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Cosmarium taxillus (Desmidiaceae) in Finnish Lapland

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Cosmarium taxillus was recently described from Finnish Lapland. We found the species in another similar locality. Our material displays a wider morphological variation, especially towards larger dimensions, than described in the protologue. The morphology of a developing zygospore with the attached parental semicells is illustrated. *Cosmarium bioculatum* var. *subhians* is combined into *C. taxillus* as *Cosmarium taxillus* var. *subhians*.

Key words: Algae, Charophyceae, *Cosmarium*, Desmidiaceae, taxonomy, Zygnematales

Introduction

Coesel and Delfos (1986) described *Cosmarium taxillus* as a new species on the basis of a sample collected from a pool in the esker system east of "*Neljän Tuulen Tupa*", in Kaamanen, Inari, Finnish Lapland. The type locality was described as having a hardly developed moss layer, the dominant macrophytes being *Carex rostrata* (3%) and *Menyanthes trifoliata* (2%), the pH was 4.5 and conductivity 10 μS cm^{-1}.

Material and methods

Our find of *Cosmarium taxillus* is from a similar locality (69°29´52´´N, 28°30´40´´E) approximately 70 km NE of the Kaamanen locality, also in the municipality of Inari. The species occurs sparsely in five of our samples (Nos. 92-171–175) collected on 1 August 1992 from a small (30–50 × 100 m), shallow, unnamed bog lake 1 km W of the southern part of lake Nilijärvi, which lies 3 km SW of the village of Sevettijärvi. The vegetation on the shore was dominated mainly by *Sphagnum* spp., *Ledum palustre* and *Betula nana*.

The algal samples were collected into 30 ml liquid scintillation bottles by squeezing the vegetation by hand, with tweezers from macroscopic algal growth, with a knife from stone and rock surfaces, and the epipelon with a spoon. The plankton sample was collected from the shore with a 10-μm nylon net attached to a 7-m long glass fibre fishing rod.

Sample 92-171 is squeezings from *Sphagnum* on the western shore, the most abundant species being *Actinotaenium cucurbita*, *Netrium digitus* and *Chroococcus turgidus*.

Sample 92-172 is a 1-cm thick layer of *Hapalosiphon fontinalis* and *Stigonema ocellatum* growing on *Sphagnum* at a depth of 5 cm, the dominant desmid being *Actinotaenium cucurbita*.

Sample 92-173 is epipelon from a depth of 10 cm, with *Euastrum insigne*, *Xanthidium armatum*, *Netrium digitus* and *Docidium undulatum* the main species.

Sample 92-174 is epiphytes on the stems of *Ledum* and *Menyanthes* at a depth of 10–15 cm and contains mainly *Eucapsis alpina*, *Actinotaenium cucurbita, Cosmarium pericymatium* and *Staurastrum elongatum*.

Sample 92-175 is plankton dominated by *Botryococcus braunii*.

The samples were fixed immediately in the field with formalin added to a final concentration of about 2%. For microscopy, a drop of glycerine was added to the slide, which delayed the drying of the preparation, and by increasing the viscosity of medium quenched Brownian movement in small cells, which improved photography.

Results and discussion

The morphology of the vegetative specimens in our material (Figs. 1–30) closely matches the description by Coesel and Delfos (1986), but the dimensions are more variable, especially the cell width (Table 1). Actually, Coesel and Delfos emphasized "…that the length of the cell and the isthmus are relatively constant, whereas the width of the cell and the isthmus vary a great deal". In our material this variation is even greater (Figs. 1–30; in Fig. 20 the new semicell has but started to develop). The apex of the cells is usually very slightly concave rather than flat; it is rarely convex (Figs. 5, 12). Generally speaking, the wider the cell the bigger the apical convexity (Figs. 9, 18, 21). In side view the cells are linear (Fig. 13). In apical view there is a very slight lateral constriction (Figs. 26 and 27).

A couple of empty cells showed traces of the rows of the dots (pores) which Coesel and Delfos (1986: fig. 23) illustrated. They were very faint and are barely visible in the photographs (light spots in Fig. 28, dark dots in Fig. 29, light and dark marks in Fig. 18). Pairs of cells (Figs. 22–25), and four-celled linear aggregates of cells (not shown) as illustrated by Coesel and Delfos (1986: figs. 21–22) were occasionally seen. The cell contents were not described by Coesel and Delfos (1986) in any detail. We found chloroplasts with one central pyrenoid in each semicell (Fig. 14, Fig. 25, lower cell) of Teiling's (1952: p. 277, fig. 1) type F2: they are furcoid, biradiate and monocentric.

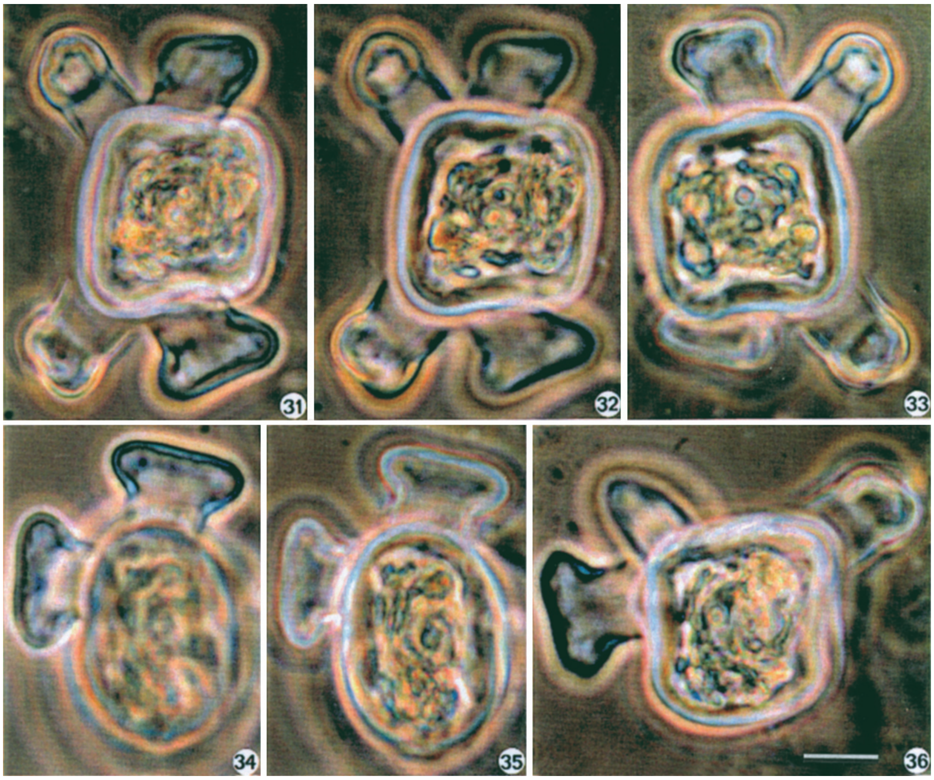
After thorough scrutiny of the samples we found one zygote with the parental semicells attached (Figs. 31–36). The zygospore appears to be somewhat immature. Therefore we cannot describe the texture or colour of the zygospore wall. The cushion-like shape of the zygospore, however, seems to have been established at this stage; being roundedly trapezoidal in face view with the shorter sides, approximately 23–27 μm, slightly concave and the longer sides convex, approximately 26–29 μm (Figs. 31–33, 34). Diagonally from the side the zygospore is oval, 22 μm thick and 33 μm long (Figs. 34 and 35).

Coesel and Delfos (1986) suggested that *Cosmarium taxillus* might be more closely related to species in the genera *Sphaerozosma* and *Spondylosium* than members of the genus *Cosmarium* "as presently understood". In our opinion, pending a revision and possible splitting of the genus, there is no doubt that the species belongs in *Cos-*

Table 1. Comparison of measurements of vegetative cells in the known finds of *Cosmarium taxillus* var. *taxillus* and *C. taxillus* var. *subhians*

	C. taxillus v. *taxillus*		*C. taxillus* v. *subhians*		
Measurement	Coesel & Delfos	Our material	Grönblad	Our material	Kouwets
Cell length (µm)	21–25	20–27	11.5	13.5	9.3–10.9
Cell width (µm)	16–19	18–36	11.5	11.3	10.1–12.0
Cell thickness (µm)	11–14	11–16	6	–	5.7
Isthmus width (µm)	–	11–21(–31.5)	5.5	6.7	5.9–6.2
Isthmus length (µm)	–	4.4–9.0	–	–	–

Figs. 1–30. *Cosmarium taxillus* var. *taxillus,* vegetative cells. — **1**–**8**: Dead cells in front view. — **9**: A large dead detached semicell in front view. — **10**–**12**: Moribund or dead cells in front view. — **13**: Dead cell in side view, image rotated 90 degrees. — **14**: Cell preserved alive, in front view, showing the arrangement of the chloroplasts and location of the pyrenoids. — **15** and **16**: Dead cells in front view. — **17**: Exceptionally large (wide) cell in front view, image rotated 90 degrees. — **18**: Large dead cell in front view showing pores. — **19**: Small dead cell in front view. — **20**: Recently divided, small dead cell in front view. — **21**: Cell preserved alive in front view. — **22**–**25**: Two-celled chains. — **26** and **27**: Apical views (**26** slightly oblique). — **28**–**29**: Pores in different foci on the same semicell; image rotated 90 degrees. — **30**: *Cosmarium taxillus* var. *subhians*, a dead cell, with the lower semicell slightly deformed. Scale bar = 10 μm.



Figs. 31–36. *Cosmarium taxillus* var. *taxillus,* conjugation and zygospore formation. — **31** and **32**: Conjugating cells and zygospore in two different foci. — **33**: The same cell rotated 180 degrees. — **34** and **35**: The same cell rotated 45 degrees. — **36**: The same cell rotated 90 degrees relative to Figs. **31**–**35**. Scale bar = 10 μm.

marium in its widest sense. It somewhat resembles *C. enontekiense* (Grönblad 1921: p. 43–44, pl. 7, figs. 67 and 68; Grönblad 1942: p. 37, pl. 2, fig. 15 and Messikommer 1943: pl. 10, fig. 6). The front and side views are similar, although the isthmus of *C. taxillus* is more clearly set apart from the apices and thus quadrangular-rectangular, whereas it is triangular and V-shaped in *C. enontekiense*. Also the apical (end or vertical) views are different; oval in *C. taxillus*, rectangular with constrictions at the ends in *C. enontekiense*. Finally *C. taxillus* is about three times larger in all dimensions, which indicates that we are dealing with two different species.

Cosmarium bioculatum var. *subhians* is a very similar taxon. The depicted cell (Grönblad 1963: fig. 42a) has a fairly wide and rounded isthmus, but not as elongated and angular as in *C. taxillus*. In the diagnosis, however Grönblad (1963: p. 23) wrote: "*sinu valde aperto lateribus angulatis*" — a widely open sinus with angulate sides. The apical view is rather irregularly oval. It seems evident that Grönblad was very ill at the time of the preparation of the manuscript (*see* the preface, p. 3, by H. Luther), and that the quality of the illustrations was not always up to his previous standards. This taxon is much closer to *C. taxillus* than to *C. bioculatum* and needs to be transferred to *C. taxillus* (Table 1). Being, however only half the size of the type of *C. taxillus* and having a slightly different isthmus, it deserves the rank of a variety.

A very similar taxon is ? *C. truncatellum*, *forma*, as described by Kouwets (1987: p. 235, pl. 13, figs. 15–17). The apical view is more rhombical, and the dimensions, as measured from the figures, are only marginally smaller than in Grönblad's and our cells. In Kouwets's (1987: pl. 13, fig. 16) illustration even a couple of pores are drawn in a similar position as they occur in typical *C. taxillus*. Considering that Grönblad apparently based his description on one single cell, Kouwets depicted three, and we have seen one, the small differences in outline and measurements cannot be considered significant. Thus we propose the following nomenclatural changes:

Cosmarium taxillus Coesel & Delfos var. ***subhians*** (Grönblad) Kukk & G. Hällfors, *comb. nova*

BASIONYM: *Cosmarium bioculatum* Brébisson *ex* Ralfs var. *subhians* Grönblad, Soc. Sci. Fennica Comm. Biol. XXVI: 23, *pl. V, fig. 42a, b*. 1963.

SYNONYM: ? *Cosmarium truncatellum* Perty, *forma* Kouwets, Hydrobiologia 146: 235, *figs. 15–17*. 1987.

This taxon is not closely related to *Cosmarium truncatellum*, a species of about the same size, but with a much narrower V-shaped isthmus and differently shaped, more acute, semicells.

The ecological provenience of *Cosmarium taxillus* is impossible to assign with the scarce data available. The dominant and subdominant accompanying species include several taxa from the arcto-alpine (*Cosmarium pericymatium, Eucapsis alpina)* and atlantic (e.g. *Staurastrum elongatum*) elements or sphagnophiles (*Actinotaenium cucurbita, Docidium undulatum, Euastrum insigne*).

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