RICCIA

SYSTEMATIC POSITION

Kingdom — Plantae
Sub kingdom — Embryophyta
Division — Bryophyta
Class — Hepaticopsida
Order — Marchantiales
Family — Ricciaceae
Genus

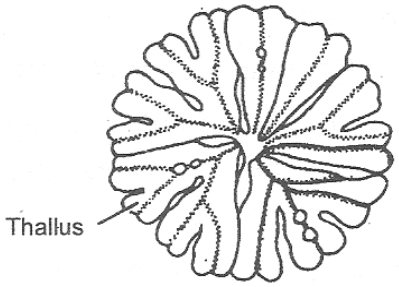
Riccia

Habit & Habitat :

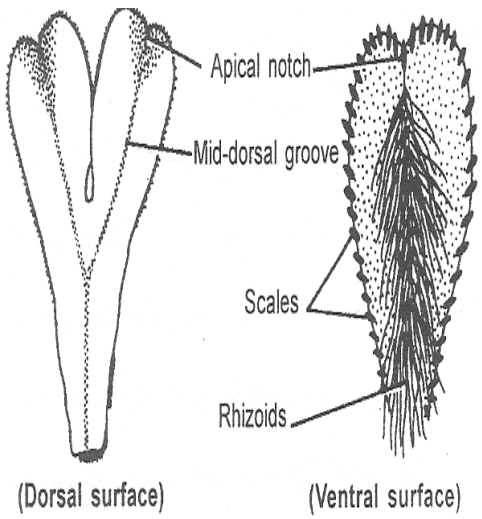
- **Riccia** was discovered by **F.F. Ricci.**
- Riccia is generally found in moist and shadhy paces.
- The common Indian species are as follows :
  i. ***Riccia discolor / R.himalayensis***
  Ii. ***R. glauca***
  iii. ***R.pathankotensis***
  iv. ***R.robusta***
  v. ***R.crystallina***
- **Riccia discolor** found in Rajasthan
- Some speicies of Riccia are **aquatic.**
  Such as - **Riccia fluitans, R.abuensis etc.**

STRUCTURE

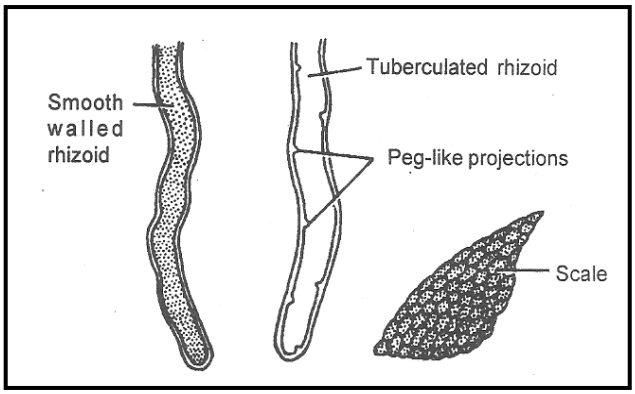
- The main plant of Riccia is gametophyte in the form of thallus.
- It is green, flat, dorsivenrl and **dichotomously** branched. It grows **prostrate** on the soil.
- At the growing point of thallus a notch is present, at the apical end. It is known as **Apical nothc.**
- At the base of apical notch a apical cell is present. It is **pyramidal** shape. The thallus grows by the activity of this spical cell.
- Each lobe of the thallus is this in the middle and thin at their margins.
- On the **upper (dorsal) surface** of each lobe vein is present in the middle which extends from anterior to posterior. It is known s **longitudinal median vein.**
- A long groove is present in the region of median vein, is called **Median groove.**
- In this groove, sex organs are developed in **cropetal order** on the dorsal surface of thallus.
  Note : The dorsal surface of the **Marchantia** thallus (Liver shaped) bears **gemma cups** along the mid rib.



[Rosette form in terrestrial species] due to the presence of several dichotomies close to each other



(a) Rhizoid : Rhizoids are found in the mid rib region on the **ventral/Adaxial** surface of the Riccia thallus. (In scattered form)



- Rhizoids are **univellular, unbranched, colourless** and **tubular.**

Two types of rhizoids and found in Riccia.

1. **Smooth walled :**

- Outer and inner walls of rhizoids are smooth & straight.

2. **Tuber culated :**

Peg like ingrowths are present on the surface of inenr wall.

- Tubercalated rhizoids are absent in **Riccia sanguinae.**

Note : Smooth walled & tuberculated rhizoids are also found in **Marchantia** & **Plagiochasma.**

- Rhizoids are absent in the aquatic species of Riccia. Such as **R.fluitns.**

Function : The main function of the rhizoids is to fix the plant with the substratum and it absorbs some amount of
water and minerals.

- The whole venral surface also absorbs water and minaerals.

(b) Scales : Trangular, multicellular and **violet colour sles** are present on the margin of **ventral surface** of thallus

- **Violet (Purple)** colour of the scales is due to the presence of **anthocyanin** pigment in their **cell sap.**
- They are **lingulte/ligulate.** The slaces are single called thick. Maximum scales are found in apical notch.

Note : In **Marchantia** sales are **appendiculate** & **ligulate.**

- In Riccia the half scales are found at the margin of the thallus. Complete scales are count in the apical notch.

Function :

(1) The main function of the scales is the **protection of growing points :**
(2) Some amount of water also absorbed through the scales.

- Scales are formed by the activity of the apical cell and arranged in a single row, but as the thallus grows had widen, each scale splits into two halves along the median line, so that two rows of scales are seen, one row near each margin of the thallus.

Note : Scales are arranged in **acropetal** order.

- Scales are absent or less developed in aquatic species of **Riccia.** Plant growing moist terrestrial habitats usually have small and ephameral scales, whereas those of dry habitats have large and persistent **scales**
- In terrestrial species e.g. **R.sanguinea, Riccia robusta etc.** scales are completely absent.

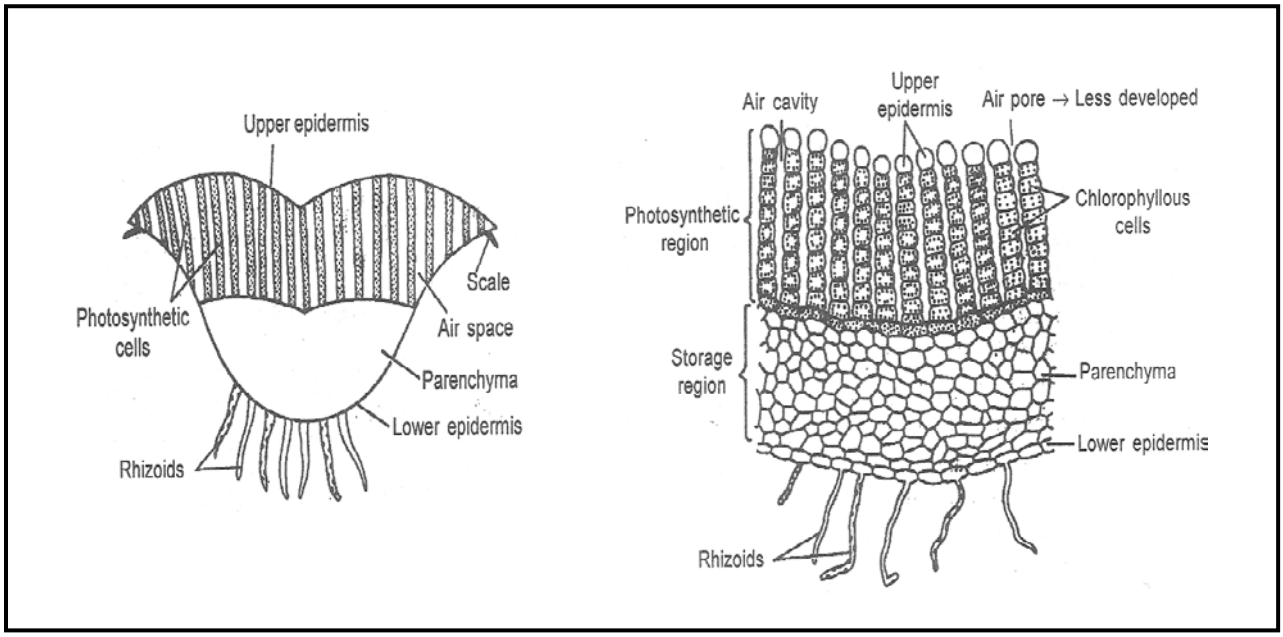
Internal Structure :

Internally, the thallus is divided into two distinct zones or regions.

(i) Upper or dorsal : **Photosynthetic** or **assimiltory region.**
(ii) Lower or Ventral : **Strorage region**

(i) Assimilatory Region or Photosynthetic region :

- The cells of this region are loosely arranged and parenchymatous.
- Chloroplasts **(Discoid type)** are found in the cells of this region. So this region is able to carry the process of photosynthesis. Therefore it is known as **photosynthetic region.**



- The chlorophyllous cells are arranged in vertical rows. A narrow, deep space is found in between vertical rows, called **air space** or **air canal.** Upper cell of each vertical row is colourless, larger in size & differentiated to form upper epidermis.
- Each air canal is surrounded by four vertical rows. Air canal opens at upper epidermis through the pore called **air pore.** Air canals are **schizogenous** in origin. It means it is formed by the separation of cells.
- The presence of **air canal** or **air chamber** is the ancestral feature. They shows aquatic ancestral Character.
- Food material synthesize in this region through the photosynthesis.

(ii) Storage Region :

- The cells of this region are **colourless, compct, parenchymatous** and without intercellular spaces.
- The starch is stored by the cells of this region as food.
- The lower most layer of cells are arranged systematically to form a **lower epidermis.**

REPRODUCTION :

It reproduces by two different ways.

I. Vegetative Reproduction. II. Sexual Reproduction

I. Vegetative Reproduction : It is responsible for the **gregarious** (Growing close together but not matted)

(i) By progressive death and decay of older parts of thallus.

- It is normal method of vegetative reproduction. It takes place in favourable growth season (period).
- The older parts of the plant body gradually become aged, die and ultimately decay. When this process of decay reaches up to **dichotomous point,** two branches get separated and each branch forms a new thallus through the apical growth.

(ii) By Rhizoidal tips :

- It is has been reported by ***Fellener*** in ***R.glauca.***
- During this reproduction at the tips of **rhizoids,** a multicellular mass of cells is formed by segmentation & repeated divisions, which becomes green in colour and act as a **bud.** These buds separate from the rhizoids and grow into a new plant.

(iii) By Adventitious branches :

- This method of reproduction is found in aquatic species of Riccia such as ***R.fluitans.***
- Special adventitious branches arise from the **ventral surface** of the thallus in the mid rib region. These branches are detached from the parent thallus and grow into a new plant.

(iv) By tuber formation :

- In many species like ***R.discolor, R. perennis*** growing regions having dry season.

- When the dry season starts, the apical cell divide to for, the multicellular mass of cells on the apex of each branch. This mass of cells of the lobes becomes thick due to storage of food materials and develop a thick protective layer around it after degeneration of marginal cells. This thick structure is known as **tuber.**
- The thallus becomes dry and dead in dry season. The **bubers** remains **dormant** in **dry season.**On the returns of favourable condition or moist season, each tuber resumes growth and give rise to new thallus. Tubers shows **"perennation".**

  (v) By perisistent apices/By death of thallus in drougth condition except growing region.

  This method found in regions having prolonged dry season as in **Punjab** and **Rajasthan** e.g. **R.discolor.**
- In the begining of dry season entire body of the thallus becomes dry **except the apies.** The apices very often grow down into the soil and becomes thick due to the storage of food materials. On the advent of favourable condition (i.e. riny season) ll the spices grow and form a new plant.

  II. Sexual Reproduction : The main plant of **Riccia** is gametophyte. It reproduced by **gameete formation.**

  III.
- It is oogamous type. Male sex organ clled as **antheridium** and female sex organ alled as **archegonium**
- The sex organs of Riccia are borne on **dorsal surface** of the thallus in the median groove.
- The sex organs are develop singly, usually depply in the tissue in **acropetal order** i.e. youngest sex organs near the apex and oldest sex organ, **low sun light** and **temperature** is required.
- The species of Riccia are **Monoecious** and **dioecious**. But most of the species of Riccia are **monoecious.**

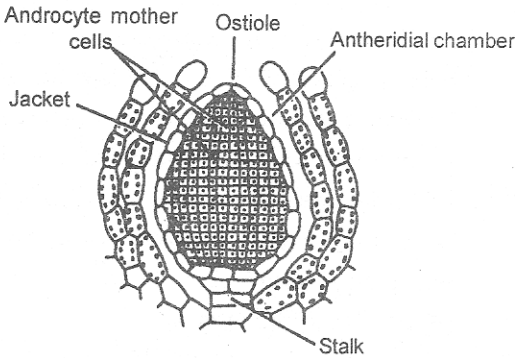
  (i) Monoecious species : Male and female sex organs lies on the same thallus. Such as **R.robusta, R. glauca, R.pathankotensis, R. crystallina R. gangetica etc.**

  (ii) Dioecious species : Male and female sex organs are present on separate thallus such as : **R. dicolour/R.himalayensis, R.bischoffii, Rcurtisis etc.**
- Most of the species of Riccia as **homothallic** in nature, i.e. fertilization taken place in between genetically identical gametes. But ***R.bischoffii*** *and* ***R.curtisis*** and ehterothallic, i.e. fertilization takes place in genetically different gametes.

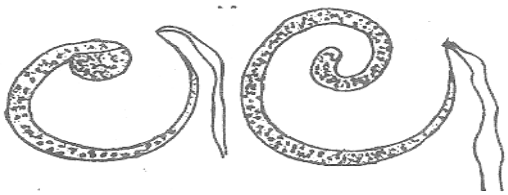
  Note : Most of the species of **Marchantia** are **dioecious** r **heterothallic.**

[i] Antheridium :

- Each mature antheridium is some what elongated oval or pear shaped and stalked strucutre. In most os species **antherdium** is **oval shaped.**
- Each antheridium enclosed in a cavity or chamber, known as **antheridial-chamber.**
- Each entheridium has a short, **few called stalk** by which it is attached with the base of antheridial chamber.
- The jacket of the antheridium is made up of sterile cells.
- Jacket is single celled thick and multicellular. Antheridium has large number of smaller cells, called **Androgonnial cells.**
- An oblique of diagonal cell division takes place in each androgonial cell. Resulting, two **androcytes** or **antherozoid mother** cells (sperm mother cells) are formed.
- Each androcytes convertes into a **male gamete** (elongated nucleus present) or **antherozoids** by metamorphosis
- These antherozoids are **motile** male gametes.
- They are **comma** life or **curve** shave and beflagellate. (In **Marchntia**-rod like & biflagellate)



V.S. OF ANTHERIDIUM

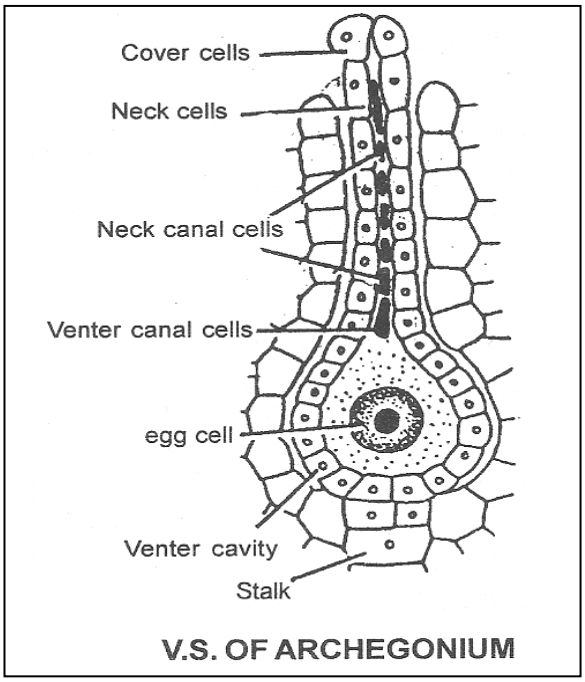

ANTHEROZOIDS

- At the maturation of antheridium cell wall of the androcytes dissolves during the metamorphosis and mucilage is formed.
- It is **hygroscopic** in nature. The apical cell of antheridial jacket absorbs water by imbibition from the antheridial chamber resulting, a pressure increase on the apical region of antheridium and the Jacket bursts at the apex the antherozoids comes out with mucilage. On coming in contact with water, the antherozoids swim freely with the help of their flagella.

Dehisence of antheridium takes in the presence of high amount of water, is called **Hydrochasy.**

[ii] Archegonium :

- A mature archegonium is **flask shaped** strcuture and enclosed in archeogonial chamber. It is attached with the base of archegonial chamber with the stalk
- The basal swollen portion of archegonium is called **Venter.** The upper narrow tube like protion is termed **neck.** The archegonium has a **single layered** jacket.
- The jacekt in the neck region is composed of **six vertical rows** of cells. In each vertical row 6 to 9 (mina ly 6) neck cells are present.
- **The** single layered **Jacket in ventre region** is composed of **many** rows of cells.
- Venter region contains two cells. A large cell which is termed **egg** or **oosphere** and above the oophere is a small **venter cnala cell.**
- The neck region has **4-6 neck canal cells.** (In **Marchanitia** 4-8 N.C.C.) The axis of archegonium is made up of **6-8 cell.** The four terminal cells of jacket of the neck of archegonium function as **cover-cells**



V.S. OF ARCHEGONIUM

Fertilization :

- When archegonium is fully mature, the **neck canal cells** and **venter canal cells** of archegonium degenerate. Only one cell remains which is called egg cell. Disintegration of the cells give rise to mucilagenous substance.
- Mucilage is **hygroscopic** in nature. It absorbs water, results increase a pressure in archegonium and concequently the cover cell of archegonium separate from each other and forming funnel shaped opening and the mucilage oozes out. **Inorganic potassium salts** and **Soluble protein** are present in mucilage which attracts the antherozoids.
- Antherozoids shows **chemotactic** movement. Due to this chemotactic response many antherozoids enter into the neck of archegonium. But eventually only **one antherozoid** fuse with the egg cell and other perish.

DEVELOPMENT OF SPOROPHYTE

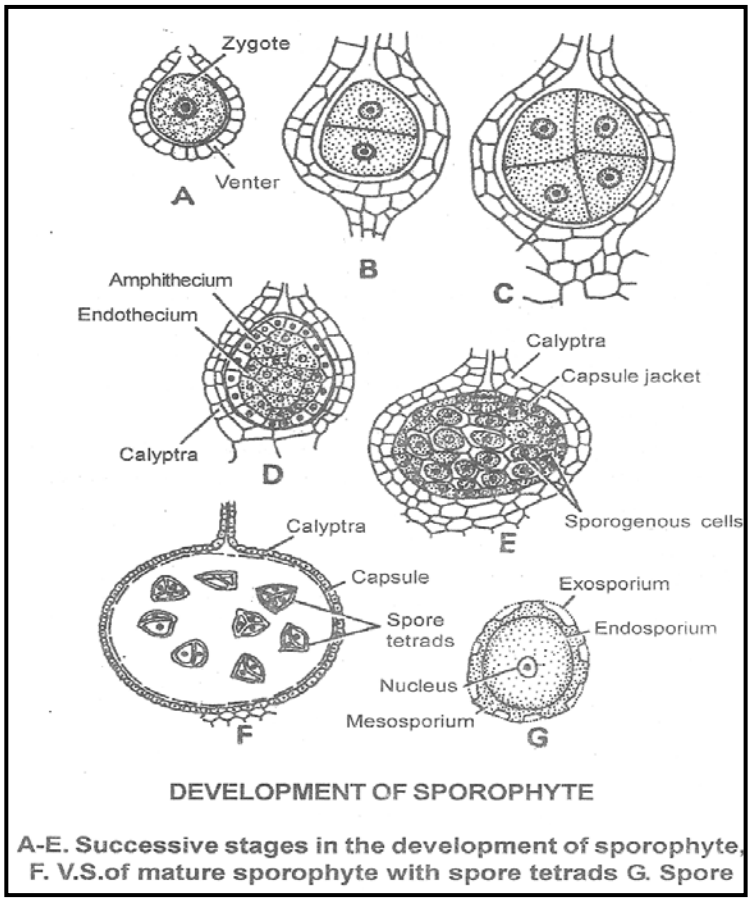
Development of zygote takes place only inside the archegonium.

- Zygote is the first cell of sporophytic generation.
- A sprophytic structure is formed by the **development** of zygote, is called **sporogonium** or **capsul.** The wall of the sporogonium is single celled thick and **spore mother cells** or **sporocytes** are filled inside the capsule.
- The first division is transverse in zygote and second one is perpendicular to the first one while the third division is vertical whicy give rise to **8-celled-embryo [octant]**
- Subsequent divisions occur in all possible planes until a mass of 20-40 cells is formed. The superficial cells of this mass now undergo periclinal divisions, resulting in an outer **amphithecium** layer and a central mass of cells, the **endothecium.**

- The cells of amphitecium divides again and again antilinically to form the wall of sporogonium. It is **single layered.**

Note : Endothecium acts as a **archesporiumm.**

- The cells of endothecium divided in all planes, resulting, a mass of cells **(sporogenous tissue)** is formed. It has two types of cells
  (i) **Sporocytes** or **spore mother** cells and
  (ii) **Nutritive cells** or **Nurse cells.** (Nurse cells are called **prestructure** of **elaters)**
  Note : In **Marchantia** nurse cells are transform into **elaters** (2N). These are hygrocscopic in nature & help in dispersal of spores.
- The nurse cells provide nutrition to the sporocytes. (In **Riccia)**
- One periclinal division takes place in the ells of center region during th edevelopment. Due to this bilayered covering is formed around the **sporogonium.** It is termed **calyptra**. Calytra is **haploid.** Because it is foremd by center region of archegonium.
- **The cell wall of sprogonium and sporocytes or spore mother cells are diploid.**
- Now, **meiotic** cell division takes place is spore mother cells, results, **haploid spores**are formed.
- Now wall of the sporogonium disinitegrates, to provide nutrition to the spores. Later inner most layer (wall) of Calyptra also breaks down to provide additional nourishment.
- In mature sprophyte spore tetrads lie in a cavity enclosed by a single layered calpytra.
- All the stucutre in capsule are haploid (n) at the mature stage.



DEVELOPMENT OF SPOROPHYTE

A-E. Successive stages in the development of sporophyte, F. V.S.of mature sporophyte with spore tetrads G. Spore

* The sporophyte of Riccia is **simplest** in **Bryophate.** It is made up of only capsule.

* The sprophyte is **devoid of food** and **seta.**
- In ***Marachantia*** sprophyte is differentitated into foot, seta and

Dehiscence of Capsule/Dehiscence of spore sac : There is not special means of dehisence of capsul of
Riccia. The liberration of the sporesis brouth about by the death and decay of capsule and thallus.

STRUCTURE OF SPORE : Spore is the **first cell** of the **gametophytic genertion.**

- The spores are aranged in **tetraheddral tetrad.**
- The sporesof Riccia are **uninucleate, pyramidal,** and rough. Thier diameter is 0.05 mm to 0.12 mm.
- The spore wall is tri-layered.

(i) Outer layer or Exosproe or Exoporium : It is thick and spiny. It is made up of **callose** and **cutin** and Tri-radiate ridges are present.

(ii) Middle layer or Mesospore or mesoporium - It is thick and solid. It is composed of **Cutin.**

(iii) Innermost layer of Endospore or Endosporium : It is thin and elastic.
It is composed of **pecto-cellulose.** These three are developed in centripetal order.

Germination of spore and Formation of young Gametophyte

- The sporesgerminate when there is enough water is the soil. The exosporium and the mesosporium ruputre at the tri radite ridge and the **endosporium comes out** is the form of a **tubular outgrowth.** It is called as **germ tube.**
- The germ tubes filled with cytoplasm which contains **oil globules** and **chloroplasts.** It elongated rapidly and forms a **club-shaped** strucutre. A **transverse** wall at the distal end of the tube forms a small cell, which udergoes **two vertical** divisions at right angles to each other, followed by **transverse division.** As a result undergoes **two vertical** divisioins at right angles to each other, followed by a **trnsverse division.** As result two tiers of four cells each (i.e. total eight cells) are formed. One of the four cells of the upper tier becomes apical cell which regularly cuts off cells on the dorsal and ventral sides. These derivatives form a new thallus.
- Simultaneously, with the division of the germ tube, a thin filamentous **rhizoid** develops from its base. This is known as the **first rhizoid.** As the new thallus grows at the tip of the germ tube, a large num bar of rhizoids develop from the **ventral/adaxial/lowr epidermis** of the thallus.

Note :

- **Heplo-diplontic** type alternation of generation is found in **Riccia.**
- Sprophyte of Riccia is **completely parasite** on gametophyte i.e. sporophyte depends upon gametophyte for nutrition and shelter.
- In most species of Riccia the haploid chromosome number in 8 (e.g. **R crystallina, R. discolor)** or 9 (e.g. R californica).
- **R. gangetica** is howerver, a **polyploid** species (n = 24).

Note : [In haplo-diplontic alternation of generation a doniannt independend, Photosynthetic, thalloid or erect phase is represented by a hoapoloid gamatophyte and it alternates with the short. Lived multicellular sporophyte which is totally or partically depended on the gamatophyte for its anchorage and nutrition.]

