23 Marchantia

Division	:	*Bryophyta*
Class	:	*Hepaticopsida*
Order	:	*Marchantiales*
Family	:	*Marchantiaceae*
Genus	:	*Marchantia*

Marchantia is a *Bryophyte*. It is an advanced ***liverwort.*** It is included in the class ***Hepaticopsida.*** The name *Marchantia* was given to the genus by ***Linnaeus*** after the famous French botanist, ***N. Marchant.***

Occurrence

Marchantia is ***cosmopolitan*** in distribution. The plants grow best in the moist shady places near the water banks, in open wood lands and in the burnt soil. These plants grow after the forest fires in the burnt soil.

Marchantia includes about ***65 species.*** Of these 11 species are reported from India. The common Indian species are

Marchantia polymorpha

Marchantia indica.

Thallus Structure (Gametophyte)

Marchantia is an ***advanced liverwort.*** It is placed in the class ***Hepaticopsida.*** *Marchantia* is ***cosmopolitan*** in distribution. The plants grow best in the ***moist shady places*** near the waterbanks, in open woodlands and in the ***burnt soil.***

The plant is a ***haploid gametophyte.*** The gametophyte constitutes the ***dominant*** phase in the life cycle. The mature plant may attain a length of 2-10 cms. The plant body is a ***leaf-like*** thallus. It is prostrate, dichotomously branched and dorsiventral.

It is fleshy and dark green in colour.

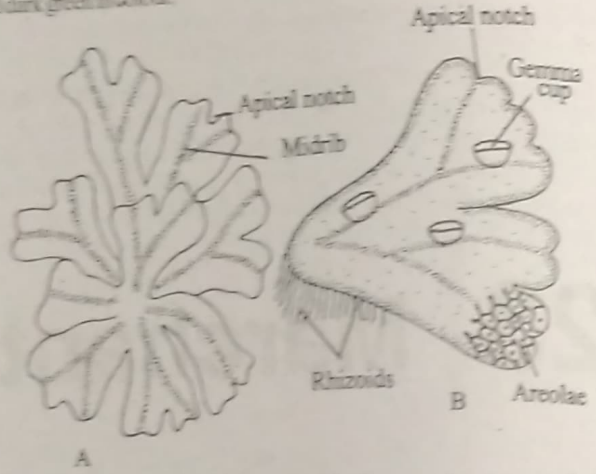

Fig.23.1: Marchantia sp. A-Thallus showing habit B-Part of thallus.

The dorsal surface of the thallus is divided into fine ***rhomboidal markings*** called ***areolae.*** Each ***areola*** has a ***central pore.*** A single air-chamber lies below the ***areola.*** The thallus bears a conspicuous ***mid-rib*** on its dorsal surface. The midrib is visible on the dorsal surface by the presence of a

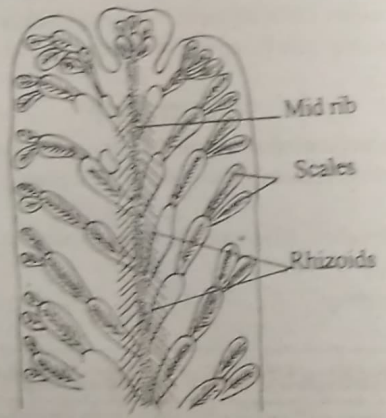

Fig.23.2: Marchantia sp. Thallus seen from the under-side showing scales and rhizoids.

groove. The midrib ends in a ***notch*** at the apex of the thallus in which ***growing point*** is situated. The margin of the thallus is slightly wavy.

Small cup-like structures called ***gemma cups*** arise from the mid-rib region. The gemma cups bear asexual reproductive bodies known as ***gemmae.*** The gemmae give rise to new ***gametophytes.***

Numerous ***scales*** and ***rhizoids*** arise from the ***ventral*** surface of the thallus. The ***scales*** or ***amphigastria*** are multicellular, flat, purple, plate-like structures. They are produced on either side of the ***midrib*** in two or more rows. The scales are of two types, namely ***simple scales*** and ***appendiculate scales.*** The scales protect the growing points from ***desiccation*** and ***mechanical injury.*** They also serve to ***retain moisture*** below the thallus.

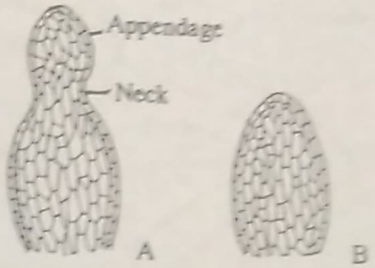

Fig.23.3: Marchantia sp. A-Appendaged scale. B-Simple scale.

The ***rhizoids*** are unicellular hair-like structures. They are of two kinds, ***simple*** or ***smooth-walled*** rhizoids and ***tuberculated*** or ***pegged rhizoids.*** The smooth-walled rhizoids are ***thin-walled*** and ***colourless.*** They are produced in the ***mid-rib*** region. These rhizoids serve as organs for attachment and absorption of minerals and water from the soil.

The ***tuberculated*** rhizoids arise from the ventral surface near the scales. Their cell wall is thick and many ***peg***-like in-growths called ***tubercles*** develop from the inner walls. These ***rhizoids*** grow into the soil and act as capillary conducting systems.

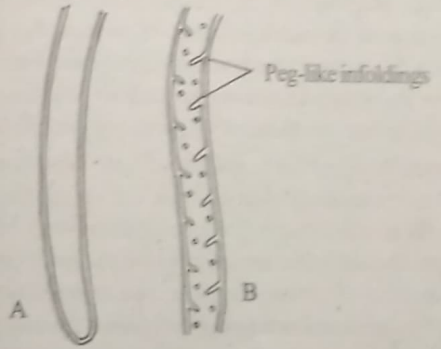

Fig.23.4: Marchantia sp. A-Smooth-walled rhizoid. B-Tuberculated rhizoid.

In *Marchantia*, some thalli produce ***erect, stalked*** up-right branches near the growing apices. These branches are called ***gametophores.*** They bear the ***male*** and ***female sex organs.*** The gametophore that bears the male sex organs, ***antheridia,*** is called ***antheridiophore.*** The gametophore that bears the female sex organs, ***archegonia,*** is called ***archegoniophore.*** *Marchantia* is ***heterothallic.*** There are separate male and female plants. ***Antheridiophores*** are produced on ***male gametophyte*** while ***archegoniophores*** are produced on ***female gametophyte.***

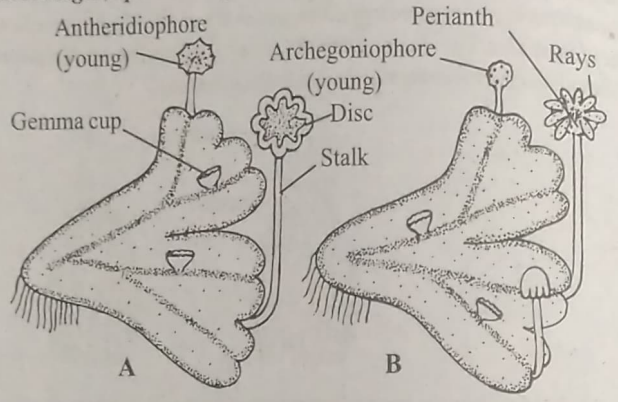

Fig.23.5: Marchantia sp. A-Male gametophyte with antheridiophore. B-Female gametophyte with archegoniophore.

Internal Structure

The vertical section of the thallus shows two distinct regions:

i. Dorsal photosynthetic region

ii. Ventral storage region

i. Photosynthetic Region: The upper most layer of the ***photosynthetic*** region is ***upper epidermis.*** It is ***single-layered.*** It is made up of compactly arranged thin-walled cells. These cells are green. The upper epidermis is interrupted here and there by many barrel-shaped openings called ***airpores***. These pores are analogous to ***stomata.*** Each air pore is surrounded by four rows of epidermal cells arranged in the form of rings of 4-8 tiers one above the other.

Below the upper epidermis is a horizontal layer of many ***air-chambers.*** These air-chambers communicate with the atmosphere through ***airpores.*** The air-chambers are separated from each other by means of ***partitions*** which connect the upper epidermis with the inner cells. The ***partitions*** are 3 or 4 cells in height. The cells of the ***upper epidermis*** and partitions contain numerous ovoid ***chloroplasts.*** From the floor of each air chamber arise ***assimilatory filaments*** or ***photosynthetic filaments.*** The filaments are ***branched,*** dwarf, ***cactus-like*** and ***chlorenchymatous*** which fill up the air-chambers. All the cells of the floor, partition wall and photosynthetic filaments contain ovoid chloroplasts. This ventilated ***photosynthetic tissue*** is the principal centre of ***photosynthesis*** in the thallus.

The upper epidermis checks rapid evaporation of water and the ***airpores*** regulate the *moisture status* in the thallus. So, the ***upper epidermis*** is ***protective*** in function. Assimilatory filaments are ***photosynthetic*** in function.

ii. Storage Region: Just below the photosynthetic region lies the ventral storage region of the thallus. It is composed of compactly arranged, thin walled parenchymatous cells. The cells are ***polygonal*** in shape and devoid of chloroplasts. The storage region is thick near the midrib region and thin towards margins. Some cells of the storage region contain oils. These cells are called ***oil cells.*** Some other cells are filled with mucilaginous substances and hence they are known as ***mucilage cells.*** The main function of the storage region is the storage of food materials such as starch, proteins and oils and of mucilage.

The lower most layer of the storage region is the ***lower epidermis.*** It is composed of a single layer of compactly arranged cells. ***Rhizoids*** and ***scales*** arise from the lower epidermis. The rhizoids are of two types, namely ***smooth-walled rhizoids*** and ***tuberculated rhizoids.*** The scales preserve moisture below the thallus. The rhizoids absorb water from the soil.

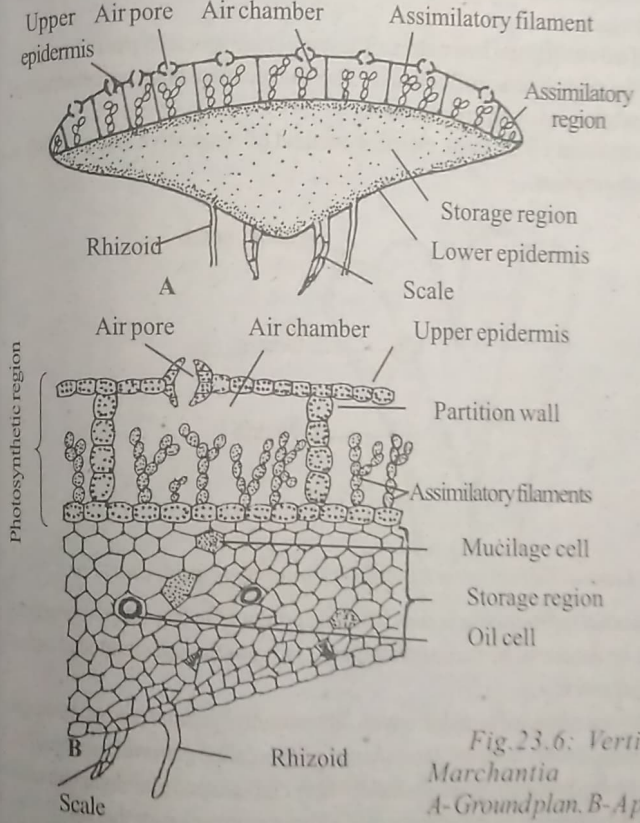

Fig.23.6: Vertical section of Marchantia thallus. A-Groundplan. B-A portion enlarged.

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Growth

The growing point lies at the bottom of a notch at the apex of each lobe. It consists of a horizontal row of meristematic cells. By the activity of these the thallus grows in length.

Reproduction

In *Marchantia*, reproduction takes place by two methods:

1. Vegetative reproduction

2. Sexual reproduction

1. Vegetative Reproduction

It takes place by the following methods:-

i. Fragmentation

ii. Formation of adventitious branches

iii. Gemmae formation.

i. Fragmentation : Owing to the ***progressive death*** and ***decay*** of old parts of the thallus, small young branches get separated off from the parent thallus. These young branches grow into independent ***gametophytes***.

ii. Formation of adventitious branches : These are small special types of branches, arising from any part of the ventral surface of the thallus. These adventitious branches get separated from the parent thallus and grow into independent plants.

iii. Gemmae formation : The most efficient method of vegetative reproduction in *Marchantia* is ***gemmae formation.***

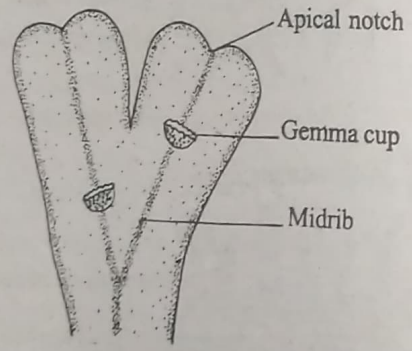

Fig.23.7: Marchantia-Dorsal view of thallus showing gemma cups.

Gemmae are ***asexual reproductive*** bodies. They are produced in cup-shaped structures known as ***gemma cups*** on the dorsal surface of the thallus. Gemma cups are situated at a short distance behind the ***apical notch.***

These cups are always restricted to midrib region. The margin of gemma cup is toothed and membranous. Many minute, doubly notched, lens-shaped bodies called ***gemmae*** are found attached to the bottom of the cup by means of small ***stalks.*** Many club-shaped glandular hairs also arise from the bottom of the cup and are found intermingled with the gemmae inside the cup.

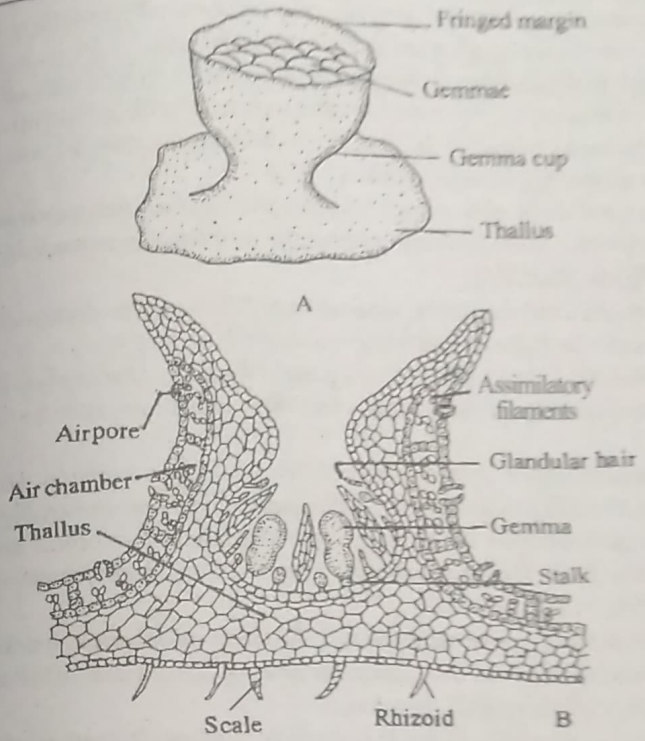

Fig.23.8: Gemma cup of Marchantia: A-Entire view; B-Longitudinal sectional view.

The mature gemma is a green, multicellular, lens-shaped structure. It has two deep lateral notches. There is a single ***growing point*** in each notch. The cells of the gemma are polygonal and

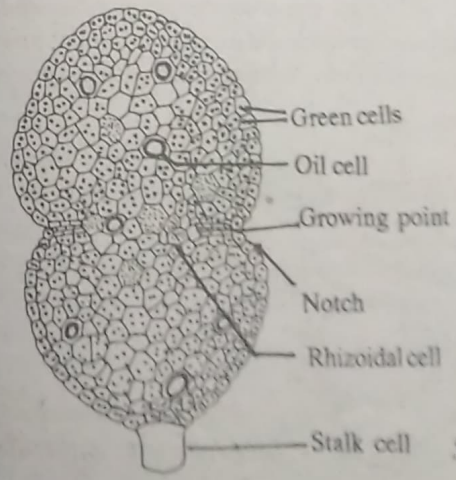

Fig.23.9: Marchantia sp. Structure of a gemma.

chlorenchymatous and hence it appears green. A few cells contain oil bodies so that they are called ***oil cells.*** Some of the cells are colourless and are called ***rhizoidal cells***.

On reaching suitable substratum, the rhizoidal cells of gemmae develop rhizoids. The meristems present in the two lateral notches grow in two opposite directions. After the development of dichotomous lobes on each side, the main body of the gemma becomes disorganised. As a result, two ***daughter plants*** are formed from a single gemma.

The gemmae produced from the male gametophyte give rise to new ***male gametophytes.*** The gemmae produced by the female gametophyte develop into new ***female gametophytes***.

2. Sexual Reproduction

In *Marchantia*, sexual reproduction is ***oogamous*** type. The sexual reproduction takes place in high humidity when the day light is long and nitrogen content in the soil is low.

In *Marchantia*, the independent plant is a ***gametophyte.*** The ***gametophyte*** is ***haploid.*** *Marchantia* is ***dioecious*** or ***heterothallic.*** That is, the male and female sex organs are produced in separate plants.

The sex organs are borne in clusters on erect branches called ***gametophores.*** The ***gametophore*** that bears male sex organs, ***antheridia***, is called ***antheridiophore. Antheridiophores*** are produced on ***male gametophytes.*** The gametophore that bears female sex organs, ***archegonia*** is called ***archegoniophore. Archegoniophores*** are produced on ***female gametophytes***.

Antheridiophore

The erect gametophore that bears antheridia is called ***antheridiophore.*** It is produced at the apical region of ***male gametophyte.*** Each antheridiophore consists of a ***stalk*** and a disc-shaped ***receptacle.*** The stalk is cylindrical and 2-3 cms long.

The receptacle is a flat and it has ***8 lobes.*** In *Marchantia germinata*, there are only ***four lobes.*** Each lobe has a single row of ***antheridia.***

The vertical section of ***antheridiophore*** shows much resemblance to the internal structure of the gametophyte. The outermost layer of ***male receptacle*** is the ***epidermis.*** It is interrupted by many barrel-shaped ***airpores.*** Below the epidermis ***assimilatory chambers*** are present. The assimilatory chambers alternate with the flask-shaped cavities called ***antheridial chambers.*** Each ***antheridial chamber*** has a ***single antheridium*** and it opens out through a ***pore*** called ***ostiole.*** The antheridial chambers are deeply sunken below the upper epidermis of male receptacle. The lower

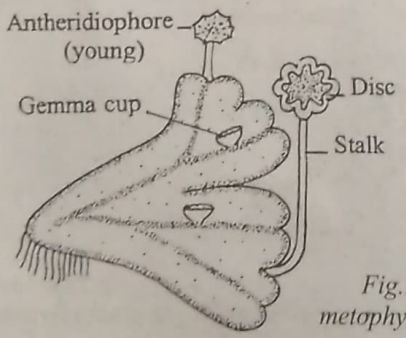

Fig.23.10: Marchantia male gametophyte with antheridiophore.

portion of the receptacle is composed of colourless thin-walled parenchymatous cells. At the ventral surface, a ***longitudinal groove*** is present. It has ***rhizoids*** and ***scales.***

Antheridium is produced singly in ***antheridial chambers*** of male ***receptacle.*** The mature antheridium is an ***ovoid*** structure

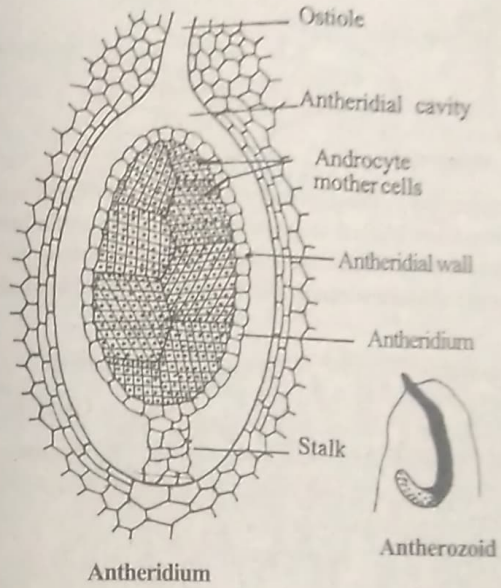

Fig.23.11: Antheridium and antherozoid of Marchantia.

which is raised by a short ***stalk.*** The antheridium is surrounded by a single-layered ***jacket*** or ***antheridial wall.*** The sterile jacket layer encloses ***androcyte mother cells.*** Each androcyte mother cell divides to produce 2 ***androcytes.*** Each androcyte develops into a biflagellate ***antherozoid.***

Each antherozoid is elongated, rod-like, uninucleate and biflagellate. The antherozoids come out of the antheridial chamber through the ostiole. The antherozoids move in the water with the help of their flagella.

Archegoniophore

The erect gametophore that bears archegonia is called ***archegoniophore.*** It is produced in the ***female gametophyte.***

It consists of a ***stalk*** and disc or star-shaped female ***receptacle.*** At the margin of the receptacle, there are ***cylindrical*** processes of sterile tissues called ***rays.*** The internal structure of archegoniophore is similar to that of the antheridiophore.

The mature female receptacle bears 8 lobes. Each lobe bears a single row of 12-14 ***archegonia*** on the upper surface.

The archegonia are produced in ***acropetal*** order. i.e. the oldest archegonium is found at the basal region and the youngest archegonium is found at the apex.

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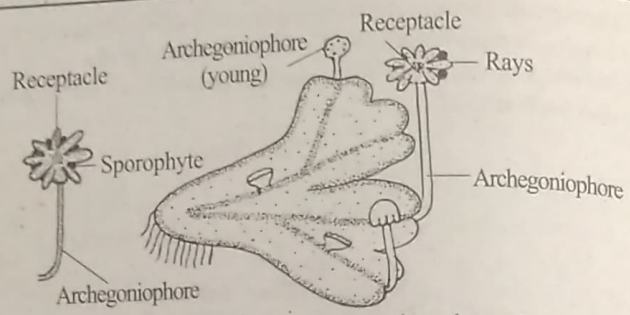

Fig.24.12: Marchantia-Female gametophyte with archegoniophore.

The mature archegonium is a flask shaped structure. It consists of a basal ***stalk***, a swollen ***venter*** and a long narrow ***neck.*** The archegonium is attached to the receptacle by the stalk. The venter consists of an ***egg*** and a ***ventral canal cell.*** The neck has 4-8 ***neck canal cells.*** The tip of the

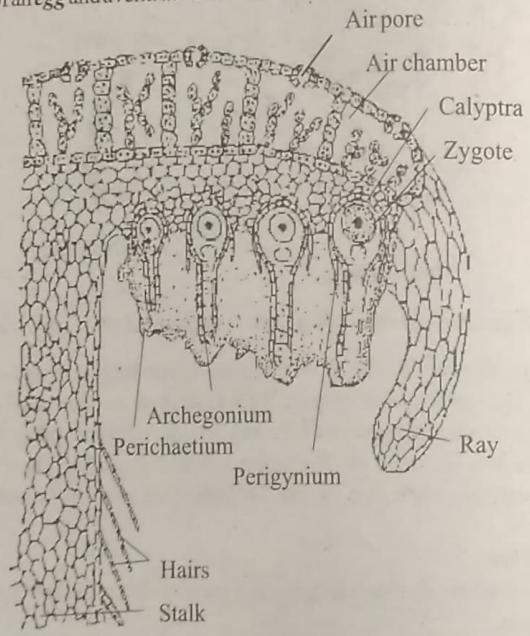

Fig.23.13: Marchantia sp. L.S.of archegoniophore.

neck has ***4 cover cells*** or ***lid cells.***

In a fully mature archegonium, the neck canal cells, and ventral canal cell disorganise forming a mucilagenous fluid. This mucilage on absorbing water oozes out of the neck forcing apart the cover cells.

Fertilization takes place when the archegonium is in the up-right position.

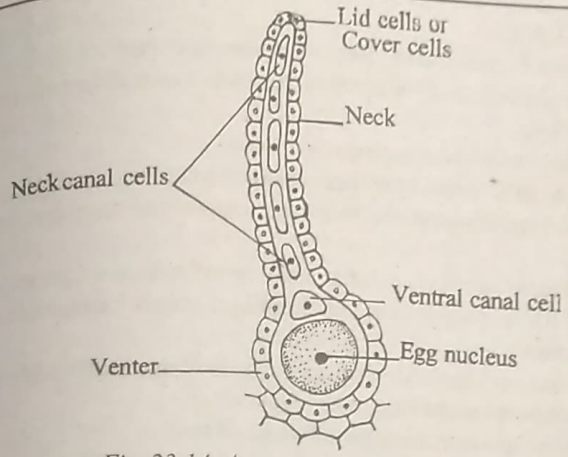

Fig. 23.14:-A mature archegonium of Marchantia.

Fertilization takes place in the presence of water. At maturity, the cover cells rupture and the neck canal cells disorganise to form a narrow passage for the entry of antherozoids to reach the egg. The wall of the antheridium ruptures and the antherozoids are set free. The antherozoids swim towards the archegonium and pass down through the neck canal to reach the egg. One of the sperms or antherozoids fuses with the egg to produce the ***zygote.*** The zygote is ***diploid.***

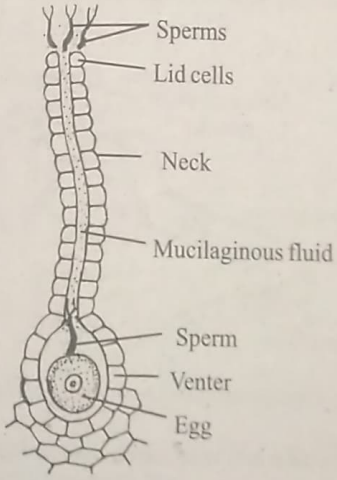

Fig.23.15: Fertilization.

After fertilization, the marginal portion of the disc becomes inverted and the archegonia become upside down. ie. their necks become downward. Now the oldest archegonia are situated towards the periphery of the disc and youngest towards the centre.

Post-fertilization Changes

After fertilization the archegoniophore undergoes the following changes:

i. The zygote enlarges in size and completely occupies the venter of the archegonium. It develops into the sporophyte.

ii. The ***stalk*** of the ***archegoniophore*** enlarges upto 4 cms.

iii. Rapid growth takes place in the centre of the dorsal part of the disc.

iv. This pushes the archegonia into the inverted or reversed position and the archegonia now hang down wards.

v. On either side of each row of archegonia, a membranous flap known as ***perichaetium*** or ***involucre*** is developed. It is one cell in thickness and has fringed margin. It separates the one row of archegonia from the other.

vi. From the upper surface of the disc develop green cylindrical processes called the ***rays.*** The rays develop from the notch between the lobes of the receptacle.

vii. The venter divides to produce a two or three-layered ***calyptra.***

viii. A ring of cells at the base of the ***venter*** becomes active, which after many divisions give rise to a collar-like cylindrical outgrowth called ***perigynium*** or ***pseudoperianth.*** Perigynium is of one cell thickness and a few cells in height. It protects the sporophyte or sporogonium against drought.

Sporophyte

The ***diploid zygote*** is the first cell of the ***sporophytic generation.*** The zygote further divides to form a globular ***embryo.*** This embryo is then differentiated into a mature ***sporophyte*** called ***sporogonium.*** The sporophyte is hanging down from the under surface of receptacle of the archegoniophore found in female thallus.

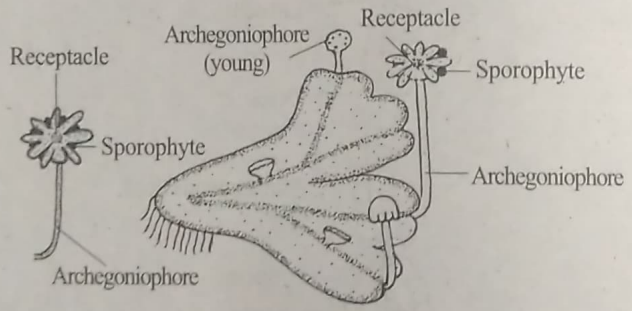

Fig. 23.16: Marchantia-female gametophyte showing archegoniophore with sporophytes.

The young ***sporogonium*** becomes surrounded by ***three protective*** sheaths.

1. Calyptra
2. Pseudo-perianth or Perigynium
3. Perichaetium or Involucre

The sporogonium is green, when young and towards maturity it becomes colourless or yellow. A mature ***sporogonium*** has three distinct parts, namely a basal ***foot,*** an intermediate ***seta*** and a terminal ***capsule.***

Foot : Foot is the basal expanded portion of the sporogonium. It is attached to the storage region of the ***female gametophyte.*** It serves as the ***anchoring*** and ***absorptive organ*** for the sporophyte. It absorbs nourishment from the female gametophyte. It is made up of parenchymatous cells.

Seta : Seta is the ***middle portion*** of the sporogonium. It connects the ***capsule*** with the ***foot.*** It is a cylindrical, stalk-like structure. It is composed of parenchymatous cells. Towards maturity seta grows rapidly and pushes the capsule downwards. When the ***calyptra*** ruptures, the ***sporogonium*** hangs freely at the ventral surface of the receptacle.

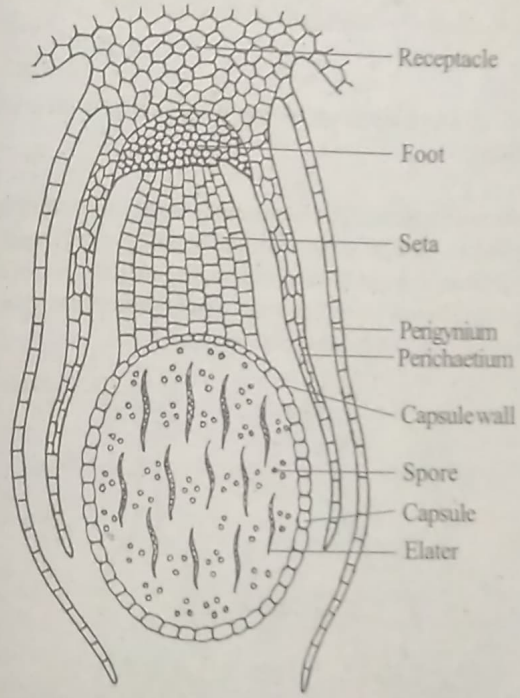

Fig. 23.17: Marchantia L.S. of mature sporogonium.

Capsule : The ***fertile region*** of the sporogonium is the ***capsule.*** It is yellow in colour and spherical in shape. The outer wall of the capsule is called ***capsule wall.*** Inner to the capsule, there present ***sporogenous tissue.*** Some cells of the sporogenous tissue develop into ***spore mother cells*** and some others develop into ***elater mother cells.***

The elater mother cells develop into ***elaters.*** The elaters are diploid and sterile. Elaters are ***elongated cells*** with ***pointed ends.*** These elaters have spiral thickenings or bands on the inner surface of their cell wall. The mature elaters lack protoplasm. They are considered as ***'dead cells'.*** Elaters readily absorb moisture from the atmosphere and are said to be ***hygroscopic.*** The elaters

help in the ***dehiscence*** of mature capsule and in the gradual ***dispersal*** of spores from the capsule.

Each ***spore mother cell*** undergoes ***meiosis*** to form four ***meiospores.*** The meiospores are ***haploid.*** The ***meiospore*** is a ***round, thick-walled cell.*** The spore wall is differentiated into an outer thick layer called ***exine*** and an inner thin layer called ***intine.*** Inner to the cell wall, there is a tiny mass of ***protoplasm*** delimited by a ***plasma membrane.*** The meiospore contains a single ***nucleus*** and ***reserve foods.*** These meiospores germinate into gametophytes.

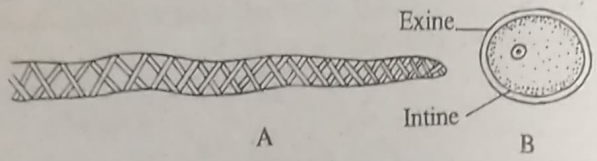

Fig.11.18: A-Marchantia sp. A part of the elater with a double spiral band of thickening. B-Spore.

Dehiscence of capsule : With the ripening of spores, the ***seta*** elongates rapidly so that the ***calyptra*** enclosing the capsule is ruptured. The capsule projects beyond the ***perigynium*** and ***perichaetium.*** The humidity change causes the bending and relaxation of ***elaters*** present inside the capsule. Owing to this movement of elaters, the ***capsule wall*** ruptures at the apex and splits along ***4-6 lines.*** As a result, the ***spores*** and ***elaters*** are exposed.

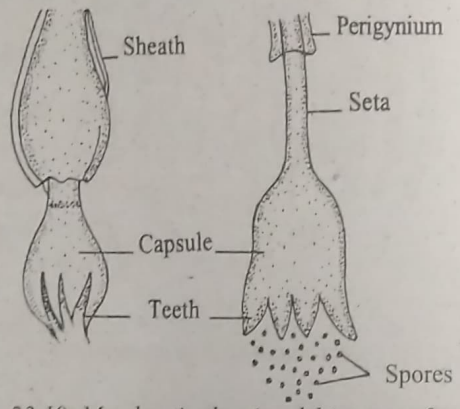

Fig.23.19: Marchantia showing dehiscence of capsule.

The spores are dispersed by wind. The hygroscopic elaters facilitate dispersal of spores from the exposed spore mass. The elaters coil and uncoil depending upon the moisture conditions in the atmosphere. This causes jerky movements of the elaters to throw the spores gradually in the atmosphere. The spores are carried by wind.

Germination of spores : The spore enlarges in size and divides into a large cell and a small cell called ***germ rhizoid cell.*** The germ rhizoid cell grows into a ***rhizoid.*** The large cell is green and it divides repeatedly to form the young thallus of the gametophyte.

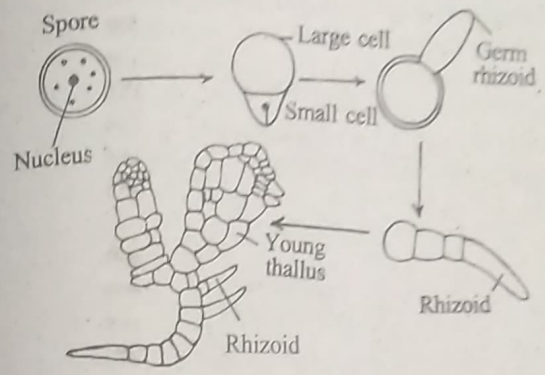

Fig.23.20: Marchantia-Germination of spore.

Conclusion

Marchantia shows distinct ***alternation*** of ***generation*** in its life cycle. The ***haploid gametophytic*** generation alternates with a ***diploid sporophytic*** generation. The plant is a ***haploid gametophyte.*** It is an independent plant. Vegetatively, it reproduces by ***fragmentation, adventitious*** branches and ***gemmae.***

Sexually it reproduces by ***gametes.*** The ***male gamete, antherozoid*** fuses with the ***female gamete, egg*** to form a ***diploid zygote*** (2N). The zygote divides and gives rise to the ***sporophyte*** or ***sporogonium.*** It is ***parasitic*** on the ***female gametophyte.*** The sporophyte produces spores by ***meiosis.*** The spores are haploid and they develop into haploid ***gametophytes.***

The ***gametophyte*** and ***sporophyte*** are morphologically ***dissimilar.*** Hence the life cycle of *Marchantia* is known as ***heteromorphic*** type.

Life Cycle of Marchantia

Marchantia is a ***Bryophyte.*** It is an ***advanced liverwort.*** It is included in the class ***Hepaticopsida.***

Marchantia is ***cosmopolitan*** in distribution. It grows best in the moist shady places, near the water banks, in open wood lands and in the burnt soil.

The plant body is a ***thallus.*** It is a ***haploid gametophyte.*** The thallus is prostrate, dichotomously branched and dorsiventral. It is dark green in colour. The dorsal surface of the thallus is divided into fine ***rhomboidal markings*** called ***areolae.*** Each areola has a ***central pore.*** A single air chamber lies below the areola. The thallus has a ***midrib,*** on the dorsal surface. The midrib ends in a ***notch,*** in which ***growing*** point is situated. Small cup-like structures called ***gemma cups*** arise from the midrib region. The gemma cups bear ***gemmae.*** The gemmae on germination give rise to new ***gametophytes.***

Numerous ***scales*** and ***rhizoids*** arise from the ventral surface of the thallus. The scales are of two types, ***simple scales*** and ***appendiculate*** scales. The scales protect the growing point and serve to retain moisture below the thallus.

The rhizoids are unicellular and are of two types, namely ***simple*** or ***smooth-walled rhizoids***

and ***tuberculated*** or ***pegged rhizoids.*** They are produced in the mid-rib region. The rhizoids serve as organs for attachment and absorption of minerals and water from the soil. *(Fig.23.1 and 4,3).*

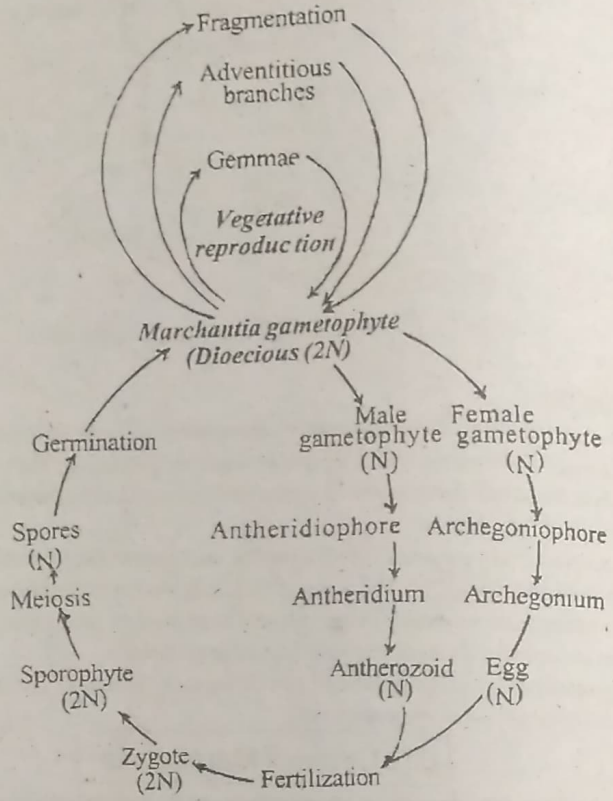

Fig.23.21: Graphic life cycle of Marchantia.

In *Marchantia*, the gametophytes are ***heterothallic.*** There are separate ***male*** and ***female*** gametophytes. The thalli produce erect, stalked upright branches. The erect branches that bear the sex organs are called ***gametophores***. The gametophore that bears the male sex organs, ***antheridia*** is called ***antheridiophore.*** The gametophore that bears the female sex organs, ***archegonia*** is called ***archegoniophore. Antheridiophores*** are produced on ***male gametophyte*** while ***archegoniophores*** are produced on ***female gametophyte*** *(Fig.11.5).*

In *Marchantia,* reproduction takes place by two methods:

1. Vegetative reproduction

2. Sexual reproduction

Vegetative reproduction takes place by ***fragmentation, adventitious branches*** and ***gemmae.***

Due to the death and decay of old parts of the thallus, small young branches get separated and they grow into new gametophyte. This method is called ***fragmentation.***

Small special branches arise from the ventral surface of the thallus. These adventitious branches get separated and grow into new gametophytes.

The most efficient method of vegetative reproduction in *Marchantia* is ***gemmae formation.*** The gemmae are produced in cup-shaped structures called ***gemma cups.*** Many minute, doubly notched, lens-shaped bodies called ***gemmae*** are attached to the bottom of the cup by means of small stalks. Many glandular hairs also arise from the bottom of the cup and are interningled with the gemmae. The gemmae on reaching suitable substratum, develop into new gametophytes. *(Fig. 11.7 and 8).*

In *Marchantia,* sexual reproduction is of ***oogamous type.*** *Marchantia* is ***dioecious*** or ***heterothallic*** and ***haploid.*** The male and female sex organs are produced in separate plants. The sex organs are borne in clusters on special, erect, upright branches called ***gametophores.*** The gametophore that bears the ***male sex*** organs, ***antheridia*** are called ***antheridiophores.*** They are produced on ***male gametophytes.*** The gametophore that bears female sex organs, ***archegonia*** are called ***archegoniophore*** and these are produced on ***female gametophytes.***

The ***antheridiophore*** consists of a ***stalk*** and a ***receptacle.*** The receptacle is disc-shaped. The male receptacle has 8-radiating lobes. Each lobe has a single row of antheridia.

The mature ***antheridium*** consists of a short ***stalk*** and a rounded ***body***. It is produced singly in antheridial chambers of male receptacle. The antheridium is surrounded by a single layered ***sterile jacket.*** The wall encloses ***androcyte mother cells.*** Each androcyte mother cell divides to produce two ***androcytes.*** Each androcyte develops into a biflagellate ***antherozoid.***

The antherozoids come out of the antheridial chamber through the ostiole.

Each ***antherozoid*** or ***sperm*** is elongated, rod-like, uninucleate and biflagellate. *(Fig.11.11)*

The archegoniophore is produced in the ***female gametophyte.*** It consists of a stalk and a disc or star-shaped female receptacle. The mature receptacle bears 8 lobes. Each lobe bears a single row of 12-14 archegonia on the upper surface.

The ***mature archegonium*** is a flask-shaped structure. It is attached to the receptacle by a short stalk. It consists of a basal swollen ***venter*** and a long narrow ***neck.*** The venter consists of an ***egg*** and a ***ventral canal cell.*** The neck has 4-8 ***neck canal cells.*** The tip of the neck has ***4 cover cells*** or ***lid cells.***

In a fully mature archegonium, the neck canal cells and ventral canal cell disorganise forming a mucilagenous fluid. This mucilage on absorbing water oozes out of the neck forcing apart the cover cells.

Fertilization takes place in the presence of water. The wall of the antheridium ruptures and the ***antherozoids*** are set free. The antherozoids swim towards the archegonium. One of the antherozoids fuses with the egg to produce a ***zygote.***

The diploid zygote develops into a ***sporophyte*** or ***sporogonium.*** The young sporogonium is covered by ***three protective*** sheaths, namely ***calyptra***, ***perigynium*** and ***perichaetium.*** The venter divides to produce the calyptra. Perigynium is a collar-like outgrowth produced from the basal cells of venter. Perichaetium is a flap like structure. It protects the rows of archegonia.

The mature sporophyte has three distinct parts, namely a basal ***foot***, an intermediate ***seta*** and a terminal ***capsule***.

Foot is the basal expanded portion. It is attached to the basal storage region of the female gametophyte. It serves as the anchoring and absorptive organ.

Seta is the middle portion of the ***sporogonium***. It connects the capsule with the foot.

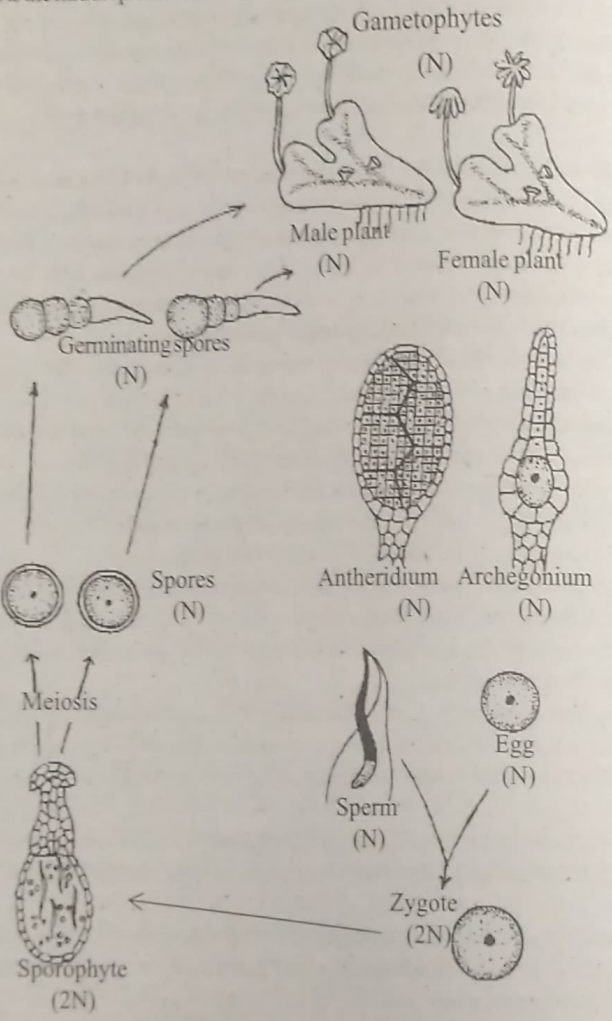

Fig.23.22: Marchantia diagrammatic life cycle.

The fertile region of the sporogonium is the ***capsule***. It is yellow in colour and spherical in shape.

It has a ***single-layered jacket*** or ***capsule wall***. Inner to the capsule wall, there present ***spore mother cells*** and ***elater mother cells***. Each spore mother cell undergoes ***meiosis*** to produce *4* ***haploid spores***. The spores are known as ***meiospores***. The elater mother cells develop into elaters. The elaters are diploid and sterile. They are hygroscopic and help in the dehiscence of the capsule and in the spore dispersal.

With the ripening of spores, the ***seta*** elongates rapidly and the ***calyptra*** is ruptured. The capsule is projected out beyond the perigynium and perichaetium.

Owing to the movement of elaters, the capsule wall ruptures at the apex and splits along 4-6 lines. As a result, the spores and elaters are exposed. The spores are dispersed by wind. The spores grow into new ***gametophytes***.

Conclusion

Marchantia shows distinct ***alternation of generation*** in its life cycle. The ***haploid gametophytic*** generation alternates with a ***diploid sporophytic*** generation. The plant is a ***haploid gametophyte***. It is an independent plant. *Vegetatively* it reproduces by ***fragmentation, adventitious branches*** and ***gemmae***. Sexually it reproduces by ***gametes***. The male gamete ***antherozoid*** fuses with the female gamete ***egg*** to form a ***diploid zygote***. The zygote divides and gives rise to the

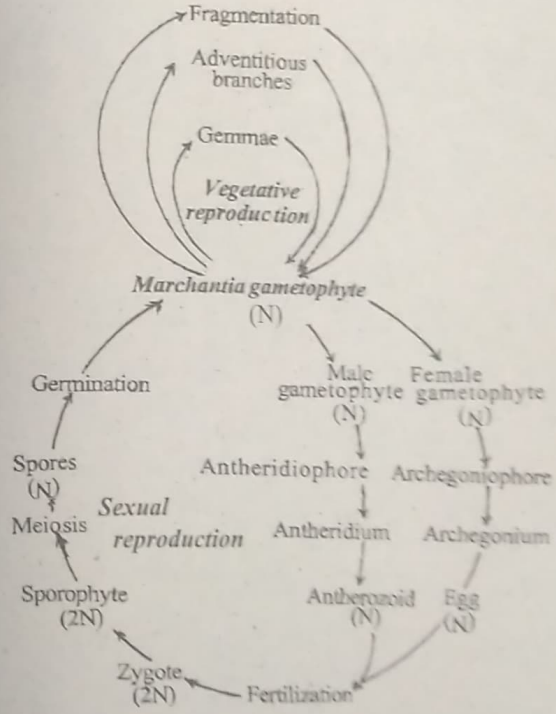

Fig.23.23: Graphic life cycle of Marchantia.

sporophyte or ***sporogonium.*** It is ***parasitic*** on the ***female gametophyte.*** The sporophyte produces spores by ***meiosis.*** The spores are ***haploid*** and they develop into haploid ***gametophytes.***

The ***gametophytes*** and ***sporophytes*** are ***morphologically dissimilar.*** Hence the life cycle of *Marchantia* is known as ***heteromorphic*** type.