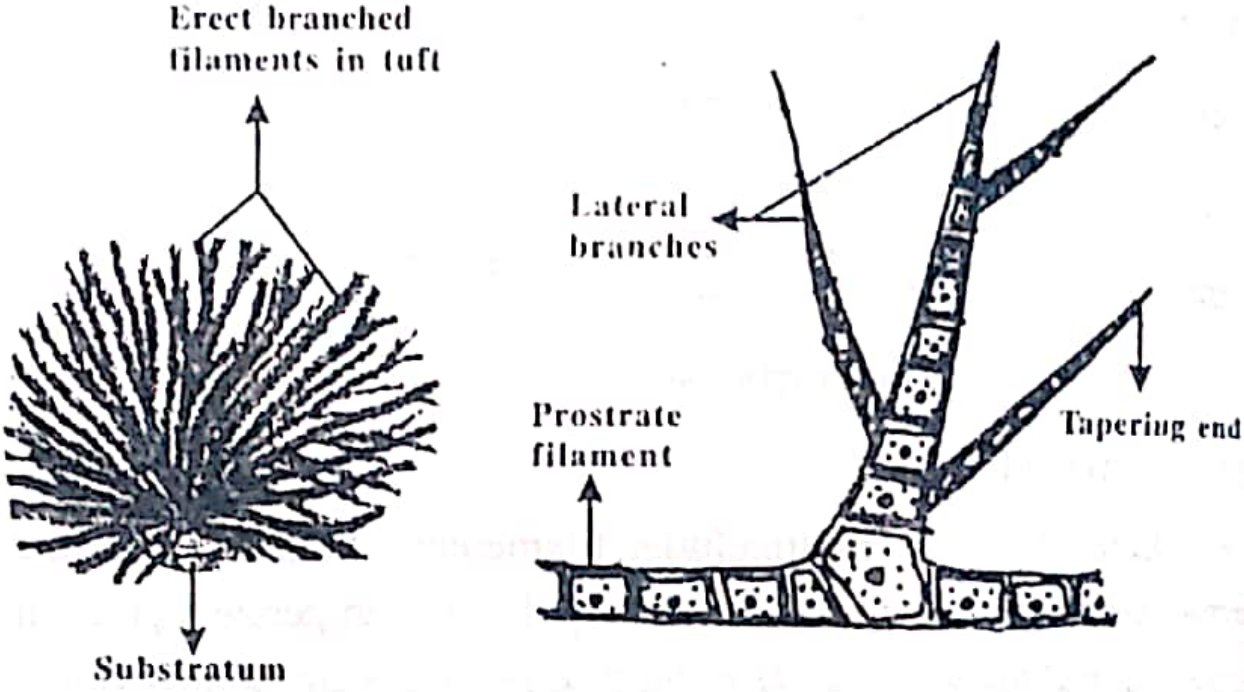

Fig.6.1. ALGAE: Ectocarpus - Thallus structure.

Single cell structure:

The *Ectocarpus* thallus is composed of many rectangular or cylindrical, uninucleate cells. The cells have double layered **cell wall.** The outer layer is **pectic** in nature and inner **cellulose** in nature. The protoplasm contains many discoid or band shaped or ribbon like chromatophores without pyrenoids. They are yellow brown in colour. The protoplasm also contains cell organells like mitochondria, ribosomes, golgi bodies, endoplasmic reticulum etc. in addition to the reserved food material in the form of complex carbohydrates.

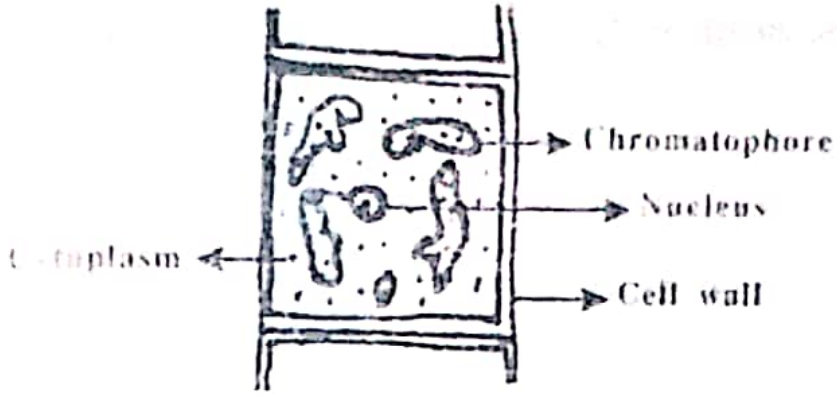

Fig. 6.2. ALGAE: Ectocarpus – Single cell structure.

REPRODUCTION:

Ectocarpus reproduces asexually and sexually.

Asexual reproduction:

Ectocarpus reproduces asexually during the period of favourable conditions by the formation of two types of sporangia i.e.

i) Plurilocular sporangia.

ii) Unilocular sporangia.

The asexual reproduction is mainly concerned with the diploid or sporophytic or asexual plant of *Ectocarpus*

Asexual reproduction by the formation of plurilocular sporangia:

The plurilocular sporangia are small, elongated, cone like, multicellular, stalked or sessile structures. They are developed on the lateral branches of diploid plants of *Ectocarpus*. The plurilocular sporangia are composed of several hundred of cubical, diploid, uninucleate cells. The cells are arranged in many transverse tiers in the sporangium.

During the process of formation of the plurilocular sporangia, many small, diploid protuberances are developed on the lateral branches called the **plurilocular sporangial initials** or **sporangial mother cells** (PSMC). The sporangial mother cells enlarged in size due to accumulation of large amount of food material. They elongate in size and become cone like. The content of the sporangial mother cells divide,

redivide, transversely, vertically, mitotically and results into the formation of many cubical cells in many transverse tiers. Now the elongated cone like, sporangial mother cells with many cubical, diploid cells behave as the **plurilocular sporangia.**

When the plurilocular sporangia mature, protoplasm of the cubical cells metamorphoses into a single, motile, biflagellate, kidney shaped, and diploid structure called the **zoospore.** The zoospores are the result of mitotic division, hence are also called as **mitozoospores.** The mitozoospores have two **flagella of unequal length.** The longer flagellum is called as the **tinsel** type flagellum and shorter as the **whiplash** type flagellum. They have a small spot just near the base of the flagella called the **eye spot.**

When the mitozoospores mature, liberated outside by rupturing wall of the plurilocular sporangium. The liberated mitozoospores swim for some time, come to rest, loose their flagella and become rounded. The rounded non motile mitozoospores germinate by putting outside a **germ tube.** The germ tube grows independently and finally gives rise to a **new diploid plant of *Ectocarpus*.**

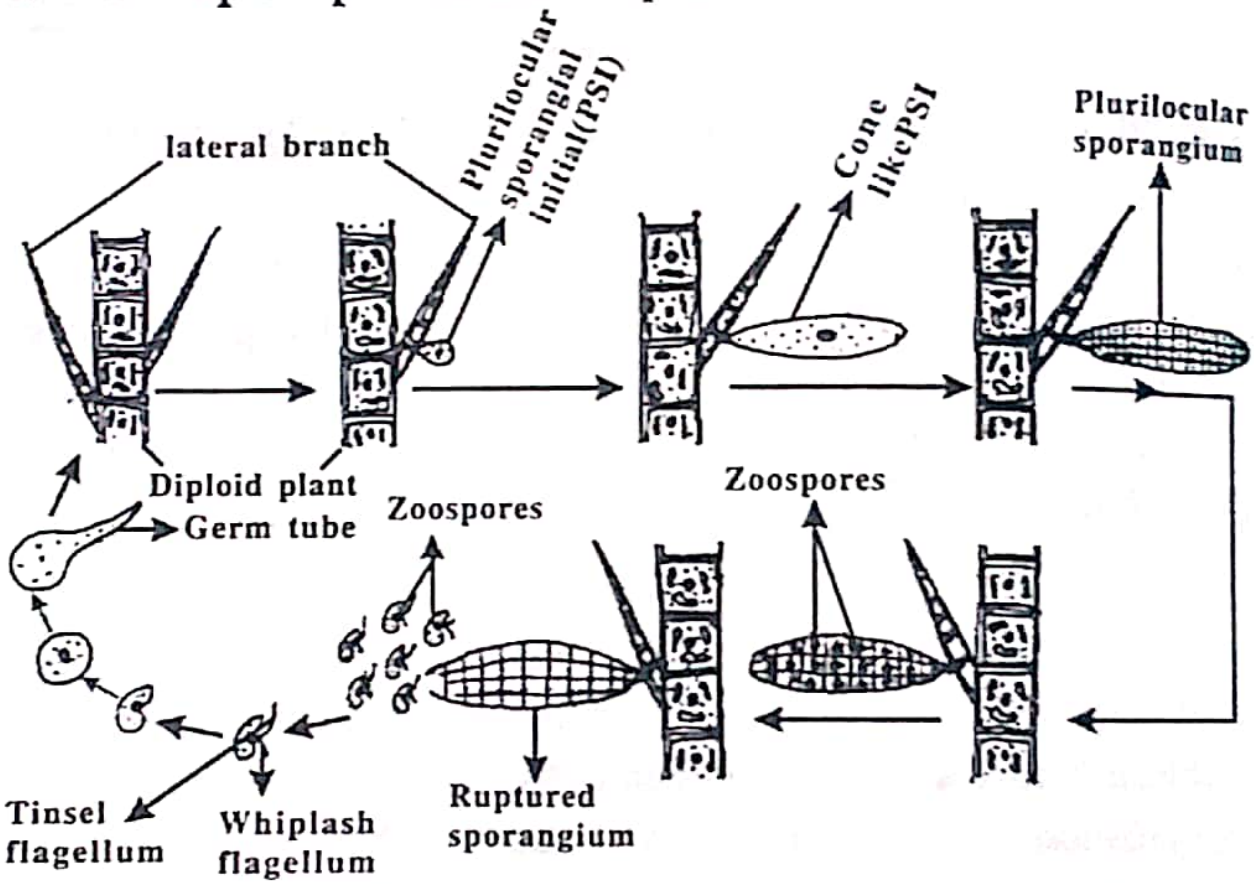

Fig.6.3 (A-K). ALGAE: Ectocarpus - Asexual reproduction by the formation of plurilocular sporangia.

Asexual reproduction by the formation of unilocular sporangia:

The unilocular sporangia are small, globose or rounded or spherical or knob like, stalked or sessile, unicellular, uninucleate, diploid structures. They are developed on the lateral branches of the diploid plant of *Ectocarpus.*

During the process of development of the unilocular sporangia, many small **diploid protuberances** are developed from the lateral branches. They are called as the **unilocular sporangial initiales** or **unilocular sporangial mother cells** (USMC). The USMC enlarged in size due to the accumulation of large amount of food material. The enlarged, knot like, unicellular, uninucleate diploid USMC are called as the **unilocular sporangia.**

When the unilocular sporangia mature, the diploid nucleus undergoes **reduction division** and results in to the formation of four haploid **daughter nuclei.** The reduction division is followed by repeated **mitotic division** and results into the formation of many haploid nuclei. The protoplasm of the haploid, multinucleate, unilocular sporangium undergoes cleavage (spliting of protoplasm into many divisions) and results into the formation of many, haploid, uninucleate, daughter protoplasmic bodies. Each dauguter protoplasmic body metamorphoses into a single, motile biflagellate, kidney shaped, haploid, structure called the **zoospore.** The zoospores are the result of meiotic division, hence they are also called as the **meiozoospores.** The meiozoospores have two flagella of unequal length like the mitozoospores. They have an **eye spot** just near the base of the flagella.

When the meiozoospores mature, liberated outside by rupturing the wall of the sporangium. The liberated meiozoospores swim for some time, come to rest, loose their flagella, become rounded and non motile. The non motile meiozoospores germinate by putting outside a germ tube. The **germ tube** grows independently and finally gives rise to a **new haploid plant of *Ectocarpus*.**

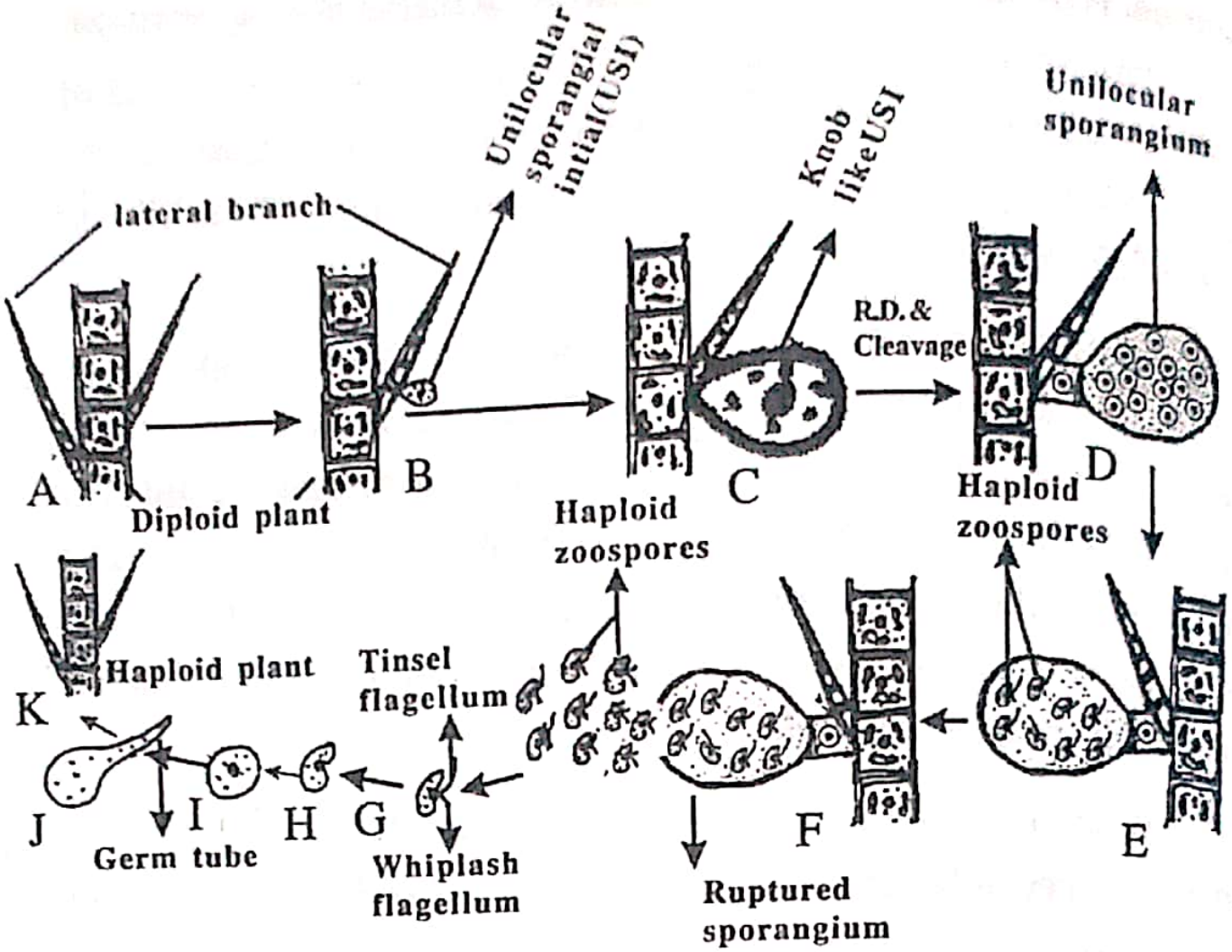

Fig.6.4 (A-K).ALGAE: Ectocarpus- Asexual reproduction by the formation of unilocular sporangia.

Sexual reproduction:

Ectocarpus reproduces sexually during the period of unfavourable conditions. The sexual reproduction in *Ectocarpus* is of three types.

i) Isogamous type.

ii) Morphological anisogamous type.

iii) Physiological anisogamous type.

Isogamous type:

The process of sexual reproduction in which the fusing gametes are morphologically and genetically similar is called as the **isogamous** type of sexual reproduction. This type of sexual reproduction is very common in *Ectocarpus*.

Morphological anisogamous type:

The process of sexual reproduction in which the fusing gametes are morphologically dissimilar and genetically similar is called as the **morphological anisogamous** type of sexual reproduction. It is very rare in *Ectocarpus*.

Physiological anisogamous type:

The process of sexual reproduction in which the fusing gametes are morphologically similar and physiologically dissimilar is called as the **physiological anisogamous** type of sexual reproduction. It is very rare in *Ectocarpus*.

The sexual reproduction in *Ectocarpus* is mainly concerned with the **gametophytic** or Haploid or Sexual plant of *Ectocarpus*. It takes place by the formation of **gametangia** which produce the gametes.

Structure and development of gametangium:

The **gametangia** are elongated, cone like, multicellular, stalked or sessile structures. They are similar in structure with that of the plurilocular sporangia. They are developed on the lateral branches of haploid plants of *Ectocarpus*.

During the process of development of the gametangia, many small, **haploid protuberances** are developed on the lateral branches called the **gametangial initials** or **gametangial mother cells** (GMC). The GMC enlarged in size due to the accumulation of large amount of food material. They elongate in size and become cone like. The protoplasm of the GMC divides and redivides transversely, vertically mitotically and results into the formation of many cubical cells in many transverse tiers. Now the GMC with many haploid cubical cells behave as the **gametangia.**

Structure and formation of gametes:

When the gametangia mature, the protoplasm of the cubical cells metamorphoses into a single motile, biflagellate, kidney shaped, haploid,

and zoospore like, very small structure called the gamete. The gametes have two flagella of unequal length. The longer flagellum is called as **tinsel type** and shorter flagellum as **whiplash type**. They have a small **eye spot** just near base of the flagella.

Types of gametes:

i) The gametes which are morphologically and genetically similar are called the **isogametes**. The isogametes are generally developed in the same gametangium on the same haploid plant (Homothallic species of *Ectocarpus*). The isogametes are very common in majority of the species of *Ectocarpus*.

ii) The gametes which are morphologically dissimilar and genetically similar are called the **morphological anisogametes**. The morphological anisogametes are generally developed in two different gametangia of different size on the same haploid plant of *Ectocarpus* (**Homothallic** sp.). The morphalogical anisogametes are very rare in *Ectocarpus*.

iii) The gametes which are morphologically similar and physiologically different are called the **physiological anisogametes**. The physiological anisogametes are generally developed in two different morphologically similar gametangia on two different haploid plants of *Ectocarpus* of opposite strain (**Heterothallic** sp.). The physiological anisogametes are very rare in *Ectocarpus*.

Fertilisation or fusion of gametes:

When the gametes mature, liberated outside by rupturing the wall of gametangia and swim in water.

During the process of fertilisation, the two gametes (Isogametes or morphological anisogametes or physiological anisogametes) come very close to each other and fuse. The wall of contact between the two

fusing gametes dissolves and **plasmogamy** takes place. Meanwhile the fusing gametes loose their flagella. The plasmogamy is followed by the **karyagamy**. The karyogamy results into the formation of a **diploid zygote**. Soon after formation, the diploid zygote germinates and put outside a **germ tube**. The germ tube grows independently and finally gives rise to a new diploid plant of *Ectocarpus*.

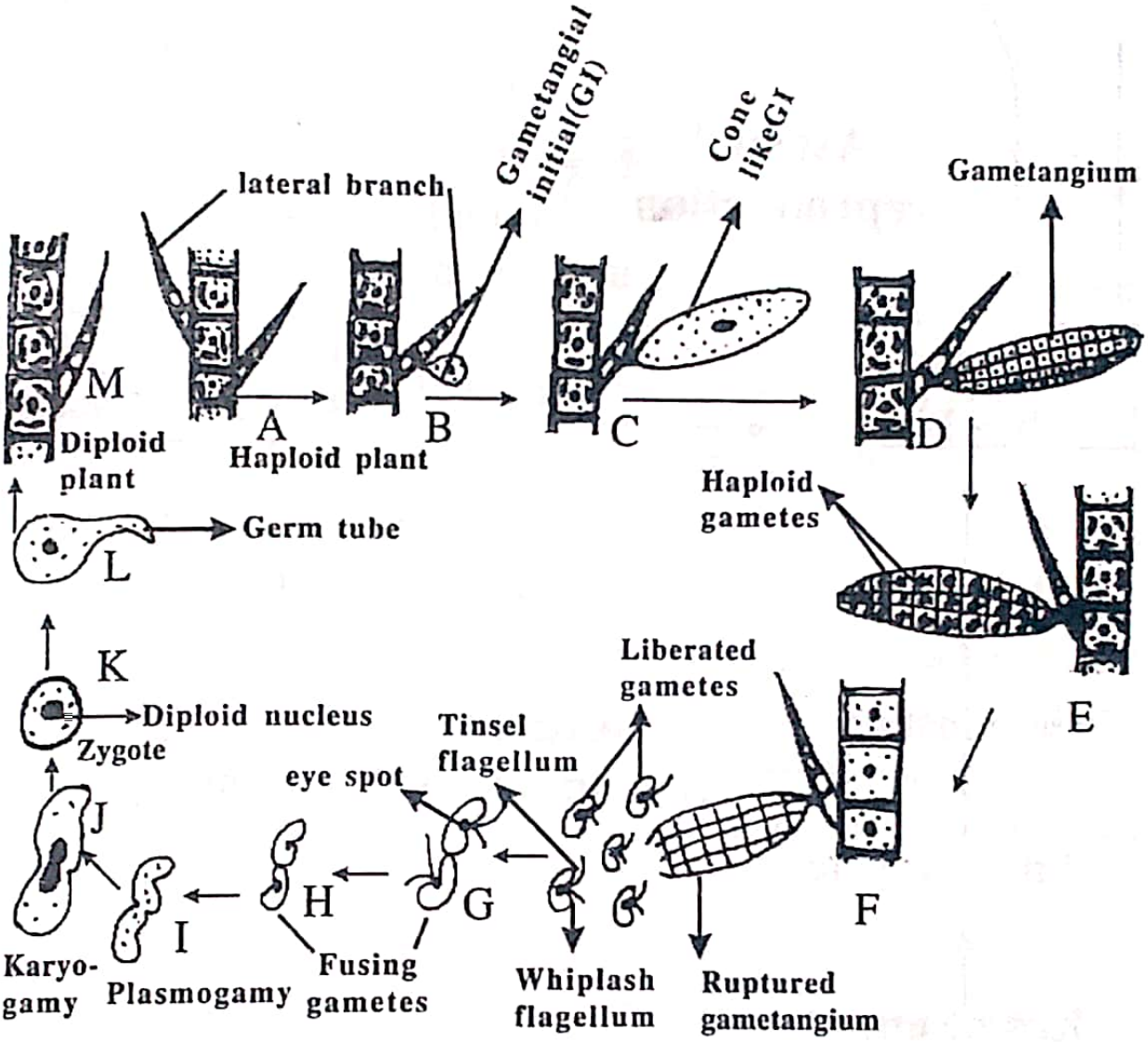

Fig.6.5 (A-M).ALGAE: Ectocarpus- Sexual reproduction

Alternation of generation:

The two morphologically similar and physiologically or genetically different plants i.e. Haploid and Diploid plants of *Ectocarpus*, alternate regularly in the life cycle. This type of alternation of generation is called the **Isomorphic type** of alternation of generation.

GRAPHIC LIFE CYCLE:

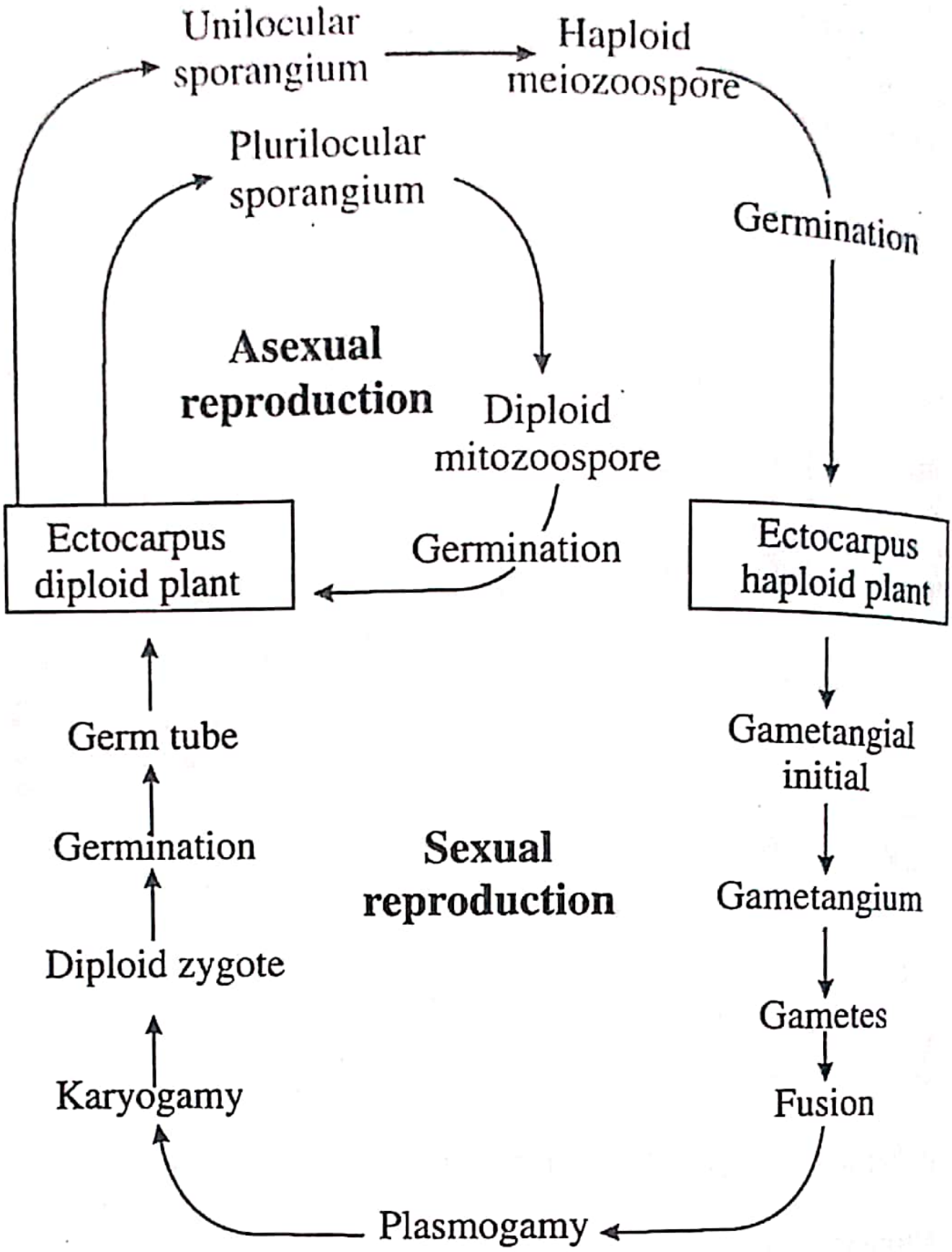

Fig.6.6. ALGAE : Ectocarpus - Graphic life cycle.