COELODISCUS ENDOPHYTUS, A CHLOROPHYCEAN ALGA FROM THE LAKE OF OHRID, JUGOSLAVIA

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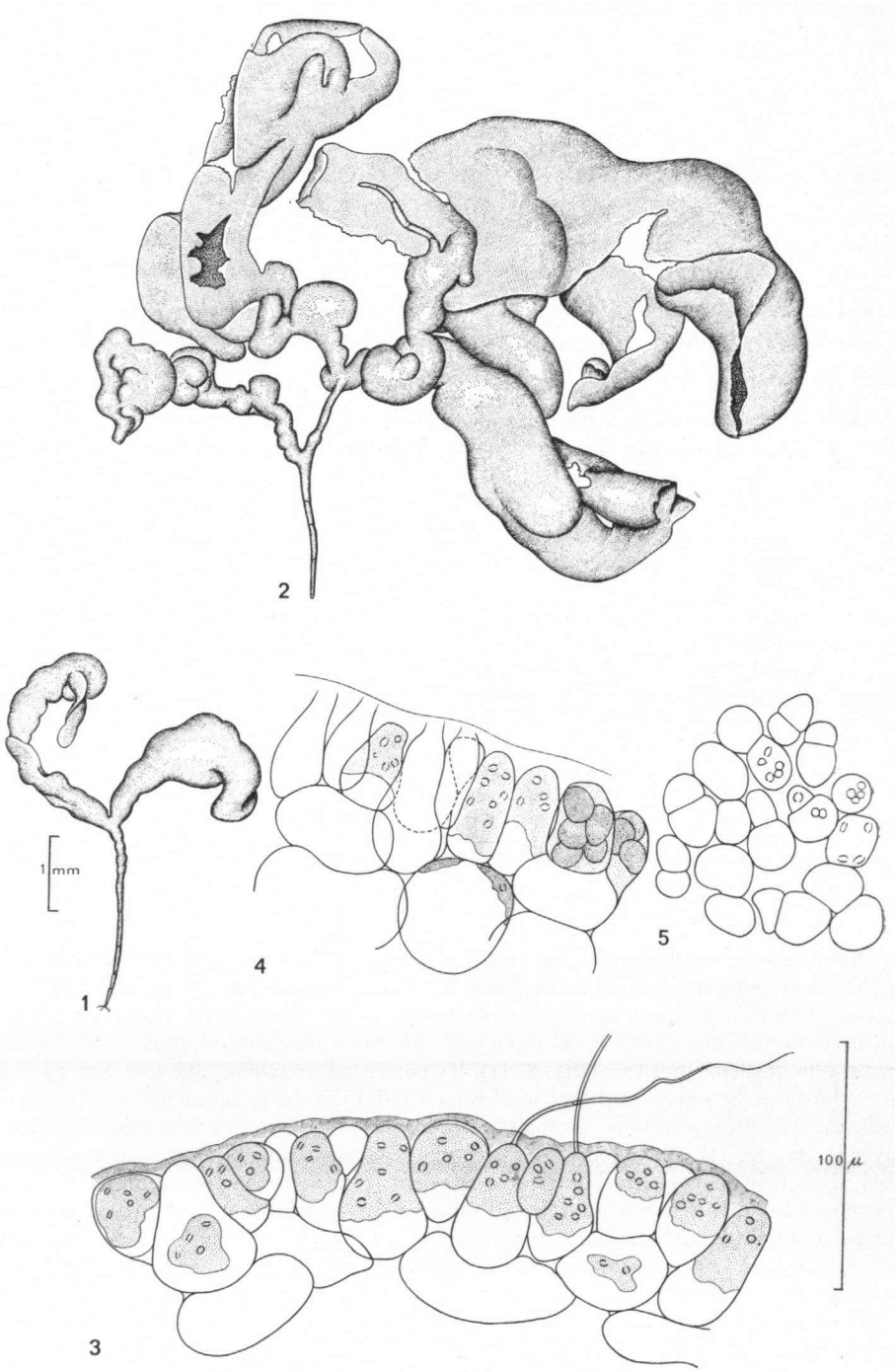
Coelodiscus endophytus (Möbius) v. d. Hoek *nov. comb.* — *Bulbocoleon endophytum* Möbius, 1891, p. 1292—1293. — *Endoderma endophytum* (Möbius) Huber, 1892, p. 325—326. — *Ectochaete endophytum* (Möbius) Wille, 1909, p. 79; Heering, 1914, p. 98; Printz, 1964, p. 204. — *Endoderma jadinianum* Huber, 1892, p. 322—326.

Thallus tubular or saccate, irregularly lobed or plicate, eventually opening and splitting, growing attached to *Cladophora glomerata* by coalescent endophytic branched filaments, up to 1 cm long and 0.5 cm broad. On cross-section, the wall of the hollow thallus consists of two to three layers; one or two innermost layers of large, rounded or slightly elongate, mostly colourless cells, 30—60 μ in diam., and one, sometimes two, outer layers of smaller, chloroplast-bearing cells, 13—30 μ in diam., which very rarely are provided on their outer face with a colourless hair, 1.5—2.5 μ in diam. The outermost cells can be transformed into flask-shaped zooidangia which produce zooids *ca* 10—15 μ in diam. and which release these zooids through apical pores. The chloroplasts are parietal and are provided with 2—7 bilenticular pyrenoids 2.5—5 μ in diam. and bearing mostly 2 bowl-shaped starch-bodies. The chloroplasts of the endophytic filaments generally contain 1—2 larger pyrenoids 3.5—6.5 μ in diam.

JUGOSLAVIA, Lake of Ohrid, growing attached to *Cladophora glomerata* (L.) Kütz. var. *glomerata* covering stones in the littoral region, *I. Čado*, 1963 (L, sh. 964. 214- 182).

So far, *Coelodiscus endophytus* seems to have been decribed from few other localities, viz.: FRANCE, Pyrénées Orientales near Collioure, rivulet 'Le Ravanet' (Huber, 1892); GERMANY, botanic gardens at Heidelberg (Möbius, 1891), Alsterbecken at Hamburg, Grosser Plöner See, Grosser Segeberger See (Müller, 1958); SWEDEN, Öregrund Archipelago (Waern, 1952); ENGLAND, in a gravel pit at Cheshunt, Hertfordshire (Belcher, 1959).

Development of the thallus. Young stages of this species consist of branching filaments which grow endophytically in the wall of *Cladophora glomerata* (fig. 7, 8, 9). The filaments coalesce to form pseudoparenchymatous strata (fig. 8) the cells of which elongate perpendicularly to the surface of the *Cladophora* wall. After that they cutt off, mostly by oblique walls, cells at their outer faces (fig. 8, 11). By tangential stretching, due to a generalized growth of the above type and by considerable swelling of the subapical and subsubapical cells, the stratum is torn off from the *Cladophora* wall, of which only the thin innermost layer is left (fig. 11). This mode of growth which is essentially apical growth of densely packed regurly di- to tetrachotomizing filaments results in the formation of enteromorphoid irregularly lobed and plicated tubes or sacs which eventually split open in an irregular way (fig. 1, 2). According to Čado (1958, p. 19, fig. 15) these sacs can grow as large as 3 cm; towards the end of the vegetative period the plants detach and form floating masses at the water surface. These tubes and sacs mostly follow or continue the form of the *Cladophora* ramifications, that is falcate (the *Cladophora* plants show the characteristic falcate tips of acropetally organized branch-systems, cf. van den Hoek, 1963a, p. 165, 166) (fig. 1, 2).



Coelodiscus endophytus (Möbius) v. d. Hoek. — Fig. 1, 2. Habit. — Fig. 3. Cross-section of full-grown thallus. — Fig. 4. Cross section of full-grown thallus with zooidangia. — Fig. 5. Surface view of outer layer of small chloroplast-bearing cells.

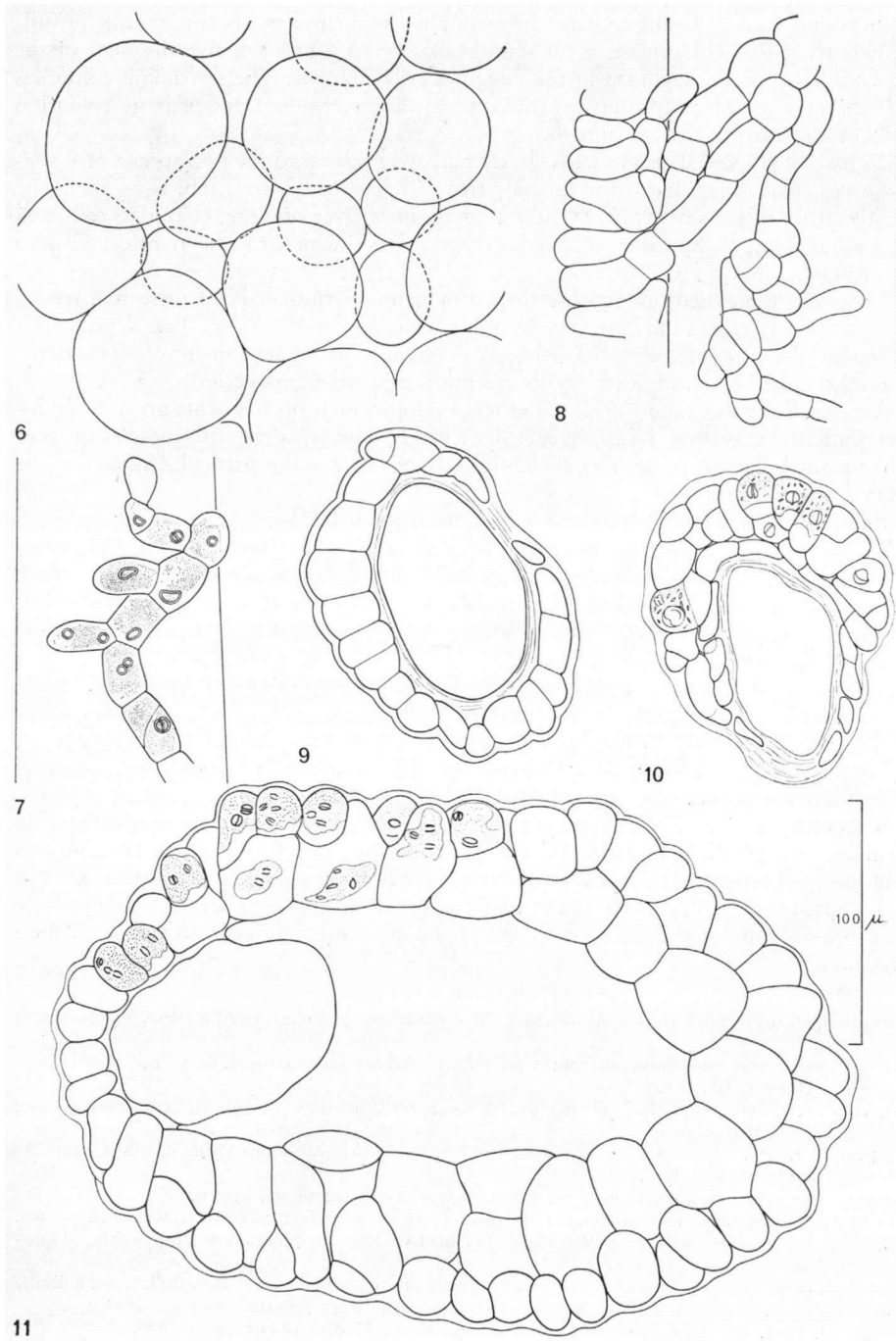


Fig. 6. Surface view of inner layer of colourless cells. — Fig. 7, 8. Endophytic filaments in surface view. — Fig. 9, 10. Endophytic filaments in cross-section of *Cladophora* axis. — Fig. 11. Thallus torn off from the *Cladophora* filament for the greater part.

In young stages all cells contain chromatophores and pyrenoids (fig. 7, 10), in full-grown plants the chloroplast, in the course of two to four successive divisions of the apical cell, is entirely included in the daughter cells (fig. 11). The remaining colourless cell enlarges considerably, thus contributing to the innermost layer of large colourless cells of the mature thallus (fig. 6).

Taxonomic position. This species is clearly narrowly related to the two species of *Coelodiscus* Jao (1941, 1947) known so far only from China (Printz, 1964, pp. 287—288). The hollow thalli of Jao's material consist also of an inner layer of large, colourless cells, and of an outer layer of smaller chloroplast-bearing cells which can be transformed into zooidangia.

However, the closed hollow disc-shaped or hemispherical thalli of these two species grow attached to rocks and stones by rhizoids which arise from cells of a basal layer which thus adheres to the substratum. The highly different mode of attachment of the material from the Lake of Ohrid warrants its retention as a seperate species.

The details of the mature thallus and its development from filaments growing endophytically in the walls of *Cladophora*, as described by Huber, agree with those in the present material. The other authors evidently did not observe the particular aspects of the later development.

Bulbocoleon endophytum Möbius has been ranged by Wille (1909, p. 74) under the genus *Ectochaete* (Huber) Wille, together with *Endoderma leptochaete* Huber, a marine chaetophoracean alga growing endophytically in the walls of several marine algae, and which does not form enteromorphoid tubes or sacs. It is proposed to typify the genus *Ectochaete* by *Ectochaete leptochaete* (Huber) Wille. *Coelodiscus* is typified by *Coelodiscus prasinus* Jao (1941).

Coelodiscus seems best ranged under the family *Chaetophoraceae* (*Ulotrichales*).

Material. In February 1964 Dr Čado (Hydrobiological Station, Ohrid) sent me a queer *Cladophora* specimen from the lake of Ohrid for identification (cf. Čado, 1958, p. 19, 43, fig. 15, as 'forme siphonale'). The curious aspect of this specimen was provoked by *Coelodiscus endophytus.*

It appeared to be very well possible to investigate most of the taxonomically valid characters in this dried material, by soaking it during several hours in a concentrated solution of detergent, or for several minutes in a heated solution of detergent (cf. van den Hoek, 1963a, p. 14; 1963b, p. 277). For a more detailed investigation of the cytology (e.g. the structure of the chloroplast) and of the life history living material is of course necessary.

LITERATURE CITED

BELCHER, J. H. 1959. *Ectochaete endophytum* (Möbius) Wille in the Lee Valley, Hertfordshire. The Naturalist 1959: 80.

ČADO, I. 1958. Sostav i zonal'nost' mikrofitov pribrežnych skal ochridskogo ozera. Rec. Trav. Stat. Hydrobiol. Ohrid 6 (5): 1—43.

CHRISTENSEN, T. 1962. Alger. In T.W. Böcher, M. Lange & T. Sørensen. Botanik II, Systematisk botanik nr 2. Copenhagen.

HEERING, W. 1914. Chlorophyceae III. In A. Pascher. Die Süsswasser-Flora Deutschlands, Österreichs und der Schweiz 6. Jena.

HOEK, C. VAN DEN. 1963a. Revision of the European species of Cladophora. Leiden.

—— 1963b. Nomenclatural typification of some unicellular and colonial algae. Nova Hedwigia 6: 277—296.

JAO, C. C. 1941. Studies on the freshwater algae of China IX. Coelodiscaceae, a new family of the Chlorophyceae. Sinensia 12: 291—298.

—— 1947. Coelodiscus bullatus sp. nov. A second species of the Coelodiscaceae. Bot. Bull. Acad. Sinica 1.

MÜLLER, J. 1958. Ectochaete endophytum — eine parasitische Alge. Mikrokosmos 47: 276—279.

PRINTZ, H. 1964. Die Chaetophoralen der Binnengewässer. Hydrobiologia 24: 1—376.

WAERN, M. 1952. Rocky-shore algae in the Öregrund Archipelago. Acta Phytogeogr. Suec. 30: 1—298.

WILLE, N. 1909. Conjugatae und Chlorophyceae. In A. Engler und K. Prantl. Die natürlichen Pflanzenfamilien, Nachtr. z. I, 2. Leipzig.