OEDOGONIUM

SYSTEMATIC POSITION:

Division	-	Algae
Class	-	Chlorophyceae
Order	-	Oedogoniales
Family	-	Oedogoniaceae
Type	-	*Oedogonium sp*

OCCURRENCE:

Oedogonium is multicellular, filamentous, unbranched, green alga. It occurs in the standing water of ponds, pools, lakes, ditches, tanks etc. It remains attached to the substratum like stones and branches, leaves and petioles of the aquatic plants. The older filaments occur freely floating in mass.

THALLUS STRUCTURE:

The plant body of *Oedogonium* is a multicellular, filamentous, unbranched, green thallus. It is composed of a row of many cylindrical or rectangular cells placed end to end. The cells are of three types such as

i) Apical cell.

ii) Intercalary cells.

iii) Basal cell.

Apical cell:

The cell at the apex of the filament is called the apical cell. The apical cell has free rounded end.

Intercalary cells:

The cells between the apical and basal cell are called the **Intercalary** cells. The intercalary cells form a major portion of the filament. Some intercalary cells here and there in the filament have certain ring like or plate like structures at the upper end called the **caps**. And the cells with caps as cap cells. The cap cells in the filament have the capacity to divide and redivide and add new cells to the filament. The formation of caps is the indication of cell division. The presence of caps is one of the most important marks of identification of the genus *Oedogonium.*

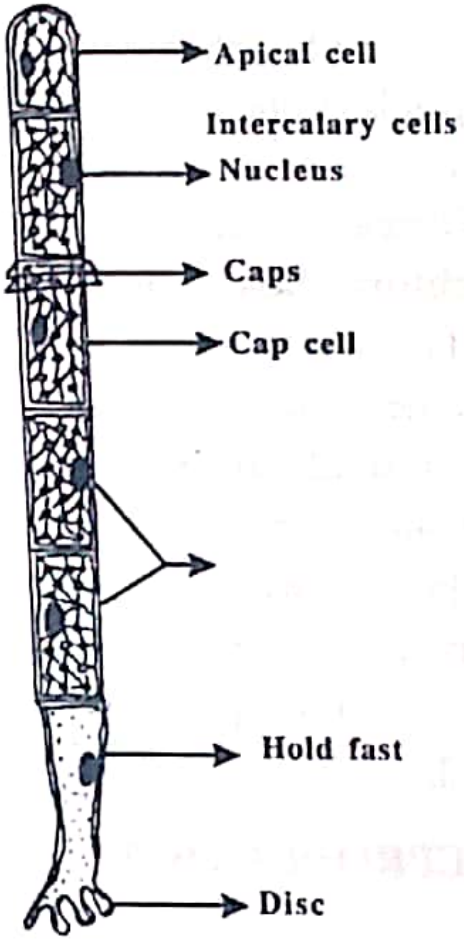

Fig.5.1. ALGAE: Oedogonium - Thallus structure

Basal cell:

The cell at the base of the filament is called the basal cell. The basal cell is colourless. It functions as an organ of attachment called **hold fast**. It is disc shaped or finger shaped at its base with the help of which it attaches to the substratum.

Single cell structure:

All the cells except the basal cell are cylindrical or rectangular in

shape. The cells have double layered cell wall. The outer layer is **pectic** in nature and inner layer is **cellulose** in nature.

The protoplasm of the cell is surrounded by a thin membrane called the plasma membrane. The protoplasm has a well developed, large, biscuit shaped nucleus just near the cell wall. The protoplasm contains chloroplast, other cell organelles like mitochondria, golgi complex, ribosomes and endoplamic reticulum in addition to the reserved food material in the form of starch and glycogen granules.

The chloroplast runs parallel to the long axis of the cell and forms a massive network. Hence it is called as **reticulate chloroplast**. The reticulate chloroplast has many **pyrenoids** at the points of intersection. The pyrenoids are small protein bodies surrounded by starch. They are white in colour. The presence of many pyrenoids gives white appearance to the cell.

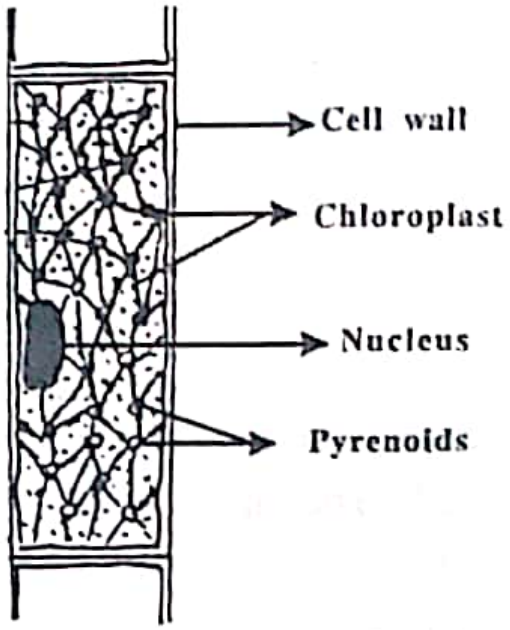

Fig.5.2. ALGAE: Oedogonium - Single cell structure

REPRODUCTION:

Oedogonium reproduces vegetatively, asexually and sexually.

Vegetative reproduction:

Oedogonium reproduces vegetatively during the period of favourable conditions. The vegetative reproduction takes place by fragmentation and by the formation of akinetes.

Fragmentation:

The fragmentation is a very common method of reproduction in

Oedogonium. During the process of fragmentation, the *Oedogonium* filaments break into many fragments due to strong water currents, animal bites or by any other mechanical means. Each fragment later on grows independently and gives rise to a new filament of *Oedogonium*.

By the formation of akinetes:

The akinetes are nothing but the enlarged, thick walled vegetative cells of the *Oedogonium* filaments. During the process of formation of the akinetes, some vegetative cells accumulate large amount of food material become enlarged, thick walled, orange or red coloured and behave as the **akinetes**. The akinetes are generally formed in a chain of about 10 to 40. When the akinetes detached from the filament, germinate and give rise to the new filaments of *Oedogonium*.

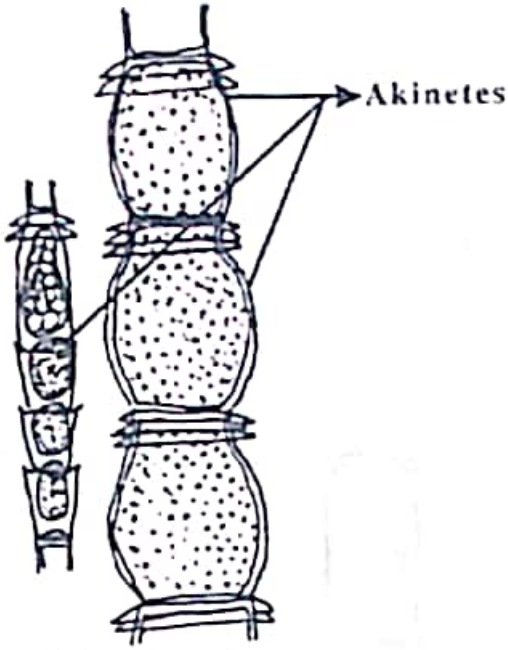

Fig.5.3. ALGAE: Oedogonium – Akinetes

Asexual reproduction:

The asexual reproduction takes place during the period of favourable conditions by the formation of **zoospores**. The zoospores are small, rounded or oval or spherical in shape. They are motile multiflagellate. They have a small antenior colourless beak.

During the process of formation of the zoospores, protoplasm of any vegetative cap cell contracts and becomes rounded or oval shaped by leaving the cell wall. A small, colourless **beak** or spot is developed at one end of the protoplasm. It is followed by the formation of a ring of many basal granules around the base of the colourless beak. The basal granules are called the **blepharoplast granules**. Each

blepharoplast granule gives rise to a flagellum. Thus a ring of flagella is formed around the base of the beak. Now this rounded or oval, multiflagellate motile protoplasm behaves as the zoospore. The vegetative cell producing the zoospore is called as the **zoosporangium**.

When the zoospore matures, liberated outside, by rupturing wall of the zoosporangium. During the process of liberation, the wall of the zoosporagium at the upper end ruptures and lifted above just like lid of a box. The inner layer of the wall comes out in the form of a thin vesicle along with the mature zoospore. Soon the vesicle dissolves in water and the zoospore becomes free.

The liberated zoospore swims in water for some times, comes to rest, attaches to the substratum by it's anterior colourless beak, looses its flagella and becomes non motile. Then it enlarges in size, divides and re-divides and finally gets converted into a new filament of *Oedogonium*

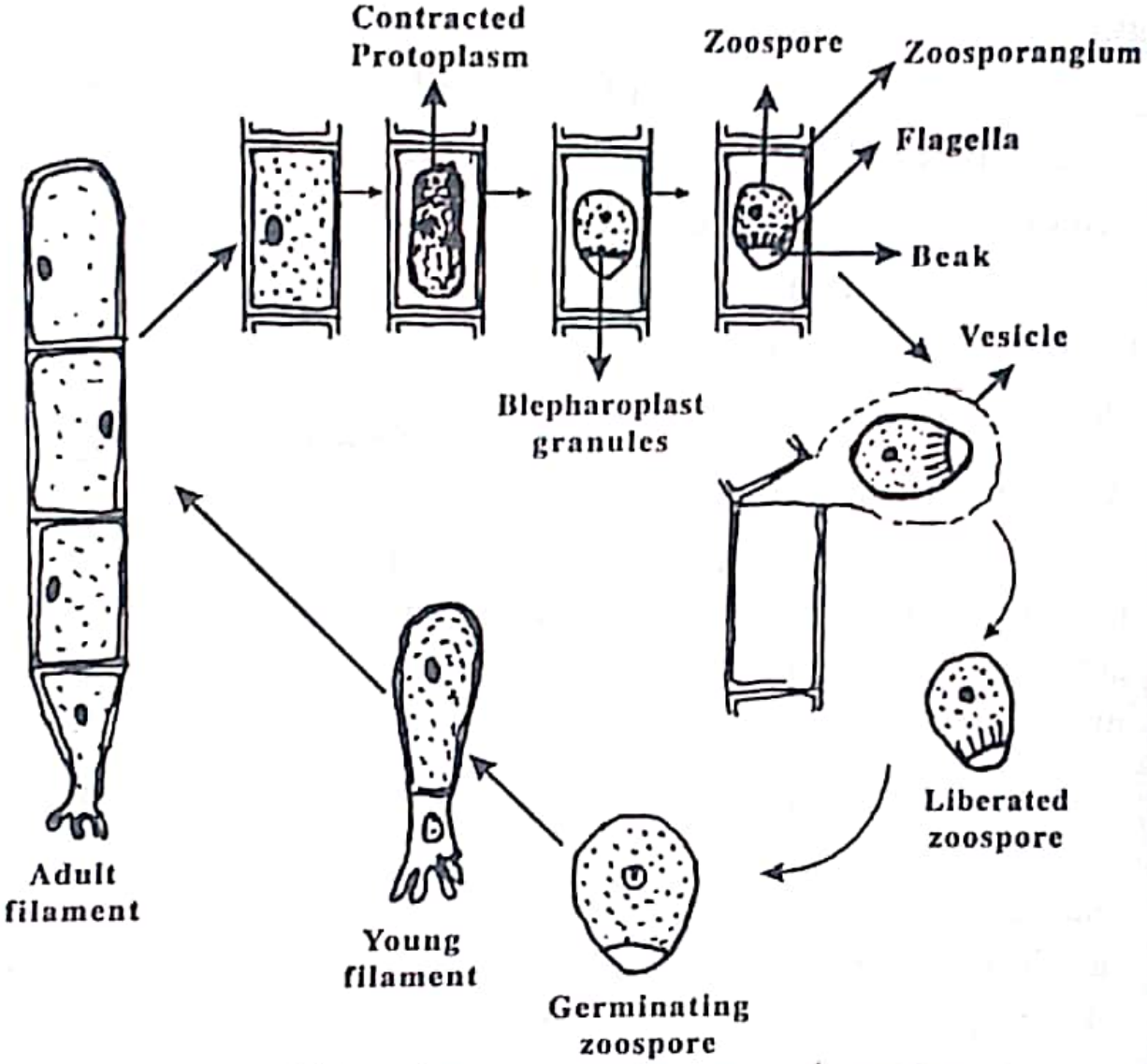

Fig.5.4. ALGAE: Oedogonium – Asexual reproduction

Sexual reproduction:

The sexual reproduction in *Oedogonium* is of oogamous type. it takes place during the period of unfavourable conditions by the formation of sex organs. The male sex organs are called as the **artheridia** and female as the **oogonia**. Both the sex organs are developed in the same filament of normal size or in two different filaments of normal size. Thus *Oedogonium* is **monoecious** or **dioecious**. The filament of normal size with antheridia is called as the male filament and with oogonia as the female filament. In very rare cases, the male sex organs or antheridia are developed in a much reduced filament of *Oedogonium*. The reduced filament with antheridia is called as the **dwarf male** or **Nannandrium.** The nannandrium always remains attached with the female filament of normal size.

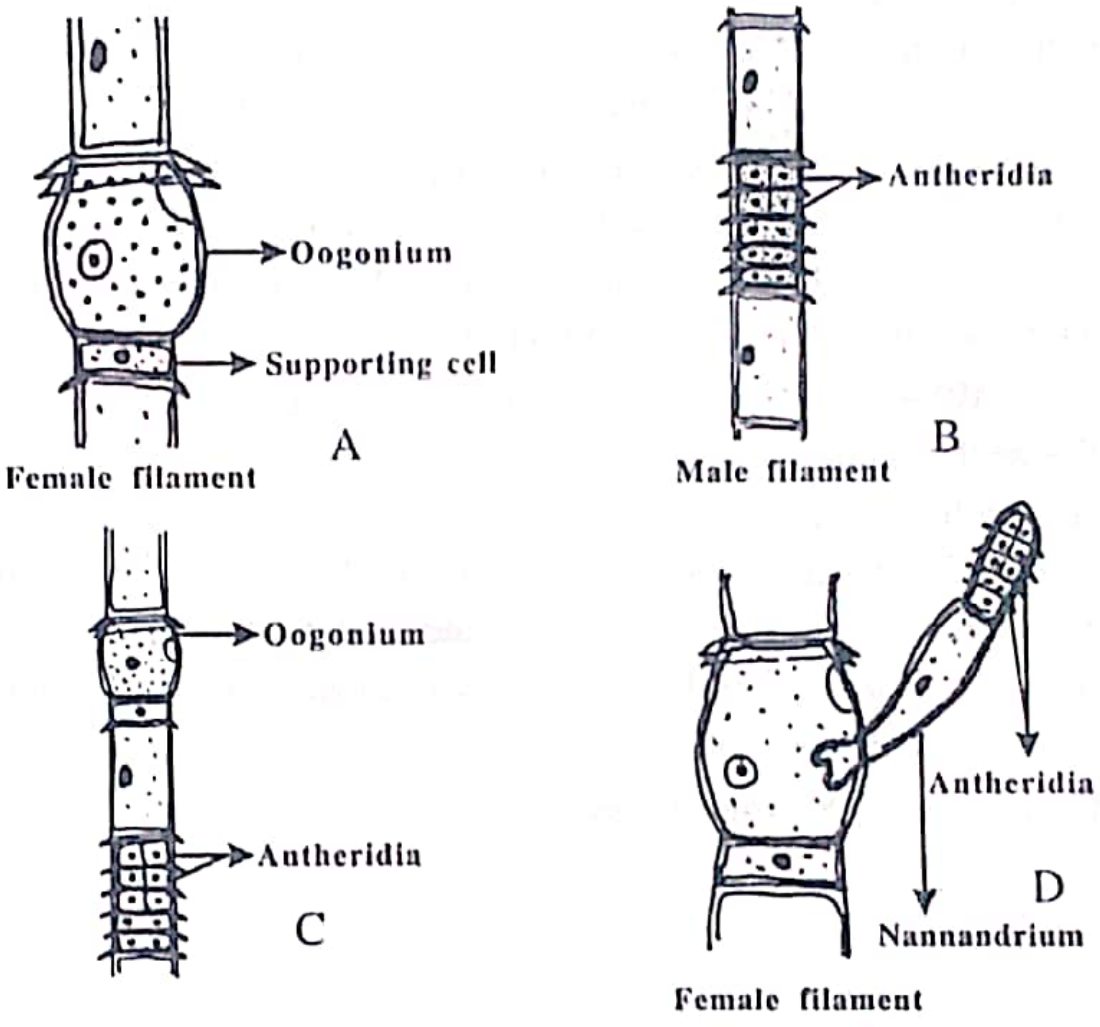

Fig.5.5 (A-D). ALGAE: Oedogonium - A - B. Macrandrous dioecious species; C. Macrandrous monoecious species; D. Nannandrous species

The *Oedogonium* species in which the male sex organs i.e. antheridia are developed in the filament of normal size are called as the **macrandrous species**. The *Oedogonium* species in which the male sex organ i.e. antheridia are developed in the filament of reduced size are called as the **nannandrous species**. The structure of antheridia and oogonia and the process of sexual reproduction are same in both the species of *Oedogonium*.

Sex organs of *Oedogonium*:

Antheridium:

The antheridia are the male sex organs. They are small, flat, disc like or cylindrical structures. They are developed in the filament of normal size (*Macrandrous* sp.) or in very rare cases in the filament of reduced size (*Nannandrous* sp.). The antheridia are unicellular and uninucleate. They are placed one above the other like coins in a **stack**. When the antheridia mature, the protoplasm divides vertically, mitotically and results into the formation of two daughter protoplasmic bodies. Each daughter protoplasmic body later on metamorphoses into a single unicellular, uninucleate, multiflagellate, motile, beaked, very small rounded or oval zoospore like structure called as the **male gamete** or **antherozoid**. Thus two antherozoids are formed in each and every antheridium.

When the antherozoids mature, liberated outside by rupturing the wall of antheridium. During the process of liberation, wall of the antheridium at the upper end ruptures and lifted above just like lid of a box. A thin vesicle along with the two antherozoids comes out side. The thin vesicle dissolves soon in water and the antherozoids become free. The liberated antherozoids swim in water in search of female gametes for fertilisation.

Formation of Nannandrium :

Some times the protoplasm of the mature antheridium fails to divide vertically and mitoticaly and results into the formation of a single protoplasmic body. The protoplasmic body later on metamorphoses in to a antherozoid like but quite large structure called the **Androspore.** The antheridium giving rise to the androspore is called **androsporangium.** When the androspore matures, liberated outside and swims in search of

female filament for germination. It germinates when and only when it comes in contact with the female filament and gives rise to a very reduced filament called the **Nannandrium** or **Dwarf** male.

Oogonium:

It is the female sex organ. It is enlarged, oval or spherical or rounded in shape. It is unicellular, uninucleate and rich in food material. The wall of the oogonium has a small pore on one side at the upper end called the **receptive pore** or **oogonial pore**. Just below the receptive pore there is a small, colourless spot in the protoplasm called the receptive spot. The oogonium has 2-3 apical caps and a small, flat cell at the base called the **suffultory** cell or **supporting** cell. When the oogonium matures the protoplasm metamorphoses into a single, non motile, rounded or oval shaped structure called the egg or ovum or female gamete.

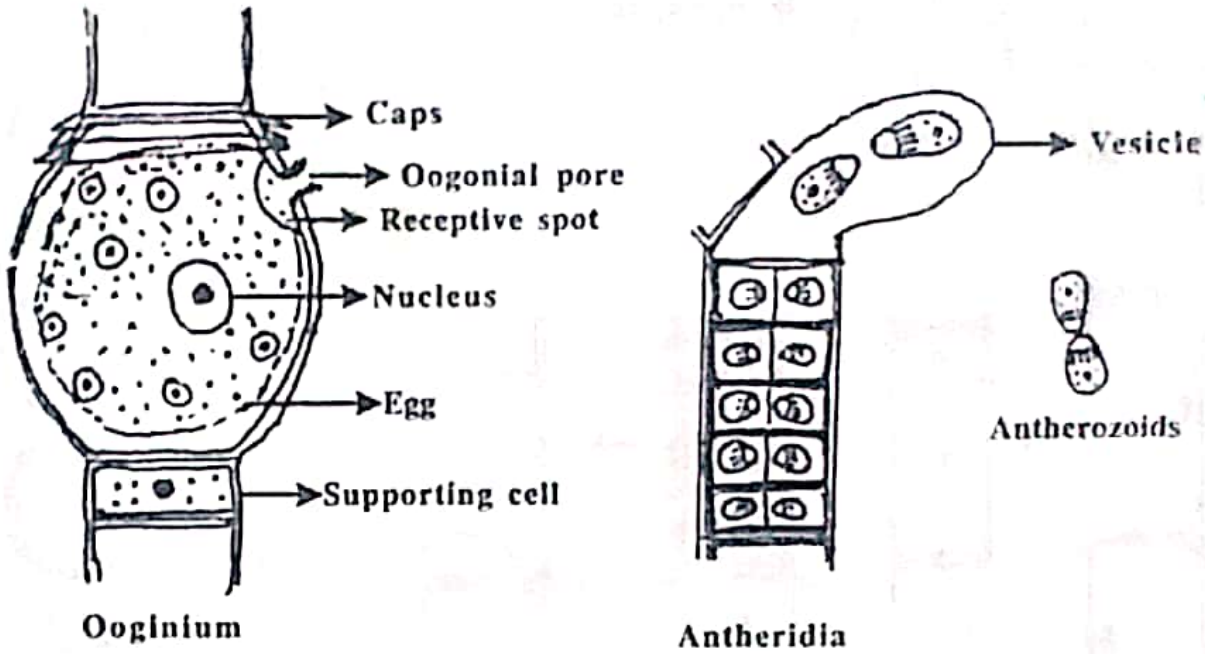

Fig.5.6. ALGAE: Oedogonium - Sex organs

Fertilisation:

During the process of fertilisation, the oogonium secretes certain chemical substances which attract the antherozoids towards it. Many antherozoids gathered around the oogonium. One of the antherozoids enters into the oogonium through the receptive pore. The antherozoid fuses to the receptive spot of the egg with its anterior beaked end. The wall of contact between the two fusing gametes dissolves and plasmogamy

takes place. The **plasmogamy** is followed by **karyogamy**. The karyogamy results into the formation of a **diploid zygote**. The diploid zygote secretes a thick, double or three layered wall around it in order to face the unfavourable conditions. The thick walled zygote is called as the **Zygospore**. The zygospore liberated out side after the death of the parent filament. It under goes rest during the period of unfavourable conditions,

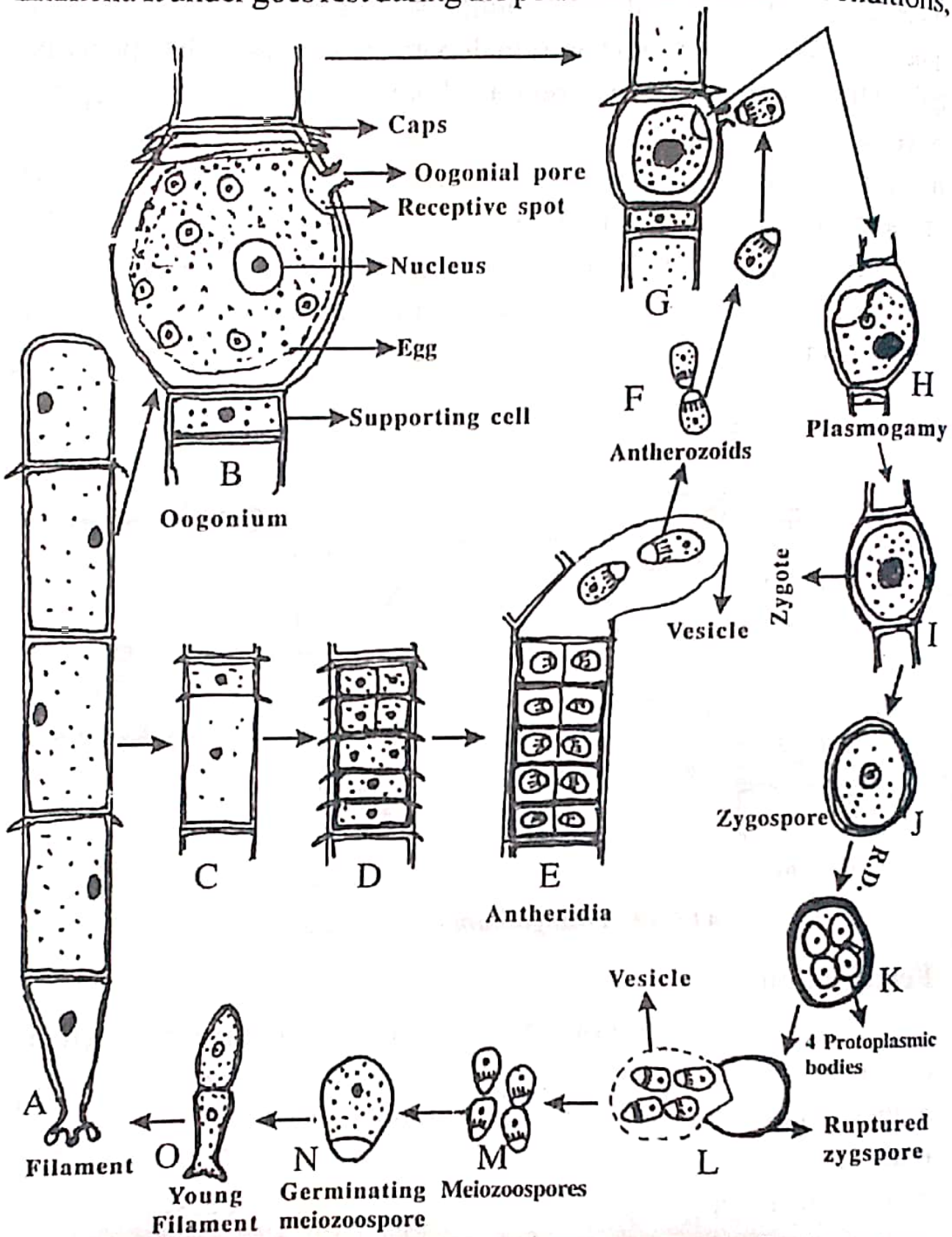

Fig.5.7 (A- O). ALGAE: Oedogonium - Sexual reproduction.

gets ripened and becomes red or orange in colour.

GRAPHIC LIFE CYCLE:

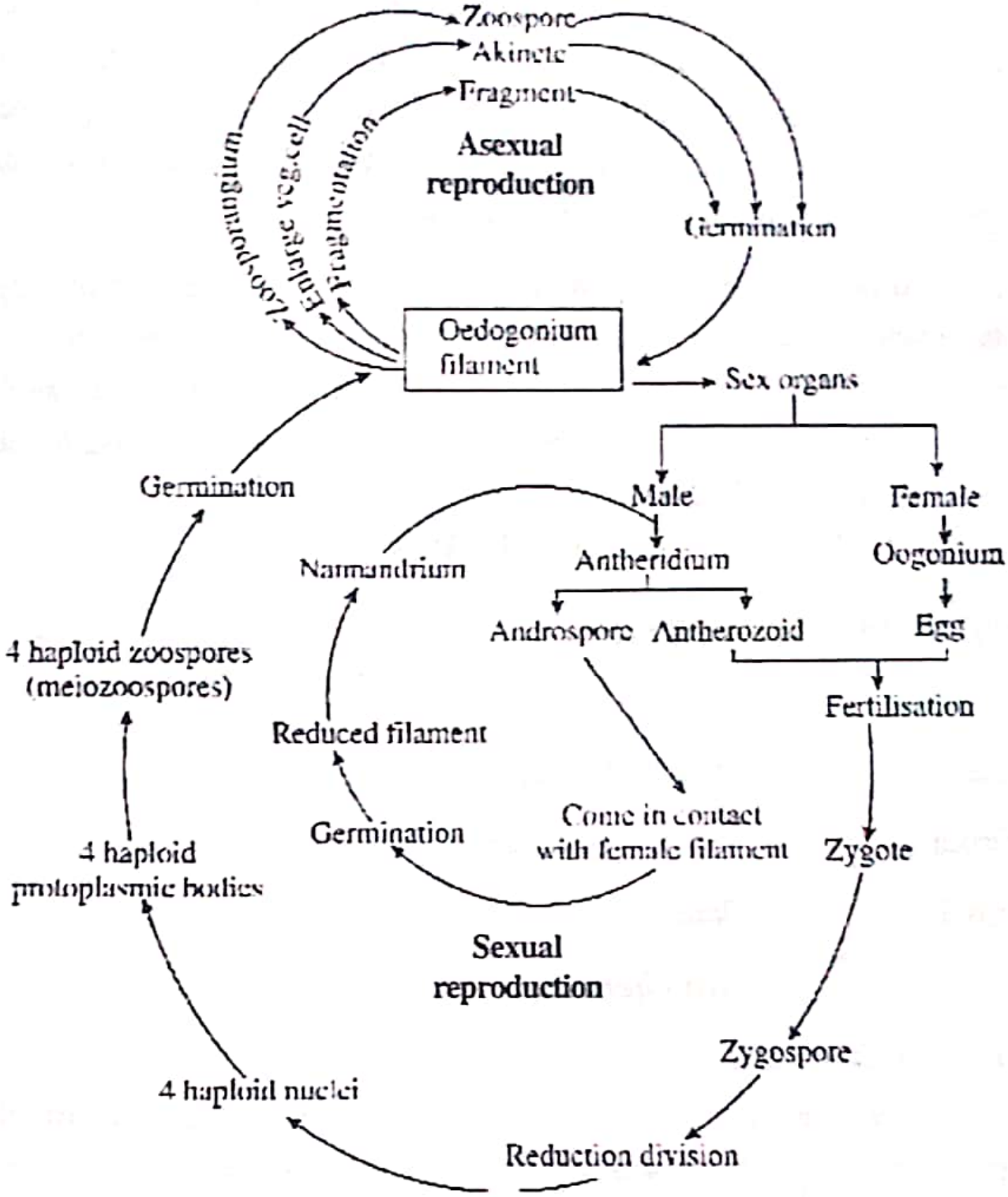

Fig.5.8. ALGAE: Oedogonium - Graphic life cycle

The zygospore begins to germinate after the return of favourable conditions. During the process of germination, the diploid nucleus undergoes reduction division. It results into the formation of four haploid nuclei. Each haploid nucleus surrounds a small amount of cytoplasm and results into the formation of four haploid uninucleate daughter protoplasmic bodies in the zygospore. Each daughter protoplasmic body metamorphoses into a small, rounded or oval motile, multiflagellate, beaked structure called the zoospore or meiozoospore. Thus four meiozoospores are formed in the zygospore.

When the meiozoospores mature, liberated outside by rupturing the wall of zygospore. They swim in water for some times, come to rest, attach to the substratum, with the anterior end, lose their flagella and become rounded. They grow in length and finally give rise to the new filaments of *Oedogonium*.