OEDOGONIUM

* Systematic Position.

⇒

Division — chlorophyta
Class — chlorophyceae
Order — Oedogoniales
Family — Oedogoniaceae
Genus — Oedogonium

* Occurrence and distribution.

⇒ The genus Oedogonium includes more than 285 species. All are aquatic and grow in fresh water ponds, pools, shallow lakes or streams. They often occur epiphytically on other aquatic plants. The mature filaments are free-floating but the younger ones are attached. It is less common in running water.

* Thallus / Vegetative structure.

⇒ The plant body is multicellular, filamentous, long and unbranched. The filament is attached to the substratum by means of basal cell called rhizoidal cell. The rhizoidal cell is modified to form the holdfast. The holdfast is expanded into

a flattened disc with outgrowths, whereas its upper part is bulbous. The apical cell of a filament is generally rounded or acuminate at its free surface and green in colour. All cells lying in between basal and apical cells are called intercalary cells.

~~* Cell structure~~.

⇒

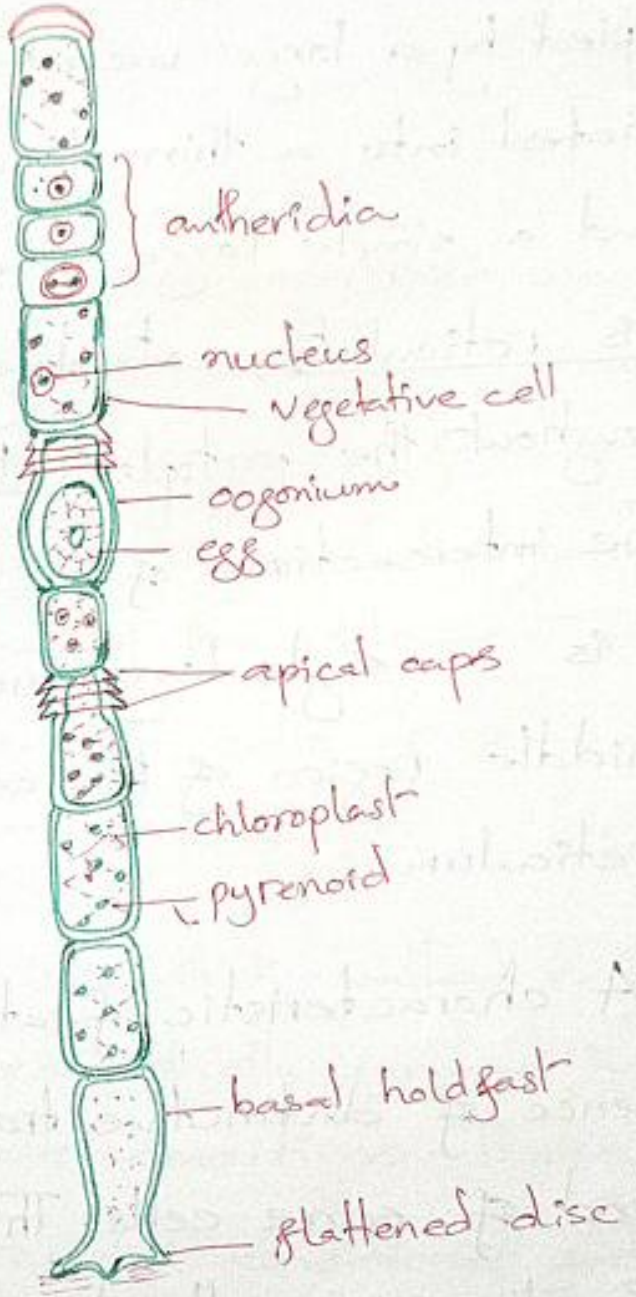

Fig: A filament of Oedogonium

* Cell structure.

⇒ The cells are elongated and cylindrical, and has a fairly thick rigid cell wall, which is differentiated into an outer chitin, a middle pectin and an inner cellulose layer. The centre of the cell is occupied by a large vacuole. The protoplast is differentiated into a thin plasma membrane, cytoplast and a single large chloroplast. The chloroplast is reticulate, extending in the form of a sheet throughout the protoplast. Many pyrenoids are present at the intersections of the chloroplast reticulum. There is a single large nucleus which lies near the middle region of the cell in between the chloroplast reticulum.

A characteristic feature of Oedogonium is the presence of distinctive transverse bands at the upper end of some cells. This rings or bands, formed at the time of cell division, is called apical cap and the cell with apical cap is known as cap-cell.

* Reproduction:

⇒ Oedogonium reproduces by vegetative, asexual and sexual methods.

I) Vegetative reproduction:

It takes place by means of fragmentation and akinetes.

1> Fragmentation: Like many other algae, small fragments of Oedogonium filament have the capability to grow into complete filaments under favourable conditions. Fragmentation takes place by accidental breaking of the filament, dying or dehydration of intercalary cells or conversion of intercalary cells into sporangia.

2> Akinetes: These are thick-walled reddish or brownish structures, usually formed in small chains during unfavourable conditions. These spores germinate under favourable conditions and form new filaments.

II) Asexual reproduction:

It takes place by zoospores formation. Zoospore formation starts in any cap cell. At the

time of zoospore formation, any cap cell of the filament may function as a zoosporangium. The entire protoplast of the zoosporangium withdraws from the wall, its nucleus moves towards one side and then the protoplast assumes a round or oval shape.

At the same time, a semi-circular colourless area appears on one side adjacent to the nucleus. Just around this area, a single or double row of blepharoplast granules appears forming a circular ring. From each granule arises a single flagellum and thus a ring of flagella is formed around the colourless area.

With the maturation of zoospore, the cell wall ruptures transversely in the region of the apical cap. Then the zoospore, surrounded by a delicate mucilaginous vesicle, slips out through the aperture. The vesicle soon dissolves liberating the zoospore. The zoospore possess an eye spot and a chloroplast. It has a ring of short flagella at the colourless area. This kind of flagellation is called stephanokont.

Germination of zoospore: The liberated zoospore swims for about an hour, then settles down on some solid object, becomes deflagellated, secretes a cell wall and starts to elongate. The elongated lower part develops into the holdfast of different shape in different species. The upper part divides and redivides transversely into a new filament of Oedogonium.

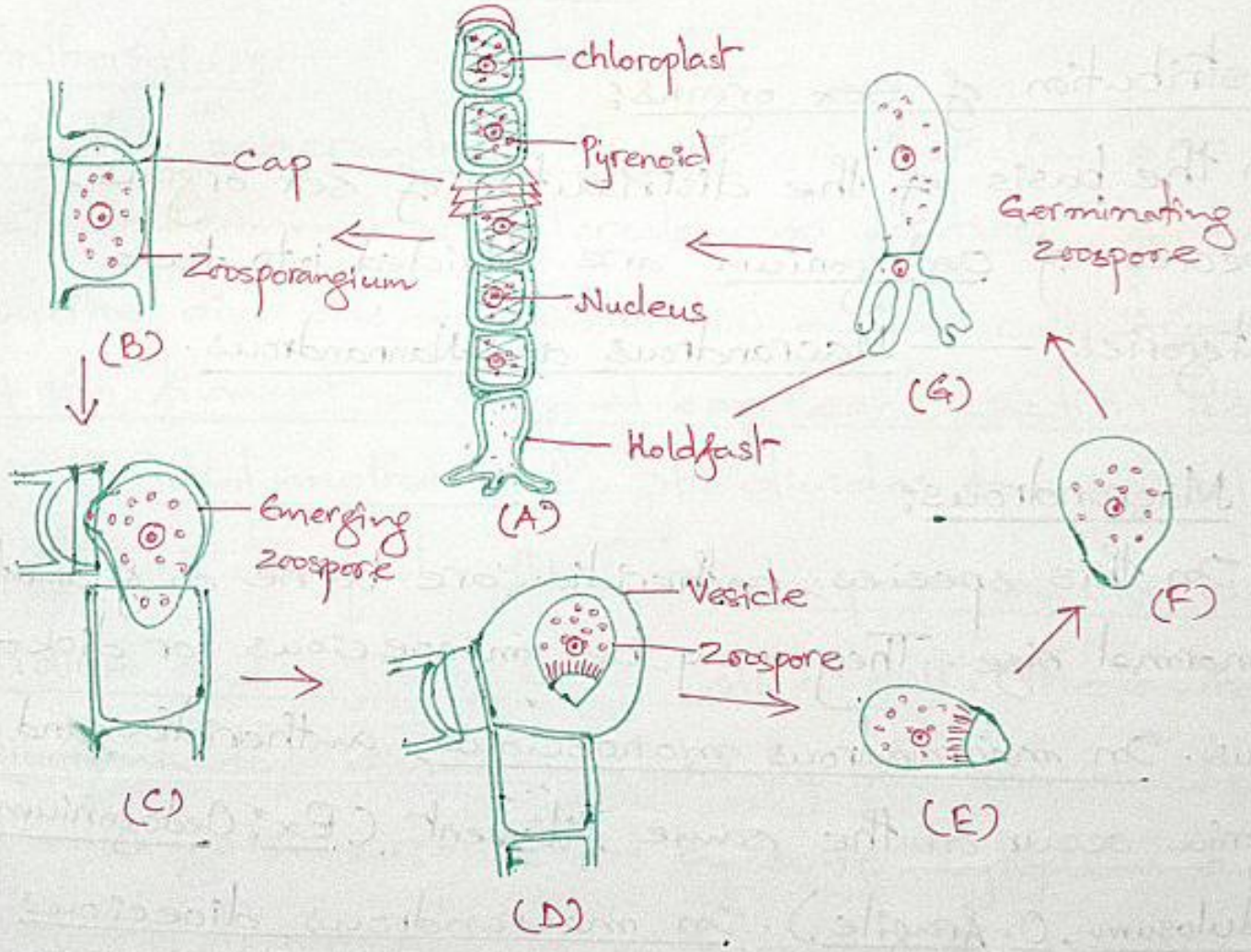

Fig: (A-G). Stages in asexual reproduction in Oedogonium sp.

III) Sexual reproduction:

It takes place by an advanced type of oogamy. The gametangium (reproductive organs) of male is called antheridium and the female oogonium. Sexual reproduction is of common occurrence in filaments growing in quiet water. The external condition which favour the process of sexual reproduction are — high pH (alkaline) and nitrogen deficiency.

Distribution of sex organs:

On the basis of the distribution of sex organs, species of Oedogonium are divided into two categories — Macrandrous and Nannandrous.

1) Macrandrous:

In this species, antheridia are borne on filaments of normal size. They may be monoecious or dioecious. In macrandrous monoecious, antheridia and oogonia occur on the same filament (Ex: Oedogonium nodulosum, O. fragile). In macrandrous dioecious species, antheridia and oogonia occur on different filaments (Ex: O. crassum, O. aquaticum). The fi-

laments are morphologically similar but differ physiologically.

2) Nannandrous:

Some dioecious species of Oedogonium exhibit dimorphism. The male and female filaments show distinct morphological differences. The male filaments are much smaller than the female and are called dwarf male plants or nannandria. It grows attached to the female filaments.

Antheridia:

In the macrandrous species, antheridia are either terminal or intercalary in position, formed by the divisions of antheridial mother cell. Any cell of the filament with apical cap can function as antheridial mother cell. It divides transversely into two unequal cells — an upper smaller antheridium and a lower larger sister cell. The antheridium nucleus divides mitotically into two nuclei, & each gets surrounded by some cytoplasm and metamorphoses into an antherozoid. Thus, each antheridium produces two antherozoids, except in O. cardiacum (produces four antherozoids per antheridium).

The antherozoids is a unicellular, uninucleate and multiflagellate structure. They resemble the zoospores, but are smaller in size and have fewer flagella. The antherozoids are also liberated by the transverse splitting of the wall of the antheridium.

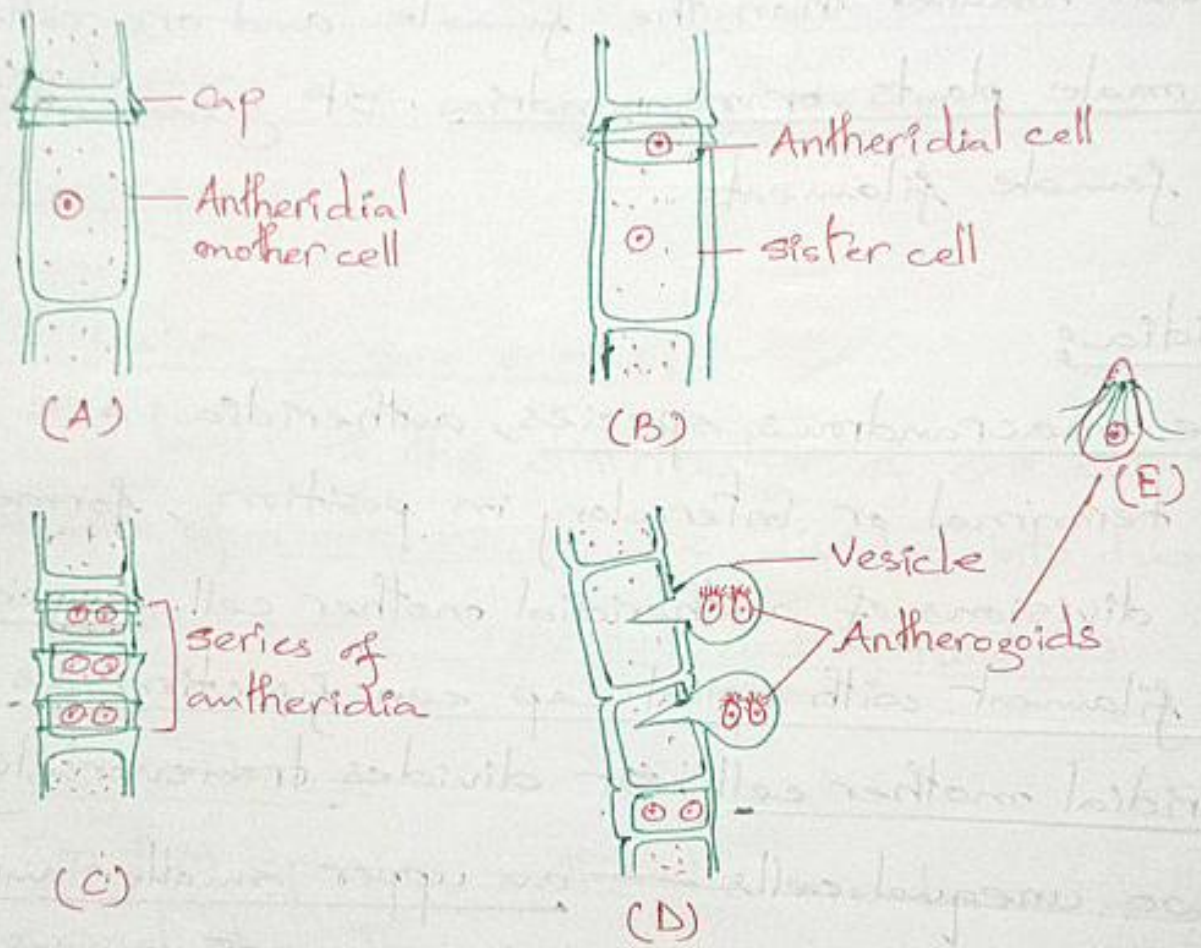

Fig: Development of antheridia in Macrandrous species of Oedogonium.

In the nannandrous species, the antheridia are produced in specialised, small, 2-4 celled filament known as dwarf male. The dwarf male are

produced from androspores, formed within androsporangia. If the androsporangia are borne in the oogonial filament, the species is known as gynandrosporous; those where the two are borne on separate filaments are named as idioandrosporous.

The nucleus of the androsporangium does not divide and the protoplast metamorphoses into a single uninucleate, multiflagellate androspore. When liberated, the androspore is enveloped in a vesicle which soon vanishes. It swims towards the female filament and gets attached to the wall of the oogonium or supporting cell. Then it germinates to form a dwarf male. The dwarf male has a basal holdfast and one or two antheridia. The nucleus of each antheridium divides to produce two antherozoids, which are similar in structure to those produced by macrandrous species. They are liberated either by the disorganisation of the antheridial cell or by the separation of a lid at the top.

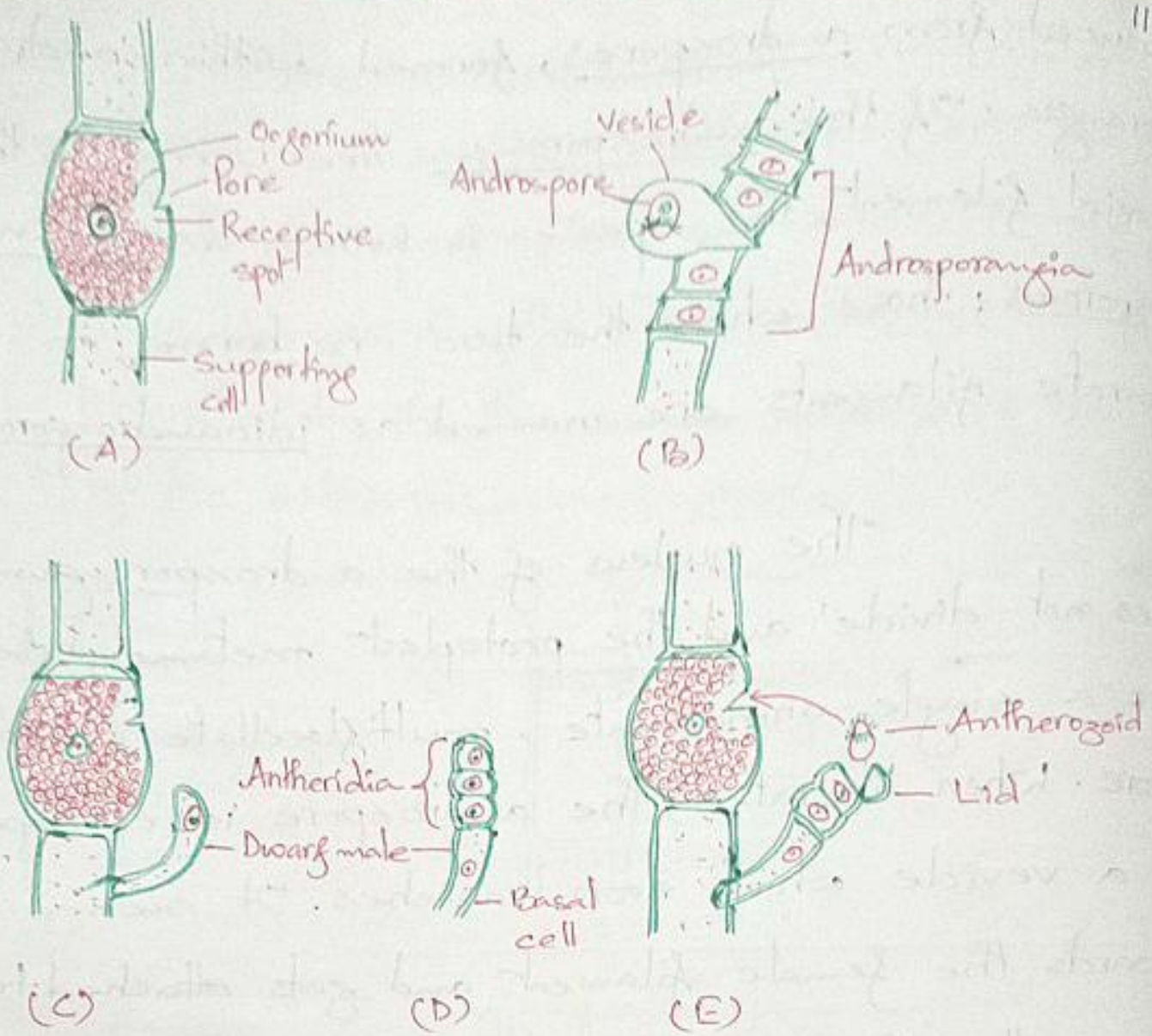

Fig: (A) Matured oogonium. (B) Development of androspore. (C) Germination of androspore and formation of dwarf male. (D) A dwarf male. (E) Liberation of antherozoids.

Oogonium:

Development of oogonium is similar in both the macrandrous and nannandrous species. Each oogonium develops from an actively growing cap cell called the oogonial mother cell. It divides transversely into an upper larger cell with larger

nucleus which functions as the oogonium, and a lower smaller cell which forms the supporting cell or the suffultory cell.

At maturity, the oogonium stores reserve food materials, swells up and forms a single egg. The oogonial wall develops a small pore or a transverse slit at maturity. Prior to fertilisation, the egg protoplast slightly recedes from the oogonial wall to form a small clear patch, the receptive spot just close to the nucleus.

Fertilisation:

It is accomplished by the swimming of the antherozoids through a pore or transverse slit in the wall of the oogonium. Only one antherozoid fuses with the egg to form the zygote.

Germination of zygote:

Prior to germination, the diploid zygote nucleus undergoes zygotic meiosis to form four haploid nuclei. Each haploid nuclei metamorphoses into a multiflagellate zoospores or meiozoospore, which are surrounded by a vesicle. The meiozoospores soon gets

liberated by the gelatinisation of the vesicle, swim for a while and then settles down on some solid object to germinate to a new haploid filament of Oedogonium.

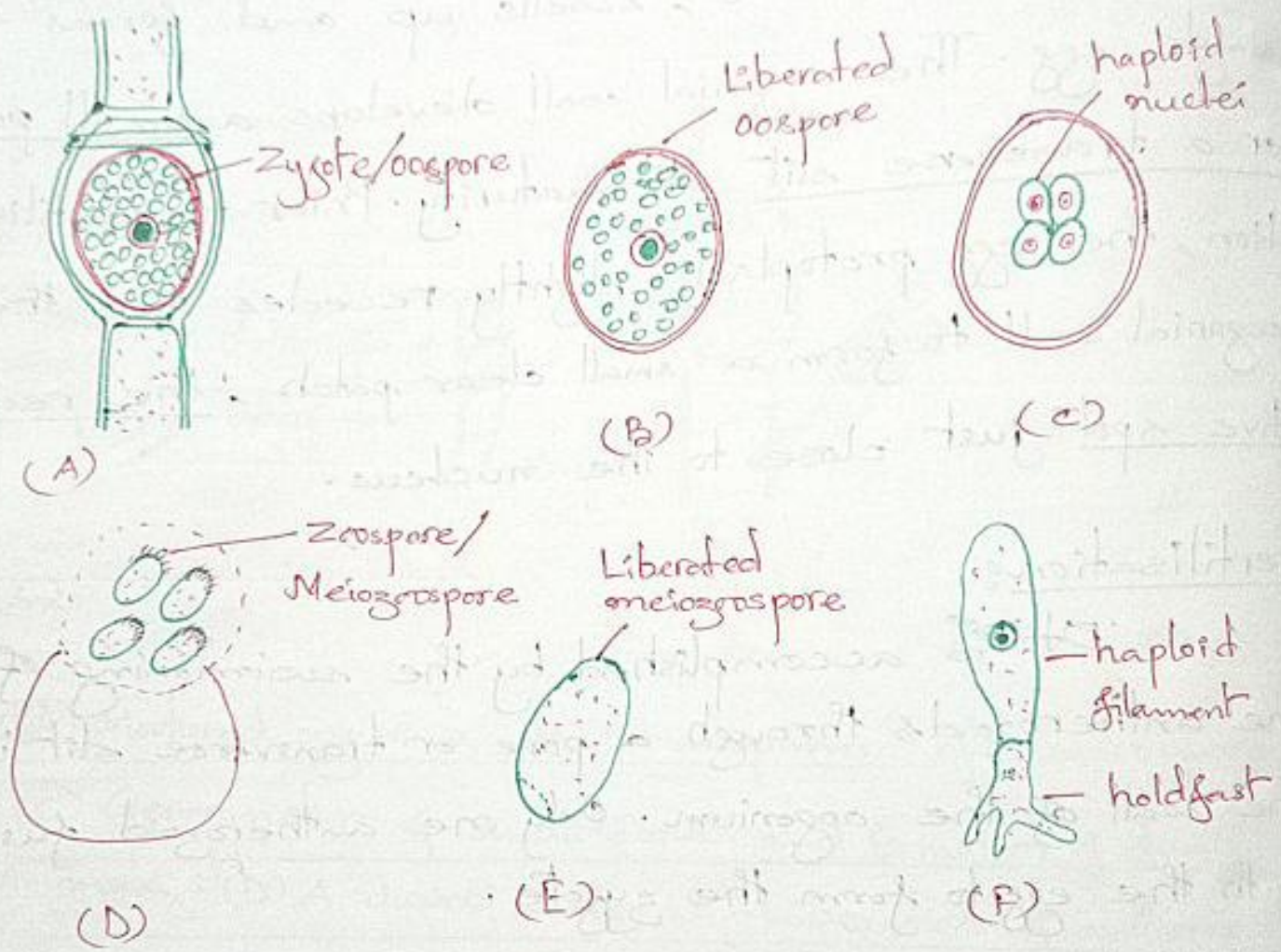

Fig: (A-F). stages in the germination of oospore.