Observations

Chara vulgaris L. em.

Wood and Imahori, 1965. p. 73, Icon: 2 – 9, 12 – 34, 75

Pal et al 1962, p. 102 Fig. 235 - 238

Plants monoecious or dioecious (3-) 5 – 60 (-100) cm high, moderately to heavily incrusted, rarely without lime. Axes moderately slender to stout, 200 -1100 μm. in diameter; internodes shorter or longer (3/4 – 3 (- 20) times longer than the branchlets, to 10 cm long: cortex (1 – 2) 2 (- 3) corticated, but basically 2- corticated, occasionally diaphanous, rarely secondaries not formed (var. *imperfecta*), occasionally secondaries overlapping a short distance causing localized 3- corticated condition, aulacanthous, isostichous to strongly tylacanthous; spine- cells variable, generally solitary, occasionally geminate (very rarely 1 -3 fasciculate), rudimentary to elongate, occasionally as long as the axis diameter, rarely longer (to 1300 μm.), generally ovoid or allantoids, rarely tapered. Stipulodes essentially in 2 tiers, rarely appearing in 1 tier if the lowers do not develop, 2 sets per branchlet, contiguous or separated, variable in size from small and obscure to as long as the axis diameter, rarely c1600 μm. long and exceeding the basal branchlet segment; uppers occasionally longer than lowers, globular ovoid or allantoid, occasionally tapered, blunt, rarely acute. Branchlets (5-) 6 -10 (-12) in a whorl, (0.5 -) 1 – 3 (-6) cm. long, spreading or incurved, occasionally reflexed, corticated or ecorticate, occasionally both nacked and corticated ones in the same whorl; segments (1 -) 2 -5 (- 8) of which (0-) 1 – 3 (-7) are (1-) 2 –corticate and 1 -3 (-7) are naked; cortex occasionally diaphanous, rarely imperfect or rudimentary (var. *denudate*); end segment 1 – 3 (-5) - celled, lowest cell occasionally enlarged; end cell variable, allantoid to tapered or conical, blunt to sharp pointed, often reduced, mucroniform; nodes rarely swollen. Bract – cells 3-6 (-8), rarely obscure or absent, unilateral, rarely verticillate; anteriors shorter than the oogonium to elongate, occasionally as long as the branchlet segment, to 2500 μm. long; posteriors generally rudimentary, globose, occasionally as long as the axis diameter, occasionally inflated, blunt, apiculate or occasionally sharp – tipped; rarely bifid. Bracteoles 2, longer (occasionally shorter) than the anterior bract – cells, to 3000 μm. long, usually exceeding the mature ooganium; rarely bifid. Bractlet only in dioecious and sejoined samples usually similar to or smaller than the bractoles. Gametangia conjoined or sejoined at the 1 – 3 (-4) lowest branchlet nodes, occasionally on separate plants (dioecious); solitary, frequently geminate; commonly incrusted forming limeshells, oogonia rarely vertically geminate (var. *oedophylla*), 500 – 1100 (-1275) μm. long (

excl. coronula), (280 -) 335 – 525 (- 660) µm. wide, commonly with limeshell; convolutions (9 -) 11 – 15 (- 18); coronula (60 -) 90 -200 (- 225) µm. high, (125-) 180-230 (-460) µm. wide, cells ovoid, spreading, occasionally erect or connivent, rarely deciduous. Oospores black or dark brown (rarely reddish or golden brown), (360-) 425 – 660 (- 780) µm. long, (225 -) 250 -420 (-530) µm. wide, often incrusted; striae of (7 -) 9 – 13 (-17) faint to prominent ridges generally prolonged into basal claws or cage; fossa 41 -57 µm. across; membrane obscurely to clearly granulate to tuberculate, rarely diffusely spotted. Anthridia (210-) 270 -610 (-800) µm. in diameter, generally larger in dioecious strains; octosculate. Bulbils rare, spheroid.

C. vulgaris as has long been recognized by specialist is highly polymorphic. When large collections are examined, a gradual continuum is found to form the next, the characters apparently occurring in all possible combinations.

Synopsis of the varieties of *Chara vulgaris*

1a Axial cortex normal (occasionally irregular) and present; branchlet cortex (if present) normal

2a Branchlets 1/3 – 1 times as long as the axial internode; bractoles not especially inflated; gametangia at nodes adjacent to corticated segments---------- **var. *vulgaris***

2b Branchlets ecorticate (rarely with 1-2 corticated segments); gametangia at nodes not adjacent to corticated segment----------**var. *gymnophylla***

2c Branchlets very short, 1/20 -1/10 as long as the axial internodes whorls often obscure----------**var. *kirghisorum***

2d Branchlets normal, but bracteoles inflated; oogonia often vertically Geminate ----------**var. *oedophylla***

2e Branchlet cortication variable, partly imperfect, commonly consisting of a few isolated cells ----------**var. *inconnexa***

1b Axial cortex 2-3 corticate; ecorticated segments of branchlets elongate, corticated segments (1-3) abbreviated----------**var. *nitelloides***

1c. Axial cortex not normal, 1-2 corticate; branchlet cortex commonly imperfect

3a Axial cortex variable, perfect to imperfectly (1 -) 2 corticate --**var. *inconnexa***

3b Axial cortex rudimentary, but secondary cells occur wherever primary cells are developed----------**var. *dendudata***

3c. Axial cortex 1 corticate, without any traces of secondary cells **var. *imperfecta***

In *C. vulgaris* nine varities are present. Our specimen showed axial cortex normal, branchlet ecorticate, gametangia at nodes adjacent to corticated segments. So it belongs to variety *gymnophylla*. In var. *gymnophylla*, there are five forma on the basis of axial cortex, stipulodes branchlets and bract cells, which are as follows-

1a Similar to f. *vulgaris* but largely gymnophyllous ----------**f. *gmnophylla***

1b Very small (c 3 cm high); axial cortex 2 (-3) corticated ----------**f. *rohlenae***

1c Similar to f. *gymnophylla*, but cortex tylacanthous; stipulodes elongate-------**f. *grovesii***

1d Small (c 5cm high); branchlets in clumps ----------**f. *conimbrigensis***

1e Extremely elongate and slender branchlets; bract cells obscure ----------**f. *sturrockii***

Out of these forma our specimen belonged to f. *gymnophylla*.

***Chara vulgaris* v. and f. *gymnophylla* (A.Br.) Nyman**

Wood and Imahori, 1965. p. 107

Plants monoecious, to c 15 cm high, grayish green, heavily incrusted. Axes moderately stout, 500 – 820 µm. in diameter; internodes 2 – 6 times as long as the branchlets; cortex 2 corticate, generally aulacanthous, occasionally isostichous; spine cells solitary, shorter than axis diameter.Stipulodes in 2 tiers, 2 sets per branchlet, blunt, deciduous, upper similar to lowers but lowers occasionally reduced, to ¼ as long as axis diameter. Branchlets (6-) 10-12 in a whorl, to 0.7 – 1.2 cm long; segments 3 – 4 of which generally all are ecorticate, rarely lowest 1 – 2 segments of isolated branchlet 2-corticate, end segment 1 – 3 celled; end cell generally reduced. Bract cells (1-) 2 – 3, unilateral, at nodes both with and without adjacent corticated segment; anteriors variable, 1 – 2(-more) times as long as oogonium, blunt; posteriors rudimentary, globose. Bracteoles 2, similar to the anterior bract cells. Gametangia conjoined or sejoined at lowest 1 – 3 branchlet nodes regardless of cortication, solitary or geminate. Oogonia c 800 µm. long (excl. coronula), 450 µm. wide; convolutions 13 – 14; coronula c 100 µm. high, 200 µm. wide. Oospores brown, 500 – 600 µm. long, 320 -350 µm. wide; striae of 11- 12 ridges; Antherdia 300 – 400 µm.in diameter.

***Chara vulgaris* v. and f. *gymnophylla* (A.Br.) Nyman**

Plate No. II

Plant monoecious to 4 – 12 cm high, grayish green, crustation absent. Axes stout 285 – 800 µm. in diameter; internodes 1 -5 times as long as the branchlets. (Branchlet length more than the internode) Cortex 2 corticate isostichous to tylacanthous, spine cells solitary, rudimentary. Stipulodes in 2 – tiers, one set per branchlet, blunt, globose, dwarf or small and often deciduous. Branchlets 10 in a whorl, 0.4 – 2.5 cm long, segement 3 – 5 of which all are ecoticated, end segment single celled, conical and pointed, branchlet nodes constricted Bract cells 4 – 6 unilateral anteriors enormously long, 3 – 5 times longer than mature oogonium blunt posteriors rudimentary, globose. 1485 – 3428 µm. long. Bractioles 2, similar to or shorter than the anteriors bracts but longer than mature oogonium 146 – 1285 µm. long. Gametangia conjoined or geminate at lowest 1 – 3 nodes. Oogonia 366 – 660 µm. long (excl. coronula) 263 – 352 µm. wide, convolutions 12 – 14. Coronula 73 - 132 µm. high and 146 – 180 µm. wide. Oospore black 400 – 460 µm. long, 300 – 352 µm. wide striae of 10 – 11 ridges; Antherdia 220 – 337 µm. in diameter.

This species of charophytes was collected from following localities:

1) Mhasvad, Tal. Man.

2) Rajewadi, Tal. Satara.

3) Degaon, Tal. Satara.

4) Rahimatpur, Tal. Koregaon.

When comparison was made our specimen showed some distinguishing features like longer length of branchlets than the internodes, length of bract cell is c 5 times longer than oogonium, length and width of oogonium was small. In Wood's specimen there was no clarity about membrane and fossa but our specimens showed granulate membrane and 29 – 44 µm. wide fossa.

Table 2.Comparative account of *C. vulgaris* v. and f. *gymnophylla* (A.Br.) Nyman

Sr No	Character	R. D. Wood' 65	Mhasvad specimen
1	Habit	Monoecious,c 15 cms	Monoecious, 4 – 12 cms
2	Axes (diameter)	500 – 820 µm.	285 – 800 µm.
3	Internodes	2 – 6 times longer than branchlets	Branchlet length more than internodes
4	Cortex	2 corticate, aulocanthous	2 corticate, isostichous to tylacanthous
5	Spinecells	Solitary shorter than axes diameter	Solitary, rudimentary.
6	Stipulodes	2 tiers, 2 sets per branchlet, blunt, deciduous	2 tiers, 2 sets per branchlet, blunt globose, dwarf, deciduous
7	Branchlets Number Length Segments	 10 – 12 in a whorl 0.7 – 1.2 cm 3 – 4 generally all ecorticate	 10 in a whorl 0.4 – 2.5 cm 3 – 5 ecorticate
8	Bract cells	2 – 3 unilateral anterior 1 – 2 times longer than oogonium Posteriors rudimentary	4 – 6 unilateral anterior up to 1485 – 3428 µm. long Posteriors rudimentary , globose
9	Bractioles	2 similar to the anterior bracts	2, similar to or shorter than the anteriors 146 – 1285 µm. long.
10	Gametangia	Conjoined , sejoined at lowest 1 – 3 branchlet nodes, solitary or geminate 2 – 3 together	Conjoined, geminate at lowest 1 – 3 nodes,
11	Oogonia Length Breadth Convolutions	800 µm. 450 µm. 13 – 14	 366 - 660 µm. 263 -352 µm. 12 -14
12	Coronula Height Width	100 µm. 170 – 180 µm.	73 -132 µm. 146 -180µm.
13	Oospore Colour Length Breadth Ridges Fossa Membrane	 brown 500 - 600 µm. 320 - 350 µm. 11 - 12 -- --	 black 400 - 460 µm. 300 -352 µm. 10 - 11 29 - 44 Granulate
14	Antheridia (diameter)	300 - 400 µm.	220 - 337 µm.

PLATE NO.II

Chara vulgaris var gymnophylla f. gymnophylla(A.Br.)Nym

Fig. 1.Axial node showing branchlet, stipulodes and corticated axis X 50.

Fig. 2 Branchlet tip X 50

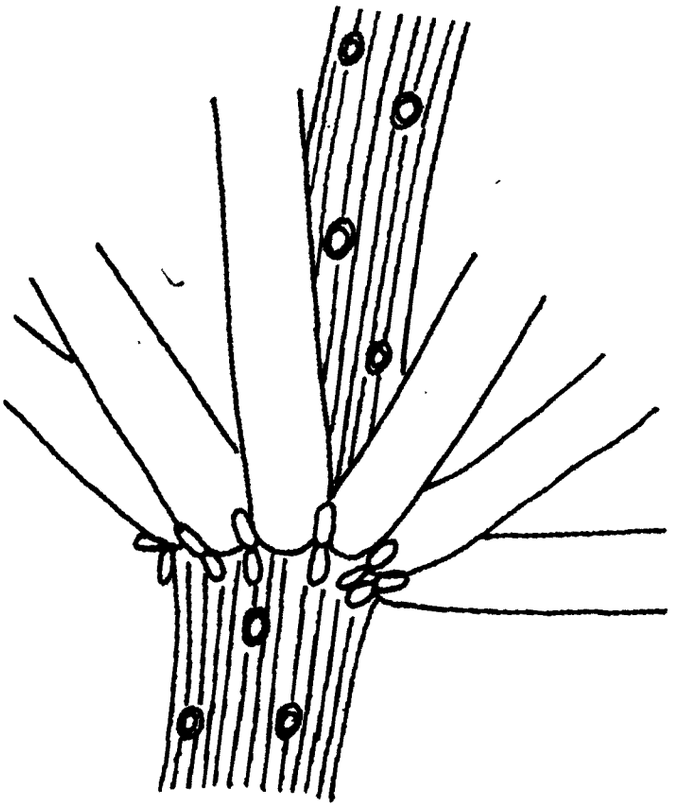
.Fig. 3 Oogonium. X 100.

Fig 4. Conjoined gamentagia with long well devoleped bractioles and unilateral bract cells X14

Fig. 5 Coronula with spreading cells X 100.

Fig 6 Oospore X100

Plate -II



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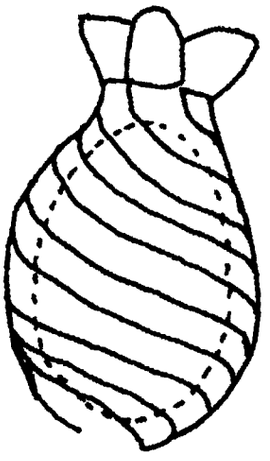

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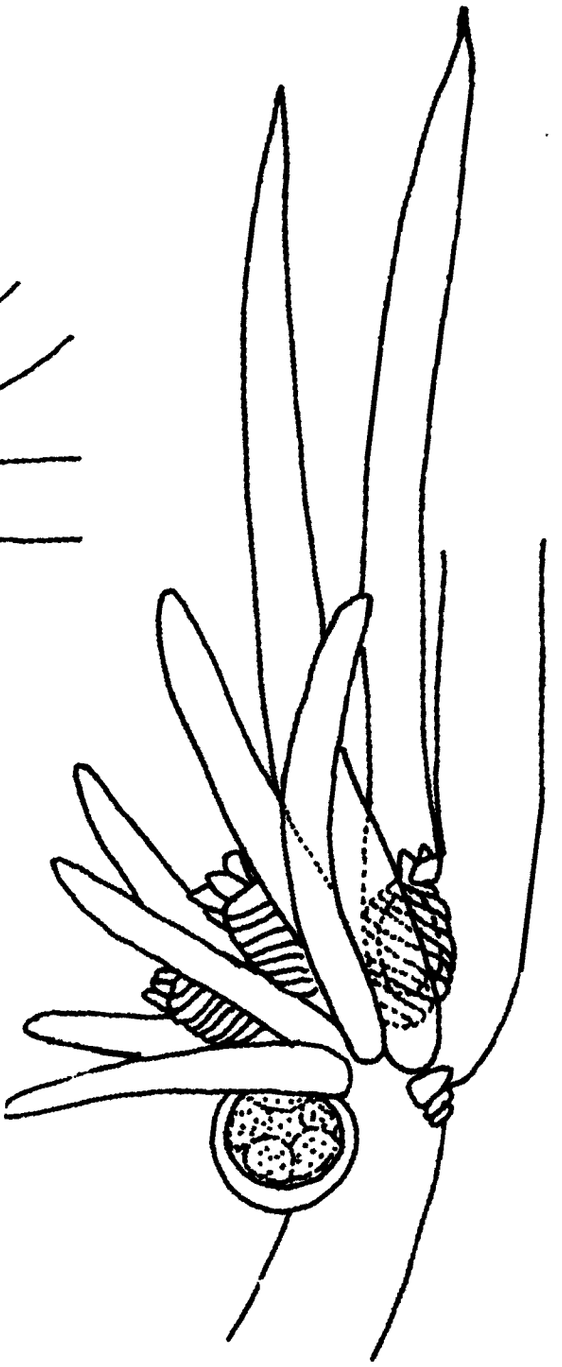

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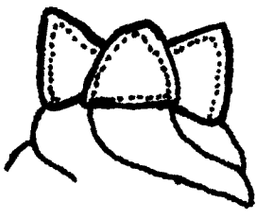

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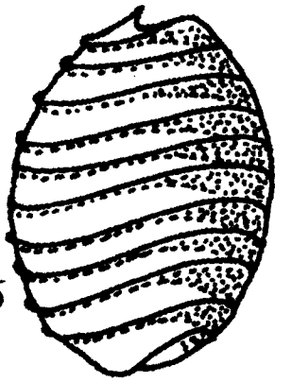

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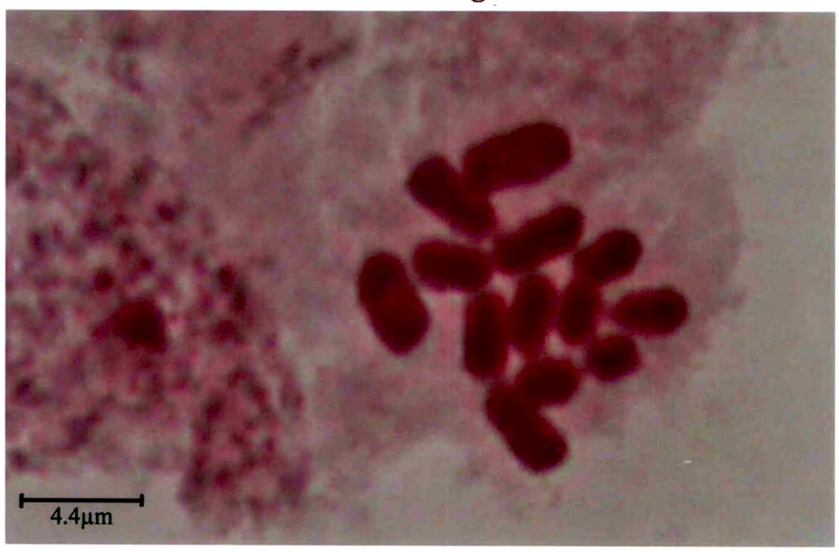
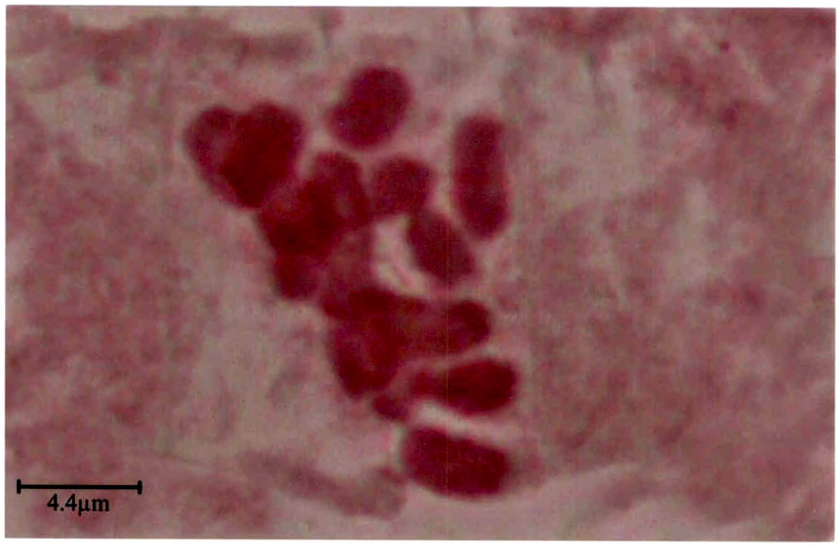
Plate -III

***Chara vulgaris* f. *gymnophylla* antheridial filament showing mitotic stages**





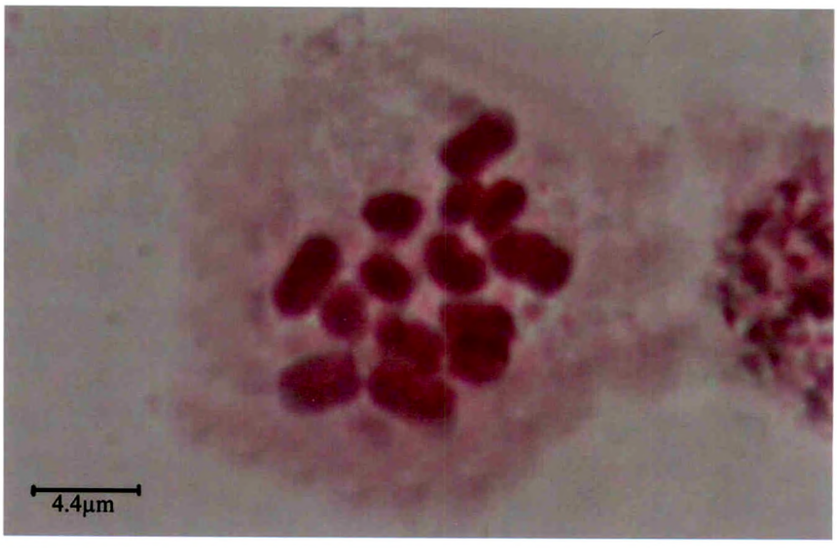


Table No. 3: Measurements of chromosomes in

***C. vulgaris f. gymnophylla* (A.Br.) Nyman**

No.	Length of chromo. arms µm.		Total Length µm.	Centromeric Position	Type of chromosome
	Long arm	Short arm			
1.	2.9	1.5	4.4	Submetacentric	Long
2.	2.9	1.5	4.4	Submetacentric	Long
3.	2.9	1.5	4.4	Submetacentric	Long
4.	2.9	1.5	4.4	Submetacentric	Long
5.	2.9	1.5	4.4	Submetacentric	Long
6.	2.9	1.5	4.4	Submetacentric	Long
7.	1.5	1.5	3.0	Metacentric	Medium
8.	1.5	1.5	3.0	Metacentric	Medium
9.	1.5	1.5	3.0	Metacentric	Medium
10.	1.5	1.5	3.0	Metacentric	Medium
11.	1.5	1.5	3.0	Metacentric	Medium
12.	1.5	1.5	3.0	Metacentric	Medium
13.	1.5	–	1.5	Telocentric	Short
14.	1.5	–	1.5	Telocentric	Short

Table No. 4: Classification of Chromosomes - *Chara vulgaris f. gymnophylla*

Chromosome type	Number of Chromosome	Length in µm.	Karyotype formula
A	6	4.4 µm.	A6 + B6 +C2
B	6	3.0 µm.	$L(sm_6) + M(m_6) + S(t_2)$
C	2	1.5 µm.	

Formula -

$$L(sm_6) + M(m_6) + S(t_2)$$

Chara globularis Thuill. em.

Wood and Imahori, 1965. p. 162, Icon : 49-69, 71-74, 76-86

Plants monoecious or dioecious, tiny to large, 9 – 45 cm high, slightly to heavily incrusted, branchlets uniform, very rarely dimorphic with fertile ones crowded into terminal 'foxtails'. Axes moderately slender or stout, 225 – 1000 µm. in diameter; internodes ¼ - 4 (-6) times longer than the branchlets, 1 – 5 (-8) cm long, rarely reduced between fertile axes; cortex regulary 3 –corticate, occasionally irregular due to incomplete overlapping of secondaries with resulting (1 -) 2 – 3 (- 4) corticated axes in some strains, isostichous or tylacanthous; spine cells varying, generally obscure, rudimentary; in some forms well developed, solitary, 1 – 3 times as long as the axis diameter, uncommonly in fascicles of 2 – 3 (-5), occasionally abundant and densely compacted. Stipulodes generally absent or rudimentary, commonly well developed (0-) 1 – 3 times longer than axis diameter, in 2 tiers, 2 sets per branchlet, but only uppers developed in some strains. Branchlets (5 -) 6 – 11 in a whorl, 0.8 -3 (- 5) cm long, straight to sharply incurved; segments (2 -) 5 – 9 (- 11) of which all are 2(- 3) corticated except the 1 – 2 (- 4) celled end segment, but partly irregularly or completely ecorticate in some strains. Bract cells 4 – 6 (- 8), unilateral, occasionally verticillate; anteriors short to elongate, ½ - 4 (-more) times as long as the branchlet diameter, to 0.6 cm long (var. *kokeilii)*; posteriors generally obscure, occasionally somewhat enlarged to conical, rarely elongate and slightly shorter than anterior bract cells. Bracteoles 2, similar to the anterior bract cells, ½ - 8 times as long as branchlet diameter, ½ - 4 times as long as matured oogonium. Bactlet 1, in dioecious strains, similar to bracteole, may be longer or shorter than bracteoles. Gametangia conjoined (rarely sejoined) or on separate plants; conjoined at 1 – 3 (-5) lowest branchlet nodes, very rarely at base of whorl (var.*tenuispina*). Oogonia 530 to 1100 µm. long (excl. coronula), 300 – 700 µm. wide; convolutions rarely colored (var. *stachymorpha* and var. *kraussii*) 10 – 15, coronula 75 – 240 µm. high, 120 – 270 µm. wide connivent to slightly spreading. Oospores dark brown to black, rarely yellow or orange (especially when immature or in limeshell), 400 – 780 µm. long, 250 – 460 µm. wide, ovoid to cylindrical and truncate; striae of (8 -) 10 – 13 (- 16) low to prominent ridges, often terminating in basal claws (rarely cage); fossa 40 – 66 µm. across; membrane smooth or finely granulate or papillate. Antheridia 225 – 575 µm. (monoecious strains), 550 – 1100 µm. (dioecious strains) in diameter; octoscutate. Bulbils uncommon, whitish in clusters to 0.15 cm in diameter.

Synopsis of the varieties of *Chara globularis*

1a Axial cortex regularly 3 – corticate; spine – cells obscure.

2a Appendages (i.e. stipulodes, spinecells and bractcells) obscure --- **var. *globularis***

2b One tier of stipulodes developed, the lowers obscure ---------- **var. *virgata***

2c Both tiers of stipulodes developed ---------- **var. *leptosperma***

1b Axial cortex regularly 3 – corticated; spine – cells developed.

3a Spine – cells small to large, often fasciculate ---------- **var. *aspera***

3b Spine – cells solitary, extremely elongate ---------- **var. *tenuispina***

3c Spine – cells solitary, normal size; branchlets naked ---------- **var. *kokeilii***

1c Axial cortex irregular 1 – 2 – 3 coticate

4a Axial cortex 2 – 3 corticate; branchlets uniform---------- **var. *kraussii***

4b Axial cortex 1 – 2 – 3 corticate; branchlets dimorphic, fertile ones crowded in to 'foxtails' ---------- **var. *stachymorpha***

In *C. globularis* eight varieties are present. Our specimen showed obscure stipulodes, spine cells and bract cells. So it belongs to variety *globularis*. In variety *globularis* there are eight forma on the basis of bract cells, spine cells, cortex and branchlets which are classified as follows -

1a Stipulodes, bract – cells and spine – cells obscure, cortex regular with or without bulbils---------- **f. *globularis***

1b Similar to 1a, but with branchlets sharply incurved and with numerous segments (-13); without bulbils---------- **f. *connivens***

1c Similar to 1a, but branchlets very slender, with many segments (8 – 13); with compound bulbils ---------- **f. *fragifera***

1d Similar to 1b, but with few (6 – 8) branchlet segments ---------- **f. *arcuatofolia***

1e Upper stipulodes larger than lower

2a Branchlets normally corticate ---------- **f. *salina***

2b Branchlets irregularly gymnophyllous

3a without bractlets ---------- **f. *leiopitys***

3b without permanent bractlet ---------- **f. *chrysospora***

1f As in 1a, but with slightly irregular axial cortex ---------- **f. *mauretanica***

1g As in 1a, but with axial cortex quite irregular, often predominately 2 (- 3) corticated ----------**f. *capensis***

1h As in 1g, but with bract – cells clasping the oogonia ---------- **f. *capensis***

***Chara globularis* v. and f. *globularis* Thuill. , em.**

Wood and Imahori, 1965. p. 172, Icon : 49-69.

Plants monoecious or dioecious, 9 – 25 (-60) cm high, slightly incrusted. Axes moderately slender, 300 – 800 µm. in diameter; internodes ½ - 2 times as long as branchlets, to 4 cm long; cortex regularly 3 – corticated, isostichous; spine cells absent or rudimentary and globular to 50 µm. in diameter. Stipulodes very small, usually obscure or absent, to 120 µm. in diameter, often replaced by large peripheral nodal cells subtending the branchlet cortex. Branchlets (7-) 8 – 9 (- 10) in a whorl, 1 – 2.5 cm long, straight, occasionally incurved and connivent; segments 6 – 13 of which 5 – 12 are 2 – 3 corticate; nodes occasionally constricted; end segment 1 – 2 celled, naked. Bract cells 4 – 6, unilateral; anteriors to 750 µm. long; posteriors small, globular obscure. Bracteoles 2, ¼ - 1 times as long as mature oogonium. Bractlet present only in dioecious strains, resembles bracteole, Gametangia conjoined (very rarely sejoined) at lowest 3 – 5 branchlet nodes or largely or entirely on separate plants (dioecious). Oogonia 800 – 1000 µm. long (excl. coronula), 500 -675 µm. wide; convolutions 12 – 15; coronula 125 – 250 µm. high, 175 – 375 µm. wide, connivent, erect or rarely spreading. Oospores black, 570 -750 µm. long, 345 – 510 µm. wide; striae of 10 -13 faint to prominent ridges occasionally terminating in basal claws or cage; fossa 58 – 66 µm. across; membrane dark, smooth or faintly granulate. Antheridia 450 -575 µm. in diameter; octoscutate. Bulbils occasionally well formed, simple to compound (to 2500µm. in diameter).

The specimens here assembled are the smooth forms with reduced spine cells, stipulodes and bract cells and complete uniform branchlet and axial cortication.

***Chara globularis* v. and f. *globularis* Thuill. , em.**

Plate No. IV

Plants monoecious 60 – 20 cm high, moderately incrusted. Axes slender, 300 – 600 µm. in diameter; internodes ½ - 2 times as long as branchlets, to 3.5 cm long; cortex regularly 3 – corticated, isostichous; spine cells absent. Stipulodes very small, globular 74 – 103 µm. in diameter, Branchlets 9 in a whorl, 0.7 – 3.6 cm long, straight, segments 7 nodes constricted; end segment 1 – 2 celled, pointed or blunt. Bract cells 3 – 5, unilateral. Length of bract cells longer than oogonium, 500 – 1200 µm. long and posteriors small, globular obscure. Bracteoles 2, ¼ - 1 times as long as mature oogonium. Gametangia conjoined at lowest 5 branchlet nodes. Oogonia 400 – 800 µm. long (incl.

coronula), 400 – 700 µm. long (excl. coronula), 200 – 550 µm. wide; convolutions 9; coronula 125 – 250 µm. high, 130 – 200 µm. wide, connivent, erect or rarely spreading. Oospores dark reddish black, 350 – 600 µm. long, 278 – 410 µm. wide; striae of 9 faint to prominent ridges terminating in basal claws; fossa 58 – 74 µm. across; membrane granulate. Antheridia 219 – 325 µm. in diameter, octoscutate.

This taxon of charophyte was collected from following localities:-

1 Mhasvad

2 Khatav

3 Rahimatpur

4 Aundh

When comparison was made, our specimen showed some distinguishing features like absence of spine cells, globular stipulodes, small sized oogonia, oospores and antheridia also.

Table No 5, Comparative account of *Chara globularis* v. and f. *globularis* Thuill., em.

Sr No	Character	R. D. Wood' 65	Mashvad Specimen
1	Habit	Monoecious, 9 – 25 (- 60) cms	Monoecious, 6 – 20 cms
2	Axes (diameter)	300 – 800 µm.	300 – 600 µm.
3	Internodes	½ – 2 times as long as branchlets 4 cm. long	½ – 2 times as long as branchlets 3.5 cm. long
4	Cortex	3 corticate, isostichous	3 corticate, isostichous
5	Spine cells	Absent or rudimentary and globular to 50 µm. in diam.	Absent
6	Stpulodes	Very small, usually obscure or absent	Very small, globular 73 – 103 µm. in diam.
7	Branchlets		
	Number	(7-) 8 – 9 (- 10) in a whorl	9 in a whorl
	Length	1 – 2.5 cms	0.7 – 3.6 cm
	Segments	6 – 13	7
8	Bract cells	4 – 6 unilateral anterior 750µm. long Posteriors small, globular obscure.	3 – 5 unilateral anterior 500 – 1200 µm. long Posteriors small, globular, obscure
9	Bracteoles	2, ¼ - 1 times as long as mature oogonium	2, ¼ - 1 times as long as mature oogonium
10	Gametangia	Conjoined , at lowest 3 – 5 branchlet nodes,	Conjoined, at lowest 5 branchlet nodes,
11	Oogonia		
	Length	800 – 1000 µm. long	400 – 700 µm.
	Breadth	500 – 675 µm.	200 – 550 µm.
	Convolutions	12 – 15	9
12	Coronula		
	Height	125 – 250 µm.	125 – 250 µm.
	Width	175 – 375 µm. connivent, erect	130 - 200µm. connivent, erect
13	Oospore		
	Colour	Black	Dark reddish - black
	Length	570 – 750 µm.	350 – 600 µm.
	Breadth	345 – 510 µm.	278 – 410 µm.
	Ridges	10 – 13	9
	Fossa	58 – 66 µm.	58 – 74 µm.
	Membrane	Granulate	Granulate
14	Antheridia(diam.)	450 – 575 µm. octoscutate	219 – 325 µm. octoscutate

PLATE NO. IV

Chara globularies f. globularies Thuill from Mhasvad specimen

Fig. 1.Axial node, three corticated axes, basal parts of branchlet with conjoined gametangia X 25.

Fig. 2. Part of branchlet with conjoined gametangia ,bracts and bracteoles X 50

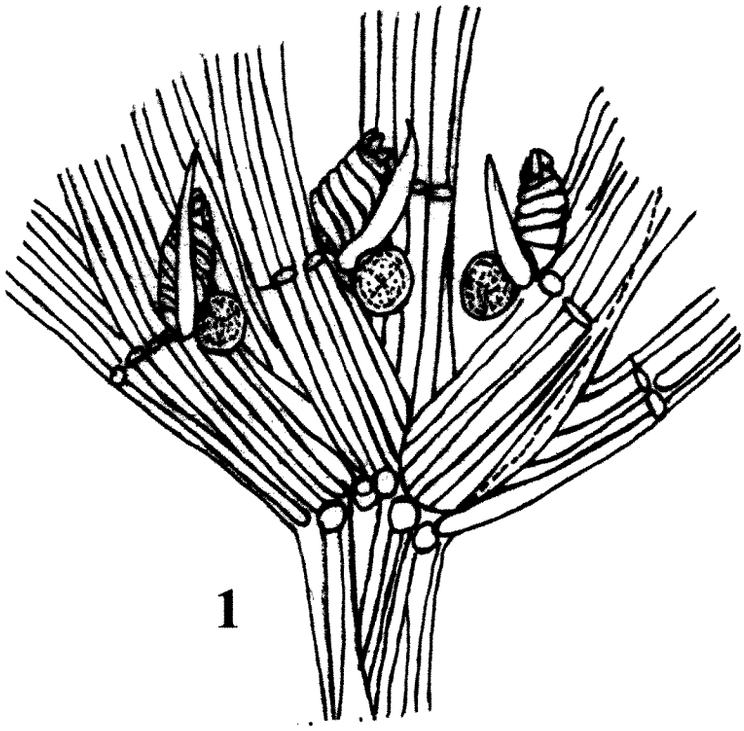
Fig. 3 Oogonium. X 50.

Fig 4. Oospore X50

Fig 5. Apex of Branchlet X 50

Fig. 6 Coronula X 50

Plate -IV



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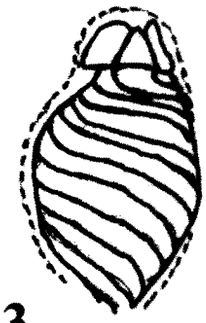

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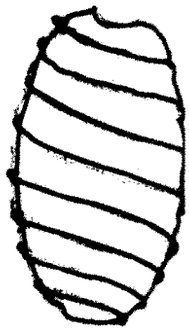

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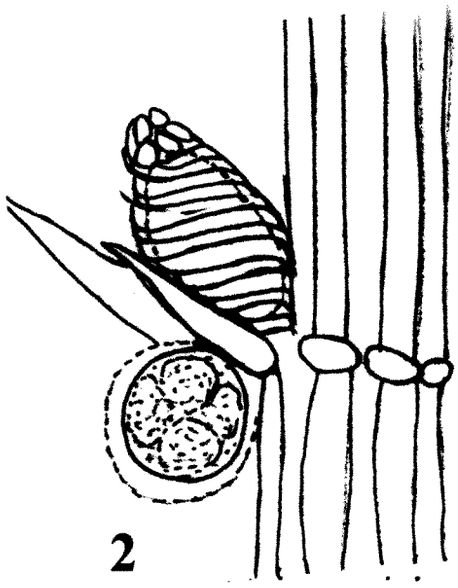

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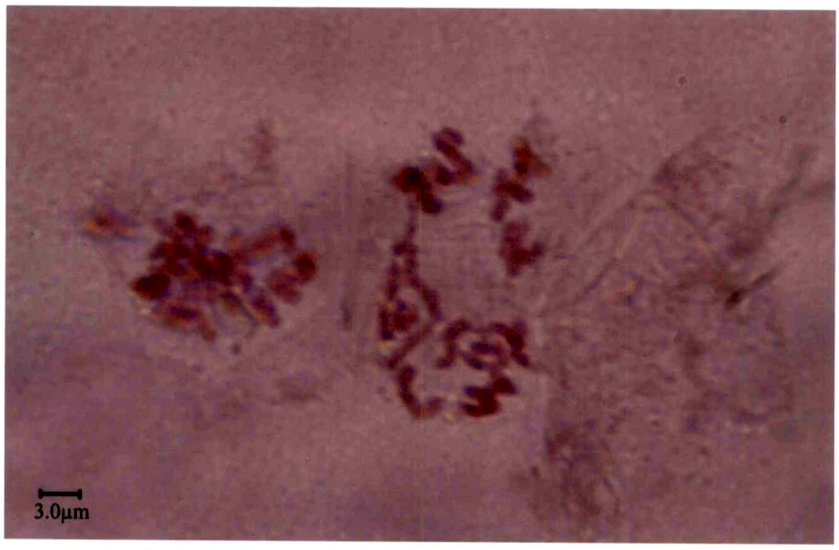
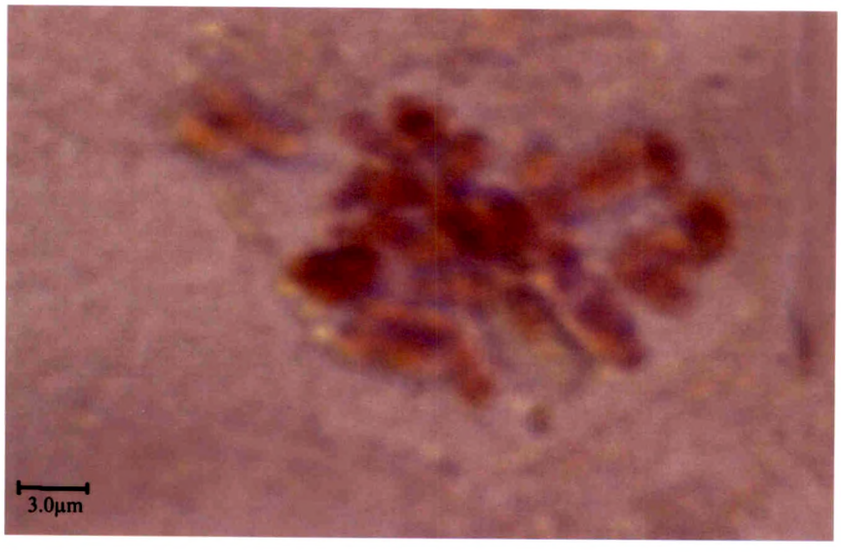
Plate -V

***Chara globularis* f. *globularis* antheridial filament showing mitotic stages**





Chara zeylanica Klein ex Willd, em.

Wood and Imahori, 1965. p. 220, Icon: 91-108,

Pal et al 1962, p. 105 Figs. 253- 255

Plants monoecious or dioecious, small to large, 8 – 60 cm high, slightly (occasionally annularly) incrusted; with or without cortication. Axes usually moderately slender, 400 – 1400 µm. in diameter; internodes longer or shorter than branchlets, to 6 cm. long; cortex essentially 3 – corticate, in some forms the secondaries do not regularly overlap leaving cortex partly 2 –corticate, isostichous to slightly tylacanthous, rarely entirely absent (var. *brittonii*); spine-cells solitary, variable, rudimentary to elongate, reaching 2-3 times as long as axes diameter, to 1600 µm. (-2700 µm. in f. *kenoyeri*) long, occasionally occurring in transverse rows, often sparce or absent on lower axial internodes. Stipulodes in 2 tiers, well developed, ¼-2 times as long as axis diameter to 1700 µm. long, uppers 1 – 4 times longer than lowers; 2 sets per branchlet, sometimes irregular in placement and possibly in number. Branchlets (6-) 8 – 13 (-15) in a whorl, 0.6 – 3.8 cm long, straight or slightly incurved, spreading or ascending; segments (2-) 5 – 15 (-16) of which the basal and terminal ones are invariably ecorticate and of which more or less of the intercalary ones are 2 – 3 corticate, (rarely branchlet entirely naked); basal segment frequently different from 2nd, often abbreviated ¾ - 4 times longer than wide, often obscured behind the stipulodes (in which case its presence is indicated if the lowest obvious (i.e. the 2nd) segment has a central ring where cortication meets); end segment 1 (rarely of 2 – more cells); naked distal segments 1 – 4 (-6) although occasionally one more branchlet partly to completely naked. Bract – cells 5 – 8 unilateral to verticillate; anteriors equal to or longer than posteriors to 1300 (-3500) µm. long, posteriors varying from obscure to elongate (to 1300) - (-3500) µm. long, spreading, ascending or adpressed; bract – cells often reduced or absent at sterile nodes and occasionally modified at the lowest node, swollen (ventricose). Bracteoles 2 shorter to longer than mature oogomium, ¼ - 2 times longer than oogonium. Bractlet below solitary oogonia of dioecious strains and often on sejoined strains, similar to but shorter than bracteoles. Gametangia conjoined, sejoined or on separate plants, (dioecious), at 2 – 7 lowest branchlet nodes, sometimes absent from lowest node; in sejoined strains oogonia

at 2 – 4 lowest nodes and antheridia at more distal ones. Oogonia (400-) 630 – 1000 (-1400?) µm. long (excl.coronula), 360 – 770 µm. wide often incrusted (i.e. with lime shell); convolutions (10-) 11 – 15 (-17); coronula 70 – 250 µm. high, 140 – 320 µm. wide connivent; errect or divergent; occasionally with diergent distal lobes. Oospores dark brown to black (405-) 480 – 900 µm. long; (270-) 350 – 570 (to 600) µm. wide; striae of (8-) 11 – 13 (-16) low to prominent ridges, rarely terminating in basel claws; fossa 41 – 73 µm. across; membrane smooth to granulate or tuberculate, occasionally mottled. Antheridia (240-) 270 – 470 (-690) µm. in diameter; larger in dioecious strains; tetrascutate (occasionally octoscutate.)

Synopsis of the varities of *Chara zeylanica*

1a Axes and branchlets ecorticated.

2a Branchlets uniformly corticated, 4-more corticateded branchlet segment segments

3a Medium to large specimens, axes (400-) 800 – 1400 µm. in diameter; gametangia redominantly conjoined----------**var. *zeylanica***

3b Small slender forms, axes 250 – 700 (-1100) 800 – 1400 µm. in diameter, gametangia predominantly sejoined or plants dioecious --**var.*sejuncta***

2b Branchlets irregularly corticated, (0-) 1 – 4 (rarely more)-corticated branchlet segments---------- **var.*diaphana***

1b Axes and branchlets entirely without cortication ----------***var. brittonii***

On the basis of cortication in axes and branchlet, *Chara zeylanica* has been split into four varieties. Our specimens were belonged to var. *zeylanica* because of uniform cortication in branchlets and conjoined gametangia.

Characteristic of the forms of variety *zeylanica*

1a Moderately developed structures bract-cells to 1 time as long as branchlet diameter; basal branchlet node occasionally fertile; oospore striae 11 -13 ; branchlet segments 10 - 13 ; spine –cells ,bract cells and stipulodes hardly visible to nacked eye ----------**f. *zeylanica***

1b. Bract- cells greatly reduced, posteriors and those at sterile nodes obscure; basal node sterile; bracteoles shorter than oogonia ; oospore striae 12 -16---**f.*michauxii***

1c As in 1b, but bracteoles as long as oogonia; bract-cells at lowest node ventricose; oospore striae few (8-10)----------**f. *berteroi***

1d. As in 1a, but spine cells slender, elongate (to 3000 µm. long); oospore striae 13 – 15-
----------**f. *trichacantha***

1e As in 1a, but branchlet segments few (6- 7); bract –cells short, usually adpressed-------
----------**f. *humboldtiana***

1f As in 1a, but with elongate bract – cells (to 1500µm.); spine-cells (to 1600µm.) and stipulodes obvious to naked eye; lowest node fertile; gametangia conjoined; branchlets to1.8 cm long----------**f. *elegans***

1g As in 1a, but axis slender (to 600µm.); lowest branchlet node, ferile---------**f. *filicaulis***

1h.As in 1f, but bract-cells (to 3500 µm.), spine – cells (to 3.8cm.); dioecious --**f. *keloyen***

Our specimen showed elongate bract - cells and stipulodes obvious to naked eye and conjoined gametangia so it belongs to f. *elegans*.

***Chara zeylanica* v.*zeylanica* f. *elegans*. (A.Br.ex.T.F.A.) H & J. Gr.**

Wood and Imahori, 1965. p. 235, Icones: 94-96.

Plants 15 – 25 cm. high, rather rigid. Axes moderately slender, 600 – 900 µm. in diameter; internodes variable, often shorter than branchlets; cortex (2 -) 3 – corticate; spine – cells variable, 600 – 1600 µm. long, often verticillate. Stipulodes exceeding basal branchlet segments. Branchlets (7 -) 9 – 12 in a whorl to 1.8 (-3) cm long; segments 7 – 9 (-10) of which 6 – 9 are 3 corticate; basal segment 1 – 2 times longer than wide; 1 – 2 (-4) end segments naked. Bract – cells 5 -6, verticillate (rarely slightly unilateral), 500 to 1300 µm. long, posteriors 300 – 1000 µm. long. Bracteoles 2, longer than mature oogonium. Bractlet absent (apeculiar isolated bract or bractlet at lowest node) Gametangia conjoined at 3 – 4 lowest branchlet nodes. Oogonia 600 – 850 µm. long (excl. coronula) 400 – 500 µm. wide; convolutions c 15; coronula 105 – 150 µm. high, 240 – 285 µm. wide at apex, spreading. Oospores black, 500 – 675 (-800) µm. long, 285 – 375 (-500) wide; striae of 11 – 14 (-15) low ridges; fossa 46 – 50 µm. across; membrane smooth, finely granulate or obscurely dotted. Antheridia 255 – 390 µm. in diameter; tetrascutate.

***Chara zeylanica* v.*zeylanica* f. *elegans*. (A.Br.ex.T.F.A.) H & J. Gr.**

Plate No. VI

Plants monocious, 15 – 25 cm. high, rigid. Axes slender, 400 – 630 µm. in diameter; internodes variable, 0.4 – 1.5 cm. shorter than branchlets; cortex 3 corticate; spine – cells variable, 39 – 117 µm. long, verticillate. Stipulodes exceeding basal branchlet segments. Branchlets 10 – 12 in a whorl to 1.8 cm long; segments – 8; basal segment 1 – 2 times longer than wide; 1 – 3 end segments. Bract – cells 5, verticillate, 500 – 900 µm. long, posteriors 300 – 650 µm. long. Bracteoles 2, shorter than mature

oogonium (c 300 µm. long).Gametangia conjoined at 4 – 5 lowest branchlet nodes. Oogonia 500 – 800 µm. long (excl. coronula), 400 – 500 µm. wide; convolutions 10 – 13; coronula 73 – 150 µm. high, 146 – 250 µm. wide at apex, spreading. Oospores black, 410 – 545 µm. long, 293 – 380 µm. wide; striae of 11; fossa 44 – 50 µm. across; membrane smooth, Antheridia 175 – 370 µm. in diameter; tetrascutate.

Plants were collected from following localities

1. Pateshwar
2. Bhartgaon
3. Angapur

The plants were growing luxuriantly in tufts when collected. Our specimen resembled in almost all characters with those described by R.D.Wood (1965). But it showed difference in bracteoles. It was having shorter bracteoles than mature oogonium.

Table 6, Comparative account of *C. zeylanica* f *zeylanica v. elegans*

Sr No	Character	R. D. Wood' 65	Satara. Specimen
1	Habit	15 -25 (-60) cm high	Monoecious, 15 - 25 cm high Slender, stout 400 – 630 µm. in diameter
2	Axes (diameter)	Moderately slender, 600 – 900 um in diameter	0.5 - 1.5 cm shorter than branchlet
3	Internodes	Variable, often shorter than branchlets.	3 corticate
4	Cortex cell	(2 -) 3 corticate	39 -117 um long , verticillate
5	Spine cells	Variable, 600 -1600um long often verticillate	Exceeding basal branchlet segments
6	Stipulodes	Exceeding basal branchlet segments	10 -12 in a whorl
7	Branchlets		
	Number	(7 -) 9 -12 in a whorl	
	Length	1.8 (-3) cm long	c 1.8 cm long
	Segments	7 – 9 (-10)	8
	Basal segment	1 – 2 times longer than wide	1 – 2 times longer than wide
8	Bract cells	5 -6 , verticillate, 500 -1300 µm. long, posteriors 300 -1000 µm. long	5, verticilliate 500 -900 µm. long, posteriors 300 – 600 µm. long
9	Bractioles	2, longer than mature oogonium	2, shorter than mature oogonium (c 300 µm. long).
10	Gametangia	Conjoined at lowest 3 – 4 branchlet nodes	Conjoined, at lowest 4 – 5 branchlet nodes.
	Oogonia		
11	Length	600 -850 µm. long (excl.coronu).	500 -800 µm. (excl. coronu)
	Breadth	400 -500 µm. wide	400 – 500 µm.
	Convolutions	c 15	10 - 13
12	Coronula		
	Height	105 – 150 µm.	73 -150 µm.
	Width	240-285 µm.	146 -250 µm.
13	Oospore		
	Colour	black	black
	Length	500 -675 (-800) µm.	410 – 545 µm.
	Breadth	285 – 375 (-500) µm.	293 – 380 µm.
	Ridges	11-14 (- 15)	11
	Fossa	46 -50 µm.	44 – 50 µm.
	Membrane	Smooth, finely granulate or obscurely dotted	Smooth
14	Antheridia (diam.)	255 – 390 µm. tetrascutate	175 – 370 µm. tetrascutate

PLATE NO. VI

Chara zeylanica var. zeylanica f. elegans (A. Br. Ex T. F. A.) h. and j. Gr..

Fig. 1.Axial node with diplostephanous stipulodes ,bases of branchlet and three corticated axial cortex. X 25.

Fig. 2 Apex of Branchlet X 50

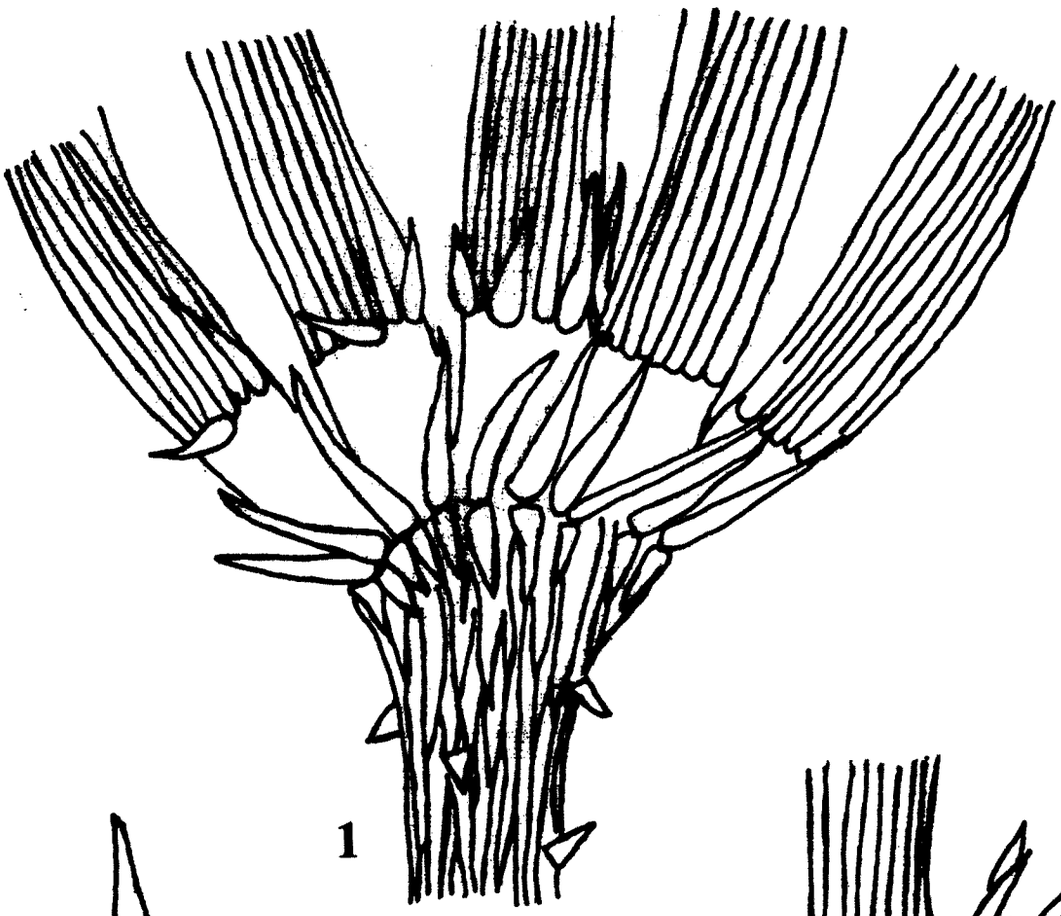
.Fig. 3 Mature Oogonium. With coronola X 100.

Fig 4. Parts of branchlet showing gametangia , bracts and bractioles X 25

Fig.5 Oospore X100

Fig 6 CoronulaX 50

Plate -VI



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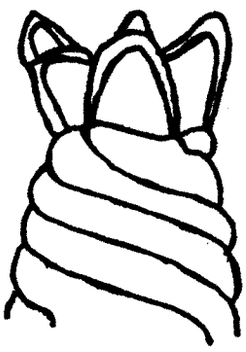

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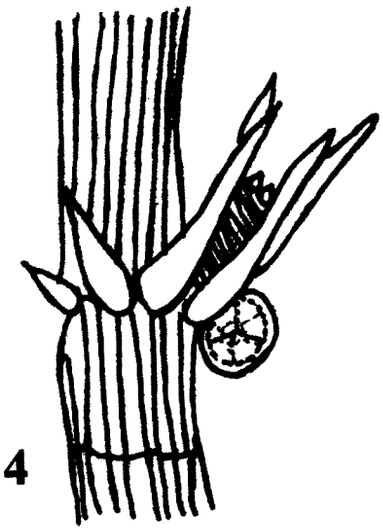

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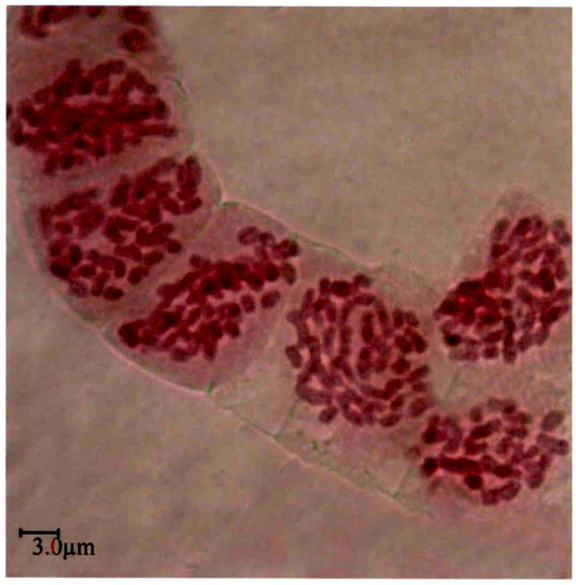
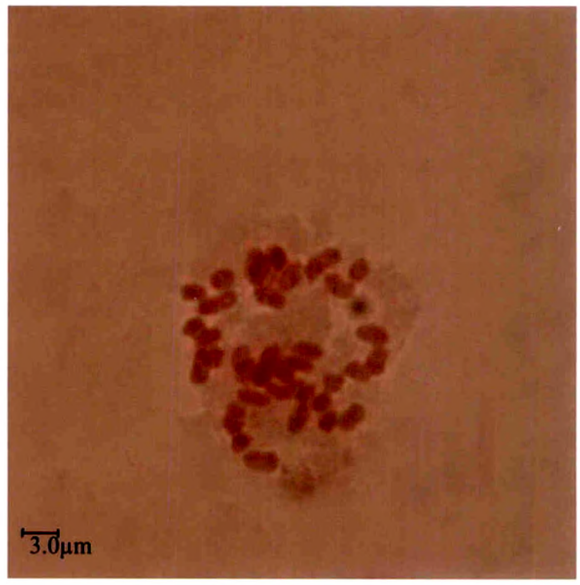
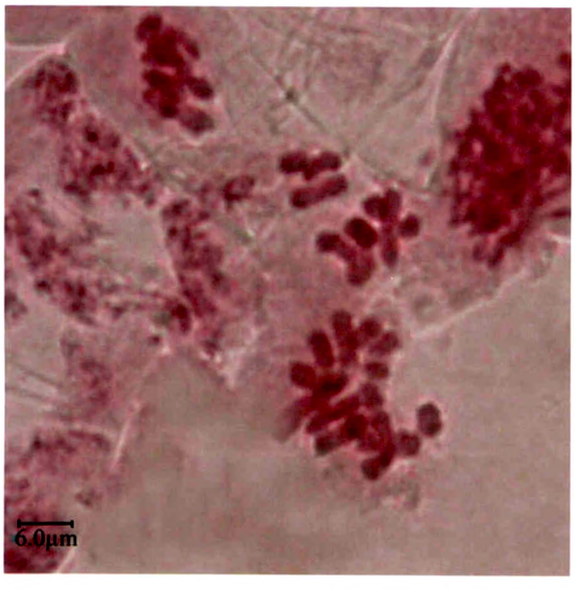
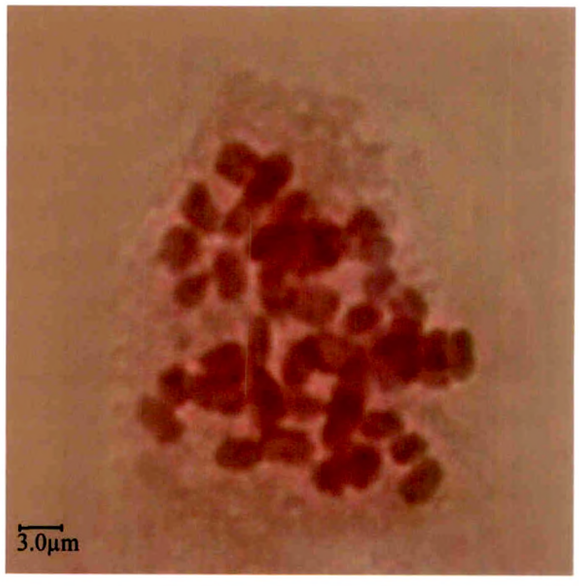
Plate -VII

***Chara zeylanica* f. *elegans* antheridial filament showing mitotic pha**









Chara braunii Gm.

Wood and Imahori, 1965. p. 257, Icon: 109,110.

Pal et al 1962, p.89.Figs. 200-203

Plants monoecious, small to robust, bright to brownish green, 10 – 30 (-80) μm. high, occasionally slightly and some time annularly incrusted. Axes slender to stout, 500 – 1300 μm. in diameter; internodes variable in length, often short in compact forms, usually about as long as branchlets; cortex none; spine cells none. Stpulodes in one tier, one per branchlet, alternate, small to large, 250 – 3500 μm. long, acute to acuminate, spreading. Branchlets 6 – 11 in a whorl, 0.8 – 5.0 cm long, straight or somewhat incurved, ecorticate, segments 4 – 5, occasionally somewhat swollen with constricted nodes, lowest 3 segments often elongate, rarely basal segment abbreviated; end segment reduced forming a tiny terminal corona with the similar subtending bract – cells. Bract-cells 3 – 5, variable, unilateral or verticillate, 0 – 2500μm. long,in some forms obvious to naked eye, occasionally rudimentary at upper sterile nodes; bracts at distal node reduced, forming tiny corona. Bracteoles 2, variable, shorter than to 3 times as long as mature oogonium, to 2500 μm. long, acuminate. Bractlets none. Gametangia conjoined at lowest 2 – 3 branchlet nodes, absent from base of whorl; occasionally granulate or aggregate (3 at a node). Oogonia 510 – 850 μm. long (excl. coronula), 375 – 530 μm. wide; convolutions 8 – 13; coronula 120 – 180 μm. high, 180 – 300 μm. wide, erect or with divergent apices. Oospores dark brown to black, 420 – 750 μm. long, 360 – 400 μm. wide; striae of 7 – 12 faint to prominent ridges; fossa c 75 μm. across; membrane nearly opaque, smooth to slightly granular. Antheridia 225 – 415 μm. in diameter, octoscutate.

On the basis of bract cells, stipulodes *C. braunii* is further divided into six forma.

Characteristics of froms of *Chara braunii*

1a Moderate bract – cells, stipulodes moderately small.

2a Robust, oospores 500 – 560 μm. long, striae of 7 – 8 ---------- **f. *coromandelina***

2b Slender, oospores 640 – 694 μm. long, striae 9 ---------- **f. *kurzii***

2c Medium size, oospores 600 – 650 μm. long, striae 9 – 10 ---------- **f. *perrottetii***

2d Medium size, oospores 420 – 600 μm. long, striae 7 – 9 ---------- **f. *braunii***

1b Small bract – cells, stipulodes very small, oospores 420 – 500 μm. long; plants pallid ---------- **f. *non - mexicana***

1c Bract – cells and stipulodes elongate, obvious to naked eye,

3a Robust, stout, bracts and stipulodes to 3500μm. long; oospores 550 – 650 μm.

long ---------- **f. *schweinitzii***

3b Plants large but slender, bract – cells slender; oospores 600 – 750 µm. long --------

----------**f. *oahuensis***

***Chara braunii* f. *kurzii* (zanev.) R.D.W.**

Wood and Imahori, 1965. p. 265

Plants monoecious. Axes moderately stout, c 1000 µm. in diameter; internodes? ; cortex none; spine - cells none. Stipulodes in 1 tier, 1 per branchlet, alternate, c 2 cm long, ecorticate, terminated by a corona; segments 5 – 6 of which 4 – 6 lower ones are elongate; end cell short. Bract – cells -3 verticillate, 2 times as long as oogonia, visible to unaided eye. Bracteoles two, similar to bract – cells. Gametangia sejoined at more distal, conjoined at 2 lowest branchlet nodes. Oogonia 712 – 757 µm. long (excl. coronula) 472 – 498 µm. wide; convolutions 9 – 10; coronula c 90 µm. high, 150 – 178 µm. wide at base, cells connate except the blunt tips oospores black 640 – 694 µm. long, 392 – 435 µm. wide; striae of 9 narrow ridges. Antheridia ?

***Chara braunii* f. *kurzii* (zanev.) R.D.W.**

Plate No. VIII

Plants monoecious, long bright green in colour, 20 – 35 cm long occasionally incrusted. Axes moderately stout, 758 – 780 µm. in diameter; internodes variable in length, usually as long as or one to two times longer than branchlets. Cortex none, spine - cells none. Stipulodes in 1 tier, one per branchlet, alternate, 424 – 606µm. long, 110µm. wide. Branchlets 8 – 10 in a whorl about 2.5 cm long straight, ecorticate, terminated by a corona; segments 4 - 5 of which lower ones are elongate, end cell short. Bract – cells -5 verticillate, rudimentary at upper sterile nodes, anteriors longer, 512 – 586 µm. long posteriors short, 219 – 235 µm. long. Bracteoles two, similar to anterior bract – cells, equal to or sometimes shorter than mature oogonium 556 – 615 µm. long. Gametangia, conjoined at 2 lowest branchlet nodes, occasionally geminate. Oogonia 586 - 660 µm. long (excl. coronula), 366 - 440 µm. wide; convolutions 9 – 10; coronula 130 - 147 µm. high, 219 - 235 µm. wide, cells connate except the blunt tips oospores black 294 - 476 µm. long, 249 - 380 µm. wide; striae of 9 wide ridges, fossa 70 µm. apart. Antheridia 219 – 260 µm. in diameter, octoscutate.

These specimens were collected from Vairatgadh fort. The plants were growing in tufts, submerged in water. Abundant growth of single species was observed during the

collection. Our specimens resembled almost in all characters with that described by R.D.Wood (1965). Comparative account of specimens has given below –

Table 7.Comparative account of *Chara braunii* f. *Kurzii* (zanev.) R.D.W.

Sr No	Character	R. D. Wood' 65	Vairatgadh fort Specimen
1	Habit	Monoecious,	Monoecious, 20 – 35 cm
2	Axes (diameter)	Stout, c1000 µm.	758 – 780 µm.
3	Internodes	Not mention	Variable 1 – 2 times longer than branchlet
4	Cortex	None	None
5	Spine cells	----------.	Absent
6	Stpulodes	In 1 tier, 1 per branchlet alternate, c 890 µm. long, 220 µm. wide	In 1 tier, 424 – 606 µm. long 110 µm. wide, .
7	Branchlets		
	Number	9 in a whorl	9 – 10 in a whorl
	Length	2 cm	2.5 cm
	Segments	5 – 6	4 – 5
8	Bract cells	3 verticillate, 2 times as long as oogonia	5 verticillate, anterious 512 – 586 µm. long, poseriors219 – 235 µm.
9	Bracteoles	2 similar to mature oogonium	2 similar to anterior bractcells
10	Gametangia	Conjoined , at lowest 2 branchlet nodes,	Conjoined, at lowest 2 branchlet nodes, occasionally geminate
11	Oogonia		
	Length	712 – 757 µm. long	586 – 660 µm. long
	Breadth	472 – 498 µm.	366 – 440 µm.
	Convolutions	9 – 10	9 – 10
12	Coronula		
	Height	C 90 µm.	130 – 147 µm.
	Width	150 – 178 µm. connate, except blunt tips	130 - 200µm. connate, except blunt tips
13	Oospore		
	Colour	Black	Black
	Length	640 – 694 µm.	294 – 476 µm.
	Breadth	392 – 435 µm.	249 – 380 µm.
	Ridges	9 narrow ridges	9 wide ridges
	Fossa	Not mentioned	70 µm.
	Membrane	Not mentioned	Opaque
14	Antheridia (diam.)	Not mentioned	219 – 260 µm. octoscutate

PLATE NO.VIII

***Chara braunii* f. *kurzii* (Zanev.)R. D. W. from Vairatgadh, near Pachwad, Satara.**

Fig. 1.Axial node showing stipulodes and basal parts of branchlet whorls. X 25.

Fig. 2 Branchlet node with conjoined gametangia bracts and bractioles X 50

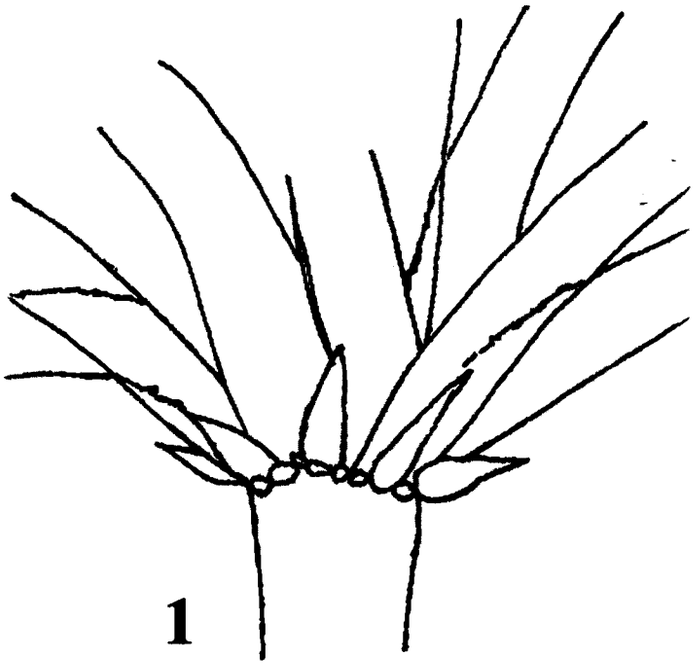
.Fig. 3 Oogonium. X 100.

Fig 4 and 5. Apices of branchlets showing coronae. X 50.

Fig. 6 Oospore X 50

Fig 7 Coronula X 100

Plate -VIII



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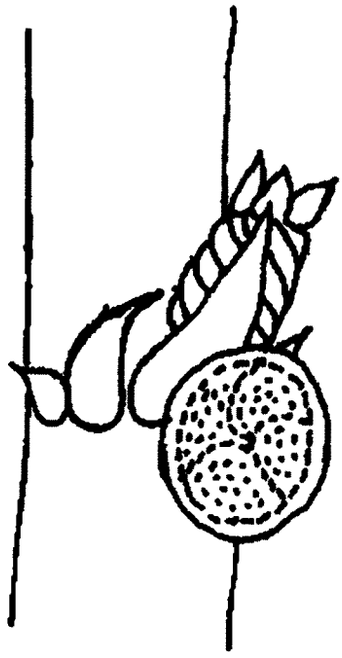

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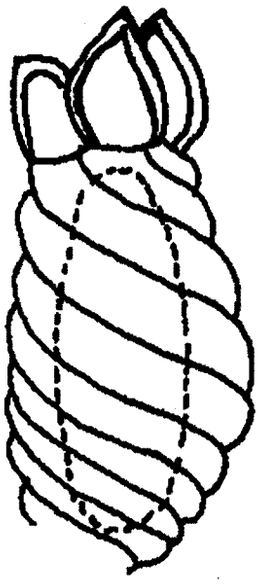

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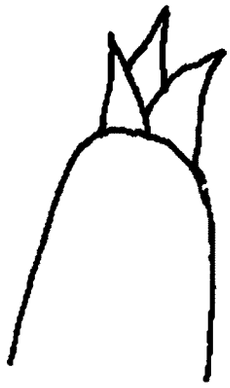

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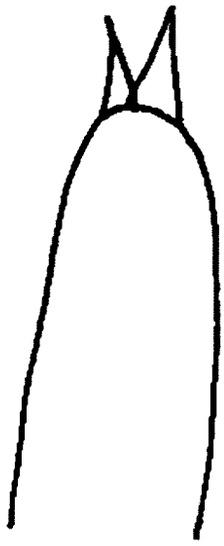

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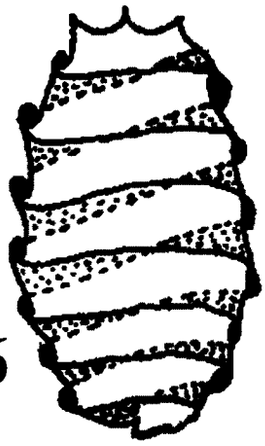

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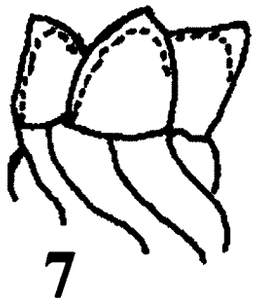

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Chara socotrensis Nordst. in Kuhn, em.

Wood and Imahori, 1965. p. 279 Icon: 119 – 121, 138.

Plants monoecious or dioecious, 5 – 16 (- 30) cm. high. Axes moderately stout, 200 – 1000 µm. in diameter; internodes 1 – 4 times as long as branchlets. Stipulodes small, often rudimentary to absent, 1 – 2 times as numerous as the branchlets, opposite or alternate. Branchlets (4 -) 10 – 12 in a whorl, to 2 cm. long; 2 – 7 segments; terminal segment 1 – 4 celled; end cell small, often mucronate, rarely subtended by bract – cells. Bract cells small, unilateral or verticillate, to as long as the branchlet diameter, absent from branchlet septa except nodes, occasionally rudimentary or absent. Bracteoles 2, to as long as oogonia occasionally rudimentary. Gametangia conjoined or on separate plants, solitary or geminate at lowest 1 – 3 branchlet nodes. Oogonia 450 – 830 µm. long (excl. coronula), 330 – 525 µm. wide; convolutions 8 – 14; coronula 60 – 150 µm. high, 105 – 195 µm. wide. Oospores dark brown to black, 420 – 450 (- more) µm. long 270 – 350 µm. wide; striae of 8 – 9 (-12) ridges; fossa 53 – 65 µm. across; membrane minutely granulate to papillate. Antheridia 180 -345 µm. in diameter; octosutate.

On the basis of bract cells, stipulodes and gametengia *C. socotrensis* is further divided into four forma. In forma *socotrensis* gametengia are conjoined and solitary, forma *fulgens* is dioecious, in f. *pashanii* gametangia are geminate or aggregate at branchlet nodes while in f. *nuda* branchlet are having 1 – 2 nodes.

Characteristics of the forms *Chara socotrensis*

- Bract – cells unilateral, stipulodes evident and alternate, gametangia conjoined, solitary---------- **f. *socotrensis***
- Bract – cells verticillate may occur at all nodes, stipulodes obscure, dioecious ----- ---------- ---------- **f. *fulgens.***
- Bract – cells equilateral, ad pressed, stipulodes absent, gametangia geminate or aggregate at branchlet nodes, monoecious ---------- **f. *pashanii.***
- Bract – cells unilateral, stipulodes evident, alternate; branchlets with 1 – 2 nodes - ---------- **f. *nuda***

Out of these four forma, in our study area only two forma viz.*C. socotrensis* f. *pashanii* and *C. socotrensis* f. *nuda* were collected.

***Chara socotrensis* f. *pashanii*. (Dixit) R. D. W.**

Wood and Imahori, 1965. P 281 Icon : 121

Pal et al 1962 Page no-93. Figs 208 – 210

Plants monoecious, 16 cm. high. Axes 200 – 400 µm. in diameter; internodes elongate. Branchlets 8 – 10 in a whorl, to 2 cm. long; segments 2 – 3. Bract cells only at lowest node, c. as long as branchlet diameter. Gametangia conjoined and aggregate at lowest 1 – 2 branchlet nodes; usually 2 antheridia below 2 – 3 oogonia. Oogonia 2 – 3 together, 525 – 615 µm. long, (excl. coronula), 460 – 480 µm. wide convolutions 8 – 10; coronula 85 – 95 µm. high, 170 - 180 µm. wide. Oospores dark brown to black, 420 – 450 µm. long, 270 – 310 µm. wide; striae of 8 – 9 ridges; fossa 53 µm. across; membrane obscurely granulate. Antheridia 180 – 210 µm. in diameter; octosutate. Bulbils at lower axial nodes, "strawberry" type.

***Chara socotrensis* f. *pashanii* (Dixit) R. D. W.**

Plate No. IX, X, XI

Plants monoecious, 4 – 15 cm. high.Stem slender, erect, stout. 234 - 460 µm. in diameter; internodes 0.5 – 2 cm long 1 – 3 times as long as branchlets. Stipulodes present in 1 tier but rudimentary. Branchlets 10 – 12 in a whorl, 0.7 to 2 5 cm. long; 2 – 5 segments; terminal segment one celled conical, acute, the lower one to two segment short and curved. Cortex entirely absent. Bract cells present only at fertile nodes 2, 115 – 180 µm. long. Bracteoles 2, shorter or nearly equal to the mature oogonium 215 – 420 µm. long.Gametangia conjoined and aggregate at lowest 1 – 2 branchlet nodes, usually 2 antheridia below 1 – 2 oogonia. Oogonia 1 – 2 together. Oogonium 360 – 805 µm. long, 175 - 530 µm. broad (incl. coronula), 400 - 820 µm. long 200 - 580 um wide (excl. coronula) convolutions 9; coronula 60 – 150 µm. high, 146 - 175 µm. wide. Oospores orange to black in colour 215 -270 µm. long, 210 – 270 µm. wide; striae of 8 – 10 prominent ridges; fossa 58 µm. across; Antheridia 205 – 265 µm. in diameter; octosutate.

C. socotrensis f. *pashanii* was abundant in its occurrence around Satara and within Satara district than other species of charophytes. This species was collected from following localities:

1. Kavathe, Tal. Wai, Satara.
2. Ozarde, Tal. Wai, Satara.
3. Medha, Tal Jawali, Satara.
4. Godoli Satara.
5. Parali Satara.
6. Pateghar, Satara.
7. Pateshwar, Satara.
8. Jarandeshwar, Satararoad
9. Rajewadi, Degoan, Satara
10. Masur, Tal.Karad, Satara.
11. Urmodi Dam, Satara.

In our survey of charophytes from Satara district, this species occurred at wide localities. The plants always occurred along the margins of pools, puddles and on wet mud where the soil was rich in calcium. Compared with the specimen described by R.D.Wood, and that originally described by S.C.Dixit, most of our specimens showed some distinguishing features like downwardly growing corticating threads running over the main axes and presence of stipulodes. Comparative account of all specimens has given below

Table 8, Comparative account of *Chara socotrensis* f. *pashanii* (Dixit) R. D. W.

Sr No	Character	R. D. Wood' 65	Satara. Specimen
1	Habit	Monoecious, c 16 cm. long	Monoecious, 4 – 15 cms long
2	Axes (diameter)	200 -400um	Slender, stout 234 -460 µm. in diameter
3	Internodes	Elongated	0.5 - 2 cm shorter than branchlet
4	Stipulodes	Absent	Rudimentary in 1 tier.
5	Cortex	None	Absent
6	Branchlets		
	Number	8 -10 in a whorl	10 -12 in a whorl
	Length	2 cm long	0.7 – 2.5 cm long
	Segments	2 – 3	2 – 5
7	Bract cells	Only at lowest nodes	2 , only at fertile nodes
8	Bracteoles	Not mentioned	2, shorter or nearly equal to mature oogonium.
9	Gametangia	Conjoined and aggregated at 1 – 2 lowest nodes usually 2 antheridia	Conjoined, geminate at lowest 1 – 2 nodes, branchlet nodes.
10	Oogonia	2 – 3 together	1 – 2 together
	Length	525 – 615 µm.	360 – 805 µm.
	Breadth	460 – 480 µm.	175 – 530 µm.
	Convolutions	8 – 10	9
11	Coronula		
	Height	85 – 95 µm.	73 – 100 µm.
	Width	170 – 180 µm.	146 – 175 µm.
12	Oospore		
	Colour	Dark brown to black	Orange to black
	Length	420 – 450 µm.	215 – 270 µm.
	Breadth	270 – 310 µm.	210 – 270 µm.
	Ridges	8 – 10	8 – 10
	Fossa	53 µm.	58 µm.
	Membrane	Obscurely granulate	Not seen
13	Antheridia (diam.)	180 – 220 µm. octoscutate	205 – 265 µm. octoscutate

Table No. 9: Measurements of chromosomes in

***Chara socotrensis* f. *pashanii* (Dixit) R. D. W.**

No.	Length of chromo. arms µm.		Total Length µm.	Centromeric Position	Type of chromosome
	Long arm	Short arm			
1.	3.3	3.3	6.6	Metacentric	Long
2.	3.3	3.3	6.6	Metacentric	Long
3.	3.3	2.7	6.0	Submetacentric	Long
4.	3.3	2.7	6.0	Submetacentric	Long
5.	3.3	2.3	5.6	Submetacentric	Long
6.	3.3	2.3	5.6	Submetacentric	Long
7.	2.3	2.3	4.6	Metacentric	Medium
8.	2.3	2.3	4.6	Metacentric	Medium
9.	1.7	1.7	3.4	Metacentric	Short
10.	1.7	1.7	3.4	Metacentric	Short
11.	1.3	1.3	2.6	Metacentric	Short
12.	1.3	1.3	2.6	Metacentric	Short
13.	2.7	--	2.7	Telocentric	Short
14.	2.7	--	2.7	Telocentric	Short

Table No. 10 : Classification of Chromosomes - *Chara socotrensis* f. *pashanii*

Chromosome type	Number of Chromosome	Length in µm.	Karyotype formula
A	6	5.6 – 6 .6 µm.	A6 + B2 + C6
B	2	4.6 µm.	$L(m_2,sm_4) + M(sm_2) + S(m_2,t_2)$
C	6	3.4 – 2.7 µm.	

Formula –

$L\ (m_2, sm_4) + M\ (sm_2) + S\ (m_4, t_2)$

PLATE NO.IX

***Chara socotrehsis* f *pashanii* (Dixit) R.D.W.**

Fig. 1 .Axial node with whorl of branchlets. X 15.

Fig. 2 Branchlet node with conjoined gametangia X 50

fig 3 Part of branchlet showing geminate gametangia at a node. X 50.

Fig. 4 Mature Oogonium. X 50.

Fig 5 Coronula with cell X100

Fig. 6 Oospore X50

PLATE NO.X

***Chara socotrehsis* f *pashanii* (Dixit) R.D.W.**

Fig. 1.Axial node showing branchlet whorl and gametangia. X 25.

Fig 2 Tip of branchlet. X 50.

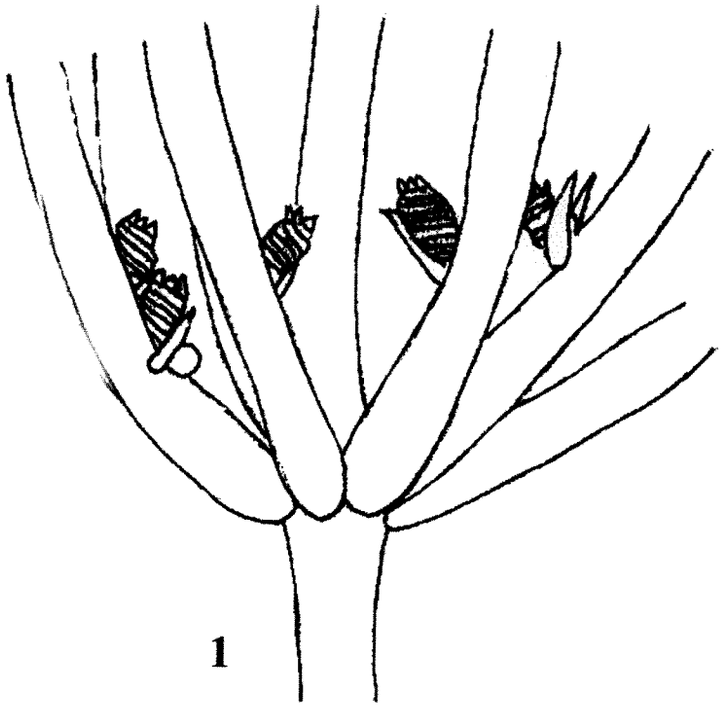
Fig. 3 Parts of branchlet showing gametangia with bracts and bractioles X 50

.Fig. 4 Parts of branchlet showing geminate gametangia X 50.

Fig 5.coronula with spreading cells X100

Fig. 6 Oospore X50

Plate -IX



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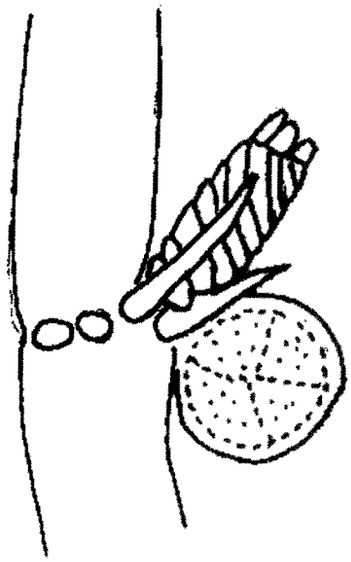

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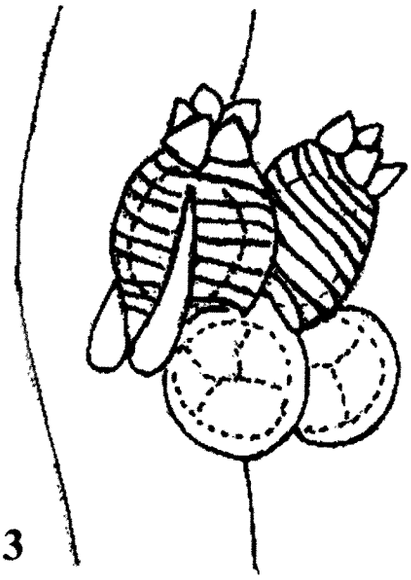

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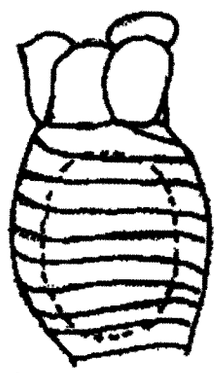

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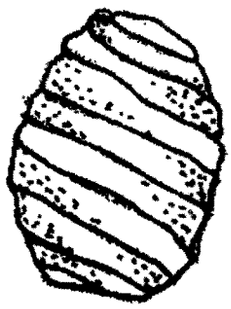

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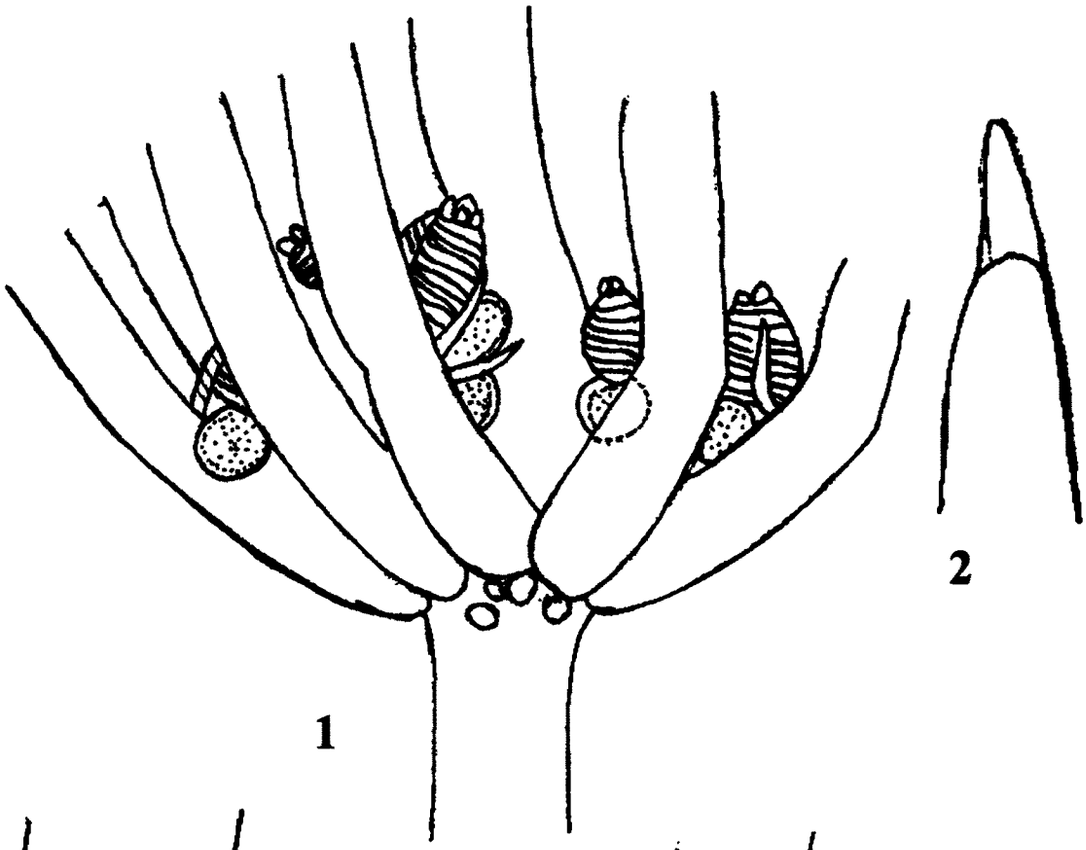
Plate -X



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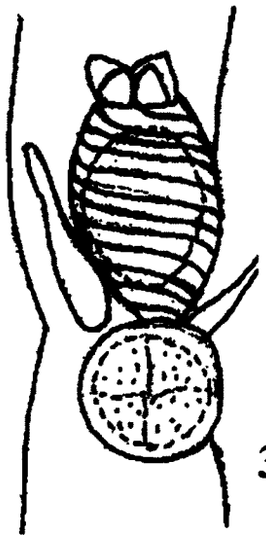

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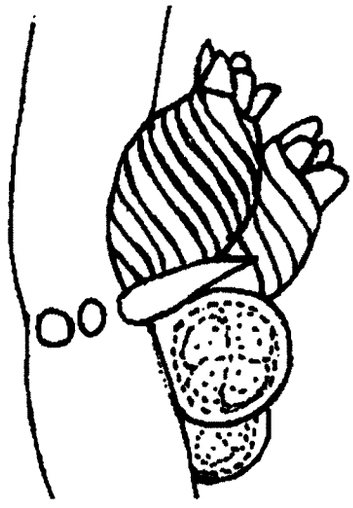

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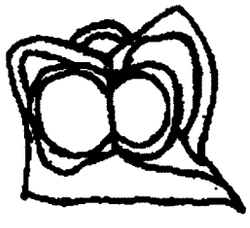

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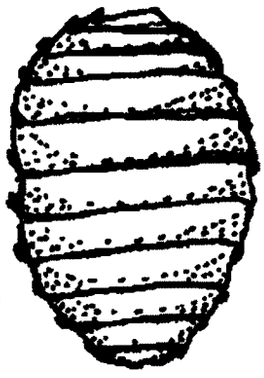

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Plate -XI

***Chara socotrensis* f. *pashanii* stem axis showing imperfect cortications**

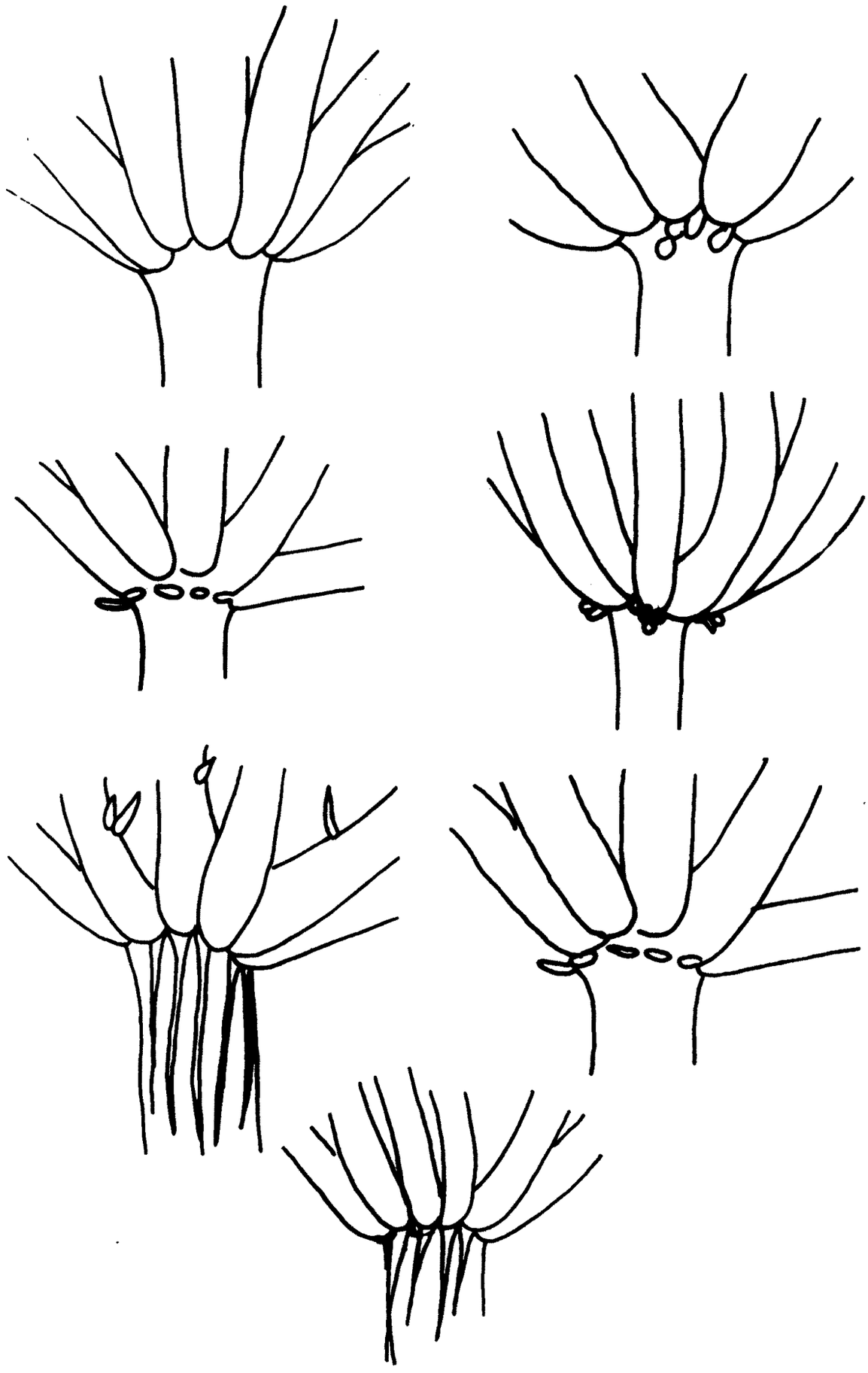
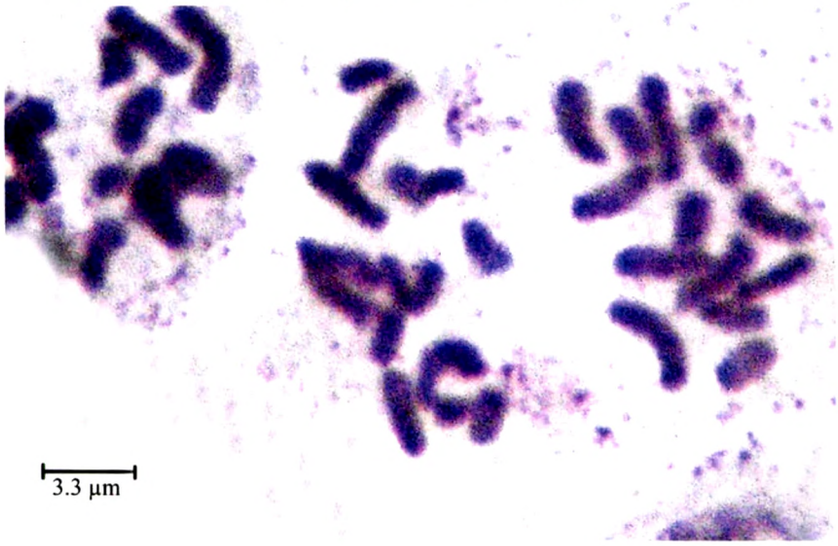
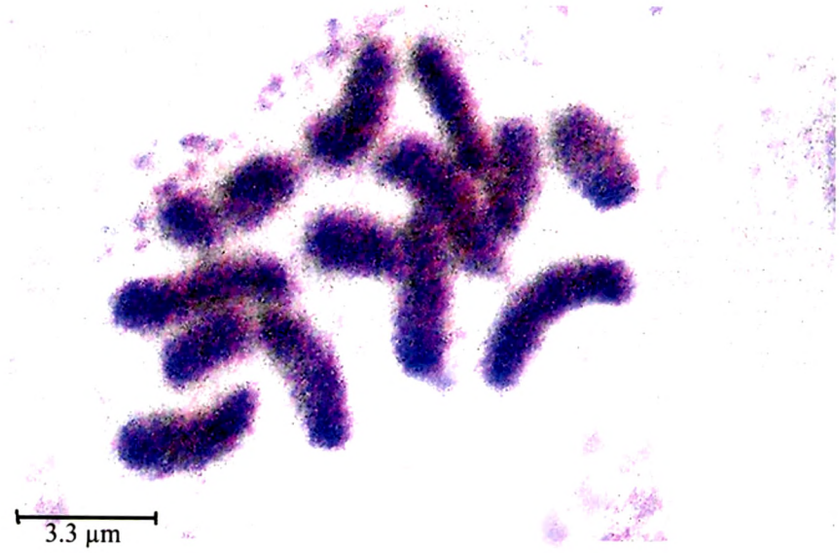
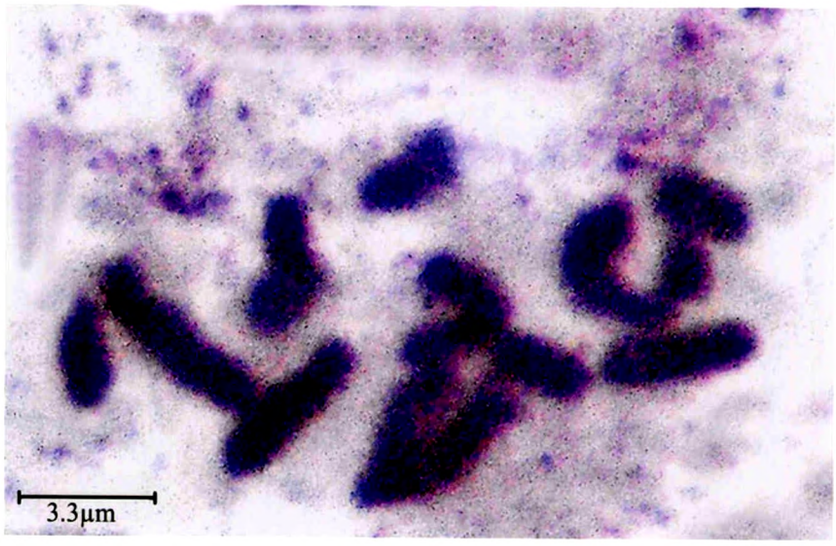


Plate -XII

***Chara socotrensis* f. *pashanii* showing mitotic stages**







Chara socotrensis f. *nuda* (Pal) R.D. W.

Wood and Imahori, 1965. p 282 Icon : 138

Pal et al 1962 p.92. Figs 204 – 207

Plants monoecious, 5.2 cm high, Axes 350 µm. diameter. Stipulodes in 1 tier, rudimentary, Branchlets 7 – 8 in a whorl 0.8 cm long, segment 2 – 3, end segment 3 – 4 celled. Gametangia conjoined at 2 lowest branchlet nodes. Oogonia solitary 730 – 800 µm. long (excl. coronula) 525 µm. wide. Convolutions 14. Coronula 70 µm. high and 190 µm. wide, connivent. Oospore black 450 µm. long, 330 µm. wide, striae of 12 ridges extending into short basal claws. Antheridia 230 µm. in diameter, octoscutate.

***Chara socotrensis* f. *nuda* (Pal) R.D.W.**

- **Plate No. XIII**

Plants, monoecious, 3 – 12 cm. high, axes slender 293 – 410 µm. in diameter, internodes c 0.3 – 0.7 cm. long, cortex haplostichous, stipulodes rudimentary in one tier. Branchlet 7 – 9 in a whorl, 0.3 – 0.9 cm. long, segments 2 – 3, totally ecorticate, end segment blunt, bract cells 2 unilateral, bracteoles 2 small. Gametangia conjoined present at two lowest branchlet node, oogonia 366 – 659 µm. long (excl. coronula), 245 – 513 µm. wide, oogonia 513 – 777 µm. long (incl. coronula) and 250 – 513 µm. wide; convolutions 10 – 12; coronula 88 – 147 µm. high, 175 – 250 µm. wide. Oospores black, 513 – 586 µm. long, 293 – 498 µm. wide, striae – 10 with prominent ridges, fossa 58 – 74 µm. Antheridia 263 – 293 µm. in diameter.

As compared to *C. socotrensis* f. *pashnii*, *C. socotrensis* f. *nuda* occurs rarely in Satara district. This species was collected from following localities:

1. Pateghar, Satara.
2. Urmodi Dam, Satara..
3. Godoli Satara.

Our specimen showed some distinguishing features like stipulodes are rudimentary and alternate, height and axes diameter was more, presence of 2 bracts and bracteoles, larger antheridia, short oogonium, height and width of coronula was more. Though it is ecorticated species, imperfect cortication was seen at nodal region of some *nuda* specimens.

Comparative account of all specimens has given below -

Table 11, Comparative account of *Chara socotrensis* f *nuda* (Pal) R.D.W.

	Character	Wood' 65	Mecheda spe., W. Bengal	Satara specimen
1	Habit	Monoecious	Monoecious	Monoecious
2	Height	5.2 cm.	Up to 15 cm.	3 – 12 cm.
3	Axes diameter.	350 µm.	617 – c 800 µm.	293 – 410 µm.
4	Internodes		1 – 2 times the length of the branchlets	0.3 – 0.7 cm. Nearly equal or longer than ranchlets
5	Stipulodes	1 tier, rudimentary	Fairly developed particularly in the upper whorls, alternate, 475 - 660 µm. long, 142 µm. wide at base	1 tier rudimentary
6	Branchlets Length segment	7 – 8 in a whorl 0.8 cm. 2 - 3	(8-) 9 -10 spreading but slightly incurved -- (2 -)3 (-4), developed equally in mature plants	7 – 9 in a whorl 0.3 -0.9 cm. 2 – 3
7	Bract cell		Verticillate (1-)2 – 3,176-370 µm. long, 76-78 µm. wide	2,146-190µm. long' 45µm. wide.
8	Bracteole		2 x c. 1 to slightly exceeding the mature oogonia	2
9	Gametangia	Conjoined at two lowest branchlet nodes	Conjoined at two lowest branchlet nodes	Conjoined at lowest 2 branchlet nodes
10	Antheridium	230 µm. in diameter octoscutate	Solitary 282 µm. in diameter	Solitary 263 -293 µm. in diameter Octoscutate
11	Oogonium	Solitary, 730-800µm. long. 525µm. wide.	Solitary,511-722µm. long,458-528µm. wide.	Soliatary, 513-777µm. long, 245-513µm. wide.
12	Coronula	70µm. high, 190µm. wide, connivent.	105µm. high, 70-105µm. wide; cells erect.	88-147µm. high, 175-250µm. wide.
13	Convolutions	14	8-9	10-12

Table 12: Measurements of chromosomes in *Chara socotrensis* f. *nuda* (Pal) R.D.W.

No.	Length of chromo. arms µm.		Total Length	Centromeric	Type of
	Long arm	Short arm	µm.	Position	chromosome
1.	2.9	2.9	5.8	Metacentric	Long
2.	2.9	2.9	5.8	Metacentric	Long
3.	2.9	2.9	5.8	Metacentric	Long
4.	2.9	1.5	4.4	Submetacentric	Long
5.	1.5	1.5	3.0	Metacentric	Medium
6.	1.5	1.5	3.0	Metacentric	Medium
7.	1.5	1.5	3.0	Metacentric	Medium
8.	1.5	1.5	3.0	Metacentric	Medium
9.	1.5	1.5	3.0	Metacentric	Medium
10.	1.5	1.5	3.0	Metacentric	Medium
11.	1.5	1.5	3.0	Metacentric	Medium
12.	1.5	1.5	3.0	Metacentric	Medium
13.	1.5	--	1.5	Telocentric	Short
14.	1.5	--	1.5	Telocentric	Short

The chromosome count found in this species was n =14, variation plates found, but rarely in the mitotic preparation with n = 12 and n = 13. Out of fourteen chromosomes eleven chromosomes were metacentric, two telocentric and one was submetacentric. (See Table No. 12) The total complement showed four groups of chromosomes. Three of the 14 chromosome measured 5.8 µm. one 4.4 µm. eight 3.0 µm. while remaining two chromosomes measured about 1.5 µm. Neither secondary constriction nor satellite portions were observed in the chromosomes.

PLATE NO. XIII

***Chara socotrensis* f. *nuda*. (Pal) R.D.W.**

Fig. 1.Axial node showing branchlet whorl and gametangia X 25.

Fig. 2 Part of branchlet showing conjoined gametangia X 50

.Fig. 3 Branchlet tip. X 30.

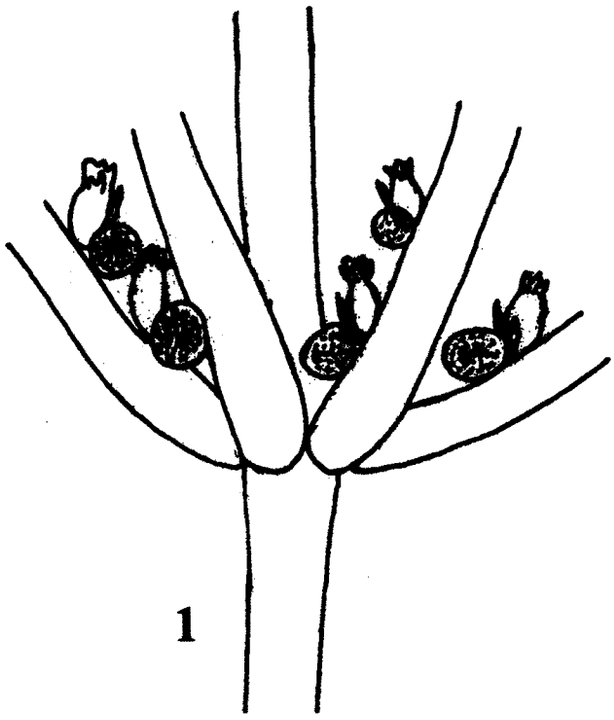
Fig 4. Coronula X450

Fig. 5 Oospore membrane X 1000

Fig 6 Mature Oogonium. X 50.

Fig 7 Oospore X100

Plate -XIII



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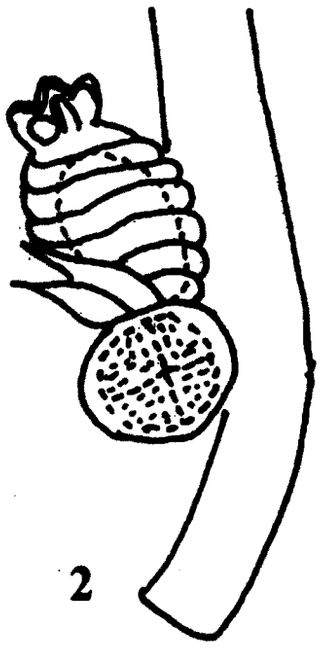

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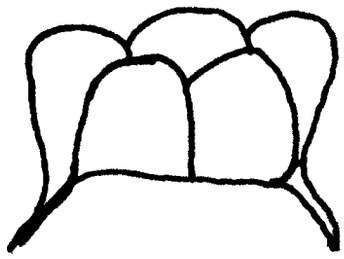

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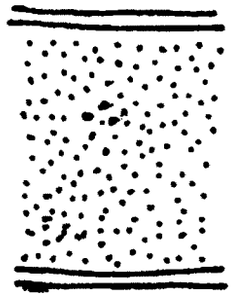

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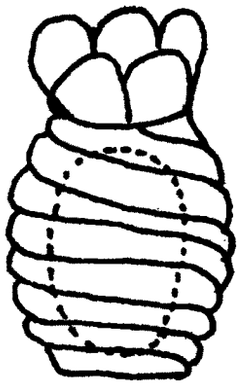

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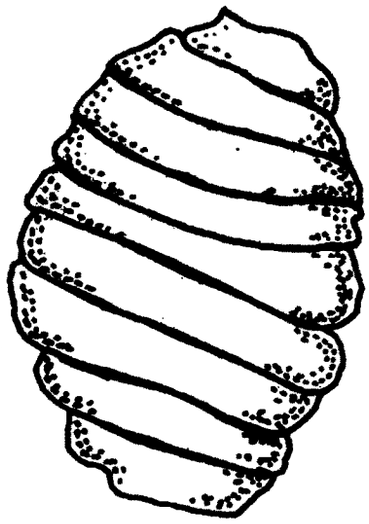

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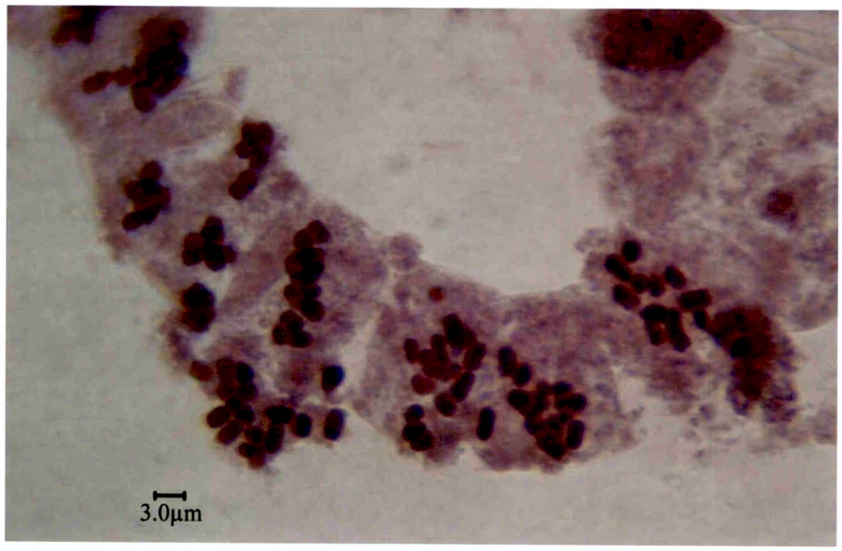
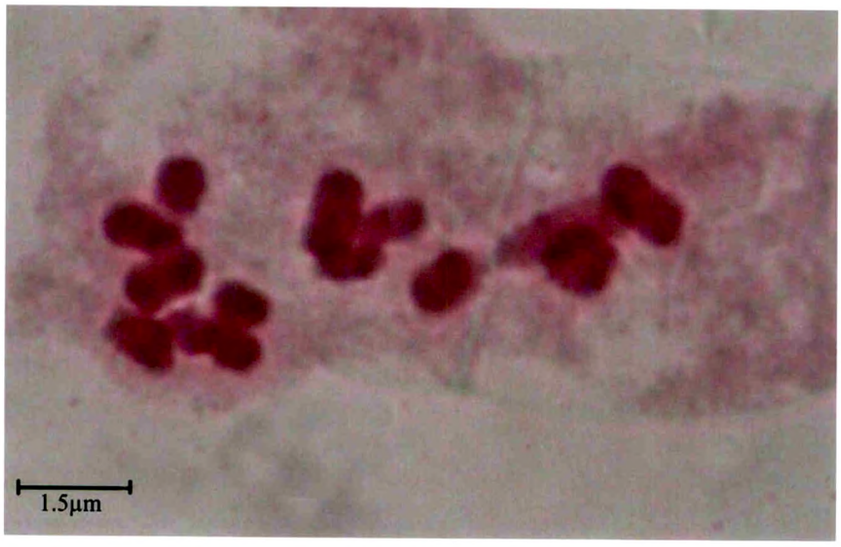
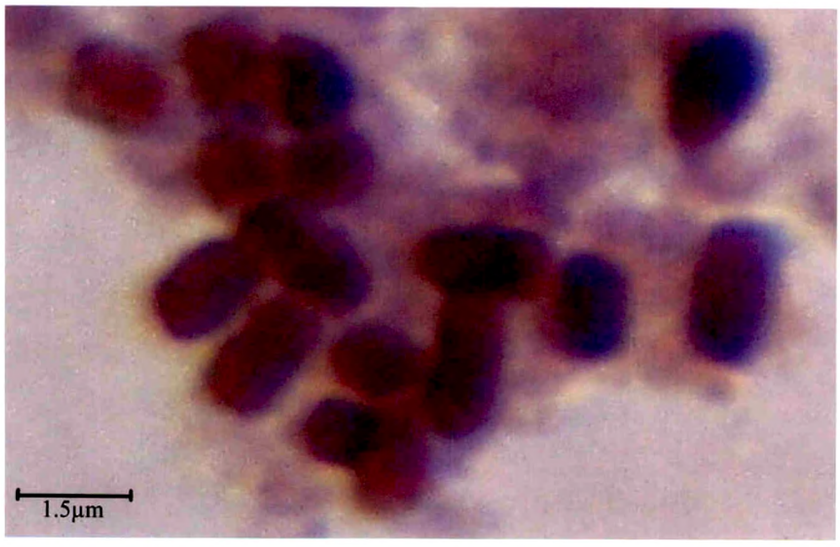
Plate -XIV

***Chara socotrensis* f. *nuda* antheridial filament showing mitotic stages**







At the onset of prophase nucleus increased in size and numerous long intertwined chromatin threads were observed. Chromosomes arranged on metaphase plate were very much condensed and appeared as short rods. A chromosome count of n =14 was obtained at this stage. A high degree of synchronization in antheridial filaments was observed throughout the length of filament. Based on length and centromeric position chromosomes were classified into three groups following Battaglia. (See Table No. 13)

Table No. 13: Classification of Chromosomes - *Chara socotrensis* f. *nuda*

Chromosome type	Number of Chromosome	Length in µm.	Karyotype formula
A	4	5.8 - 4.4 µm.	A4 + B8 + C2
B	8	3.0 µm.	$L(m_3,sm_1) + M(m_8) + S(t_2)$
C	2	1.5 µm.	

Formula –

$L\ (m_3, sm_1) + M\ (m_8) + S\ (t_2)$

Nitella gracilis (Sm.) Ag, em.

Wood and Imahori, 1965. p 597 Icons: 310-315,317-320,322,323,326-340

Plants monoecious or dioecious, 3 – 20 (- 30) cm high, axial internodes occasionally swollen, rarely with rings of primary branchlet rays remaining at nodes, rarely incrusted. Axes slender to moderately stout, (90-) 170 – 375 (- 830) μm. in diameter; internodes (3/4-) 1-4 (- 20) times as long as the branchlets to 9 cm long. Branchlets fertile (2 -) 5 – 8 (- 9) in a whorl, unmodified but also commonly somewhat compacted and occasionally condensed into dense heads, 0. 07 – 1.3 (- 2) cm long, (0 -) 1 – 3 (- 5) furcated, primary ray (1/ 10 -) ¼ – ½ (- ¾) of branchlet length, secondaries (2-) 3 – 7 (-8) of which 1 is rarely central and occasionally reduced, tertiaries (where present) 2- 4, quinaries (where present); sterial similar to fertile or also commonly larger and more diffuse, to 2.5 (-4) cm long. Dactyls, fertile 2 – 4 (- 5), (1 -) 2 – 3(- 5) celled, generally elongated but occasionally abbreviated, penuitimate cell tapering gradually or sharply to the base of the end cell or allantoid and rounded (rarely also swollen) at apex; end cells short or long conjcal, acute to acuminate, rarely somewhat curved, generally as wide at the apex as the of the end cell but also occasionally mucronate; very rarely also a short 1 – celled allantoid to lanceolate dactyl; sterile similar to fertile but occasionally more reduced and forming assort of small cuspidate terminal corona. Heads often not formed, the branchlets being uniform throughout but also commonly with upper whorls compacted and occasionally congested into dense heads. 0.2 -1.0 cm in diameter, sometimes stipitate; with or without mucus. Gametangia conjoined or sejoined at all or at 2nd – 3rd etc, branchlet nodes, occasionally absent from the lowest furcation; rarely restricted to separate plants. Oogonia 1 (-2 -3) at a node, (225-) 290 – 490 (- 535) μm. long (excl. coronula), (180 -) 225 – 350 (-500) μm. wide; convolutions (5-) 6 – 10 (-11), rarely swelling beneath the coronula (15-) 20 – 59 (-89) μm. high, 24 – 70 (-134) μm. wide at base, persistent or rarely deciduous, cells of upper tier occasionally slightly to 2 times time longer than lowers oospores golden, yellowish or golden brown, light (or reddish) to dark brown, dull brown or chestnut, black, rarely grayish due to lime, (180-) 235 – 380 (-400) μm. long, (150-) 180 – 285 (-345) μm. wide; striae of (4-) 5 – 7 (-9) prominent and occasionally flanged ridges or low ridges or limes (rarely some what displaced); fossa (33-) 41 – 52 (-60) μm. across;

membrane finely granulate, fibrous vermiforous or coarsely vermiforous, tuberculate or papillate, (rarely appearing to be somewhat reticulate), occasionally tuberculate on granulate background. Antheridia generally solitary, 120 – 370 (-450) µm. in diameter.

Synopsis of the subspecies of *Nitella gracilis*

1a Dactyls 2 – or 2 – 3 (-4)-celled, axes moderately slender (190 – 750 µm.in diameter); oospores membrane granulate to tuberculate; heads rare, obscure, occasionally with mucus ---------- **sub sp. *gracilis***

1b Dactyls pluricellulate, 3 – 5 celled

2a With numerous minute heads; primary branchlet rays short (1/10 – 1/5) of branchlet length.

3a Fertile branchlets 1 – 2 furcate; dactyls mostly 5 celled -------- **sub sp. *lechleri***

3b fertile branchlets 2 – 3 furcate; dactyls mostly 4 celled --------- **sub sp. *zeyheri***

2b Without obvious heads; primary branchlet rays normal ---------- **sub sp. *havaiensis***

1c Dactyls 1 – 3 or 2 – 3 celled; axes very slender (90 – 195 µm. in diameter); commonly with central secondary ray; oospore membrane strongly papillate ----------
----------**sub sp. *gracillima***

1d Dactyls 2 celled often much abbreviated; heads developed, terminal and axillary, cone like to spherical with mucus---------- **sub sp. *gloeostachys***

1e Similar to 1a with dactyls 2 (-3) – celled, but fertile whorls small and isolated along terminal axes in long, inflorescence like spikes; without mucus ----------
----------**sub sp. *gloeostachys* var. *spiciformis***

Synopsis of the varieties of subspecies *gracilis*

1a Dactyls 2 – 3 celled; gametangia generally at lowest branchlet furcation - **var.*gracilis***

1b Dactyls 2 - celled

2a Heads distinct, compact, without mucus.

3a Branchlets 1 – 2 (-3) furcate; gametangia rare lowest furcation; oospore membrane granulate or vermiferous ---------- **var. *leibergii***

3b Branchlets 2 – 3 furcate; with central secondary branchlet rays; gametengia absent from lowest furcation; oospore membrane obscurely granulate ----------
----------***N.pseudoflabellata* f. *habrocoma***

3c Branchlets uniformly 2 furcate; gametangia regularly at lowest fucation; oospores membrane scattered tuberculate---------- **var. *bipartita***.

2b Without heads, branchlets uniform, much furcate (3 – 4 furcate) **var.*moniliformis***.

2c With or without heads, with slight mucus, branchlets 1 – 2 (-3) – furcate; gametangia at lowest furcation ---------- **var. *confervacea***

2d With heads, enveloped in thick mucus ---------- **var. *leptosoma***

2e Without heads, but upper whorls small and isolated on loose terminal wandlike spikes, without mucus; with central secondary branchlet ray; (3 – furcate)-------- ---------- ***N. pseudoflabellata* var. *mathuatae***.

2f With obscure heads, enveloped in thick mucus----------**var. *annandalei.***

1c Dactyls 2 – 3 celled; gametangia absent from lowest furcation; fertile whorls isolated on elongate spicate upper axes ---------- **var. *pseudotenuissima***

Characteristics of the forms of variety *gracilis*

1a Dactyls 2 – 3 celled; penultimate celled tapering, end cell not mucronate; oogonia solitary, 450 – 525 µm. long; without mucus ---------- **f. *gracilis***

1b Dactyls occasionally 4 celled; penultimate cell often rounded and end cell mucronate; oogonia 1 – 3 at a node, small (300 – 355 µm.) long --- **f. *arvernica***

1c Dactyls 2 – 3 celled end cell not mucronate; upper whorls compacted and with thin mucus; branchlets thin characteristically brush like; oogonia solitary, larger (480 – 630 µm.) long ---------- **f. *intermedia***

1d Dactyls 2 celled end cell occasionally mucronate; upper whorls compacted and with thin mucus; oogonia solitary, larger (510 – 540 µm.) long ---------- **f. *minuta***

1e Dactyls 2 (rarely 3) celled, more robust than f. *gracilis* and with smaller gametangia (e.g. oogonia c 300 µm. long) ---------- **f. *africana***

***Nitella gracilis* f. *minuta* (T.F.A.) R.D.W**

Wood and Imahori, 1965. p 611 Icon - 314

Pal et al 1962, p.124 Figs 1 – 6

Plants monoecious to 6 cms high, axes slender, 130 – 150 µm. in diameter; internodes somewhat shorter than the sterile branchlets, 1.5 cm long. Branchlets fertile 6 – 7 in a whorl, compacted into heads to 0.3 cm long, 1 – 2 (- 3) furcate, primary ray c 1/3 of branchlet length, secondaries 3 – 4, tertiaries 3 – 4, sterile 5 – 6 in a whorl, about 3 diffuse sterile whorls per plant, to 1.5 cm long, 1 – 2 furcate, primary ray c 1/3 of branchlet length, secondaries 4 – 5, tertiaries 3 – 4, Dactyls 3 – 4, 2 – celled, uniform, basal cell tapering or rounded at apex, end cell conical, acute, occasionally somewhat mucronate, 90 – 120 µm. long, 30 – 39 µm. wide at base. Heads 2 – 5 on a shoot, spheroid, amidst sterile branchlets, to 1 cm in diameter, stipitate on stalk cells to 1 cm

long consisting of several reduced fertile whorls on shortened branch axes, with thick mucus. Gametangia sejoined or conjoined at all fertile branchlet nodes. Oogonia solitary, 510 - 540 µm. long (incl. coronula), 380 – 435 µm. wide, convolutions 9 – 10, elongated beneath coronula; coronula c 63 µm. high, c 63 µm. wide at base, upper cells to twice as long lowers. Oospores dark reddish or chestnut brown, 330 – 375 µm. long, 285 – 345 µm. wide; striae of (6-) 7 – 8 prominent, broad flanged ridges; fossa c 56 µm. across; membrane uniformly covered with rounded elevations visible at edge of membrane as tubercles, c 30 across fossa. Antheridia 180- 200 µm. in diameter.

Nitella gracilis f. minuta **(T.F.A.) R.D.W.-**

- **Plate No. XV**

Plants monoecious, 1.5 – 4 cms high, axes slender, 145 – 220 µm. in diameter. internodes 0.5 – 1.5 cm long, Branchlets fertile 6 – 7 in a whorl, compacted in to heads to 0.3 cm long, 3 – furcate primary ray 7, 586 – 1099 µm. long, secondaries 3 – 6, 293 – 880 µm. long, tertiaries 5, 512 – 733 µm. long, dactyls 3 – 4, 2 – celled, uniform, basal cell rounded at apex, end cell conical, acute, 29 – 74 µm. long, 15 µm. wide at base. Heads 2 – 5 on a shoot, spheroid amidst sterile branchlets, upper whorls compacted smaller than lowers, without mucus. Gametangia conjoined formed at the second and third branchlet node, absent at lowest furcation. Oogonia solitary 220 – 308 µm. long (incl. coronula) 175 – 264 µm. wide, convolutions 5 – 7 and striae 14 – 59 µm.. Coronula 14 – 44 high and 44 µm. wide at base. Oospores dark orange to brown, 117 – 293 µm. long, 117 – 162 µm. wide, 7 – 8 ridges, fossa 14 – 44 µm.. Membrane finely granulate. Antheridia 145 – 220 µm. in diameter.

The species of *Nitella gracilis* as conceived by Wood and Imahori has a great variation in form and structure. It has a range of variations exhibited in different corners of world (Wood and Imahori 1964). It is difficult to distinguish and give the proper status to the species. Our specimen closely resembles with *Nitella gracilis* f. ***minuta*** as described by R.D.Wood (1965). There are some variations like the length and breadth of oogonium, height of coronula and the dimensions of the oospores. Our specimen is smaller in size, measuring up to 4 cms.

Table 14, Comparative account of *Nitella gracilis f. minuta* (T.F.A.) R.D.W.

	Character	Wood, '65	Satara specimen
1	Habit	Monoecious	Monoecious
2	Height	6 cms.	1.5-4 cms.
3	Axes diam.	Slender 130-150 µm.	Slender 145-220 µm.
4	Internodes	1.5 cms long	0.5-1.5 cms long
5	Branchlets Fertile Sterile	6-7 in a whorl 1-2 {-3} furcate 3, diffuse	6-7 in a whorl 3 furcate 3, diffuse
6	Dactyls	3 – 4, 2 celled uniform, basal cell rounded at apex, end cell conical, acute, 90 – 120 µm. long, 30 – 39 wide	3 – 4, 2 celled uniform, basal cell rounded at apex, end cell conical, acute, 29 -74 µm. long, 15µm. wide
8	Heads	2 – 5 on a shoot, spheroid, amidst sterile branchlets, 1 cm in diameter	spheroid, amidst sterile branchlets, 0.3 cms in diameter upper whorls compacted smaller than lowers, without mucus
9	Gametangia	Conjoined or sejoined at all fertile branchlet nodes	Conjoined formed at the second and third branchlet nodes, absent at lowest furcation
11	Oogonium Length Breadth Convol.	Solitary 510 – 540 µm. long (incl. coronula), 380- 435 µm. wide 9 – 10	Solitary 220 – 308 µm. long, (incl. coronula), 175 – 264 µm. wide. 5 - 7
12	Coronula	63 µm. high, 63 µm. wide at base.	14 – 44 µm. high, 44 µm. wide at base
13	Oospore Length Width Ridges Fossa Membrane	Dark reddish or brown 330 – 375 µm. 285 – 345 µm. 7 – 8 prominent 56 µm. uniformly covered with rounded elevations visible at edge of membrane as tubercles	Orange to brown 117 – 293 µm. 117 – 162 µm. 7 – 8 prominent 14 – 44 µm. finely granulate
14	Antheridium	180 – 200 µm. in a diameter	145 -220 µm. in diameter

Table 15, Measurements of chromosomes in

***Nitella gracilis f. minuta* (T.F.A.) R.D.W.**

No.	Length of arms μm.		Total length μm.	Centromeric Position	Type of Chromosome
	Long arm	Short arm			
1	4.4	1.5	5.9	Submetacentric	Long
2	4.4	1.5	5.9	Submetacentric	Long
3	4.4	1.5	5.9	Submetacentric	Long
4	2.9	2.9	5.8	Metacentric	Long
5	2.9	2.9	5.8	Metacentric	Long
6	2.9	1.5	4.4	Submetacentric	Medium
7	2.9	1.5	4.4	Submetacentric	Medium
8	1.5	1.5	3.0	Metacentric	Short
9	1.5	1.5	3.0	Metacentric	Short

The chromosome number was reported by Lindenbein and Karling (1926) (n = 17). As the other species show higher chromosome number while our specimen shows haploid compliment n = 9. The classification of chromosomes and the karyotype shows variation from the other chromosome compliments of *Nitella gracilis*.

Table No. 16: Classification of Chromosomes

Chromosome type	Number of Chromosome	Length in μm.	Karyotype formula
A	5	5.9– 5.8 μm.	A5 + B2+ C2
B	2	4.4 μm.	$L(m_2,sm_3) + M(sm_2) + S(m_2)$
C	2	3.0 μm.	

Formula: L (m_2, sm_3) + M (sm_2) + S (m_2)

PLATE NO. XV

***Nitella gracilis* f. *minuta* (T.F.A.) R.D.W.**

Fig. 1.Habit X 15

Fig. 2 Axial node with 3 – 4 furcate branchlets X 30

Fig. 3 End cell of dactyls X 30

Fig. 4 Conjoined gametangia X 50

Fig. 5 Coronula X 450

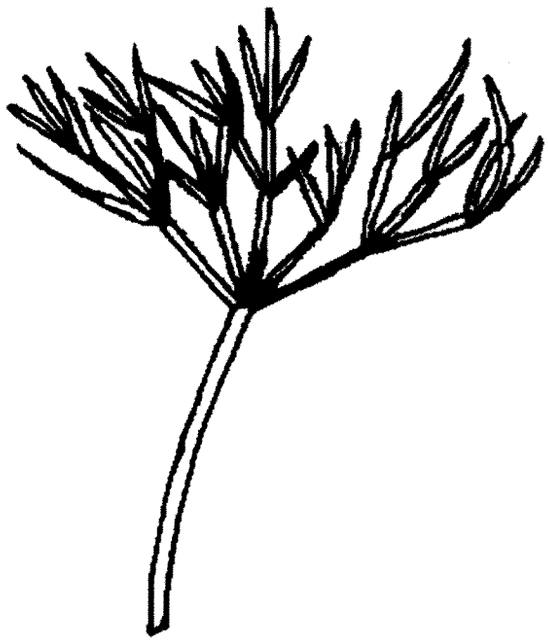
Fig. 6 Oospore X 50

Fig. 7 Oogonium X 100

Fig. 8 Oospore membrane X 1000

Plate -XV

1



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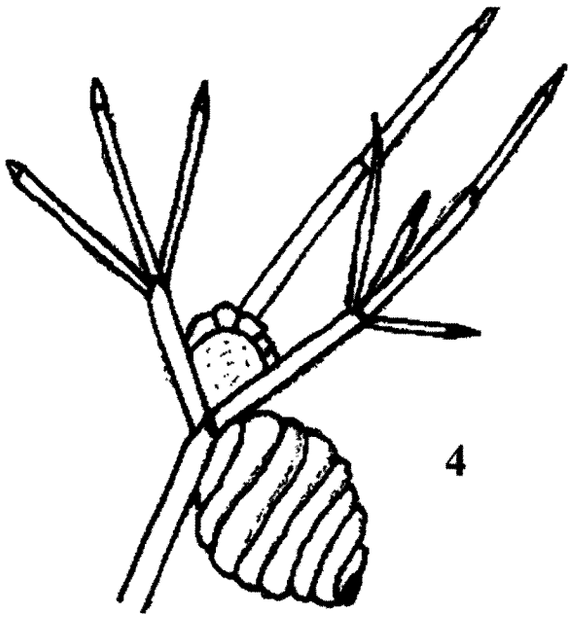

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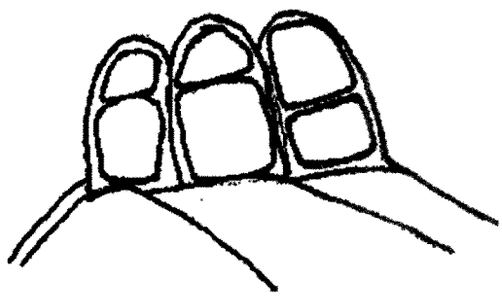

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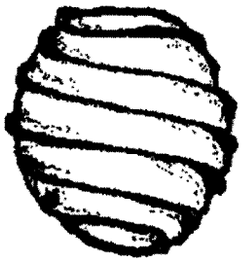

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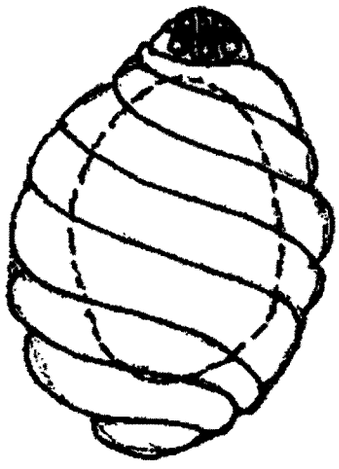

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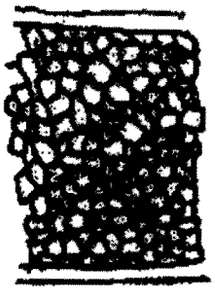

8

Plate -XVI

***Nitella gracilis* f. *minuta* antheeridial filament showing mitotic stages**