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

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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 squatrish 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 Transbaikal 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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