STUDIES ON THE MEIOBIOTIC ASSOCIATION OF THE MOSS- *Hyophila involuta (*Hook.)A. Jaeger.

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CHAPTER-1

INTRODUCTION

Bryophytes (Greek—bryon—moss; phyton—plant) include liverworts, hornworts and mosses, and occupy a position in the plant kingdom in between thallophytes and pteridophytes. These are land-inhabiting plants, restricted mostly to moist, shady places, and totally dependent on external water for completing their life-cycle. Because of these characters, bryophytes are also called "amphibians of the plant kingdom". The name ' bryophyta' was first introduced by Braun(1864). Recently, Crum(2001) in his 'Structural Diversity of Bryophytes' stated that " in the 1600's, Jung considered mosses to be aborted plant foetuses! Today, they occupy a position within the plant kingdom and may even be considered to have their own subkingdom" (O. P. Sharma. 1993).

Bryophytes represent an important part of the plant community and are one of the initial colonisers of new areas in terrestrial systems. Following lichen communities, they stabilize the substrate, prevent erosion and promote formation of litter, thereby modifying the environment and hence actively take part in ecological succession. Among the plant kingdom, bryophytes are the second largest group, exceeded only by the Magnoliophyta - the flowering plants (3,50,000 species) comprised of 15,000- 25,000 species (Crum, 2001), they occur on every continent and every location habitable by photosynthetic plants (Glime, 2006).

Among Bryophytes; mosses are a highly evolved group with approximately 17000 species falling in 3subclass, 4 orders. They attaining unique place between lower cryptograms and vascular cryptogams. They are an exotic and captivating species with unique combination of distinguishing characters. The non vascular nature is due to poorly developed conducting tubes that lack xylem tissue. Consequently Bryophytes remain small and flourish in places where there is an abundant water supply. They are ecologically important by virtue of their role in ecological succession, soil conservation, indication of pollution and so on. They are economically important by virtue of their multiple uses in the daily life of mankind.

Bryophytes are one of the most ancient lineage of terrestrial plants; dating to the Ordovician period (488 - 444 mya). Any green, seedless embryophyte without true leaf, root or stem can be called as a bryophyte and any tiny, leafy-stemmed, flowerless plant of the class Musci, reproducing by spores and growing in tufts, sods or mats on moist ground, tree trunks or rocks can be called as a moss. The bryophytes are generally classified as liverworts, hornworts and mosses. Among the bryophytes, the mosses are considered to be the most evolved. They are also of special interests as they play irreplaceable roles in almost all imaginable habitats - forests, alpine regions, spring areas, lithophytic environments, peat bogs etc.

Mosses act much like a sponge, absorbing water that is available from the soil, rain and atmosphere and retaining it (Glime, 2006). They have the ability to absorb water quickly and to 6 release it gradually. In ecosystems, they represent the component part of biomass and participate in photosynthesis, hydrological, chemical, decomposing and many other processes. Now-a-days mosses are used as environmental indicators- they can indicate air and water pollution. They are also used in monitoring of heavy metals, because they are able to accumulate and retain heavy metals of up to 60 times higher concentrations (Božanić, 2008).

They also serve as food to many organisms particularly some invertebrates such as beetles, orthoptera, collembolans, caterpillars or aphids. Several detriophagous species such as millipedes, woodlice and earthworms find food resources in bryophyte growths too (Božanić, 2008). Some predators have the ability to hunt within-mosses, although mosses present great shelter to smaller individuals for hiding from predators. Mosses can be used as camouflage by the organisms which live in bryophytes. Most mosses also serves as hatcheries and nurseries for the young ones of many smaller animals (Glime, 2006)

According to R. N. Singh, algae are large simple plants displaying a wide range of photosynthetic pigments and evolve oxygen during photosynthesis. G. M. Smith defines algae as simple plants with autotrophic mode of nutrition. Sharma (1987) defines algae as an assemblage of chlorophyll bearing autotrophic thallophytes bounded by a cell wall made up of pure or mixed carbohydrates. According to Fritsch (1935) algae must include all halophytic organisms that fail to reach the higher level of differentiation characteristic of higher plants. The first most comprehensive and authentic classification of algae was proposed by renowned phycologist of the time F. E. Fritsch (1935). He did monumental work on Algae and published his voluminous work in the form of book entitled "Structure and Reproduction of the Algae" in two volumes. The criteria selected for the classification of algae by Fritsch were: pigments in the plastids, chemical nature of reserve food material, kind, number and point of insertion of flagella of motile cells and presence or absence of organized nucleus in the cell. He classified algae into 11 classes are 1**.Chlorophyceae (green algae) 2.Xanthophyceae (Yellow-green algae) 3.Chrysophyceae 4.Bacillariophyceae (Diatoms) 5.Cryptophyceae 6.Dinophyceae (Dinoflagellates) 7. Chloromonadineae 8. Euglenophyceae 9. Phaeophyceae (Brown algae) 10. Rhodophyceae (Red algae) 11. Myxophyceae (blue green algae)**

Algae are ubiquitous; a multitude of species ranging from microscopic unicells to gigantic kelps inhabit the world's oceans, freshwater bodies, soils, rocks, and trees, and are responsible for most of the global production of organic matter by photosynthesis. They occur as dark, gelatinous, red dark or brown patches, streaks or velvet masses. They are exposed to air; absorb water, minerals and other nutrients directly from the atmosphere. They thus play a fundamental role in the world's ecosystems and a reliable and modern introduction to their kaleidoscopic diversity, systematic, and phylogeny is indispensable. Ecologically, algae and mosses have significant ecological importance in arid areas, especially in those areas where environmental problems are becoming increasingly serious.

Systematic position of *Hyophila involuta*(Hook.) A. Jaeger.

Division : Bryophyta

Class : Bryopsida

Order : Pottiales

Family : Pottiaceae

Genus : Hyophila

Species : *Hyophila involuta* (Hook.) A. Jaeger.

Description: Dioecious, acrocarpus moss. Plants erect with green leafy gametophyte. Terminal leaflets rosette, giving a star like aerial appearance. Leaves involute when dry, oblong, spathulate, carinate with percurrent costa, prominent midvein and dentate margins. Leaf tip pointed with projections. Sporophyte, terminal with long seta and cylindrical, brown erect capsule. Peristome absent and spores small, brown colored, spherical, 8-12 µm in diameter. Hyophila Brid.: a moss belonging to subfamily Barbuloideae, family Pottiaceae is represented by 7 species in India; out of these, three species: *H. involuta* (Hook.) Jaeg., *H. rosea* Williams and *H. comosa* Dix.et P. Yard, occur in Central India. Earlier H. rosea alone was reported from Pachmarhi Biosphere Reserve (PBR) but during floristic studies of bryophytes of PBR, which is well known for its biodiversity and is rich in bryophytic vegetation, *H. involuta* has been encountered for the first time. This taxon has been earlier reported from several other localities and shows wide distribution in India in Bengal, Bihar, Orissa, Arunachal Pradesh, Upper Assam, South India and Western Himalayas etc. *H. involuta* is characterised by dioecious plants, erect dark green habit and radiculose stem (5-18 mm in size). Leaves are oblong, spathulate, carinate with percurrent costa. 1.8-2.8 mm × 0.56-0.86 mm, seta erect, capsule cylindrical with beaked operculum. Peristome is absent and spores are small, brown coloured, spherical, 8-12 µm in diameter. *H. involuta* closely resembles with *H. rosea* which occurs in the same vicinity, in leaf size and shape, leaf cells and shape of capsule; however it differs in its radiculose habit, uniform leaf arrangement, longer seta and smaller spores from the latter species (Nath & Gupta, 2009)

CHAPTER-2

AIM AND OBJECTIVES

AIM

The purpose of this study is to analyze the meiobiotic association with the moss - *Hyophila involuta* (Hook.) A. Jaeger.

OBJECTIVES

- Collection of bryophytes species *Hyophila involuta* (Hook.) A. Jaeger from Mavelikara Taluk.
- To study and enumerate the Meiobiota (micro and macro organisms) seen associated with the selected moss - *Hyophila involuta* (Hook.) A. Jaeger.

CHAPTER-3

REVIEW OF LITERATURE

Mosses could hold a successful biotic community whose components balance in itself like that of larger ecosystems with abiotic substances, and producer, consumer and decomposer organisms (Odum, 1959).

Bryophytes are the most simplest and primitive terrestrial plants formed on earth. These non - vascular plants are divided into liverworts, hornworts and mosses. They consists of nearly 25,000 species worldwide (Kenrick & Crane 1997).

Most of the bryophytes are ectohydric in nature, which means that the water is held and transported out through capillary action (Schofield, 2001). The spiral leaves and their bases, paraphyllia, papillae and rhizoids trap water (Schofield, 2001; Proctor, 1982) not only for their hydration, but also provide a microhabitat for other microorganisms to live.

In return, not only the inhabitants get protected from large predators due to the minute size of moss, mosses provide a better area for living. Cryptobiosis during unfavourable conditions can also be regarded as a reason for the success of invertebrates inhabiting the mosses (Glime, 2006). Meiofauna of bryophytes comprises of briobionts, bryophiles, bryoxenes and occationals (Glime, 2006).

Due to their global ubiquity, fast-growing nature, substrate specificity and dominant haploid gametophytes, bryophytes can regarded as excellent plant group for evaluating various ecological aspects including habitat fragmentation (Pharo & Zartman, 2007).

Genus *Hyophila* Brid: a moss belonging to subfamily Pottiaceae is represented by 7 species in india and out of three species occur in Central India. *H. involuta* is characterised by dioecious plants, erect dark green habit and radiculose stem (5-18 mm in size). Leaves are oblong, spathulate, carinate with percurrent costa. 1.8-2.8 mm × 0.56-0.86 mm, seta erect, capsule cylindrical with beaked operculum. Peristome is absent and spores are small, brown coloured, spherical, 8-12 µm in diameter. H. involuta closely resembles with H. rosea which occurs in the same vicinity, in leaf size and shape, leaf cells and shape of capsule; however it differs in its radiculose habit, uniform leaf arrangement, longer seta and smaller spores from the latter species (Nath& Gupta, 2009)

Bacteria inhabit terrestrial plants as both as endophytes as well as epiphytes and have a predominant role in the degradation of organic pollutants (Morgan *et al*., 2005; Mastretta *et al*., 2006; Afzal *et al*., 2014), N2 fixation, resistance to bacterial and fungal diseases (Strobel *et al*., 2004; Shcherbakov *et al*., 2013), better adaptability (Raymond, 2016).

Though the functional diversity of the microorganisms inhabiting on bryophytes are unknown (Koua *et al*., 2015), a few studies has entrenched the fact that plant microbial interactions do exist (Hornschuh *et al*., 2002; Opelt & Berg, 2004; Tian & Li, 2017).

Phyllosphere being an outstanding habitat for soil microorganisms to live, they serve various physiological and ecological roles like N2 fixation, soil-enrichment, promotion of protonemal growth and bud formation (Saumya *et al*., 2019).

On comparing the 16s rRNA analysis of bacterial communities inhabiting on some selected mosses including *H. involuta* with bacterial genome database, Pseudomonas fluorescens strain D19 found to be the predominant bacterial species inhabiting on *H. involuta* (Saumya *et al*., 2019).

The morphological variations of *H. involuta* grown on wet habitats were larger gametophytic characters than dry habitats such as stem height, leaf size, stem diameter, innermost perichaetia, and archegonia. Number of branching and length of branches in wet habitats were up to 6 branches and 15 mm long (vs unbranched in dry habitats). Innermost perichaetial leaves in wet habitats were ovate-lanceolate with abruptly narrow acuminate leaf apices and shortly excurrent costae (vs lingulate with obtuse-rounded leaf apices and the costae ending below leaf apex in several cells found in dry habitats). T-test of independent samples separated H. involuta populations into 2 groups according to wet and dry habitats and distinguished 2 distinct forms of ecotypes (Narin & Arunothai, 2020)

The first most comprehensive and authentic classification of algae was proposed by renowned phycologist of the time F. E. Fritsch (1935). He did monumental work on Algae and published his voluminous work in the form of book entitled" Structure and Reproduction of the Algae" in two volumes. The criteria selected for the classification of algae by Fritsch were: pigments in the plastids, chemical nature of reserve food material, kind, number and point of insertion of flagella of motile cells and presence or absence of organized nucleus in the cell. He classified algae into 11 classes (Fritsch, 1965)

From being known over a few locations, *H. involuta* has been disperses too far away locations by humans, especially in Canada (Ireland and Shchepanek, 1993).

Most of the Pottiaceae family members are able to withstand as well as establish over high environment constraints like extreme temperatures and anthropogenic activities (Zander, 1996).

Due to the close proximity of opposite sex organs and also among the same population, sexual reproduction is frequent in monoecious species (Gemmell, 1950; Rohrer, 1982; Longton, 1992; Oliveira & Pôrto, 1998).

Studies conducted in southwest Nigeria proves that gametangial development requires ample amount of water- begins in rainy season (Fatoba, 1998).

Poikilohydry and desiccation tolerance in mosses are some of the strategy of morphological adaptation to smaller size and growth on limited moisture (Proctor & Tuba, 2002).

Every population of *H. involuta* may not exhibit perfect 1:1 sex ratio. Population analysis shows that, micro climatic variations cannot be the reason for this bias in sex ratio (Oliveira & Cavalcanti, 2005).

On the locations where the gametophytes have been never reported forming sporophytes, they completely rely on the multicellular gemmae developing from leaf bases (Glime, 2006).

It is one of the most light tolerant moss (Kariyappa *et al*., 2015). A study conducted from Karst rocky desertification area of China, *H. involuta* was one the most drought resistant mosses. In a long run, physiologically and morphologically it had attained resistance. The results also recommend the use of *H. involuta* in bio-crust cultivation for restoration (Cao *et al.*, 2020).

For maintenance of moisture content inside plant body and enhance water absorption, H. involuta contains hyaline cells, which makes this moss poikilohydric. The involute nature of leaves when dry is another moisture retention strategy (Printarakul and Jampeetong, 2021).

H. involuta can propagate both by means of spores and propagules. It may be the reason for its cosmopolitan distribution, especially in low lands (Printarakul and Jampeetong, 2021).

CHAPTER-4

MATERIALS AND METHODS

Study Site and Sample collection

Area of study

10 random places in Mavelikara Taluk were selected as area of study. The regions includes low lying areas of the district, as the moss was favorably growing on low lying domesticated areas. Samples collected included moss growing on tree barks, roofing tiles, stones, floors and mostly from cement laid surfaces.

Study material

The plant selected for the study was *Hyophila involuta* (Hook.) A. Jaeger (Plate 1). The plant is commonly available throughout the selected region under study. Healthy mats of the plants were selected from each site for sampling.

Sample collection

A notable point is that, almost every time, the healthiest population of *Hyophila involuta* was noted to be growing on cement laid surfaces. Knife or spoon was used for obtaining the samples. Occasionally, samples along with substratum were collected, like in the case of epiphytic samples, moss along with the tree bark were collected. The uniform factor that determined the selection of sites was the presence of Hyophila mats (Glime, 2006) in high density.

Obtaining the sample

Bryophytes could be easily sampled by hand grabs but to maintain uniformity, they were collected using a sharp knife or spoon (Glime, 2006). The knife was used particularly for collecting samples from tree barks and walls whereas spoon was proved helpful in obtaining samples from soil, terrestrial floors and in cases where the sample was closely adhered to the substratum. The epiphytic samples were collected along with the attached bark. Excess amount of substratum, if associated was discarded at the site with the help of brushes and knife.

Sample size and purity

An ideal sample should be the size of a palm of human hand (Glime, 2006). Every time, it was tried to maintain the ideal sample size, except in some occasions. For rough identification, magnifying lens was used from the site. Healthy populations with roughly a diameter of 10 centimeters were scraped out from the centre of a plant mass. It was essential for maintaining the purity of samples (Plate 2, fig B, C). Mixed samples were completely avoided (Glime, 2006).

Time of collection

To ensure uniformity in collection of samples, the time for field collection was mediated between 6:00am – 12:00pm

Temporary storage and transport of samples

The samples were collected and immediately packed in transparent zip lock plastic covers. The collection covers were serially numbered and data sheets were immediately labeled including details regarding the collection site and number, date, location and time of collection. No two samples were mixed together so as to maintain individuality of the samples. The collection cups or covers were immediately sealed to prevent contamination of the sample by foreign organisms while transport. Air holes were intentionally not provided for serving the same purpose.

Maintenance of moisture

The stability and survival of organisms in the specimens largely depended on the moisture levels. Moisture and viability of samples were maintained by trapping them inside an air tight polythene bags and were labeled.

Time period of the study

The samples were obtained from the selected sites between the months of February, 2022 – June, 2022. The initial months were cooler and then the weather changed to summer season ending with rainfall in June. Specimens were collected from each site three or more times, whenever available.

Specimen Preparation

From each samples, maximum amount of adhered substratum/soil were removed prior to observation. Each time more or less 1g of moss were taken and mixed with 10 ml of sterilized double distilled water and stirred properly, in a 50 ml beaker (Plate 2, Fig D). The beaker was then covered using plastic cover. After about 10 minutes, a constant amount of sample was taken using brush for slide preparation.

Slide preparation

Glass slides with dimensions of 75 mm x 25 mm x 1.1 mm were used. The slides were washed properly with water and then were sterilized with the help of 95% alcohol and stored prior to lab observations. From each of the 10 ml sample solutions, random sampling was done for maximum representation. The solution was the covered with a clean cover slip and the slide was then observed under the ocular lens microscope.

Microscopic observations

Photographs of organisms were taken whenever spotted. The dimensions of each organism were also recorded with the help of ocular lens microscope (Plate 2, Fig F). The ocular micrometer was calibrated under all objective powers with the help of a stage micrometer.

Identification of associated organisms

The associated organisms were identified with the help of respective online database. The associated organisms were identified with the help of experts in the respective fields. The photographs of the organisms were sent via e-mail to professors of our college and were identified. Protozoan's were identified by using "Free living Freshwater Protozoa - A Color Guide", by DJ Patterson. Basically the classification system of the widely accepted "Honigberg report of 1964" was used to illustrate the conventional situation concerning the systematic of protozoa. The cyanobacteria and other algae were classified according to the classification system proposed by Fritsch F. E., 1935. The arthropods classification follows the system proposed by Giribet *et al*., 2001.

CHAPTER-5

RESULT AND DISCUSSION

Enumeration of the various Meiobiota taxa associated with *Hyophila involuta* (Hook.) A. Jaeger.

The meiobiota associated with *Hyophila involuta* (Hook.) A. Jaeger. includes representations from various groups of lower plants and animals. The frequency of occurrence of organisms varied between sites and seasons. The groups of organisms and their representations includes:

Algae

The study could report 10 species of Algae and the recorded members are represented below and are arranged per classification system proposed by Fritsch F. E., 1935. They also include Cyanobacteria. The recorded members include unicellular, filamentous and colonial forms. The algal species associated with *Hyophila* mats are:

1. ***Cylindrocystis brebissonii* (Ralfs) De Bary 1858 (**Fig: Plate 3A)

Systematic Position

Division : Charophyta
Class : Zygnematophyceae
Order : Zygnematales
Family : Mesotaeniaceae
Genus : Cylindrocystis
Species : brebissonii

Description: As name indicates, Cylindrocystis is marked by cylindric cells. Length 20- 90 µm. The star-like chloroplast configuration is particularly well visible in relatively short cells.

Chloroplasts of more elongated cells disrupt this shape. Most common species are present in acidic, oligotrophic, benthic habitats, Sphagnum vegetation, in temperate regions.

Ecology: Freshwater algae

Remarks: Nil

2. ***Closterium acutum*** **Brébisson in Ralfs 1848 (**Fig: Plate 3B)

Systematic Position

Division : Charophyta
Class : Conjugatophyceae
Order : Desmidiales
Family : Closteriaceae
Genus : Closterium
Species : acutum

Description: Crescent, long, curved in shaped with tapered at both ends; cell wall smooth or with longitudinal lines, banded in some species; chloroplast laminae ridged and radially arranged; pyrenoids aligned or scattered.

Ecology: Freshwater algae

Remarks: Nil

3. ***Cosmarium lundellii*** **Delponte 1877 (**Fig: Plate 3C)

Systematic Position

Division : Charophyta
Class : Zygnematophyceae
Order : Desmidiales
Family : Desmidiaceae
Genus : Cosmarium

Species : lundelli

Description: Unicellular; variable in shape; a constriction at the centre of the cell body; mostly longer than wide; flattened; each semi-cell hemispherical; no apical indentation, apex flattened, wrinkled margins.

Ecology: Freshwater algae

Remarks: Nil

4 . ***Cosmarium subcrenatum*** **Hantzsch var. subcrenatum (**Fig: Plate 3D)

Systematic Position

Division : Charophyta
Class : Zygnematophyceae
Order : Desmidiales
Family : Desmidiaceae
Genus : Cosmarium
Species : subcrenatum

Description: Unicellular; variable in shape; a constriction at the centre of the cell body; mostly longer than wide; flattened; each semi-cell pyramidal shaped; no apical indentation, apex flattened, wrinkled margins.

Ecology: Freshwater algae

Remarks: Nil

5. ***Hantzschia amphioxys*** **(Ehrenberg) Grunow in Cleve & Grunow 1880. (**Fig:Plate 4A)

Systematic Position

Division : Bacillariophyta
Class : Bacillariophyceae
Order : Bacillariales

Family : Bacillariaceae

Genus : Hantzschia

Species : amphioxys

Description: Asymmetric valves to the apical axis. The raphe is within a canal and eccentrically positioned on the valve margin, and is always located on the concave, or ventral, margin of the valve. Striae are uniseriate.

Ecology: Freshwater or terrestrial algae.

Remarks: Nil

6 . **Nostoc Vaucher, 1888, Ex Bornet and Flahaul (**Fig: Plate 4B)

Systematic Position

Division : Cyanobacteria

Class : Cyanophyceae

Order : Nostocales

Family : Nostocaceae

Genus : Nostoc

Description: The blue green algae mentioned above has cells arranged in bead like chains which is grouped together in a gelatinous mass. Masses of Nostoc may be found on soil and wet floors. A special thick-walled cell, akinetes has the ability to withstand desiccation for long periods of time.

Ecology: Freshwater or terrestrial algae

Remarks: Heterocyst can fix atmospheric nitrogen.

7 *Oscillatoria princeps* Vaucher ex Gomont, 1822 (Fig:Plate4C)

Systematic Position

Division : Cyanobacteria

Class : Cyanophyceae

Order : Oscillatoriales

Family : Oscillatoriaceae

Genus : Oscillatoria

Species : princeps

Description: The characteristics blue green algae is due the combination of phycobilin and chlorophyll. The cells are broad and cylindrical. It consists of a single row of cells forming trichomes or unbranched filaments with a very thin gelatinous sheath.

Ecology: Fresh water algae

Remarks: Nil

8. **Gloeocapsa Kützing, 1843**(Fig: Plate 4D)

Systematic Position

Phylum : Cyanobacteria

Class : Cyanophyceae

Order : Chroococcales

Family : Chroococcaceae

Genus : Gloeocapsa

Description: Cells within gelatinous sheaths seen as sheaths around divided cells within outer sheaths. Recently divided pairs appear as only as they cohere temporarily. Also known as glow caps, due to yellowish hue released by the cap.

Ecology: Humid surfaces or rocks, periphytic on aquatic plants, Freshwater form. **Remarks:** Ecological influences are largely conditioned by development of different morphological stages.

9. **Coelosphaerium Nägeli, 1849** (Fig: Plate5A)

Systematic Position

Phylum	: Cyanobacteria
Class	: Cyanophyceae
Order	: Synechococcales
Family	: Coelosphaeriaceae
Genus	: Coelosphaerium

Description: unicellular-colonial; colonies microscopic, spherical, free-living, enveloped by colorless, indistinct or limited fine mucilage, without any inner stalk system, cells spherical, mainly distant from one another; peripherally situated, found more densely in old colonies.

Ecology: Freshwater

Remarks: Nil

Protozoa

10**.** ***Corythion delamarei*** **Bonnet & Thomas, 1960** (Fig: Plate5B)

Systematic Position

Phylum	: Cercozoa
Class	: Imbricatea
Order	: Euglyphida
Family	: Trinematidae
Genus	: Corythion
Species	: delamarei

Description : Small testate, Length up to 25 µm, elongated, not compressed, oblique aperture- (about 45°) relative to the axis of the test. Aperture circular or slightly elliptical, with toothed inner border, weak invagination of the pseudostome, 1 µm or smaller.

Ecology: Soil, in mosses and lichens.

Remarks: Test comprises of granules or elliptical scales irregularly distributed, never overlapping, each rarely larger than 1 μm.

Arthropods

11**. Polydesmus Latreille, 1802** (Fig : Plate 5C)

Systematic Position

Kingdom	: Animalia
Phylum	: Arthropoda
Subphylum	: Myriapoda
Class	: Diplopoda (Millipedes)
Order	: Polydesmida (Flat-backed Millipedes)
Family	: Polydesmidae
Genus	: Polydesmus

Description: This millipede species of the introduced European genus Polydesmus that are common in urban environments and are frequently found under rocks and debris. Off white body, pair of legs arising from each segment.

Ecology: Terrestrial.

Remarks: Younger individuals are common inside moss mats.

Other biological elements

There were several unidentified parts of higher plants and biological debris in moss plants. This proved that they also take part in active capturing of organic debris from the environment, which subsequently turns in to nutrients for the mosses to grow. This way they also act as a site for decomposers to thrive and multiply. Some of the selected biological elements that remain unidentified are represented in (Plate 6).

PLATE -1

Plate 1: Fig.A - *Hyophila involuta* (Hook.) A. Jaeger.

PLATE-2

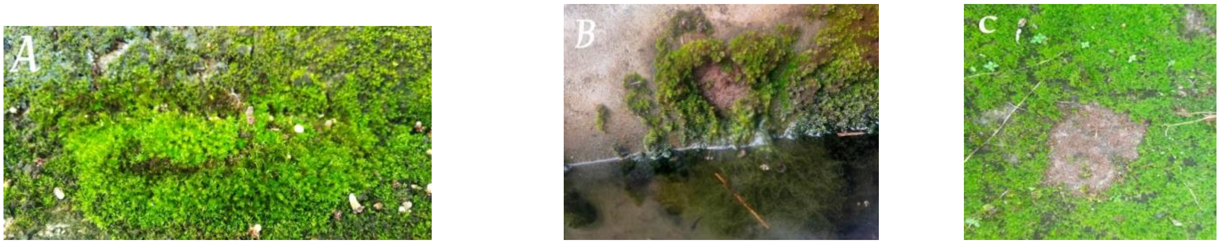

Plate 2: **Procedure of sampling**. Fig. A - Specimen from field before collection; Fig. B, C - Specimen from field after collection;

Plate 2 : Fig. D, E & F - Sample prepared for microscopic observation.

PLATE- 3

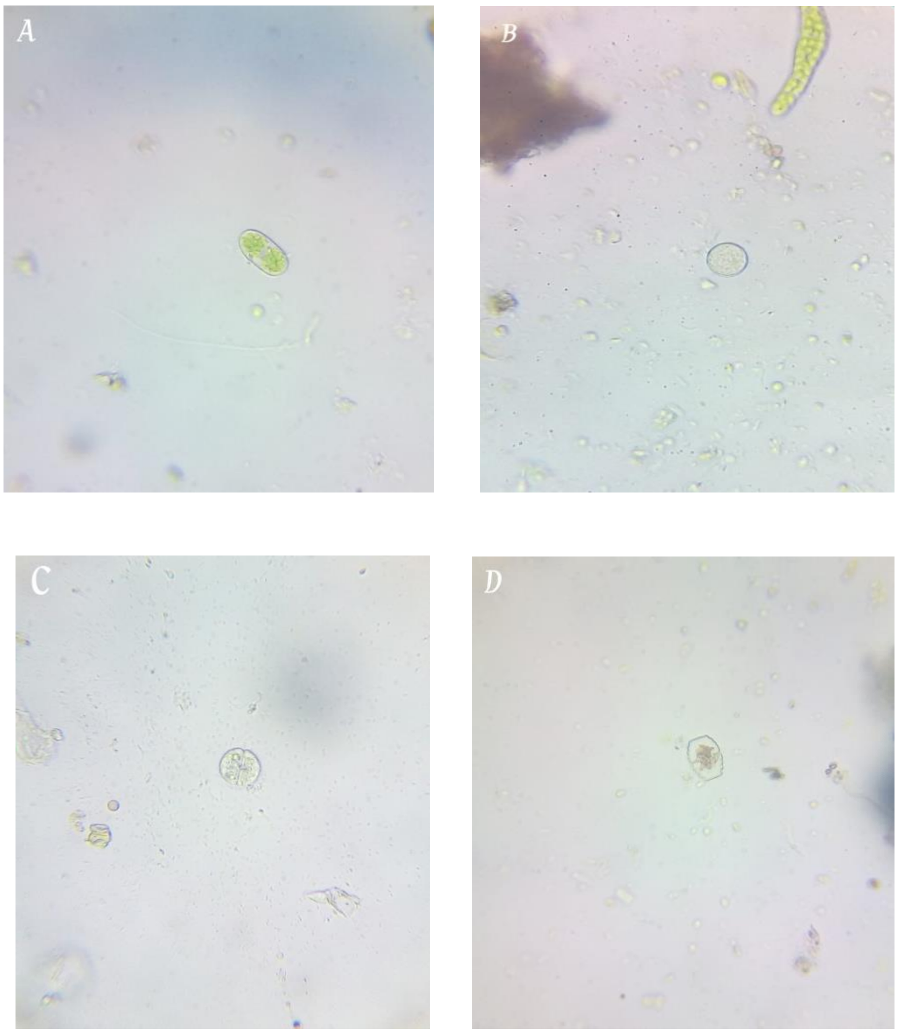

Plate 3: A. *Cylindrocystis brebissonii* (Ralfs) De Bary 1858; B. *Closterium acutum* Brébisson in Ralfs 1848; C. *Cosmarium lundellii* Delponte 1877; D. *Cosmarium subcrenatum* Hantzsch var. subcrenatum

PLATE- 4

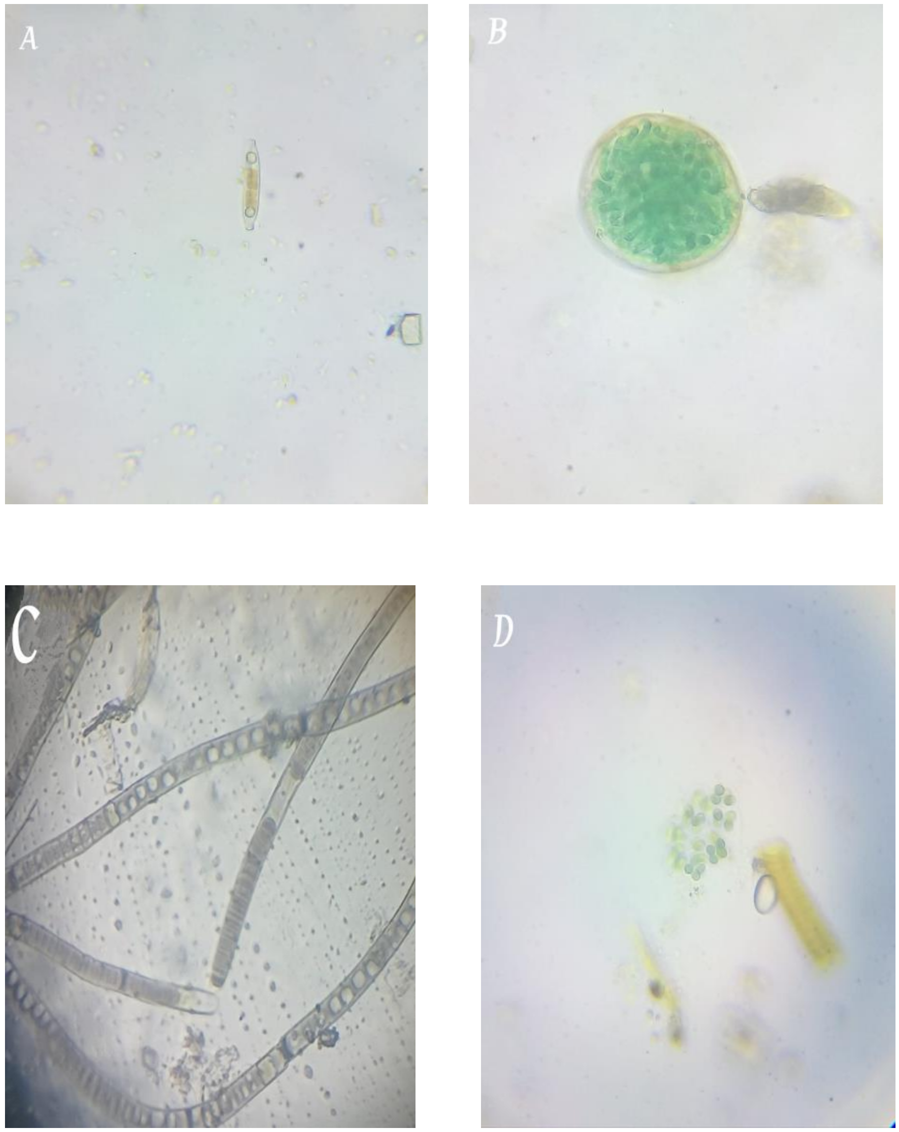

Plate 4: A. *Hantzschia amphioxys* (Ehrenberg) Grunow in Cleve & Grunow 1880; B. Nostoc Vaucher, 1888, Ex Bornet and Flahaul; C. *Oscillatoria princeps* Vaucher ex Gomont, 1822; D. Gloeocapsa Kützing, 1843.

PLATE- 5

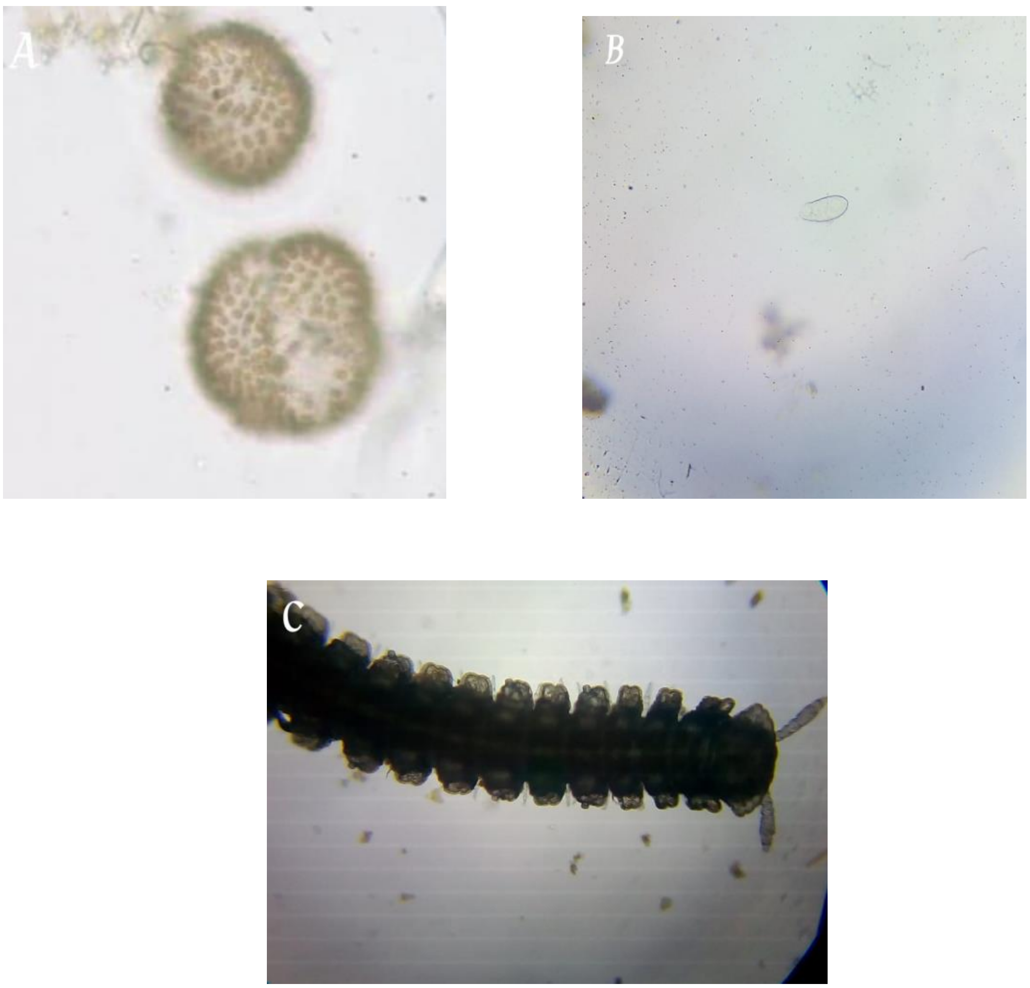

Plate 5: A. Coelosphaerium Nageli, 1849; B. *Corythion delamarei* Bonnet & Thomas, 1960; C. Polydermus Latreille, 1802.

PLATE- 6

Plate 6: Remnants of organisms found. A, unknown plant part; B-C, remnants probably of algae; D, unknown part particles.

CHAPTER-6

SUMMARY AND CONCLUSION

The present study was aimed to find out the meiobiotic associations involved with the moss, *Hyophila involuta.* The selected plant was obtained from different sample sites distributed in the Mavelikara Taluk. The study could report a total of 11 organisms belonging to Algae, Protozoa and Arthropoda. The dominant group was Algae with 9 species, followed by 1 member from Protozoa, 1 from Arthropoda. Of the 11 organisms reported, 4 organisms were identified up to the generic level and 7 species were identified to the specific level. Through this work, it has been proved that *Hyophila involuta* (Hook.) A. Jaeger. supports a unique ecosystem in itself, which is balancing and self-sustained also. Bryophytes especially mosses provide an exceptionally good habitat for microorganisms as well as some macro-organisms to thrive, grow and reproduce.

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2. https://www.algaebase.org/

GLOSSARY

Cryptobiosis - Metabolic state of an organism during adverse conditions

Lithophyte - Plants growing on rocks

Meiobiota - Microscopic organisms seen associated with any physiologically and ecologically active system

Poikilohydry - Inability in maintain water content and to maintain homeostasis