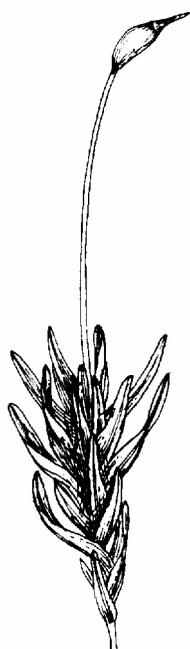


COSEWIC
Assessment and Status Report

on the

Incurved Grizzled Moss
Ptychomitrium incurvum

in Canada



EXTIRPATED
2002

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA



COSEPAC
COMITÉ SUR LA SITUATION DES
ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Cover illustration:
Incurved grizzled moss: Reproduced, with permission, from Crum & Anderson (1981).

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COSEWIC Assessment Summary

Assessment Summary – November 2002

Common name

Incurved grizzled moss

Scientific name

Ptychomitrium incurvum

Status

Extirpated

Reason for designation

A small moss that is widely distributed in the eastern deciduous forests of eastern North America, and whose frequency of occurrence alternates toward the northern portion of its range. In Canada, the only known location for the species is a single record from a boulder in southern Ontario in 1828. Despite many years of collection made in the region, the species has never been rediscovered.

Occurrence

Ontario

Status history

Designated Extirpated in November 2002. Assessment based on a new status report.



COSEWIC
Executive Summary

Incurved Grizzled Moss
Ptychomitrium incurvum

Species information

Ptychomitrium incurvum (Schwägr.) Spruce, a small (2-6 mm high) moss species, grows in yellow-brown to blackish-green tufts on rocky substrates. It was originally described by C.F. Schwägrichen in 1823 as *Weissia incurva*, and belongs to the moss (division Bryophyta, subdivision Musci) class Bryopsida, order Grimmiiales, and family Ptychomitriaceae. Although there appears to be no recent controversy surrounding the taxonomic status of this species, the only known Canadian specimen is an isotype of *Grimmia hookeri* Drumm., which is presently considered a synonym of *P. incurvum*.

Distribution

Ptychomitrium incurvum is temperate in global distribution, with populations both east and west of the Atlantic Ocean. It is relatively widespread in eastern North America but its distribution is concentrated in the southern United States. In the northeastern United States, it is known from relatively few, historical locations, but more research is required before the existence of a declining trend in the states bordering Canada can be confirmed or rejected.

A single historical record (1828) of this species constitutes the only known Canadian collection of this species. The herbarium label for this collection bears no more detail than “On a rock, near the Falls of Niagara, Ontario”. The precise location is uncertain and no extant populations are known. Given the fact that almost 200 years have passed without the species being re-discovered despite active collection in the region, doubt exists as to whether or not *Ptychomitrium incurvum* is currently part of the Canadian flora.

Habitat

Ptychomitrium incurvum is commonly found in hardwood forests, inhabiting surfaces or tiny crevices of exposed or protected rocks of variable chemistry (calcareous or non-calcareous). It occurs rarely at the bases of trees or on logs. Although human disturbance, particularly forest destruction and fragmentation, is known to have affected many eastern deciduous forest plant species in southern Ontario, it is not likely that it accounts for the absence of *P. incurvum* there. The fact that

P. incurvum can inhabit a variety of anthropogenic and natural rock substrates suggests that substrate availability does not limit its distribution; its southerly distribution may indicate, rather, a climatic limitation.

Biology

Little is known, specifically, of the biology of *Ptychomitrium incurvum*. Like most mosses, it is dispersed as spores, although it is occasionally known to produce gemmae (asexual propagules). *P. incurvum* is autoicous (and therefore can presumably self-fertilize), and spore production is very common. The only known Canadian specimen bears abundant sporophytes. Establishment may present particular challenges to mosses like *P. incurvum*: the rocky habitats preferred by *P. incurvum* are hostile in that they do not retain moisture well and in that they often offer little protection from the elements.

Cushion-forming mosses like *Ptychomitrium incurvum* are less adapted to vegetative proliferation than the more branched, spreading mat-forming species. Species such as *P. incurvum*, which occur in rock crevices, also have limited space in which to expand before dispersal over longer distances becomes necessary. This preference for discrete habitats necessitates dispersal through unfavourable habitats, which cannot be accomplished through vegetative expansion of colonies.

Population sizes and trends

As no extant populations of *Ptychomitrium incurvum* are known, and as the historical collector of the species did not make note of the species' abundance on the herbarium label, population sizes and trends cannot be assessed.

Limiting factors and threats

As noted above, climate appears to limit *Ptychomitrium incurvum*'s northern extent in eastern North America. Human activity (pollution, habitat destruction) may also contribute to the species absence from southern Ontario. Since no living Canadian populations are known, threats cannot be assessed.

Special significance of the species

The Ontario occurrence of *Ptychomitrium incurvum* is significant in that it represents the only Canadian population of the species and in that it helps to delineate the northernmost occurrence of the species in North America. *P. incurvum* ranks among a large suite of Carolinian plants that are endangered in Canada.



COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

- * Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.
- ** Formerly described as “Not In Any Category”, or “No Designation Required.”
- *** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list.



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COSEWIC Status Report

on the

Incurved Grizzled Moss

Ptychomitrium incurvum

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2002

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SPECIES INFORMATION

Name and classification

Ptychomitrium incurvum (Schwägr.) Spruce was originally described in 1823 as *Weissia incurva*. The name *Ptychomitrium incurvum* was applied in 1849 (Spruce 1849). Several other nomenclatural combinations exist for *W. incurva* (e.g. *Brachysteleum hampeanum* Müll. Hal., *Brachysteleum incurvum* (Schwägr.) Müll. Hal., *Glyphomitrium incurvum* (Schwägr.) Broth., *Grimmia muehlenbergii* Brid., *Grimmia parvula* Arn.). The same species has also been described as *Grimmia hookeri* Drumm., the type specimen of which constitutes the only Canadian specimen. There appears to be no recent controversy surrounding the taxonomic status of *P. incurvum*.

Ptychomitrium incurvum belongs to the moss (division Bryophyta, subdivision Musci) class Bryopsida, order Grimmiales, and family Ptychomitriaceae (e.g. Anderson et al. 1990).

Description

Good descriptions of *Ptychomitrium incurvum* are given by Crum and Anderson (1981) and Reese (1999). Illustrations from Crum and Anderson (1981) are reproduced in Figure 1. Definitions for technical terms used in the description below can be found in Crum and Anderson (1981) or in Magill (1990).

General: *Ptychomitrium incurvum* is an inconspicuous, small (2-6 mm high), acrocarpous moss that grows in blackish-green tufts on rocky substrates.

Leaves: Leaves of *P. incurvum* are crisped (curled) when dry, and erect-spreading and somewhat incurved (hence the name (Crum and Anderson 1981)) when moist. They measure about 2 mm in length. The leaves are narrow, concave, and rounded at the hood-shaped apex. Leaf margins are untoothed and erect, and the costa (midrib) runs almost to the tip of the leaf.

Leaf cells: The quadrate (square-ish) leaf cells, with firm walls, are two layers thick in the upper half of the leaf. At the leaf base, the cells become short-rectangular, with thinner walls.

Gemmae: Reese (1999) reports that *P. incurvum* rarely produces short, uniseriate or branched gemmae, several cells long, on branched axillary filaments.

Seta: The seta is 2-4 mm long, bearing capsules 0.8-1 mm long.

Capsules: Capsules are ovoid or oblong-cylindric and smooth or somewhat wrinkled when dry and empty. The peristome is made up of 16 unpaired, sharply-papillose, narrow, erect or spreading teeth, which are fused at their bases.

Ptychomitrium incurvum is small and inconspicuous enough that it is likely to be over-looked or neglected in the field, especially since the plants resemble members of the notoriously difficult family Pottiaceae. To anyone looking specifically for this species, however, it is easily distinguishable in the field. Reese (1999) writes “these dark-green little plants growing on rock, with their glossy leaves tightly crispate when dry, are unmistakable”.

Crum and Anderson (1981) distinguish *Ptychomitrium incurvum* from *P. leibergii*, with which it is most likely to be confused, by the longer, broader leaves, larger leaf cells, longer setae and capsules, and streakily bistratose leaves of the latter. Reese (1999) warns that sterile colonies of *P. incurvum* can be very reminiscent of *Weissia controversa*, but adds that unlike *W. controversa*, *P. incurvum* is more glossy, its leaves have smooth cells, and its leaf margins are not strongly involute.

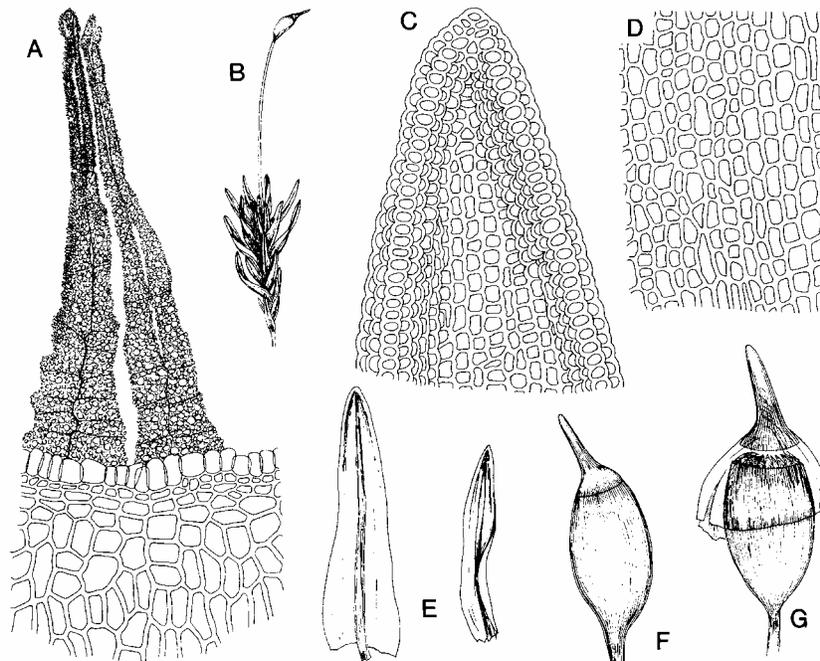


Figure 1. Illustration of *Ptychomitrium incurvum*, reproduced (with permission of Columbia University Press) from Crum & Anderson (1981). – A. portion of peristome. – B. habit. – C. cells at leaf tip. – D. cells near leaf base. – E. leaf outlines. – F. capsule. – G. capsule with calyptra.

DISTRIBUTION

Global range

Ptychomitrium incurvum has a temperate global distribution, with populations centred largely in eastern North America (Crum & Anderson 1981, Missouri Botanical Garden 2001) but also in some mountainous regions of Europe (Pyrenees, Alps,

status list for rare New York mosses (Clemants & Ketchledge 1993) indicates that it is known only historically in that state. Norton Miller (personal communication) advises caution in interpreting this pattern, as he knows of no botanist who has looked for the species recently in New York. In neighbouring northeast states, very few recent collections are reported at the New York Botanical Garden (NY), the Missouri Botanical Garden (MO), or the University of Alberta (ALTA) (Figure 2).

Canadian range

Only one Canadian occurrence of *Ptychomitrium incurvum*, very near the United States border, has ever been documented. The record is based on a specimen (No. 61) from Drummond's 1828 exsiccata, Musci Americani (Specimens of the Mosses Collected in British North America). According to the herbarium label of the specimen housed at the Canadian Museum of Nature, it was found "on a stone near the Falls of Niagara in Upper Canada". Macoun and Kindberg (1892) revised the locality to 'Ontario', as the province as such did not exist when Drummond's collection was made.

Some uncertainty exists as to the location from which Drummond collected *Ptychomitrium incurvum*. The general nature of his description would have made relocating the population difficult, even soon after the collection was made, and the location information on many specimens in Drummond's 1828 exsiccata have been found to be inaccurate (Crum 1969). The conditions associated with travel and botanical collection in the early 1800s beg the question: was the Canada-United States border strictly observed on specimen labels as Drummond passed through the region on his way from New York (Pringle 1995) to the Canadian west? However, the existence of several New York specimens by other collectors shows that *P. incurvum* once grew in the vicinity (see discussion under 'Global range' and Figure 2). A historical Niagara Falls locality is phytogeographically plausible given the proximity of historical sites for the species in New York (1960), Ohio (1936), Pennsylvania (1938), Vermont, and Michigan.

The exact collection locality aside, it is clear that *Ptychomitrium incurvum* has not been observed in the region for some time. Southern Ontario is densely populated and relatively well explored, and it seems that if *P. incurvum* is still present there, it is unlikely that no collector since Drummond has encountered it. In connection with the current report, the author also examined a variety of rock microhabitats around Niagara Falls proper and in the Niagara Glen for one day in 2001 without encountering *P. incurvum*. More time devoted to a more concerted search effort may yet reveal populations of *P. incurvum* in southern Ontario. For now, however, the passage of almost two hundred years without the re-discovery of the species suggests that it is likely to have been extirpated.

HABITAT

Habitat requirements

Ptychomitrium incurvum is an eastern deciduous (Carolinian) forest species that grows on rocks of variable chemistry (calcareous or non-calcareous). It is commonly found on surfaces and in tiny crevices of exposed or protected boulders in open hardwood forests, and, rarely, at the bases of trees or on logs (Crum and Anderson 1981, Reese 1999). *P. incurvum* is commonly observed on anthropogenic habitats such as rock walls and gravestones (New York Botanical Garden 2001, Norton Miller personal communication).

Trends

Without extant populations or a clear understanding of the habitat from which the only Canadian specimen was collected, it is not possible to assess habitat trends specific to the Canadian population. As *Ptychomitrium incurvum* inhabits several substrate types of variable chemistry that are abundant in southern Ontario, and as it appears to be adaptable to anthropogenic substrates, it seems unlikely that substrate availability limits its distribution. The species' range, centred as it is in southeast North America, may indicate, instead, climatic limitation. Climate change, therefore, has the potential to affect the range limits of this species in the future.

Human activity is often cited as a threat to rare Carolinian plant species in Canada (e.g. Argus & Pryer 1990, Klinkenberg et al. 1990, Lamb & Rhynard 1994, Maycock 1963). In particular, acid precipitation and deforestation in southern Ontario (and in the northeastern United States) have considerable potential to affect the distribution and abundance of *Ptychomitrium incurvum* there. However, human impacts are felt throughout the eastern deciduous forest (e.g. Delcourt & Delcourt 2000), and *P. incurvum* remains common in the south-eastern United States (Herbarium records at CANM, MO, NY, NYS; Nancy Slack, Norton Miller, personal communication).

Protection/ownership

Protection and ownership information is unavailable in the absence of extant Canadian populations of *Ptychomitrium incurvum*.

BIOLOGY

Very little has been published on the specific biological characteristics of *Ptychomitrium incurvum*. The information presented below is characteristic of other moss species with some of the features observed in *P. incurvum*.

General

The moss life cycle has four main stages, each of which is characterized by different ecological requirements:

- Dispersal:** Mosses such as *Ptychomitrium incurvum* are dispersed as spores, which sift into the air through specialized teeth surrounding a hole, or peristome, at the end of the capsule. Upon contact with a favourable substrate in a suitable microhabitat, spores germinate to produce protonemata.
- Establishment:** At the protonemal stage, mosses are very sensitive to desiccation, and require high humidity. Leafy plants called gametophores grow from the protonemata. These plants generally possess features that allow them to withstand the challenges characteristic of their habitat. Rocky habitats are especially hostile in that they do not retain moisture well and they often offer little protection from the elements. Passing from the protonemal to the leafy stage while moist, undisturbed conditions persist is very important to the establishment of saxicolous (rock-dwelling) mosses (Schofield 1985).
- Growth:** Moss gametophytes proliferate vegetatively as colonies. Acrocarpous mosses (usually forming cushions and turfs) are less adapted to vegetative proliferation than the more branched, spreading pleurocarps (generally forming mats). Species such as *P. incurvum*, which occur in rock crevices, also have limited space in which to expand before dispersal over longer distances becomes necessary.
- Reproduction:** Gametophytes produce non-motile eggs and flagellate sperm, and free water is required for the two to unite. A fertilized egg, still enclosed within the gametophyte, grows into a sporophyte consisting of a spore-filled capsule at the end of a stalk, or 'seta'.

Reproduction

Ptychomitrium incurvum is autoicous, meaning that the sperm-producing antheridia and egg-producing archegonia occur together on each plant. This presumably makes it possible for the species to self-fertilize, eliminating the need for male and female plants to grow in close proximity. The Canadian collection of *P. incurvum* has abundant sporophytes, and according to Reese (1999), sporophytes are very common in *P. incurvum*. Given that the species is quite common further south, it seems unlikely that reproductive features limit the species' range to a greater degree than climatic factors.

Movements/dispersal

Ptychomitrium incurvum is probably largely spore-dispersed, as asexual propagules are rare (Reese 1999). Its preference for discrete habitats (rocks and trees) necessitates dispersal through unfavourable habitats, which cannot be accomplished through vegetative expansion of colonies.

Nutrition and interspecific interactions

Because *Ptychomitrium incurvum* has no apparent preference with respect to substrate chemistry, it seems unlikely that nutrition limits its distribution.

Behaviour/adaptability

Ptychomitrium incurvum is quite small (2 – 6 mm high), allowing it to exploit tiny niches on dry rocks that are unavailable to most other species. These adaptations make it inconspicuous, and thus likely to be overlooked by casual or inexperienced collectors.

Ptychomitrium incurvum appears to display considerable adaptability compared with many bryophyte species. While many mosses are known for their substrate specificity, *P. incurvum* displays considerable flexibility with respect to the substrates it occupies. It also possesses two means (sexual and asexual) of reproduction and dispersal.

POPULATION SIZES AND TRENDS

No extant Canadian population of *Ptychomitrium incurvum* is known, and none has been documented since 1828.

LIMITING FACTORS AND THREATS

Canadian populations of *Ptychomitrium incurvum* would fall near the northernmost range limit of the species in North America. It seems likely that its presence and abundance here is limited by climatic factors, although the apparent withdrawal of the species from New York State may also suggest an (unexplained) shift in the species' northern range limit over the last 100-150 years.

SPECIAL SIGNIFICANCE OF THE SPECIES

The Niagara Falls location for *Ptychomitrium incurvum* marks part of the northern range limit for the species in North America.

EVALUATION AND PROPOSED STATUS

Existing protection or other status

Ptychomitrium incurvum is currently ranked G4 (April 1991), meaning that the global population is apparently secure, and S1 (March 2000), indicating that five or fewer occurrences are known in Ontario, by the Ontario Natural Heritage Information Centre (ONHIC 2001). In the State of New York, the species is ranked SH, meaning that it is known from historical records and although it may be re-discovered, no extant sites are known in the state (Clemants & Ketchledge 1993). Most eastern U.S. conservation data centres appear not to have published tracking lists for non-vascular plants.

Assessment of status and author's recommendation

Based on the absence of recorded populations since the species was last collected in Canada 177 years ago, the author recommends "Extirpated" (XT) status: it no longer exists in the wild in Canada, but occurs elsewhere.

TECHNICAL SUMMARY

Ptychomitrium incurvum

Common English names: Incurved grizzled moss, Incurved shrunken leaf moss

Common French name: Ptychomitre à feuilles incurvées

Known from one 1828 collection “on a rock near the Falls of Niagara in Upper Canada”

Extent and Area information	
• extent of occurrence (EO)(km ²)	Unknown
• specify trend (decline, stable, increasing, unknown)	
• are there extreme fluctuations in EO (> 1 order of magnitude)?	
• area of occupancy (AO) (km ²)	Unknown
• specify trend (decline, stable, increasing, unknown)	
• are there extreme fluctuations in AO (> 1 order magnitude)?	
• number of extant locations	None known
• specify trend in # locations (decline, stable, increasing, unknown)	
• are there extreme fluctuations in # locations (>1 order of magnitude)?	
• habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat	Unknown
Population information	
• generation time (average age of parents in the population) (indicate years, months, days, etc.)	Unknown
• number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)	None known
• total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals	Unknown
• if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)	
• are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?	
• is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?	Unknown
• list each population and the number of mature individuals in each	
• specify trend in number of populations (decline, stable, increasing, unknown)	
• are there extreme fluctuations in number of populations (>1 order of magnitude)?	
Threats (actual or imminent threats to populations or habitats)	
- Threats to <i>P. incurvum</i> are unknown; it may be climatically limited	
Rescue effect (immigration from an outside source)	
• does species exist elsewhere (in Canada or outside)?	Yes
• status of the outside population(s)?	Apparently secure
• is immigration known or possible?	Yes, possible
• would immigrants be adapted to survive here?	Unknown
• is there sufficient habitat for immigrants here?	Yes
Quantitative analysis	None possible

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BIOGRAPHICAL SUMMARY OF CONTRACTOR

Jennifer C. Doubt completed a B.Sc. in Botany at the University of Guelph in 1995. In 2001, she received an M.Sc. in Bryophyte Ecology at the University of Alberta for work on bryophyte diversity in Waterton Lakes National Park, Alberta. As a botanical consultant based in Edmonton, Alberta, she specializes in bryophyte identifications, inventories, and rare species surveys and assessments. An acknowledged expert on Alberta bryophytes, she is known locally as an instructor of bryophyte identification skills and as a contributor to provincial rare species tracking efforts. Having collected and identified over 8000 of her own bryophyte specimens, she has accumulated considerable field experience throughout Alberta, as well as in Saskatchewan, Ontario, the Northwest Territories, and the State of Washington.

AUTHORITIES CONSULTED

- Frank Cook (df.cook@rogers.com), an Ontario bryologist, who along with Bill Stewart has collected and/ or examined thousands of southern Ontario bryophyte specimens.
- Jan-Peter Frahm (frahm@uni-bonn.de), a European bryologist whose collecting experience also extends to the United States.
- Robert Ireland (robertireland@hotmail.com) and Wilf Schofield (wilfs@unixg.ubc.ca), two experienced bryologists who have collected extensively in Canada.
- Linda Ley (lindaley@storm.com) and Mike Schepanek (mshchepane@mus-nature.ca), who work with specimens housed at the Canadian Museum of Nature.
- Norton Miller (nmiller2@MAIL.NYSED.GOV), an active American bryologist, and curator of the NYS herbarium.
- Michael Oldham (Michael.Oldham@mnr.gov.on.ca), who provided Ontario Natural Heritage Information Centre records on *Ptychomitrium incurvum*.

Nancy Slack (slackn@sage.edu), an active American bryologist.
R.H. Zander (rhzander@sciencebuff.org) and P.M. Eckel (pmeckel@sciencebuff.org),
botanists at the Buffalo Museum of Science, who have collected bryophytes
extensively in New York, particularly in the Niagara Falls region.

COLLECTIONS EXAMINED

The only known Canadian specimen of *Ptychomitrium incurvum* was examined for
this report: CANM (Canadian Museum of Nature) #152283, isotype of *Grimmia hookeri*.