

# FIRST RECORD OF *GOMPHONEMA LACUNICOLA* PATRICK ET FREESE (BACILLARIOPHYTA) FROM THE PÂRENG MTS (SOUTHERN CARPATHIANS, ROMANIA)

Krisztina BUCZKÓ<sup>1,2\*</sup>, Csilla KÖVÉR<sup>3</sup>, Enikő MAGYARI<sup>4,5</sup>, Zoltán SZABÓ<sup>2,5</sup>  
and János KORPONAI<sup>2,6</sup>

<sup>1</sup>Department of Botany, Hungarian Natural History Museum, H-1431 Budapest, Pf. 137, Hungary;  
\*buczko.krisztina@nhmus.hu

<sup>2</sup>Aquatic Ecological Institute, Centre for Ecological Research,  
H-1113 Budapest, Karolina u. 29, Hungary

<sup>3</sup>H-3531 Miskolc, Báthori István u. 36, 3/1, Hungary,

<sup>4</sup>MTA-MTM-ELTE Research Group for Paleontology,  
H-1117 Budapest, Pázmány Péter sétány 1/C, Hungary

<sup>5</sup>Department of Environmental and Landscape Geography, Eötvös Loránd University,  
H-1117 Budapest, Pázmány Péter sétány 1/C, Hungary

<sup>6</sup>Department of Water Supply and Sewerage, Faculty of Water Science, National University of Public  
Service, H-6500 Baja, Bajcsy-Zsilinszky u. 12–14, Hungary

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**Abstract:** Here we report and document the occurrence of the diatom *Gomphonema lacunicola* Patrick et Freese 1961 from the Pâreng Mts of the Carpathian Mountains, Romania. This observation was made within the framework of a systematic sampling campaign and analyses that were conducted in the Southern Carpathians, covering 40 mountain lakes for discovering the cladoceran fauna and diatom flora of this region between 2012 and 2014. *G. lacunicola* was found only in one of the 40 lakes, namely in Lake Câlcescu, where it was extremely rare, but the characteristic feature of the lake promoted the presence of the species. Lake Câlcescu is a subalpine lake, located 1,934 m a.s.l. This is the first record of this diatom species in Romania.

**Key words:** Carpathian Mountains, Cryptic project, diatom taxonomy, *Gomphonema*, Pâreng Mts, Romania

## INTRODUCTION

In the last couple of years, intensive taxonomic work has been carried out in the Botanical Department of the Hungarian Natural History Museum in order to explore the diatom flora of mountain lakes in the Carpathian Mts (BUCZKÓ 2016, BUCZKÓ and MAGYARI 2007, BUCZKÓ *et al.* 2018a, b, 2021). These studies have two main directions (1) a palaeolimnological survey covering the Last

Glacial and Holocene period, and (2) exploring the recent diatom assemblages of the mountain lakes. The main aim of the second task is to build a reliable database for quantitative palaeoecological reconstruction.

This observation was made within the framework of a systematic sampling campaign and analyses that were conducted in the Southern Carpathians, covering 40 mountain lakes for discovering the cladoceran fauna and diatom flora of this region between 2012 and 2014 by Csilla Kövér (KÖVÉR 2016).

Representatives of the *Gomphonema* genus are frequent, but never dominant in the diatom assemblages of the glacial and crater lakes in the Carpathians, so their occurrence records are often apt to be overlooked (BUCZKÓ *et al.* 2018*b*). More than 1,500 species names belonging to the genus *Gomphonema* are currently listed in the relevant database (GUIRY and GUIRY 2022, ПОТАРОВА *et al.* 2022), but many of them have been confused and incorrectly identified (KOCIOLEK and KINGSTON 1999). To gain a clearer picture of species variability of rare species our aim was to document the occurrence of a rare *Gomphonema* species from the Southern Carpathians. These results contribute with new data to earlier published data and to the study conducted in the region (BUCZKÓ 2016, BUCZKÓ *et al.*, 2018*a*, 2021).

## MATERIALS AND METHODS

### Study site – Lake Câlcescu

Lake Câlcescu is located in the Gâlcescu cirque in the Pâreng Mts of the Southern Carpathians (Fig. 1). The area is dominated by Proterozoic and Palaeozoic granite, gneiss, and amphibolite rocks (GHEORGHIU *et al.* 2015). The Gâlcescu cirque is surrounded by high steep walls in the southern and south-eastern part. Lake Gâlcescu is limited by a frontal glacial moraine at the northern end. On the eastern side of the lake, lateral moraines were deposited along the cirque floor (GHEORGHIU *et al.* 2015). The lake surface area is 3.09 ha and has an average depth of 3.66 m (PÉTERFI *et al.* 2001).

### Sampling

Samples were collected on 14 August 2012 by Csilla Kövér and Sándor Harangi from the deepest point of Lake Câlcescu (45° 21' 1.5" N, 23° 36' 44.04" E), which was 9.3 m at the date of sampling. The lake is located at 1,934 m a.s.l., near the origin of the River Lotru, just above the upper edge of the *Pinus mugo* belt. The diatom species were identified by Krisztina Buczkó.



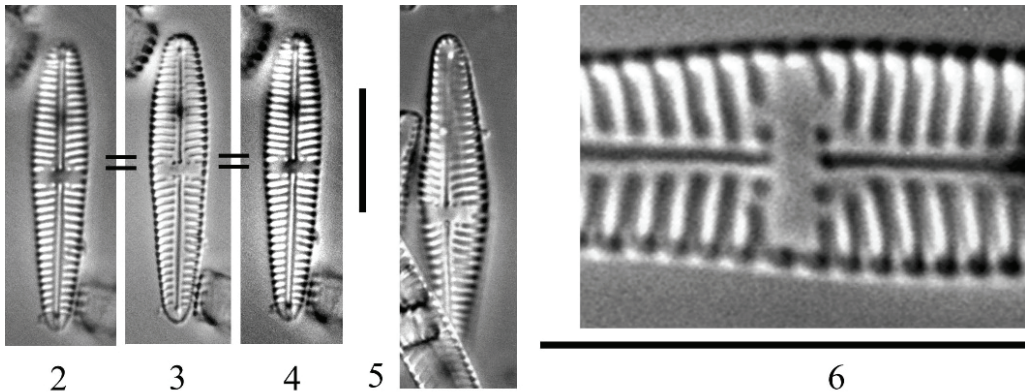
Fig. 1. Lake Călcescu, Păreng Mts, Romania in 2012 (photo: Cs. Kövér).

Samples for diatom analysis were prepared by standard digestion procedures (BATTARBEE 1986). A small portion of the wet sediment was digested in hot 30%  $H_2O_2$ ; then washed several times. The cleaned valves were dried on coverslip and embedded in Naphrax resin. Diatom counting was conducted using a Leica DM LB2 light microscope (equipped with 100 HCX PLAN APO objective and Olympus SC180 digital camera) at  $\times 1,000$  magnification under oil immersion and phase contrast. The studied slide is deposited in the Algological Collection of the Hungarian Natural History Museum as HNHM-ALG-D-2013/7.

## RESULTS

Description of the studied *Gomphonema lacunicola* Patrick et Freese sample (Figs 2–6). – Valves heteropolar, clavate, with the largest valve width in the upper valve half. Headpole protracted, footpole not protracted, apices rounded. Valve length 23–28  $\mu m$ , width 4.8–6  $\mu m$ . Axial area very narrow, linear. Central area large, rectangular, bordered on each valve side by 1–2 strongly shortened central

striae. Four isolated pores (distinct puncta), two on each side of the proximal raphe endings, arranged to form a small rectangle about the central nodule. Raphe filiform terminating with slightly expanded proximal raphe endings. Striae in upper half of valve almost parallel, in lower half of valve slightly radiate. Striae, 14–18 in 10  $\mu\text{m}$ . Areolae not distinguishable in light microscope.

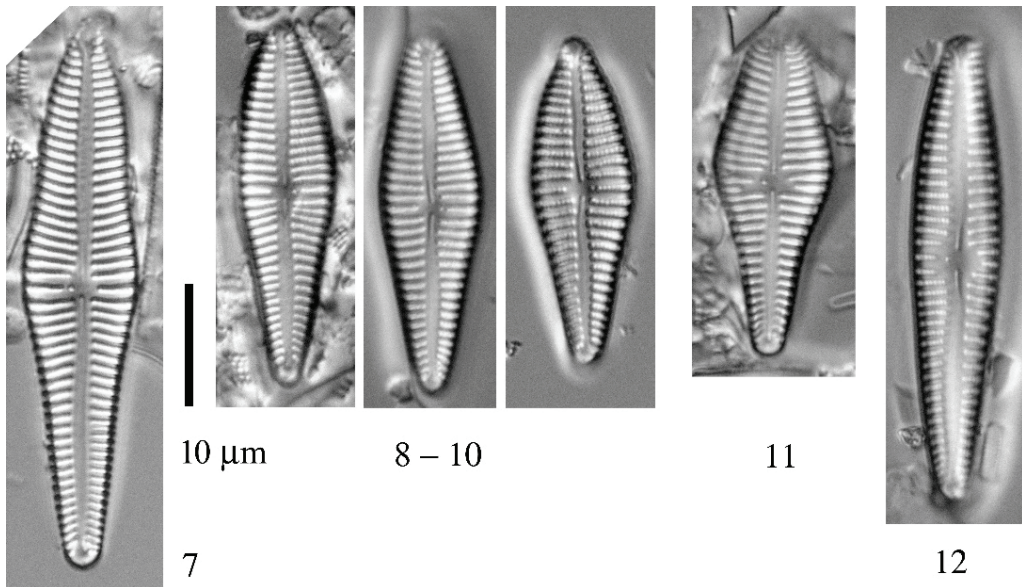


**Figs 2–6.** Light microscopic pictures of *Gomphonema lacunicola*. – Figs 2–4 are the same specimens. Fig. 6. Fourfold magnification of the central area with characteristic arrangement of stigmata. The scale bars are 10  $\mu\text{m}$ .

The water chemical parameters measured on the field: pH 8.11, water temperature 13.7 °C, conductivity 18.23  $\mu\text{S}/\text{cm}$ . The water chemistry:  $\text{Na}^+$  0.88 mg/l,  $\text{K}^+$  0.35 mg/l,  $\text{Ca}^{2+}$  2.17 mg/l,  $\text{Mg}^{2+}$  0.35 mg/l,  $\text{HCO}_3^-$  16.15 mg/l,  $\text{Cl}^-$  0.36 mg/l,  $\text{SO}_4^{2-}$  2.50 mg/l,  $\text{NH}_4^-$  0.06 mg/l,  $\text{NO}_2^-$  0.31 mg/l).

The sample was dominated (> 5% in relative abundance) by fragilarioids, like *Staurosirella pinnata*, *Staurosira* cf. *venter*, small celled *Psammothidium* taxa (*Psammothidium microscopicum* (Cholnoky) S. Blanco, *P. scoticum* (Flower et Jones) Bukhtiyarova et Round, *Aulacoseira alpigena* (Grunow) Krammer and *A. ambigua* (Grunow) Simonsen, *Diatoma mesodon* (Ehrenberg) Kützing, *Adlafia minuscula* (Grunow) Lange-Bertalot, *Karayevia carissima* (Lange-Bertalot) Bukhtiyarova, *Sellaphora pupula* (Kützing) Mereschkowksy and *Pinnularia microstauron* var. *nonfasciculata* Krammer.

The *Gomphonema* genus was represented in the sample by *G. longiceps* Ehrenberg (Fig. 7), *G. pseudaffine* Levkov, Mitic-Kopanja et Reichardt (Figs 8–10), *G. italicum* Kützing var. *tumidum* Levkov, Mitic-Kopanja et Reichardt (Fig. 11), and *G. cf. subclavatum* Grunow (Fig. 12) – all of them were rare in the sample (< 1% in relative abundance).



**Figs 7–12.** Light microscopic pictures of further *Gomphonema* species in the Lake Călcescu sediment samples. – Fig. 7. *G. longiceps*, Figs 8–10. *G. pseudaffine*, Fig. 11. *G. italicum* var. *tumidum*, Fig. 12. *G. cf. subclavatum*.

## DISCUSSION

*Gomphonema lacunicola* is easily distinguished by the arrangement of the puncta in the central area and the fine striae. This species is most closely related to *G. olivaceoides* Hustedt from which it differs by the angle and fineness of the striae (PATRICK and FREESE 1961). *G. variostigmatum* Reichardt is also similar to *G. lacunicola* in dimensions but differs in the density of striae (12–14 in 10 µm in the case of *G. variostigmatum*, while more than 14 in 10 µm for *G. lacunicola*). *G. calcifugum* Lange-Bertalot et Reichardt has smaller valves (length 11–27 µm, width 4–6 µm) (Table 1).

**Table 1.** The main published dimensions of *Gomphonema lacunicola*.

Reference	Length (µm)	Width (µm)	Striae (in 10 µm)
PATRICK and FREESE (1961)	15–31	4–7	15–20
REICHARDT (2009)	8.4–35.7	4.5–7.0	14–20
LEVKOV <i>et al.</i> (2016)	12–36	5.5–7.0	14–18
This study	23–28	4.8–6.0	14–18

Distribution and ecology: *Gomphonema lacunicola* was described from an alkaline, oligotrophic lake in Alaska (PATRICK and FREESE 1961). In 1998, the species was recorded in Germany from a moderately eutrophic lake in Brandenburg (REICHARDT 2009). In North Macedonia *G. lacunicola* was observed from the spring of the tributary of Lake Prespa; from oligotrophic water with low mineral content and high macrophyte-bryophyte cover (LEVKOV *et al.* 2016).

Data on diatoms from Lake Câlcescu were earlier reported by OLTEAN (1963), who listed 48 taxa; three of them belonged to the *Gomphonema* genus; under the names of *Gomphonema clavatum* Ehrenberg, *Gomphonema longiceps* Ehrenberg var. *montanum* (Schumann) Cleve f. *suecicum* Grunow (the currently accepted name of this taxon is *G. montanum* var. *suecicum* Grunow in Van Heurck 1880), and *Gomphonema longiceps* Ehrenberg var. *subclavatum* Grunow (the currently accepted name is *G. subclavatum* Grunow var. *subclavatum*).

Moreover, some sporadic records of diatoms can be found in PÉTERFI *et al.* (2001), who reported a bloom of *Mallomonas acaroides* Perty emend. Ivanov in Lake Câlcescu in 1992. During this sampling, *Fragilaria crotonensis* Kitton, *Aulacoseira subarctica* (O. Müller) Haworth (sub nominee *Melosira italica* var. subsp. *subarctica*), *Pinnularia burkii* Patrick, and *Stephanodiscus hantzschii* Grunow were reported from the algal bloom.

According to CARAUS (2017) and GUIRY and GUIRY (2022) the here presented occurrence data of *Gomphonema lacunicola* in Lake Câlcescu is a new record for the diatom flora of Romania.

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**Summary:** In the last couple of years, diatoms of the mountain lakes of the Southern Carpathians have been examined with special attention in the Botanical Department of the Hungarian Natural History Museum. On the one hand, the work is motivated by palaeolimnology. On the other hand, its aim is to build a reliable database for quantitative reconstructions. In doing so, rare taxa are constantly being unearthed. From the subalpine lake of the Pâreng Mountains, we detected and documented the occurrence of *Gomphonema lacunicola* from Lake Câlcescu as the first Romanian data on the species.

**Összefoglaló:** Az elmúlt években a Déli-Kárpátok hegyi tavaiban élő kovaalgákat megkülönböztetett figyelemmel vizsgáljuk a Magyar Természettudományi Múzeum Növénytárában. A munka egyrészt paleolimnológiai indíttatású, másrészt a célja, hogy kvantitatív rekonstruk-

ciókhoz megbízható adatbázist építsünk. Ennek során folyamatosan kerülnek elő ritka taxonok is. A Pâreng-hegység egyik szubalpin tavából, a Câlcescu-tóból mutattuk ki és dokumentáltuk a *Gomphonema lacunicola* előfordulását, mint első romániai adatát a fajnak.

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