# Course- B.Sc.Part-I Botany Subsidiary

## PAPER-I

### Topic - Life cycle of Vaucheria and Chara(Algae)

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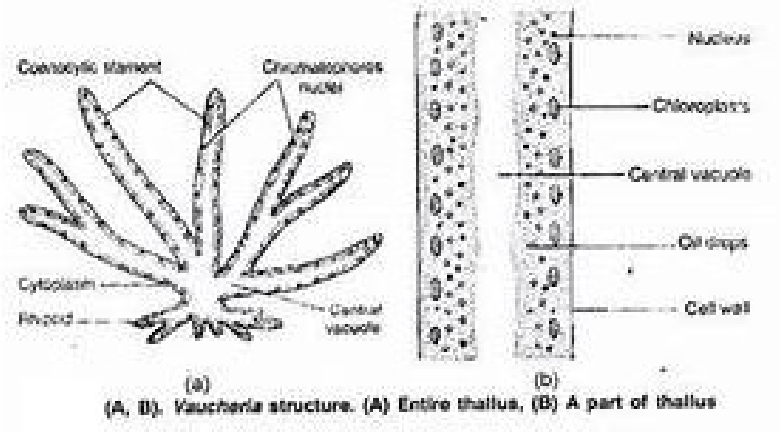
## Life cycle of Vaucheria

Vaucheria is green freshwater alga found in ponds, ditches and wet soil. It is not free floating like spirogyra but is mostly attached to substratum by colourless rhizoids or holdfasts. It is thallus is single branched tubular filament. It contain many minute nuclei present in living layer of cytoplasm surrounding a large central vacuole. Such structure is called coenocyte. Septa appear in connection with reproductive organs.




(A, B). *Vaucheria* structure. (A) Entire thallus, (B) A part of thallus

Reproduction in Vaucheria:

Reproduction in Vaucheria takes place by vegetative, asexual and sexual methods.

(i) Vegetative Reproduction in Vaucheria: By fragmentation of thallus

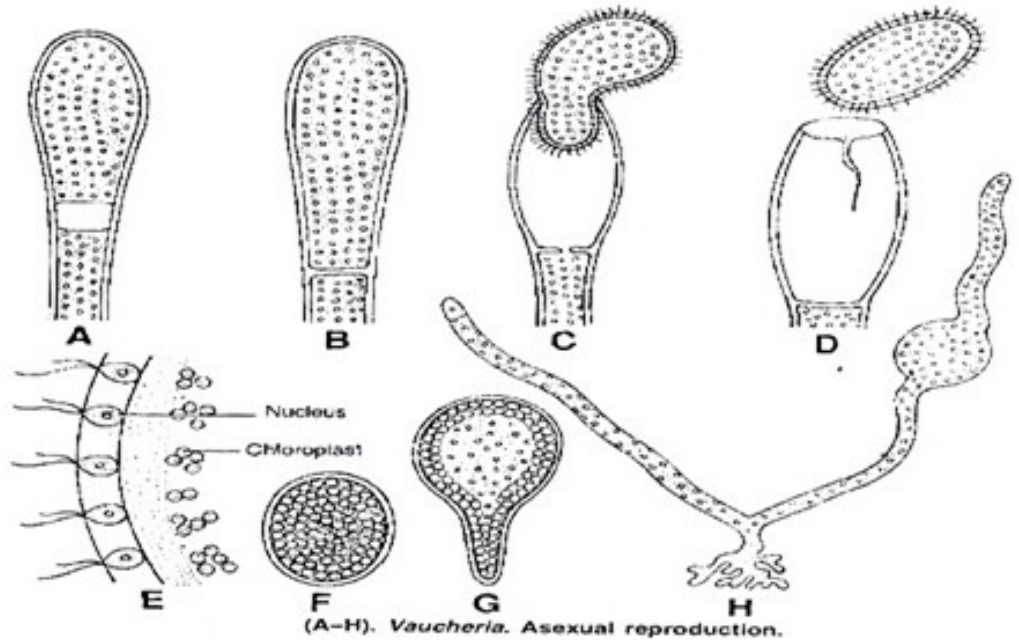
(ii) Asexual Reproduction in Vaucheria:

The asexual reproduction takes place by formation of zoospores, aplanospores and akinetes

(a) By Zoospores:

Zoospore formation takes place in favourable seasons or can be induced if aquatic species are transferred from light to darkness or from running water to still water.Zoospores are formed singly within elongated club shaped zoosporangium. The development of zoosporangium begins with a club shaped swelling at the tip of a side branch. A large number of nuclei and chloroplasts along with the cytoplasm move into it to be called as protoplast. The protoplast secretes thin membrane and zoosporangium gets separated by a cross wall. Inside zoosporangium the vacuole decreases, the contents of sporangium become very dense

and round off. The entire protoplasm of the zoosporangium contracts to form oval zoospore. Opposite to each nucleus two flagella are produced making zoospore a multi-flagellate structure. Each zoospore is large yellow green, oval structure. It has a central vacuole which has cell sap and may be traversed by cytoplasmic strands. The protoplasm outer to vacuole has many nuclei towards the walls and chromatophores towards vacuoles. Two flagella arise opposite to each nucleus. This part of cytoplasm can be regarded equivalent to one zoospore.



(A–H). *Vaucheria*. Asexual reproduction.

(b) By Aplanospores:

Aquatic species form aplanspores under unfavorable condition of drought. The aplanospores are non-motile asexual spores formed in special structures called aplanosporangia. The aplanospores are produced singly in cells at the terminal end of the short lateral or terminal branch.

(c) By Akinetes:

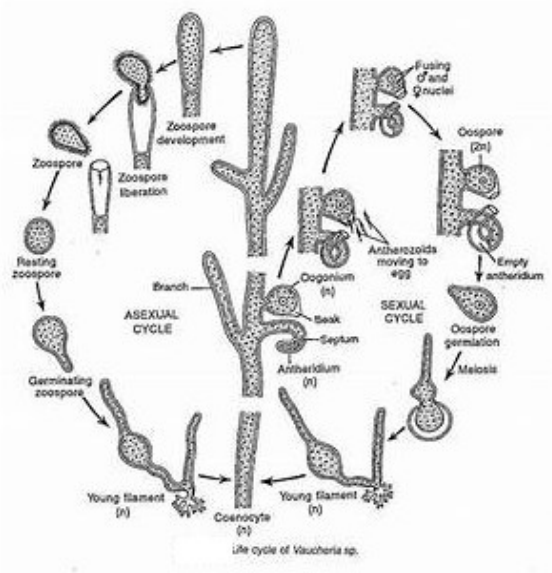
Akinetes are thick walled structures formed during unfavorable conditions like drought, and low temperature. The akinetes have been commonly observed in V. geminata, V. megaspora and V. uncinata.

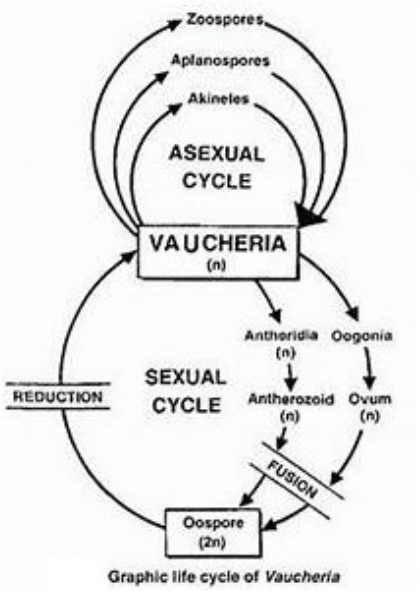
Sexual Reproduction:- It takes place by the method of fertilization i.e. by sharply differentiated male and female organs. Male organs are antheridia and female organs oogamia and these are developed at scattered intervals as lateral outgrowths. In monoecious species of vaucheria antheridia and oogamia usually arise side by side on same filament, or on short lateral branches of it.The outgrowth that forms oganium swells out, assumes a more or less rounded form and is cut off by basal septum. The apex of oogonium develops a beak either towards antheridium or away from it. The protoplasm of oogonium contains one

nucleus and forms a single large female gamete. i.e. the egg (ovum or oospore) which fills ooganium. Each antheridium arises as a short tubular branch by side of ooganium. The terminal portion of it is cut off by a septum then it becomes actual antheridium. As it matures it becomes much curved towards the oogonium. The protoplasm contains many chloroplasts and nuclei. Many male gametes or antherozoids are produced inside each antheridium. They are minute in size and are biciliated. Cilia point in opposite direction.

Fertilization: Self-fertilization is common but in diochious species cross fertilization is present. Antheridium bursts at the apex and many antherozooids called around the beak which opens at about the same time.

Several antherozooids may enter the oogonium through the beak but only one of them fuses with the ovum, while the rest perish. After fertilization ovum becomes invested with a thick cell wall and is known as oospore. Oospore undergoes period of rest and germinates into a new vaucheria filament.



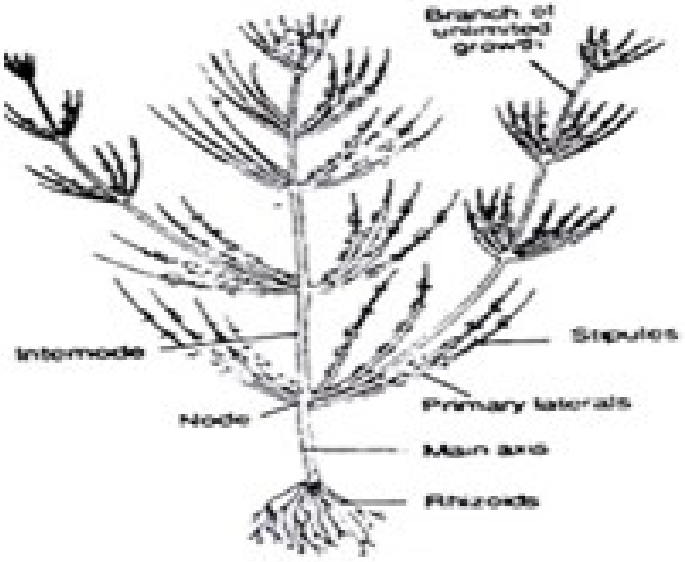
Graphic life cycle of *Vaucheria*

## Life cycle of Chara

Systematic position

Chara is aquatic attached to muddly or sandy bottom of the pools, lakes and slow flowing streams. Few species are marine. Plant body consists of an erect branched axis which may grow to 20-30 can. The axis has district nodes and internodes. From each node arise a whorl of laterals of limited growth called leaves. From the axis of some leaves branches of unlimited growth may arise. Each branch bears nodes and internodes. Plant is attached to substratum by colourless branched multi-cellular rhizoids which arise from lower nodes of axis.Growth of axis in length takes place by means of single dome shaped apical cells. Each node has a plate of cells while inter-node consists of single elongated cells. Each cell has a

cell wall made up of cellulose and deposit calcium carbonate. They contain a single nucleus, dense cytoplasm with many discoid chloroplasts.



*Chara*. External features.

Reproduction: In Chara it takes place by vegetative and sexual method.

1. Vegetative reproduction: It takes place as under:

**(i) By amylum stars: a star**-shaped propagative body densely filled with starch and formed about the lower nodes of certain species of Chara. They can give rise to new plant but their exact mode of development is not known.

**(ii) By bulbils**: Some of the rhizoids or lower nodes may form bulbils which also give rise to new plants when detached.

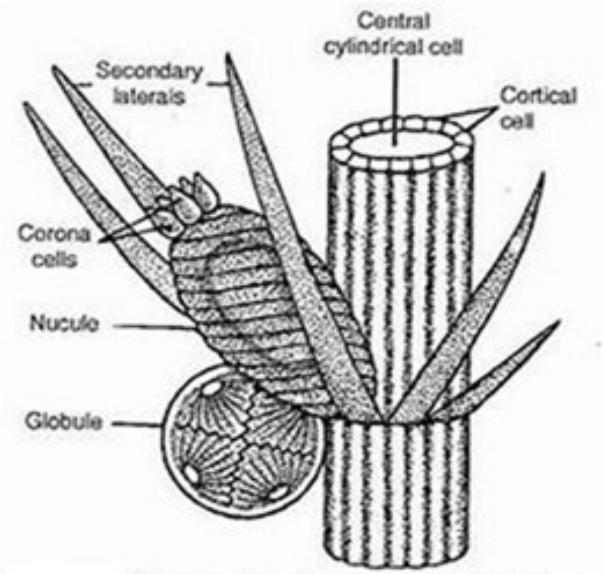
**(iii) By Protonena formation**: Some on the nodes protonema like branches are developed and they also form new plants.

2. Sexual Reproduction:

It takes place by male and female reproductive organs called globule (antheridium) and nucule (oogonuim).

Mostly species are monoecious, a few may be heterothallic or dioecious.

Two structures are found just aposed at a node, nucule being above the globule.




*Chara* sp. : A portion of the branch of limited growth showing attachment of nucule, globule and secondary laterals at the node

**Structure of Sex organs:**

The main axis of Chara consists of nodes and internodes. From nodes arise branches of limited growth. This also possesses nodes and internodes. The sex organs are developed on the nodes of these branches.

**Structure of the globule or Antheriduim**: Mature globule or antheriduim is circular in outline and green when immature becomes red or orange in colour during maturation. Wall of globule consists of eight shield cells. From the centre of each shield cell there arise a rod like out-growth the manubrium which bears at its upper end primary capitulum cells which may form secondary and tertiary cells. Secondary capitulum cell bear, branched uniseriate spermatigenous filaments which are divided into small segments by transverse septa. Each segment functions as a single antheriduim. Cytoplasmic contents of each segment give rise to single speematozooid or antherozoid. Each antherozooid is spirally coiled and biflagellate structure.

**Development of Globule:**

Globule like male reproductive organ arises in the axis of branches of limited growth from single superficial cell. This cell cuts off one or two discoid cell at its basal and then becomes spherical. The lower two cells form a pedicle while the upper cell enlarges in size and becomes hemispherical in shape. Upper spherical cell divides by two longitudinal and one transverse division to form octant (Scelled structure). This octant divides by two curved plates or shields) and form wall of globule. As the shield cells mature they develop red pigments and radial in growths. Middle eight cells elongate form a rod shaped manubrium which projects imvard from the centre of curved shield cells. Each of the inner eight cells becomes a primary capitulum borne at the tip of manubrium. Each primary capitulum buds off about 4 to 6 secondary capitulum cells which may further give rise of tertiary and

quaternary ones. From each capitulum cell develop antheridial filament. Each antheridial filament consists of about 200 discoid cells the antheridia. Within each antheridium is produced single elongated spirally coiled and biflagellate antherozoid. When the globule or antheriduim is mature the shield cells fall apart and the antherozooids are liberated by gelatinisation of antheridial walls or through a pore formed in each antheridial cell.

**Structure or Nucule or Oogonuim:**

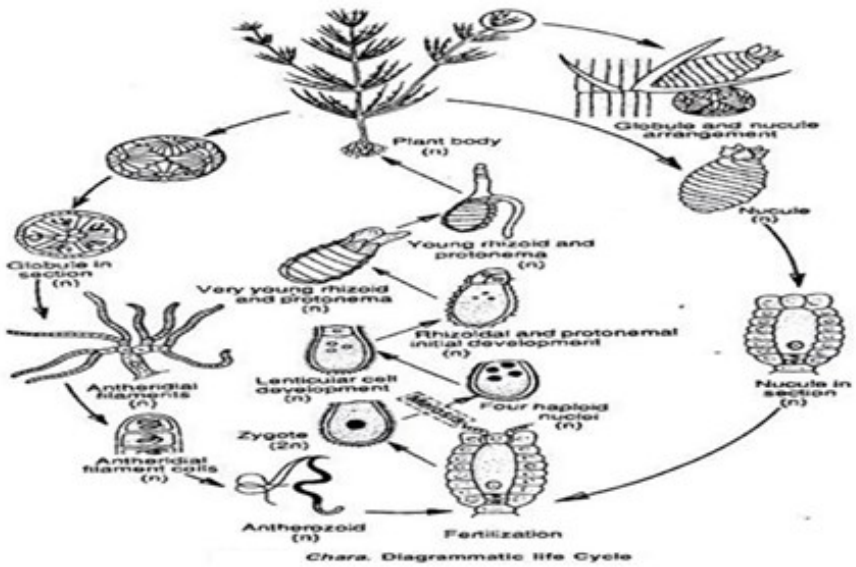
Nucule or Oogonium is short stalked body attached to the body of primary lateral or leaf or dwarf shoot or branch of limited growth just above the antheridium. A mature oogonium consists of a large oval or elliptical egg surrounded by a cover of five tubular cells which make two or more clockwise spiral turns around it. From the upper end of each of the tubular cells a cell is cut off forming the crown or corona of oogonium.

**Development of Nucule:**

Oogonuim or nucule, the female reproductive organ develops in the axil of the branches of limited growth on the ad axial side. It develops from single superficial ad axial cell. This cell undergoes two divisions to form three cells. Lower most cells elongates and forms pedicel, the middle cell gives rise to five peripheral cells and upper most act as oogoial mother cell. Each peripheral cell divides to form upper cell Corona cell and lower larger cell tube cell. Five Corona cells elongate many times become spirally coiled around oogonium. Nucule when mature, tube cells separate from one another below corona to form five small shits for entrance of antherozooids.

Fertilization: Tube cells of oogonium separate thus forms slit. Antherozoids enter by slits, only on succeeds in the formation of oospore or zygote.

Germination of Zygote: Zygote secretes a coloured wall around it and undergoes a period of rest within oogonium. It falls from plant sinks to bottom of pond where it germinates after few weeks.



*Chara*. Diagrammatic life Cycle