NOTES ON SOME CLADOPHORALES FROM INDIA

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ABSTRACT

Four members of the order Cladophorales are described with the description of the mechanism of the spore liberation in *Pithophora polymorpha*.

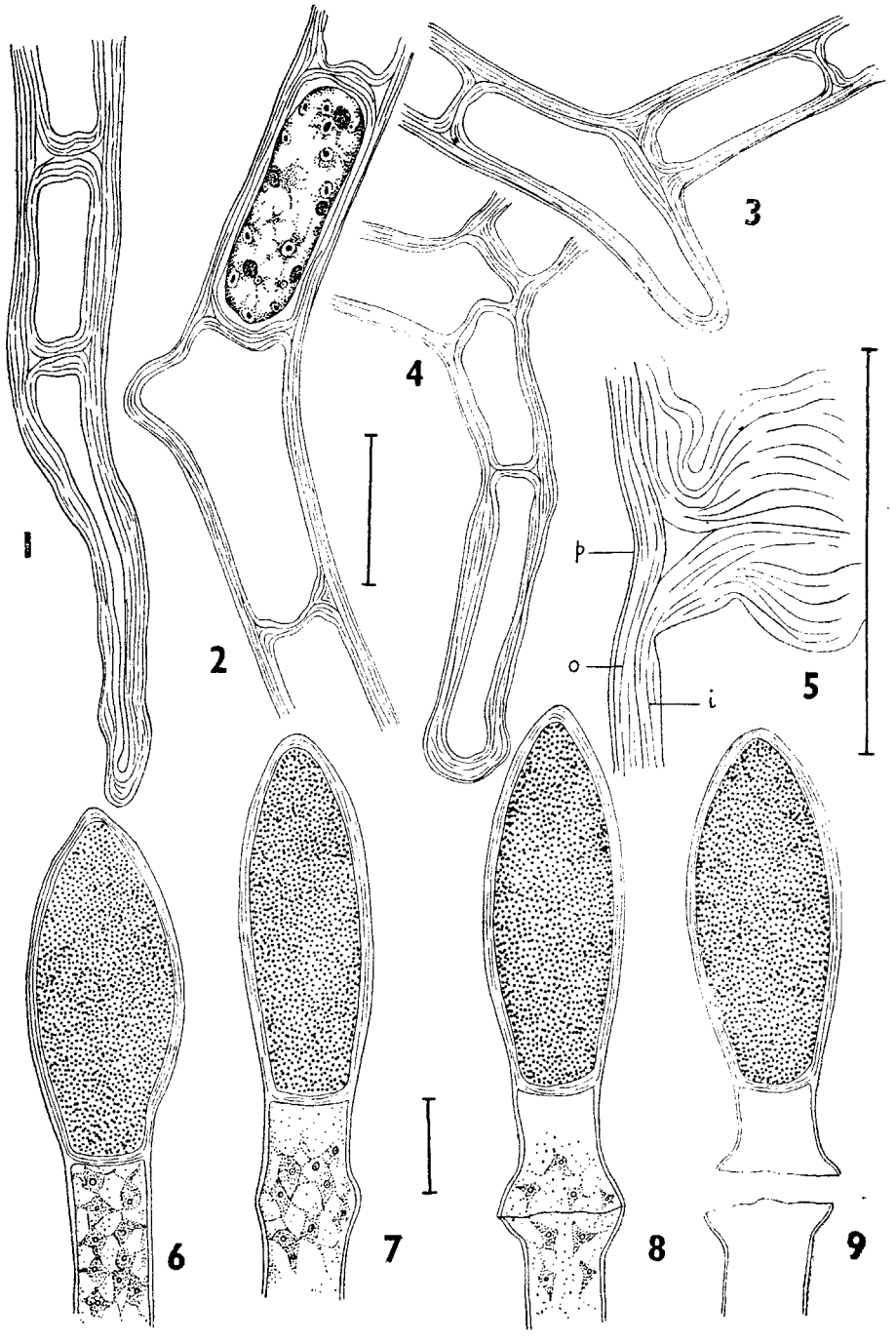
The object of this paper is to record four members of the order Cladophorales from India. The members of Cladophorales occur in fresh water as well as in the sea, and are also terrestrial. The genus *Pithophora* is confined exclusively to fresh water, while *Chaetomorpha* occurs in the sea as well as in brackish water. *Rhizoclonium hieroglyphicum* occurs both in aquatic and terrestrial habitats; *Cladophora glomerata*, either free-floating or epiphytic or attached to substrates. *Cladophora glomerata* and *Pithophora polymorpha* are abundant in North India.

1. *Rhizoclonium hieroglyphicum* (Ag) Kützing (Heering 1921, p. 22, Fig. 21, *a–c*).

Filaments cylindric, very slightly or scarcely constricted at the cross-wall regions. Rhizoidal branches short, 1-2 celled (Fig. 4). Cell wall is very thick up to 5·7 μ. Cell wall consists of three portions—an inner and outer stratified lamella and a superficial pellicle (Fig. 5). The inner lamella of the wall is individual to each cell. Cells 26·6–38 $\times$ (57) 76–95 μ. The protoplast is thick, viscous; chloroplast parietal reticulate; pyrenoids many, scattered; cells multinucleate, the nuclei are arranged in a more or less linear row.

The rhizoidal branches arise just beneath a septum. In the initial stages they form a wide angle with the main filament (Figs. 2, 3) and the rhizoidal branch is cut off by a wall perpendicular to that in the main filament. Later, due to the localized surface growth of the membrane of the parent cell below the branch, the branch becomes upwardly displaced and the main axis is pushed to one side (Fig. 4). This *evection* gives an appearance of dichotomy. In some cases, the terminal cell of the filament itself gets attenuated and functions as a rhizoidal cell.

Habitat: Terrestrial, forming green mats on moist soil, Agri-Horticultural Society grounds and on pavements in Calcutta (23-11-58); on the lawns of the rest-house, Aarey Milk Colony, Bombay (24-9-59); inside the



TEXT-FIGS. 1–5. *Rhizoclonium hieroglyphicum* (Ag) Kütz. 1, attenuated basal cell; 2–4, formation of the rhizoidal branch; 5, wall structure. TEXT-FIGS. 6–9. *Pithophora polymorpha* Wittr. 6, a terminal akinete with a portion of the subsporal cell; 7, a terminal akinete with the ring-like swelling just developing in the subsporal cell; 8, subsporal cell showing the region of breakage; 9, akinete cut off from the subsporal cell. *i*—inner lamella; *o*—outer lamella; *p*—pellicle. (Scale 50 μ.)

greenhouse, Division of Botany, I.A.R.I., New Delhi (18-10-58). Generally found after the monsoons.

2. *Pithophora polymorpha* Wittrock (Wittrock 1877; Ramanathan 1939).

The filaments are freely branched, the branches arising from a short distance below the septum. The branches are usually solitary but sometimes opposite. The cells are cylindrical, multinucleate, 34·2–53·2 μ in diameter and up to 12 times as long as broad. Cell wall is up to 3·8 μ thick. The chloroplast is a parietal reticulum.

Reproduction is by terminal or intercalary akinetes which are either solitary or in series (Plate III, figs. 3, 4). The akinetes are (57) 60·8–76 $\times$ (125·4) 148·2–178·6 μ. During akinete formation the contents of the cell slowly migrate towards the upper end of the cell which is later cut off by a cross-wall. Thus the original mother cell is divided into an upper sporal cell and a lower subsporal cell (Wittrock 1877; Ramanathan 1939). However, small amounts of cell contents are always left behind in the subsporal cell and these also gradually move upwards and accumulate near the upper portion, forming a ring-like band, a little below the spore portion (Fig. 7). Subsequently the cell wall at this region becomes swollen and a circumcissal split in the cell wall all round the swelling becomes discernible (Fig. 8). This split later widens and the akinetes get separated from the subsporal cells (Fig. 9).

The present observations agree with those of Ramanathan (1939) and substantiate the view that the release of the akinetes in this alga is not due to the decay and disintegration of the thallus, but is brought about by a definite organic process.

Habitat: Free-floating in fresh-water puddles as thick mats at Agra and in puddles along the G.T. Road, Karnal District, Punjab, during August to October, 1958; free-floating in Najafgarh Jhil, Delhi, November, 1959; Coimbatore, Madras State, January, 1960.

3. *Cladophora glomerata* (L) Kützing (Heering 1921, p. 35, Figs. 14, 15 and 39).

Filaments attached to shells of snails by well-defined rhizoidal cells (Plate III, fig. 1). The filaments are profusely branched in glomerate clusters. The branching is lateral but appears to be dichtomous due to *evection* of the original axis of the branch. The branch initials originate from the upper end of the cell as small lateral outgrowths. Cells of the main axis 76–133 μ broad and 5 to 15 times long. Cells of the branches 38–76 $\times$ 114–380 μ. The cell walls are thick in the main axis and primary branches, and usually thin in the branch clusters. The chloroplast is a thick reticulum with

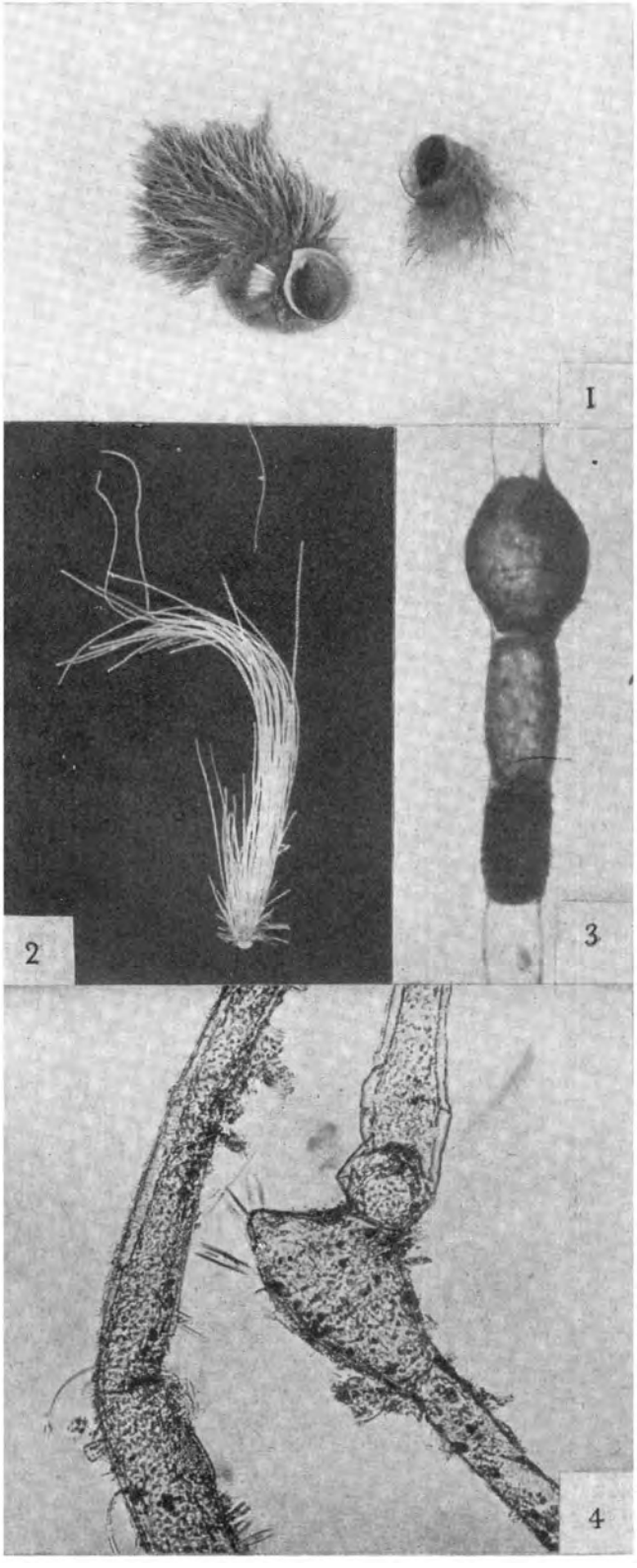


FIG. 1. *Cladophora glomerata* (L) Kütz. FIG. 2. *Chaetomorpha media* (Ag) Kütz. FIGS. 3 and 4. *Pithophora polymorpha* Wittr.

scattered pyrenoids. The cells are multinucleate. Plant mass light green to dirty green.

Habitat: Free-floating or epiphytic on the shells of snails in the river Jumuna, Okhla, July 1957.

4. *Chaetomorpha media* (Ag) Kützing (Boergesen 1932, p. 51).

The plants are tufted and attached to the rocks near the sea-shore, reaching a height of about 4–10 cm (Plate III, fig. 2). The basal cell is long with a thick, lamellated wall having annular constrictions. The filaments are dark green and unbranched. Cells 380–570 μ broad and same as or $1\frac{1}{2}$ times longer than broad; cross-wall regions constricted; cell wall very thick and lamellated and distinguishable into pellicle and inner and outer lamellae. The filaments are attached by means of branched rhizoids and sometimes many erect filaments arise from a branched rhizoid.

Habitat: Marine, attached to rocks, Cape Comorin, May, 1956.

References

Boergesen, F. (1932). *J. Indian bot. Soc.*, **11**, 55.

Heering, W. (1921). Chlorophyceae. IV. *Siphonales, Siphonocladiales*, in A. Pascher's Süsswasserflora Deutschlands, Österreich und der Schweiz, **7**, Jena.

Ramanathan, K. R. (1939). *J. Indian bot. Soc.*, **18**(1), 25–29.

Wittrock, V. B. (1877). *Nova Acta Reg. Soc. Sci. Uppsala*, Ser., 3, p. 19.