Research Article

Fresh water algae of Maidan, District Dir, Khyber Pakhtunkhwa Pakistan

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Abstract

Forty species of fresh water algae were collected from different localities of District Dir, belonging to 12 classes, 27 genera, 18 orders during Sep 2014- Feb 2015. Among them major class were found to be Conjugatophyceae 9 spp (22.5%) Cyanophyceae 7 spp (17.5%) Ulvophyceae 6 spp (15%) Bascillariophyceae 5 spp (12.5%) Zygnematophyceae and Chlorophyceae 3 spp (7.5%) Fragilariophyceae 2 spp (5%) Dinophyceae, Xanthophyceae, Tribophyceae, Floridiophyceae, Klebsormidiophyceae (2.5%) 1 species each.

Keywords: Dir; Conjugatophyceae; Cyanophyceae; Zygnematophyceae; Chlorophyceae

Introduction

Dir is a District of Khyber Pakhtunkhwa, province of Pakistan. It is 1,582 Square Kilometers in area and total area of the district is 5284 Sq. Km. It is situated 35° and 34° North and 71° and 72° East. This District was divided into two separate districts i.e. Upper Dir and Lower Dir in 1996 [1]. Algae are found throughout the biosphere inhabiting the world's oceans, lakes, ponds, wet-lands, streams, rivers, and estuaries [2]. Algae contribute oxygen to the atmosphere. They directly or indirectly serve as food for fish and other aquatic animals including man. Freshwater algae are present in all freshwater bodies. Many researchers have identified algae from various parts of Khyber Pukhton Khwa [3-8]. The present work was carried out to add further information to the obtainable knowledge about some members of algal flora from freshwater habitats of Maidan (Dir) Valley.

Materials and methods

Forty Algal specimen were collected from different localities of Dir (Lower) Maidan (Kumber, Daro, Atoo, Islamkot, Batrawar, Shadas, Barjugat, Mulyano banda, Markhanie, Lagharie, Shakhelay, Kotkay, Lalqilla, Gumbatii, Kotkidherie, Shandi Inzar, Khan abad, Khona baba, Sangar shah) with the help of forceps, hands picking, direct taking water in the bottle for the floating algal flora and picking by hand. These collected algal specimens were preserved in 3% formalin. Collection were made from September 2014 to February 2015. These specimens were identified following the methodology of [9-11].

Results and discussions

In present study 40 species belonging to 27 genera, 18 orders and 12 classes were identified from different fresh water habitats of Maidan, District Dir Lower. Major class were found to be Conjugatophyceae which have one order Zygnematales have 4 genera

and 9 species, class Cyanophyceae have 4 order Oscillatoriales have 1 genera and 2 species, order Chroococcales have 1 genera and one species, order Synechococcales have 1 genera and 3 species, order Nostocales have 1 genera and 1 specie class Ulvophyceae have 2 ord... Cladophorales have 3 genera and 4 species, order Ulothricales have 1 genera and 2 species, class Bascillariophyceae have 4 orders Cymballales have 2 genera and 2 species, order Mastogloiales have 1 genera and 1 species, order Fragilariales have 1 genera and 1 species, order Naviculales have 1 genera and 1 species, class Zygnematophyceae have 1 order Zygnematales have 2 genera and 3 species, class Chlorophyceae have 2 order Chaetophorales have 2 genera and 2 species, order Sphaerophorales have 1 genera and 1 species, class Fragilariophyceae have 2 order Licmophorales have 1 genera and 1 species, order Fragilariales have 1 genera and 1 species, class Dinophyceae have 1 order Peridinales have 1 genera and 1 species, class Xanthophyceae have 1 order Tribonematales have 1 genera and 1 species, class Tribophyceae have 1 order Tribonematales have 1 genera and 1 species, class Floridiophyceae have 1 order Acrochaetiales have 1 genera and 1 species, class Klebsormidiophyceae have 1 order Klebsormidiales have 1 genera and 1 species.

Spirogyra Link 1820.

Filaments long and unbranched usually without basal-distal differentiation. Cells cylindrical, short, to very long in some species, with plane, replicate, or colligate end walls. Chloroplast a parietal band or ribbon, 1-16 chloroplasts in a cell. Conjugation either lateral or scalariform, Zygospores formed in one of the gametangial cells. Zygospores ovate, subglobose, ellipsoid, or oblong, with 3-layered wall, of which the middle layer may be smooth or decorated and colored.

Key to species

1. Vegetative cells 23-25 μ in diameter, with plane end walls.....*S. aequinocialis*
1. Spores ovate2
2. Vegetative cells 19-30 μ in diameter with replicate end walls *S. weberi*.
2. Chloroplasts 3-53.
3. Vegetative cells 28-33 μ in diameter with replicate end walls *S. gratiana*
3. Spores ellipsoid.....4.
4. Vegetative cells 40-44 μ in diameter, up to 240 μ long plane end walls chloroplasts 3-4..... *S. Fuellebornei*
4. Oogonia ellipsoid.....5.
5. Vegetative cells 35-40 $\times$ 150-320 μ with replicate end walls and 2-4 chromatophores*S. rectangularis*
5. Vegetative cells large.....6.
6. Cells, 30-34 μ in diameter, 90-136 μ long with plane end walls; chloroplast solitary*S. scrobiculata*.
7. Vegetative cells 28-32 $\mu \times$ 55-144 μ with plan end walls*S. dictyospora*.
7. Median spore wall reticulate.....8.
8. Cells, 30-35 μ in diameter, 70-148 μ , long, with plane end walls, chloroplast solitary*S. daedaleoides*.

(i) *Spirogyra aequinocialis* GS. West 1907

Reference: Prescott PI. 72, Figs. 3, 4 p311

Vegetative cells long-cylindric, 23-29 μ in diameter, up to 150 μ long, with plane end walls. Chloroplasts 2-3 with crenate margins. Conjugation by tubes from both gametangia. Zygospores ovate or elongate ellipsoid.

(ii) *Spirogyra scrobiculata* Czurda 1932

Reference: Prescott P 320 PI 76, Figs. 3, 4

Filaments of short cells, 30-34 μ in diameter 90-136 μ long with plane end walls; chloroplast solitary, making 1 to 5 turns. Conjugation by tubes from both gametangia, Zygospores ellipsoid.

(iii) *Spirogyra weberi* Kuetzing 1843

Reference: Prescott P 322 PI 76, Figs. 8-10

Filaments of long cells, 19-30 μ in diameter, 80-480 μ long, with replicate end walls; chloroplast solitary, broad, making 3 to 6 1/2 turns. Conjugation by tubes from both gametangia. Zygospores cylindric-ovate.

(iv) *Spirogyra gratiana* Transeau 1938

Reference: Prescott PL 74, Fig. 9
 Filaments of elongate-cylindric cells 28-33 μ in diameter, 144-400 μ long, with replicate end walls, chloroplasts 2-3 μ . Conjugation lateral or scalariform. Zygospores ellipsoid or cylindric- ellipsoid median spore wall smooth and yellow.

(v) *Spirogyra daedaleoides* Czurda 1932

Reference: Prescott p313, Pl. 72, Figs.9-11

Filaments of rather stout cylindrical cells, 30-35 μ in diameter, 70-148-(240) μ , long, with plane end walls; chloroplast solitary, making 3 to 4 turns. Conjugation scalariform by tubes from both gametangia or lateral. Zygospores ellipsoid or ovate-ellipsoid

(vi) *Spirogyra rectangularis* Transeau.

Reference: Tiffanay p160 pic 522
 Vegetative cells 35-40 $\times$ 150-320 μ with replicate end walls and 2-4 chromatophores making 2-5 turns in the cell. Conjugation lateral and scalariform; tubes form by both gametangia.

(vii) *Spirogyra fuellebornei* Schmidle 1903

Reference: Prescott 315 PL 73, Fig. 6
 Filaments of stout cylindrical cells 40-44 μ in diameter 120-200- (240) μ long, with plane end walls. Chloroplasts 3-4, making 1 to 2 turns. Conjugation by tubes from both gametangia. Zygospores ellipsoid

viii) *Spirogyra dictyospora* Jao 1935

Reference: Transeau p179 plXXVIII Fig. 14

Vegetative cells 28-32 $\mu \times$ 55-144 μ , with plane end walls; chromatophore 3

sometime 2, making 2-5 turns in the cell. Cojugation scalariform tubes form by both gametangia. Median spore wall reticulate.

Oscillatoria; Voucher 1803

Filamentous and elongate, without a sheath, straight, or twisted and entangled; trichomes solitary and scattered, or forming expanded plant masses and slimy layers on submerged objects or on the bottom, apical cell smoothly rounded, or swollen and capitate.

Key to species

1. Cells 7-8 μ in diameter.....2.
2. Trichomes bent or hooked at the apex*O. anguina*.
3. Cells 11-13-(20) μ in diameter, 4-5 μ long.....4.
4. Trichomes slightly capitate at the apex, with calyptras*O. sancta*.

Oscillatoria anguina *Oscillatoria sancta***Cladophora** Kuetzing 1843

A repeatedly-branched filamentous thallus with basal-distal differentiation; branching alternate, opposite, or sometimes di- or trichotomous. Cells cylindrical or swollen; walls thick and lamellate in most species. Chloroplast a parietal reticulum, pyrenoids present.

Key to species

1. Cells 2.5-50 μ in diameter, 36-250 μ long in the main axis2.
2. Cells irregularly inflated or subcylindric*C. profunda*.
3. Cells in the main axis 75-100 μ in diameter.....4

Cladophora profunda var

4. Cells very slightly attenuated toward the apices of the branches*C. glomerata*.

(i) *Cladophora profunda* var. *ordstediana* Brand 1902a

Reference: Prescott p 139 PI 22, Figs. 1-4
Thallus composed of attached, irregularly and much branched filaments. Cells irregularly inflated or subcylindric, 2.5-50 μ in diameter, 36-250 μ long in the main axis.

(ii) *Cladophora glomerata* Kuetzing 1845

Reference: Prescott P 138 PI 20, Figs. 8, 9
Filaments successively and regularly branched. Main axis 75-100 μ in diameter, 6-7 times the diameter in length.

Cladophora glomerata

Aphanocapsa Naegeli 1849

A globular, ovate, or sometimes amorphous mass, gelatinous, and free-floating, in which spherical cells are usually widely and evenly distributed through a yellowish or hyaline, homogeneous colonial mucilage, cells often in pairs as a result of recent division.

Key to species

1. Cells minute, bluish.....2.
2. Cells 0.5-0.8 μ , in diameter or less*A. delicatissima*.
3. Cells spherical, blue-green, finely granular.....4.
4. Cells 3.4-4.5 μ in diameter...*A. pulchra*.
5. Cells in pairs, in groups of four and crowded, or solitary, with pseudovacuoles.....6.
6. Cells 3.8-5.5 μ in diameter...*A. grevillei*.

(i) ***Aphanocapsa pulchra*** Rabenhorst 1865

Reference: Prescott P 454 PL 101, Fig. 14

Aphanocapsa pulchra

Colonies ovate or globose, free-floating; cells spherical, loosely and evenly dispersed with in a copious mucilage, contents bluegreen, finely granular 3.4-4.5 μ in diameter.

(ii) ***Aphanocapsa delicatissima*** West 1912

Reference: Prescott p 453, PL 101, Figs. 8, 9

Colonies spherical or elliptical, free-floating cells minute, bluish evenly distributed throughout copious, colorless mucilage 0.5-0.8 μ in diameter.

(iii) ***Aphanocapsa grevillei*** Rabenhorst 1865

Reference: Prescott PL 101, Figs. 15, 16

Free-floating colonies, spherical or, in age, irregularly shaped; cells in pairs, in groups of four and crowded, or solitary evenly dispersed through colorless mucilage, blue-green, with pseudovacuoles 3.8-5.5 μ in diameter.

Aphanocapsa delicatissima

Aphanocapsa grevillei

Tribonema Derbes & Solier 1856

Filaments composed of cylindrical cells, cells forming H-shaped pieces when fragmentation of the filament occurs; chromatophores disc-shaped, light yellow-green, 2 to several in a cell, without pyrenoids.

Key to species

- Cells long-cylindric with thin walls.....2.
- Cells 5-5.6 μ in diameter, 35-40 μ long.....*T. affine*
- Cells stout with relatively heavy walls....4.
- Cells 10-17 μ in diameter, 15-53.5 μ long.....*T. utriculosum*.

(i) ***Tribonema affine*** G. S. West 1904

Reference: Prescott p 367 pl 96 Fig.

Filaments straight and slender; cells long-cylindric with thin walls, 5-5.6 μ in diameter, 35-40 μ long. Chromatophores 4 pale, yellow- green parietal plates with smooth margins.

(ii) ***Tribonema utriculosum*** Hazen 1902

Reference: Prescott p 368 pl 96

Filaments long or short, cells stout with relatively heavy walls, clearly showing the overlapping of the 2 wall pieces in the midregion of the cell; chromatophores many irregular discs; cells 10-17 μ in diameter, 15-53.5 μ long.

Tribonema affine *Tribonema utriculosum***Zygnemopsis** (Skuja) Transeau 1934

Filaments composed usually of cylindrical cells which are as much as 10 times their diameter in length; chloroplasts 2 stellate. Conjugation scalariform. Zygospores formed in the enlarged conjugating tube, the median spore wall smooth or variously sculptured.

Zygnemopsis desmidioides Transeau 1934

Reference: Transeau Pl VIII, P 53 Fig 14

Vegetative cells 8-11 μ x 19-56 μ , constricted at the ends; chromatophore an axial plate with 2 pyrenoid; "conjugation between free cells" scalariform.

*Zygnemopsis desmidioides***Mougeotiopsis** Palla 1894

Filaments slender, composed of short cylindrical cells; 1 axial, plate-like, folded chloroplast without pyrenoids; conjugation scalariform, the zygospore formed in the tube.

(i) Mougeotiopsis calospora Palla 1894

References: Prescott P 306, Pl. 69, Figs. 4-6

Filaments light green, long and loosely entangled. Cells short cylindric 12-14 μ in diameter, 14-18 μ long. Chloroplast broad, folded axial plate.

Rhizoclonium Kuetzing 1843

Filamentous, coarse and wiry, forming tangled floating mats or caught about submerged aquatics. Cells stout, either short- or long-cylindric. Chloroplast a parietal reticulum, often dense and difficult of interpretation.

Stigeoclonium Kuetzing 1843

A branched filament arising from a prostrate portion of a thallus, which may be reduced to a pseudoparenchymatous mass of cells. Chloroplast a parietal plate covering most of the cell wall, especially in the cells of the branches 1 to several pyrenoids.

(i) Stigeoclonium attenuatum Collins 1909

Reference: Prescott p 115 pl 13

Filaments elongate with upper branching mostly alternate, but dichotomously branched below. Cells cylindrical, diameter of cells in the main axis 5-7 μ , length 12-20 μ .

*Stigeoclonium attenuatum***(i) Rhizoclonium fontanum** Kuetzing 1843

References Prescott P 706 Pl 23, Fig. 2

Filaments coarse, crooked or straight. Cells cylindrical but with uneven lateral walls that are 1.5-2 μ thick; 12-22 μ in diameter and up to 80 μ long.

Audouinella Bory 1823

Thallus consisting of sparingly branched filaments of cylindrical cells from rhizoidal holdfasts, chromatophores discoid or plate-like bodies, without pyrenoids; reproduction by monospores.

(i) Audouinella violacea Hamel 1925

References: Prescott P 565 Pl 135, Figs. 1, 2 Filaments sparingly branched; varying in length from one cell to as long as the main filament; cells cylindrical, with 2-3 plate-like chromatophores and 8-12 μ in diameter.

Mougeotia calospora

Rhizoclonium fontanum

Audouinella violacea

Ulothrix Kuetzing 1833

Simple, unbranched filaments of cylindrical cells. Chloroplast a parietal band which extends 2/3 to 3/4 of the way around the cell. Asexual reproduction by 4-8 quadriflagellate zoospores; sexual reproduction by isogametes.

Key to species

1. Filaments long.....1.
2. Cell cylindrical.....2.
3. Cells 16-20 in diameter...*U. tenuissima*.
3. Filaments planktonic.....4.
4. Cells slightly inflated...*U. subconstricta*
- (i) *Ulothrix tenuissima* Kuetzing 1833

Ulothrix tenuissima

References: Prescott P 97 PI 67, Figs.11, 12

Filaments long, composed of cylindrical cells that are shorter than wide, 16-20μ in diameter, Chloroplast a broad band with 2 or several pyrenoids.

(ii) *Ulothrix subconstricta* G. S. West 1915

References: Prescott p 673 PI 6, Fig. 11

Filaments planktonic, composed of slightly inflated cells, Chloroplast parietal. Sometimes with a pyrenoid. Cells 5.7-9 μ in diameter, 10-36 μ long.

Ulothrix subconstricta

Chaetophora Schrank 1783

Thallus consisting of highly branched filaments arising from a prostrate palmelloid mass of cells. Chloroplast a parietal band which in the upper cells completely covers the lateral walls with 1 or more pyrenoids. Zoospores and

isogametes formed in the outer cells of the branches.

(i) *Chaetophora attenuata* Hazen 1902

References: Prescott P 118 PI 13, Figs. 4, 5

Filaments usually dichotomously branched, ending in sharply pointed,

setiferous cells; cells 5-6 μ in diameter 15-30 μ long.

Basicladia Hoffman & Tilden 1930

Thallus a coarse, erect, and attached filament with prostrate, rhizoidal portions serving as anchoring organs. Walls thick and lamellate Chloroplast a thin, sometimes dense, parietal reticulum. Sexual reproduction isogametes asexual reproduction by zoospores.

Chaetophora attenuata

Peridinium Ehrenberg 1832a

Cells globose, ovoid, or fusiform usually somewhat dorsiventrally flattened, arrangement and number of plates in the epitheca variable, usually 4 apical, 3 intercalary and 6-7 precingular plates.

(i) *Peridinium inconspicuum*

Lemmermann 1900

References: Prescott P 433 PI 90, Figs.22-24 Cells 18.5-20 μ in diameter, 22-25 μ long. Cells small, ovoid, with the apical region slightly produced and pointed, the posterior pole broadly rounded with 2 or 3 short, sharp, horn-like projections.

Peridinium inconspicuum

Entransia Elwyn Hughes 1943

Filaments with cylindrical cells and one or two laminate or parietal chromatophores extending lengthwise of the cell with several irregular finger like processes

(i) *Basicladia chelonum* Hoffmann & Tilden 1930

References: Prescott P 143 PI 23, Figs. 8-12

Frond a coarse, attached, erect filament; branching only at the base. Main filament 12-20 μ , in diameter below and up to 35 μ in diameter in the distal region. Cells cylindrical, walls thick and lamellate.

Basicladia chelonum

Chroococcus Naegeli 1849

One-celled, or an association of 2-32 spherical, hemispherical or ovate individuals, each cell with a sheath which may be distinct from or confluent with the common mucilage investing a group of cells.

(i) *Chroococcus turgidus* Naegeli 1849

References: Prescott p 450 PI. 100, Fig. 19 A free-floating colony of 2-4 ovoid or hemispherical cells inclosed by a very wide hyaline. Cells bright blue-green, 8-32 μ in diameter without sheath, 15-50 μ wide including sheath.

Chroococcus turgidus

extending outward. Each chromatophore have several scattered pyrenoids.

(i) *Entransia fimbriata* Hughes 1943

References: Transeau pl xx p121 fig 15

Filaments with cylindrical vegetative cells 19-22.4 $\mu \times$ 16-64 μ 1 or 2 parietal chromatophores.

Nodularia Mertens, in Jiirgens 1822

A sheathed filament, either solitary among other algae or forming thin expansions or tufts, cells disc-shaped or compressed spheroidal, constricted at the cross walls; gonidia spherical or disc-shaped, occurring in short series.

Entransia fimbriata

Ankistrodesmus Corda 1838

Cells acicular, crescent-shaped, or narrowly fusiform; solitary or clustered in fascicles, usually curved. Chloroplast thin, parietal plate covering most of the cell wall.

(i) **Ankistrodesmus Braunii**

References: Prescott Pl 46, Fig.8

Cells relatively broadly fusiform, lateral margins convex but irregularly. Chloroplasts 2 parietal plates. Cells 8-10 μ in diameter.

Rhoicosphenia Grunow 1860

Cell curved and cuneate in girdle view, hypovalve concave with median raphe with

Ankistrodesmus Braunii

Synedra Ehrenberg 1830

Cell narrow and much elongated, solitary or in tufted, fan shape or radiating colonies, free-floating or epiphytic, sessile or stalked.

(i) **Synedra ulna** Ehrenberg.

References: Tiffnay p 236 pic 713

(i) **Nodularia spumigena** Mertens in Jiirgens 1822

References: Prescott P 527 PI 122, Figs. 3-5

Filaments usually entangled and clustered in a loose, gelatinous mass; 8-12 μ in diameter. Cells disc-shaped, very much compressed constricted at the cross walls 6-7.8-(10) μ , in diameter, 5.6 μ long.

Nodularia spumigena

central and polar nodules; epivalve convex with median pseudoraphe both valve oblanceolate in outline with transverse striation girdle striate. Intercalary bands smooth, longitudinal septa two. Chromatophore single, often extending across the cell.

(i) **Rhoicosphenia curvata** Grunow

References: Tiffnay p 244 pic 753

Cells 4-8 $\times$ 12-75 μ curved, valves clavate, transversely striate with 12-15 striate in 10 μ ; hypovalve concave, with filamentous raphe and small central area; epivalve convex.

Rhoicosphenia curvata

Cells 5-9 $\times$ 50-350 μ , linear in girdle view, with widened extremities, solitary; valves linear to linear-lanceolate, gradually narrowed toward the ends.

Achnanthes Bory 1822

Cells somewhat rectangular and longitudinally bent or curved, generally

attached by gelatinous stalks. Chromatophores one, two or numerous and discoid.

(i) *Achnanthes lanceolata* Grunow.

References: Tiffinay p240 pic 724

Synedra ulna

Fragilaria Lyngbye 1819

Cells rectangular in girdle view, with one or two intercalary bands, without septa and costae, united into free-floating or sessile colonies, chromatophores numerous small discoid bodies or one to four laminate plates with pyrenoids.

(i) *Fragilaria virescens* Ralfs.

References: Tiffinay p234 pic 702

Cells 5-10×12-120 μ, united into long chains; valves linear, with straight to slightly convex sides, transverse striations moderately fine, parallel.

Netrium Naegeli 1849

Fragilaria virescens

Diatoma DeCandolle 1805

Cells united at the corners, free-floating or sessile, zigzag to linear chains, with one or two intercalary bands. Chromatophores numerous, ellipsoid. Auxospores formed singly within the cells.

(i) *Diatoma hiemale* Heiberg.

References: Tiffinay p230 pic 684. Cells 7-13 × 30-100 μ, united into closed chains,

Cells 4-10×8-40μ; valves elliptic-lanceolate, with transverse striation 13-17 in 10μ; hypo-valve with pronounced thread-like raphe, with central area broad rectangular; with a U-shaped spot on one side.

Achnanthes lanceolata

Cells large, length at least 3 times diameter, straight, cylindric, oblong cylindric without a median constriction. Cell-wall smooth without pores, and consisting of a homogenous inner layer of cellulose and an outer layer of pectose. Chromatophores 2 in each semi cell.

(i) *Netrium digitus* Itzigsohn and Roth.

References: Tiffinay p166 pic 534

Cells 32-100×130-187 μ (apices 12.5-40.0 μ), 3-5 time longer than the diameter, not constricted. Chromatophore axial, with 5-8 radiating plates deeply serrate at margins. Cell-wall smooth. Zygote spherical, smooth, thick-walled, 73-74 μ in diameter.

Netrium digitus

with numerous intercalary bands, transverse striation 18-20 in 10 μ.

Neidium Pfitzer 1871

Cells usually solitary and free-floating, rectangular in girdle view and without girdle bands; two longitudinally incised chromatophores, each with a pyrenoid. Two auxospores formed by the conjugation of two approximated cells.

(i) *Neidium amphigomphus* Pfitzer.

References: Tiffinay p262 pic 818

Cells 12-40 × 90-150μ valves broadly linear, with cuneate rounded ends; axial

Diatoma hiemale

Gomphonema C. A. Agardh 1824

Cells usually epiphytic on the ends of dichotomously branched gelatinous stalks, sometime sessile, sometimes solitary and free-floating. Chromatophores single, lobed plate, usually with a single pyrenoid. Auxospore formed in pair between two conjugating cells.

(i) *Gomphonema sphaerophorum*

Ehrenberg.

References: Tiffinay p272 pic 847

Cells 7-10 × 30-47μ valves elliptic-clavate, sharply narrowing toward a rounded and slightly capitate basal pole and with a much wider knob-like apical pole, axial area

Gomphonema sphaerophorum

Authors' contributions

Conceived and designed the experiments: S Zaib & T Yaseen, Performed the experiments: S Zaib, Analyzed the data: FM Sarim, Contributed reagents/ materials/ analysis tools: M Shakeel & HA Bagum, Wrote the paper: T Yaseen & S Zaib

area narrow central area small, quadrately oval, striation parallel.

Neidium amphigomphus

narrow, linear, central area small, with a dot at one side.

Mougeotia Wittrock 1872

Unattached filaments of cylindrical cells without basal-distal differentiation. Conjugation usually scalariform, the zygospore formed in the tube between the gametangia.

(i) *Mougeotia scalaris* Hassall 1842

References: Prescott PI 71, Figs. 6, 7

Vegetative cells 20-27-(34) μ in diameter, 40-180μ long; chloroplast a broad plate with 4 pyrenoids. Zygospores formed in the tube by scalariform conjugation, walls smooth 25-31μ in diameter, 27-40μ long.

Mougeotia scalaris

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