



## Phylogenetic position of the diatom genus *Geissleria* Lange-Bertalot & Metzeltin and description of two new species from Siberian mountain lakes

MAXIM KULIKOVSKIY<sup>1\*</sup>, EVGENIY GUSEV<sup>1</sup>, SVETLANA ANDREEVA<sup>2</sup> & NATALIA ANNENKOVA<sup>3,4</sup>

<sup>1</sup>Department of Water Plants taxonomy and Geography, I.D. Papanin Institute for Biology of Inland Waters, Russian Academy of Sciences, 152742 Yaroslavl, Nekouz, Borok; Russia

<sup>2</sup>S.- Petersburg State University, Universitetskaya nab., 7-9, St. Petersburg, 199034, Russia

<sup>3</sup>Limnological Institute Siberian Division, Russian Academy of Sciences, Ulan-Batorskaya 3, RUS-664033, Irkutsk, Russia

<sup>4</sup>Aquatic Ecology, Department of Biology, Lund University, Ecology Building, 22362 Lund, Sweden

\*Corresponding author, e-mail: max-kulikovsky@yandex.ru

### Abstract

Two new *Geissleria* species from Siberian mountain lakes Baikal and Frolikha are described based on molecular and morphological data. The two new species are *Geissleria baicalosimilis* Kulikovskiy, Gusev, Andreeva & Annenkova sp. nov. and *G. frolikhiensis* Kulikovskiy, Gusev, Andreeva & Annenkova sp. nov. According to partial 18S rDNA and *rbcL* gene fragment analyses, *Geissleria* does not belong to the large catch-all genus *Navicula* as it was previously thought. Morphological features such as slit like areolae without hymenes, presence of one isolated pore near the central nodule and presence of props in areolae and an annulus structure support this conclusion. Plastid morphology of *Geissleria* species is typical for the Cymbellales, with one large chloroplast divided into two plates lying one against each valve, connected by a broad column. All of our data show that *Geissleria* is most closely to the genus *Placoneis*, with which they share naviculoid symmetry. Given these results, *Geissleria* should be included in the order Cymbellales.

**Key words:** Cymbellales diatoms, *Geissleria*, morphology, phylogenetic position, new species, lakes, Baikal, Frolikha

### Introduction

The genus *Geissleria* was described by Lange-Bertalot and Metzeltin (1996: 66) typified with *Geissleria moseri* Metzeltin, Witkowski & Lange-Bertalot (1996: 66–67) (Lange-Bertalot & Metzeltin 1996). Their new genus included taxa from the section Annulatae Hustedt of the genus *Navicula* Bory (1822: 128) sensu lato. According to Lange-Bertalot and Metzeltin (1996) and Lange-Bertalot (2001) this genus is characterized by solitary cells and biraphid, isovalvar, isopolar frustules. The internal raphe-sternum system is without the complication of super-imposed raphe costa like in the genus *Navicula* sensu stricto. Most species possess a simple stigma close to the central nodule. The most unique feature of the genus *Geissleria* is the presence of groups of peculiar subpolar areolae, elongated apically (annulus); the apical frets between these areolae possess numerous warty outgrowths (Lange-Bertalot & Metzeltin 1996, Lange-Bertalot 2001). Lange-Bertalot (2001) considers the systematic position of this genus to be within the naviculoid diatoms. According to Novais *et al.* (2013), the lack of internal hymens, present in *Navicula* s.s. and the presence of additional small props between the pores are reminiscent of cymbelloid diatoms. According to Novais *et al.* (2013) species of the genus *Geissleria* have an isolated pore (stigma *sensu* Lange-Bertalot 2001). Novais *et al.* (2013) have postulated that the exact taxonomic position of *Geissleria* species should be clarified using molecular techniques. The genus *Geissleria* currently comprises 74 taxa, distributed worldwide in different freshwater reservoirs such as lakes, rivers, springs, waterfalls and can occur epilithically, epiphytically or in soils (Novais *et al.* 2013). Revision of species with comprehensive references is given in Novais *et al.* (2013).

Modern determinations of the phylogenetic relationships of organisms are usually based on both morphological observations and DNA analysis. Molecular genetic studies of diatom taxa have already been carried out at higher taxonomic categories, at the level of genus and for describing new species (see Behnke *et al.* 2004, Medlin &

like areolae (Figs 44–49). The props are present around the edges of the annulus areolae in *Geissleria* (Figs 44–47). The same props surround the isolated areolae at the valve poles in *Geissleria* (Fig. 44, 45). These dolioform props are similar with props are visible around the edges of the areolae in incomplete pores of *Placoneis* (Fig. 50). In *Placoneis* these props are covered by round or squarish flap-like coverings. The pore occlusions are each termed a tectulum (“little roof”) according to Cox (2004). Props can be distinguished in pores of pore fields in the genus *Cymbella* (Fig. 51). These data support the opinion of Mann (1981) and Cox (2004, 2012) that similar pore occlusions should characterize natural, monophyletic groups.

Discovery of two new species of *Geissleria* from Lake Baikal and Lake Frolikha, supports our idea that Transbaikalian lakes are hotspots for many endemic species (Kulikovskiy *et al.* 2012a, Gusev & Kulikovskiy 2013, Kulikovskiy & Kociolek 2014). Future investigations of diatom diversity from water bodies of this area using additional molecular techniques are important for clarifying phylogenetic position of some genera, not yet studied, and for revealing species diversity and biogeography of freshwater species.

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