



Tetracyclus hinziae (Bacillariophyta), a new species from the central Cascade Mountains (WA, USA)

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Abstract

Here we describe a new freshwater diatom species from the Cascade Mountain Range in Washington State, including observations of living cells and chloroplast structure. The species represents the fourth known extant species within the genus, as most species of *Tetracyclus* Ralfs are extinct. The new species can be distinguished from other *Tetracyclus* species and *Diatoma mesodon* Kützing by its lanceolate-elliptical shape, apiculate ends, small size, rimoportula placement, and distinct septa pattern. The distribution of the new taxon is currently catchments within the Mt. Baker-Snoqualmie National Forest and Mount Rainier National Park, and is found in greatest abundance in aerophilous, moss and liverwort habitats in first- and second-order streams.

Key words: araphid, Cascade Mountain Range, Mt. Baker-Snoqualmie National Forest, *Tetracyclus*

Introduction

Over 40 valid species (not including valid intraspecific varieties) have been described within the freshwater genus *Tetracyclus* Ralfs (1843: 105) (Fourtanier & Kociolek, 2011), nearly all of them extinct. The genus has a distinct circum-Pacific biogeographic pattern of distribution (Williams 1996), both in fossil and extant forms. Its peak diversity appeared in the late Miocene (Williams 1989, Williams & Li 1990; Williams *et al.* 2002). Presently, *Tetracyclus glans* (Ehrenberg 1838: 135) Mills (1935: 1602), *T. emarginatus* (Ehrenberg 1845: 74) W. Smith (1856: 38), and *T. rupestris* (Braun in Rabenhorst 1853: 33) Grunow in Van Heurck (1881: 52) are the only known extant species (Williams 1987). Here, we describe a new extant species within *Tetracyclus* from western Washington.

The Mt. Baker-Snoqualmie National Forest encompasses more than 1 million hectares in the Cascade Mountain Range, spanning approximately 225 km between North Cascades National Park to the north and Mount Rainier National Park to the south. It contains nearly one-third of Washington State's remaining 789,000 hectares of old growth forest, more than 800 alpine lakes, and a rich network of cool, oligotrophic streams (Bolsinger & Waddell 1993). Despite the accessibility and pristine quality of the water resources of western Washington, little is known of the diatom flora. Between March 2013 and September 2014, algal samples were collected containing a species that does not conform to currently described species. In addition to the new description, we compare this new *Tetracyclus* species to *Diatoma mesodon* Kützing (1844: 47), a taxon that shares some of the same microhabitats and a high degree of morphological similarity.

Materials and methods

Epiphytic samples were collected at 5 sites in the Snoqualmie and Skykomish River Basins:

- Site 1. Mason Creek, a second order stream outlet from Mason Lake, upstream of Forest Service Road 9031, 47.423015° N, 121.580220° W, elevation 672 m a.s.l., 0.3 km SE of the Ira Spring trailhead.
- Site 2. South Fork Snoqualmie River, 0.2 km downstream of Twin Falls, 47.446311° N, 121.700504° W, elevation 260 m, just before first substantial river bend after the falls.
- Site 3. North Fork Miller River, where river abuts Miller River Rd NE approximately 1 km south of South Fork Skykomish River convergence, 47.710806° N, 121.397547° W, elevation 293 m a.s.l.

Ecology:—Many samples found to contain *T. hinziae* specimens were collections of communities living on the liverwort *Chiloscyphus polyanthus*. This dense, dark liverwort was found in cool, fast-moving streams which are highly oligotrophic and slightly acidic. This corresponds with the low pH, conductivity, and temperature habitat parameters it has been shown to prefer elsewhere (Furness & Grime 1982, Haury 1996). Other araphid taxa that were often present included *Tabellaria flocculosa* (Roth 1797: 192) Kützing (1844: 127), *D. mesodon*, *Meridion anceps* (Ehrenberg 1843: 415) D.M. Williams (1985: 182), and *Meridion circulare* var. *constrictum* (Ralfs 1843: 458) Brun (1880: 128). Although not abundant, *T. glans* (Ehrenberg) Mills also co-occurred in South Fork Snoqualmie River samples.

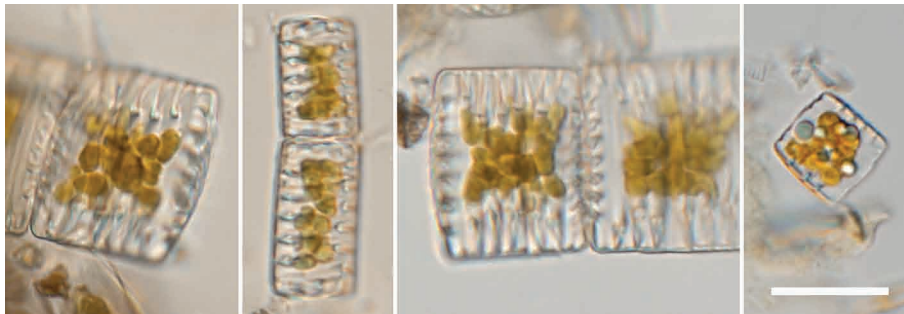


FIGURE 40. Light micrograph images of live *Tetracyclus hinziae*. Material from Site 5 (INSTAAR 15106). All valves in girdle view showing multiple discoid chloroplasts and numerous septa per cell. Scale bar = 20 μ m.

TABLE 1. Material from the H.E. Sovereign Collection, California Academy of Sciences (CAS), San Francisco examined for presence of *Tetracyclus*. Samples were selected for further observation based on reported *D. mesodon*. All samples are from Washington State. Site name, details of location, year collected, CAS accession number and occurrence are included.

Site Name	Location Information	Year	CAS Accession	Occurrence
Christine Falls	Mt. Rainier NP, 3667 ft elevation	1936	184037	Present
Davis Lake	T32N, R44E 1/2 Sec 31, NE shore, littoral zone	1939	186065	Not observed
Davis Lake	T32N, R44E 1/2 Sec 31, NE shore, littoral zone	1939	186067	Not observed
Obstruction Point	T28N, R5W, Lake #2, 6300 ft elevation	1936	184007	Not observed
Ozette Lake	T30N, R15W, Sec 31, sediment	1941	183021	Not observed
Ozette Lake	T30N, R15W, Sec 31, sediment	1941	183038	Not observed
W. of Sunrise Creek	1 mile NW of Sunrise Y, Mt. Rainier NP	1938	185044	Not observed
Wolf Creek	T29N, R7W, Olympic NP, Elwa Forest, 4000 ft elevation	1936	184020	Not observed

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