A PROJECT REPORT

ON

DIVERSITY OF GREEN ALGAE FROM BAHONA COLLEGE CAMPUS AREA, JORHAT

Submitted By:

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CERTIFICATE

This is to certify that the submitted Project work entitled **"DIVERSITY OF GREEN ALGAE FROM BAHONA COLLEGE CAMPUS AREA, JORHAT"** is a bonafied work of **BORNISHA BORAH** as partial fulfillment of B.Sc. 6th Semester under Dibrugarh University, Assam, who carried out the project work under my supervision.

28/10/20

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Bornisha Borah

CONTENT

AIMS AND OBJECTIVES

1. To collect different freshwater algal species available in the selected are of study.
2. To collect photographs of the collected algal specimens.
3. To identify the collected algal species.

ABSTRACT

Fresh water microalgae has drawn much attention due to their primary productivity in the water food chain of water ecosystem diversty,their biological assessment of water quality ,pollution treatment capacity and as a source of structurally novel and biologically active metabolites with microbial capacity etc. The filamentous algae were identified based on microscopic observation and characters. The results revealed that we found two major classes Chlorophyceae, Ulvophyceae. The occurrence of fresh water algae, their diversity and distribution was interpreted with water quality and its physic-chemical characteristics. The present study not only discusses the basic information of fresh water algal presence, distribution but also helps for future environmental monitoring studies.

Key Words: Algae, Chlorophyta, Charophyta.

INTRODUCTION

Algae are complex living organisms that have been around at least 3 billion years. They have a long interesting history because of their place in our evolution. All land plants are consume originate from algae. New species of algae are discovered every year. They are incredibly important because they are the primary plant in both salt and fresh water aquatic environment. The study of algae is called phycology, which is a subdiscipline of botany.

Algae are typically found in aquatic environments, but they can be found anywhere. They travel as spores can be found in water, air and mixed with dust etc. They are typically associated with smelly swamps sceemmy ponds. They are coloured bright red, brown or green. Photosynthesis is the ability for plant to produced energy and give off oxygen. Algae are the primary producer of oxygen on Earth. Without algae couldn't survive.

Algae have been dubbed "the world's most important plant". Lots of research is devoted to the study of phycology. Large research universities , massive corporations and even everyday folks benefit from algae. It has an incredible environmental and financial potentials.

Algae are commonly used as food ingredients, fertilizers, thickeners dyes, pharmaceuticals, fuels, pollutions controls, nutritional supplements, sewage treatments and animal feed. Algae are often found in foods like Sushi and certain salads.

Agriculture and Algal farmers use microalgaes for health supplements or bio diesel fuel. This new algae application is a big deal and has some serious potential for algae as a source of biofuel.

Only time will tell what else the world's most important plant can do. In our college area ,we found 7 species of algae during the month February to March.

MATERIALS AND METHODS

Materials:

In this algae project we have used some materials to examine the species that we have found. These materials are

- Microscope
- Container for algae collection
- Petri dishes
- Forceps
- Slides
- Needle
- Chemicals – safranin, formaldehyde (4%)

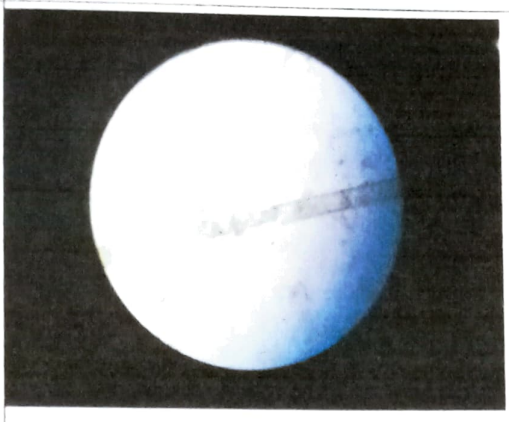
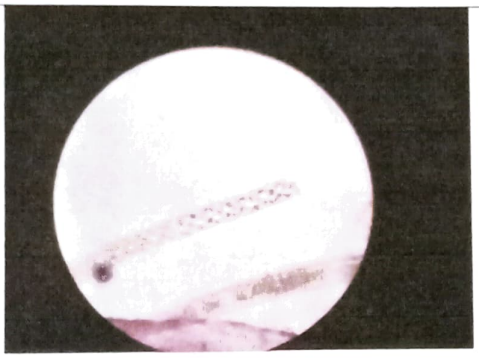
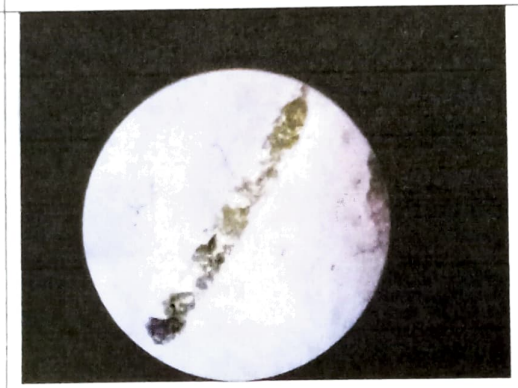
Methods:

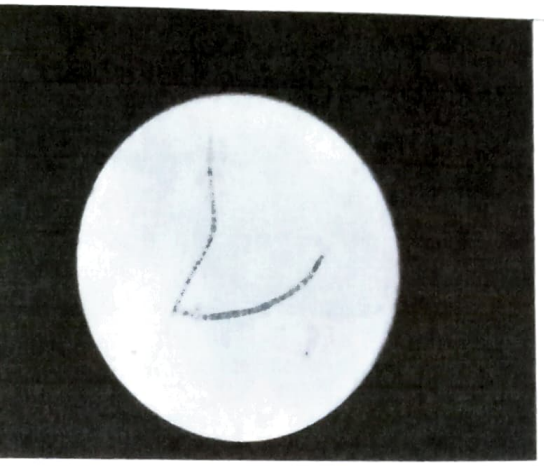
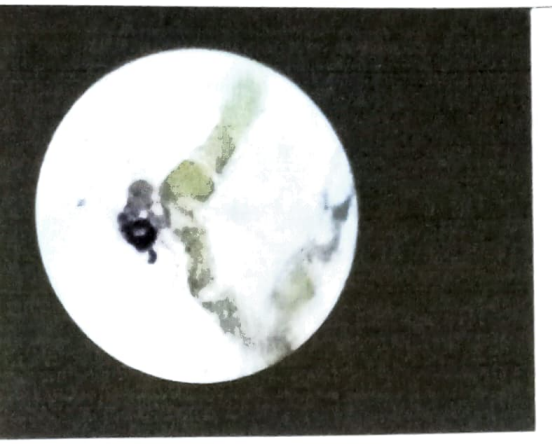
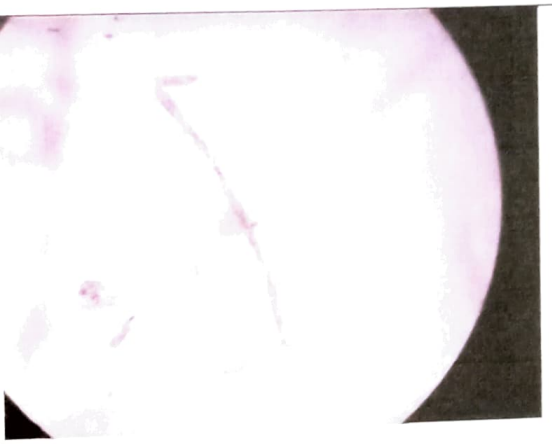
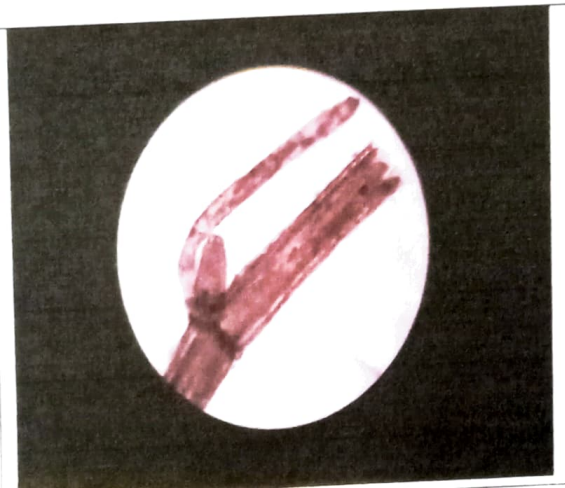
The genuses of algae were collected by hand from easy access rocky substrates and from water sources samples were collected during the month February to March. After collection, the samples were fixed and stored in a solution of 4% formaldehyde. After this the samples were examined under the microscope.

The identification of species was based on morphological characteristics. The following characteristics were considered:

1. Structure of cell
2. Structure of thallus
3. Apical cells, cells in ultimate branches and cells in main axes
4. Mode of attachment
5. Position of internal wall etc.

EXPERIMENTAL FINDINGS

SL NO	PHOTOS	IDENTIFICATION CHARACTER	IDENTIFICATON
A		• They have a multicellular filamentous body with a mucilaginous sheath. • They bear 2-10 spiral and ribbon shaped chloroplast with many pyrenoides.	From these characters it is identified that the species **A** is *Spirogyra*
B		• It is typically free floating as wool like structures • Fertile filaments are easily identified by characteristic akinets.	From these charaters the species **B** is Identified as *Pithophora*
C		• Branching filaments have cross walls separating multinucleate segments • It grows in the form of tuft or ball with filaments.	From these characters the species C is identified as Cladophora

	• It is a filamentous green algae filaments are typically unbranched. • Each cell contains a distinct nucleous a central vacuole.	From these characters the species **D** is identified as *Ulothrix*.
	• *Microspora* species are unbranced filamentous green algae. • There is a single dense net like chloroplast, usually filling the cell, no pyrenoid	From these characters the species **E** is identified as Microspora.
	• The plant body is unbranched and filamentous. The cell wall is characteristically straight and parallel sided.	From this identification characters it is identified that this species is Mougeotia
	• The main axis is differenciate into nodes and internodes • Each nodes bears both the sex organs i.e. Nucule and globule	From this identification characters it is identified that this species is **G** is *Chara*

DISCUSSION

CHARA

Family- Characeae

Order- Charales

Class- Charophyceae

Division- Charophyta

Occurrence- *Chara* is a submerged aquatic alga of freshwater ponds, lakes, tank or slow flowing streams, a common stonewort. It is attached to the bottom by branched, filaments rhizoids and is gregarious in habit. Some species grow in brackish water.

Structure- The plant body consists of an eract, branched stem, usually 20-30cm in height , differentiate into distinct node and internode.

Branches is of following type—a)a whorl of short branches, branchlets, or leaves, consisting of usually 3-8 nodes and internodes at each nodes of stem and long branches.

b)whorls of short branches arising from the long branches, and

c) shorter branches and appendages with one internode and somewhat pointed ends called bracts and bracteoles, growing out of the branchlet or leaves.

Besides these, there may be some unicellular outgrowth called stipulodes or stipuloids arising in 1or2 whorls from the basal node of each branchlet or leaf.

The stem grows in length by means a dome-shaped apical cells. All the cells contain numerous small chloroplast but no pyrenoids, and the reserve food occurs in the form of spindle-shaped starch.

Reproduction: *Chara* reproduces by vegetative and sexual methods only. Asexual method of reproduction by means motile and non-motile spores is completely lacking.

Vegetative Reproduction: This type of reproduction may be effected by the following methods-

(i)Amylase stars, Amylum stars or Starch stars-These are star shaped aggregate of cells, densely filled with starch grains and produced the lower node to the main axis.

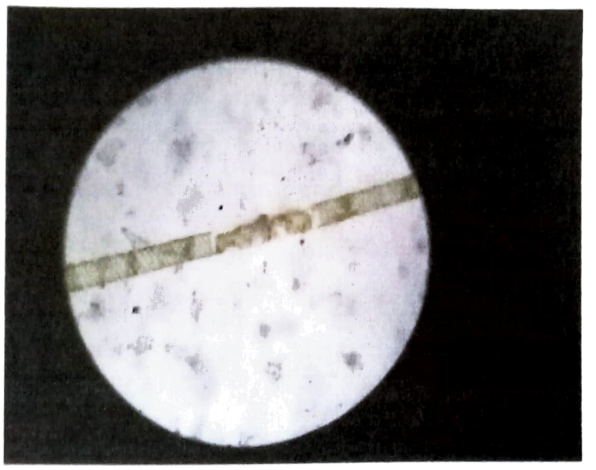
(ii)Bulbils-Small masses of cells , usually spherical or star shaped , formed on the stem ,at the node or on the rhizoids.

(iii)Secondary Protonema-These tubular bodies called secondary protonema develop either from the rhizoidal node of primary protonema or from the basal cell of the primary rhizoids.

Sexual Reproduction-All species of *chara* normally reproduce sexually. Sexual reproduction of *Chara* in an advanced oogamous type. The sex organs is spherical and yellow to red in colour called globule. The female sex organ is more or less oval and green in colour called nucule or ooganum. They develop on the nodes of the branch of limited growth, intermingled with secondary tubules. Finally each secondary capitulum develops 2-4 long antheridial filaments. Each antheridial filaments has 25-25 cells and each cell i.e; antheridium forms a biflagellate, coiled and uninucleate antherozoids .

Development of sex organ in Chara: The gloule develops at the node of branches of limited growth. Single peripheral functions as the antheridial initial. The antheridial initial first undergoes transverse division to form 2 cells, which forms the stalk.

SPIROGYRA



Family: zygnemataceae

Order: Zyngematales

Class: Chlorophyceae

Genus: *Spirogyra*

Occurrence: *Spirogyra* is a green filamentous alga occurring in a tangled mass that floats about freely in water. *Spirogyra* is cosmopolitan plant of fresh water, and is found growing abundantly in ponds ,ditches, springs, slow running streams,etc. In some species growing in running water, short, unicellular organ of attachment, called hapteron ,is formed . S.maxima ,S.longata, and S.nitida are some of the common species.

STRUCTURE: Each *spirogyra* plant is an unbranched filament, a few to many cm. in length, consisting of a single row of cylindrical cells. The walls are made of cellulose and pectin. Pectin swells in water into a gelatinous sheath which encases the *spirogyra* filament. The filament is not differentiated into base and apex. Each cell has a lining layer of cytoplasm in which one or usually more spiral bands of chloroplasts. The characteristic feature of *spirogyra* –lie embedded. The nucleus is situated somewhere in the center the nucleus usually has one large nucleolus frequently more growth by elongation by cell division by mitosis usually takes place at night. If the filaments happen to be broken up into individual cells or short pieces, the cells divide and give rise to new filaments.

REPRODUCTION IN *SPIROGYRA*: vegetative and sexual reproduction in *spirogyra* is common, whereas asexual reproduction occurs occasionally.

VEGETATIVE REPRODUTION: vegetative reproduction is the shortest method of reproduction. Fragment of *spirogyra* undergoes multiple divisions

to form an elongated vegetative filament. Under favourable conditions, augmentation is the most common method of reproduction in *spirogyra*.

ASEXUAL REPRODUCTION: asexual reproduction is less common among *spirogyra*, but it occurs in some species under favorable conditions by means of the formation of asexual spores like aplanospores, akinets, and zygospores.

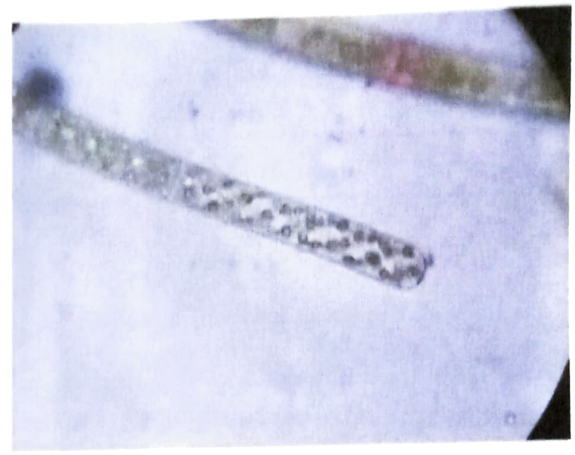
SEXUAL REPRODUCTION: sexual reproduction in *spirogyra* occurs via alternation between a haploid filament and a diploid zygospore. Conjugation is the method of sexual reproduction in *spirogyra* where the fusion of two gametes. The gametes are morphologically identical, but during conjugation, one of the gametes becomes active while the other becomes passive. Conjugation in *spirogyra* is of two types: Scalariform and lateral conjugation.

USES:

(i) Some species of *spirogyra* are used as a source of food in different parts of the world as they are rich in vitamins and minerals.

(ii) Some *spirogyra* species have been found to have the potential for the treatment of municipal wastewater and biomass production for biofuel applications.

PITHOPHORA



FAMILY: *pithophoraceae*

ORDER:*cladophorales*

CLASS: ulvophyceae

GENUS:*pithophora*

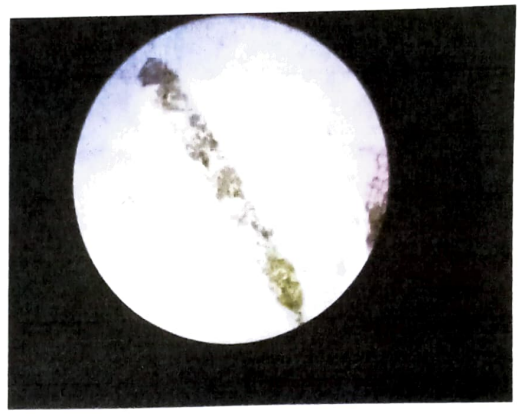
OCCURANCE:*pithophora* is found attach to the surface to the stones,fresh water,ponds,pools and slow running stream.

STRUCTURE: *Pithophora* is a filamentous algae. Cells are remain attached after cell division and form a cell chain. Adjuscent cells share cell wall . it may be unbranced or branched. Branching pattern typically falcate sometime opposite. Cells are long, slender and cylindrical. Cell wall contains chitin as well as cellulose providing an explanation for the distinctive mode of branching.

REPRODUCTION: Akinets are formed by most of the cell contents of a vegetative cell migrating to the upper end of the cell,followed by transverse division leaving a short akinet and much longer vegetative cell with very little cytoplasm. Akinets can be intercalary and terminal. Germination of akinets and development of a new thallus by transversedivision into 2 daughter cell, one developing into a short primary rhizoid, the other into a branched filament. The other mode of vegetative eproduction is by fragmentation. Sexual reproduction is unknown.

USES: pithopora oil was extracted and can be used as a potential source of biofuel for the production of biodiesel. *Pithophora* is used for fish nutrition and food for the anima

CLADOPHORA



FAMILY: *cladophora*ceae

ORDER:*cladophora*les

CLASS:Ulvophyceae

GENUS:*cladophora*

OCCURRENCE: *Cladophora* found growing attach to rocks or timbers submergeds in shallow lakes and streams; there are some merine species.

STRUCTURE: in appearance; *Cladophora* with regular branching filaments that have cross walls separating multinucleate segments, *cladophora* grows in the from of tuft or ball with filaments that may range up to 5 inches. Thallus remains attached to the substratum by a holdfast. A large central vacuole and many pyrenoids are present in itself.

REPRODUCTION: *Cladophora* reproduces by vegetative,asexual and sexual methods.

- Vegetative reproduction: During vegetative **reproduction** the erect portion of the thallus dies back, while the rhizoidal system persists. Many of the cells of the rhizoid become swollen and assume pear-shaped form.
- Asexual reproduction: Asexual reproduction takes place by means of biflagellate or quadriflagellate zoospores formed by the cleavage of the protoplasts of vegetative cells of the younger apical filaments in base-petal succession. Before the formation of zoospores, the nuclei multiply by divisions and in some species it has been recorded that meiosis takes place at this stage.
- Sexual reproduction: Sexual reproduction takes place by means of biflagellate gametes. The modes of formation and liberation of gametes are much the same as those of the zoospores. Certain species are definitely heterothallic and the fusing gametes, belong to different thalli. Reproduction is isogamous. After fusion a zygote is formed, which directly develops into a diploid plant.

USES:

(i) Use in food and feed sources,

(ii) Medicinal uses; antimicrobial,anti-oxidant,antidiabetic, antiulter,antiperasitic etc

(iii) Biotectionlogical use: biodiesel and bioethanol production and phycoremediation.

(iv) It is used as fertilizer and source of cellulose.

ULOTHRIX

FAMILY: Ulotricheceae

ORDER: Ulotrichales

CLASS: Ulvophyceae

GENUS: *Ulothrix*

OCCURRENCE: The majority species of *Ulothrix* are found attached on rocks, stones and some other substratum in slow running fresh water of ponds, pools etc.

STRUCTURE: *Ulothrix* is an unbranched , multicellular filamentous alga of indefinite plant. Each cell of filaments contains a nucleus and peripheral , band –like chloroplast with entire or lobed margine. Usually, there are many pyrenoids lying embedded in the chloroplast . The plant body is differentiated into three regions i.e; basal cells, apical cell and middle cell.

REPRODUCTION: *Ulothrix* reproduces by all three means vegetative ,asexual and sexual.

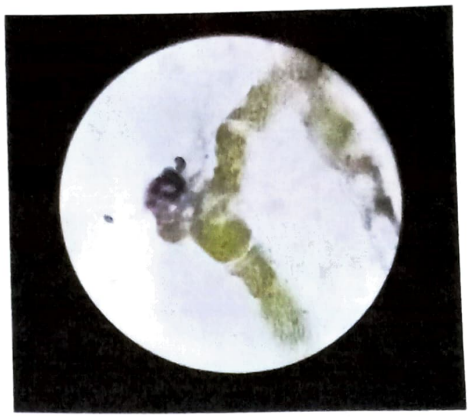
Vegetative reproduction: It takes place by fragmentation. The filaments breaks up into a number of parts. Each part is capable of developing a new plant like its parents.

Asexual reproduction: Asexual reproduction takes place in winter during its active growth. Its takes place by the formation of zoospores, akinetes and palmella stage.

SEXUAL REPRODUCTION: The sexual reproduction is isogameous. The fusion takes place between the gametes developed in different filaments. Morphologically gametes are similar to the microzoospores. Through the gametes are morphologically similar, physiologically different and designated as positive and negative strains. After forming the zygote, the nucleus undergoes meiosis and forms four haploid nuclei. The nuclei along with some cytoplasm form meiospores. These are haploid and quadriflagellate. On germination they developed into haploid *Ulothrix* filaments.

Uses: *ulothrix* serve as food and oxygen sources for aquatic organisms. The algal biomass can be used as a fertilizer.

MICROSPORA



FAMILY: *cladophora*ceae

ORDER:sphaeropleales

CLASS:chlorophyceae

GENUS:*micosphora*

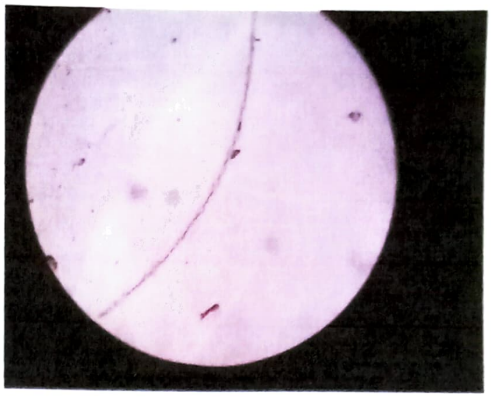
OCCURANCE: *Microspora* are most frequently found in stream water, pools; and tangled in moss or other vegetation. Some specis of *microspora* ase merine .

STRUCTURE: *Microspora* species are unbranched filamentous green algae. There is a single dense net-like chloroplast, usually filling the cell, no pyrenoid. *Microspora* frequently show the presence of darkened, brown bands between adjacent cells.

REPRODUCTION: *Microspora* may reproduce sexually or asexually. In asexual reproduction, nuclear division takes place and form one or more pairs of nuclei, and cellular division may isolate the nuclei or pair them in a diplokaryon arrangement.

USES: some specis of *microspora*(*microspora* floccose) algae considered to be favorable for biofuel production.

MOUGEOTIA



FAMILY: zygnemataceae

ORDER: zygnematales

CLASS: zygnematophyceae

GENUS:*mougeotia*

OCCURANCE: the alga occurs in fresh water lakes, pools,ponds, springs and slow running streams.

STRUCTURE: the filaments are normally unbranded but occasionally short, few celled laterals are developed. The cells of filaments are cylindrical and joint end to end. Each cell is usually four time longer than broad.

REPRODUCTION:

Vegetative reproduction takes place by fragmentation of filaments into indivisual cells.

Asexual reproduction takes place by akinetes, aplanospores, parthenospores and azygospores.

Mougeotia usually reproduces sexually via **conjugation** tubes that form between two parallel filaments, creating a ladder-like structure. Inside, the gametes join and develop into zygotes. The zygotes then germinate into a single **filament**. Conjugation in mogeotia is of two types-lateral and scalariform.

USES: No major economic *uses* or nuisance. Widely *used* in experimental studies of phytochrome-mediated movement of platelike chloroplast; in fossil studies *used* as marker for clean, oxygen-rich, shallow stagnant, mesotrophic water in habitats subject to seasonal warming; some species tolerant to heavy-metal pollution.

CONCLUSION

In our present study, a good number of freshwater algae belonging to the classes Chlorophyta and Charophyta were observed and studied.

Algae are an integral part of the ecosystem that serves for various purposes such as fooder, photosynthesis and waste management. Algae are widely distributed in all over the world.

- Algae are easy to grow
- Can produce a high yield of oil
- Algae is a very efficient means of producing biofuel
- The oil production from algae farms is feasible and scalable
- Further research necessary to unlock full potential of algae
- Help to solve dependence on fossil fuels
- Can be better for the earth

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