Fossil Bryophytes

(Lesson Structure)

3.0 Objective :

Study of fossils provides geographic history of the earth. It indicates definite lines of ancestry for living plants and animals. This lesson provides the knowledge of fossil history of Bryophytes.

3.1 Introduction :

"Fossils are remains of organisms (both plants and animals) which has been preserved within the sedimentary rock beds, under favourable geologic conditions".

Due to absence of lignified vascular tissues and non-cutinised epidermis in the stems and thalli, the bryophytes are not well-suited to fossilization. So only a few incomplete fossil Bryophytes have been discovered.

These are mentioned in Table-1

TABLE - 1

Era	Period of Epoch; and approximate number of years ago to commencement of period.	Bryophyte types
Quaternary	Pleistocene (1,000,000)	Hypaticopsida and Bryopsida referable to existing genera (sub-fossils).
	Pliocene (8,000,000)	Hepaticopsida and Bryopsida identical with the living ones (sub-fossils).
	Miocene (20,000,000)	Marchantites; Jungermannites; Muscites; Polytrichites; Plagiopodopsis; Palaeohypnum.
Cainozoic (Cenozoic)	Oligocene (35,000,000)	Muscites yallournensis (Moss capsule)
Mesozoic	Eocene (60,000,000)	Marchantites; Jungermannites; Muscites; Palaeohypnum
	Cretaceous Upper (110,000,000)	Marchantites yukonensis; Jungermannites cretaceus; Muscites lesquereuxi; Sphagnum sp.
	Lower	Marchantites (M. blairmorensis; M. sewardi).
	Jurassic (140,000,000)	Hepaticites (H leavis, H.rosenkrantzi, H. glebosus, H. wonnacotti, H. arcuatus, H. halburnensis and H.hymenoptera)
	Trassic (180,000,000)	Ricciopsis (R. florinii, R. scanica); Marchantiolites porosus; Hepaticites (H. amauros; H. solenotus); Naladita lanceolata, Muscites guecselini.
	Permaian (205,000,000)	Marchantites sp.; India (I. vermicularis, I. Variablis. I. falciformis and I. angustifolia); Saluria longifolia; Uskatia conferta; Polyssnievia; Bajdaievia linearis; Buchtia ovata; Jungagia glottophylla; Vorcutannularia plicata and Protosphylla; Vorcutannularia plicata and Protosphagnum nervatum.
	Carboniferous Upper (285,000,000)	Hepaticites (H.willsi, H. Langi H. lobatus, H. kidstoni, H. metzgerioides); Muscites (M bertrandi, M. polytrichaceus).
	Lower	
Palaeozoic	Devonian (330,000,000)	Hepaticites devonicus
	Silurian (370,000,000)	
	Ordovician (448,000,000)	
	Cambrian (525,000,000)	
Proterozoic	Pre cambrian (1,250,000,000)	

3.2 Fossil history of different groups:

Fossil Hepaticopsida - In 1925, Walton published the first account of upper carboniferous liverworts which bore evidence of relationship to the living Hepaticopsida. In 1928, Walton described five species of *Hepaticites* which are - *H willsi, H langi, H lobatus, H kidstoni and H. metzgerioides.* These are known only in the vegetative state and bear a close resemblance to some modern Metzgeriales. *H. kidstoni* is differentiated into a broad axial region and two definitely arranged series of lobes or leaves with two accompanying series of smaller scale-like appendages thus resembling the living genus *Treubia. H. lobatus* is differentiated into an axial region and lobed wing.

Fossil Hepaticopsida from the Devonian are rare except for the reported occurrence of *H. devonicus* from the upper Devonian by Hueber (1961). This is a thallose Jungermanniales and consists of a rhizome-like portion with non-septate rhizoids and a dichotomously branched tholloid portion with non-septate rhizoids and a dichotomously branched thalloid portion with a thick midrib and unistratose wings. The plant bears resemblance to *Pallavicinia (Makodnothallus) zollingeri* and can be attributed to Metzgerineae (anacrogynous Jungermanniales).

During Mesozoic, more fossil hepatics have been reported. Three species of Hepaticites (*H laevic, H rosenkrantzi and H. glebous)* from the Jurassic of Greenland (Harris, 1931, 1937) and four species (*H. wonnacoti, H. arcuatus, H. haiburensis and H. hymenoptera)* from the Jurassic of Yorkshire fossil Hepaticopsida *(H. amauros)* from the Triassic of Greenland (Harris, 1939) and another *(H. solenotus)* from the upper Rhaetic (Triassic) of England (Harris, 1938) have also been reported. All these fossils described by Harrris also seem allied to the anacrogynous jungerm anniales. The most completely known and also leafy is the remarkable Mesozoic plant *Naiadita* discovered by Harris (1931) from the Rhaetic (upper Triassic) of England.

Naiadita lanceolata consists of sparsely branched upright axis 1-3 centimetres high. Numerous unicellular rhizoids with evenly thickened walls arise usually from the slender base of the stem. The stem lacks differentiation and is made up mainly of parenchymatous cells. Leaves are inserted transversly by a broad base. The leaves are formed of a single layer of cells, there being no midrib. The gemma are multicelluar oval bodies contained in gemma cups which accupy. a terminal position on the shoots. The archegonia are lateral, sessile or

have short stalks. The sporophyte shows a spherical capsule and probably a minute hemispherical foot, seta absent. The jacket of the capsule is formed of one layer of evenly thickened cells inside which there are lenticular spores. There are no elaters or a columella. The capsule open irregularly.

Lundbland (1954) described *Ricciopsis Florinii* and *R. scanica* (forms like *Riccia)* and *Marchatiolites porosus* from Triassic Jurassic of Scanio, Sweden. There are few mesozoic fossils which can be brought fairly closely into line with modern genera of the Marchantiales.

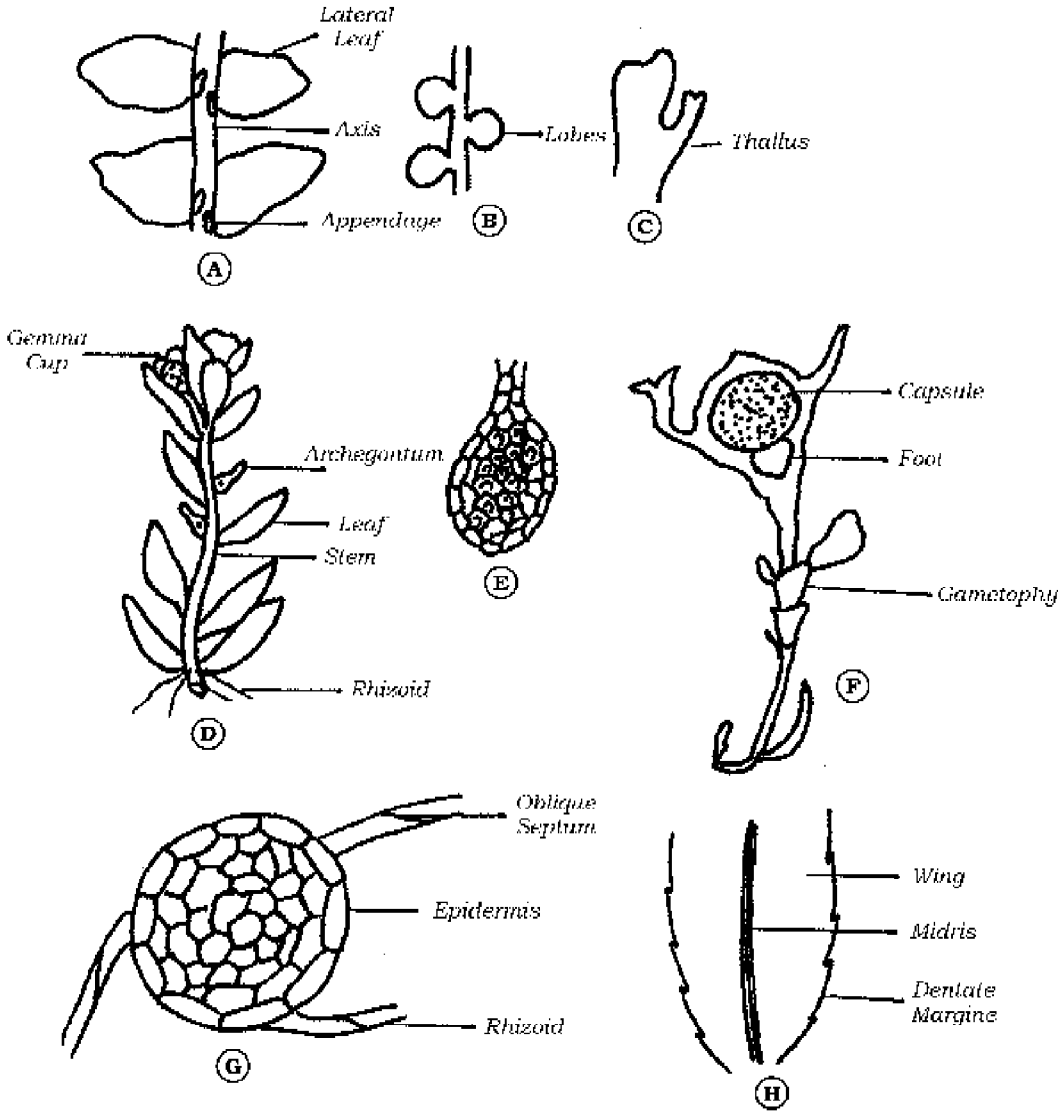

Fig- 4.1 : Fossil Bryophytes
A. Hepaticites Kidstonii; B. Hepaticites Lobatus;
C. H. Metzgeroides; D-F Naiadita Lanceolata
D. Thallus; E. Gemma; F. Plant with mature sporophyte
G. Muscites bertrandi-T.S. of stem; H. Intia vernicularis
A part of leaf impression.

In the still younger Mesozoic rocks the earliest record of fossils having the characteristics of the Marchantiales and assigned to the form genus *Marchantites* is from the lower Cretaceous. Other species of Marchantites are M. blairmorensis and M. sewardi described by Berry (1920,1929) from North America and M. hallei described by Lundbland (1954) from south America.

Fossil Bryopsida -

The earliest record of Bryopsida fossils are two species of Mosses, *Muscites bertrandi* and *Muscites polytrichaceus* from the upper Carboniferous. However, the specimens are fragmentary and incomplete and show stem with anatomy definitely like that of a moss, simple leaves with single veins and rhizoids with oblique cross walls. But their affinity is uncertain and although *M. polytrichaceus* is compared with *Polytrichum,* according to Dixon (1927), it is not at all related to the latter.

In recent years, the researches of Neuberg (1951, 1960) have shed light on the past history of two groups of Mosses Sphagnidae and Bryidae. She has given the first real informative account of fossil Mosses from the lower and Upper Permian rocks of U.S.S.R. She assigns six of such genera to Subclass Bryidae and three to subclass Sphagnidae. The genera. belonging to Bryidae are *Initia* with four species (1. *vermicularis* ,1. *variabilis,* 1. *falciformis,* 1. *angustifolia*). The specemens of *Initia* bear some remarkable resemblances to the modern genera *Mnium* and *Bryum.*

Neuberg has erected a new order *Protosphagnales* to contain the three fossil genera each with a single species *Jungagia glottophylla, Vorcut annularia, Plicato* and *Protosphagnum nervatum.* The leaves of these fossil genera, in varying degrees, resemble those of modem *Sphagnum.*

Gam (l962) regards the erection of the new order Protosphagnales for these three genera as premature as it is based on vegetative characters alone (the reproductive structure have not yet been traced in these fossils).

Mesozoic Moss fossils are remarkably rare, there being only one species of *Muscites (M lesquereuxi* - possibly a moss) from the late Cretaceous of North America (Berry, 1928) and leaf fragments of *Sphagnum* species from the Upper cretaceous of Greenland (Arnold, 1937).

A large number of Bryopsida fossils have been reported in the Cenozoic.

During Miocene there are fossils of Polytrichites (possibly belonging to Polytrichales), Plagiopodopsis (possibly referable to acrocarpous fossil mosses) and Palaeohypnum (possibly Pleurocarpous mosses).

The geological records of Bryophyta indicate that they are an ancient group. However, they do not throw any light on the origin and evolution of the group. It is evident that the principal groups of both hepatics and mosses must have been differentiated by the end of the Palaeozoic. There is evidence of the thallose Jungermanniales in the Devonian and of Hepaticopsida (possibly the anacrogynous Jungermanniales) and the Bryopsida (acrocarpous mosses) in the upper Carboniferous.

3.3 Questions for Exercise

1. *Give an account of Fossil Bryophytes.*
2. *Write notes on-*

   i.) Fossil Hepaticopsida

   ii.) Fossil Bryopsida

3.4 Suggested readings

1. *An Introduction to Embryophyta: Bryophyta by N.S. Parihar (Central Book Depot)*
2. *Bryophytes : Morphology, Growth and differentiation by Dr. (Mrs.) Prem Puri (Atma Ram & Sons)*
3. *Bryophyta by Dr. H.N. Srivastava (Pradeep Publication)*

■ ■ ■