MADAN ACADEMY

MADAN ACADEMY

MADAN ACADEMY
ULOTHRIX (POND WOOL)

- Discovered by Knitzing.

**SYSTEMATIC POSITION:**

- **Kingdom:** Plantae
- **Sub kingdom:** Thallophyta
- **Division:** Chlorophyta
- **Class:** Chlorophyceae
- **Order:** Ulotrichales
- **Family:** Ulotrichaceae
- **Genus:** Ulothrix

**HABIT AND HABITAT:**

- Ulothrix mainly found in fresh water.
- The majority of species of Ulothrix occurs in cold slow moving streams.
- Marine species, eg., Ulothrix flacca. (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:**

![Diagram of Ulothrix filament, transverse section of a cell, and chloroplast structure.](image-url)
THALLUS STRUCTURE ::

- The thallus of *Ulothrix* is multicellular, filamentous, unbranched and **bright green** in colour.
- All the cells of the filament are similar but basal cell and apical cell are different. All cells present between basal cell and apical cell are called **intercalary cells**.
- Shape of the cells are **cylindrical** but they looks **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 **Rhizoidal cell** or **Hapteron**.
- At the base of holdfast develops fine **processes or fingers like** structure 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 **Protopectin**. (Precursor of pectin and insoluble in water). The inner layer is **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**.
- Chloroplast contains **two or three pyrenoids**. (Protein particles which are surrounded by starch.)
- These pyrenoids are concerned with storage of starch.

REPRODUCTION ::

- *Ulothrix* reproduce by three methods:
  1. Vegetative reproduction.
  2. Asexual reproduction.

VEGETATIVE REPRODUCTION ::

- It takes place generally in **favourable conditions**.
- **Fragmentation** : The filaments break up into two or more pecies. 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
ASEXUAL REPRODUCTION:

- It takes place in **favourable** and **unfavourable** conditions.

**In favourable conditions:** By Zoospores.

- Zoospores formation occurs generally near the apex and progresses towards the base of filament. **(Basipetal order)**
  - Zoospores are of two types –
    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 from 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 from 4-8.
   - Their germination begins from the posterior end.

STRUCTURE OF ZOOspORE:

- Zoospores are **naked**. It means cell wall is absent in them. **Cup shaped** chloroplast is present in which one **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 of **carotenoids**. (Hematochrome)
  - **Note:** Contractile vacuole is absent in zoospore of *Ulothrix flacca*.

GERMINATION OF ZOOspORE:

- Zoospores, after the liberation from zoosporangium swim in water for sometime.
- When they tired then settle down on any solid object.
Micro zoospore attached with their anterior end and macro zoospore attached with their posterior end.

The zoospore withdraws its flagella and secretes a wall around it. During this period it elongated and divides.

First of all **transverse division** takes place, it is **asymmetrical** after that two cells are formed.

The lower long cell transform into hold fast and upper cell divides continuous transversely to form Ulothrix Filament.

(ii) **Asexual Reproduction in Unfavourable condition** :

(A) **By Aplanospore** :
- When the unfavourable condition returns **slowly**, then all the cells of thallus except hol fast form aplanospore.
- Aplanosporos are **thin walled** and **Non-flagellated** structure.
- On the approach of favourable condition the aplanospore may germinates by two different ways:
  (i) **Direct germination** :
  - Aplanosporos germinates directly, when the availability of **water is less**.
  - Aplanosporos absorb water and swells up and their covering breaks and aplanospores become free then transverse division takes place.
  (ii) **Indirect germination** :
  - It take place by formation of zoosporos. When water is available in more amount then zoospores are formed in alplanospores.
  - Each alplanospore act as a zoosporangium and each zoospore produce new Ulothrix filament.
  - Alplanospore shows "**in situ**" germination also.

(B) **By Hypnospores** :
- When highly adverse conditions are **coming fast** then the protoplast of the Ulothrix cell shrinks and collect in the centre.
• Shrinked protoplast secretes a thick wall around itself. These **thick walled non-motile** structures are called **Hypnospores**.

• They are **more resistant** as compared to aplanospores. These are **perennating** bodies.

• On the approach of favourable conditions hypnospores also germinates **directly** or **indirectly**.

  **Example – U. fimbriata.**

(C) **Akinetes**

• When adverse conditions come **suddenly** then vegetative cell transform into **thick walled** structure, in which **food** has been accumulated, called **akinetes**.

• They shows **perennation**. When favourable conditions come they germinate either directly or indirectly.

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

(D) **Palmella stage**

• This type of reproduction take place in those Ulothrix species, which lies at the banks of reservoirs.

• The water start drying in the unfavourable conditions, Ulothrix faces deficiency 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 daughter cells.

• The cell wall of cells dissolves and to form a **mucilaginous** envelope. Later it dries and form a protective covering.

• On the approach of favourable conditions, mucilage layer dissolves and cells give rise to new thallus through **direct** 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.

**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 of zoogamete. They are motile and **biflagellated**.

- 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 fused completely and a **diploid, quadriflagellated** structure is formed which is called **synkaryon**.

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

**GERMINATION OF ZYGOSPORE :**

- **One zygospore** → **4-16 Ulothrix filament**.

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

**PARTHENOGENESIS :**
Fusion of motile gametes is a thought of luck. When these gametes fail to fuse. They settle down, withdraw their flagella, round off and secrete a thick wall around itself. These are called as azygospores or parthenosporeres.

Their germination is through the mitotic cell division. Homogenetic thallus is formed through the germination of azygospore.

**Special point:**

- *Ulothrix* is heterothallic. It means fusing isogametes have different strains genetically.
- Sexual reproduction of *Ulothrix* begins after the growth period/ Vegetative season.
- Sporophytic generation is represented only by the zygote. In the life cycle of Ulothrix, Zygote is very short in duration.
- 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.
- *Ulothrix zonata* shows the origin of **Sexual reproduction**.

---

**LIFE CYCLE: HAPLONTIC**

- Fragmentation (Vegetative propagation)
- Zoospores
- Aplanospores
- Hypnospores
- Akinetes
- Palmella stage
- Asexual reproductions
- Young filament (new plant)
- Sexual reproduction
- Isogametes
- Zoogamete
- Fusion (syngamy)
- Meiosis
- Sporophytic stage (diploid phase)
- Zygote
- Zygospore (resting)
- Life cycle of Ulothrix - Haploptic
<table>
<thead>
<tr>
<th>Question</th>
<th>Text</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.1</td>
<td>A motile flagellate asexual cell is known as -&lt;br&gt; (1) Zoospore  (2) Zygospore  (3) Tetraspore  (4) Zygote</td>
<td></td>
</tr>
<tr>
<td>Q.2</td>
<td><em>Ulothrix</em> is a green algae because-&lt;br&gt; (1) It has a cell-wall  (2) Each cell has a single nucleus  (3) Each cell has a single chloroplast  (4) It has chl.'a', chl.'b', β-carotene and xanthophyll</td>
<td></td>
</tr>
<tr>
<td>Q.3</td>
<td><em>Ulothrix</em> produces&lt;br&gt; (1) Quadri flagellate macrozoopores  (2) Biflagellate micro zoospores  (3) Quadriflagellate micro zoospores  (4) All the three types of zoospores stated above.</td>
<td></td>
</tr>
<tr>
<td>Q.4</td>
<td>The organ by which <em>Ulothrix</em> is attached to its substratum is called a-&lt;br&gt; (1) Rhizoid  (2) Holdfast  (3) Trichome  (4) Root</td>
<td></td>
</tr>
<tr>
<td>Q.5</td>
<td>The number of flagella in the gametes of <em>Ulothrix</em> is -&lt;br&gt; (1) six  (2) four  (3) one  (4) none of the above</td>
<td></td>
</tr>
<tr>
<td>Q.6</td>
<td>The non-motile, highly thickened asexual spores are called-&lt;br&gt; (1) hypnospores  (2) macro-spores  (3) aplanospires  (4) micro zoospores</td>
<td></td>
</tr>
<tr>
<td>Q.7</td>
<td>The basal cell of <em>Ulothrix</em> is devoid of-&lt;br&gt; (1) Nucleus  (2) Cytoplasm  (3) Chloroplast  (4) All of these</td>
<td></td>
</tr>
<tr>
<td>Q.8</td>
<td>In <em>Ulothrix</em> reduction division occurs-&lt;br&gt; (1) In the gamete  (2) In the zygospores  (3) In the zoospores  (4) In the somatic cell</td>
<td></td>
</tr>
<tr>
<td>Q.9</td>
<td>The species of <em>Ulothrix</em> preferring Salty water is-&lt;br&gt; (1) <em>U. flacca</em>  (2) <em>U. tenarima</em>  (3) <em>U. zonata</em>  (4) <em>U. variabilis</em></td>
<td></td>
</tr>
<tr>
<td>Q.10</td>
<td>The akinete formed during unfavourable conditions in the <em>Ulothrix</em> life cycle is-&lt;br&gt; (1) Protoplasm + thin cell  (2) Protoplasm + cell wall  (3) Cell + thick wall  (4) Naked protoplasm</td>
<td></td>
</tr>
<tr>
<td>Q.11</td>
<td>Which cell of <em>Ulothrix</em> does not divide-&lt;br&gt; (1) Rhizoidal cell  (2) Apical cell  (3) Both the above  (4) None of these</td>
<td></td>
</tr>
<tr>
<td>Q.12</td>
<td>In <em>Ulothrix</em>, colony formation occurs during-&lt;br&gt; (1) Formation of aplanospores  (2) Formation of zoospores  (3) Palmella stage  (4) All of the above</td>
<td></td>
</tr>
<tr>
<td>Q.13</td>
<td>In <em>Ulothrix</em>, eye spot does not occurs in-&lt;br&gt; (1) Zoospores  (2) Gametes  (3) Microzoospores  (4) None of the above</td>
<td></td>
</tr>
<tr>
<td>Q.14</td>
<td>In <em>Ulothrix</em>, gametes are released in-&lt;br&gt; (1) Morning  (2) After noon  (3) Evening  (4) Night</td>
<td></td>
</tr>
<tr>
<td>Q.15</td>
<td>Which type of spores fix to substratum by anterior end at the time of germination-&lt;br&gt; (1) Macro zoospore  (2) Micro zoospores  (3) Aplanospores  (4) Hypnospores</td>
<td></td>
</tr>
</tbody>
</table>
Q.16 If *Ulothrix* is removed from water and placed in dry soil then it will produce-
(1) Aplanospores  (2) Hypnospores  
(3) Akinetes  (4) Palmella stage

**Hint**: In a colony cells mechanically held together generally in a gelatinous envelope. The cells in the colony have little or no dependence upon one another.

Q.17 When single thick walled aplanospore is produced in a cell of *Ulothrix* it is called-
(1) Akinete  (2) Hypnospore  
(3) Oidium  (4) Torula

Q.18 Which type of gametes are produced in *Ulothrix*-
(1) Biflagellate zoogametes  
(2) Biflagellate antherozoids  
(3) Quadriflagellate  (4) Non motile gametes

Q.19 *Ulothrix* is-
(1) Homothallic  (2) Heterothallic  
(3) Protoandrous  (4) 2 & 3 both

Q.20 *Ulothrix* inhabits-
(1) Slow flowing warm water  
(2) Stagnant cool water  
(3) Slow flowing cool water  (4) Any of the above

Q.21 Cells of *Ulothrix* are-
(1) Rectangular  (2) Spherical  
(3) Cylindrical  (4) Ellipticle

Q.22 Pyrenoids are composed of-
(1) Starch  (2) Protein  
(3) Starch and lipid  (4) Starch and protein

Q.23 Why *Ulothrix* is not considered a linear colony of cells-
(1) Because all cells are in a common cell wall  
(2) Because cell exhibit a division of labour  
(3) Because cells have plasmodesmatal connections  (4) All the above

Q.24 Apical cell of thallus in *Ulothrix* is-
(1) Dome shaped  (2) Cylindrical  
(3) Rectangular  (4) Club shaped

Q.25 Chloroplast of *Ulothrix* is-
(1) Girdle shaped with grana & intergrana  
(2) Girdle shaped without or less developed grana & intergrana  
(3) Disoidal with well developed grana  (4) Discoidal with poorly developed grana

Q.26 Hold-fast of *Ulothrix* is-
(1) Living and without chloroplast  
(2) Living and without nucleus  
(3) Non-living and without chloroplast  (4) Non-living and with nucleus

Q.27 Red eye spot of zoospores of *Ulothrix* is made up of-
(1) Lycopene  (2) Haematochrome  
(3) Carotene  (4) Leutine

Q.28 The name "Palmella Stage" is after the name of a-
(1) Lady  (2) Slime molds  
(3) Scientist  (4) Algae

Q.29 How many mating types occur in *Ulothrix*-
(1) One  (2) Two  
(3) Three  (4) Many

Q.30 Vegetative reproduction in *Ulothrix* takes place by-
(1) Parthenogenesis  (2) Fragmentation  
(3) Harmogonium  (4) Aplanospore
Q.31 Lithophytic species of Ulothrix is-
(1) \textit{U. implexa} (2) \textit{U. flacca} (3) \textit{U. zonata} (4) \textit{U. flaccida}

Q.32 In Ulothrix food is stored in the form of-
(1) Protein (2) Starch (3) Pyrenoid (4) Lipid

Q.33 Which type of sexual reproduction occurs in Ulothrix-
(1) Isogamous (2) Anisogamous (3) Oogamous (4) Conjugation

Q.34 In Ulothrix, Zygote is initially-
(1) Uniflagellate (2) Biflagellate (3) Quadriflagellate (4) Aflagellate

Q.35 One celled sporophyte are found in-
(1) Ulothrix (2) Riccia (3) Moss (4) Fern

Q.36 The zoospores of Ulothrix exhibit a closer resemblance to the thallus of-
(1) Ulothrix (2) Chlamydomonas (3) Palmella (4) Chlorella

Q.37 Micro zoospores in Ulothrix are-
(1) Biflagellate (2) Quadri flagellate (3) Both (1) & (2) (4) Multiflagellate

Q.38 How many zoospores are produced in a single cell of Ulothrix-
(1) 1-8 (2) 8-16 (3) 8-32 (4) 8-64

Q.39 The type of zoospores not formed in Ulothrix are-
(1) Quadriflagellated macro zoospores (2) Quadriflagellated micro zoospores (3) Biflagellated macro zoospores (4) Biflagellated micro zoospores

Q.40 How many chloroplast occur in Ulothrix cell-
(1) One, Girdle shaped (2) Two, star shaped (3) Three, Girdle shaped (4) Biflagellated zoospores

Q.41 The zoo gametangia and zoo sporangia of Ulothrix are-
(1) Jacketed and unicellular (2) Non-jacketed and unicellular (3) Jacketed and multi cellular (4) Non jacketed and multi cellular

Q.42 Parthenogenesis in Ulothrix forms a resting structure called-
(1) Zygospore (2) Azygospore (3) Hypnospore (4) Zoospores

Q.43 The cause of polarity in Ulothrix is due to-
(1) Apical cell (2) Basal cell (3) Intercalary cell (4) Both apical and Basal cell together

Q.44 Which of the following reproductive structure is equivalent to a complete cells-
(1) Aplanospore (2) Zoospore (3) Akinete (4) Hypnospore

Q.45 Ulothrix is-
(1) A colonial algae (2) An anchored & branched algae (3) An attached filamentous algae (4) A free floating algae
Q.46 Filaments of Ulothrix are-
(1) Brick shaped
(2) Branched
(3) Girdle shaped
(4) Unbranched

Q.47 How many thalli (filaments) are produced from the germination of a zygospore of Ulothrix-
(1) 1-4
(2) 4-16
(3) 16-32
(4) 4-64

Q.48 What type of nuclear division occurs at the time of the germination of zoospores and zygospore respectively?
(1) Both mitotic
(2) Mitotic and meiotic
(3) Meiotic and mitotic
(4) Both meiotic

Q.49 If total 52 cells are present in a Ulothrix filament, how many of them can divided to produce zoospore or aplanospores-
(1) All the 52
(2) 51 only
(3) 40 only
(4) 1 only

Q.50 Ulothrix cell have a double layered cell-
(1) The outer of cellulose and inner of protopectin
(2) Inner of cellulose and outer of protopectin
(3) Both of cellulose
(4) Both of pectin

Q.51 In Ulothrix the common mode of Asexual reproduction take place by-
(1) Aplanospores
(2) Macro-zoospores
(3) Micro-zoospores
(4) Macro & micro zoospores

Q.52 In Ulothrix, Zygote is-
(1) Quadriflagellate
(2) Biflagellate
(3) Unifilagellate
(4) Aflagellate

Q.53 Life cycle of "Ulothrix" is -
(1) Haplonetic
(2) Diplonetic
(3) Haplodiplonetic
(4) None of them

Q.54 Morphologically similar but physiologically different gametes are called-
(1) Isogamete
(2) Oogamete
(3) Physiological anisogamete
(4) Syngamous

Q.55 Pigments present in chloroplast of Ulothrix-
(1) Chlorophyll a, Ch-b, fucoxanthin β-carotene
(2) Ch-a, Ch-b, Ch-c, C-phycocyanin, C-phycoerythrin
(3) Ch-a, Ch-b, β-carotene and xanthophylls
(4) Ch-a, Ch-b, r-phycocyanine, r-phycoerythrin

Q.56 In Ulothrix, zoospores are liberated by-
(1) Degeneration of lateral walls
(2) Formation of pore in lateral wall
(3) Gelatinisation of lateral walls
(4) Gelatinisation of all cell walls

Q.57 Which one of the following shows haplontic life cycle-
(1) Ulothrix
(2) Funaria
(3) Selaginella
(4) Pinus
Q.58 Meiosis in Ulothrix take place during-[MP PMT 2002]

(1) zoospore formation
(2) gamete formation
(3) zygospore germination
(4) zoospore germination

Note :-

Aplanospore –
A non-motile and thin walled spore, in which spore wall is not derived from wall of its parents cell.

Hypnospore –
A thick walled non motile spore of Ulothrix, meant for perennation, called as hypnospore.

Akinete –
A thick walled non motile resting spore formed by the modification of a vegetative cell in which food has been accumulated.

Answer Key

<table>
<thead>
<tr>
<th>Ulothrix</th>
<th>EXERCISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ques. 1</td>
<td>2 3 4 5 6 7 8 9 10 11 12 13 14 15</td>
</tr>
<tr>
<td>Ans. 1</td>
<td>4 4 2 4 1 3 2 1 3 1 3 1 4 1 2</td>
</tr>
<tr>
<td>Ques. 16</td>
<td>17 18 19 20 21 22 23 24 25 26 27 28 29 30</td>
</tr>
<tr>
<td>Ans. 3</td>
<td>2 1 2 3 3 4 3 1 2 1 2 4 2 2</td>
</tr>
<tr>
<td>Ques. 31</td>
<td>32 33 34 35 36 37 38 39 40 41 42 43 44 45</td>
</tr>
<tr>
<td>Ans. 3</td>
<td>2 1 3 1 2 3 3 1 2 2 4 3 3</td>
</tr>
<tr>
<td>Ques. 46</td>
<td>47 48 49 50 51 52 53 54 55 56 57 58</td>
</tr>
<tr>
<td>Ans. 4</td>
<td>2 2 2 2 4 1 1 3 3 2 1 3</td>
</tr>
</tbody>
</table>
मध्य एक्सेस