ULOTHRIX

Discovered by Knitzing

SYSTEMATIC POSITION :

Kingdom — Plantae
Sub kingdom — Thallophyta
Division — Chlorphyta
Class — Chlorophycease
Order — **Ulotrichales**
Family — Ulotrichaceae
Genus — **Ultohrix**

HABIT AND HABITAT :

- **Ulothrix** mainly found in **fresh water.**
- The majoirty of species of Ulotharix occurs in **cold slow moving streams.** It is attached to the substratum like stones in river, springes etc. with the help of hold fast.
- Some species are found in marine water e.g. **Ulothrix flacca.** (It is found in **intertidal zone** of sea and **saline marshes**)
- **Lithophyte species - Ulothrix implexa**
- **Fresh water species - Ulothrix zonata**
- **Ulothrix zonata** is the main species of **Ulothrix** which is found in **India.**

STRUCTURE :

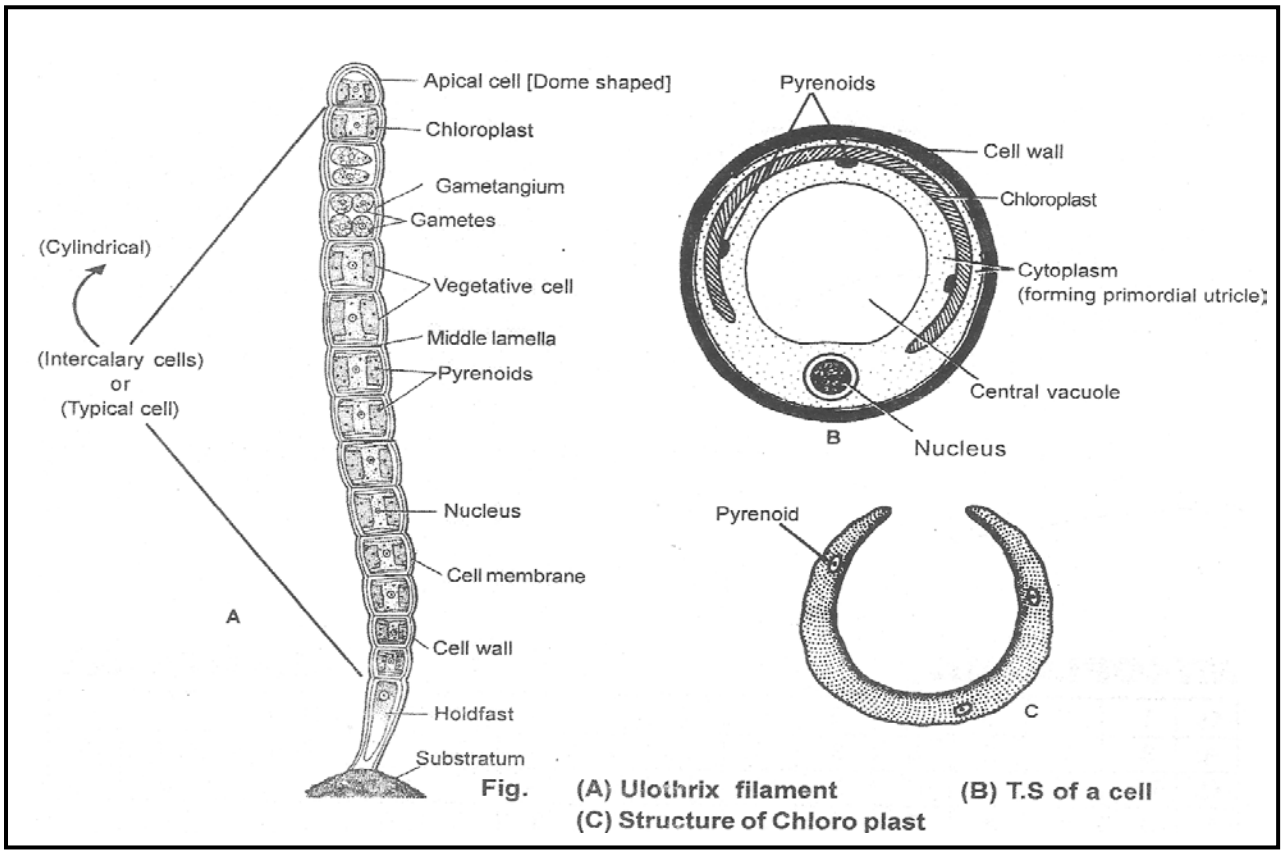


Fig. (A) Ulothrix filament (B) T.S of a cell
(C) Structure of Chloro plast

- The thallus of **Ulothrix** is multicellular, filamentous, unbranched and **bright green** in colour. Each filament is made up of large number of cells joined to each other from end to end in a row.
- All the cells of the filament are similar but basal cell and apical cell are different. The length of each cell is less and width is more. Except the **apical cell** and **basal cell,** all the cells are **rectangular** in shape. All cells present between basal cell and apical cell are called **intercalary cells.**
- Shape of the cells are **cylindrical** but they look **rectangular** in **external appearance.**
- The upper most or apical cell is somewhat **dome shaped** and basal cell is elongated and narrow at the base.
- The filament attached to the substratum with its specialized cell which is called **Holdfast** or **Rhizodial cell** or **Hapteron.** T the base of holdfast develops fine **processes or fingers like** structures are called **Haptera.**
- The **Holdfast** cell of the thallus is **living** and **non green**. Chloroplast absent in hold fast.
- The cell wall of the filament is double layered. The outer layer is made up of **protopectin** which is precursor of **pectin** and partially soluble in water. The inner layer of cell wall is made up of **cellulose.**
- A large vacuole is present in the centre of the cell. Surrounding the vacuole, the cytoplasm present as a thin layer and to form a **primordial utricle.**
- A large nucleus and a **girdle** shaped or **collar** like chloroplast (grana and integrana absent or less developed) present in the **primordial utricle.**
- Chloroplast contains **two** or **three pyrenoids.** These pyrenoids are protein particles which are surrounded by starch. These pyrenoids re concerned with storage of starch.

Special point

- The variation in the shape of chloroplast in Algae has significance in taxonomy.
- **Centriols** are present in **Ulothrix.**
- All the cells of Ulothrix have power of cell division except holt fast.
- **Diffused growth** found in Ulothrix.
- Al the cells of filament are join together through the **middle lemalla.**

REPRODUCTION :

Ulothrix reproduce by three methods -

(1) Vegetative reproduction

(2) Asexual reproduction

(3) Sexual reproduction

(1) Vegetative Reproduction :

- It takes place generally in **favourable conditions.**
- Vegetative reproduction occurs by the process of **fragmentation.**
- The filaments break up into two or more pieces. They are called fragments.
- Each fragment divides to form a **new Ulothrix filament.**

Fragmentation occurs due to -

* Incidental reasons

* Death of intervening cells or **middle lamella**

* Strong waves of water

* Change of pH or temperature

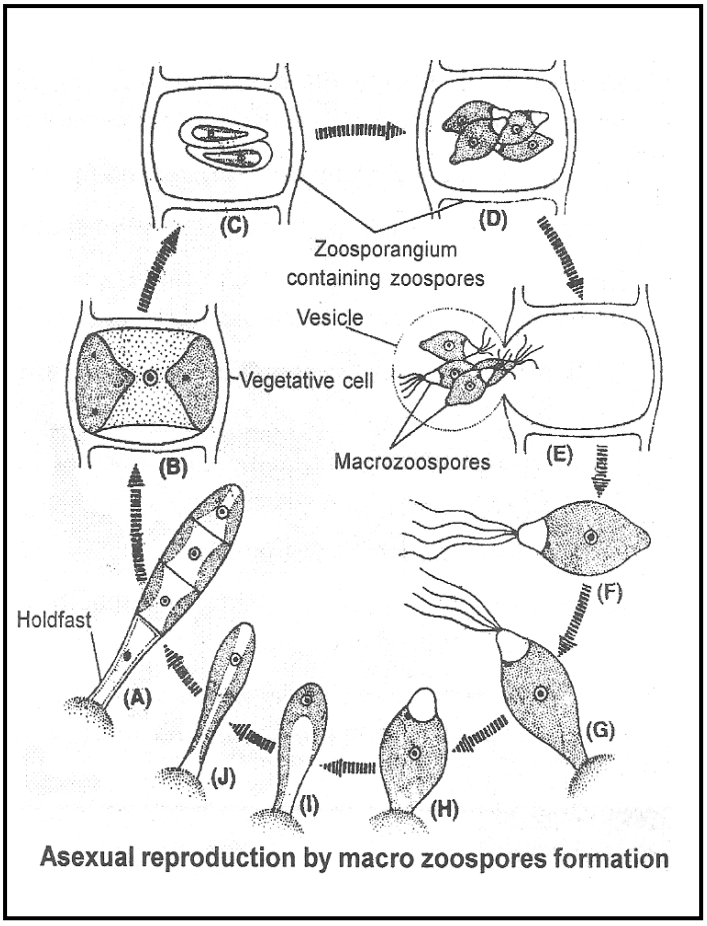
(2) Asexual Reproduction :

- It takes pacle in **favourable** and **unfavourable** conditions

(i) In favourable conditions : It takes place by **zoospores** formation. Zoospore formation commences generally near the apex and progress towards the base of filament **(Basipetal order)**

(a) By Zoospores :

- Any cell of the filament **except hold fast** can form zoospores.
- A cell which produce zoospores is called **zoosporangium.** A sporangium produce **8-32** zoospores.
- Zoospores are formed through the **mitotic division.**
- A membrane is spread around the zoospores, is called **vesicle.** This vesicle originates from the innermost layer of cell wall. It means it is made up of **cellulose.**
- A pore is formed in the lateral side of cell wall of zoosporangium. Zoospores are liberated with vesicle through this aperture. and Vesicle bursts and zoospores become free in water.



Asexual reproduction by macro zoospores formation

- Zoospores are of two type -

(1) Micro zoospores **(2) Macro zoospores**

(1) Micro zoospores : They are oval shaped. They may be **biflagellate** or **quadriflagellate**. Eye spot lies at the **anterior lateral position.**

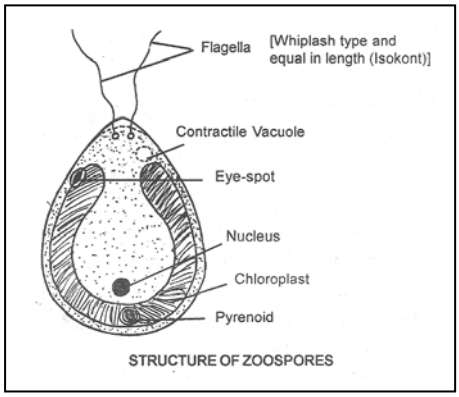
Their swimming period is **2-6 days.** Their number in mother cell varies form **8** to **32.** Their germination begins from the anterior end.

(2) Macro zoospores : They are spindle or pear shaped with a pointed posterior end. They are always **quadriflagellate.** Eye spot lies at the anterior in middle region. Their swimming period is about **24 hours** (1 day). The number of macro zoospores in sporangium fro m **4-8**. Their germination begins from the posterior end.

STRUCTURE OR ZOOSPORE :

- zoospores are **naked.** It means cell wall is absent in them. Cut Shaped chloroplast is preset in which on **pyrenoid** is present.
- A **contractile vacuole** is present which is concerned with **osmoregulation.**
- A red colour eyespot is found in zoospores for **reception** of light, which is made up ot **carotenoids** (Hematochrome).

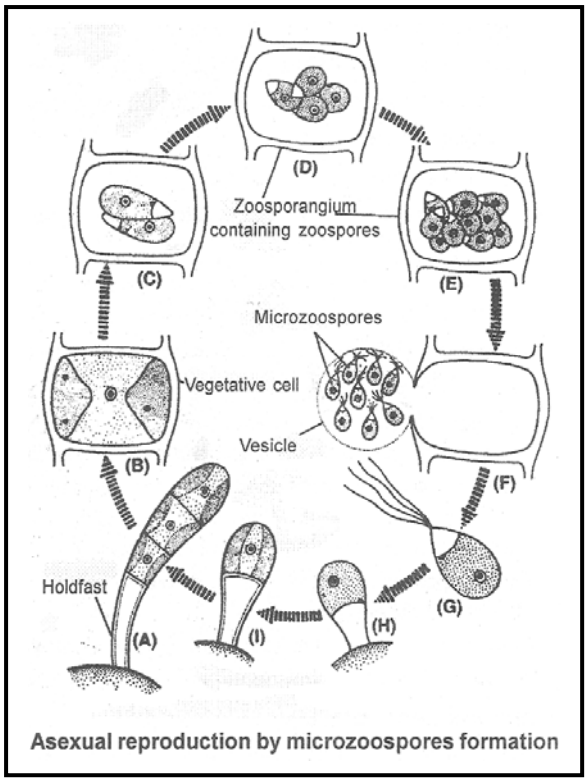
Note : Contracticle vacuole is absent in zoospore of ***Ulothrix flacca.***



STRUCTURE OF ZOOSPORES

Germination of zoospores

- Zoospores, after the liberation from zoosporangium swim in water for sometime.
- When they tired settle down on any soild object.
- Micro zoospore attached with their anterior end and macro zoospore attached with the posterior end. the zoosporers withdraws is flagella and secretes a wall around it. During this period it elongates and divides.
- First of all **transverse division** takes place, it is **asymmetrical** after the two cells are formed.
- The lower long cell transform into hold fast and upper cell divides continuous transversely to from Ulothrix Fila ment.



Asexual reproduction by microzoospores formation

(ii) Asexual Reproduction in Unfavourable conditions :

(A) By Aplanospore :

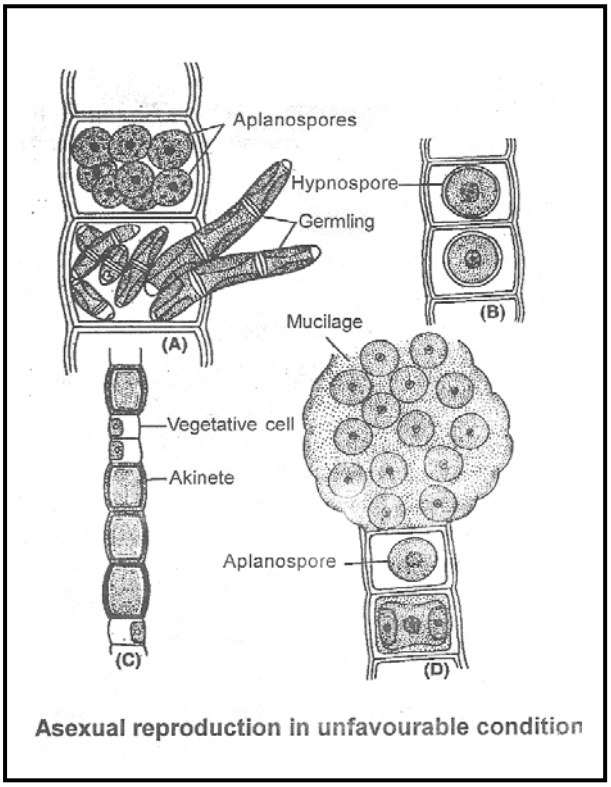
- When the unfavourable conditions returns **slowly,** they all the cells of thallus except hood fast forms **aplanospore.** Divided protoplast becomes round inside the cells of **Ulothix** and form a cell wall around itself. Aplanospores are **thin walled** and **Non-flagellated** structures.
- The thallus of **Ulothrix** degenerates in **unfavourable conditions.** Aplanospores passes unfavourable conditions On the approach of favourable conditions the aplanospore may germinates by two different way :

(1) Direct germination :

Aplanospores germiantes direictly, when the availability of **water is less.** Aplanospores absorb water and swells up and their covering breaks and aplanospores become free then transverse division takes place, Lower cell transform into hold fast and upper cell produce Ulothrix filament through **continuous** transeves division.

(2) Indirect germination :

It take place by formation of zoospores. When water is available in more amount then zoospores are formed in aplanospores. Each **aplanospore** act as a **zoosporangium and each** Zoospore produce new Ulothrix filament.



Asexual reproduction in unfavourable condition

Aplanospre shows **"in situ" germination** also.

(b) By Hypnospores :

- When highly adverse conditions are **coming fast** then the protoplast of the **Ulothrix** cell shrinks and collects in the centre.

- Shrinked protplast secretes a thick wall around itself. These **thick walled** non-motile structuresare called **Hypnospores.** They are usuallyformed single in a cell.
- They are **more resistant** as compared to aplanospores. The are **perennating** bodies.
- On the approach of favourable conditions hypnospores also germinate **directly** or **indirectly.**

Example - ***U. fimbriata***

(c) Akinetes :

- When adberse conditions come **suddenly** then vegetative cell transform into thick walled structure. In which food has been accumulated.
  (In which spore wall is joined with the wall of sporangium) These are called **akinetes.** They shows **perennation.**
  When the favourable conditions come they may be germiante directly or indirectly.

Example : ***U. idiospora, U. zonata, U. subtilissima***

(d) Palmella stage :

- this type reproduction takes place in those Ulothrix species, which lies at the bank of reservoirs. The water start drying in the unfavourable conditions, Ulothrix faces dificiency of water **step by step.**
- Certain cells of the thallus divides in uncontrolled manner during such type of changes and to form group of a large number of small daurghet cells. The cell wall of cells dissolves and to form a **mucilagenous** envelope. Later it dries and form a protective covering.
- On the approach of favourable contidions mucilage layer dissolves and cells give rise to a new thallus through **direc** or **indirect** germination.
  Note : Above stage is identicle to an another **algae-Palmella,** Therefore it is known as **palmella stage.**
  Note : In **Ulothrix,** colony formation occurs during palmella stage.

(3) Sexual reproduction :

- Sexual reproduction **isogamous type.** (Such type of sexual reproduction in which fusing gametes are morphologically and physiologically similar called as isogamous).

- Gametes are type zoogamete. They are motile. they appears like a **biflagelalte microzoopores.**
- Each cell can function as **zoogametangium** except the hold fast. The process of gamete formation and liberation is similar to that of zoospores. **8 to 64** zoogametes are formed in a zoogametangium.

- the fusing gametes first unite by their anterior ends in lateral side and later on they get fusded completely and a **diploid, quadrilflagellated** structure is formed which is called **sykaryon.** (When the cells of gametes fused together then it is called **Plamogamy** and fusion of their nucleus is called **Karyogamy.** Resulting a dipolid **zygote** is formed).

* In the begining zygote is **qudriflagelale** and later losses its flagella. Zygote secretes a thick wall around it self. It is known as **zygospore.**

Germination of zygospore : One zygosproe Germination : 4-16 Ulothrix filament

- Germination of zygospore is direct or indirect in favourable conditions and meiotic division takes place during germination.

- A **heterogenetic** thallus is formed through the **direct germination** in which some of the cells cell of opposite strains.

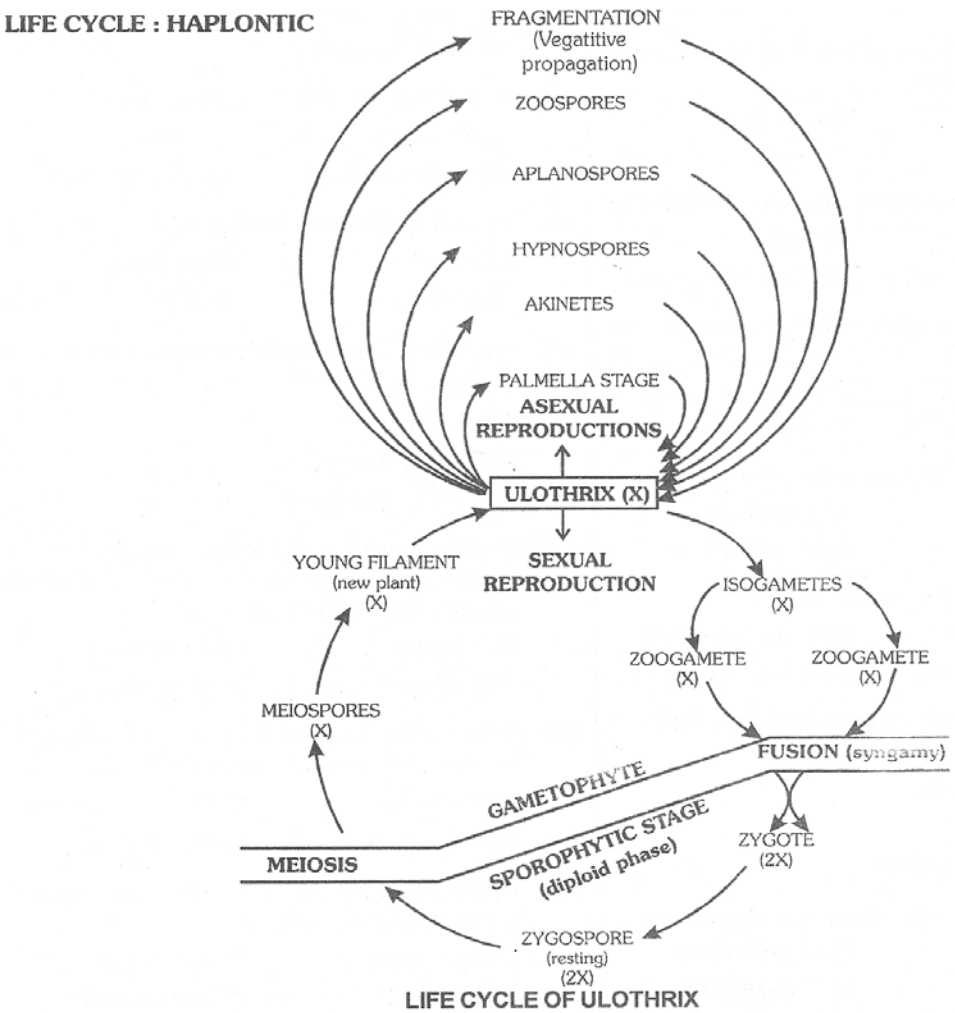
- During indirect germination of zygospores meiotic division takes place and **four haploid** spores are formed. They are called **meiospores.** These meisopores are may be motile **(meizoospore)** r non motile **(meio aplanospores).** The motile meiozoospores are **quadriflagellate.**● A **homogenetic** thallus is formed through the **indirect germination** of zoospore. It means ll the cells formed in thallus are identicle.

"PARTHENOGENESIS"

- Fusion of motile gamtes in a through of luck. When these gametes fail to fuse. They still down, withdraw their flagella, round off and secretes a thick wall around itself. These are called **as azygospores or parthenospores.** They germinate by **direct** or **indirect** methods. Their germination is through the **mitotic** cell division. Homogenetic thallus is formed through the germination of azygospore.

Special points

- **Ulothrix** is heterothallic. It means isogametes have different strains genetically.
- Sexual reproduction of **Ulothrix** geins after the growth period. (Vegetative season)
- Sprorophytic generatioin is represented only by the zygote. In the life cycle of Ulothix, Zygote is very short in duration. Becuase of the formation of **meiospores,** the zygosproe of **Ulothrix** is called **incipient sprophyte.**
- Gametes are formed in **semi drying** condition and released in the **morning.**
- In Ulothrix primary division of labour is found. The work of the holdfast is to make the filament stable on the base. For food it depends on other cell, which does the work of food formation and reproduction.
- In Ulothrix gamtes units first by flagella then by opposite ends then laterally and proceeds towards posterior end.
- Ininitial stage of zygote of **Ulothrix.** four flagella, two eye sports, two chloroplasts and one diploid nucleus are present.
- Resting zygospore of **Ulothrix zonata** forms a rhizoid like structure, this is called **"Codiolum stage".** This rhizoid like structure meant for fixation.



LIFE CYCLE OF ULOTHRIX