

# SYSTEMATIC STUDIES ON SPECIES OF CHARA L. FROM JAMMU (J & K)

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In the present communication, taxonomic studies on eight species of *Chara* Linn. collected from different habitats of Jammu have been dealt for the first time.

**Keywords :** Chara, Systematics, Jammu.

Taxonomic enumeration of the species is as follows :

### *Chara*

Stem and branchlet corticate or ecorticate; branchlet segmented; stipulode present; bract cells present, antheridium below the oogonium, coronula 5-celled.

### Key to the local species

- 1 a. Stipulode in a single whorl ----- 2
  - Haplostephanous
- b. Stipulode in a double whorl ----- 4
  - Diplostephanous
- 2 a. Stem and branchlet ecorticate ----- 3
- b. Stem corticate and branchlet ecorticate ----- *C. benthamii*
- 3 a. Oogonia produced at the base of branchlet whorl and also at lower branchlet nodes ----- *C. corallina*
- b. Oogonia not produced at the base ----- *C. braunii*
  - iv orls
- 4 a. Cortex diplostichous ----- 5
- b. Cortex triplostichous ----- 6

- 5 a. Primary series of cortical cells more prominent than the secondary series ----- *C. contraria*  
 b. Secondary series of cortical cells more prominent than the primary series ----- *C. vulgaris*  
 6 a. Lowest segment of the branchlet ecorticate ----- *C. zeylanica*  
 b. Lowest segment of the branchlet corticate ----- 7  
 7 a. Stipulodes and spine cells rudimentary ----- *C. fragilis*  
 b. Stipulodes and spine cells well developed ----- *C. brachypus*

**Table 1** : Occurrence and distribution of different species of *Chara* collected from different habitats of Jammu.

Species	Occurrence/Distribution
<i>Chara corallina</i>	1(VC), 2(C), 5(VC), 6(C).
<i>Chara braunii</i>	1(VC), 2(VC), 6(C), 15(R), 18(R), 21(VC), 26(VC), 28(R), 32(VC)
<i>Chara benthamii</i>	2(C), 6(C).
<i>Chara vulgaris</i>	3(C), 4(VC), 7(VC), 8(C), 9(VC), 10(C), 11(C), 12(C), 14(VC), 15(R), 16(C), 19(VC), 20(C), 22(C), 23(C), 24(C), 25(R), 27(R), 29(R), 30(C), 31(R).
<i>Chara contraria</i>	10(C), 23(C).
<i>Chara zeylanica</i>	13(VC), 17(C), 28(C).
<i>Chara fragilis</i>	2(VC), 5(VC), 6(VC), 26(C).
<i>Chara brachypus</i>	17(C).

C=Common, R=Rare, VC=Very Common.

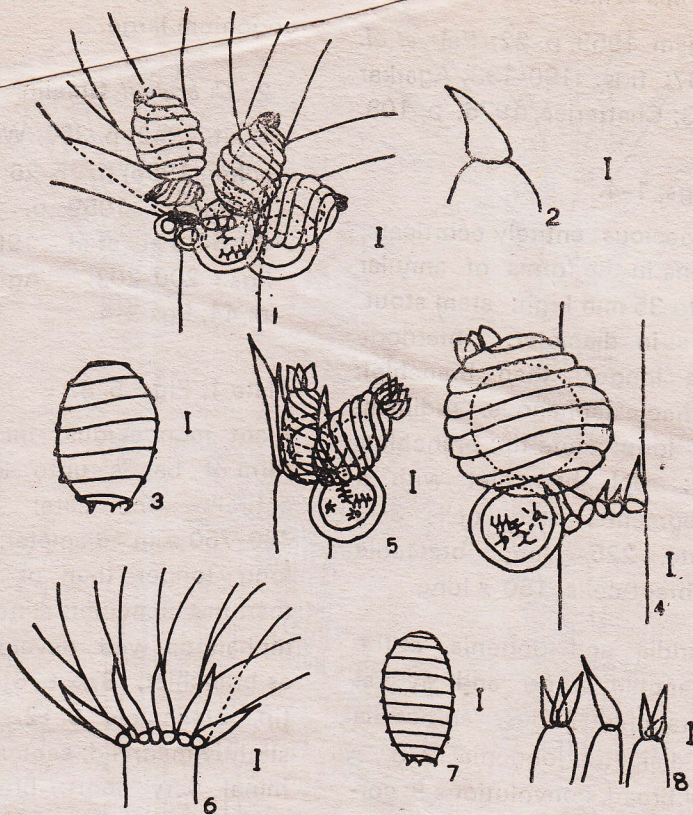


PLATE 1

- Figs. 1-4 *Chara corallina* Linn
- Fig. 1. Stem node showing game-tangia at the base of branchlet whorl.
- Fig. 2. Apex of branchlet
- Fig. 3. Oospore
- Fig. 4. Branchlet node with antheridium and oogonium.

- Figs. 5-8 *Chara braunii* Gmelin.
- Fig. 5. Branchlet node with two antheridia and two oogonia.
- Fig. 6. Stem node showing stipulodes.
- Fig. 7. Oospore
- Fig. 8. Apices of branchlets.

1. *C. corallina* Willd.

Sundralingam, 1959, p. 22; Pal *et al.* 1962, p. 87; figs. 190-193; Agarkar 1963, p. 43; Chatterjee, 1975, p. 108.

## Plate 1, Figs. 1-4.

Plant monoecious, entirely ecorticate, incrustations in the forms of annular bands; upto 35 mm high; stem stout, 560-1125  $\mu$  in diameter; internode 1-3 times longer than branchlet; stipulode haplastephanous, rudimentary, 290  $\mu$  long; acute tip; branchlets 6 in whorl; each branchlet with 4 swollen segments; bract cells 3-4, small, acute, 225  $\mu$  long; bracteole similar to bract cells, 150  $\mu$  long.

Antheridia and oogonia at the base of branchlet whorl and at 1st and 2nd branchlet nodes; antheridia 525  $\mu$  in diameter; oogonia 975  $\mu$  long, 375  $\mu$  broad, convolutions 9; coronula 120  $\mu$  long, 100  $\mu$  broad; Oospore black 705  $\mu$  long, 465  $\mu$  broad, ridges 7.

Sundralingam (1959) described this plant from different localities of Madras. The present plants differed from the type described by Sundralingam (1959) in the diameter of stem, oospore dimension and number of branchlets. The present species agrees in full with that of Pal *et al.* (1962) and Agarkar (1963). However it differed with the description of Chatterjee (1975) with respect to the height of plant being

much higher, antheridium and oogonium large.

2. *C. braunii* Gmeiin

Dixit, 1942, p. 360; Wood & Muencher, 1956, p. 25-26, pl. 8; Sundralingam 1959, p. 23-27; figs. 58-64; Pal *et al.* 1962, p. 89-92; figs. 200-203; Agarkar, 1963, p. 44, figs 3-4.

## Plate 1, Figs. 5-8.

Plant monoecious, incrustated in the form of bands upto 30 cms high; entirely ecorticate; stem stout; 480-750  $\mu$  in diameter; internode as long, longer than or even shorter than the branchlet; stipulodes haplostephanous, well developed as many as branchlet, 375-675  $\mu$  long, acute tip, branchlets 8-12, straight or slightly incurved; segments 4-6, terminal very short; bract cells 3-4; equal to the length of oogonia; 270-1050  $\mu$  long, bract cell of distal branchlet node together with the upper segment form corona like structure; bracteole similar to bract cell and larger than oogonium.

Antheridia and oogonia together at 1-3 nodes; solitary, rarely geminate; antheridia 315-390  $\mu$  in diameter, oogonia 600-935  $\mu$  long, 315-495  $\mu$  broad, convolutions 8-12; Coronula 105-225  $\mu$  long, 105-270  $\mu$  broad; oospore black, 434-930  $\mu$  long, 300-390  $\mu$  broad, ridges 8-10.

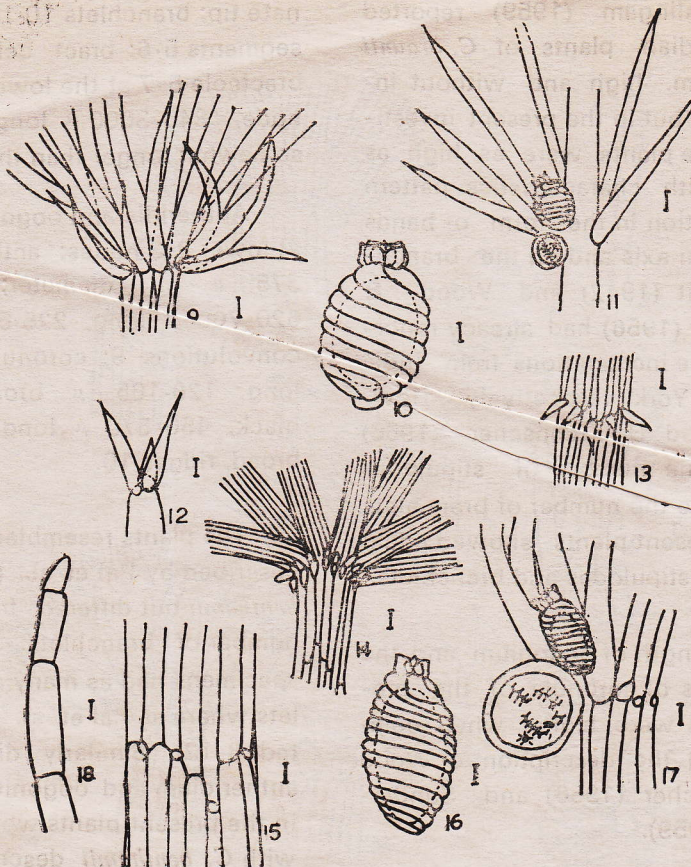


PLATE 2

Figs. 9-13 *Chara benthamii* Braun.

- Fig. 9. Stem node showing the stipulodes and ecorticate branchlets.
- Fig. 10. Oogonium
- Fig. 11. Branchlet nodes with antheridium, oogonium.
- Fig. 12. Apex of the branchlet.
- Fig. 13. Stem cortex.

Figs. 14-18 *Chara vulgaris* Linn.

- Fig. 14. Stem node showing two rows of stipulodes and corticate branchlets.
- Fig. 15. Stem Cortex.
- Fig. 16. Oogonium
- Fig. 17. Branchlet node with antheridium and oogonium.
- Fig. 18. Apex of branchlet.

Sundralingam (1959) reported South Indian plants of *C. braunii* about 10 cm. high and without incrustations but in the present investigations, the plants were as high as 35 cms. with characteristics pattern of incrustation in the form of bands on the main axis and on the branchlets. Dixit (1942) and Wood & Muenscher (1956) had already reported the lime incrustations from India and New York respectively. However, Wood & Muenscher (1956) reported the number of stipulodes being twice the number of branchlets but the present plants showed equal number of stipulodes and branchlets.

The length of oogonium and the dimensions of coronula of the present plants were higher when compared with the description of Wood & Muenscher (1956) and Sundralingam (1959).

### 3. *C. benthamii* Braun.

Pal et al. 1962, p. 94, figs. 218-219.

Plate 2, Figs. 9-13.

Plant monoecious, incrustated, 20 cms high; stem thick, 500-825  $\mu$  in diameter, internode equal to or longer than the branchlets; main axis corticate, diplostichous, spine cells present forming a circle, acute, 130-300  $\mu$  long; stipulodes 10-13; haplostephanous, well developed, acumi-

nate tip; branchlets 10-13, ecorticate; segments 5-6; bract cells including bracteole 5-7 at the lowest branchlet node, 840-3000  $\mu$  long bracteole somewhat longer than the bract cell.

Antheridia and oogonia together at lower 2-3 nodes; antheridia 300-375  $\mu$  in diameter; oogonium 620-700  $\mu$  long, 225-525  $\mu$  broad; convolutions 9; coronula 60-105  $\mu$  long, 120-165  $\mu$  broad; oospore black, 450-570  $\mu$  long, 285-345  $\mu$  broad, ridges 10.

The plants resembled the species described by Pal et al. (1962) as *C. benthamii* but differed from it in the number of branchlets. The present specimens had as many as 13 branchlets where as Pal et al. (1962) reported 8-12. Similarly dimensions of antheridium and oogonium were large in the present plants when compared with *C. benthamii* described by Pal et al. (1962).

The present plants approximate *C. erythrogyna* in many characters but antheridia and oogonia are borne at different nodes in *C. erythrogyna*, which is not met in present plants. Hence the present specimens are more close to *C. benthamii*.

### 4. *C. vulgaris* Linn.

Wood & Muencher, 1956, p. 28, pl. 10;

Pal et al., 1962, p. 102, figs. 235-238;

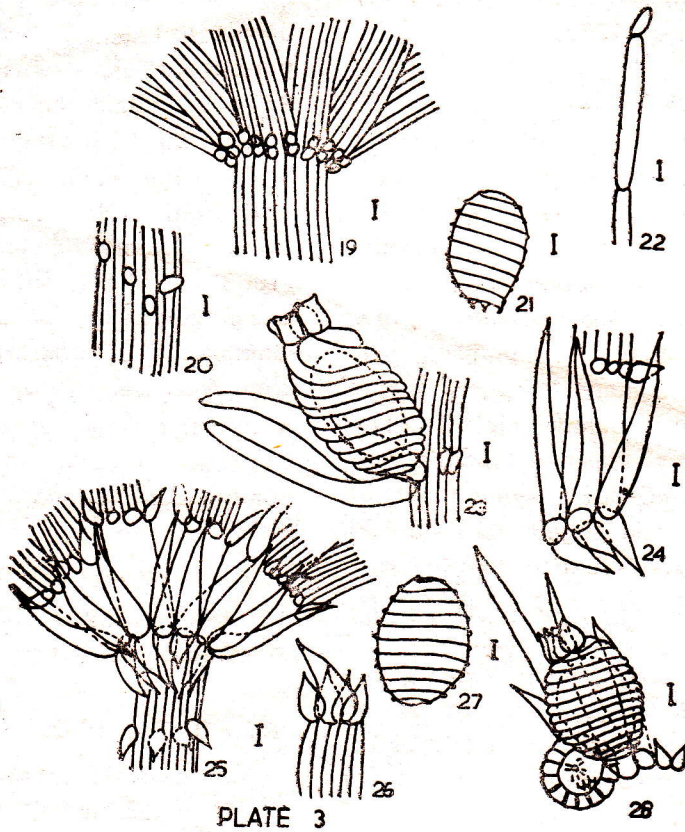


PLATE 3

Figs. 19-23 *Chara contraria* Kutzing.

- Fig. 19. Stem node showing two rows of stipulodes and corticate branchlets.
- Fig. 20. Stem cortex
- Fig. 21. Oospore
- Fig. 22. Apex of branchlets.
- Fig. 23. Branchlet node with mature oogonium.

Figs. 24-28 *Chara zeylanica* Willd.

- Fig. 24. Lowermost ecorticate segment and sterile node of branchlet.
- Fig. 25. Stem node showing two rows of stipulode and lower ecorticate segment.
- Fig. 26. Apex of branchlet
- Fig. 27. Oospore
- Fig. 28. Branchlet node with antheridium and oogonium

Agarkar, 1963, p. 46; figs. 10-11;  
Chatterjee, 1975, p. 105.

Plate 2 Figs. 14-18.

Plant monoecious, corticate, heavily incrustated, length upto 30 cm. high; stem diameter variable ranging between 420-975  $\mu$ ; internode usually twice the length of branchlet; cortex diplostichous, cells of secondary row prominent than the primary row; spine cells solitary, stout, short or papilla like; stipulode diplostephanous, length of upper stipulodes ranged from 45-225  $\mu$  while that of lower stipulode ranged from 45-195  $\mu$ ; branchlets 7-10 in a whorl; segments 5-8, upper 3-5 ecorticate; bract cells 4-6 with acuminate tip, variable in length, anterior bract cells 2-3 times longer than oogonium, bract cells in some plants 1650  $\mu$  long; bracteole equal to or longer than the anterior bract cell.

Antheridium and oogonium together at 2-5 nodes, antheridium 300-450  $\mu$  in diameter; oogonium 375-975  $\mu$  long, 225-600  $\mu$  broad, convolutions 9-13; coronula 45-90  $\mu$  high, 150-240  $\mu$  broad; oospore 375-660  $\mu$  long, 225-330  $\mu$  broad, ridges 11-13.

The present specimens differed with the description of Wood & Muenschler (1956) in the dimension of antheridium and oogonium being towards lower side.

Pal et al. (1962) reported the diameter of stem 500  $\mu$  but in the present studies, it was found upto 975  $\mu$ . Similarly the number of branchlets was 10 in the present case whereas Pal et al. (1962) reported upto 9 only. However, the description of specimens given by Agarkar (1963) are within the range of the description of this species complex. Chatterjee (1975) described this plant from West Bengal which was also within the range of description in the present investigation, except for the number of convolutions.

5. *C. contraria* kutz.

Dixit, 1952, p. 361; Pal et al. 1962, p. 103, figs. 243-247.

Plate 3, Figs. 19-23.

Plant monoecious corticate, heavily incrustated, 25 cms high; diameter of stem ranged from 375-825  $\mu$  in diameter; internode as long as, or 2-4 times the length of branchlets, cortex diplostichous, cells of primary series more prominent than the secondary series; spine cells present, short; stipulodes diplostephanous; upper and lower stipulodes equal, 45-90  $\mu$  long, branchlets 6-8; segments 7; upper 2-3 ecorticate, bract cells 6; equal to oogonium; bracteole longer than the anterior bract cells.

Antheridium & oogonium together at 1st and 2nd node; sometimes



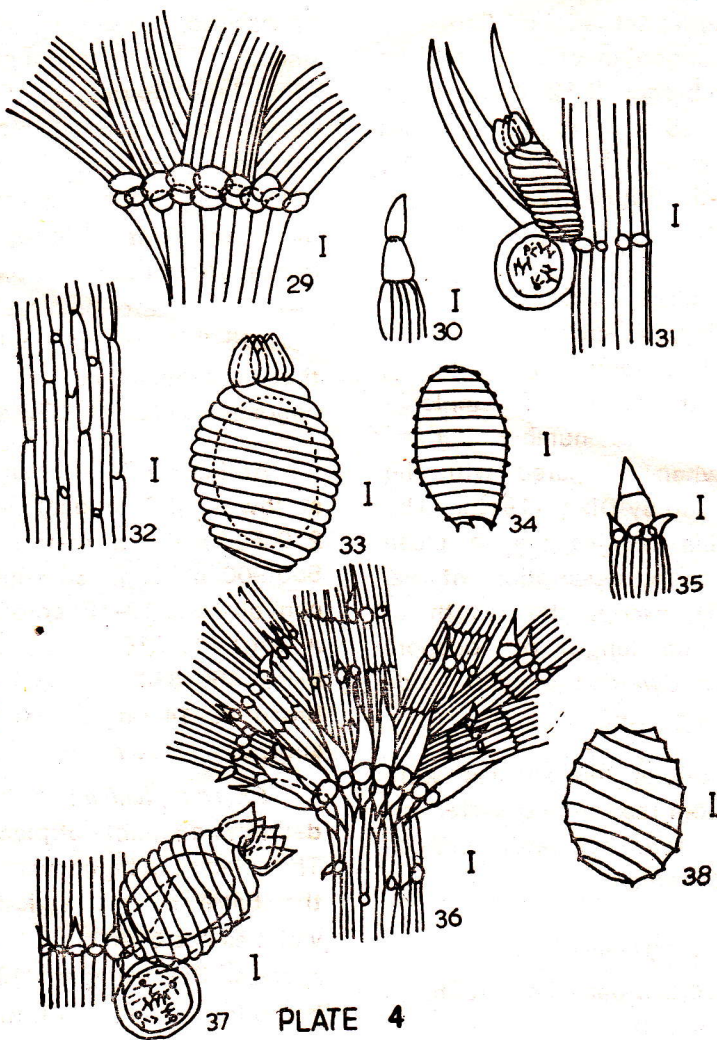


PLATE 4

Figs. 29-34 *Chara fragilis* Desvaux.

- Fig. 29. Stem node showing rudimentary stipulodes and branchlets.
- Fig. 30. Apex of branchlets.
- Fig. 31. Branchlet node with antheridium and oogonium.
- Fig. 32. Stem cortex
- Fig. 33. Oogonium
- Fig. 34. Oospore

Figs. 35-38 *Chara brachypus* Braun.

- Fig. 35. Apex of branchlet
- Fig. 36. Stem node showing stipulodes and branchlets.
- Fig. 37. Branchlet node with antheridium and oogonium.
- Fig. 38. Oospore.

upto 4th node; antheridium  $375 \mu$  in diameter; oogonium  $600-975 \mu$  long;  $375-600 \mu$  broad, 9-12 convolutions, coronula  $105 \mu$  high;  $180 \mu$  broad; oospore black,  $525 \mu - 600 \mu$  long,  $330 \mu$  broad, ridges 12, prolonged into a cage.

Dixit (1942) described this plant from Bombay, the specimens collected from this region were having relatively large diameter of stem, large oogonium and less number of convolutions when compared with the type described by Dixit (1942). The plants of this species are in close agreement to the description of Pal et al. (1962), except the length of oogonium and length of oospore which were towards the lower side in the present case.

The plants of this species were collected from the running water and mostly they form sympatric population with *C. vulgaris*.

#### 6. *Chara zeylanica* Willdenow

Wood & Muenscher, 1956, p. 37, pl. XIII;

Sundralingam, 1959, p. 41; Pal et al., 1962, p. 105, figs. 253-255; Agarkar, 1963, p. 46, figs. 14-16 Wood (1965)

#### Plate 3, Figs. 24-28

Plant monoecious; incrusting; stem  $360-525 \mu$  thick; internode 1.5 to 2 times the length of branchlet; stipulodes in two series, well developed,

tip pointed, two sets of stipulode to one branchlet, upper stipulode  $360-750 \mu$  long, lower  $325-600 \mu$  long; cortex triplostichous; spine cells prominent, acute, solitary,  $60-540 \mu$  long giving a spiny appearance to the plant; branchlet 8-10; segment 7-11, lowest segment and upper 1-2 segments ecorticate; bract cells 6, anterior  $225-630 \mu$  long; bracteole longer than the bract cells and exceeds oogonium in length,  $375-900 \mu$  long.

Antheridia & oogonia together at lowest 3-6 nodes; antheridium  $270-525 \mu$  in diameter, oogonium  $550-900 \mu$  long,  $330-450 \mu$  broad; convolutions 12-15; coronula  $75-150 \mu$  long;  $180-210 \mu$  broad; oospore black,  $450-630 \mu$  long,  $225-375 \mu$  broad, 10-14 ridges prolonged into short basal claws.

*Chara zeylanica* has been recorded from a number of places in India. This species is highly variable and on the basis of the variations, many varieties has been created under this species. Sundralingam (1959) described 5 forms from South India. During the course of present investigation, the author found that the species collected from Jammu did not resemble any form described by Sundralingam (1959).

#### 7. *Chara fragilis* Desvoux

Pal et al., 1962, p. 110, fig. 261;

Agarkar, 1963, p. 47, figs. 17-18.

## Plate 4, Figs. 29-34.

Plant monoecious, 38-45 cms. long; stem 550-600  $\mu$  in diameter; corticate triplostichous; spine cell very reduced; internodes equal to or twice the length of branchlets; stipulodes diplostephanous, very reduced; branchlets 6-8; segments 9-11, ultimate segments ecorticate; bract cells 6, bracteole longer than the anterior bract cells or equal to the oogonium.

Antheridia and oogonia at lowest 2-4 nodes, diameter of antheridium 300  $\mu$ ; oogonium 850-1050  $\mu$  long; 475-600  $\mu$  broad; convolutions 15-16; coronula 180-210  $\mu$  long, 255-270  $\mu$  broad, oospore black, 675-825  $\mu$  long, 330-450  $\mu$  broad, ridges 13-14.

The variations encountered in the specimens studied from different spots were not prominent except that the plants collected from Sacoon Pond were larger as compared to the lakes. The specimens from this region agreed in full with the type described by Pal et al. (1962) except the diameter of stem. Agarkar (1963) reported this species from Gwalior (M.P.). Our specimens differed from his description with respect to the dimension of antheridium, oogonium and oospore.

8. *Chara brachypus* Braun.

Dixit, 1940, p. 237; Sundralingam, 1959, p. 39.

figs. 83, 84, 86, 88; Pal et al., 1962, p. 111. figs. 259-260; Agarkar, 1963, p. 48, figs. 19-20.

## Plate 4, Figs. 35-38.

Plant monoecious, corticate, 16-20 cms high, heavily incrustated; stem slender, 450-600  $\mu$  diameter; internode as long or little longer than the branchlets, cortex triplostichous, spine cells solitary, abundant on young internode, tip pointed, 75-90  $\mu$  long; stipulodes well developed, acute, diplostephanous, upper whorls 525-600  $\mu$  long and that of lower 150-165  $\mu$  long, two pairs to one branchlet; branchlets 8-10; segments 8, upper 1-2 segments ecorticate; bract cells 6, anterior bract cell 450  $\mu$  long, shorter than oogonium; bracteole longer than the anterior bract cells.

Antheridia and oogonia at lower 4 nodes, antheridium 225-315  $\mu$  in diameter; oogonium 540-900  $\mu$  long, 330-450  $\mu$  broad; convolutions 12-15; Coronula 75-90  $\mu$  high, 150-240  $\mu$  broad; oospore black, 450-585  $\mu$  long, 300-375  $\mu$  broad, ridges 12.

Dixit (1940) described this species from Bombay. The specimens from this region varied the type described by Dixit (Loc. cit.). The present plants also differed in the dimensions of oogonium and number

of branchlet from the description of plants described by Agarkar (1963).

However, the present specimens resembled the plant described by Pal et al. (1962) except the dimension of oospore and number of branchlets. Sundralingam (1959) described 2 varieties of *C. brachypus* var. *Gracilescens* A. Br. & Var. *ehrenbergiana* A. Br. So far as the plants of Jammu region are concerned, these resembled var. *gracilescens* being possessing 8 branchlets but the spine cells in the present specimens were not inconspicuous as reported by Sundralingam (1959) in the variety *gracilescens*.

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