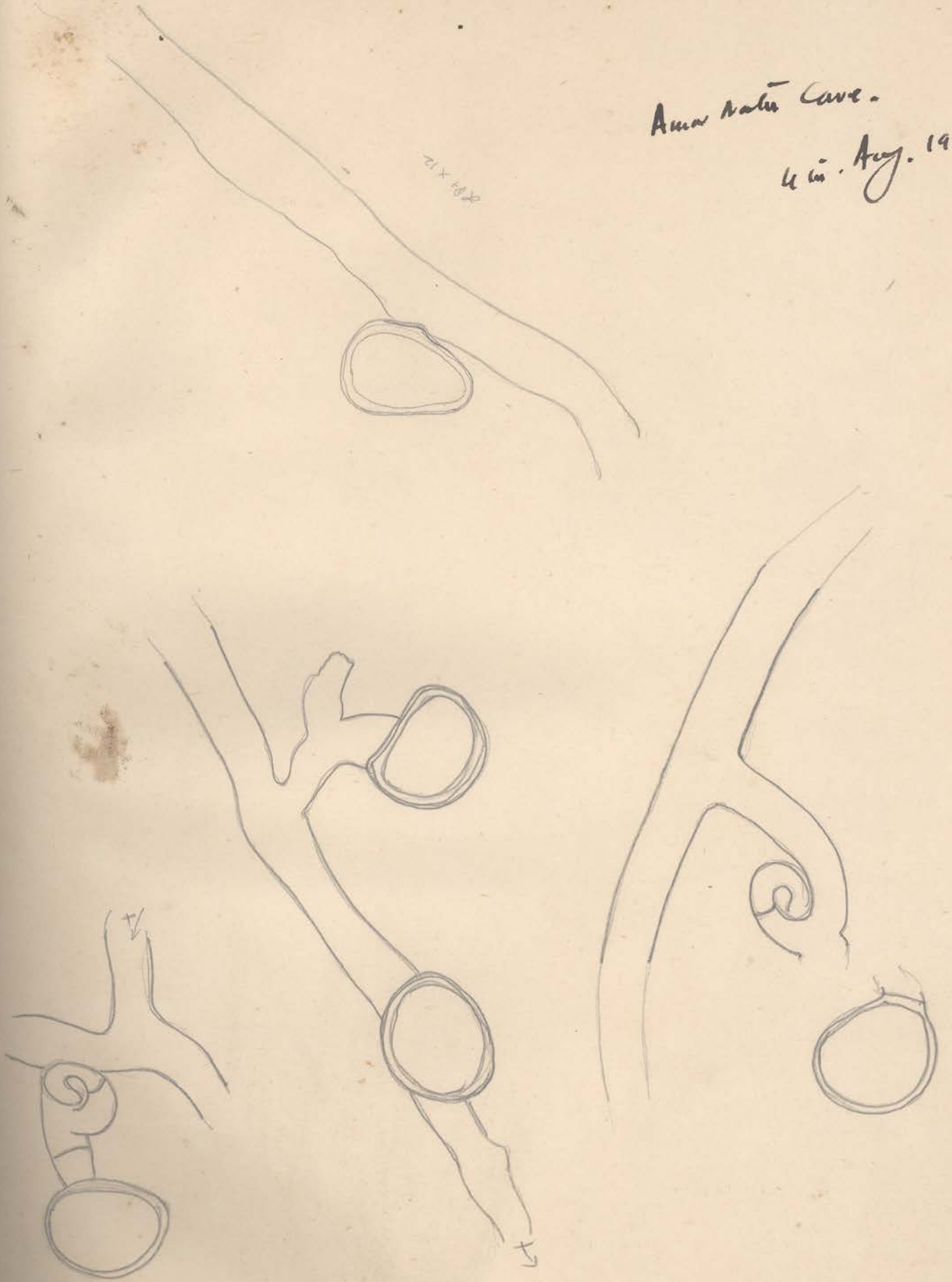
Vaucheria terrestris

Ama Natū Cave.

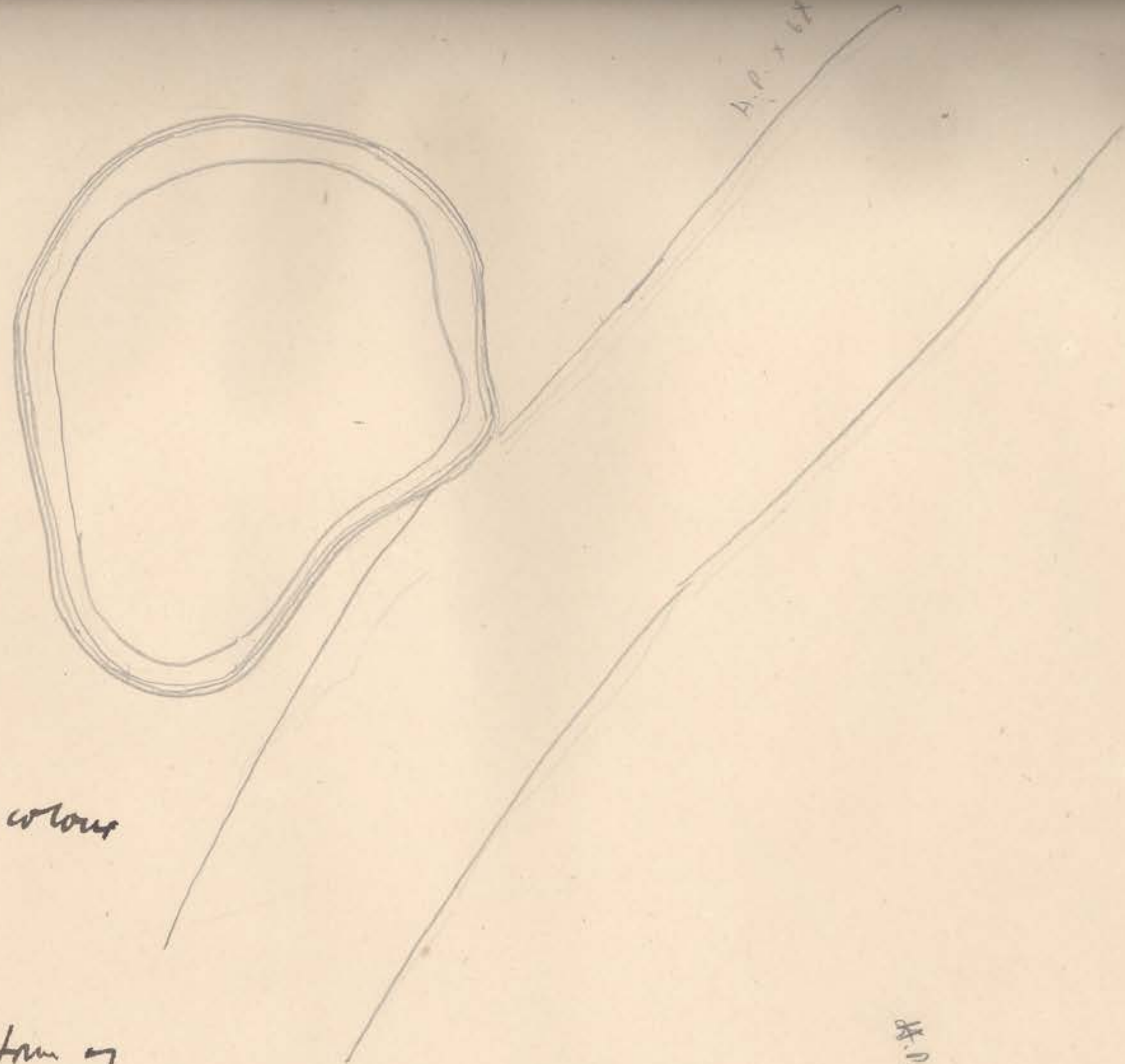
4 Aug. 1941



Vaucheria terrestris.

Anaa Natu Cave.

4.8.41



Spores are black in colour
& are quite abundant.

Habit.

Found in the form of
a yellowish green felt-like patches
(woolly) in Anaa Natu cave
filaments which had many
branches had developed big
crops of oospores. Water dripping
from above.

4th. August 41

Vaucheria terrestris

Amar Nath Cave - terrestris

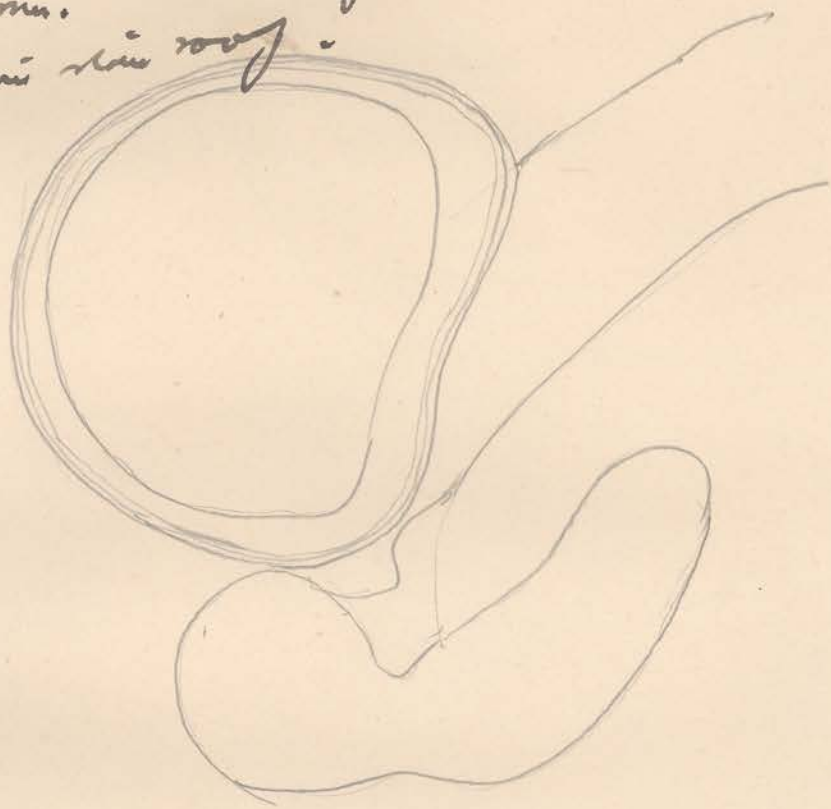
12,730 feet above sea level.

Amar Nath Cave

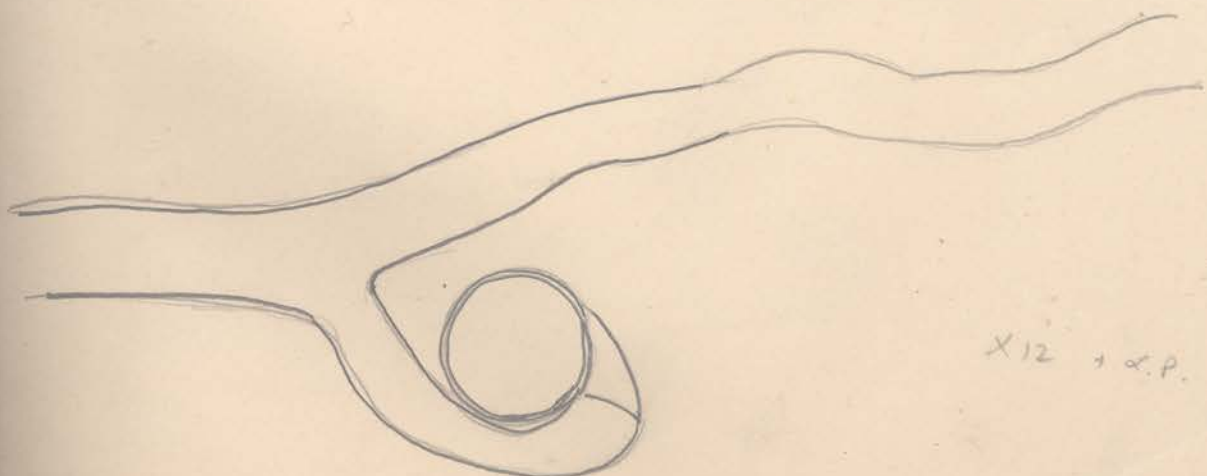
4.9.41

150 feet deep & wide

Algae, just below the wooden platform. Wet trickly from the rock roof.



A.P. × 6X



× 12 + A.P.

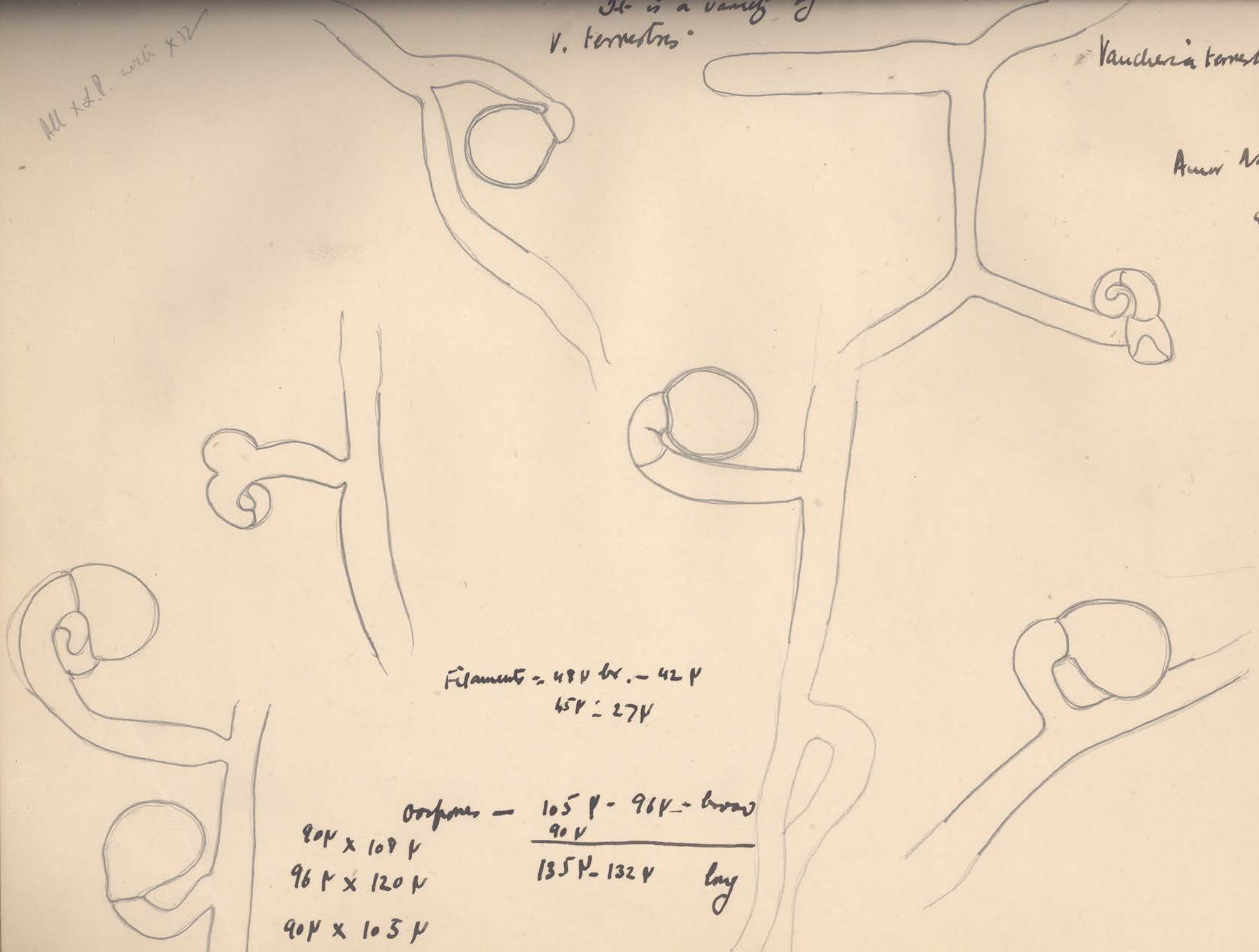
All x-l. units x 12

V. terrestris.

Vaucheria terrestris.

Amer Nat Case

4 - P. 4,



Filament = 48 μ br. - 42 μ
45 μ = 27 μ

Oospore — 105 μ - 96 μ = brown
90 μ

135 μ - 132 μ long

90 μ x 108 μ
96 μ x 120 μ
90 μ x 105 μ

Ulothrix

Key to the species.

I Cells up to 10μ thick, chromatophores mostly
one pyrenoid.

1. Cells up to 5 μ thick.

A. Cells 4–5 μ thick. 1. U. subtili

B. Cells 2–4 μ thick. 2. U. limneti

2. Cells 5–10 μ thick.

A. Gelatinous ~~cover~~ sheath interlaced with strands
standing vertically to the long axis of the
cells. Filaments provided with a
gelatinous foot . . . 3. U. muco

B. Gelatinous sheath lamellate. Filam
possessing a toothed basal cell.

Cells 5–7 μ thick. ... 4. U. varia

Cells 7–10 μ thick ... 5. U. tenerri

II. Cells more than 10 μ thick, chromatophores ~~with~~
mostly with 2 to several pyrenoids.

1. Membrane frail (delicate).

A. Cells 10–14 μ thick. . . 6. U. oscillar

B. Cells 15–28 μ thick ... 7. U. tenuissi

2. Membrane thick, often clearly lamellate.

A. Filaments generally already in the vegetative condi
slightly constricted, 9–14 μ thick. 8. U. moniliform

B. Filaments mostly only during ~~zoo~~spore formation constricte
cells 13–16 (–18) μ thick, 1–2 times as
long . . . . . 9. U. aequal

C. Filaments of varying form, 11–72 μ thick, mostly
30–40 μ thick ... . . . 10. U. zonata

Ulothrix

Key to the species.

Cells up to 10μ thick, chromatophores mostly with one pyrenoid.

1. Cells up to 5 μ thick.
   - A. cells 4–5 μ thick. 1. U. subtilissima
   - B. cells 2–4 μ thick. 2. U. limnetica

2. Cells 5–10 μ thick.
   - A. Gelatinous sheath interlaced with strands standing vertically to the long axis of the cells. Filaments provided with a gelatinous foot . . . 3. U. mucosa
   - B. Gelatinous sheath lamellate. Filaments possessing a toothed basal cell.
     - Cells 5–7 μ thick. . . . 4. U. variabilis
     - Cells 7–10 μ thick . . . 5. U. tenerrima

Cells more than 10 μ thick, chromatophores mostly with 2 to several pyrenoids.

1. Membrane frail (delicate).
   - A. Cells 10–14 μ thick. . . 6. U. oscillarina
   - B. Cells 15–28 μ thick . . . 7. U. tenuissima

2. Membrane thick, often clearly lamellate.
   - A. Filaments generally already in the vegetative condition slightly constricted, 9–14 μ thick. 8. U. moniliformis
   - B. Filaments mostly only during zoospore formation constricted, cells 13–16 (–18) μ thick, 1–2 times as long . . . . . 9. U. aequalis
   - C. Filaments of varying form, 11–72 μ thick, mostly 30–40 μ thick . . . . . 10. U. zonata

Enteromorpha

Key to the species

I. Thallus consisting only of 1-4 cell rows, which form a completely closed filament.. 1. E. percursa.

II. Thallus tubular.

1. Thallus in the older parts with irregularly arranged cells.

A. Branched, branches constricted at the base ..... 2. E. compressa

B. Single or with ~~little~~ few branches.

a. Cells up to 16 μ thick. 3. E. intestinalis

b. Cells 4-5 μ thick. 4. E. micrococca

2. Thallus in the greater parts consisting of row-wise arranged cells.

A. Thallus single, uniformly thick rarely branched. ... 5. E. tubulosa

B. Thallus richly branched.

a. Branches thick. .. 6. E. prolifera

b. Branches mostly consisting of only 1-2 cell rows. 7. E. salina

Prasiola

Key to the species.

Thallus with the base not stitched together. 1- and 2-rowed condition very frequent . . . . 1. P. crispa

Thallus with a stalk or the whole base stitched together.

1. Thallus broad, a few mm. long. 2. P. furfuracea

2. Thallus narrow.

A. Thallus up to 2 cm. long, on stones, aerial algae. 3. P. calophylla

B. Thallus 2–11 cm. long, on stones in cold springs and streams. 4. P. fluviatilis

Prasiola fluviatilis. Thallus without clear axis gaining in breadth gradually from below, rarely strongly expanded above. The largest observed thallus was 11 cm. long, 3½ mm. broad. The broadest form measured 6.75 cm. The apex of the narrower thalli is mostly rounded, that of the broader obtuse or wavy. Cells in the lower part in rows, above in 'Feldern' — in cold springs and streams of the Alps and in the Tara

Microspora.

(Key to the species).

I. The H-shaped structure of the membrane in the vegetative condition hardly noticeable. Membrane thin.

1. Chromatophore invested with a granular coat without clear refraction .. Cells less than 1 μ thick.

A. Filaments cylindrical. Cells similar or half as long as broad; cells generally 6.5 μ thick.

1. M. quadrata

B. Filaments slightly constricted. Cells 1-2 times as long as broad; cells generally 7.5 μ thick. . . . . 2. M. tumidula

C. Filaments cylindrical. Cells 1-4 times as long as thick. Chromatophore covering a really smaller part of the cell wall than in the preceding species. . . 3. M. stagnorum.

2. Chromatophore often perforated or consisting of rose-garland-shaped bands. Cells 10-18 μ thick.

A. Cells 11-16 μ thick, Akinetes 14-18 μ thick.

4. M. Willeana

B. Cells 14-18 μ thick, Akinetes 18-22 μ thick.

5. M. floccosa.

II. The H-shaped structure of the membrane appears often clearly already in the vegetative condition. Cell wall as a rule thick, chromatophore mostly clearly reticulately perforated or band-shaped.

1. Cells 8-12 μ thick.

A. Cells at the most as long as broad. Filaments bent backwards and forwards.

6. M. Lauterborni

B. Cells 1-2 times as long as broad. Filaments straight - - - -

7. M. pachyderma

2. Cells 12-20 μ thick.

A. Filaments hardly constricted at the transverse walls, often with iron incrustation. Cells 12-18 μ thick, 1-3 times as long.

8. M. rufescens

B. Filaments slightly or clearly constricted at the transverse walls.

a. Cells 14-15 μ thick, 2-3 times as long.

9. M. elegans

b. Cells (13-) 16-20 μ thick, $\frac{3}{4}$-2 times as long.

10. M. Loefgrenii

3. Cells mostly over 20 μ thick.

A. Cells 12-24 μ thick, cellwall ca. 1.5 μ thick

11. M. Wittrockii

B. Cells 20-60 μ thick, cellwall 2.5-8 μ thick.

a. cells 20-25 μ thick. 12. M. amoena

b. Cells (25-) 28-33 μ thick. 13. M. crassior

c. Cells 30-60 μ thick. 14. M. subsetacea

II

Vandera sessili collected from cave. eiin vaults at Vairnag on 22. 8. 41.

III Vandera polyandra collected from air rids of Chambal river below Pinahat in Agra district on 18th. Jan. 1941

———— • ————

Binuclearia tatrana

Keratinella kashmiriana.

1. Ulothrix oscillarina.

2. U. zonata

3. U. subtilissima — Almora

4. U. tenerrima — Agra.

5. U. tenuissima — sulphur spring Kashmir

Schizomeris

1. S. irregularis — Kashmir & Punjab

Microspora
1. M. indica
2. M. torrulosa

1. Enteromorpha
2. lanceolata . .
flavidulus

Gemmella
1. G. interrupta

Ulothrix tenerrima Kutz.

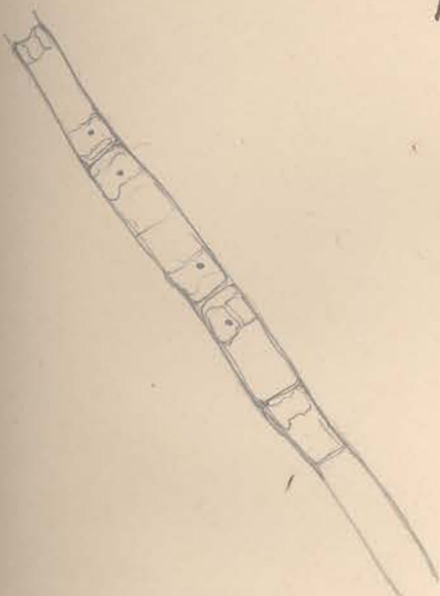
from Jumna river
near Baleshwar – Agra.
January 1941

Cells – 9 μ broad – 8–10 μ

Chloroplasts

Each chloroplast with one pyrenoid only.

Formation of zoospores.



— ∘ —

Ulothrix subtilissima

From a dripping rock at Almora 5. 8. 1939.

Single pyrenoid – cells 5 μ broad.

— ∘ —

Ulothrix tenuissima Kutz.

Sulphur springs. Anant-Nag Kashmir, – 23. 8. 41
Membrane thin, not lamellate
15 μ broad — 18 μ broad
[illegible]

Schizomeris irregularis -
Fritsch & Rich.

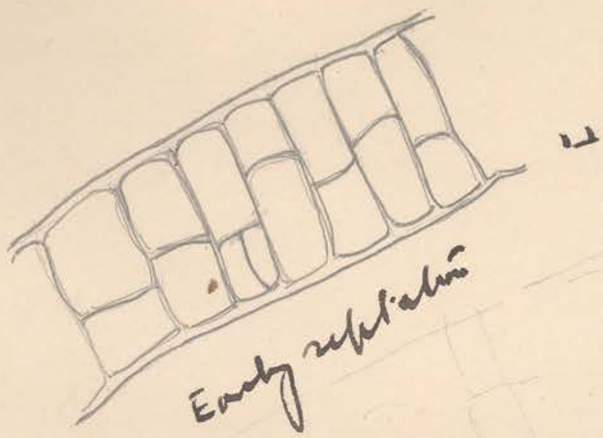
From Vericky stream, source of
gladden [illegible]

22 - 8 - 41

15 ~ 16 = ~~X660~~ X630

14 = X210

X33



Early septation

2 X ~~1000~~ 500 / 42

X660
220

Resembles more S. irregularis
1. Irregular septation of [illegible]
2. Fragmentation
3. Size -
Much [illegible] - [illegible]
bigger.
In Eyles 21 - 37 μ broad
In this 30 - 60 μ.

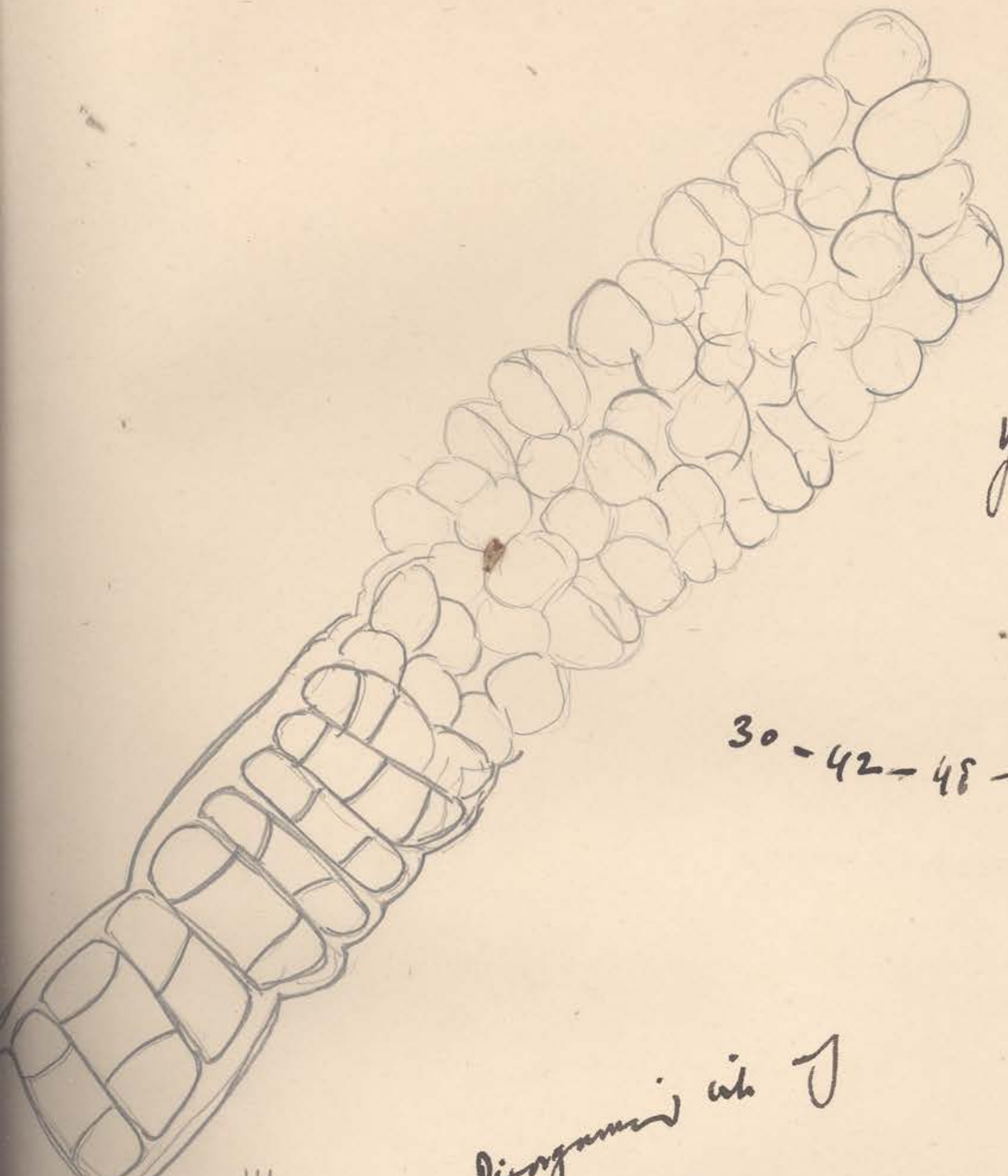
660

13 - 48 32000 / 288 660 320 / 288 3.20

48 μ broad.
annular chloroplast -

Ist is a broad variety
of S. irregularis -

Schizomeris irregularis



14.

X620

Young filaments resemble those of Ulothrix.

30 – 42 – 48 – 45 – 57 μ – 60 μ

Thallus dark green

Dissogamie in [illegible] a thallus

51 / 32000 (627
306
140
102
38

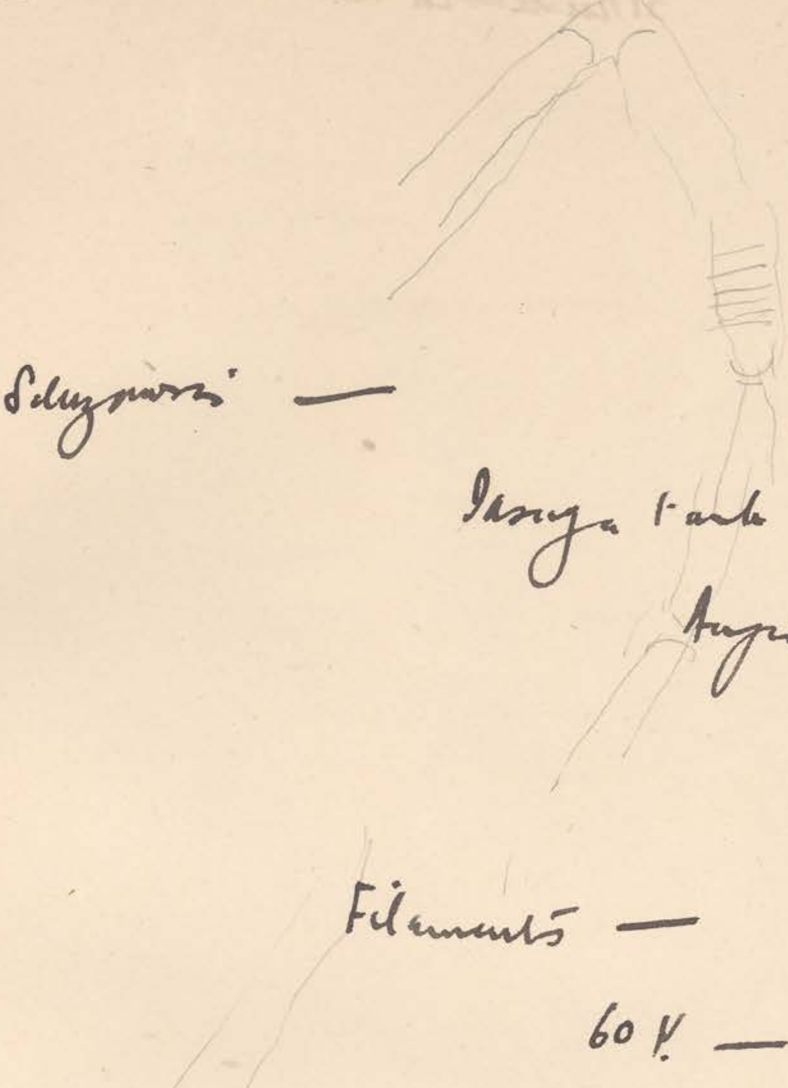
Constrictions in the thallus.

Thallus — 51 μ broad.

Outer cell wall – 3 μ broad.

hyaline.

Thallus divided into 3–4 cell layers.



Schizoporri —

Dasoga tank

August 1929.

Filaments —

60 V. — 66 V —

Lower part — 40 V brown.

Binuclearia tatrana Wittrock.

cells 9 μ broad

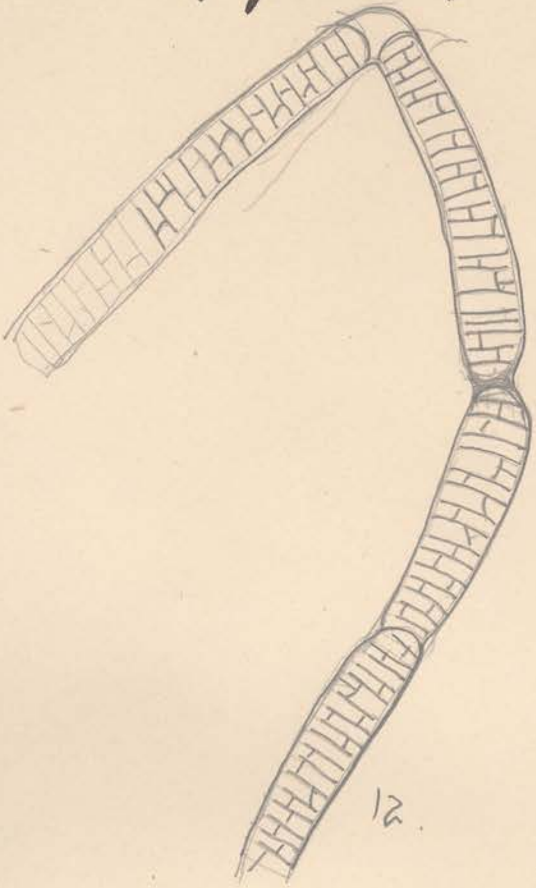
9–12 μ long

Collected from the bog in front of Dhakuri bungalow, altitude 8500 feet above sea level. mid Sept. 1932

-///

Schizomeris irregularis

Constriction & very fragmentation.



12

x120

Septation is irregular

Microspora indica

Cells — 18μ broad. – 21μ.

15–18 = 21μ – long.

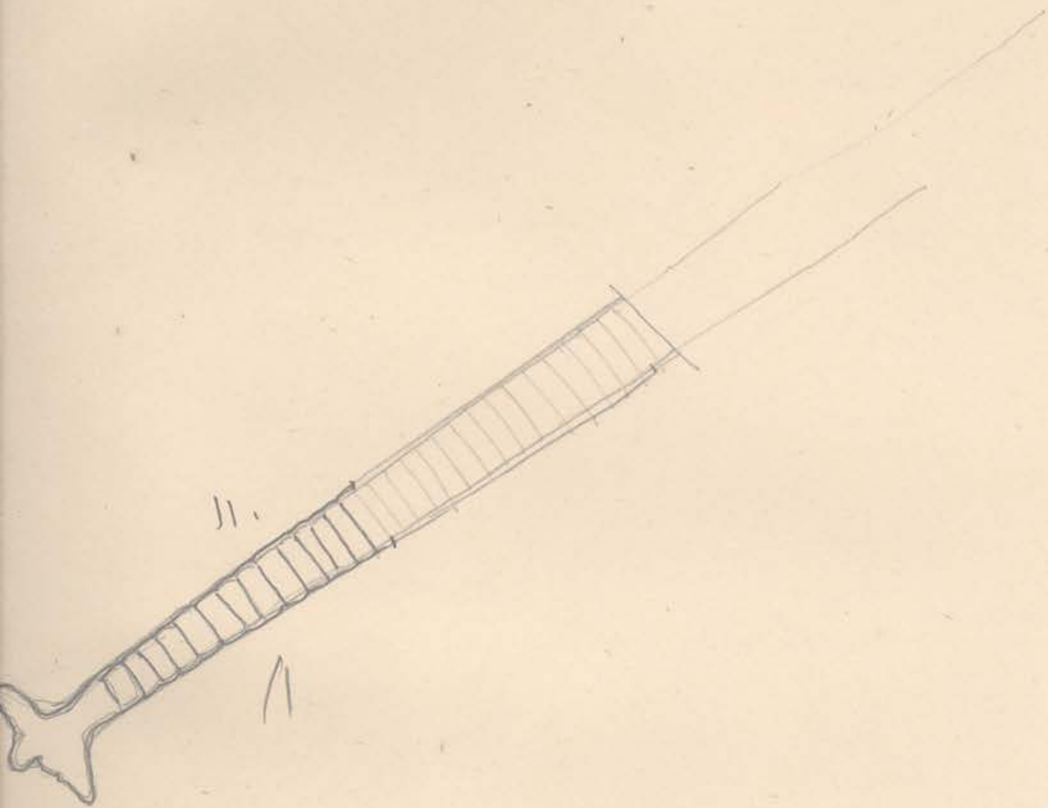
Jhil Lachhan Sarovar.

Tehsil Bangna...

Allahabad

Schizomeris from Domiya.

S. irregularis



Basal cell is usually hyaline

Same cells — 78 µ long

Lower part of the [illegible] was [illegible] layers of cells, layer of ring became septate

Lower cells with collar. [illegible] Chloroplasts

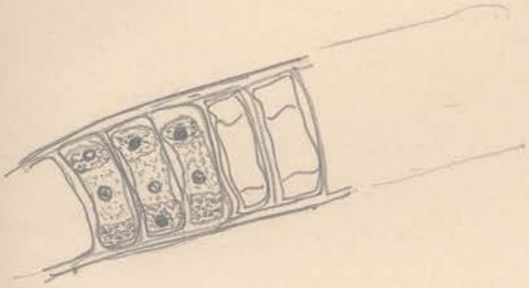
7) 4 × 4000 (

15 × 30 µ

Ulothrix gracilis   ) 4000

from sulphur spring Anantnag

23. 8. 41



18 × 1000 / 36.2   27) 1000 (524

Cells 33 µ broad – 36 µ broad

9 – 12 µ long

130   × 500

16) 8 × 8000 (5

6 × 6000 / 8   40 8   740

8) 6000 (750

Ulothrix tenuissima.

Anant-Nag.

4 × 1000 / 48

Cells 18 µ broad

12 – 15 µ long.

Each chloroplast having

2 – 3 pyrenoids.

2 µ = 2 cms

10   × 500

18) 10000 (55

Alga from Lidder river

Pearsoniella kashmiriensis

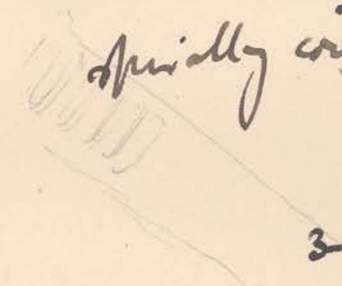
new species

Filaments — 18µ broad

Sheath — mucilaginous, 3µ broad

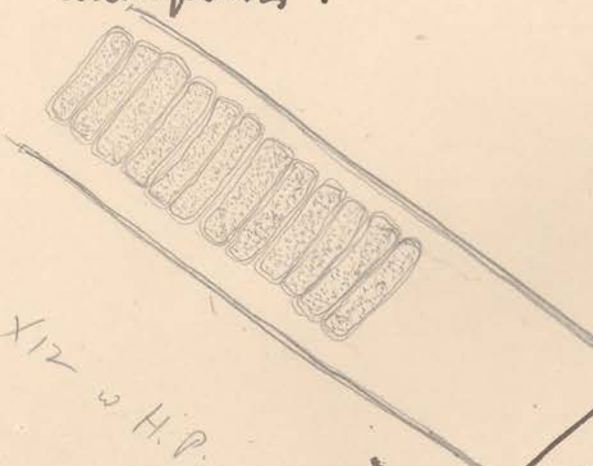
Cells — 18µ x 4µ

Chloroplasts in bars. Filaments are spirally coiled.



3-4µ broad.

Stain with iodine for the study of chloroplasts.



X12 w H.P.

surface film lining the inside of an old wooden well tub, Maritzburg, South Africa.

Pearsoniella variabilis — filaments 21-35µ broad.

Differences :— 1. Much narrower filaments

2. Chloroplasts annular, no lobing seen.

3. Thick mucilaginous sheath, no lamellation

4. Growing in a torrential alpine stream with a nodular thallus.

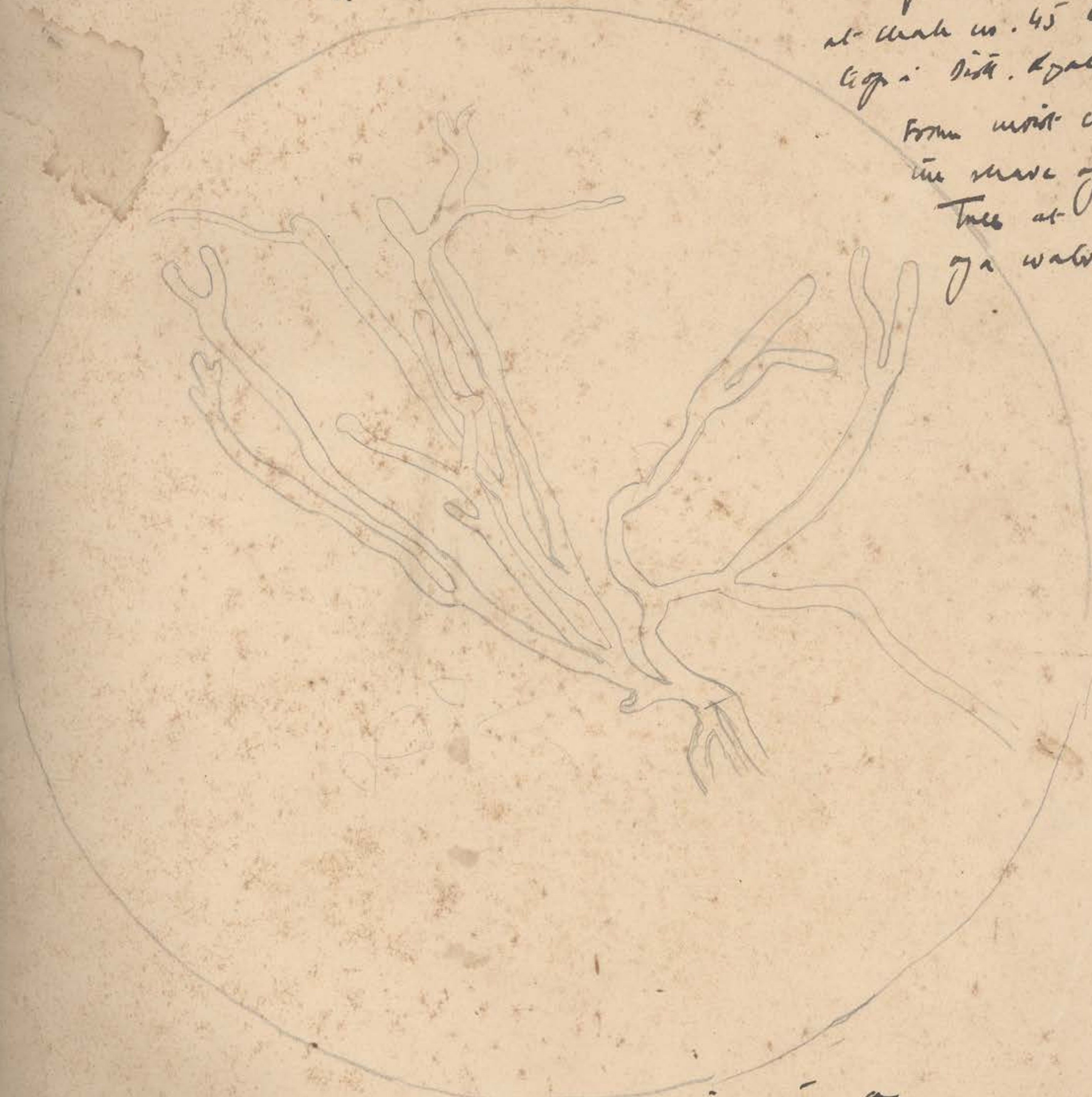
Vaucheria geminata (Vauch.) De Candolle

var. longistipitata. Chapman. 1939.

Dec. 39 & Dec. 40

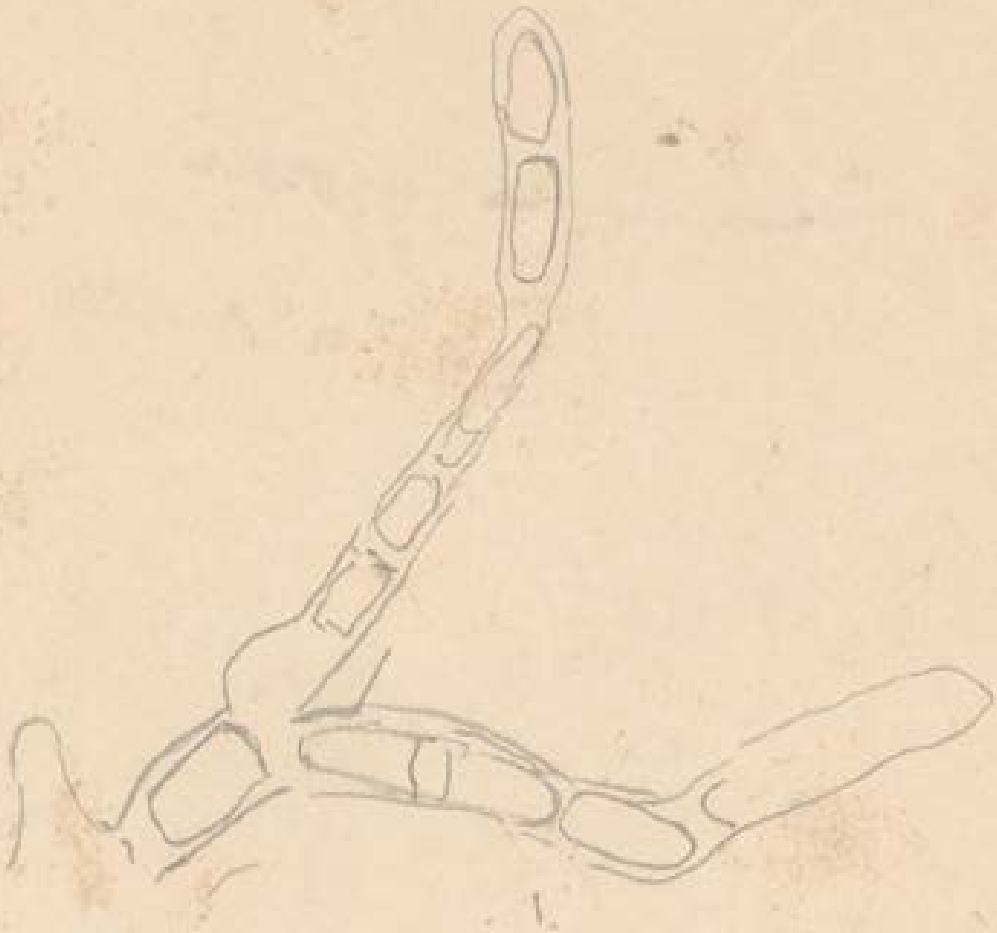
1. Habit

Garden of Dr. Hoolahmayan Iyer: at Street no. 45 C.B. near Agri. Dist. Agallamma by... From moist clay under the shade of orange trees at the side of a water-course.



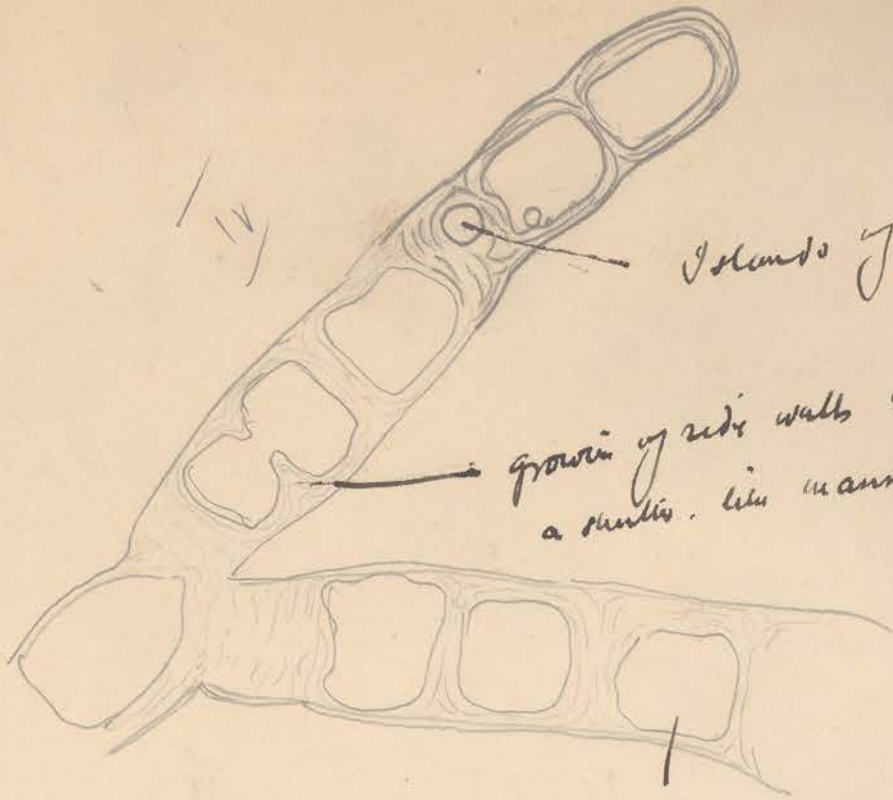
Intense dichotomous branching with a radial distribution.

Sex organs very rarely found. Usually borne at the ends of long branches.



Akineti · formation v. geminata v. longipitata.

IV

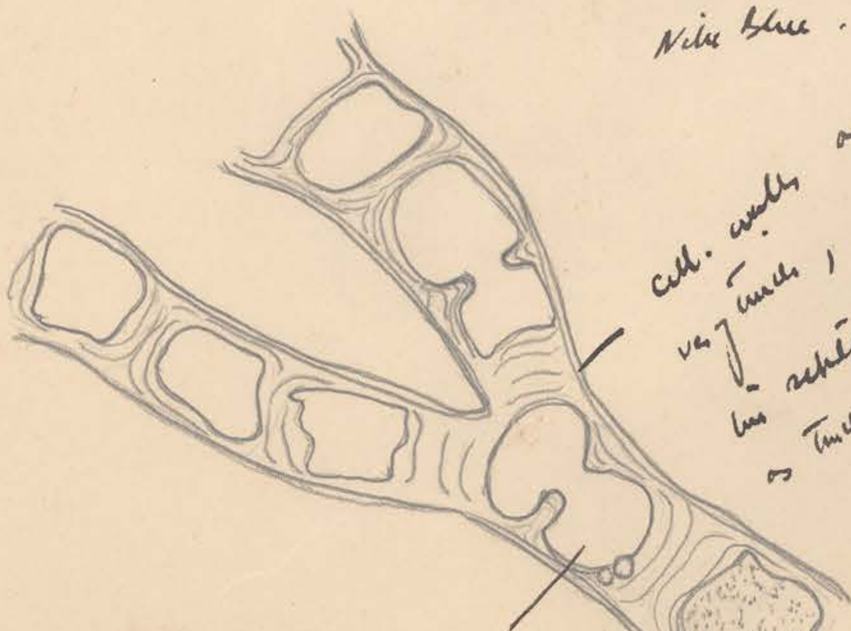


Islands of protoplasm left

growth of side walls in a similar like manner.

Cysts are rich in oil contents and some have a frothy appearance. Contents stain deep blue with Nile blue.

III

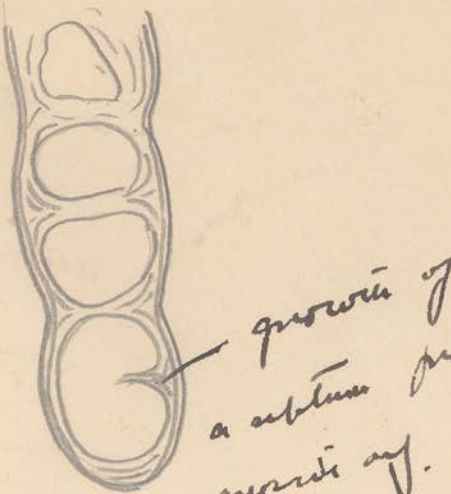


cell. walls are very thick, the cysts are twice as thick as the cellwalls.

Stahl has shown the cysts alone surrounded by thick walls

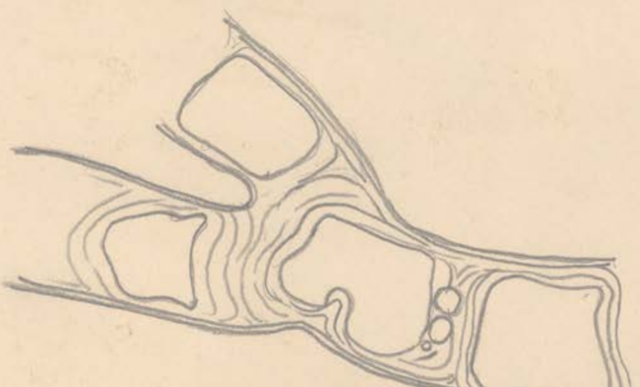
A later stage in the growing of cysts. appearing double cell. deepened

VII

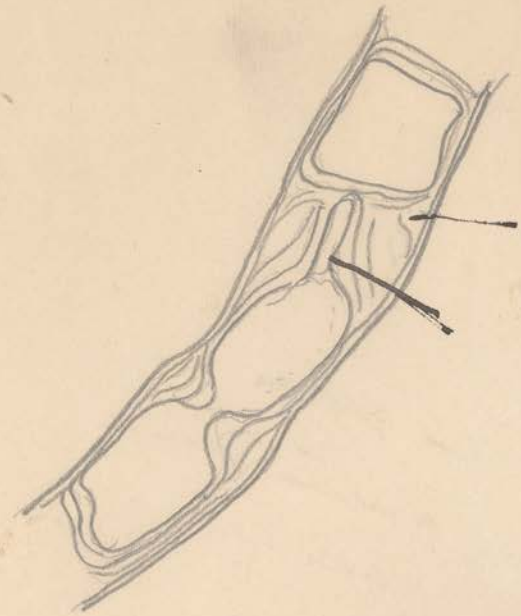


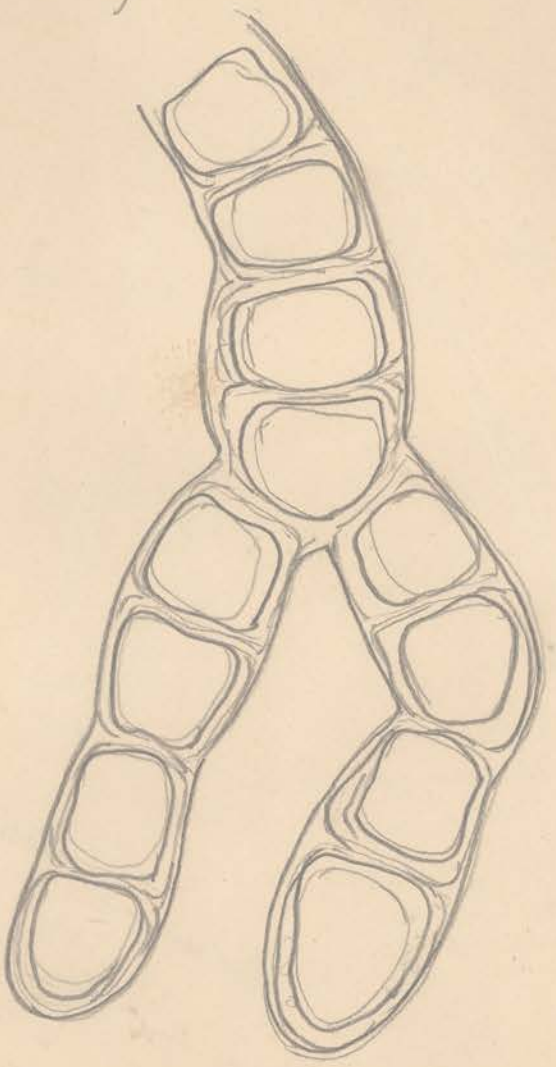
VII

IV



II



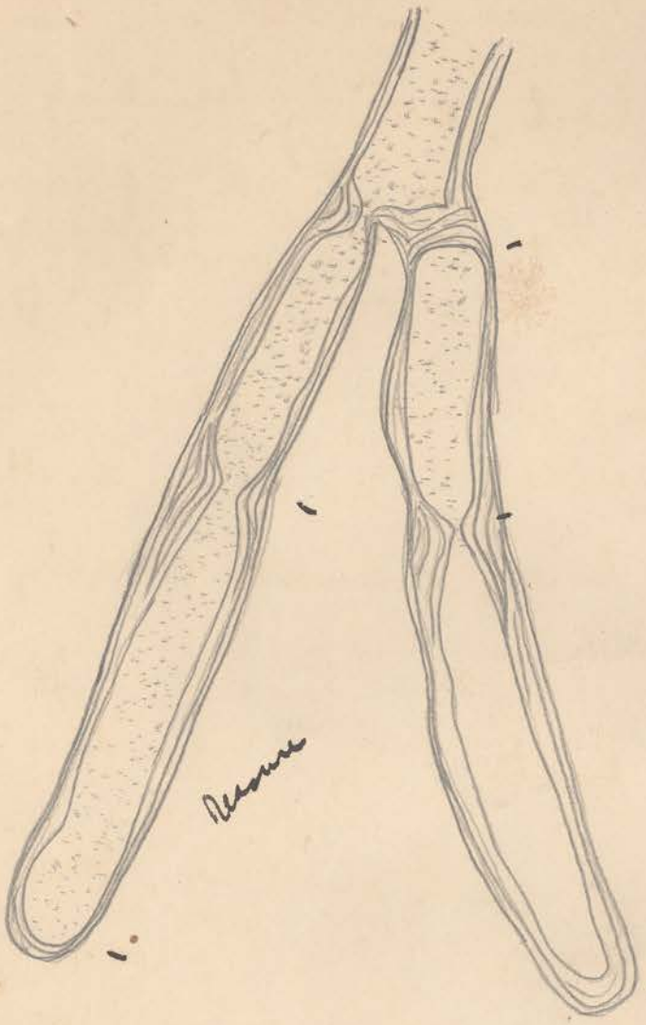


Coenocytic condition is derivable from cellular condition. Others view that cellulars (Vaucheria) are derived from cellular form like Cladophora by a gradual loss of the lower of cells.

This replacement is remnant of Vaucheria

Vaucheria geminata
var. longistipitata

Gopri
Dec. 1940.



I

Key to the Species of Hormidium

I. Aerial algae, rarely in water. Section Euhor

1. Filaments short, easily breaking.
   A. Cells 2.5-3 μ thick, filaments const
      cellwall thin, pyrenoids fainly
      visible ..... 1. H. pseudostich
   B. Cells 7-8 μ thick, cell wall as a rule thick
      pyrenoids clear .... 2. H. dissectu
2. Filaments long, cellwall generally thin, cell
   5-14 μ thick ..... 3. H. flacci

II. Water inhabitants. ... Section Pseudulo

1. Filaments short, easily breaking, forming a sl
   rasig cover ... 4. H. fluitan
2. Filaments long, not fragile.
   A. In standing or drifting water, rarel
      branched-like formation .. 5. H. s
   B. In rapidly moving water, branched
      formations frequent .. 6. H. ri

Key to the Species of Hormidium

Aerial algae, rarely in water. Section Euhormidium

1. Filaments short, easily breaking.
   A. Cells 2.5-3 μ thick, filaments constricted, cellwall thin, pyrenoids fainly visible ..... 1. H. pseudostichococcus
   B. Cells 7-8 μ thick, cell wall as a rule thick, pyrenoids clear .... 2. H. dissectum.
2. Filaments long, cellwall generally thin, cells 5-14 μ thick ..... 3. H. flaccidum

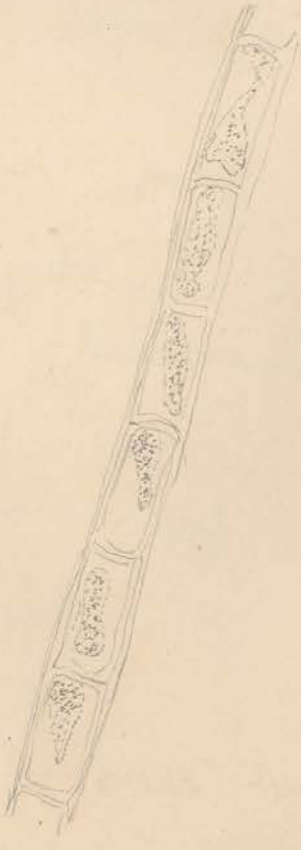
Water inhabitants. .... Section Pseudulothrix

1. Filaments short, easily breaking, forming a short-rasig cover ... 4. H. fluitans
2. Filaments long, not fragile.
   A. In standing or drifting water, rarely branched-like formation .. 5. H. subtile
   B. In rapidly moving water, branched-like formatins frequent .. 6. H. rivulare.

Hormidium flaccidum.

Hormidium flaccidum Kütz.

Autobleb.



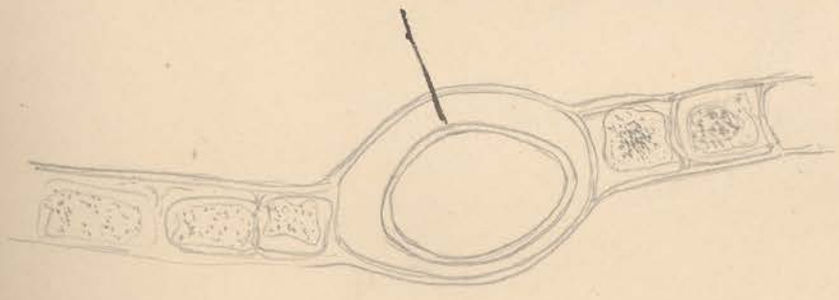
Hormidium from Busir v. Uganda

Hormidium flaccidum. A. Br.

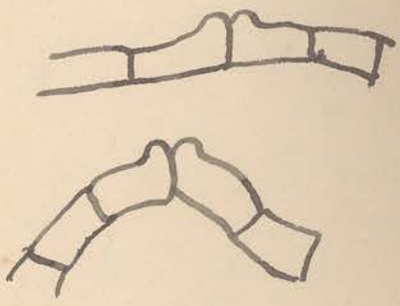
forma montana

(= Hormiscia flaccida Lagh.

var. montana Hansg.



Knee-shaped bends are also seen.



Nearest species is Hormidium flaccidum.

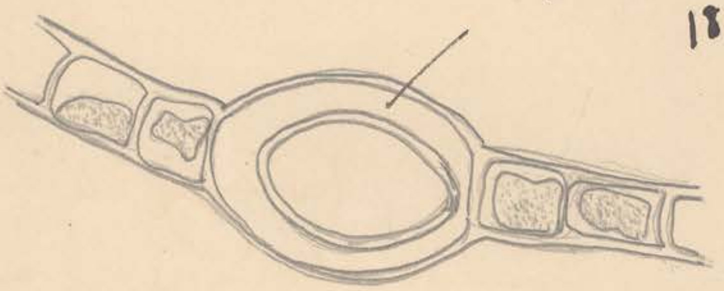
Hormidium flaccidum

In its soil becomes pale yellowish green and filaments with light yellowish green cells are almost hyaline seen.

Cells 9μ broad
6–70μ long.

A filamentous, shows chloroplasts, each with a conspicuous pyrenoid — Ganandi. Chloroplasts with irregular outline.

Hormidium



Abnormally enlarged cells with content rounded off often seen. In some the content form spore-like bodies.

Chloroplast — is in the form of a half-girdle, sometimes with one pyrenoid. Very often no pyrenoid is seen.

The material from Ganandi shows a conspicuous pyrenoid in each chloroplast.

Baiwa — 7800 feet.
Ganandi — 6000 feet.

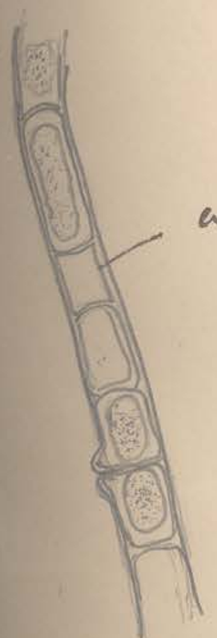
Hormidium from Banihal

Hormidium flaccidum forma montana.

Cells are rectangular or squarish in outline.

Cells — 6-7 μ - 9 μ broad

7 - 9 - 15 μ, long



Many empty cells are seen, probably on account of the escape of motile swarmers. Sometimes rows of empty cells are seen.

Cell-wall thick, mucilaginous.

No specialised rhizoids.

Fragmentation by decay of inter[illegible] cells is common.

Collected from Banihal and Lanarastr from an altitude of 6000- above sea-level in September 1938. Surface clayey soil.

Also collected from near Srinagar (Pahalgam) Kashmir on clay soil on 30. 7. 1941

Geminella Turpin

Key to the species.

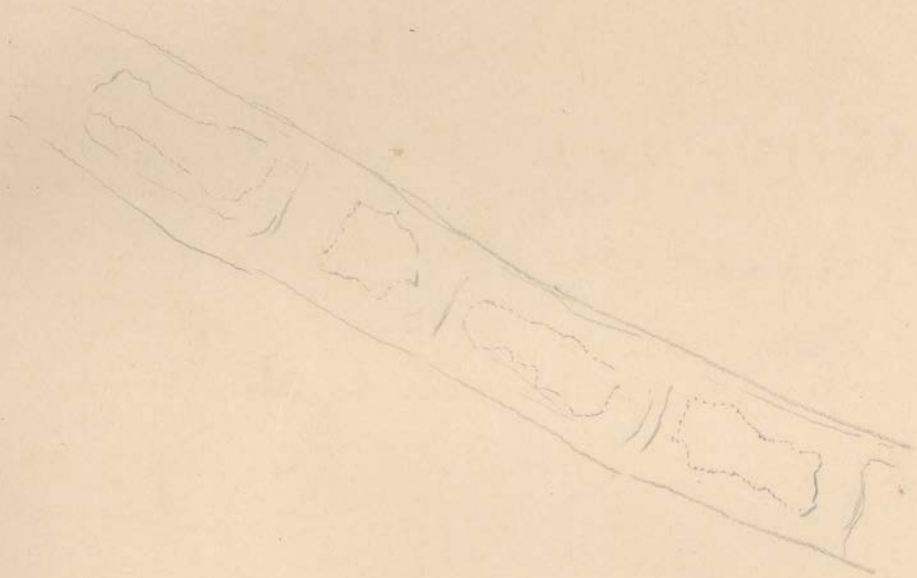
I. Cells clearly separated from one another mostly two close together, ~~+~~ (in pairs), ~~4~~ 4.7-8 μ thick ... 1. G. interrupta

II. Cells mostly placed together.

1. Cells 12-20 μ thick. 2. G. mutabilis

2. Cells 2-10 μ thick. 3. G. minor.

III. Cells clearly separated, at a uniform distance .... 4. G. ordinata

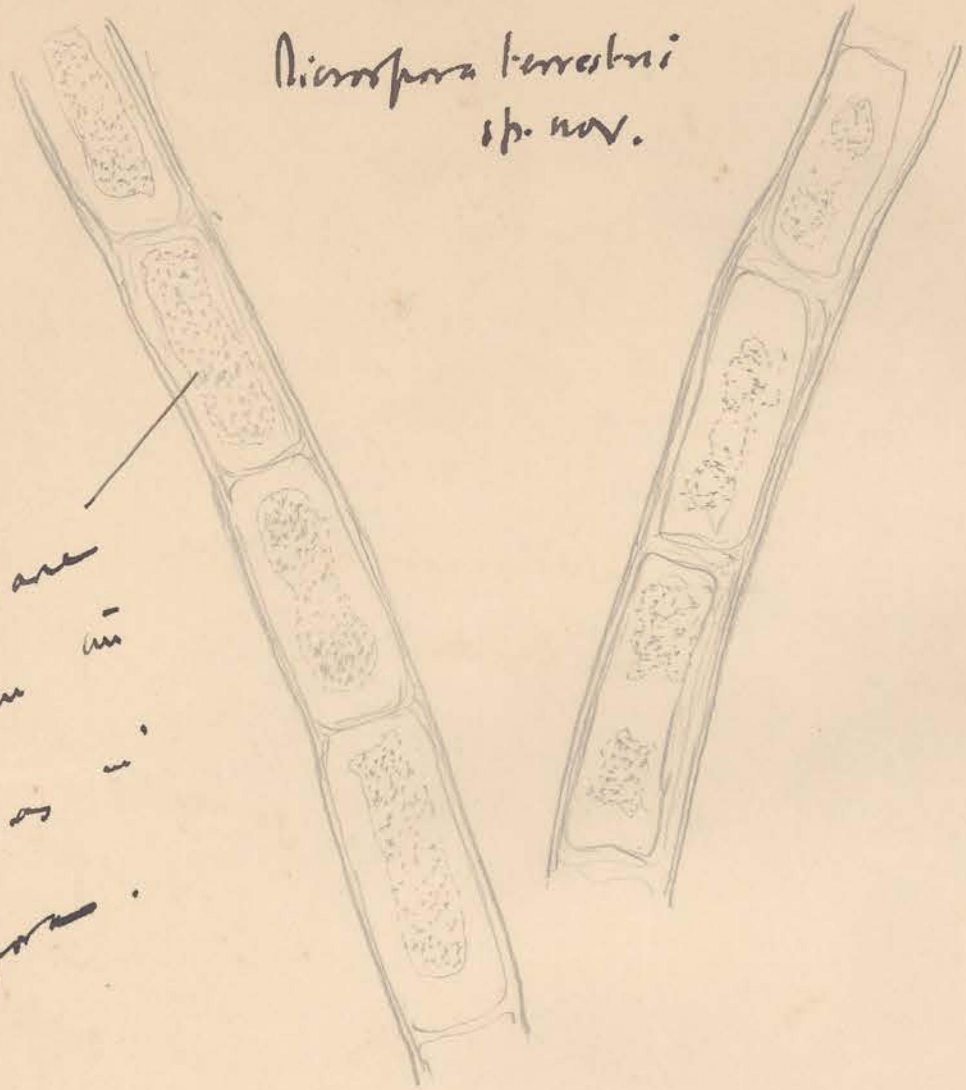


Chloroplasts of alga from Bhandari house.

Dense at the holes, loosely fo

x1000.

Microspora terrestris sp. nov.



Pyrenoids are lacking from the chloroplasts as in Microspora.

Resembles M. floccosa in which cells are 14–18μ broad, and there is no clear formation of H-shaped pieces.

Differs in narrower filaments, and cells longer. terrestrial habit. structure of chloroplasts

Find out the thickness of cell-walls.

H-shaped structures not clear.

Lamellate cell-wall

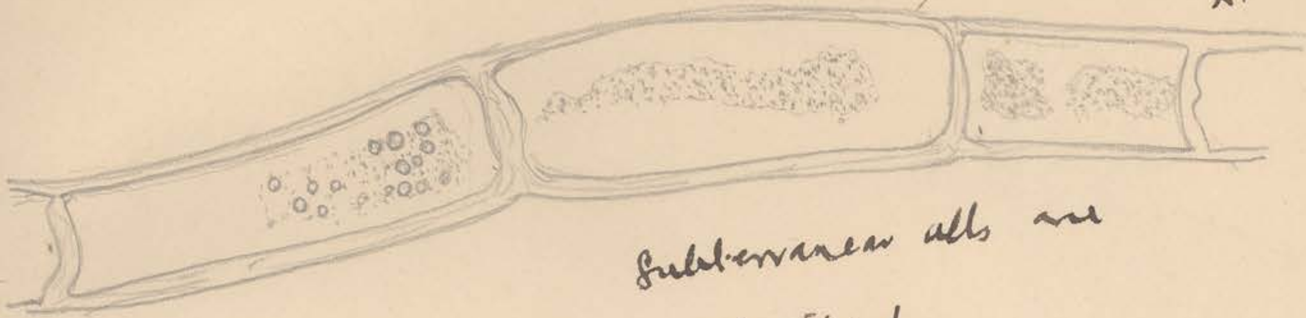
No akinetes seen.

Alga from Brandon House.

N. terrestris. sp. nov

walls, much striated.

X1000.



Subterranean cells are very much lengthened.

Cell-wall = 2-3μ thick

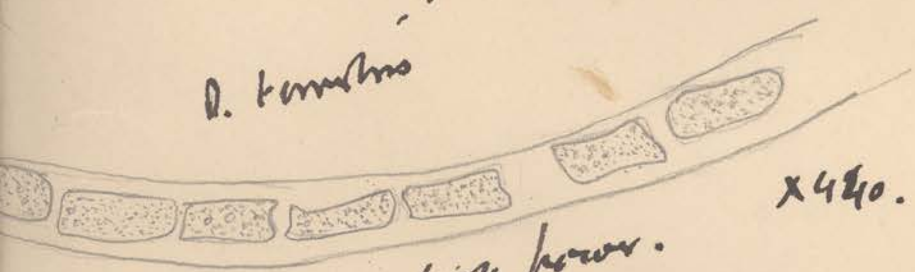
In size of cells resembles N. Lagerheimi (Nordstedt) Lagerheimi

Differs in absence of A. pieces from cells

also N. wittrockii

Differentiate from wittrocki.

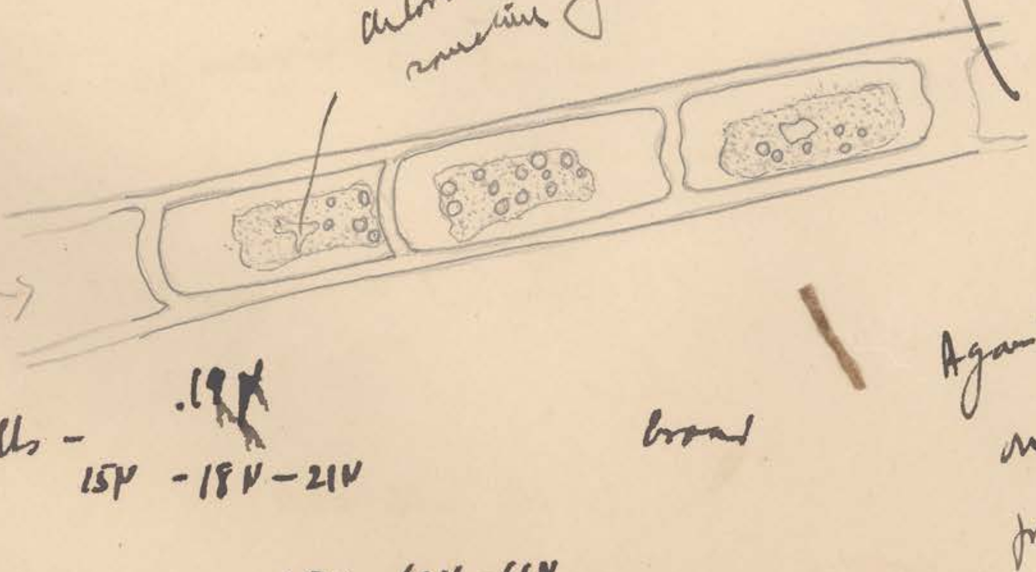
N. terrestris



X440.

X6 on high power.

chloroplasts are sometimes fenestrated.



Cells - .19μ 15μ - 18μ - 21μ broad

15-18-21-45μ-60μ-66μ long

Again collected on 12.5.41 from ... near ...

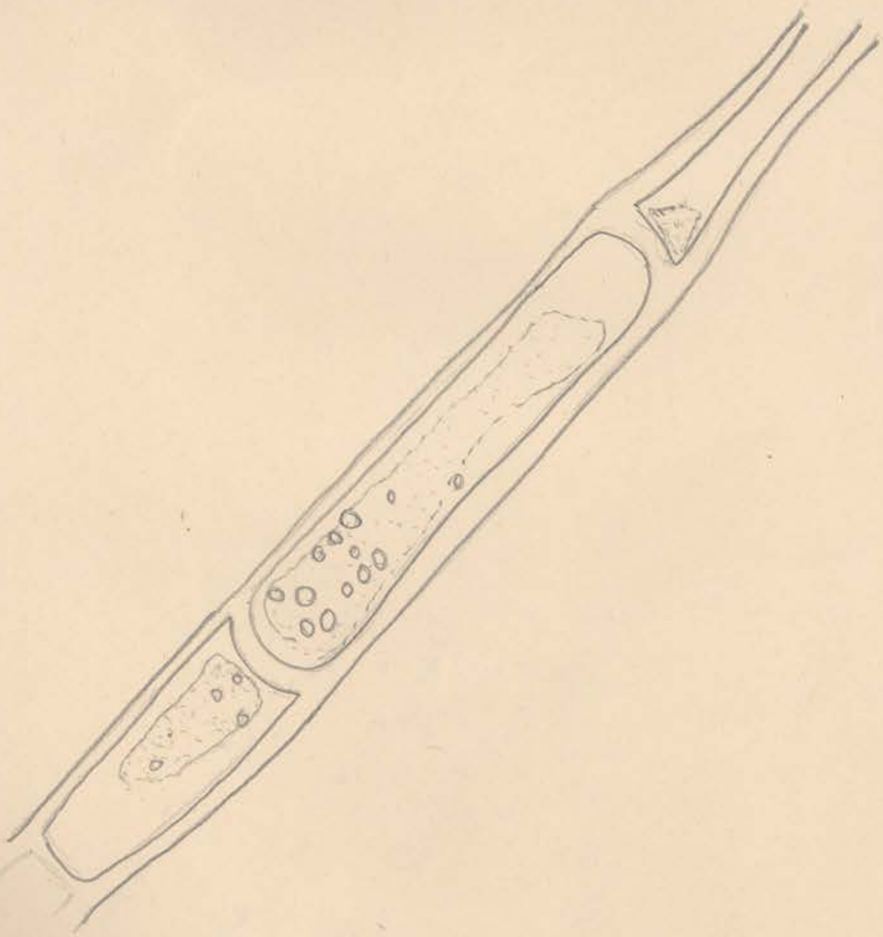
Microspora indica —

18 μ broad

21 – 27 μ long

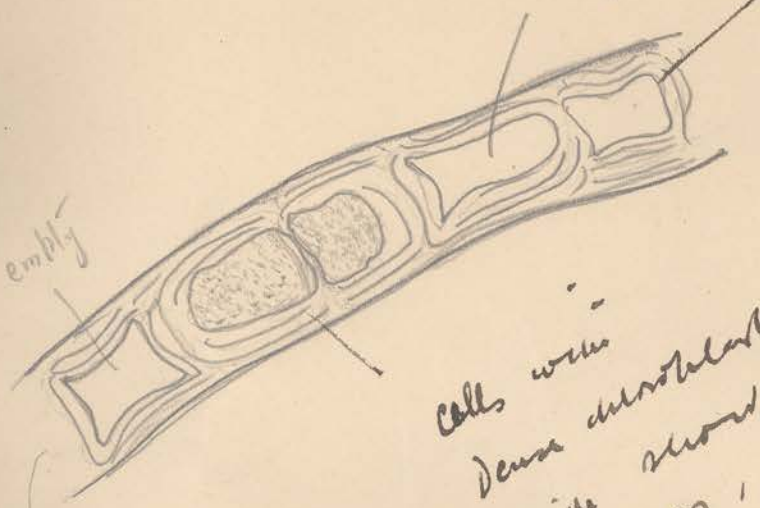
Phil Rachelm Sareera.

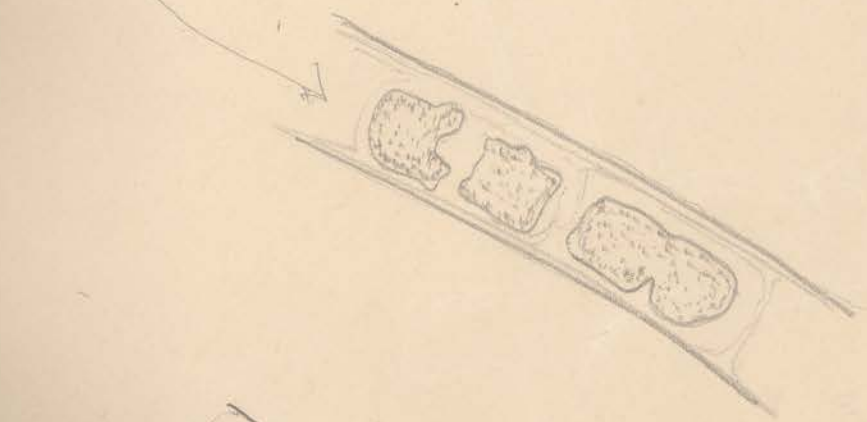
— Feb. 1940

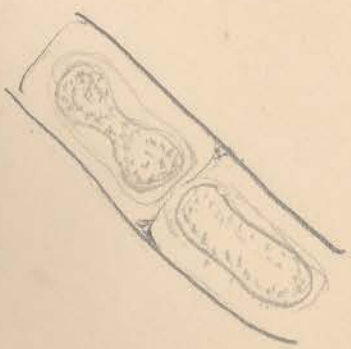


A. terrestris

N. terrestris



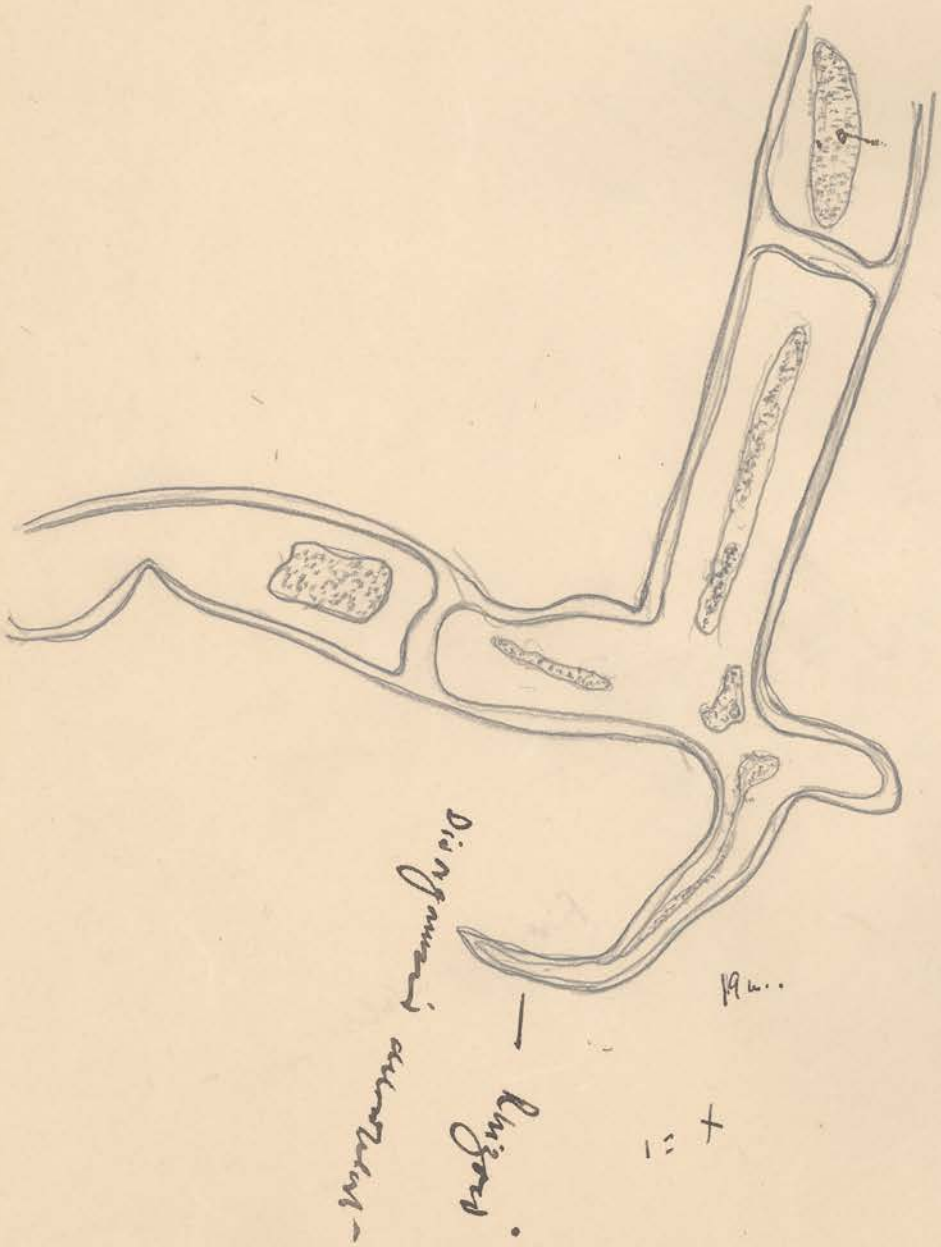




Microspora terrestris sp. nov.

Structure of Chloroplast — 239

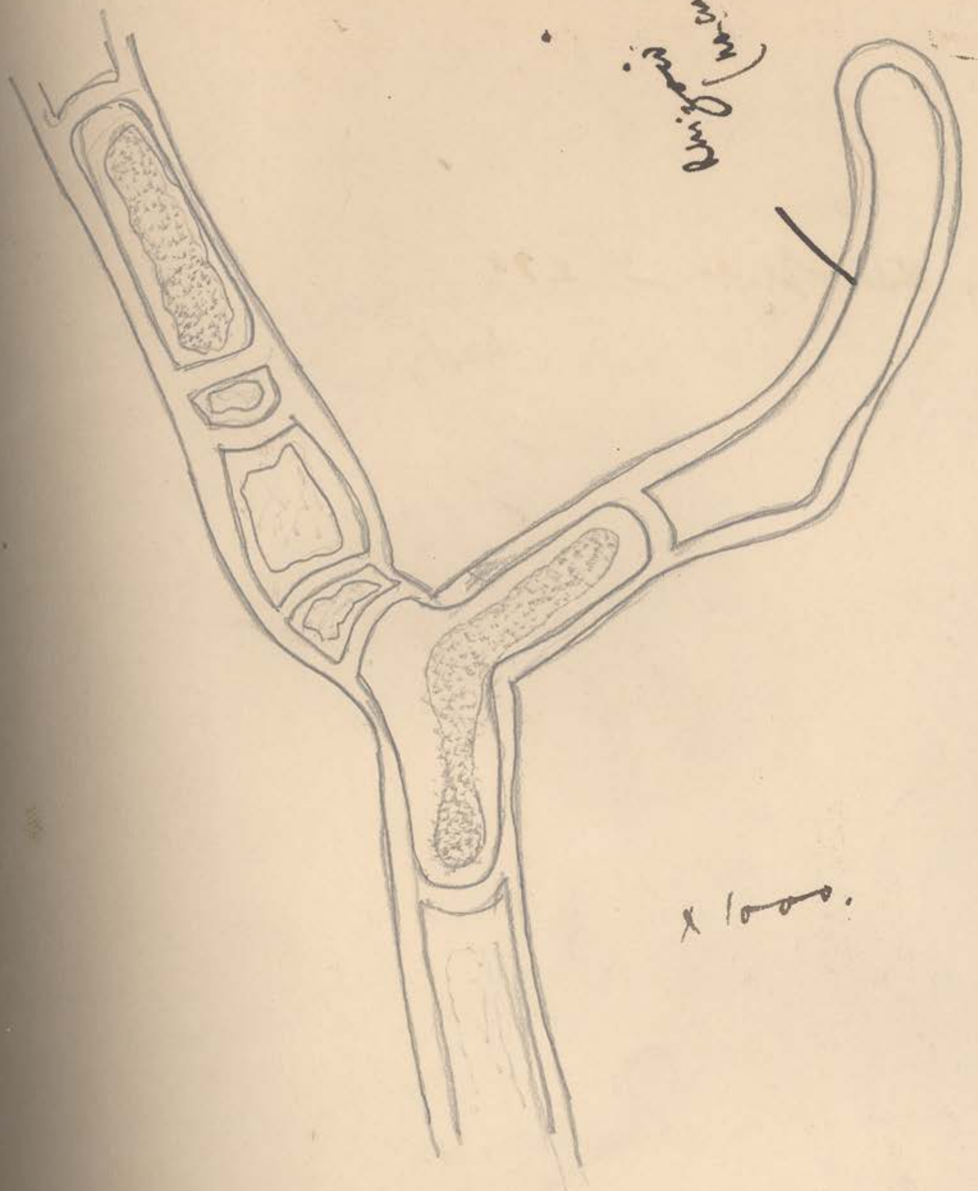
West.



18

18

19 x 1000



x 1000.

Alga from sh an
home. Collected a
on 18/4/41. Had
[illegible] dried

Genus Cylindrocapsa in India

Introduction — Species of Cylindrocapsa are by no means rare in India. During his collections of algae in the Punjab and the United Provinces, the author came across two species. Of these the narrower one is C. oedogonioides with vegetative cells 18-20 μ broad and 12-28 μ long, which was collected in fertile condition from a tank at Moanga in the Punjab, and in sterile con from various places in Fyzabad and Gonda Districts in the United Provinces. The broader spec with cells 24-30 μ broad, was described as C. scytonemoides, with a peculiar mode of vegetative propagation was described from a freshwater drainage channel from Fyza District by the present author.

→ A very interesting note was communicated by Iyengar on the life hi of a Cylindrocapsa collected by him from Madras, which he provisionally de as C. geminella Wolle. In a foot-note Iyengar observes, "The alga in its lif differs in several respects from C. involuta and also from C. geminella". ~~Agr~~ Th dimensions of the cells and filaments of the Madras Cylindrocapsa were not given by Iyengar in his prelim note, from his photomicrographs, the present author ~~noticed~~ saw a number of rese between the Madras Cylindrocapsa, and the Fyzabad Cylindrocapsa, which he had desc as C. scytonemoides. Iyengar was very kind in sending a sample of his alga whic was closely examined and compared with the Fyzabad alga. This comparison convinced the present author, that the Madras alga is identical with C. scy

Chloroplasts of C. scytonemoides: — The samples collected from were in a living vegetative condition with plenty of starch, which obscured structure of the chloroplast, which were described as massive parietal as in other species of Cylindrocapsa. Iyengar observed about the Madras alg "A careful examination of the living material shows very clearly that the chloroplast definitely stellate." An examination of Iyengar's material revealed that the in most of the filaments were in an active state of cell-division, and chloroplasts were of a stellate shape in younger and smaller cells, while the were of the usual massive parietal type in the more mature cell

C. reinhardtii

♀ 1. Quadriciliati macrozoosporum → oogonium →

♂ 2. Quadriciliati microzoosporum → Antheridium →

— • —

—

Ulothrix

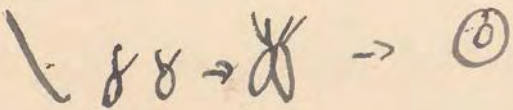
Zoosporen

1. Quadriflagellati macrozoosporen 

2. biflagellati = gametische Zoosporen 

Gameten — o —

3. biflagellati gameten



The stellate shape results possibly from the ingrowth of lamellae of the cell-wall

Vegetative ~~Reproduction~~ Propagation in *C. septonemoides*.

— Examination of Iyengar's material also revealed the presence of the peculiar mode of vegetative ~~reproduction~~ propagation described by the present author from the Fyzabad material of *C. septonemoides*. Unlike other filamentous algae, species of *Cylindrocapsa* are more primitive in their filamentous organization for the individual cells retain the power of independent growth and development not only in a straight linear direction but also laterally, thus the filament becoming biseriate at some places (Fig 2.) This results in the production of hormogonium-like filaments, which remain glued together for some time and ultimately dissociate (Fig 3).

Occurrence of detached oogonia in *C. oedogonioides* Randhawa: —

Usually oogonia develop by the enlargement of ordinary vegetative cells in the filaments, singly or in pairs as in species of *Oedogonium*. On reading Iyengar's account of the life-history of *Cylindrocapsa septonemoides*, which is unique and very unusual among algae, the author re-examined his material. On certain filaments of a species of *Oedogonium* which was found mixed with *C. oedogonioides*, he discovered certain detached oogonia also ~~with~~ with ripe oospores, similar to those figured by Iyengar (Fig 4.). Though such detached oogonia were seen before also but their significance was missed, as the author was under the impression that they may have got accidentally detached from certain filaments. It is very likely that in *C. oedogonioides* also quadriciliate female macrozoospores are produced, which after a period of swarming settle down, secrete a cell-wall, which becomes the loose sheath of the oogonium, while the protoplasmic contents round off as body an oosphere. It would be interesting to find that the oospheres in the oogonia found in the filament have also a flagellated free-swimming. Though altho phase. However at present it remains merely a conjecture and a speculation.

Significance of the female macrozoospores and
in male microzoospores of C. scytonemoides : —— } Nirogami
Nannandri. amongst

The life-cycle of C. scytonemoides is unique among green algae. A certain parallelism is seen between the dwarf males of Oedogonium and those of C. scytonemoides, but there is no structure comparable with the detached zoospore of the latter, which Pringsheim calls dwarf female plants in Oedogonium. The quadriflagellate macrozoospores of C. scytonemoides with female hermaphrodites and quadriflagellate microzoospores with male hermaphrodites show certain resemblances with quadriflagellate macro & microzoospores of Ulothrix. While in Ulothrix the macro & microzoospores subserve the purpose of vegetative multiplication only, & sexual union is seen only among biflagellate gametes, in the case of C. scytonemoides sexuality is extended among the macro & microzoospores as well, the former producing a non-motile oosphere, fertilisable by a macrogamete, which the latter produces 2-4 microgametes or antherozoids.

— : —

References.

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2. Iyengar M.O.P. – On the life-history of Cylindrocapsa geminella Wo Current-Science, Vol VIII, No. 5, May, 1939.

3. Landhawa M.S. – A new species of Cylindrocapsa from India," Cylindrocapsa oedogonioides sp. nov. Proc. Ind. Acad. Sc. Vol IV. No. 5.

4. " – Observations on some new and interesting Algae from Northern India. Hedwigia Band 78, 1939.

Diagram

4.

Randhawa's Notes on Botany.

by

Dr. M.S. Randhawa.