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THE OCCURRENCE OF *APHANOTHECE STAGNINA* (SPRENG.) A. BR. IN LAKE VELENCE, WESTERN HUNGARY

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This report discusses the occurrence of the cyanobacterium species *Aphanothece stagnina* in Lake Velence. Besides the report summarised here, earlier occurrences of this species in Hungary are also presented in this article. Easily observed and well visible to the naked eye, this cyanobacterium was found in the sediments of "Lángi-" and "Német-tisztás" as well as in the phytoplankton of "Német-tisztás". It has probably lived in the lake for decades but only appears from time to time. Observations on its presence and occurrence have been a contribution to the assessment of the biological diversity of the mosaic-like Lake Velence. Although the sediment of the lake has been well studied from 1989, this species was only detected in 1997. Its multiplication and growing distribution may well be connected with the growing biological uniformity of the lake. Further studies of *Aphanothece stagnina* in the lake may be an ideal tool for the biomonitoring of this precious lake.

Key words: *Aphanothece stagnina*, biomonitoring, cyanobacteria, Lake Velence

INTRODUCTION

In the summer of 1997, during the collection of sediment samples from Lake Velence for the Central Danubian Environmental Protection Inspectorate, we observed some peculiar, bean-sized, vivid green colonies of algae in the upper layers of the sediment near "Németh-tisztás". In August of the same year, while collecting algae around the so called "black-brown waters" of the lake, we again noticed larger, peanut- or walnut-sized pieces of mucilaginous colonies of brownish, greenish or sometimes yellowish colour. We paid special attention to this fact as such phenomenon had never been observed in the lake before.

Some habitat characteristics of Lake Velence

With its reeds, floating islands and open water surfaces of varying size, the lake, environmentally and conservation-wise, is one of the most remarkable and diverse natural landscapes of Hungary. Its surface totals at 24.5 km^2, with a water-

shed area of 615 km^2. Its average water depth is 1.2 m, which means that great winds may easily stir up the water affecting it down to the bottom.

In the 70s, before the lake regulation, one of the main characteristics of the lake was its mosaic-like pattern, in which the quality of the different parts of the entire water body was clearly separable. Among the two streams providing water supply for the lake, the "Császár-víz", flowing through the western part of the lake, abundant in reeds, looses most of its organic matter in a natural way, while the other stream in the eastern part of the lake runs directly into it. Due to this, near the place called "Fürdető" the amount of organic matter is the largest in the lake, and the colour of the water is greener than elsewhere. The interior parts of the lake, surrounded with reeds, with their dark brownish water, have been habitats of swampy character. The third type of habitat is usually referred to as the waters of transitional features (BARTHA 1977, BARTHA and HAJDÚ 1979). LAKATOS (1976, 1978), LAKATOS and BARTHA (1989) have provided details on the benthonic eutrophisation of Lake Velence.

MATERIAL AND METHODS

Macroscopic mucilaginous colonies were sampled from the water surface in August 1997. The material was partly fixed by formalin solution, and partly dried up, and placed into the Collectio Algarum of the herbarium at BP under the number 1997/47.

Collecting the lake bottom samples was carried out by an Ekman-Birge sampling instrument, and each sample was taken from a bottom surface of 15 by 15 cm. The samples taken by this method are considered undisturbed, thus well representing the circumstances in the lake bottom. In the monitoring of the lake we have been using this method continuously since 1989.

The first author identified the taxa using Felföldy's guide (FELFÖLDY 1972), and it was confirmed by O. VINOGRADOVA. Her microscopic examination was made under an Olympus BX–40 light microscope. Identification was performed using "Süsswasserflora von Mitteleuropa" (KOMÁREK and ANAGNOSTIDIS 1999).

RESULTS AND DISCUSSION

As a result of macroscopic observation and microscopic investigation of the material collected in Lake Velence, it was identified as *Aphanothece stagnina* (Spreng.) A. Br.

The species description is given below: Colonies macroscopic, gelatinous, irregularly spherical, up to 5–6 cm in diameter, dark grape-green, with loosely dispersed cells. Action on colonies by lactic acid testified the presence of calcite. Mucilage of the individual cell envelopes is confluent, invisible. Cells cylindrical with

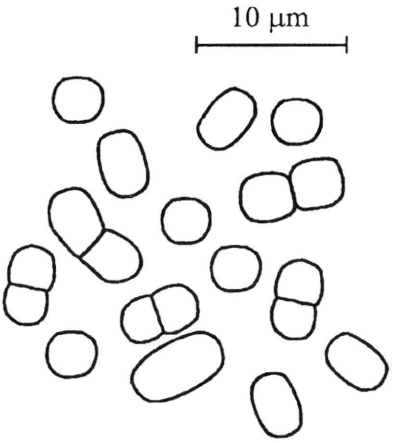


Fig. 1. The cells of *Aphanothece stagnina*.

rounded ends, with homogeneous pale- to bright blue-green content, 3.8–4.4 × 7.6–8.4 μm (Fig. 1). Occurs on the water surface and in sediments of Lake Velence.

The size of the colonies in the sediment was quite variable. The samples collected near the "black waters" were relatively small (with diameters of 0.7–1 cm, like beans) while near the "brown waters" we sampled larger ones detached from the bottom. These have reached the size of 5–6 cm (like the dimensions of a peanut or walnut). The surface of the sample gathered in June 1997, with its greenish colour was in sharp contrast to the ochre-brown colour we had expected and had been accustomed to. Besides the colonies having homogeneous greenish colouration, we also detected some vivid green ones of the size of a bean.

Thus, it was the first occasion of detecting such phenomenal occurrence of algae either in the water or on the sediment. In August 1997, besides the vicinity of "Német-tisztás", these mucilaginous colonies appeared in the "Mély víz" area, and by the end of the autumn, these were not only visible near the sediment surface, but also close to the water surface.

Having reviewed the reports on Lake Velence we did not find any data or reference concerning the presence of *Aphanothece stagnina*. According to the fishermen who know these parts of the lake well, there is a massive occurrence of this cyanobacterium from time to time, however, depending on the weather conditions. There is a high probability that it is more widely distributed in the sediments. Based on our observations, the most probable occurrence of this species is in the areas illustrated in Figure 2.

Near the areas of the "black waters", the water is clear and well illuminated. The bottom of "shallow waters" and canals is covered with peculiar algal mats which later arise as a result of the bacterial decay following the ageing of these mats, combined with the changes in the atmospheric pressure, and detach from the sediment from time to time. In a similar way, *Aphanothece stagnina* starts to develop (near the bottom) yet it takes some time until it lifts up and reaches the water surface. During the whole year of 1997, in the plankton of the "Német-tisztás" the dominance of Cryptophyta and Bacillariophyceae was observed. However, it was interesting, and even surprising, to detect *Aphanothece stagnina* in the sediment of "Lángi-tisztás". This location represents the transitional water body between the reserve and the recreation area. In the year 1997, "Lángi-tisztás" was the area of the whole lake with the highest degree of algae presence, that is, the area where they recorded the highest amount of biomass of the phytoplankton. Surviving the winter in the sediment, the dominant species of the summer plankton, *Microcystis aeruginosa*, causes occasional water bloom in the lake (RESKÓNÉ and TÖRÖKNÉ 2000).

Aphanothece stagnina is known as a species quite common in the temperate zones (KOMÁREK and ANAGNOSTIDIS 1999). In Hungary, according to the computerised data base of the Flora et Iconographia Algarum Hungariae, *Aphanothece stagnina* can be found in the Danube (SZEMES 1967), in Lake Balaton (TAMÁS 1964) in Lake Fehér near Szeged (V. VARGA 1959, 1966) and recently in Kis-Balaton (VÍZKELETY 1996) and in Lake Baláta (BORICS *et al.* 1998).

Besides water bodies, *Aphanothece stagnina* was also recorded in soils (FEHÉR 1936). For example, FEHÉR (1948) studied 122 soil samples from different

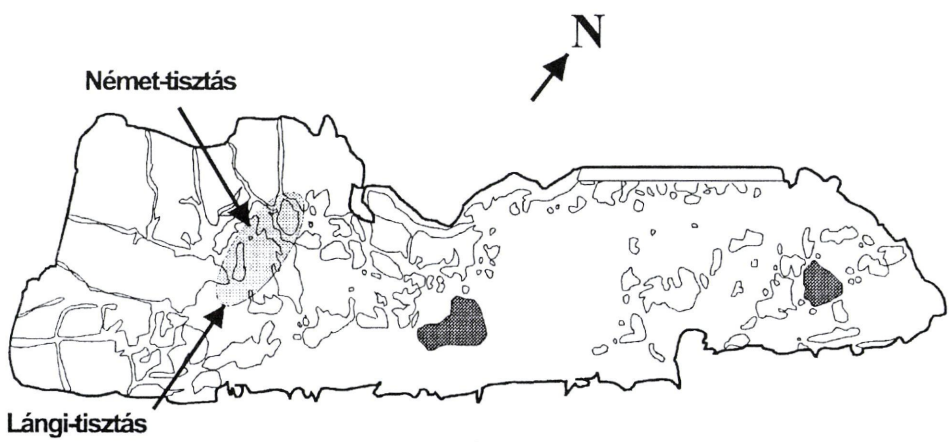


Fig. 2. The occurrence of *Aphanothece stagnina* in Lake Velence.

places of the world, and reported the distribution of this species in the northern hemisphere. The pH of the soil samples that contained this taxon falls in the acidic category (4.56–6.02). It is a cosmopolitan species detected in soil samples from Europe, Africa, Asia and even Australia. (The humidity of the soil samples examined varied between 0.5 and 32.1%.)

According to the measurements and data reports of the Central Danubian Environmental Protection Inspectorate, the once characteristic biological diversity of Lake Velence has begun to decline, the water bodies of differing qualities separated by patches of reed loosing their features and are on the way of homogenisation. This phenomenon is true for the entire lake. *Aphanothece stagnina* is one of a few algae which can be observed directly and visually and its occurrence easily mapped. Following some "confirmative identification", it may play a key role in the monitoring of the lake.

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