

Fabronia ciliaris, a Moss New to Canada from Southeastern Manitoba

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Fabronia ciliaris (Fabroniaceae, Bryophyta) was recently discovered in the Great Lakes–St. Lawrence forest region in southeastern Manitoba. This collection represents the first record of the species in Canada and the northernmost extent of the species in North America.

Key Words: Bryophyta; distribution; *Fabronia ciliaris*; *Fabronia pusilla*; Fabroniaceae; Great Lakes; Manitoba; moss; phyto-geography; St. Lawrence; Whiteshell Provincial Park

Introduction

In North America, the moss family Fabroniaceae contains a single genus, *Fabronia* Raddi (Fabroniaceae, Bryophyta), that is represented (McIntosh 2014) by only two species: *F. ciliaris* (Bridel) Bridel (Fabronia Moss) and *F. pusilla* Raddi (Silver Hair Moss). Several previously recognized taxa are now considered to be synonymous with *F. ciliaris*, including *F. ciliaris* var. *polycarpa* (Hooker) W. R. Buck, *F. ciliaris* var. *wrightii* (Sullivant) W. R. Buck, *F. ravenelii* Sullivant, and *F. wrightii* Sullivant (McIntosh 2014; for additional synonyms see Tropicos.org 2017).

The genus *Fabronia* in North America comprises diminutive, sparsely branched, perennial plants that often form thin and silky whitish-green mats (Buck 1994; McIntosh 2014). Leaves are tiny (0.4–0.9 mm long), mostly ovate-lanceolate, loosely appressed when dry, and terminate in linear apical cells. Leaves also have single, short costae that extend to about half the leaf length, rhomboidal laminal cells, and quadrate to short-rectangular basal cells. Plants are autoicous, with female and male reproductive structures on the same shoots. Plants regularly contain sporophytes, with erect, ovoid to pyriform capsules that have sinuose cells in their outer walls (exothecia). *Fabronia ciliaris* is distinguished from *F. pusilla* in having acute or acuminate leaf apices and low-dentate (sometimes entire) leaf margins with teeth of one cell each. *Fabronia pusilla* has acute to long-acuminate leaf apices and ciliate-dentate leaf margins with teeth often composed of more than one cell.

Fabronia ciliaris is known in North America from the United States and Mexico (Figure 1). In the United States, the species has a wide distribution, occurring mainly from the northeast to the southwest (Arizona, Arkansas, California, Colorado, Georgia, Indiana, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Missouri, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wisconsin) based on McIntosh (2014). Worldwide,

the species is also known from the West Indies, Central America (Guatemala), South America, Europe, eastern Asia (Japan), Pacific Islands (Hawaii, New Zealand), and Australia (McIntosh 2014). *Fabronia ciliaris* has not been reported previously for Canada. The species was not included for Canada in the Bryophyte Flora of North America (McIntosh 2014) or in the 2015 list of the General Status of Species in Canada (CESCC 2016). There are no known Canadian specimens in the digitally accessible Consortium of North American Bryophyte Herbaria (CNABH 2017) or BRYOQUEL (Faubert *et al.* 2017) databases, and, based on personal communications, there are no known Canadian specimens at multiple Canadian herbaria (ALTA, CAFB, CANM, MMMN, PMAE, UADBG, UBC, WIN; refer to Thiers 2017 for standardized, stable herbarium abbreviations) or United States herbaria with substantial Canadian bryophyte collections (F, FH, MO, NY, US). Also, Grout (1928–1940) and Crum and Anderson (1981) do not list the species for any Canadian jurisdiction.

A specimen from the University of British Columbia herbarium (UBC B56875), collected by W. B. Schofield (59600) on 27 March 1976, from “Sumas Mountain escarpment near Chilliwack”, was labelled *F. ciliaris*, but was subsequently annotated to *F. pusilla* by T. T. McIntosh in January 2008. A collection from the Pacific Northwest Herbarium at Western Washington University (WWB B-2535) by J. S. Martin (4985) on 23 July 1975, from Algoma District in northeastern Ontario, found growing on granitic rock, near Brownlee Lake, about 9.5 km east of Thessalon, was labelled “*Fabronia ciliaris* (?) (Brid.) Brid.”. However, on examination by the author, the specimen was determined to be *Hypnum pallescens* (Hedwig) P. Beauvois. *Fabronia ciliaris* is not included in the list of bryophytes for Ontario and is not ranked or tracked by the Ontario Natural Heritage Information Centre (David Bradley, personal communication, 13 January 2017).

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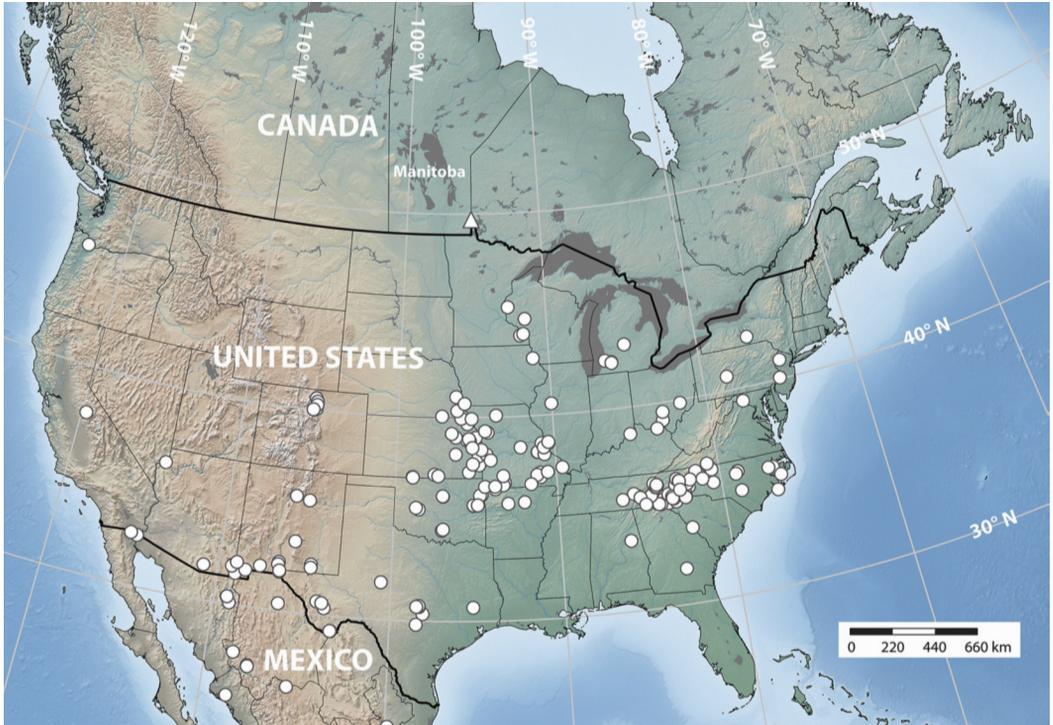


FIGURE 1. Distribution of *Fabronia ciliaris* in North America based on search results from the Consortium of North American Bryophyte Herbaria (CNABH 2017) database. Map generated and modified from SimpleMapp (Shorthouse 2010). The triangle depicts the new collection from Whiteshell Provincial Park in southeastern Manitoba, the first record for Canada. Specimens associated with data points have not been verified by the author and represent the approximate distribution for the species only.

Methods

Surveys to document bryophyte diversity in southeastern Manitoba were conducted in late September 2016. One survey was held on 27 September 2016 at Hunt Lake in Whiteshell Provincial Park, Manitoba (49°44'N, 95°10'W; 343 m elevation) under Manitoba Sustainable Development, Parks and Protected Spaces permit no. PP-PHQ-16-026. The park is situated in the Great Lakes–St. Lawrence forest region (Rainy River section) of Canada, which extends across southern and eastern Canada, from the St. Lawrence River in Quebec to its western limits in southeastern Manitoba (Rowe 1972). Climate in the vicinity of the study site has an annual daily average temperature of 2.5°C and total annual precipitation of 630.8 mm, with 506.8 mm falling as rain (data from Indian Bay meteorological station, Manitoba; 49°37'N, 95°12'W; 327 m elevation; Environment and Climate Change Canada 2017).

Results

The survey at Whiteshell Provincial Park revealed the moss *Fabronia ciliaris* (Figure 1). The species was

growing on a forested, calcareous rock outcrop close to the lake shore (Figure 2). The tree canopy was dominated by Eastern White-cedar (*Thuja occidentalis* L.), Balsam Fir (*Abies balsamea* (L.) Miller), and Paper Birch (*Betula papyrifera* Marshall). The cliff face supported numerous microhabitats that ranged from xeric on exposed vertical rock faces to mesic in sheltered rock crevices. *Fabronia ciliaris* was growing on a dry, vertical rock face among shoots of *Orthotrichum anomalum* Hedwig, as several scattered gametophytes containing sporophytes, over an area of several square centimetres. A collection of the species was made from this area to confirm its identity. Extended searches for the species in the vicinity were not conducted. Although the cliff face had a northwest aspect overall, the specimen was collected on a segment of the cliff that was south facing. Morphological characteristics of the specimen were typical of other collections from the northern United States (Figures 3–5; see Specimens Examined). The collection (*R. T. Caners* 7994) has been deposited at the Royal Alberta Museum herbarium (PMAE accession no. C16.3.1).



FIGURE 2. Rock outcrop in Whiteshell Provincial Park, Manitoba, where *Fabronia ciliaris* was collected. Photo: Richard Caners, 27 September 2016.

Discussion

The Great Lakes–St. Lawrence forest region in southeastern Manitoba hosts a distinctive bryophyte flora and supports a number of bryophyte species that are almost certainly restricted to this portion of the province (personal observation). The discovery of *Fabronia ciliaris* within this forest region in southeastern Manitoba represents the first record of the species in Canada and the northernmost occurrence in North America. The closest known occurrence of *F. ciliaris* is Taylors Falls, Minnesota (see Specimens Examined), more than 500 km to the southeast, where the species was first collected by J. M. Holzinger in 1895 (MO 90065179; CNABH 2017) and has been collected multiple times over the past century. In Manitoba, the species was growing on calcareous rock, a substrate type that has been reported for the species in other parts of its range in the United States (CNABH 2017; see Specimens Examined). Calcareous rock outcrops occur in the Thunder Bay region and along the north shore of Lake Superior, and these areas are closer to Taylors Falls, Minnesota, than to the Manitoba site. However, the species is also reported frequently on the bark of trees and other rock types, including granite (e.g., see



FIGURE 3. Several shoots of *Fabronia ciliaris* growing among *Orthotrichum anomalum*. The length of the scale bar represents 1.0 mm. Photo: Richard Caners.

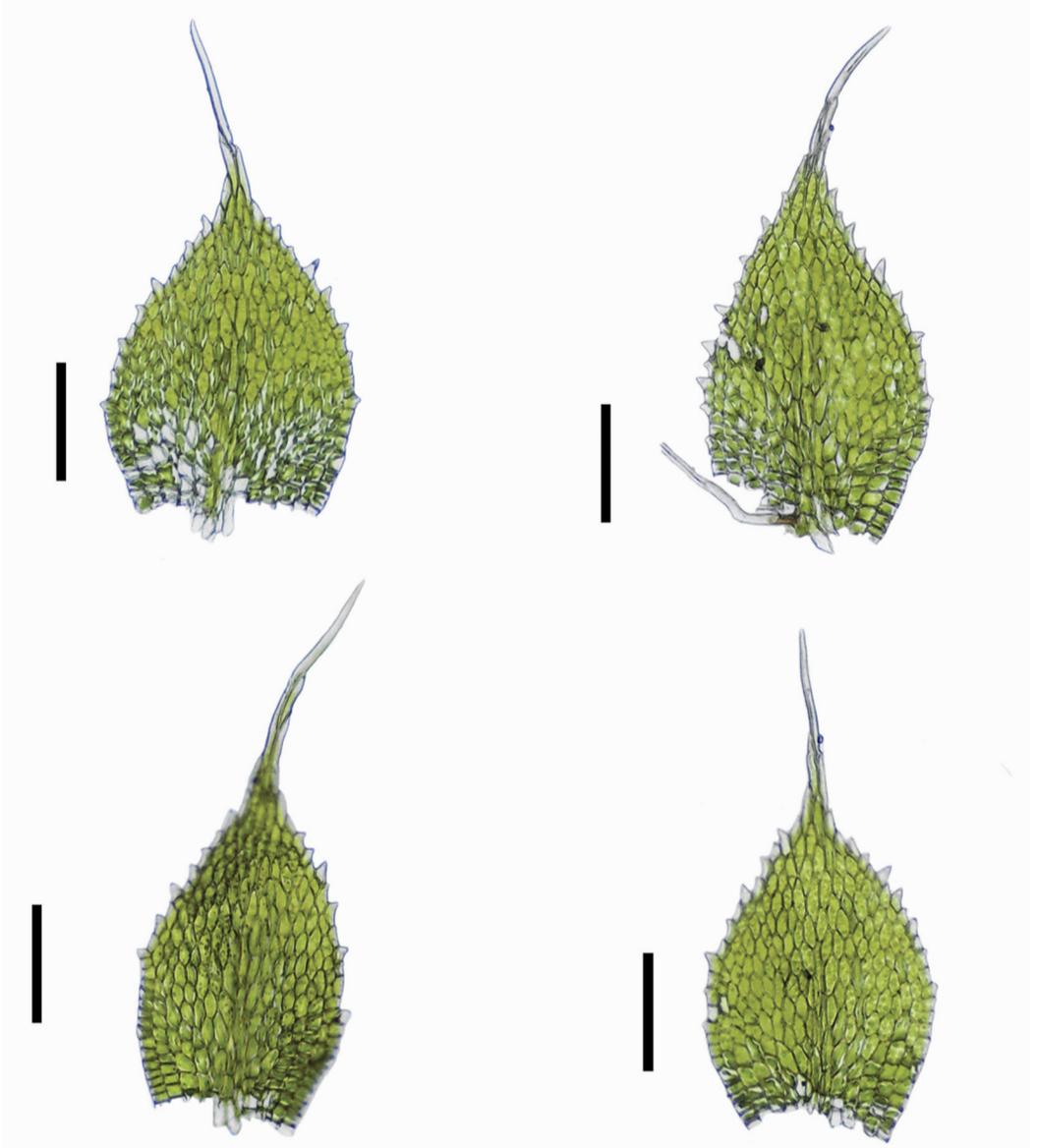


FIGURE 4. Representative stem leaves of *Fabronia ciliaris* collected in southeastern Manitoba. The length of the scale bar next to each leaf represents 0.1 mm. Photos: Richard Caners.

Specimens Examined for Taylors Falls, Minnesota), substrates that are widespread throughout the Great Lakes–St. Lawrence forest region in Canada.

Fabronia ciliaris appears to become less frequent at the most northerly latitudes in the eastern United States. This may be because of increasingly harsh growing conditions or, perhaps, because of slow expansion of the species into northern regions following the retreat of the Laurentide Ice Sheet at the end of the Wisconsin glaciation. Indeed, there are few records of the species

to the north of the maximum extent of glacial ice. Rapid retreat of ice began after about 14 000 ^{14}C years ago (Mickelson and Colgan 2003) and was markedly faster in the area to the west of the Great Lakes compared with areas further east (Dyke 2004, 2005). This could have provided more time for the species to expand into southeastern Manitoba from Minnesota and Wisconsin. *Fabronia ciliaris* is autoicous and produces sporophytes frequently (McIntosh 2014), suggesting that it may be able to disperse over long distances by its small spores

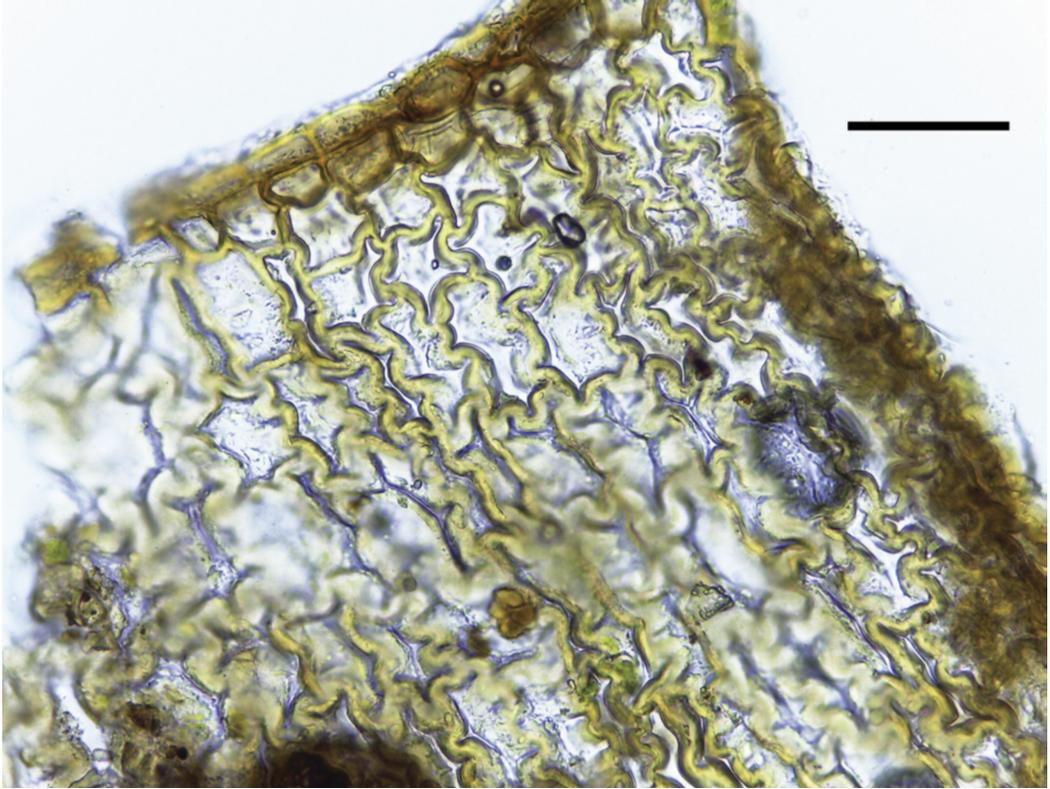


FIGURE 5. Exothecial cells from a sporophyte capsule of *Fabronia ciliaris* collected in southeastern Manitoba. The length of the scale bar represents 0.1 mm. Photo: Richard Caners.

(9–15 μm ; Lawton 1971). The lack of records in Canada to date suggests that the Great Lakes could possibly represent a barrier to expansion into northern regions. There have been relatively more collectors in southern Ontario than in many other parts of the country (personal observation), providing opportunity for *F. ciliaris* to have been reported from this area in the past. However, there still remain large areas of under-surveyed habitat within the Great Lakes–St. Lawrence forest region, especially to the west of Lake Superior and the northernmost part of the forest region, suggesting there may be other undiscovered colonies in the region.

The only other species of *Fabronia* in North America is *F. pusilla*. This species occurs mostly in the west, where it is known in the United States from Arizona, California, Colorado, Idaho, Oregon, and Washington State, and in Mexico from Baja California Sur (McIntosh 2014). In Canada, *F. pusilla* is known from a single site on sandstone in south-central British Columbia, where it reaches the northern extent of its range in North America (COSEWIC 2002, 2012; British Columbia Recovery Team 2007) and is listed as endangered under the federal *Species at Risk Act* (SARA Registry 2017). *Fabronia ciliaris* may similarly reach

its presumed northernmost extent in southeastern Manitoba, but surveys are needed to assess its distribution in Canada. *Fabronia ciliaris* risks being overlooked because of its small size; however, the survey that first detected this species in Canada was not a targeted survey.

***Fabronia ciliaris* Specimens Examined**

UNITED STATES: KANSAS. Cherokee County: 5 miles (8 km) east of Baxter Springs, on trunk of bur oak, oak-hickory ravine, 29 July 1969, *R. R. Ireland* 22595 (ALTA 044458). MINNESOTA. Chicago County: Taylors Falls, St. Croix River, on granite rock, 24 August 1966, *D. H. Vitt* 409 (ALTA 044441). MISSOURI. Barry County: cedar glade just south of Roaring River State Park on Hwy. F, beneath limestone ledge, 23 May 1973, *P. L. Redfearn, Jr.* 28483 (ALTA 044442); Greene County: wooded east-facing slope above James River just below Lake Springfield Dam, alt. ca. 1300 feet (400 m), common on trunks of red cedar, 1 November 1985, *P. L. Redfearn, Jr. & A. Rushing* 33569 (ALTA 044456); Pike County: Louisiana, Stark Brothers Nursery retain building, on large tree trunk in commercial nursery area, 30 May 1994, *D. H. Vitt s.n.* (ALTA 044451); Vernon County: 3 miles

(4.8 km) west of El Dorado Springs, north along county line road, on trunk of dead deciduous tree, 26 August 1966, *R. R. Ireland 9815* (PMAE C95.1.19021). NEBRASKA. Jefferson County: 5 miles (8 km) south of Fairbury on Hwy 15 and 1/4 mile (0.4 km) east, 1/2W, Sec.14, T1N, R2E, upland tributary, moss on trunk of *Ulmus*, 0–2.5 feet (0–0.8 m) on NE-side, 1 October 1975, *S. P. Churchill 6845* (PMAE C95.1.19025). OKLAHOMA. Payne County: Stillwater, southeast of OSU campus, 8 feet (2.4 m) high on bark of elm tree, 16 January 1959, *C. D. Bird 2920* (PMAE C95.1.19020).

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