

NEW CHLOROCOCCALES SPECIES IN THE DANUBE HYBRID ALGAE?

T. HORTOBÁGYI

Department of Botany, University Gödöllő

(Received February 18, 1979)

Abstract

Three new Chlorococcales species, observed by the author in the Budapest reaches of the Danube, are reported on: *Actinastrum mixtum* HORTOB. n. sp., *Micractinium extremum* HORTOB. n. sp., *Tetrastrum nonsens* HORTOB. n. sp. The supposition of hybrid character is justified by the appearance of all the three organisms.

The coenobia of *Actinastrum mixtum* HORTOB. are built of cells of two types. One of the cell types agrees with the cells of *Actinastrum gracillimum* G. N. SMITH, the other with those of *Actinastrum aciculare* PLAYF.

Micractinium extremum HORTOB. combines the characteristics of *Micractinium pusillum* FRES. and of *Micractinium crassisetum* HORTOB.

On the cells of *Tetrastrum nonsens* HORTOB. the characteristics of *Tetrastrum parallelum* HORTOB. and of *Tetrastrum staurogeniaeforme* (Schroed.) Lemm. can be observed.

Although the most characteristic way of the reproduction of Chlorococcales is the autospore-formation, zoogamy also occurs in some genera. And by this the possibility of hybridization is supported.

Hereinafter, the description of three new species is published, in respect of whose origin the question may come up, if they aren't hybrid descendants.

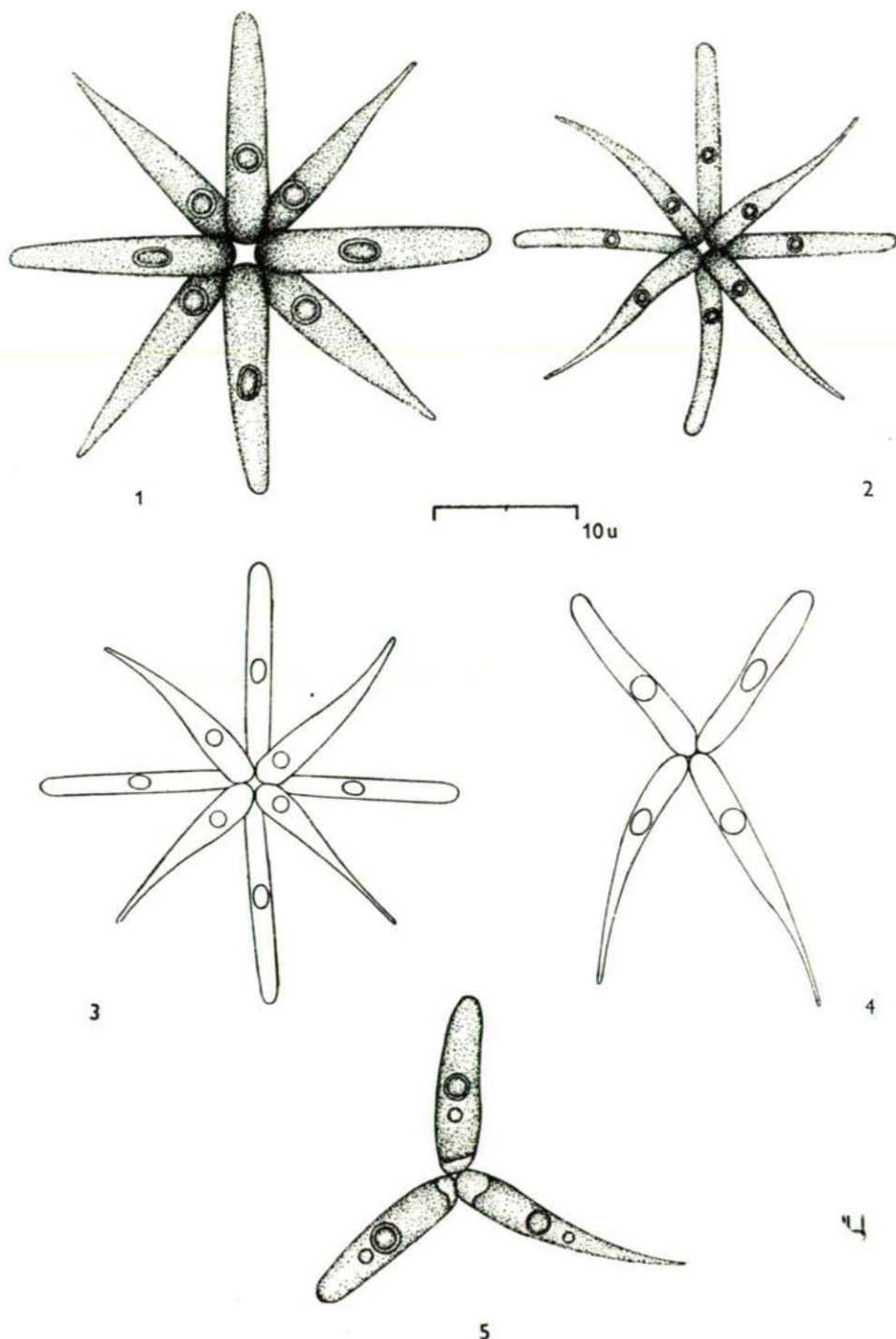
Actinastrum mixtum HORTOB. n.sp.

(Figs. 1—5)

In the reaches of the Danube at Budapest, on 28 August, 1974, at river kms 1586 and 1608, as well as on 16 September, 1975 at river km 1643, it did not belong to the rare algae. In August, the temperature of water was 20.8 °C, pH 7.85; in September, water temperature was 16.5 °C, pH 7.96.

The cells have two kinds of shape: half of them are straight or very slightly curved rods; about their ends they may be somewhat narrower, their ends being broadly rounded. The other half of the cells of coenobium are widely rounded at their lower part, towards their peak they become gradually thinner and thinner and pointless. These cells are more rarely straight, they are mostly slightly curved. The rod-shaped and elongated drop-shaped cells are alternately present in coenobia. The length of cells is 12.5–31 μ , their width is 1.4–2.6 μ . The cells are quite or almost quite filled by a large chloroplast, which is parietal containing a well-developed pyrenoid. At the contact of cells, a larger or smaller cavity is formed.

It sometimes occurs that the cells of two shapes cannot be observed alternately but two cells of identical type can be found beside each other, as seen in Figure 4.



5
Fig 1—5

The cells in the coenobium are rarely of odd number. In this case, there is more of one of the cell types, like e.g. in Figure 5.

The new species differs from every *Actinastrum*, known so far, in its two kinds of cell shape. The blunt-ended cylindric cells are entirely identical with the cells of *Actinastrum gracillimum* G. M. SMITH, while those becoming thin correspond to the cells of *Actinastrum aciculare* PLAYF.

On 28 August 1974, there was a rich phytocoenosis in the Danube, with a large number of litres and many kinds of taxons. Green algae took quantitatively part in 60 per cent, diatoms in 37 per cent, at river-km 1586. From among the green algae, *Ankistrodesmus*, *Actinastrum*, *Hortobágyiellae*, *Dictyosphaerium*, *Coelastrum*, *Scenedesmus*, *Chlamydomonas*, and from diatoms *Stephanodiscus* were characteristic. At river-km 1608 a similar association developed.

On 16 September 1975, at river-km 1643, in a quantitative sequence, diatoms, blue-green algae and green algae dominated. From the blue-green algae *Achroonema*, *Romeria*, from the green algae the above mentioned ones and *Hyaloraphidium* are characteristic. *Planctomyces* also present themselves in a considerable number

Micractinium extremum HORTOB. n.sp.
(Figs. 6-7)

It was found in a water sample from 26 May 1976, close to the left bank of the Danube, at river-km 1630. It is rare. The pH of water was 7.82.

The thalluses are, as a rule, 8-celled, the cells stand cluster-like, they are of spherical form, their diameter is 5.2-6.4 μ , linking up closely with one another, but preserving, nevertheless, their regular spherical form. The spines are thin and pointed as a pin, or they are thick and similarly end in a fine point. There always occur only one or exceptionally two spines in a cell. These are either thin or thick. They can never be observed mixed. The length of thin spines may reach 30 μ , that of the thin ones 52 μ . The thin spines are 1 μ wide at their base, the width of the thick ones is 3-4 μ at their base. In each cell a parietal chloroplast is formed, containing a well-developed pyrenoid.

This combines the properties of *Micractinium pusillum* FRES. and *Micractinium crassisetum* HORTOB. In the former only thin spines are formed, in the latter only thick ones.

On the cells of *Micractinium strigoniense* HORTOB. the thin and thick spines can be found. On one cell, however, both kinds of spine occur, arranged regularly in such a way that the thick spines coming from about the middle of the cell are accompanied, from right and left, by a thin spine each, much smaller than the thick spine.

In the days of collecting, the phytocoenosis was characterized by Bacillariophyceae: they were present in 95 percent. The participation of Chlorophyceae is not more than 4.3 per cent. The number of Cyanophytos is very low: 2 percent. Caulobacteriales were the remaining 0.5 per cent. The most characteristic and frequent alga was *Stephanodiscus Hantzschii* GRUN.

In the time of collecting, both *Micractinium pusillum* FRES. and *Micractinium crassisetum* HORTOB. were present. Hybridization could, therefore, take place.

Tetrastrum nonsens HORTOB. n.sp.
(Fig. 8)

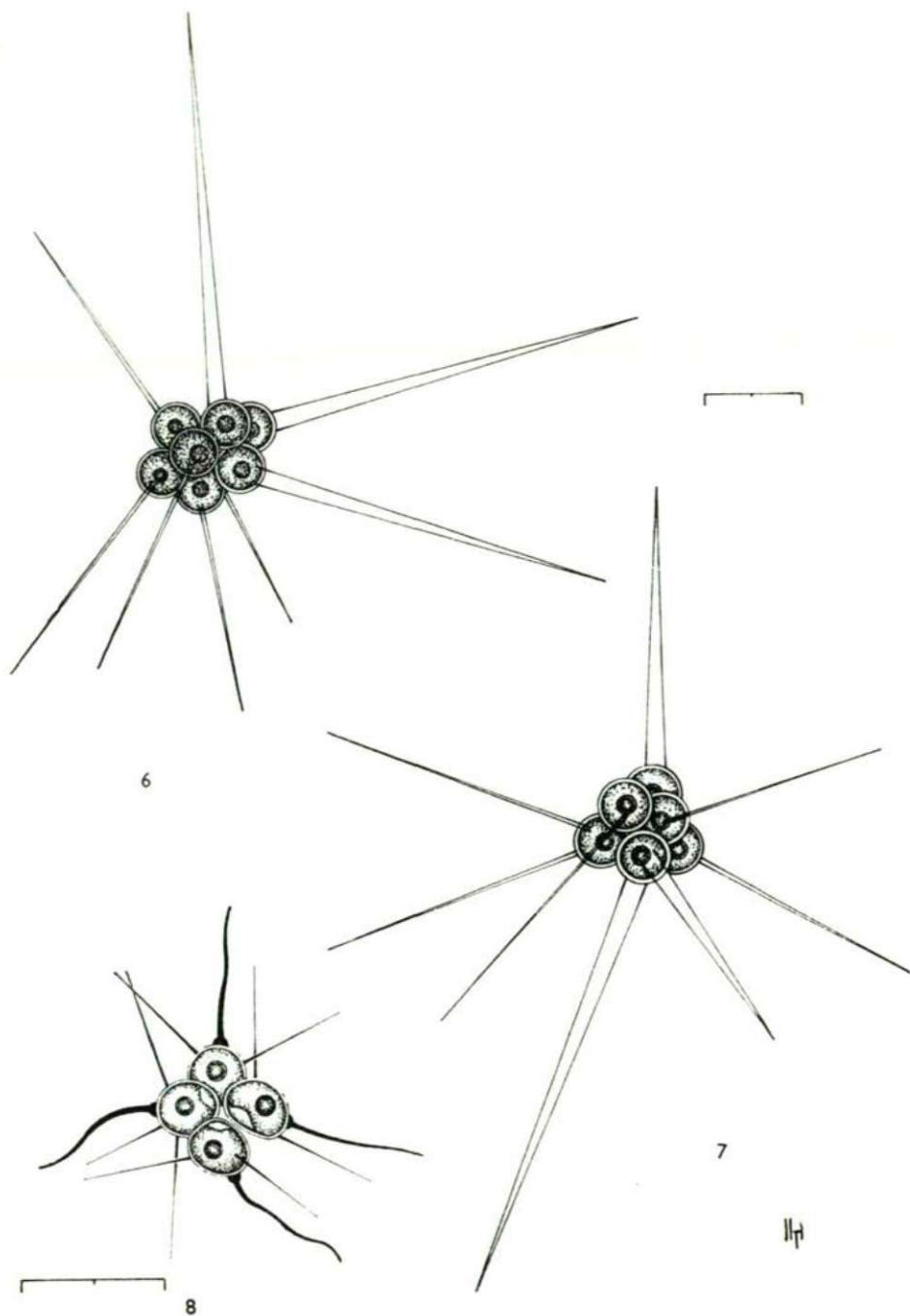


Fig 6—8

This organism was found in the collection of 9 May 1974, at river-km 1608; pH: 8.06. It belonged to the very rare algae.

Cells may be spherical, globular or a little compressed. Their diameter is 4–4.6 μ . In the coenobia they take place in fours, hold fast to one another, yet touching each other at a small surface. They are not always at the same level. In the parietal chloroplast a well-developed pyrenoid is to be seen. The lumen is almost filled in fully with chloroplast. From the part of cells looking outwards two kinds of spines originate. One of the types is represented by the spine standing in the axis of cells, one of them taking place in each cell. This is thick, curved or wavy, becoming somewhat thinner at the peak, and ending in a blunt point. Its lower part grows wider hemisphere-like, it sticks with this to the cell. The length of the thick spine is 9–11 μ . To the right and left from this thick spine, one or two straight, thin spines develop which are somewhat shorter, pointed as a pin, becoming hardly thick at their forming a joint with the cell. Their length is 6.5–8.8 μ . The shorter, straight spines have no spine base.

Tetrastrum nonsens HORTOB. combines the properties of *Tetrastrum parallelum* HORTOB. *Tetrastrum staurogeniaeforme* (SCHROED.) LEMM. To the former a thick, curved-wavy spine of blunt point and wide base refers, to be seen in each cell, taking shape in each cell at the *parallelum*, at the axis of cells. Of the latter alga, the thin, straight and very much pointed spines — to be observed at the species described now, on the right and left from the thick spine — remind us.

Tetrastrum nonsens HORTOB. was a member of a poor coenosis in May, 1974, only Bacillariophyceae appearing in a higher taxon-number. They formed 85 per cent of algae, most of them being *Stephanodiscus Hantzschii* GRUN.

Hybridization is possible, because both the algae *Tetrastrum parallelum* HORTOB. and *Tetrastrum staurogeniaeforme* (SCHROED.) LEMM. occur in the Danube.

The most characteristic way of the multiplication of Chlorococcales is forming autospores. In addition, in the families Palmellaceae and Coccomyxaceae also reproduction by fission is to be found. The possibility of hybridization is supported by that we also know of zoogamy, taking place by means of the copulation of gametes in more than one genus, like e.g. *Pediastrum*, *Hydrodictyon* (BRAUN, 1855), *Micractinium* (KORSCHIKOV, 1937), *Golenkinia* (KORSCHIKOV, 1937), *Dictyosphaerium* (IENGAR and RAMANATHAN, 1940), *Scenedesmus* (TRAINOR and BURG, 1965), *Eremosphaera* (KIES, 1967), *Chodatella* (RAMALEY).

It is highly probable that the existence of a number of Chlorococcales taxons is due to hybridization.

Diagnoses

Actinastrum mixtum HORTOB. n.sp.
(Fig. 1–5)

Coenobia 4-, vel 8-cellularis, e cellulis diversiformibus: rectis vel lenissime inclinat, cylindricis, versus apices forte parum tenuiescentibus et subtus latis deinde gradatim tenuiescentibus, apice obtusis, rectis vel parum inclinat, 12.5–31 \times 1.4–2.6 μ magnis, alternatim dispositis constructa. Chloroplastis unicis, basin cellulae non semper attingens, pyrenoidam unicam, bene evolutum habens.

Fig. 5: coenobium abnormale: tricellulare, duae cellularum cylindricae.

Danubius, VIII-IX. 1974. — Non rare.

Cellulis diversiformibus ab omnibus speciebus generis *Actinastrum* distinctum.

Micractinium extremum HORTOB. n.sp.

(Fig. 6-7)

Thalli pelumque 8-cellulares, e cellulis arcte dispositis, 5.2-6.4 diam., compositis. Spinae 1-2 aut tenues, aut valde crassae in unaquaque cellula. Spinae tenues usque ad 30 μ , crassae usque ad 52 μ longae. Pyrenoidae pro cellula singulae, conspicuae. Chloroplasti singuli, parietales.

Species haec nova nostra notas et *Micractinium pusilli* FRES. et *Micractinium crassiseti* HORTOB. ad instar hybridae in speciem colligens. — *Micractinium strigoniense* HORTOB. per dispositionem regularem spinarum mixte tenuium crassarumve in unaquaque cellula distinctum.

Danubius, V. 1976. — Rare.

Tetrastrum nonsens HORTOB. n.sp.

(Fig. 8)

Cellulae 4-4.6 μ diam., blobulosae, parum compresse, forte paene triangulares, non semper in uno plano dispositae, in polis spinis singulis, crassis, inclinatis vel undulatis, obtusis, ad basin dilatatis, 9-11 μ longis, in duobus lateribus earum spinis singulis, rarissime 2, brevioribus, 6.5-8.8 μ longis, rectis, gracilioribus, mucronatis, ad basin non dilatatis ornatae. Chloroplastis unicus, cellulam paene implens, in eo pyrenoida bene evoluta.

Danubius, V. 1974. — Rarissime.

Tetrastrum parallelum HORTOB. et *Tetrastrum staurogeniaeforme* (SCHROED.) LEMM. ei proxima. Species nova nostra a *Tetrastrum parallelo* spinis tenuibus acutis, a *Tetrastrum staurogeniaeforme* spinis singulis, crassis, obtusis, inclinatis, ad basin dilatatis polarum distincta.

References

- BARTHA, Zs. et al. (1976): A zöldalgák Chlorococcales rendjének kishatározója (A small identification book of the Chlorococcales order of green algae). — *Vizügyi Hidrobiológia* 4, 1-343.
 HORTOBÁGYI, T. (1973): The Microflora in the Settling and Subsoil Water Enriching Basins of the Budapest Waterworks. — Budapest.
 HORTOBÁGYI, T. (1979): Algological notes on Hungarian reach of Danube with regards to water works supplied with Danube-water. — Budapest. (In litt.)
 HORTOBÁGYI, T. (1976): On the thick-spined species of *Micractinium*. — *Acta Bot. Hung.* 22, 361-365.
 KIRYAKOV, I. K. (1977): Rod *Scenedesmus* Meyen. — Plovdiv.
 PHILIPPOSE, M. T. (1967): Chlorococcales. — Indian Council of Agricultural Research, New Delhi.

Address of the author:
 Prof. Dr. T. HORTOBÁGYI
 Department of Botany, University,
 Gödöllő