



Taxonomy of three new *Rhoicosphenia* (Bacillariophyta) species from California, USA

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Abstract

Nearly two centuries of diatom floristic and ecological studies in North America have resulted in the recognition of relatively few *Rhoicosphenia* species. Three new species of *Rhoicosphenia* are described from water quality monitoring samples from streams across the state of California. *Rhoicosphenia stoermeri* is large, with a panduriform central area. *Rhoicosphenia lowei* is also large, but the valve is narrower than *R. stoermeri*, and its central area is smaller. *Rhoicosphenia californica* is narrow and linear and the most commonly encountered of the newly described species. Light and scanning electron microscope observations of these new species with comparisons to previously described taxa, coupled with ecological and distribution data from across the state, highlight the overlooked *Rhoicosphenia* diversity in North America. The ultimate goal of this work is to aid in refined taxonomic identifications within the genus with the possibility of increased resolution in ecological studies using diatoms.

Keywords: *Rhoicosphenia*, Bacillariophyta, diatom, endemic, streams, pseudocryptic, dichotomous key

Introduction

Rhoicosphenia Grunow (1860: 511) is a diatom genus that is commonly reported in freshwater ecosystems of the United States and is distributed across the country. *Rhoicosphenia* has been reported from the West (Sovereign 1958, Patrick & Reimer 1975, Leland *et al.* 2001, Bahls 2009), Southwest (Czarnecki & Blinn 1977, 1978, Czarnecki 1979), Mountain West (Benson & Rushforth 1975, Lawson & Rushforth 1975, Patrick & Reimer 1975, Clark & Rushforth 1977, Grimes & Rushforth 1982), Great Lakes (Wujek 1967, Stoermer *et al.* 1999), Northeast (Patrick & Reimer 1975, Reavie & Smol 1998, Potapova & Charles 2002), and Southeast (Hendricks *et al.* 2006, Johansen *et al.* 2007). However, out of the 27 species and approximately 30 intraspecific taxa currently described and listed in the *Catalogue of Diatom Names* (Fourtanier & Kociolek 2011), only two species, *Rhoicosphenia abbreviata* (C. Agardh 1831: 34) Lange-Bertalot (1980: 586) and its synonym *R. curvata* (Kützing 1833: 567) Grunow (1860: 511) account for the vast majority of records in the previously listed studies. These studies suggest that *Rhoicosphenia* diversity in the US is low and that the morphological diversity and ecological niche of the commonly reported *R. abbreviata* and *R. curvata* are broad.

In terms of other *Rhoicosphenia* taxa reported from the United States, five have been described as new; *Rhoicosphenia curvata* var. *gracilis* M. Schmidt in Schmidt *et al.* (1899: 213), *Rhoicosphenia curvata* f. *minor* M. Schmidt in Schmidt *et al.* (1899: 213), *Rhoicosphenia curvata* var. *subacuta* M. Schmidt in Schmidt *et al.* (1899: 213), *Rhoicosphenia patrickae* E.W. Thomas & Kociolek in Thomas *et al.* (2015: 49), and *Rhoicosphenia reimeri* E.W. Thomas & Kociolek in Thomas *et al.* (2015: 43). Most of these taxa are known only as fossils in the US. Only *R. curvata* var. *subacuta* has been reported in an extant sample and it only made up 0.00238% relative abundance of the sample in which it was found (Stoermer & Yang 1969). The ‘cosmopolitan’ species *Rhoicosphenia genuflexa* (Kützing 1844: 101) Medlin in Medlin & Fryxell (1984: 257) and *Rhoicosphenia marina* (Kützing 1844: 85) M. Schmidt in Schmidt *et al.* (1899: 213) are two marine species reported in coastal marine waters of the US.

Globally, *Rhoicosphenia* is commonly reported in freshwater (e.g. Lawson & Rushforth 1975, Rivera 1983, Foged 1984, Gil-Rodríguez *et al.* 2003, Hu & Wei 2006, Al-Handal & Wulff 2008, Harper *et al.* 2012), brackish (Levkov *et al.* 2010), and coastal marine ecosystems (Misra 1956, Giffen 1970, Medlin & Fryxell 1984) and can be found on

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