

***Monoraphidium flexuosum*, a New Chlorococcal Alga from the Lakes of Northwestern Ontario (Canada)**

***Monoraphidium flexuosum*, nová chlorokokální řasa z jezer severozápadního Ontaria (Kanada)**

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KOMÁREK J. (1974): *Monoraphidium flexuosum*, a new chlorococcal alga from the lakes of northwestern Ontario (Canada). — Preslia, Praha, 46 : 118—122.

A sample of the summer phytoplankton from the lake No. 227 (Experimental Lakes Area of the Freshwater Institute, northwestern Ontario, Canada) yielded an unknown species of a unicellular green alga of the genus *Monoraphidium* (*M. flexuosum* sp. nova). Its relationships to the spirally twisted species of *Monoraphidium* are discussed. The morphological features of the new species are compared with similar ones of algae known from European water reservoirs. The main ecological data and notes on the taxonomic position of the genus *Monoraphidium* within the subfamily *Ankistrodesmoideae* (*Chlorellaceae*), are included.

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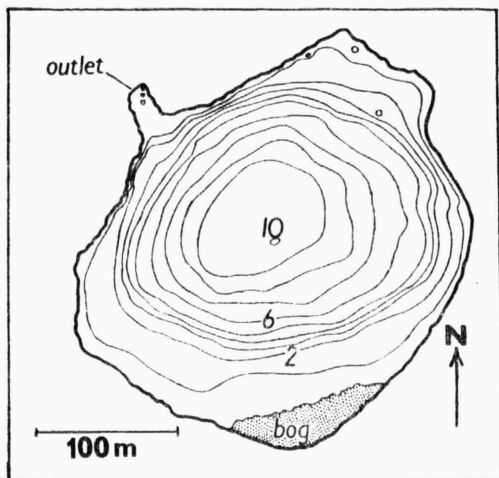
The genus *Monoraphidium* was established by KOMÁRKOVÁ-LEGNEROVÁ in 1969 for a group of species of the extensive and unclearly defined genus *Ankistrodesmus*. The diacritical features within the subfamily *Ankistrodesmoideae* (*Chlorellaceae*) and the generic characteristic of *Monoraphidium* are summarized in Tab. 1. The present content of the genus will be found in the papers of KOMÁRKOVÁ-LEGNEROVÁ (1969) and HINDÁK (1970).

In July 1970, a sample of planktic algae was collected by Miss Hedy KLING in the lake No. 227 in the Experimental Lakes Area of the Freshwater Institute of F. R. B. (northwestern Ontario, Canada). The sample was found to contain abundant populations of *Oscillatoria* cf. *redekei*, *Synechococcus leopoliensis* and one unknown species of *Monoraphidium* with typical features of the genus: solitary, elongated cells with spirally twisted ends, with autospores situated in the mother cell in series, without mucilage.

A detailed characteristic of the lake No. 227 is given in the papers of ARMSTRONG et SCHINDLER 1971, BRUNSKILL et SCHINDLER 1971, SCHINDLER 1971 and SCHINDLER et HOLMGREN 1971. The main data are as follows: The lake (Fig. 1) is situated 52 km east-southeast of Kenora, Ont., in the southwestern part of the Canadian Precambrian Shield. The water inflow is supplied by precipitation and by groundwater flow. The drain is directed north into Eagle Lake and the Wabigoon-English rivers. The surface area is 5×10^4 m² (5 ha), the shoreline 909 m, maximal depth 10 m, mean depth 4.4 m. The lake is approximately circular in outline, and the maximal depth is located in the middle of it. The earlier average ionic concentration was low as compared with other lake districts of the world, making it possible for the lake to be classified as an oligotrophic one. However, since 1969 the lake has been intensely eutrophized artificially (SCHINDLER et al. 1971). In winter, the water temperature (measured in 1969—1970) is 1—3° C under the ice-cover and increases rapidly up to 12° C during a few weeks from the end of April to May. In the summer season (i.e. in the time of *Monoraphidium* vegetation), the highest temperature ranges from 16° to 22° C near the surface, and decreases again rapidly to 4° C at the end of October. The midsummer maximal primary production is low, representing 0.150 g C/m³ day.

Fig. 1.— Bathymetric map of lake 227 (according to BRUNSKILL et SCHINDLER 1971).

The description of *Monoraphidium flexuosum* sp. nova (Fig. 2 — iconotypus): Cells solitary, without mucilage, thin ($0.8-3\ \mu\text{m}$), curved in the central part, elongated to both ends and gradually tapering to fine points, $40-60\ \mu\text{m}$ long; both ends are slightly flexuous or sigmoid, and slightly helicoidally twisted. Chloroplast parietal, without pyrenoid. Nucleus in the middle of the cell. Reproduction by 4–8 autospores, situated in series in the mother cell.



Diagnosis: Cellulae solitariae, longissimae, arcuatae, ad apices elongatae et acutissimae, paulo sigmoideae, $40-60\ \mu\text{m}$ longae, $0.8-3\ \mu\text{m}$ latae, cum chloroplasto uno, parietali, sine pyrenoido; propagatio 4 vel 8 autosporis, seriatim in cellula matriciali dispositis.

M. flexuosum is mostly related to the thin, arcuate and slightly distorted species as *M. arcuatum*, *M. contortum* and *M. irregulare*. The curvation of the cells with elongated, very thin ends bent outwards are typical for this group of species. The slight torsion of the cells (characteristic of the genus *Monoraphidium*) is shown on the „flexuous arms“ of the cells. The reproduction is by autospores, differentiated in series in the mother cells, as is the case in other species of the genus.

Ankistrodesmus falcatus var. *mirabilis* f. *longiseta* NYGAARD seems to belong to *M. flexuosum*, too. This form was described from Danish lakes (Fig. 3).

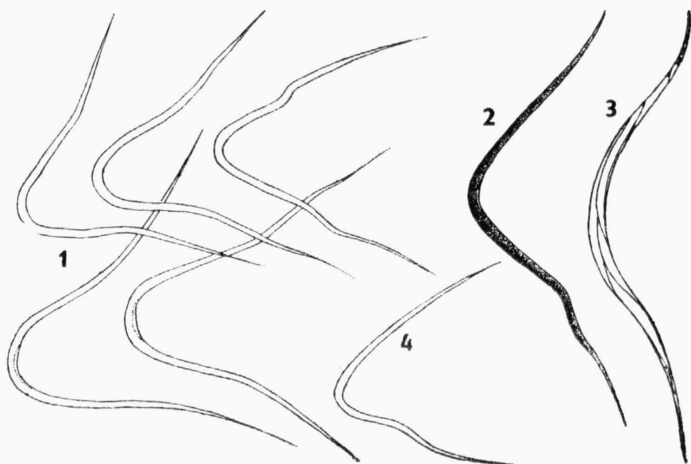


Fig. 2. — *Monoraphidium flexuosum* f. *flexuosum* (orig., iconotype); 1–2 solitary cells, 3 mother cell with differentiated autospores, 4 young cell.

Its original diagnosis: "Cellulae valde et plerumque irregulariter curvatae, abrupte acuminatae adversus apices elongates et setiformes, 27—98 μ inter apices, lat. 1—2 μ ." KOMÁRKOVÁ-LEGNEROVÁ (1969) preliminarily included this alga (together with all other unsufficiently described infraspecific taxa referred to as "*Raphidium*/*Ankistrodesmus mirabile*") into the synonymy of the unclear *Ankistrodesmus mirabilis* (W. et G. S. WEST) LEMM. 1908 (based on *Raphidium polymorphum* var. *mirabile* W. et G. S. WEST 1897). However, the typical *A. mirabilis* belongs probably to the genus *Closterium* (comp.

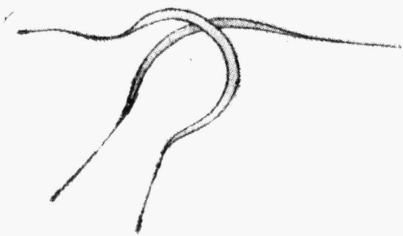


Fig. 3. — *Monoraphidium flexuosum* f. *longiseta* (NYG.) comb. nova (iconotype from NYGAARD 1945).

original diagnosis and iconotype of W. et G. S. WEST 1897: ... "cellulis... nonnumquam sigmoideis" ... "regularly curved" ... "near the middle of the cell... the chromatophores are completely interrupted"). The iconotype of f. *longiseta* NYGAARD is morphologically similar to *M. flexuosum*, with the exception of setiform ends and distinctly longer cells (27—98 μ m between the ends of arcuated cells, the length of cells according to the figure = 50 to 115 μ m). The reproduction process of this alga is unknown. However, the species does not

appear referable to *Ankistrodesmus* or *Closterium*, resembling by its habit mostly *M. flexuosum*. Therefore, the NYGAARD's alga is considered to be a special taxonomic form, *Monoraphidium flexuosum* f. *longiseta* (NYGAARD) comb. nova (Basionym: *Ankistrodesmus falcatus* RALFS var. *mirabilis* WEST f. *longiseta* NYGAARD Dansk Plantep., p. 52, Fig. 4 : 45, 1945).

The ecology and geographical distribution of *M. flexuosum* require further study. It is supposed that this alga grows in clear lakes of northern parts of temperated zone (Canada, Denmark). It probably does not occur in Central European waters; no other alga with similar features is known to occur there according to the literature. In chlorococcal algae, a cosmopolitan geographical distribution is not at all common and the limited geographical area has already been proved in some species. *M. flexuosum* seems to belong to such a group of algae.

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Souhrn

Ve vzorcích letního fytoplanktonu z jezera č. 227 (Experimentální jezerní oblast kanadského výzkumného rybářského ústavu — Fishery Research Board) v sz. Ontariu (Kanada) byl nalezen dosud neznámý druh planktonní chlorokokální řasy z r. *Monoraphidium* (*M. flexuosum* sp. nova). V článku je uveden jeho popis s diagnosou a ikonotypem, a je diskutováno jeho taxonomické postavení uvnitř r. *Monoraphidium*. K novému druhu patří pravděpodobně jako samostatná taxonomická forma také *Ankistrodesmus falcatus* var. *mirabilis* f. *longiseta*, popsaná NYGAARDEM v r. 1945 z dánských jezer. Taxonomické postavení této řasy nemohlo být dosud úspěšně řešeno pro nedostatek novějšího materiálu. Práce je doplněna ekologickými daty o nálezšti nového druhu a je připojena tabulka s přehledem mezirodových znaků v podčeledi *Ankistrodesmoideae* (*Chlorellaceae*).

Table 1. — Review of the subfamily *Ankistrodesmoideae* (*Chlorellaceae*) within the order *Chlorococcales*

unicellular and colonial algae; reproduction only by autospores (CHLORELLACEAE)	elongated cells; the mother cell wall not enlarging before the reproduction of autospores (ANKISTRODESMOIDEAE)	green plants, with assimilation pigments	apochloric; cells thin, elongated to both ends and tapering to fine points				<i>Hyaloraphidium</i> PASCH. et KORŠ. 1931
			cells attached to the substrate by one end	cells not attached to the substrate by a long stipe; upper end not tapering to the top	cells $\pm$ ovoid, attached by gelatinous disc	<i>Pseudococcomyxa</i> KORŠ. 1953	
					cells $\pm$ arcuate, attached by narrowed basal end, without gelatinous disc	<i>Chlorolobion</i> KORŠ. 1953	
				cells attached to the substrate by a long stipe; the apical end of cells elongated and tapering to the top	<i>Podohedra</i> DÜRING. 1958		
			cells not attached to the substrate by one end	autospores differentiated in series in the mother cells; cells solitary or in colonies	cells without mucilage, obviously solitary	cells $\pm$ asymmetrical with hyaline processes at one or both ends; autospores 2—4	<i>Keratococcus</i> PASCH. 1915
						cells $\pm$ symmetrical, with morphologically identical ends; autospores 4—8(16)	adult cells with more pyrenoids
				cells in mucilaginous colonies	cells oval, fusiform or in an elongated helix	adult cells without (or with only one) pyrenoids	<i>Monoraphidium</i> KOM.-LEGN. 1969
						cells fusiform or in a long helix, max. in 8 in the colony, mucilage thin	<i>Fusola</i> SNOW 1903
						cells broadly fusiform or oval, with many cells in colony, mucilage distinctly limited	<i>Coccomyxa</i> SCHMIDLE 1901
				autospores in the mother cells differentiated parallelly; cells in colonies	cells lunar or shortly helicoidal curved (the ends very close to each other)	cells in the colony detached from each other; mucilage clearly limited	<i>Kirchneriella</i> SCHMIDLE 1893
						cells in the colony touch each other; mucilage not clearly visible, sometimes reduced in a small cluster in the centre of colony	<i>Quadrigula</i> PRINTZ 1915

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M. Bidault:

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