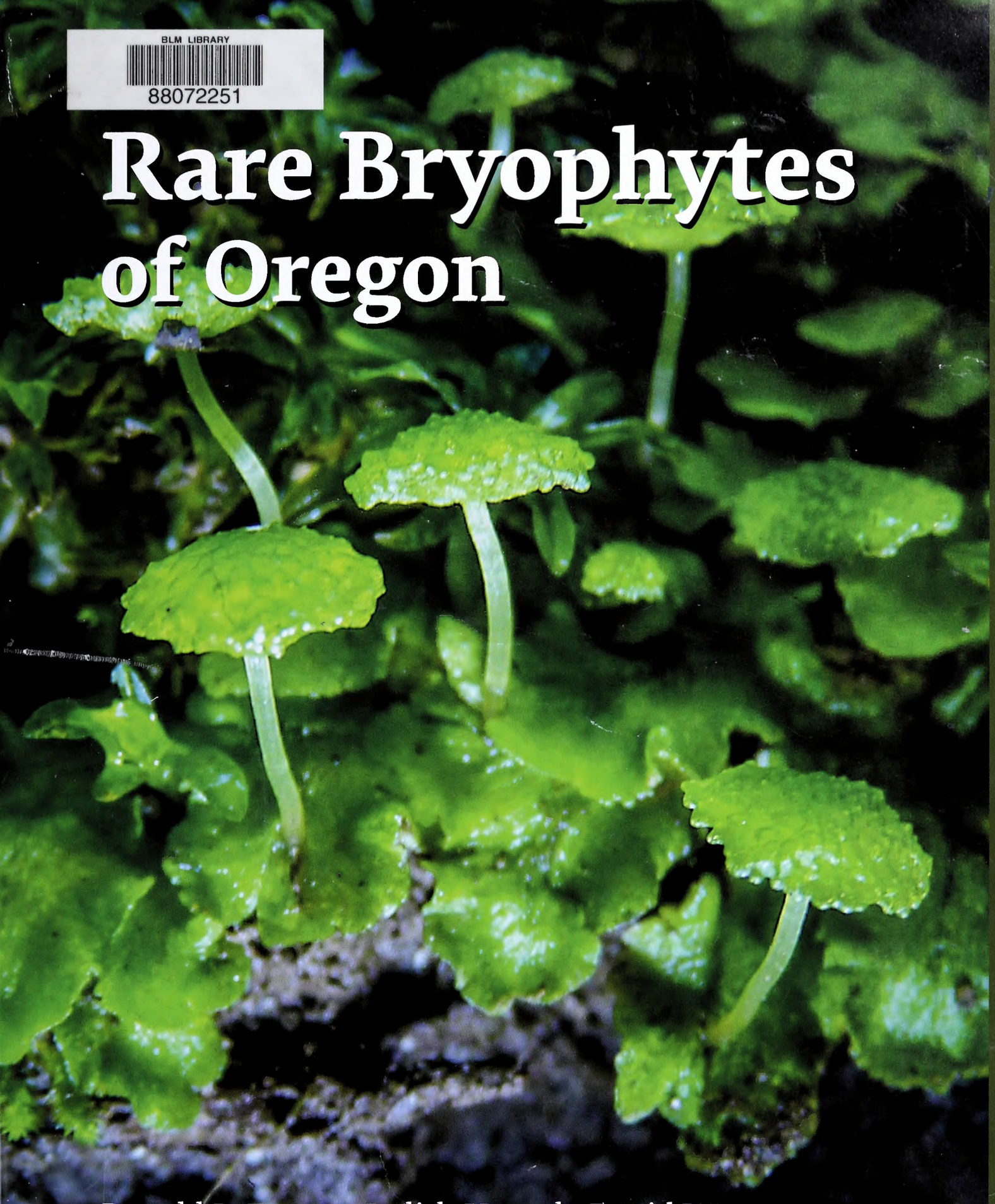
Rare Bryophytes of Oregon



Ronald L. Exeter • Judith Harpel • David Wagner

Front Cover:
Cryptomitrium tenerum by David Wagner

Back Cover:
Top left: *Cryptomitrium tenerum.* Spores and elators.
Top right: *Conostomum tetragonum.* Peristome teeth and capsule.
Middle left: *Tetraplodon mnioides.* Capsule exothecial cells with stomates.
Middle right: *Mnurella julacea.*
Bottom left: *Radula brunnea.*
Bottom right: *Phymatoceros phymatodes.*

Rare Bryophytes of Oregon

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Rare Bryophytes of Oregon

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Abstract.

The 2013 Oregon Biodiversity Information Center's (ORBIC) species of concern list identifies one hornwort, 39 liverworts and 102 moss species occurring in Oregon as rare, threatened or endangered. This Bureau of Land Management publication provides for each species current nomenclature, distinctive taxonomic characteristics, technical description, similar species, ecology, mapped known distributions, references, and a photomicrograph plate. This work gives a much-needed review of known species locations by both county and ecoregions. Additionally, this publication includes species proposed for inclusion into the 2016 ORBIC list.

Key words: bryophyte, liverwort, hornwort, moss, rare, endangered, Oregon, BLM, Bureau of Land Management, ORBIC.

Rare Bryophytes of Oregon

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We also thank the following individuals and herbaria for lending specimens and providing vouchers for examination and photography.

> California Academy of Sciences (CAS); California State University North Ridge (SFV); J. Christy (Christy pvt); R. Dewey (Dewey pvt); David Wagner (DHW pvt); Duke University (DUKE); R. Exeter (Exeter pvt); J. Harpel (Harpel pvt); R. Helliwell (Helliwell pvt); M. Hutten (Hutten pvt); D. Kofranek (Kofranek pvt); S. Loring (Loring pvt); Ken Kellman (Kellman pvt); New York Botanical Garden (NY); Olympic National Park Herbarium (OLYM); Oregon State University (OSC); Provincial Museum of Alberta (PMAE); D. Toren (Toren pvt); University of British Columbia (UBC); University of California Berkely (UC); University of Washington (WTU).

Special thanks to Max Ratkai and Mike Hamel for their expert assistance and improvements to the authors' design and for formatting and submitting the document for press. Our efforts would have been futile without their willingness to support this project.

Photo Credits — Judith Harpel mosses; David Wagner hornwort and liverworts; *Sphagnum oregonense* reprinted with permission from Jon Shaw; *Anastrophyllum minutum* reprinted with permission from Des Callaghan; *Pressia quadrata*, reprinted with permission of University of Washington Press. Schofield, W. B. Illustrated by Patricia Drukker-Brammall and Muriel Pacheco. Field Guide to Liverwort Genera of Pacific North America. pp. 166. © 2002.

Color Bar Key

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Introduction

The Oregon Biodiveristy Information Center's (ORBIC) *Rare, Threatened and Endangered Species of Oregon* (2013) includes one hornwort, 39 liverworts, and 102 moss species. This Bureau of Land Management publication presents approximately 1,350 photos on 153 plates and provides the following information for each species: current taxonomy, distinctive characteristics, technical description, similar species, ecology, references, and distribution with maps. We include all species covered by the 2013 ORBIC publication and include species proposed for listing in 2016 with the following modifications: *Pohlia sphagnicola,* now treated as a synonym of *Pohlia nutans* (Shaw 2014a), is excluded. *Bartramia stricta* is excluded; North American populations represent a newly described species (*Bartramia rosamrosiae*) that is not known from Oregon (Damayanti 2012). Name changes since ORBIC (2013) include *Elodium blandowii* (≡ *Helodium blandowii*), *Mesoptychia gillmanii* (≡ *Lophozia gillmanii*), and *Schistochilopsis laxa* (≡ *Lophozia laxa*). In addition, the liverwort originally cited as *Porella vernicosa* subsp. *fauriei* has been redetermined as *Porella arboris-vitae,* and *Kurzia makinoana* is now referred to *K. sylvatica.*

Much of the information for this publication was gleaned from the United States Department of Interior, Bureau of Land Management (USDI-BLM) and the United States Department of Agriculture, United States Forest Service (USDA-USFS) special status species fact sheets, conservation assessments and photos compiled from past contracts.

Site location data was obtained from ORBIC, government databases, technical publications, journals, various Internet websites, and personal communications.

Technical descriptions of moss species were adapted mostly from Lawton (1971), Crum and Anderson (1981), and two volumes of *Flora of North America: Volume 27, Bryophytes: Mosses part 1* (2007) and *Volume 28, Bryophytes: Mosses part 2* (2014). Descriptions of hornwort and liverworts were adapted primarily from provisional online drafts of *Flora of North America Volume 29*, Schuster (1966–1992), Paton (1999), and Damsholt (2002). Author citations follow those included in the *Flora of North America* or, where not available, from the Tropicos.org website; nomenclature conforms to the International Code of Nomenclature for algae, fungi, and plants ("Melbourne Code"; McNeill & al., 2012).

The divisions are presented in the following order: Bryophyta, Anthocerotophya, Marchantiophyta. Species are treated alphabetically within each division.

The authors considered adding a full glossary to this publication but decided to save space by omitting the glossary because glossaries on bryophytes are easily found on the Internet and in other publications (See Malcolm and Malcolm (2006)): *Mosses and other bryophytes, an illustrated glossary*. A list of abbreviations and acronyms and a cross reference of vascular plant scientific and common names are included.

Although this publication focuses on the rare bryophytes of Oregon, 89 moss species are found in California, 112 in British Columbia, and 100 in Washington, making this publication useful throughout the Pacific Northwest. It also updates Christy and Wagner (1996), who treated rare liverworts and mosses within the area of the Northwest Forest Plan in Washington, Oregon, and northern California.

History of rare plant protection in Oregon

Included in the Oregon Natural Heritage Program's May 1991 publication, "Rare, Threatened and Endangered Plants and Animals of Oregon," is a brief history by Rhoda M. Love on rare plant protection. It reads in part,

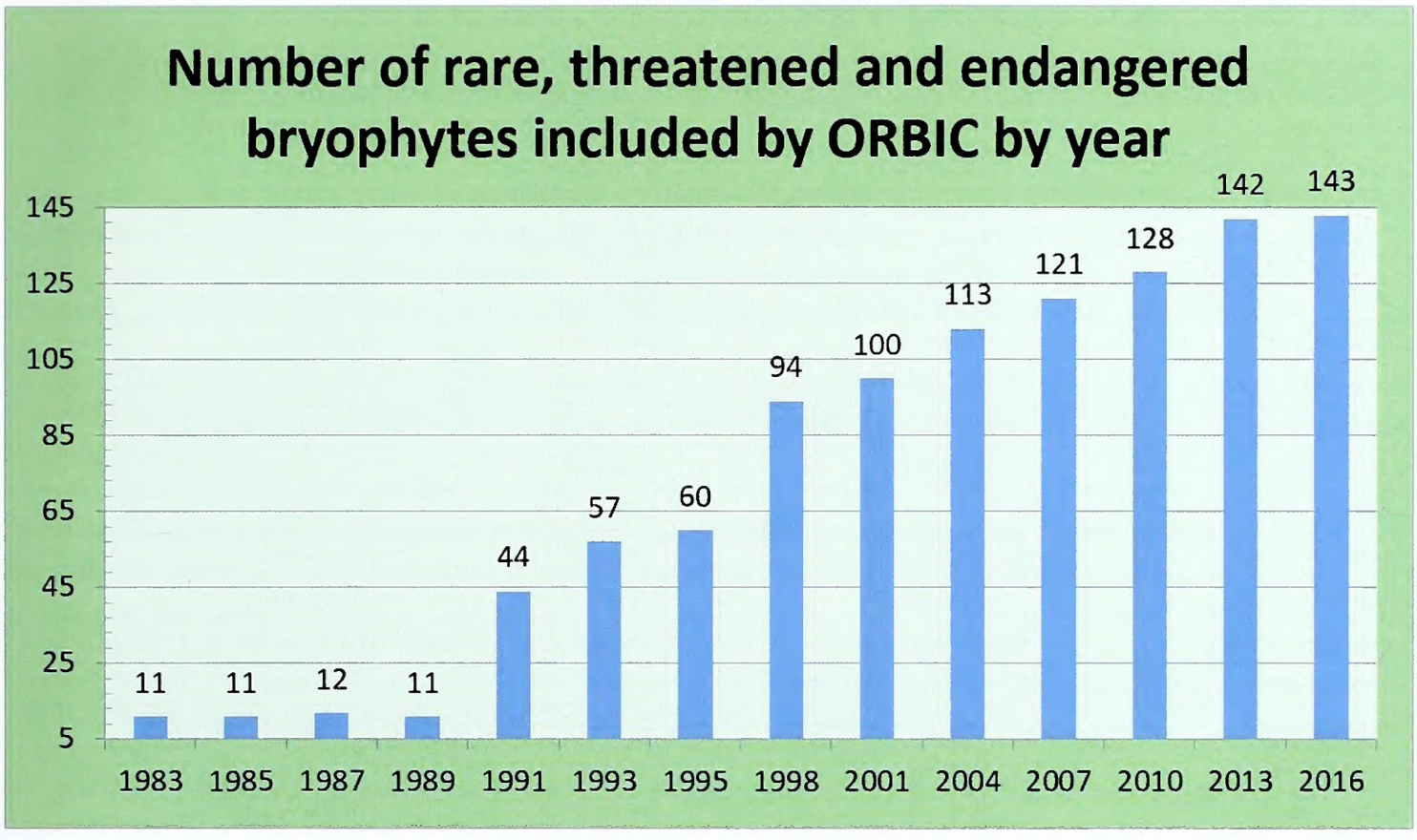
> *When the Federal Endangered Species Act was passed in 1973, the attention of the nation began to focus on the country's rare and endangered plants. That year, the Smithsonian Institution in Washington, D.C., was directed by Congress to prepare a list of U.S. plants species thought to be extinct or in danger of extinction. Dr. Kenton L. Chambers of the Oregon State University Herbarium in Corvallis began a list of plants rarely collected from Oregon. At about the same time, Jean L. Siddall of Lake Oswego was preparing a list for the Oregon Natural Area Preserves Advisory Committee, of those plants considered rare by Oregon botanists. Chambers and Siddall pooled their efforts.*
>
> *In June, 1975, the U.S. Fish and Wildlife Service published the names of nearly 3,000 rare and endangered United States plants in the Federal Register. At about that time, Jean Siddall set up an Advisory Committee of professional taxonomists, and an office called the Oregon Rare and Endangered Plant Project. The Project created the state's first list of rare, threatened and endangered plant species. The list was published by the Oregon Natural Area Preserves Advisory Committee to the State Land Board in 1979. The book*, Rare, Threatened and Endangered Vascular Plants in Oregon–An Interim Report, *was authored by Jean L. Siddall, Kenton L. Chambers and David H. Wagner of the University of Oregon Herbarium in Eugene* [Siddall et al. 1979].
>
> *Shortly after the appearance of this Interim Report in 1979, the Oregon Natural Heritage Program (ONHP), an office established by the Oregon Field Office of The Nature Conservancy and the state of Oregon in 1975, initiated a comprehensive computerized database for Oregon rare plant and animal species. This database is constantly updated as new information on Oregon's rare species is received.*

The *Interim Report,* which did not include any bryophytes, explained,

> *It should be noted that only vascular plants have been considered to date. Other plant groups such as mosses, liverworts and lichens are also worthy of concern.*

The *Interim Report* was updated and published in July 1983 as *Rare, Threatened and Endangered Plants and Animals of Oregon*, by the Oregon Natural Heritage Program (ONHP). This updated report was the first to include bryophytes on the state's rare, threatened and endangered list. Subsequent updates have been published (1985, 1987, 1989, 1991, 1993, 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016). ONHP changed its name in 2002 to the Oregon Natural Heritage Information Center (ONHIC) and in 2010 to the Oregon Biodiversity Information Center (ORBIC).

The following chart displays the number of bryophytes listed as species of concern by ORBIC over the past thirty years.



As interest in the study of bryology continues to increase, additional populations of rare species will be found. Data collected along with the vouchers will aid in understanding species habitat requirements and distribution and range. Future inventories will likely lead to the discovery of additional new bryophyte records for Oregon. Species with a single site or relatively few sites, or species that occur in rare, unique, or ephemeral habitats are potential candidates for the list of Rare, Threatened and Endangered Species of Oregon.

As new species are added to this list, they can become an incentive for bryologists to locate additional sites. Over time, distribution patterns and habitat requirements begin to unfold for a species. When enough sites are found, suggesting that a population is stable in Oregon, the species then becomes a candidate for removal from the ORBIC list. TABLE 1 provides a list of bryophyte species previously included by ORBIC but subsequently removed. (This table does not include species dropped due to name changes.)

Table 1: Bryophytes formerly listed as rare, threatened or endangered in Oregon.

Species	Date listed	Date removed	Reason
Bartramia stricta	July-13	2016*	Unknown in Oregon
Brachythecium turgidum	March-98	February-01	Taxonomic reasons
Bryoerythrophyllum columbianum	August-93	2016*	Too common
Calliergon stramineum	July-83	April-87	Too common
Campylopus atrovirens	July-83	April-87	Unknown in Oregon
Crumia latifolia	August-93	March-07	Too common
Diplophyllum plicatum	July-93	July-13	Too common
Encalypta intermedia	March-98	October-10	Taxonomic reasons
Fabronia pusilla	February-01	March-07	Too common
Fissidens fontanus	May-04	2016*	Too common
Fissidens grandifrons	March-98	March-07	Too common
Fissidens pauperculus	March-98	March-07	Too common
Funaria muhlenbergii	August-93	March-07	Too common
Grimmia anomala	March-98	2016*	Too common
Grimmia donniana	July-13	2016*	Taxonomic reasons
Hedwigia detonsa	May-04	March-07	Too common
Hedwegia stellata	March-98	March-07	Too common
Metzgeria violacea	May-91	2016*	Too common
Micromitrium tenerum	March-98	May-04	Unknown in Oregon
Plagiothecium piliferum	March-07	2016*	Too common
Platyhypnidum riparioides	March-98	October-10	Too common
Pohlia sphagnicola	July-83	2016*	Taxonomic reasons
Pseudoleskeella serpentinensis	March-98	2016*	Too common
Racomitrium pacificum	August-93	March-98	Too common
Rhizomnium nudum	March-98	March-07	Too common
Schistostega pennata	March-98	July-13	Too common
Sphagnum crispum	April-87	May-89	Taxonomic reasons
Tayloria serrata	May-91	2016*	Too common
Tetraplodon mnioides	May-91	2016*	Too common
Tomentypnum nitens	May-04	2016*	Too common
Tortula subulata	March-98	May-04	Too common
Tripterocladium leucocladulum	August-93	March-07	Too common
Tritomaria exsecta	May-91	December-95	Unknown in Oregon
	January-14	n/a	Recently discovered in Oregon
Tritomaria exsectiformis	May-91	July-13	Too common

* proposed changes, October 2015.

Publications & References

The *Flora of North America North of Mexico* (FNA) *Volume 27* (2007, *Bryophytes Part 1*) and *Volume 28* (2014, *Bryophytes Part 2*) are currently the most comprehensive bryophyte publications in North America. They include keys and descriptions of moss species known from North America north of Mexico. Bryologists await compilation and printing of *Volume 29, Hornworts and Liverworts*.

Norris and Shevock (2004a) *Contributions toward a Bryoflora of California: II. A Key to the Mosses* includes the most updated identification keys for mosses, specifically for California, but also useful for pacific northwestern North America. Doyle and Stotler (2006) provide the companion guide for liverworts and hornworts. David Wagner's (2014) illustrated keys and color photomicrographs complement the Doyle and Stotler treatment.

Lawton's (1971) *Moss Flora of the Pacific Northwest* is outstanding but dated. Although its keys to species should be used with caution, its line drawings and species descriptions are valuable and should be available as a reference.

Paton's (1999) *The Liverwort Flora of the British Isles* is a valuable publication on liverworts filled with line drawings and species descriptions. Paton's work should be included in every bryologist's library.

Flower's (1973) *Mosses of Utah and the West* and Porley (2008) *Arable Bryophytes, A Field Guide to the Mosses, Liverworts and Hornworts of Cultivated Land in Britain and Ireland* are useful in more arid climates in western North America such as east of the Cascade Mountain Range and in the Great Basin.

Bill and Nancy Malcolm's (2006) *Mosses and other Bryophytes – An Illustrated Glossary* is invaluable.

Two color publications are worth the investment. *California Mosses* (Malcom et al. 2009) features 67 moss species included in this publication, and *Mosses and Liverworts of Britain and Ireland. a Field Guide* (Atherton et al. 2010) covers 43 mosses and 21 liverworts included here.

The hardbound *Rare and Threatened Bryophytes of Ireland* (Lockhart et al. 2012) provides over 600 pages in color and is worth purchasing, although it is not essential for western North America.

Jean Faubert's (2012) *Flore des bryophytes du Québec-Labrador. Volume 1: Anthocérotes et hépatiques* is in French, covers 20 of our rare liverworts and has nice line-drawings.

The Lincoln (2008) publication, *Liverworts of New England,* features 17 species included here. This hardback publication with its many color photographs, line drawings, and illustrated keys is a good supplement to the Malcolm and Atherton publications.

Schofield's (2002) *Field Guide to Liverwort Genera of Pacific North America* offers a key to genera and line drawings for each genus and lists distinguishing characteristics, similar genera, and local distribution. This publication is a good companion to the liverwort keys provided by Doyle and Stotler (2006).

NOTE: the line drawings are switched on p. 76 and 78 with *Cephaloziella* shown on p. 76 and *Cephalozia* on p. 78.

Other corrections (in the key) are as follows:

On p. 25, in couplet 1 of Key II, the second key lead should read:
1. Thallus lacking dorsal pores .....19 (p. 26).

On p. 26, couplet 19 should read:
19. Thallus a single cell thick, except for a midrib ..... 20.
19. Thallus mainly several cells thick, thicker in middle, thinning to margins ..... 25.

Other moss references include *Mosses of Eastern North America* (Crum and Anderson 1981), *The Moss Flora of Mexico* (Sharp, Crum and Eckel 1994), and *The Moss Flora of Britain and Ireland* (Smith 2004 2nd ed.). These publications can often be found at bargain prices and provide good references for species with ranges in and outside of western North America.

Certainly there are many Internet pages devoted to bryology. A few important webpages include:

British Bryological Society [http://www.britishbryologicalsociety.org.uk]
Images of California Bryophytes [https://www.csun.edu]
David Wagner's website [http://www.fernzenmosses.com]
Consortium of North American Bryophyte Herbaria [http://bryophyteportal.org/portal/]

The Tropicos website [http://www.tropicos.org] is a good site to verify nomenclature, synonyms, references, distributions, and author citations.

SUMMARY OF RECOMMENDED PUBLICATIONS AND GUIDES

Atherton, Ian, Sam Bosanquet, and Mark Lawley. 2010. *Mosses and Liverworts of Britain and Ireland: a Field Guide*. British Bryological Society, 848 pp. ISBN: 978–0–9561310–1–0.

Crum, H. and L. Anderson. 1981. *Mosses of Eastern North America*. 2 volumes. Columbia University Press, New York. 1328 pp.

Damsholt, K. 2002. *Illustrated Flora of Nordic Liverworts and Hornworts*. Nordic Bryological Society, Lund, Sweden. Pp. 837.

Doyle, William T. and Raymond E. Stotler. 2006. *Contributions toward a Bryoflora of California III.* Keys and Annotated Species Catalogue for Liverworts and Hornworts. Madroño. 53, (2):89–198.

Faubert, Jean. 2012. *Flore des bryophytes du Québec-Labrador. Volume 1: Anthocérotes et hépatiques*. Société Québécoise de bryologie, Saint-Valérien, Québec, xvii + 356 p., illus.

Flora of North America (FNA), *North of Mexico Volume 27* (2007), *Bryophytes Part 1* and *Volume 28* (2014), *Bryophytes Part 2*. New York and Oxford.

Flowers, S. 1973. *Mosses: Utah and the West*. Brigham Young University Press, Provo, UT. Pp. 567.

Lincoln, Mary S. G. 2008. *Liverworts of New England*. Memoirs of the New York Botanical Garden, Volume 99. The New York Botanical Garden Press, 161 pp.

Lockhart, Neil, Nick Hodgetts and David Holyoak 2012. *Rare and Threatened Bryophytes of Ireland*. National Museums Northern Ireland. ISBN 978 1 905989 35 5

Malcolm, Bill and Nancy. 2006. *Mosses and other Bryophytes an Illustrated Glossary*. Second Edition. Micro-Optics Press. Pp. 336. ISBN:0–9582224–7–9.

Malcolm, Bill and Nancy, Jim Shevock and Dan Norris. 2009. *California Mosses*. Micro-Optics Press. Pp. 430. ISBN: 0–9582224–5–2.

Norris, Dan H. and James R. Shevock. 2004. *Contribnitions toward a Bryoflora of California: II. A Key to the Mosses*. California Botanical Society. Madroño. 51, (2): 133–270.

Paton, J.A. 1999. *The Liverwort Flora of the British Isles*. Harley Books, Colchester, U.K. Pp. 626.

Porley Ron. 2008. *Arable Bryophytes – A Field Guide to the mosses, liverworts and hornworts of cultivated land in Britain and Ireland*. Wild Guides LTD. Pp. 140. ISBN: 978–1–903657–21–8.

Schofield, W.B. 2002. *Field Guide to Liverwort Genera of Pacific North America*. University of Washington Press. Pp. 228.

Sharp, A., and H. Crum, P. Eckel. 1994. *The Moss Flora of Mexico*. Memoirs of the New York Botanical Garden. Vol. 69 Part 1 Sphagnales to Bryales, and Vol. 69 Part 2 Orthotrichales to Polytrichales. New York Botanical Garden Press. Bronx. Pp. 1113.

Smith, A.J.E. 2004. *The Moss Flora of Britain and Ireland* 2nd Edition. Cambridge University Press. Cambridge, England. Pp. 1012.

Smith, A.J.E. 1990. *The Liverworts of Britain and Ireland*. Cambridge University Press, Cambridge, England. Pp. 362.

Wagner, D.H. 2014. *Guide to the Liverworts of Oregon*. December 2014 edition. Northwest Botanical Institute, Eugene, Oregon. HTML document on compact disk. ISBN: 978-0-9906193-0-7.

Life history strategies & ecological roles

Individual life history strategies for most bryophytes covered in this publication are either unknown or undocumented. Bryophyte protonema formation and growth is inconspicuous, and most species are assumed to form buds and shoots as usually described for bryophyte growth and development.

Life histories are as follows for a few selected groups below.

In LIVERWORTS the protonema is reduced and short-lived. Drought induced dormancy is more frequent in thalloid liverworts than in leafy liverworts. Most thalloid liverworts grow on soil with a small organic component while most leafy liverworts are on organic substates like peat, rotting wood or bark.

Bryophytes in ARID HABITATS are often sterile. Contributing factors may include high soil surface temperatures and low precipitation, which would reduce opportunities for fertilization.

ASEXUAL STRATEGIES are common in bryophytes and include production of brood bodies, propagula, gemmae, tubers, and plant fragmentation. Asexual reproduction serves as an alternative method for distribution, but may lack the genetic diversity needed for long-term survival. In some cases suitable habitat or substrate is lacking, ephemeral, uncommon, or rare and may be the limiting factor.

EPHEMERAL BRYOPHYTE species often take advantage of short-term habitats such as muddy shores of receding water features such as lakes and ponds. These habitats often have few competitors. Most ephemeral bryophytes complete their life cycle within a few months. When water levels recede, spores germinate to form an extensive felt-like protonema over damp soil. The protonema forms buds and shoots and a turf of leafy plants develops as the protonema disappears. Capsules usually mature in late summer and fall before winter rains inundate the habitat. Some are annuals, with a new generation appearing from spores each year, while some are perennials, which survive dry periods by developing dormant propagules.

DUNG MOSSES and mosses that develop on NITROGEN-RICH SUBSTRATES (such as carcasses and bones) often depend on flies to disperse their sticky spores. They attract flies by exuding foul-smelling compounds from specialized and often conspicuously swollen or colored tissues immediately below the capsule. The odor varies from dung to carrion. Because of the ephemeral substrate, dung mosses may disappear from a locality within a few seasons after detection or may persist at a location depending on available substrate.

SPHAGNUM, unique amongst the mosses, has a thalloid (not filamentous) protonema, fascicled branching, the ability to store water and conduct ion exchange within hyaline cells, and spores that are dispersed under pressure. In addition, unlike the Bryopsida, *Sphagnum* does not have a diploid seta as part of the sporophyte but has instead a capsule supported by haploid gametophytic tissue called a pseudopodium (Buck and Goffinet 2000). These features indicate *Sphagnum* has followed an evolutionary line independent from that of the Bryopsida (Schofield 1985).

Although the life histories and ecological roles of individual bryophyte species are often not well understood, in general bryophytes contribute to ecosystem function in a number of ways. According to Schofield (1985) extensive bryophyte mats can significantly influence the water balance of a forest by absorbing and releasing moisture and recycling leached nutrients from the tree canopy into the ecosystem. Many microorganisms (such as protozoa, fungi, bacteria, and blue-green alga) often are associated with bryophytes, and some species have been found to possess antibiotic properties (Richardson 1981).

Bryophytes also directly interact with other organisms by providing nesting material and food for birds, voles, and lemmings (Longton 1992, Slack 1988). Both aquatic and terrestrial bryophytes provide shelter and food for the larvae and adults of numerous invertebrate species (Richardson 1981). Finally, bryophytes are often pioneer species that represent the first step in vascular plant succession and contribute to soil formation through accelerating the physical and chemical weathering of rock. While individual life histories may not be well understood, bryophytes serve an important roll in the eco-system.

Threats to bryophyte sites

Human impact and natural events can threaten species distribution. They may affect habitat (or microclimate) and/or the actual bryophyte. Changes, which may be sudden or occur over a long period, can result from direct and indirect actions, which include vegetation modification or removal, compaction or disruption of the soil layer, pollution, natural succession, or microclimatic changes.

Many Pacific Northwest rare bryophyte species are found in subalpine and alpine habitats, locations that often lie in remote regions and are visited by few people. In these cases, a natural habitat evolution tends to determine the vigor of the populations. Nonetheless, air pollution and climate change must be considered long-term threats. Species growing on peaks and ridge tops can accumulate harmful aerosols from the atmosphere. In addition, populations in temperate climates may be at risk due to changing global temperatures, which could result in the loss of alpine habitat.

Conservation considerations

Conservation considerations include mitigation to eliminate or minimize potential threats to species persistence. Sites should be revisited periodically and monitored in sufficient detail to determine if populations are stable, increasing, or declining. A proactive approach for maintaining populations and suitable habitat should be employed in the case of a proposed or ongoing threat. Such approaches might include fencing or netting to protect sites from damage; restoration of riparian zones and upland habitats following wildfires, landslides, or processes altering the hydrologic flow; management of vegetation density for additional sunlight or shade; establishment of buffers to sites to protect a population during management activities.

Data gaps

Many rare bryophyte herbarium records have little or no habitat data. Sites of Oregon rare bryophyte species lacking specific habitat descriptions should be revisited to provide detailed habitat descriptions that would help develop habitat models for rare species and locate additional sites.

Often historical vouchers lack good site information. Specialists should re-examine herbarium records to verify species identifications and record accurate locations. Confirming historical sites would enhance habitat data and provide a better understanding of species distribution. Currently some site locations that have been recorded lack vouchers or are so imprecise that even county or ecoregion are uncertain.

Many Oregon rare bryophyte species share the same habitat or occur within the same ecosystem. Perceived species rarity may be the product of too few inventories in these areas. Habitats or ecosystems targeted for additional inventories should include subalpine and alpine habitats, bogs, fens, and wetlands. In view of the fact that several ephemeral species are listed as taxa of concern, ephemeral ecosystems should also be targeted for inventories.

For the most part, this publication should meet the need to complete fact sheets for ORBIC listed species that currently lack government fact sheets and photomicrographs. In the future, however, newly listed bryophytes will require their own fact sheets and photomicrographs to aid in locating and identifying sites.

Distribution

The following table displays species treated in this publication and identifies site distribution by Oregon ecoregion (Thorson et al., 2003). This table and the Oregon County and Ecoregion Map that follows should be helpful in determining whether or not a species might occur in an adjacent county or ecoregion. We also provide (under "Distribution") Oregon county and ecoregion site data in each species treatment.

Ecoregions with a greater number of rare species may either represent areas in which past bryophyte inventories have been concentrated (Coast Range, Klamath Mountains, West Cascades, and Blue Mountains) or reflect the natural higher habitat diversity within the ecoregion itself.

Species name	Coast Range	Willamette Valley	Klamath Mountain	West Cascades	East Cascades	Columbia Basin	Blue Mtns.	Northern Basin and Range
MOSSES								
Aloina bifrons						X		
Andreaea nivalis				X				
Andreaea schofieldiana			X	X				
Anoectangium aestivum			X				X	
Anomobryum julaceum	X						X	
Barbula unguiculata		X						
Brachydontium olympicum				X				
Bruchia bolanderi				X			X	
Bruchia flexuosa		X						
Bryoerythrophyllum columbianum					X	X		
Bryum calobryoides	X		X	X			X	
Buxbaumia aphylla	X		X	X	X		X	
Calliergon richardsonii							X	
Campylium stellatum			X				X	
Campylopodiella flagellacea			X					
Campylopus schmidii	X		X					
Campylopus subulatus	X		X					
Conostomum tetragonum				X				
Cynodontium jenneri	X							
Dichodontium olympicum							X	
Didymodon eckeliae				X		X		
Didymodon norrisii			X					
Ditrichum flexicaule	X		X					
Elodium blandowii				X			X	
Encalypta brevicollis	X		X					
Encalypta brevipes	X		X					
Enthosthodon californicus			X					
Entosthodon fascicularis			X	X				
Ephemerum crassivervium		X	X					X

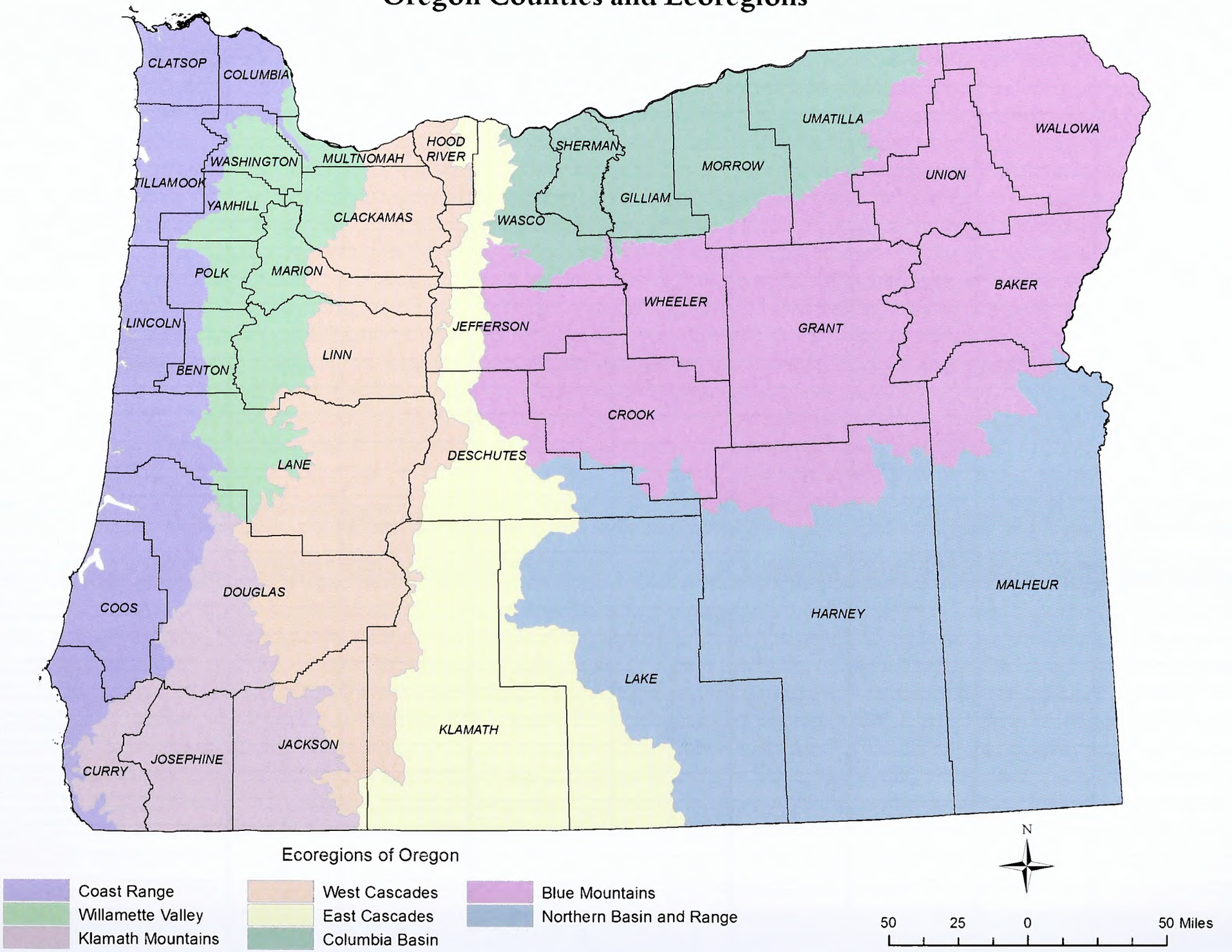
Species name	Coast Range	Willamette Valley	Klamath Mountain	West Cascades	East Cascades	Columbia Basin	Blue Mtns.	Northern Basin and Range
Ephemerum serratum		X						
Eucladium verticillatum	X		X					
Fissidens fontanus		X						
Gemmabryum barnesii	X	X						
Grimmia anomala	X		X	X				
Grimmia donniana			X			X	X	
Grimmia lisae	X		X					
Gymnostomum viridulum			X					
Hygrohypnum alpinum				X				
Hygrohypnum cochleariifolium							X	
Hypnum lindbergii				X			X	
Hypnum pratense							X	
Iwatsukiella leucotricha	X							
Limbella fryei	X							
Meesia uliginosa			X				X	
Micromitrium synoicum		X						
Mielichhoferia elongata							X	
Mnium blyttii							X	
Myurella julacea				X				
Orthodontium gracile	X							
Orthotrichum pellucens	X							
Orthotrichum bolanderi			X					
Orthotrichum euryphyllum			X				X	X
Orthotrichum hallii			X	X				
Orthotrichum holzingeri							X	
Orthotrichum pallens							X	
Orthotrichum pellucidum							X	
Philonotis yezoana			X					
Physcomitrella patens		X						
Physcomitrium immersum	X	X						
Plagiobryum zieri	X			X				
Plagiopus oederianus				X				

Species name	Coast Range	Willamette Valley	Klamath Mountain	West Cascades	East Cascades	Columbia Basin	Blue Mtns.	Northern Basin and Range
Plagiothecium cavifolium	X			X				
Plagiothecium piliferum	X		X	X				
Pohlia bolanderi				X				
Pholia cardotii				X				
Pohlia ludwigii				X				
Pohlia obtusifolia				X				
Pohlia tundrae				X				
Polytrichastrum sexangulare var. *sexangulare*				X				
Polytrichastrum sexangulare var. *vulcanicum*				X				
Polytrichum strictum	X							
Pseudoephemerum nitidum		X						
Pseudocalliergon trifarium				X	X			
Pseudocrossidium hornschuchianum			X					
Pseudoleskeella serpentinensis			X					
Pseudoleskeella tectorum					X		X	
Ptilium crista-castrensis							X	
Ptychostomum cyclophyllum				X				
Ptychostomum pacificum			X	X				
Racomitrium brevipes	X		X	X			X	
Racomitrium depressum				X				
Racomitrium molle				X				
Racomitrium pygmaeum				X				
Racomitrium ryszardii	X			X				
Rhytidiadelphus subpinnatus	X			X				
Rhytidium rugosum	X							
Rosulabryum gemmascens				X		X		
Schistidium cinclidodonteum			X		X		X	
Schistidium flaccidum							X	X
Schistidium heterophyllum						X	X	
Schistidium tenerum			X				X	
Scouleria marginata			X	X			X	
Sphagnum oregonense				X				

Species name	Coast Range	Willamette Valley	Klamath Mountain	West Cascades	East Cascades	Columbia Basin	Blue Mtns.	Northern Basin and Range
Splachnum ampullaceum					X			
Splachnum sphaericum							X	
Tayloria serrata	X	X	X	X				
Tetraphis geniculata	X			X				
Tetraplodon mnioides	X			X				
Thamnobryum neckeroides			X	X				
Tomentypnum nitens				X	X		X	
Tortella fragilis	X			X				
Tortella tortuosa	X		X				X	
Tortula inermis						X		
Tortula mucronifolia			X				X	X
Tortula protobryoides						X		
Trematodon asanoi				X				
Trichostomum crispulum			X	X				
Trichostomum tenuirostre var. *tenuirostre*	X		X	X				
Triquetrella californica	X							
HORNWORTS								
Phymatoceros phymatodes	X	X						
LIVERWORTS								
Anastrophyllum minutum				X				
Anthelia julacea				X			X	
Asterella bolanderi			X					X
Barbilophozia barbara	X							
Barbilophozia lycopodioides							X	
Blepharostoma arachnoideum	X			X				
Calypogeia sphagnicola	X			X				
Cephaloziella hampeana	X		X		X		X	
Cephaloziella spinigera	X			X	X			
Cryptomitrium tenerum			X					
Gymnomitrion concinnatum				X				
Haplomitrium hookeri	X			X				
Harpanthus flotovianus				X			X	

Species name	Coast Range	Willamette Valley	Klamath Mountain	West Caseades	East Caseades	Columbia Basin	Blue Mtns.	Northern Basin and Range
Herbertus aduncus subsp. *aduncus*	X			X				
Herbertus dicranus	X							
Hygrobiella laxifolia				X				
Jamesoniella autumnalis var. *heterostipa*				X				
Jungermannia polaris				X			X	
Kurzia sylvatica	X							
Marsupella condensata				X				
Marsupella emarginata var. aquatica				X				
Marsupella sparsifolia				X				
Marsupella sprucei	X							
Mesoptychia gillmanii							X	
Metzgeria violacea	X							
Nardia japonica				X				
Peltolepis quadrata							X	
Plagiochila semidecurrens	X							
Porella arboris-vitae				X				
Porella bolanderi			X	X				
Preissia quadrata		X					X	
Ptilidium pulcherrimum							X	
Radula brunnea	X							
Radula obtusiloba subsp. *polyclada*	X							
Riccia californica			X					
Rivulariella gemmipara			X	X				
Scapania gymnostomophila				X				
Scapania obscura				X				
Schistochilopsis laxa	X			X				
Schofieldia monticola				X				
Sphaerocarpos hians		X						
Tritomaria exsecta							X	
Tritomaria quinquedentata	X							

Oregon Counties and Ecoregions



Classification

The following is the current classification of bryophytes included in this publication. Their placement within this classification should aid in understanding the relationships among species. Please be aware, however, that in this age of molecular analyses, bryophyte classification is continually changing. Liverwort classification follows Crandall-Stotler et al. (2009). Species descriptions are listed alphabetically within each division (mosses, hornworts, liverworts — thalloid, then leafy).

Division: Bryophyta

Class: *Andreaeopsida*

Order: *Andreaeales*

Family: Andreaeaceae

Andreaea schofieldiana
Andreaea nivalis

Class: Sphagnopsida

Order: Sphagnales

Family: Sphagnaceae

Sphagnum oregonense

Class: Bryopsida

Order: Bryales

Family: Bartramiaceae

Conostomum tetragonum
Philonotis yezoana
Plagiopus oederianus

Family: Bryaceae

Anomobryum julaceum
Bryum calobryoides
Gemmabryum barnesii
Plagiobryum zieri
Ptychostomum cyclophyllum
Ptychostomum pacificum
Rosulabryum gemmascens

Family: Meesiaceae

Meesia uliginosa

Family: Mielichhoferiaceae[1]

Mielichhoferia elongata
Pohlia bolanderi
Pohlia cardotii
Pholia ludwigii
Pohlia obtusifolia
Pohlia tundra

Family: Mniaceae

Mnium blyttii

Family: Orthodontiaceae[2]

Orthodontium gracile
Orthodontium pellucens

Order: Buxbaumiales

Family: Buxbaumiaceae

Buxbaumia aphylla

Order: Dicranales

Family: Bruchiaceae

Bruchia bolanderi
Bruchia flexuosa
Trematodon asanoi

Family: Dicranaceae

Campylopodiella flagellacea
Campylopus schmidii
Campylopus subulatus
Cynodontium jenneri
Dichodontium olympicum

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[1] *Mielichhoferia*, *Pohlia* (and *Epipterygium*), which were once included in the Bryaceae, have been transferred to Mielichhoferiaceae following phylogenetic studies.

[2] Members of the Orthodontiaceae, *Orthodontium* have traditionally been placed in the Bryaceae.

Family: Ditrichaceae
Ditrichum flexicaule
Pseudephemerum nitidum[3]

Order: Fissidentalaes
Family: Fissidentaceae
Fissidens fontanus

Order: Funariales
Family: Ephemeraceae
Ephemerum crassinervium
Ephemerum serratum
Micromitrium synoicum

Family: Funariaceae
Entosthodon californicus
Entosthodon fascicularis
Physcomitrella patens
Physcomitrium immersum

Family: Splachnaceae
Splachnum ampullaceum
Splachnum sphaericum
Tayloria serrata
Tetraplodon mnioides

Order: Grimmiales
Family: Grimmiaceae
Grimmia anomala
Grimmia donniana
Grimmia lisae
Racomitrium brevipes
Racomitrum depressum
Racomitrium molle
Racomitrium pygmaeum
Racomitrium ryszardii
Schistidium cinclidodonteum
Schistidium flaccidum
Schistidium heterophyllum
Schistidium tenerum

Family: Scouleriaceae
Scouleria marginata

Order: Hypnales
Family: Amblystegiaceae
Calliergon richardsonii
Campylium stellatum
Hygrohypnum alpinum
Hygrohypnum cochleariifolium
Limbella fryei
Pseudocalliergon trifarium

Family: Brachytheciaceae
Tomentypnum nitens

Family: Helodiaceae
Elodium blandowii

Family: Hylocomiaceae
Rhytidiadelphus subpinnatus

Family: Hypnaceae
Hypnum lindbergii
Hypnum pretense
Ptilium crista-castorensis

Family: Leskeaceae[4]
Pseudoleskeella serpentinensis
Pseudoleskeella tectorum

Family: Plagiotheciaceae
Plagiothecium cavifolium
Plagiothecium piliferum

Family: Pterigynandraeeae
Iwatsukiella leucotricha
Myurella julacea

Family: Rhytidiaceae
Rhytidium rugosum

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[3] *Pseudoephemerum* was previously included in Dicranaceae.

[4] *Pseudoleskeella* is included in the Thuidiaceae by some authors.

Order: Leucodontales
Family: Neckeraceae
Thamnobryum neckeroides

Order: Orthotrichales
Family: Orthotrichaceae
Orthotrichum bolanderi
Orthotrichum euryphyllum
Orthotrichum hallii
Orthotrichum holzingeri
Orthotrichum pallens
Orthotrichum pellucidum

Order: Polytrichales
Family: Polytrichaceae
Polytrichastrum sexangulare var. *sexangulare*
Polytrichastrum sexangulare var. *vulcanicum*
Polytrichum strictum

Order: Pottiales
Family: Encalyptaceae
Encalypta brevicollis
Encalypta brevipes

Family: Pottiaceae
Aloina bifrons
Anoectangium aestivum
Barbula unguiculata
Bryoerythrophyllum columbianum
Didymodon eckeliae
Didymodon norrisii
Eucladium verticillatum
Gymnostomum viridulum
Pseudocrossidium hornschuchianum
Trichostomum tenuirostre
Tortella fragilis
Tortella tortuosa
Tortula inermis
Tortula mucronifolia
Tortula protobryoides
Trichostomum crispulum
Triquetrella californica

Order: Seligeriales
Family: Seligeriaceae
Brachydontium olympicum

Order: Tetraphidales
Family: Tetraphidaceae
Tetraphis geniculata

Division: Anthocerotophyta

Class: Anthocerotopsida

Order: Notothyladales
Family: Notothyladaceae
Phymatoceros phymatodes

Division: Marchantiophyta

Class: Haplomitriopsida

Order: Calobryales
Family: Haplomitriaceae
Haplomitrium hookeri

Class: Marchantiopsida

Order: Marchantiales
Family: Aytoniaceae
Asterella bolanderi
Cryptomitrium tenerum

Family: Cleveaceae
Peltolepis quadrata

Family: Marchantiaceae
Preissia quadrata

Family: Ricciaceae
Riccia californica

Order: Sphaerocarpales
Family: Sphaerocarpaceae
Sphaerocarpos hians

Class: Jungermanniopsida

Order: Metzgeriales

Family: Metzgeriaceae
Metzgeria violacea

Order: Porellales
Suborder: Porellineae
Family: Porellaceae
Porella arboris-vitae
Porella bolanderi

Suborder: Radulineae
Family: Radulaceae
Radula brunnea
Radula obtusiloba subsp. *polyclada*

Order: Ptilidiales
Family: Ptilidiaceae
Ptilidium pulcherrimum

Order: Jungermanniales[5]
Suborder: Cephaloziineae
Family: Cephaloziaceae
Hygrobiella laxifolia
Schofieldia monticola

Family: Cephaloziellaceae
Cephaloziella hampeana
Cephaloziella spinigera

Family: Jamesoniellaceae
Jamesoniella autumnalis var. heterostipa

Family: Scapaniaceae
Anastrophyllum minutum
Barbilophozia barbata
Barbilophozia lycopodioides
Mesoptychia gillmanii
Scapania gymnostomophila
Scapania obscura
Schistochilopsis laxa
Tritomaria exsecta
Tritomaria quinquedentata

Suborder: Jungermanniineae
Family: Antheliaceae
Anthelia julacea

Family: Calypogeiaceae
Calypogeia sphagnicola

Family: Geocalycaceae
Harpanthus flotovianus

Family: Jungermanniaceae
Jungermannia polaris
Rivulariella gemmipara

Family: Gymnomitriaceae
Gymnomitrion concinnatum
Marsupella condensata
Marsupella emarginata var. *aquatica*
Marsupella sparsifolia
Marsupella sprucei

Family: Solenostomataceae
Nardia japonica

Suborder: Lophocoleineae
Family: Herbertaceae
Herbertus aduncus
Herbertus dicranus

Family: Lepidoziaceae
Kurzia sylvatica

Family: Plagiochilaceae
Plagiochila semidecurrens

Family: Pseudolepicoleaceae
Blepharostoma arachnoideum

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[5] Söderström et al. (2010) note that in the past, Lophoziaceae has been recognized as a distinct family or included within the Jungermanniaceae. They suggest that molecular data has shown that the two families are not related and that Scapaniaceae and Cephaloziellaceae nest within the Lophoziaceae clade. Additionally they describe Anastrophyllaceae as new. Meanwhile, Konstantinova and Vilnet (2009) describe one new family, Hygrobiellaceae and 7 new genera within the Jungermanniales.

DIVISION Bryophyta:
The mosses

Aloina bifrons (De Notaris) Delgadillo

Recent synonym: *Aloina pilifera* (De Notaris) H.A. Crum & Steere
Common name: aloina moss

Summary — An acrocarpous moss with filaments on the ventral surface of an ovate leaf. Terrestrial.

Diagnostic characteristics — *Aloina bifrons* is a diminutive moss somewhat resembling a bulb of garlic. It can be distinguished by its (1) clusters of 4–8 thick, erect, brown to reddish-brown, glossy, awned leaves; (2) hyaline hair point; (3) incurved margins concealing rows of filaments on the leaf surface; and (4) strongly twisted peristome teeth.

Technical description

Gametophyte — **Plants** minute, reddish-brown to yellowish or olive-brown. **Stems** less than 1 mm long. **Leaves** ovate-oblong, erect, turgid, glossy, 0.25–0.5 mm wide, up to 2.5 mm long (usually < 1 mm), rounded at the back with no obvious costa or keel, the margins strongly infolded, and hood-like when dry concealing photosynthetic filaments which consist of 4–8 subspheric to cylindric cells, piliferous, the hyaline awns up to 1.2 mm long; costa undifferentiated with few or no stereid cells. **Dioicous**.

Sporophyte — **Seta** reddish-brown, (4–) 6–14 mm long, straight or slightly curved. **Capsules** occasional to frequent, reddish-brown, cylindric, rostrate, erect or slightly inclined, straight or slightly curved, 2.5–3 mm long. The narrow and elongate operculum is up to 1/3 the length of the urn. Peristome teeth are strongly twisted. **Spores** 9–24 µm.

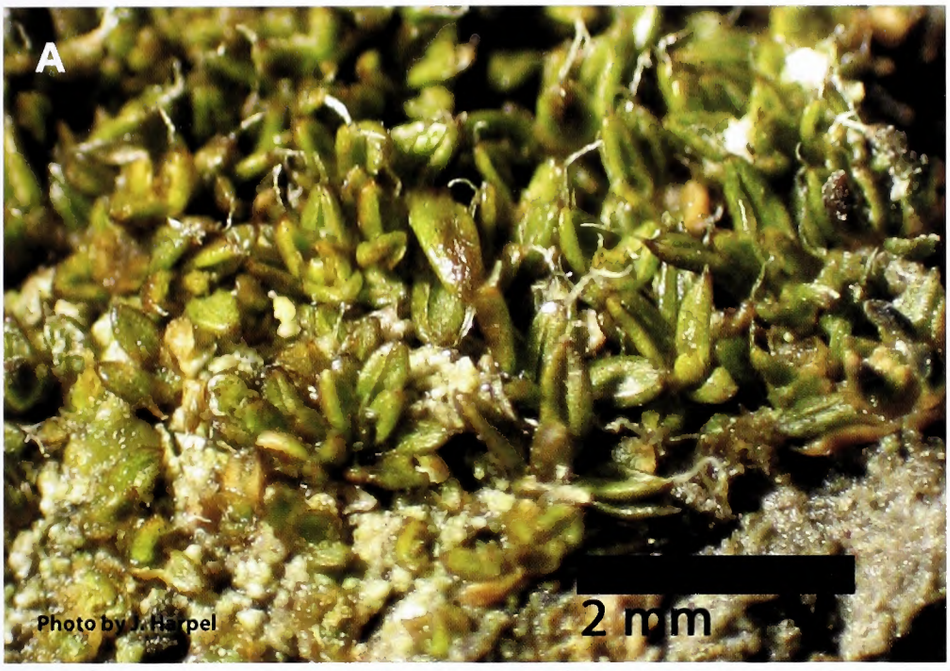
Similar species — *Aloina bifrons* is the only *Aloina* species with a piliferous leaf tip. *Pterygoneurum ovatum* and *P. subsessile* have erect glossy, non-turgid leaves with obvious costae, lamellae and awns exserted or immersed among the leaves. *Crossidium* also has filaments on the ventral leaf surface but has plane to recurved leaf margins.

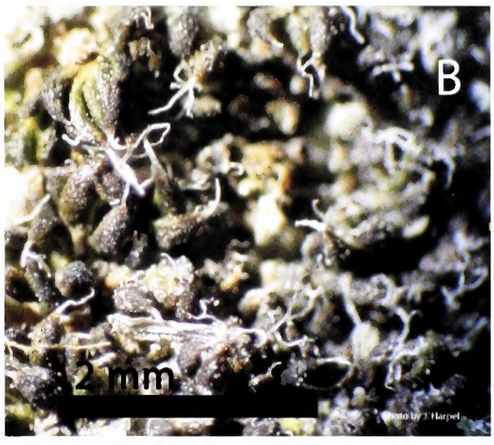
Ecology — In western North America, *Aloina bifrons* is a component of biological soil crusts in arid shrub-steppe and grassland habitats. It occurs on soil as scattered individuals or clusters of individuals over rock, soil, or sand in grassland and sagebrush steppe habitats at elevations below 4,000 feet. It may be common locally but is most frequent in least-disturbed, well-developed soil crust communities on silt loams of moderately low pH (McIntosh 2003a, 2003b). Vascular plant associations include *Poa secunda* and *Pseudoroegneria spicata* with varying densities of *Artemisia tridentata* subsp. *wyomingensis*. Stark and Delgadillo (2001) found *Aloina bifrons* plants in the Mojave Desert that were often connected to each other by subterranean rhizoids, forming clonal colonies that they felt might enhance sporophyte production in arid environments. Capsules mature from January to July.

Distribution — *Aloina bifrons* is known from Africa, North America, Central and South America, New Zealand, and Australia. In western North America, it is known from Washington, Oregon, California, Idaho, Utah, Arizona and Mexico. In Oregon, *Aloina bifrons* is reported from Morrow and Umatilla counties within the Columbia Basin ecoregion.

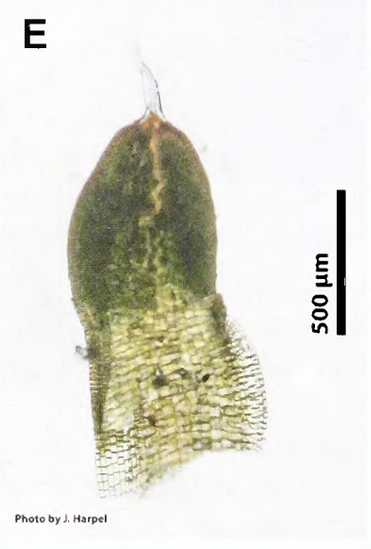
References with descriptions and/or illustrations — Delgadillo (in FNA 2007, p. 615), Stark and Delgadillo (2001, p. 106), Delgadillo (1994, p. 364), Delgadillo (1975, p. 245), Flowers (1973, p. 176 as *Aloina pilifera*), Lawton (1971, p. 86 as *Aloina pilifera*).

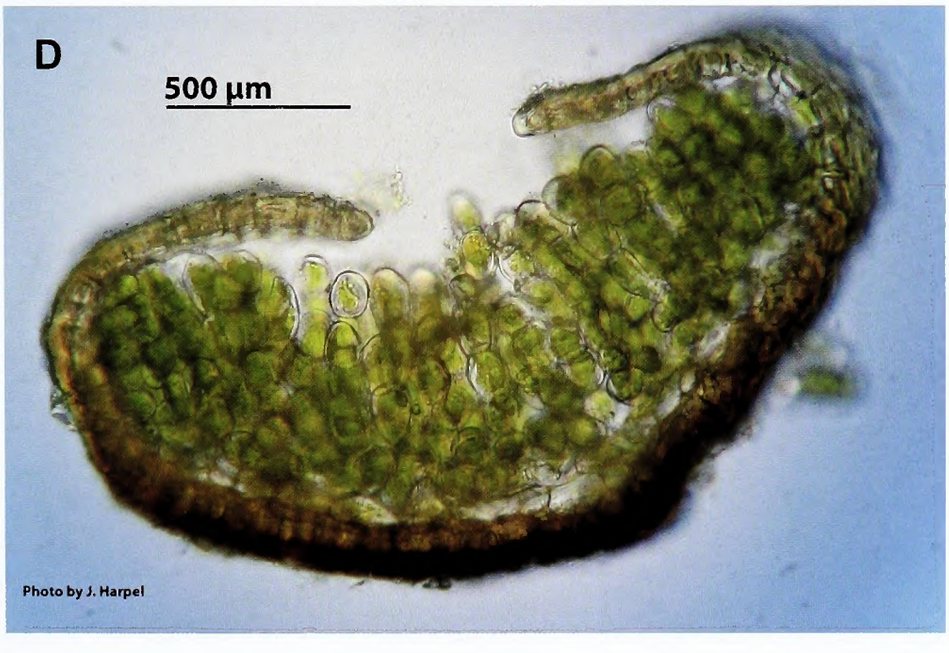
Plate 1. Aloina bifrons. *A. Moist habitat. B. Dry habitat. C. Individual plants. D. Leaf cross-section. E–F. Leaves. (T. McIntosh 4. UBC)*


A
2 mm
Photo by J. Harpel


B
2 mm


C
Photo by J. Harpel
1mm


E
500 µm
Photo by J. Harpel


D
500 µm
Photo by J. Harpel


F
500 µm
Photo by J. Harpel

Andreaea nivalis Hooker

Recent synonyms:

Andreaea baileyi (Holzinger) Holzinger

Andreaea macounii Kindberg

Common names: granite moss, lantern moss

Summary — An acrocarpous, costate, papillose moss with lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Andreaea nivalis* can be distinguished by its (1) unique capsules opening by four vertical valves, (2) strong costa, (3) distinctly crenulate to strongly denticulate leaf margin, and (4) laminal papillae.

Technical description

GAMETOPHYTE — **Plants** formng small tufts, reddish-brown to greenish-brown. **Leaves** falcate to secund-falcate, ovate-lanceolate to lanceolate, 0.6–1.5 mm long, median cells quadrate to short-rectangular, unistratose, papillose, 7–10 µm in diameter, costa strong, percurrent, margins crenulate to strongly denticulate. **Dioicous**. Perichaetial leaves similar to the vegetative leaves but sometimes slightly larger.

SPOROPHYTE — **Seta** lacking, present as a pseudopodium. **Capsules** immersed to emergent, reddish-brown to blackish, up to 0.9 mm long when closed, opening by 4–6 longitudinal slits; calyptra tiny, campanulate-mitrate; peristome and operculum absent. **Spores** (18–) 20–30 (–40) µm.

Similar species — *Andreaea blyttii*, *A. rothii*, and *A. schofieldiana* are similar species with a costa, but they have smooth leaf cells and lack the denticulate leaf margins that characterize *A. nivalis*. *Andreaea rupestris* is similar but lacks a costa.

Ecology — *Andreaea* is placed in its own class (Andreaeopsida) based on its unique morphology. The thalloid protonema, four-valved capsule, and haploid pseudopodium separate it from the Bryopsida. According to Schofield (1985), *Andreaea* evolved independently from the rest of the bryophytes. The longitudinal valves on the capsule bulge open when dry, often appearing as a small birdcage or lantern, and close when wet. *Andreaea nivalis* forms reddish-brown mats on damp boulders in streamlet gullies, exposed rock outcrops, boulders next to melting snow, dry cliffs, sandy soil over boulders, and damp cliff faces in alpine to subalpine areas in the Pacific Northwest. Although referred to as a "granite moss," *Andreaea nivalis* often occurs on igneous rocks. It may form large mats or small patches.

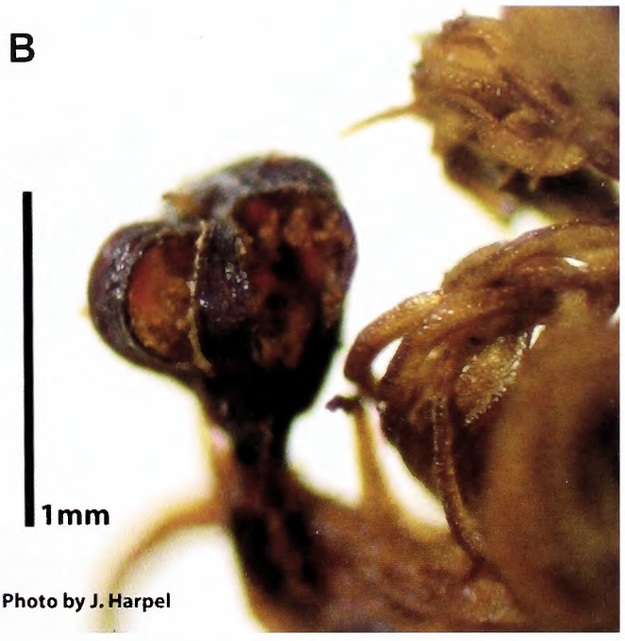
Distribution — *Andreaea nivalis* is known from Eurasia, Greenland, and North America. In western North America, it is known from Alaska south through Yukon, British Columbia, Washington, Oregon, and California. In Oregon, *A. nivalis* is reported from Clackamas and Lane counties within the West Cascades ecoregion.

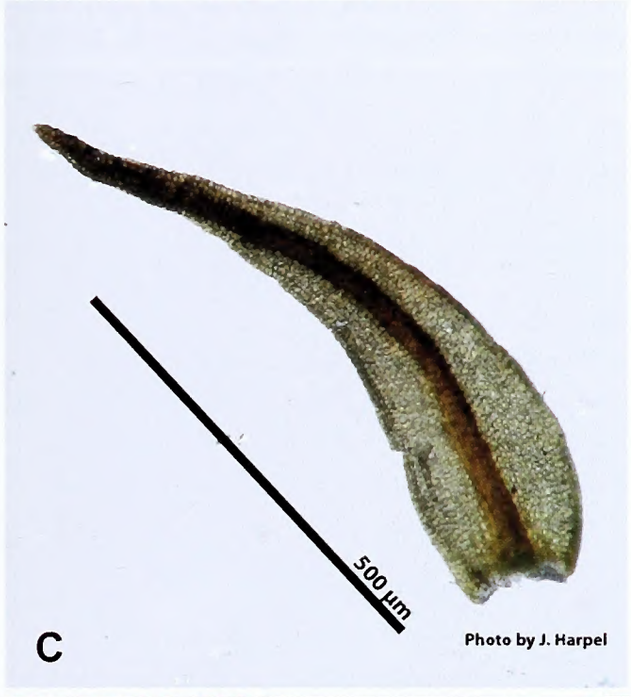
References with descriptions and/or illustrations — Zander (in FNA 2007, p. 105), Lawton (1971, p. 26), Murray (1987).

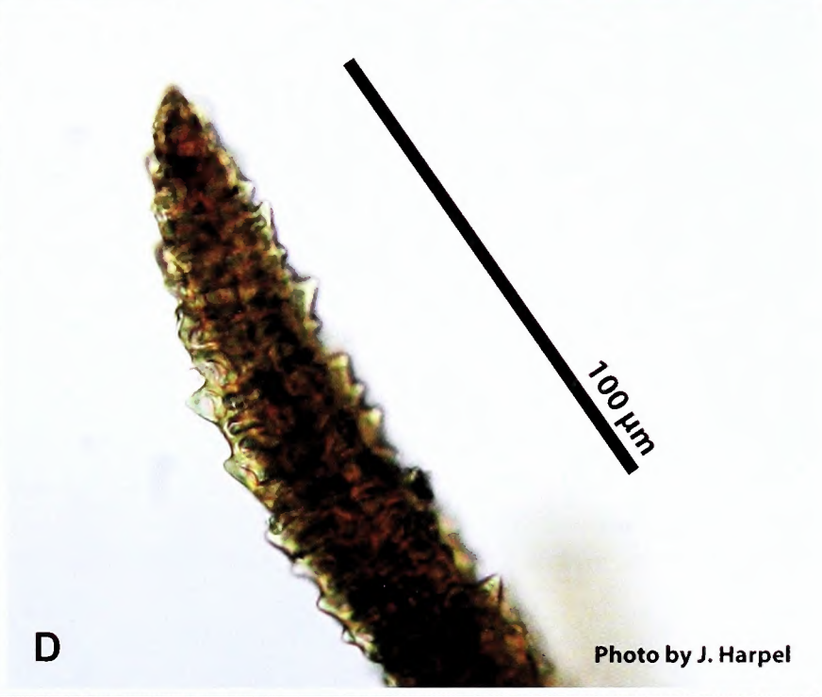
References with photos — Malcolm et al. (2009, p. 29).

Plate 2. Andreaea nivalis. *A. Dry habitat. B. Sporophyte. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Alar and basal cells. (W. Schofield. 14569. 15975. UBC)*

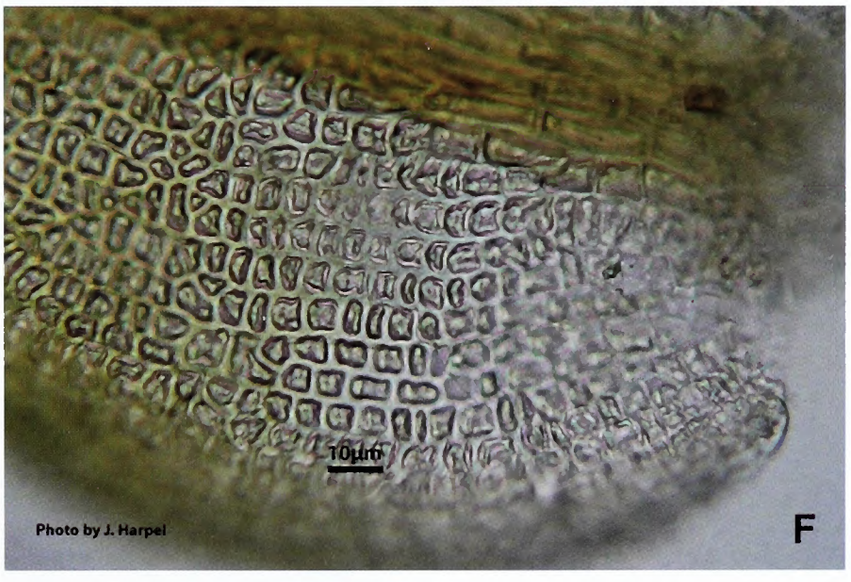

A
2 mm
Photo by J. Harpel


B
1mm
Photo by J. Harpel


500 µm
C
Photo by J. Harpel


100 µm
D
Photo by J. Harpel


E
10µm
Photo by J. Harpel


10µm
Photo by J. Harpel
F

Andreaea schofieldiana B.M. Murray

Recent synonyms: None
Common names: broad-leaved lantern moss, Schofield's black moss, Schofield's andreaea moss

Summary — An acrocarpous, costate moss with lanceolate leaves lacking papillae. Terrestrial.

Diagnostic characteristics — *Andreaea schofieldiana* can be distinguished by its (1) unique capsules opening by four vertical valves, (2) flattened leaves with blades visible on either side of a well-defined costa, (3) lack of papillae, (4) small spores (20–30 (–36) µm), and (5) alpine habitat.

Technical description

GAMETOPHYTE — **Plants** erect, rarely over 1 cm tall, dark reddish-brown to blackish. **Leaves** lanceolate, 2–2.5 mm long, brittle, costate, imbricate when dry, sometimes curved (falcate) at the tips of shoots, broad enough at the back to show a portion of the blade on each side of the well-defined costa. Leaf margins entire or finely toothed (crenulate) toward the tips due to projecting cells. Upper medial cells are rounded-quadrate, bistratose, becoming unistratose toward the leaf margins or sometimes unistratose throughout; papillae lacking; basal laminal cells rectangular to short-rectangular, usually sinuose, slightly pitted. **Cladautoicous**.

SPOROPHYTE — **Seta** lacking, present as a pseudopodium. **Capsules** open by four vertical valves, the urn shrinking vertically when dry to resemble a Chinese or Japanese paper lantern. **Spores** 20–30 (–36) µm.

Similar species — *Andreaea rothii* and *A. megistospora* are similar but have larger spores (30–) 35–50 (–60) µm and (40–) 50–90 (–110) µm, respectively. *Andreaea nivalis* has papillose cells and toothed leaf margins.

Ecology — *Andreaea schofieldiana* forms mats on dry and exposed moist, shaded igneous rocks, montane to subalpine. Associated vascular plant species include; rock garden genera such as *Saxifraga, Sedum, Selaginella*; the liverwort *Gymnomitrion,* and mosses such as: *Amphidium californicum, Bartramia ithyphylla, Grimmia ramondii, Grimmia torquata,* and *Racomitrium elongatum*. Plant associations include *Abies amabilis, Abies lasiocarpa, Abies procera, Pseudotsuga menziesii, Tsuga heterophylla, Tsuga mertensiana*, and *Picea breweriana*. See *Andreaea nivalis* for additional information on Andreaeopsida.

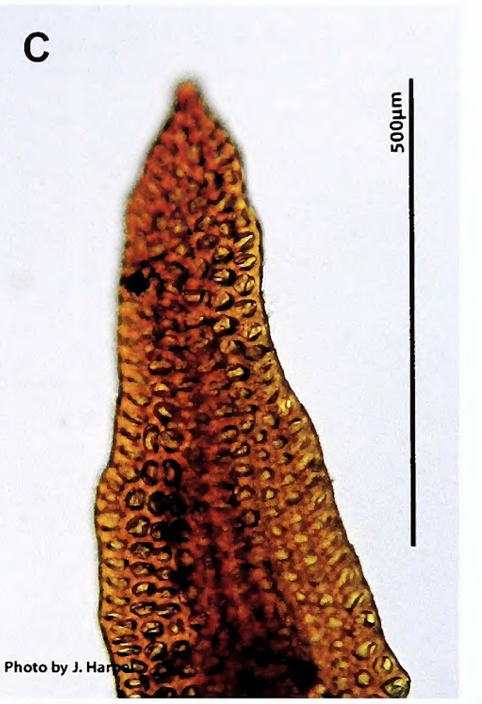
Distribution — *Andreaea schofieldiana* is endemic to western North America. It is known from British Columbia, Washington, Oregon and California. In Oregon, *A. schofieldiana* is reported from Curry and Linn counties within the Klamath Mountain and West Cascades ecoregions.

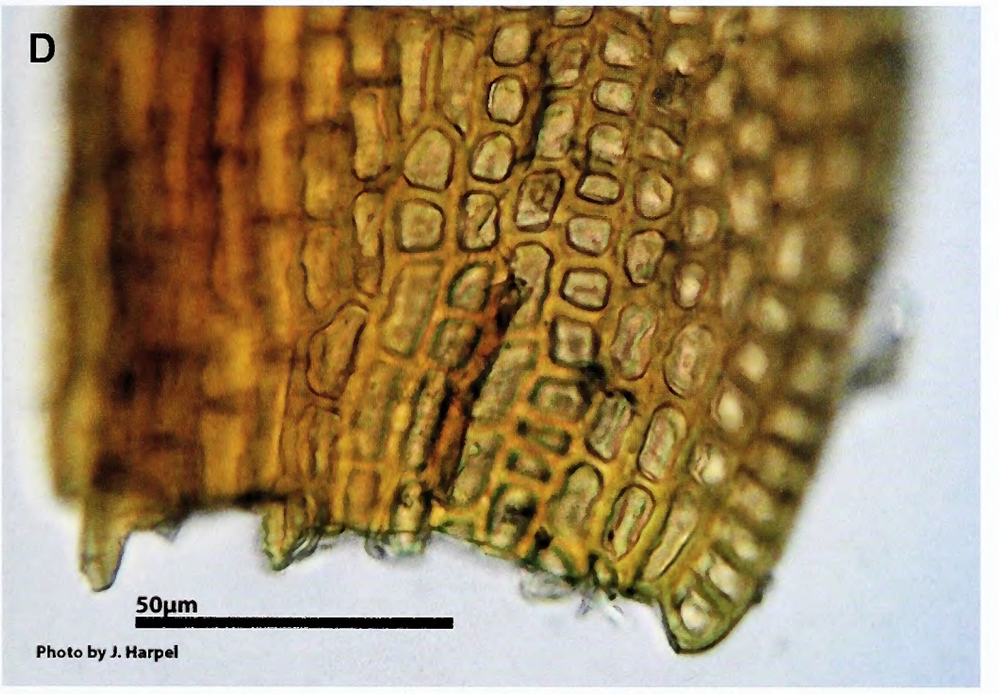
References with descriptions and/or illustrations — Zander (in FNA 2007a, p. 107), Christy and Wagner (1996, part VII, p. 1), Murray (1987a, p. 16).

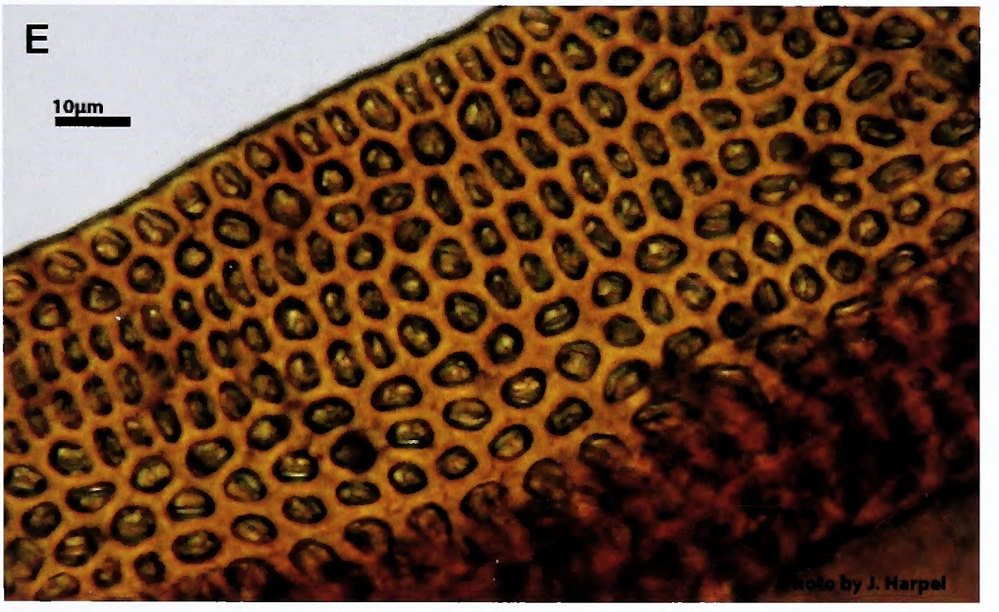
Plate 3. Andreaea schofieldiana. *A. Individual plant. B. Leaf. C. Leaf apex. D. Alar and basal cells. E. Upper medial cells. (W. Schofield 12555. UBC)*


A
2 mm
Photo by J. Harpel


B
1 mm
Photo by J. Harpel


C
500µm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


E
10µm
Photo by J. Harpel

Anoectangium aestivum (Hedwig) Mitten

Recent synonym: *Gymnostomum aestivum* Hedwig
Common name: summer moss

Taxonomic note: Arizona specimens with blunt leaves have been named *A. euchloron*, representing a morphologically somewhat intergrading, wide-ranging variant.

Summary — An acrocarpous, costate moss with oblong-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Anoectangium aestivum* is characterized by its (1) leaves with dense multifid or occasionally bifid papillae obscuring the cell lumens, (2) crisped leaves when dry, (3) lack of gemmae, (4) percurrent costa ending in a sharp cell, (5) leaves distant on the stem, and (6) costa with one stereid band.

Technical description

GAMETOPHYTE — **Plants** green to dark green in dense tufts or cushions, often appearing brownish below from rhizoids. **Leaves** oblong-lanceolate, 1–2 mm long, acute usually apiculate or mucronate with 1–3 clear cells, or sometimes broadly acute, incurved and twisted when dry, wide spreading and recurved when wet; median cells quadrate to hexagonal to rounded-hexagonal, 6–9 µm, densely covered with 1–4 low papillae; basal cells short-rectangular, smooth, thick-walled, yellowish; costa ending before the apex, with a single dorsal stereid band; margins plane or crenulate above by projecting cells or papillae. Dorsal laminal cells turn a strong orange color in 2 percent KOH. **Dioicous**. Perichaetia are located on lateral stems, leaves up to 1 mm with smooth cells.

SPOROPHYTE — **Seta** 5–10 mm long, straight or flexuous. **Capsules** ovoid to elliptical with a short neck, 0.5–1.5 mm long; operculum long-rostrate with cells in straight rows; calyptra long, cucullate, smooth. **Spores** 9–12 µm.

Similar species — *Hymenostylium* has similar but shallow keeled leaves with elongate cells on the ventral surface, terminal perichaetia, lacks a stem central strand, and medial laminal cells are commonly longitudinally elongated. *Amphidium* species are similar in appearance but are autoicous or papillae are simple and elliptical and the stem lacks a central strand. *Anoectangium handelii* has abundant gemmae. *Anoectangium stracheyanum* has dense leaves obscuring the stem and an excurrent costa.

Ecology — *Anoectangium aestivum* occurs on moist cliffs, humid cliff crevices, and overhanging rocks (acid and basic). According to Schofield (1968) this species occurs from near sea level to subalpine areas and is found mostly in coastal areas, although it is known from scattered locations in interior British Columbia.

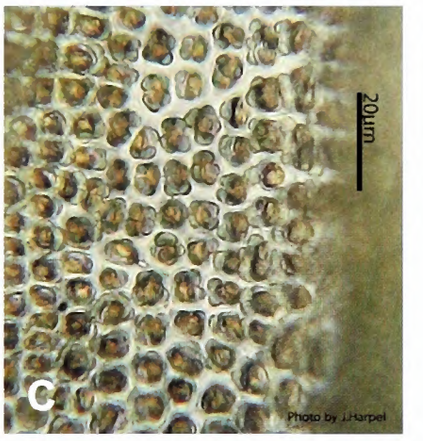
Distribution — *Anoectangium aestivum* is known from Eurasia, Africa, Greenland, North America, Central and South America, and New Zealand. In western North America, it is known from Alaska, Washington, Oregon, Arizona, and Colorado. In Oregon, *A. aestivum* is reported from Grant, Jackson, Josephine, and Union counties within the Klamath Mountain and Blue Mountain ecoregions.

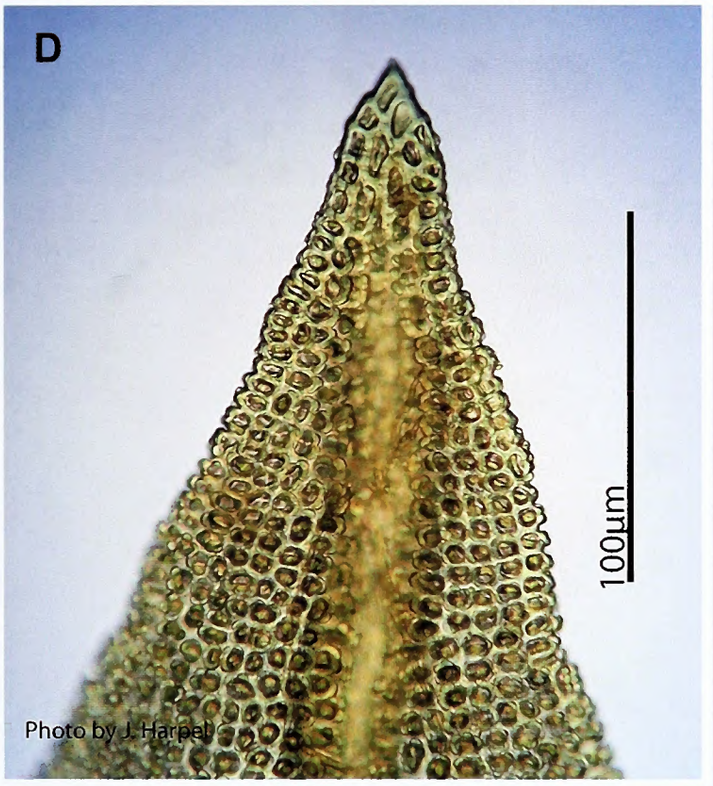
References with descriptions and/or illustrations — Zander and Eckel (in FNA 2007, p. 522), Sharp et al. (1994, p. 257), Zander (1993, p. 137), Crum and Anderson (1981, p. 271), Zander (1977), Lawton (1971, p. 87).

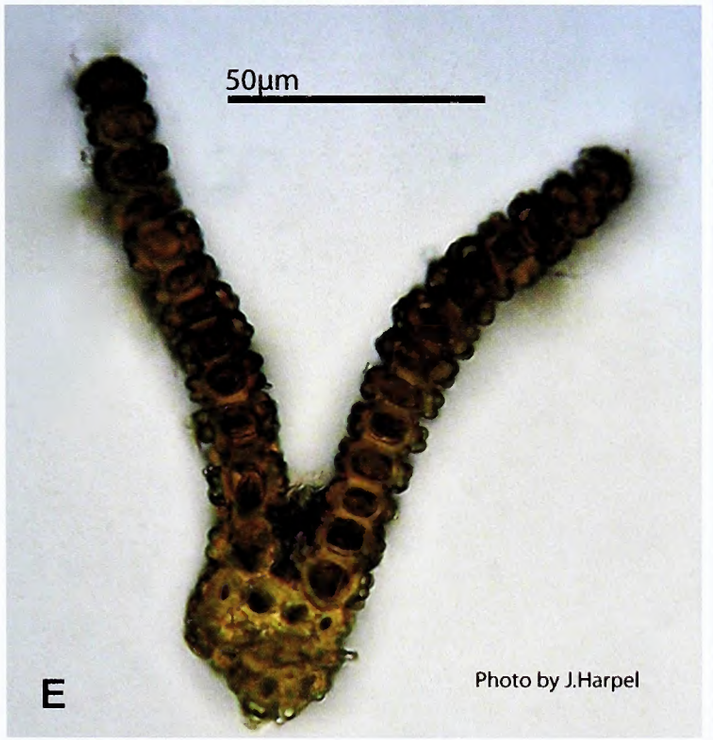
Plate 4. Anoectangium aestivum. *A. Moist habitat. B. Dry habitat. C. Upper medial cells. D. Leaf apex. E. Leaf cross-section. F. Leaf. (W. Schofield. 127124. UBC)*


3 mm
A
Photo by J.Harpel


B
3 mm
Photo by J.Harpel


20µm
C
Photo by J.Harpel


D
100µm
Photo by J. Harpel


50µm
E
Photo by J.Harpel


F
1 mm
Photo by J.Harpel

Anomobryum julaceum (Schrader) Schimper

Recent synonyms:

Anomobryum filiforme (Griffith) A. Jaeger
Pohlia filiformis (Dickerson) Andrews
Bryum julaceum Schrader

Common name: anomobryum moss

Summary — An acrocarpous, costate moss with ovate leaves. Terrestrial.

Diagnostic characteristics — *Anomobryum julaceum* is distinguished by its (1) small size, (2) shiny, yellowish-green plant, (3) strongly julaceous habit with small imbricate leaves, (4) broadly obtuse and concave leaves, (5) weak evanescent costa, and (6) nodding capsule with a well-developed peristome.

Technical description

GAMETOPHYTE — **Plants** small, slender, julaceous, yellowish to pale-green, often whitish-green, forming dense somewhat shiny tufts that are occasionally branched. **Stems** reddish. **Leaves** ovate or oblong-ovate, obtuse, concave, not decurrent, 0.5–1.5 mm long; margins plane, entire or sometimes slightly serrate at the apex; costa strong, percurrent; upper median cells oblong-rhomboidal more or less thick walled. **Dioicous.**

SPOROPHYTE — **Seta** up to 2 cm long, flexuose. **Capsules** 1–2 mm, oblong-cylindric; peristome double; endostome with appendiculate cilia. **Spores** 8–13 µm.

Similar species — *Anomobryum julaceum* is distinguished from *Bryum argenteum* by the strongly julaceous, shiny green or yellowish leaves with occasional branches. *Bryum argenteum* shoots are never branched. *Anomobryum concinnatum* has an erect capsule and a strongly reduced single peristome. It is weakly julaceous, has a percurrent to short-excurrent costa and often has leaf axil bulbils.

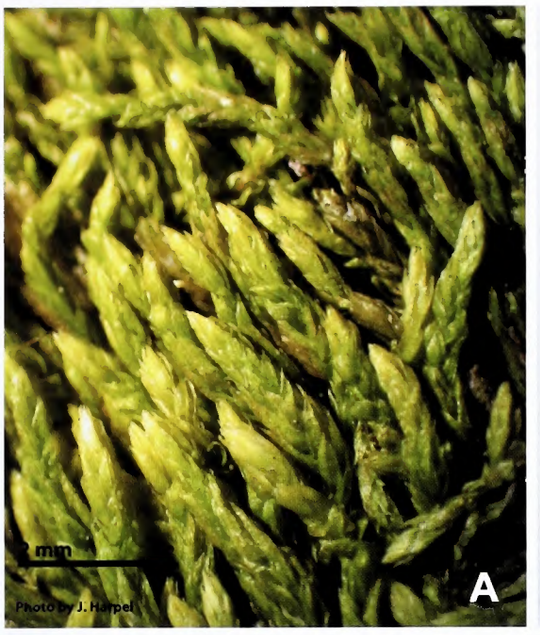
Ecology — On Saddle Mountain (Clatsop County, Oregon), *A. julaceum* occurs on a damp outcrop along a trail. Additional habitats include cliff crevices, tussock tundra with seeps and late snow melt areas, and granitic outcrops. In eastern North America, the moss appears to be restricted to acid habitats in wet crevices of sandstone cliffs or other seepy niches.

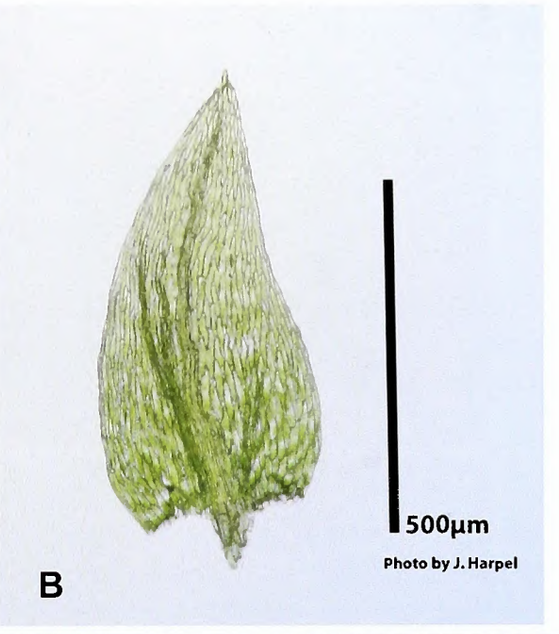
Distribution — *Anomobryum julaceum* is known from Eurasia, Africa, Greenland, North America, Central and South America. In western North America, it is known from Alaska, Northwest Territories, Yukon, British Columbia, Alberta, Oregon, California, Mexico, and Colorado. In Oregon, *A. julaceum* is reported from Baker and Clatsop counties within the Blue Mountain and Coast Range ecoregions.

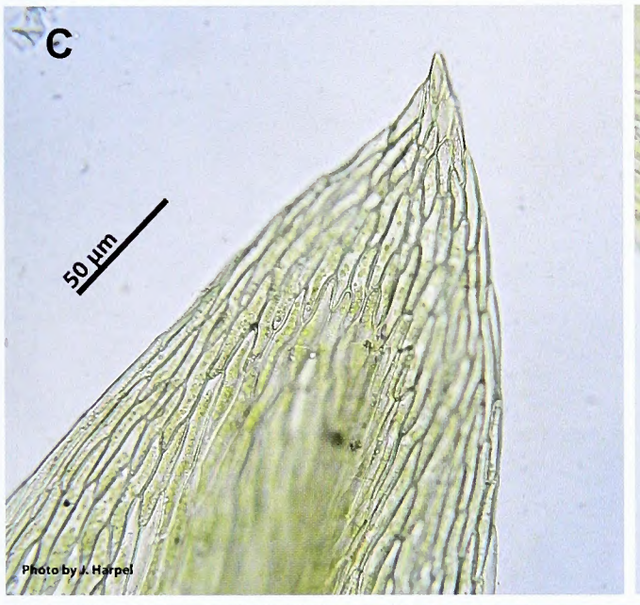
References with descriptions and/or illustrations — Spence (in FNA 2014, p. 121), Noguchi (1988, as *A. filiforme*), Ireland (1982, as *Pohlia filiformis*), Crum and Anderson (1981, p. 513 as *P. filiformis*), Lawton (1971, p. 185, as *P. filiformis*), Nyholm (1958, p. 213), Grout (1935, p. 205 as *P. filiformis*).

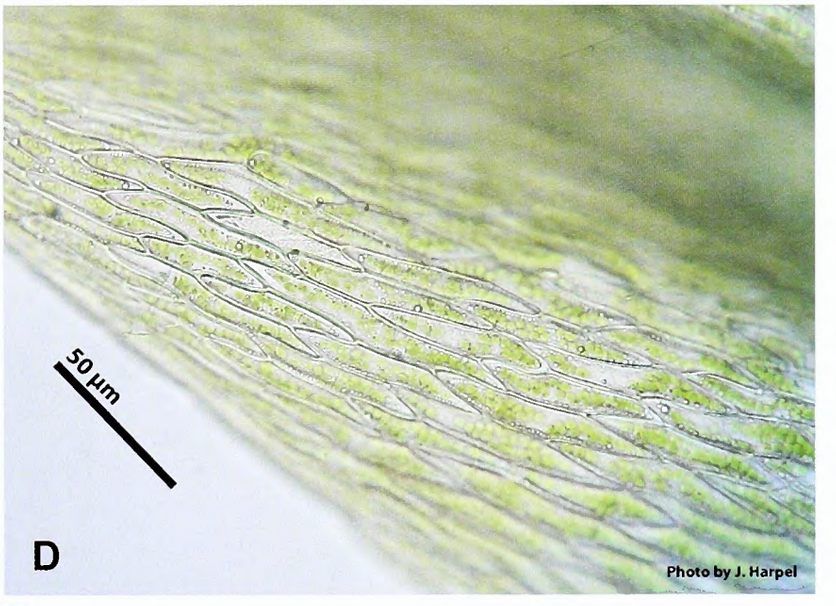
References with photos — Atherton et al. (2010, p. 579), Malcolm et al. (2009. p. 165).

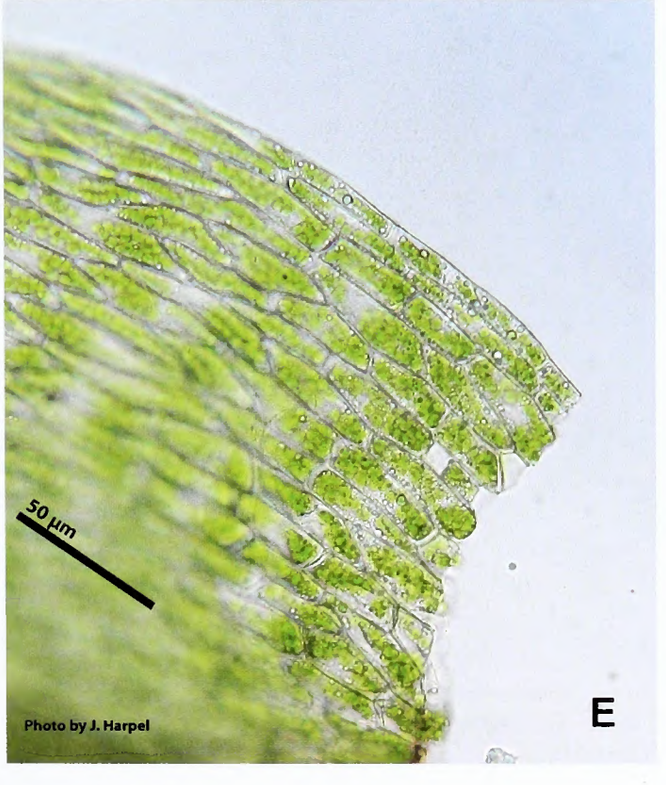
Plate 5. Anomobryum julaceum. *A. Habitat. B. Leaf. C. Leaf apex. D. Upper medial cells. E. Basal cells. (D. Wagner 8179. OSU)*


1 mm
A
Photo by J. Harpel


500µm
B
Photo by J. Harpel


C
50 µm
Photo by J. Harpel


50 µm
D
Photo by J. Harpel


50 µm
Photo by J. Harpel
E

Barbula unguiculata Hedwig

Recent synonym: *Barbula unguiculata* var. *apiculata* (Hedwig) Bruch et al.
Common name: bird's-claw beard-moss

Summary — An acrocarpous costate moss with oblong-lanceolate to ligulate leaves. Terrestrial.

Diagnostic characteristics — *Barbula unguiculata* is distinguished by its (1) light to dull dark green overall appearance, (2) obtuse to broadly acute leaves, (3) recurved leaf margin, (4) red to brown colored setae, (5) exserted capsules, and (6) long and twisted peristome teeth.

Technical description

GAMETOPHYTE — **Plants** in green to dark green tufts. **Stems** 0.5–1.5 cm. **Leaves** 1–2.5 mm long, oblong to lingulate, broader at the base, obtuse or sometimes apiculate, contorted when dry; margins reeurved in the lower 1/2 to 2/3, rarely to near the apex or plane; apex rounded; costa excurrent, more or less mucronate, dorsal costal surface with scattered papillae; upper medial cells quadrate, somewhat thickened, 8–12 µm wide, 1:1, papillose. Gemmae absent. Perichaetial leaves weakly differentiated. **Dioicous**.

SPOROPHYTE — **Seta** 1–2.5 cm, reddish-brown. **Capsules** ovoid to cylindric, 1.6–2 mm long, erect or nearly so; operculum about 1.2 mm long; annulus wanting; peristome teeth long and twisted. **Spores** 8–11 µm.

Similar species —*Barbula unguiculata* plants with strongly mucronate leaf apices have been referred to var. *apiculata,* although modern authorities generally treat this as a form. *Barbula indica,* which is often confused with *B. unguiculata*, differs in having conduplicate leaves that are not contorted when dry; it has plane or weakly recurved leaf margins and the dorsal surface of the costa is prorate. *Barbula convoluta* is similar but has plane margins and a costa that is not excurrent as a mucro and yellow setae.

The genus *Didymodon* is similar and distinguished by its usually lanceolate to long-lanceolate leaves, axillary hairs with 1 or more brown basal cells and basal laminal cells usually little differentiated from the upper quadrate dorsal costal cells, laminal papillae either lacking or simple to only occasionally multiplex, smaller (1–10 celled) gemmae, and peristome teeth seldom twisted or occasionally absent or rudimentary.

Ecology — *Barbula unguiculata* is known from soil, sand, gravel, sandstone, granite, limestone, walls, roadeuts, paths, lawns, and ditches, usually in calcareous regions and from low to high (150–8,100 foot) elevations. *Barbula unguiculata* capsules mature in winter and early spring, but occasionally in summer or fall.

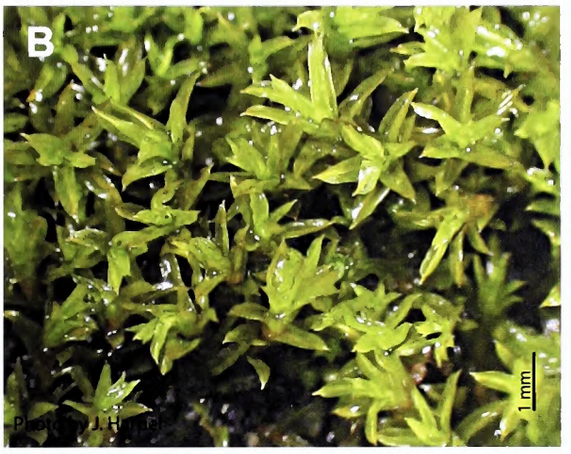
Distribution — *Barbula unguiculata* is known from Eurasia, Africa, North America, Central and South America, and Australia. It is common in eastern North America, Europe, and elsewhere in the North and South Temperate zones. In western North America, it is known from most Canadian provinces and the United States with the exception of Nevada. In Oregon, *B. unguiculata* is reported from Lane County within the Willamette Valley ecoregion.

References with descriptions and/or illustrations — Zander (in FNA 2007b, p. 529), Flowers (1973, p. 154), Lawton (1971, p. 92), Nyholm (1956, p. 115).

References with photos — Atherton et al. (2010, p. 455), Porley (2008, p. 72).

Plate 6. Barbula unguiculata. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Alar and basal cells. G. Leaf cross-section. H–I. sporophytes. (S. Joya sn. Harpel Private)*

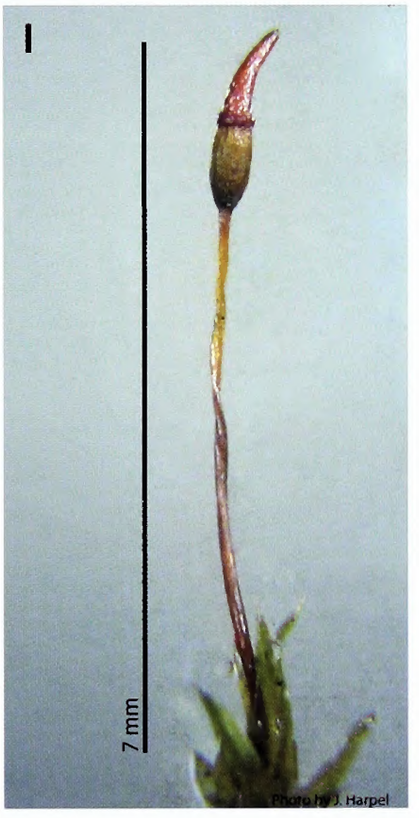

2 mm
A
Photo by J. Harpel

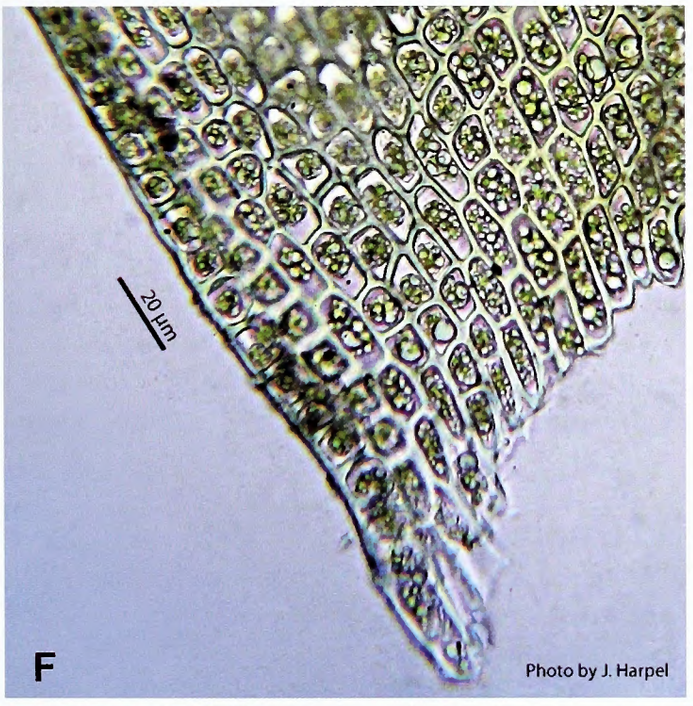

B
1 mm

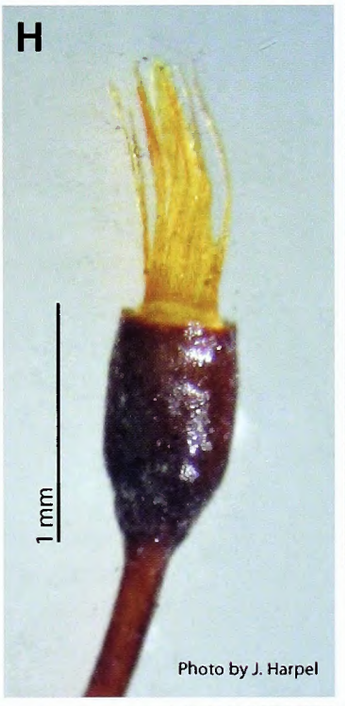

C
700µm
Photo by J. Harpel


D
50 µm


E
20 µm
Photo by J. Harpel


I
7 mm
Photo by J. Harpel


20 µm
F
Photo by J. Harpel


H
1 mm
Photo by J. Harpel


G
200 µm
Photo by J. Harpel

Brachydontium olympicum (Britton) T.T. McIntosh & J.R. Spence

Recent synonyms:

Grimmia olympica E. Britton

Brachydontium polycarpum H. Akiyama

Common name: Olympic brachydontium moss

Taxonomic note: McIntosh and Spence (1986) transferred this taxon from *Grimmia* (Grimmiaceae) to *Brachydontium* (Seligeriaceae). Iwatsuki et al. (2004) reported that *Brachydontium polycarpum* from Japan is identical to *B. olympicum* from the Pacific Northwest. The name *Brachydontium olympicum* has priority over *B. polycarpum*.

Summary — An acrocarpous costate moss with lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Brachydontium olympicum* can be distinguished by its (1) tiny size, (2) olive-green to brownish color, (3) subulate blunt-tipped leaves that have incurved margins and bistratose isodiametric cells in the upper half, (4) short (0.5–2 mm) and usually twisted arcuate setae, (5) globose, ribbed capsules that lack a peristome, (6) mitrate calyptra, and (7) habitat on acidic rock (often volcanic) at high elevations.

Technical description

Gametophyte — **Plants** tiny, 2–5 mm tall, green to brownish, sometimes branched. **Leaves** 1–2.5 mm long, erect-spreading, more or less curved in the same direction (secund) when moist to slightly contorted when dry, lanceolate or subulate, concave, the tips blunt; basal cells rectangular and thin-walled; upper cells mostly rounded-quadrate and 1:1 or occasionally 2:1 and thick-walled, usually bistratose in upper half; walls between the cells often bulging; the entire margins sometime incurved near the tips; costa strong. **Dioicous.**

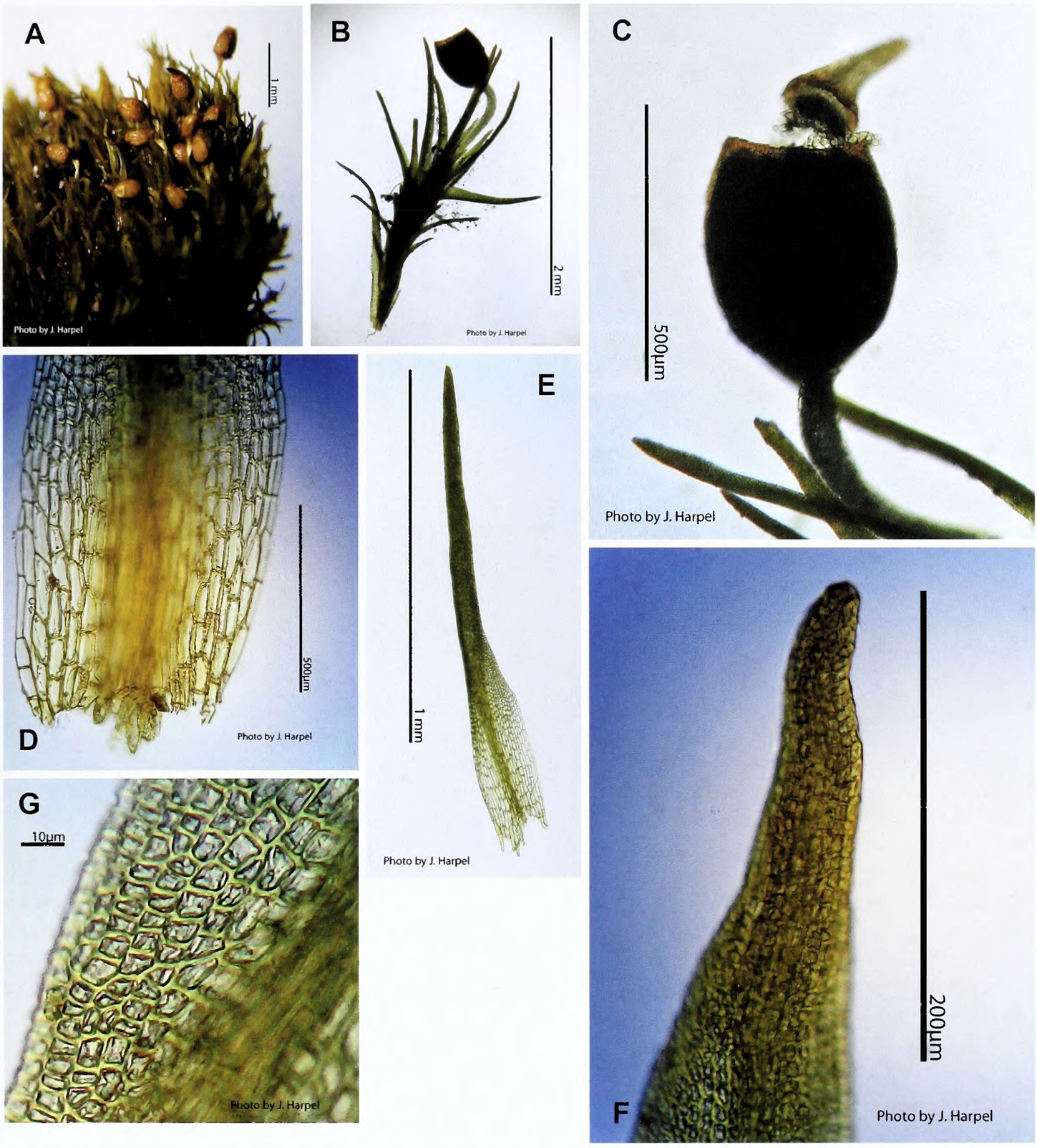
Sporophyte — **Seta** 0.5–2 mm long, twisted counterclockwise and curved when dry. **Capsules** brown, immersed in the leaves to shortly exserted, spherical or shortly ovate, 0.4–1 mm long, ribbed or wrinkled when dry; operculum with a beak, peristome absent. **Spores** 6–10 μm.

Similar species — *Brachydontium trichodes* is similar but is only 1.2 mm tall, has distal leaf cells that are short-rectangular to rhombic and 16 short peristome teeth. *Blindia* and *Seligeria* species have smooth capsules and all but *Seligeria donniana* have a peristome. In addition, *Brachydontium* has mitrate calyptras while *Blindia* and *Seligeria* have cucullate calyptras.

Ecology — *Brachydontium olympicum* forms loose mats on exposed acidic boulders or soil in rock crevices or at the base of boulders in subalpine to alpine habitats at 5,000–6,000 foot elevations. It is often associated with boulder fields, moraines, and cliff ledges in late snowmelt areas. On Oregon's Mt. Hood, *B. olympicum* occurs at about 6,000 ft above timberline and may be associated with *Cassiope mertensiana* and *Phyllodoce empetriformis*. Elsewhere in western North America, *Brachydontium olympicum* is suspected in *Abies amabilis*, *Abies lasiocarpa*, *Pinus albicaulis* and *Tsuga mertensiana* associations.

Distribution — *Brachydontium olympicum* is known from Japan and North America. In western North America, it is known from Alaska, British Columbia, Washington, and Oregon. In Oregon, *B. olympicum* is reported from Clackamas County within the West Cascades ecoregion.

Plate 7. Brachydontium olympicum. *A. Moist habitat. B. Individual plant. C. Sporophyte. D. Alar and basal cells. E. Leaf. F. Leaf apex. G. Upper medial cells. (E. Lawton 4794. WTU)*


A
1 mm
Photo by J. Harpel
B
2 mm
Photo by J. Harpel
C
500µm
Photo by J. Harpel
D
500µm
Photo by J. Harpel
E
1 mm
Photo by J. Harpel
F
200µm
Photo by J. Harpel
G
10µm
Photo by J. Harpel

References with descriptions and/or illustrations — Vitt and Spence (in FNA 2007, p. 328), Iwatsuki et al. (2004), Noguchi (1988, p. 333, as *Grimmia olympica*), McIntosh and Spence (1986, p. 200), Lawton (1971, p. 130, as *G. olympica*), Jones (1933, p. 26, as *G. olympica*), Frye (1910, as *G. olympica*).

Bruchia bolanderi Lesquereux

Recent synonym: none
Common names: Bolander's pygmy moss, Bolander's candle moss

Summary — An acrocarpous, costate moss with lanceolate to lanceolate-subulate leaves. Terrestrial.

Diagnostic characteristics — *Bruchia bolanderi* can be distinguished by its (1) cylindric cleistocarpus capsule with a long seta, (2) long neck, (3) warty spores, and (4) ephemeral habit.

Technical description

GAMETOPHYTE — **Plants** small, ephemeral, approximately 5.1–12.0 mm long, including sporophytes. **Leaves** lanceolate to lanceolate-subulate, 1.1–2.8 mm long, 0.2–0.6 mm wide, with poorly defined shoulder regions; margins entire, sometimes serrulate at the apex; costa percurrent; upper median cells linear-oblong, thin-walled, 35–65 µm long, 10–17 µm wide. **Autoicous**.

SPOROPHYTE — **Seta** (1.5–) 3–7 mm long. **Capsules** cleistocarpus, cylindric with an elongated neck. **Spores** 24–30 µm, warted.

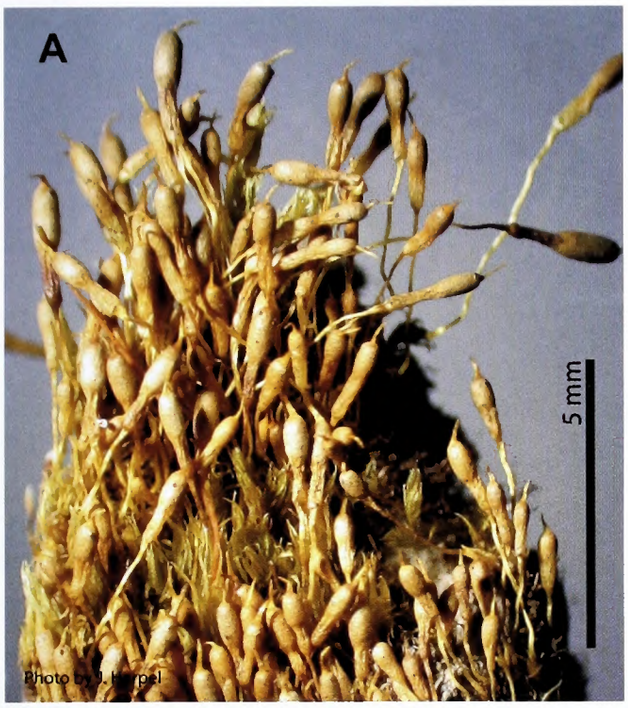
Similar species — *Bruchia bolanderi* can be separated from other *Bruchia* species by the long setae, warty spores, short distal leaves, and ovate to oblong leaf bases. According to Rushing (1985) spinose spores separate *Bruchia flexuosa* from *B. bolanderi*. *Trematodon* has a long exserted stegocarpous capsules and a conic to long-cylindric neck. *Voitia nivalis* has a cleistocarpous capsule but lacks a hypophysis. Small, sterile species of *Bryum* may also be confused with *B. bolanderi*.

Ecology — *Bruchia bolanderi* occurs on disturbed moist organic soil along roadside ditches and fallow fields. In Oregon, *B. bolanderi* occurs in the subalpine zone and within montane meadows and stream banks in the Cascade Mountain Range between 3,500 and 5,000 feet in elevation. *Bruchia bolanderi* is also documented on soil in a mixed coniferous forest (*Abies concolor*, *Pinus contorta*, *Tsuga heterophylla*) and on roots of a fallen tree near a swampy lake. In the Blue Mountains, *Bruchia bolanderi* is known from wet meadows at elevations around 5,000–6,640 feet.

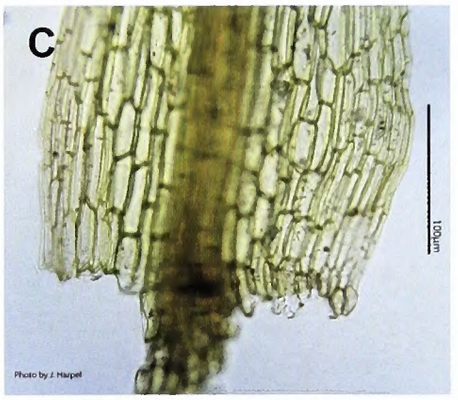
Bruchia bolanderi has a short ephemeral life cycle. Spores generally germinate in the fall and develop over the winter. Sporophytes mature in early spring; after spore dispersal, the entire plants wither and are gone by midsummer. Because *Bruchia* does not compete well with other plants, it may be that some disturbance provides suitable substratum for successful spore growth and development. Bliss and Linn (1955) suggest that *Bruchia* species may serve as pioneers in old-field succession.

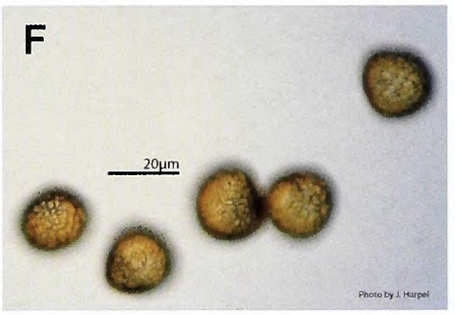
Distribution — *Bruchia bolanderi* is a western North American endemic known from California and Oregon. In Oregon, *B. bolanderi* is reported from Clackamas, Deschutes, Klamath, Lane, and Union counties within the Blue Mountain and West Cascades ecoregions.

Plate 8. Bruchia bolanderi. *A. Habitat. B. Leaf. C. Alar and basal cells. D. Calyptra. E. Leaf apex. F. Spores. G–H. Sporophytes. (A. Chambers 88. UBC)*


A
5 mm
Photo by J. Harpel

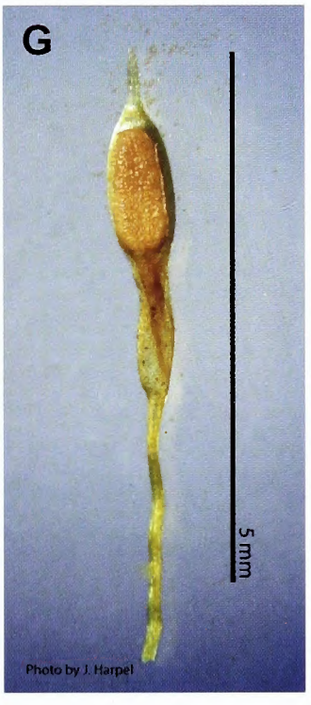

B
1 mm
Photo by J. Harpel

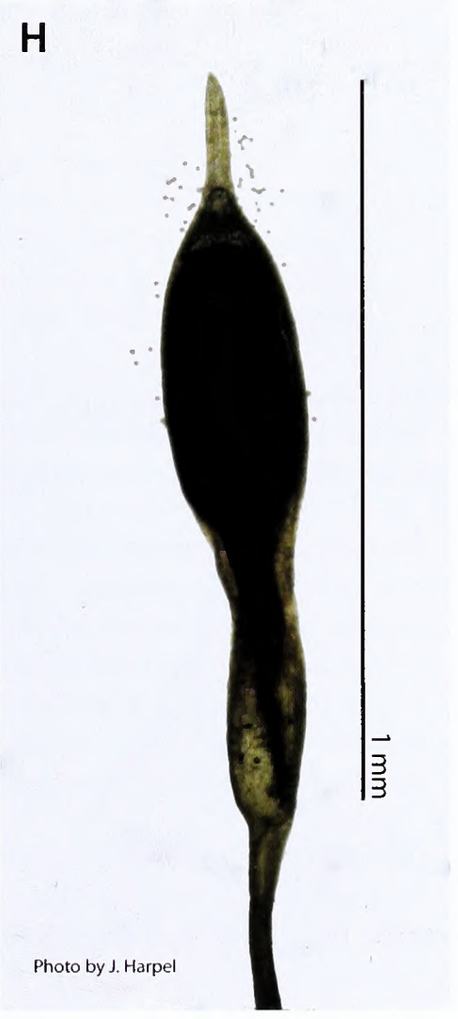

C
100µm
Photo by J. Harpel


F
20µm
Photo by J. Harpel


D
90µm
Photo by J. Harpel


E
300µm
Photo by J. Harpel


G
5 mm
Photo by J. Harpel


H
1 mm
Photo by J. Harpel

References with descriptions and/or illustrations — Zander (in FNA, 2007c, p. 434), Rushing (1985, 1986), Grout (1936, p. 37).

References with photos — Malcolm et al. (2009, p. 95).

Bruchia flexuosa (Schwägrichen) Müller Hal.

Recent synonym: none
Common names: pygmy moss, bruchia moss

Summary — An acrocarpous, costate moss with subulate leaves beyond an ovate base. Terrestrial.

Diagnostic characteristics — *Bruchia flexuosa* is distinguished by its (1) cleistocarpus capsule with an elongated neck, (2) short seta, (3) spinose spores, and (4) ephemeral habit.

Technical description

GAMETOPHYTE — **Plants** green, erect, 1–4 mm tall, stems and capsules together only 2.8–8 mm tall. **Leaves** 0.6–3 mm long, broadly ovate at base but tapering abruptly to a long, narrow, curved or wavy tip; margins entire; costa filling the narrow apex, smooth or roughened on the outer (dorsal) side of the leaf. **Paroicous**.

SPOROPHYTE — **Seta** 0.8–2 mm long, averaging 1.2 mm, usually curved but not twisted below the capsule. **Capsules** partly immersed among the leaves to slightly emergent (the most conspicuous part of the plants), 1–2 mm long, yellow, light brown, beige, or grayish at maturity, shaped like an elongated inverted pear with no obvious area of dehiscence and no peristome, widest near the rounded top, with a long tapering neck. **Spores** spinose, 18–44 μm.

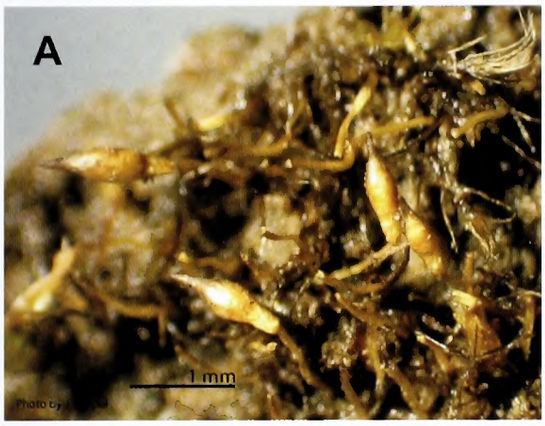
Similar species — *Bruchia bolanderi* has straight setae usually longer than 3 mm and warted spores. In Oregon it occurs at elevations between 3,500 and 6,640 feet. See *Bruchia bolanderi* for additional similar species. Zander (2007c) notes, "*Bruchia flexuosa* is the most widely distributed and most morphologically variable species of the genus."

Ecology — *Bruchia flexuosa* occurs in small clusters in openings among grasses, or forming larger colonies on open expanses of seasonally moist bare soil such as fallow fields or mud flats. In the Pacific Northwest, *B. flexuosa* is known only from native and degraded *Deschampsia* prairie habitats in the Willamette Valley and in mud flats around reservoirs. It is restricted to low elevations of about 500 feet in the interior valleys west of the Cascade Mountain Range. *Bruchia flexuosa* is opportunistic, taking advantage of disturbed sites and minimal competition from other vegetation. Associated bryophyte species include other ephemeral mosses and liverworts such as *Acaulon*, *Ephemerum*, *Phascum*, *Pleuridium*, and *Riccia sorocarpa*. See *Bruchia bolanderi* for similar lifecycles.

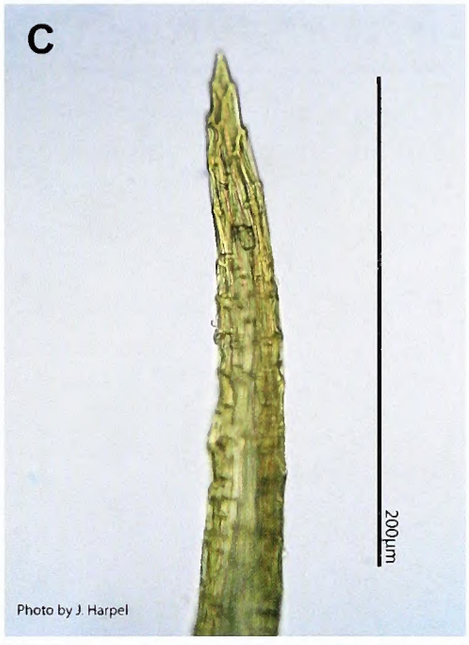
Distribution — *Bruchia flexuosa* is known from North America and Europe. In North America, it is known from most eastern Canadian provinces and U.S. states with disjunct populations in Oregon and California. In Oregon, *B. flexuosa* is reported from Benton and Lane Counties within the Willamette Valley ecoregion.

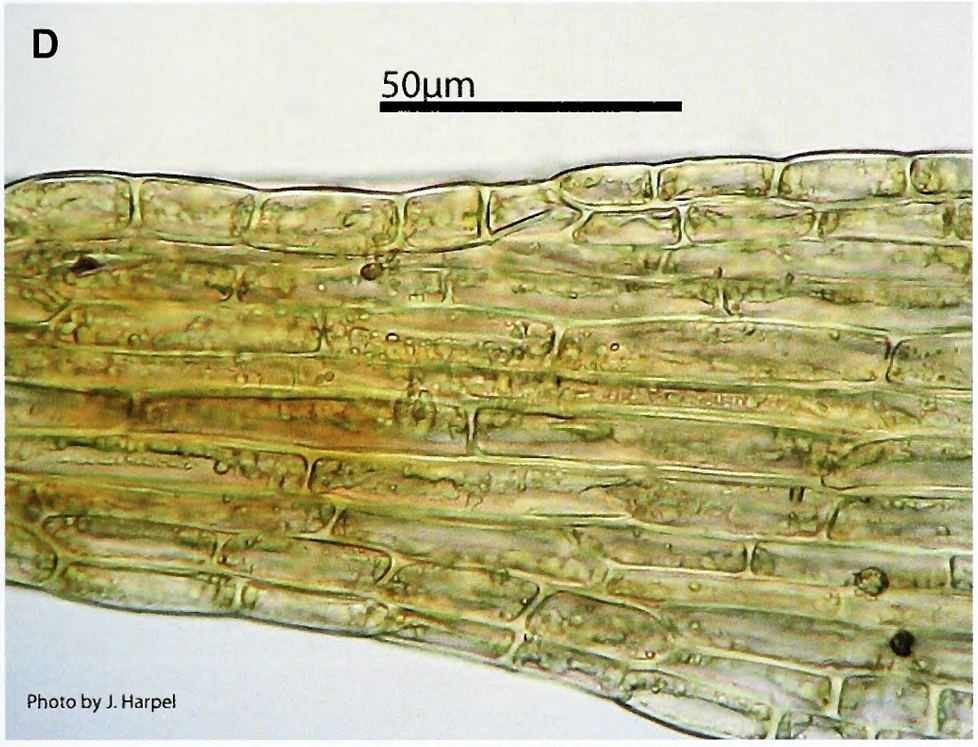
References with descriptions and/or illustrations — Zander (in FNA 2007c, p. 436), Crum (2004, p. 104), Rushing (1986, p. 65), Rushing and Christy (1984), Crum (1983, p. 84), Crum and Anderson (1981, p. 154), Grout (1936, p. 33).

Plate 9. Bruchia flexuosa. *A. Habitat. B. Individual plant. C. Leaf apex. D. Upper medial cells. E. Leaf. F. Alar and basal cells. G. Spores. H. Calyptra. (J. Christy 5517. OSU)*

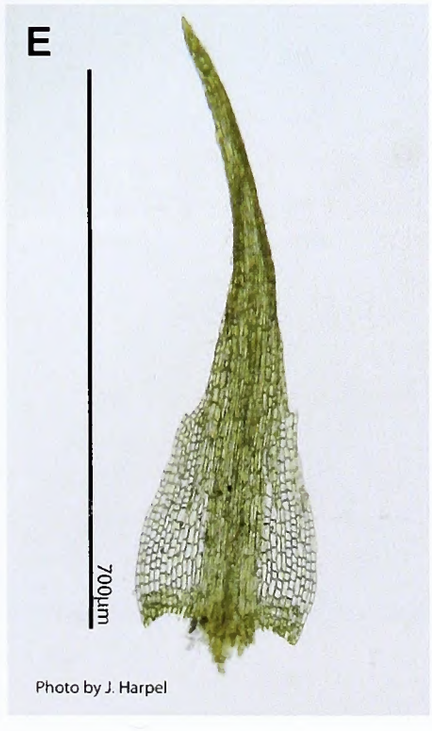

A
1 mm


2 mm
B


C
200µm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


G
30µm
Photo by J. Harpel


E
700µm
Photo by J. Harpel


30µm
F
Photo by J. Harpel


H
500µm
Photo by J. Harpel

Bryoerythrophyllum columbianum (F.J. Hermann & E. Lawton) R.H. Zander

Recent synonym: *Didymodon columbianus* F.J. Hermann & E. Lawton
Common names: Columbian carpet moss, Columbian bryoerythrophyllum moss

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Bryoerythrophyllum columbianum* is distinguished by its (1) erect, imbricate, reddish-brown lanceolate leaves; (2) blunt leaf tips with partially recurved margins; (3) costa expanding distally to fill the leaf acumen; and (4) soil crust habit.

Technical description

Gametophyte — **Plants** forming tufts or sods, 5–20 (–30) mm tall, green to yellowish-green, brownish-red when older. **Stems** 4–9 mm tall. **Leaves** ovate to short ovate-lanceolate, 1–1.6 × 0.3–0.45 mm, tapering from below the middle to an acute apex, composed of elongated cells; margins entire, narrowly recurved to near the apex; costa percurrent or shortly excurrent, wider near the middle of the leaf; upper medial cells 8–15 µm, quadrate to irregular with 1–4 papillae per cell; basal cells quadrate to short-rectangular, thin-walled. Dwarf plants may barely reach 1 mm tall and form sods of erect, imbricate, reddish-brown lanceolate leaves with blunt tips, partially recurved margins and a strong costa on back of leaves. **Dioicous**.

Sporophyte — **Seta** 6–10 mm long, twisted. **Capsules** cylindric, smooth, 1–1.4 mm long, erect and straight, dark brown; operculum conic-rostrate; peristome rudimentary or absent. **Spores** 8–13 µm.

Similar species — *Didymodon brachyphyllus* (= *D. vinealis* var. *brachyphyllus*) has the same reddish-brown color but has deltoid-ovate leaves that are blunt and hooded at the tips (cucullate). It has a longitudinal groove on the ventral side of the costa with the adjacent costal cells quadrate, and a costa that does not expand distally. Other members of *Bryoerythrophyllum* have rounded to narrowly obtuse leaf apices. *Didymodon* leaves are weakly papillose and have a brownish proximal cell in axillary hairs. *Bryoerythrophyllum* and *Pseudocrossidium* leaves are distinctly papillose and all axillary cells are clear. *Pseudocrossidium hornschuchianum* is similar and is distinguished by its narrowly grooved ventral surface of the costa. Distal laminal cells in *Pseudocrossidium* turn yellow to orange in KOH, while the distal laminal cells of *Bryoerythrophyllum* turn brick red in KOH.

Ecology — In the Pacific Northwest, *Bryoerythrophyllum columbianum* is a component of biological soil crusts in arid shrub-steppe and grassland habitats. It occurs as individual plants or forms loose to dense sods over rock, soil, or sand in grassland and sagebrush steppe at elevations below 4,000 feet. Vascular plant associations include *Poa secunda* and *Pseudoroegneria spicata* with varying densities of *Artemisia tridentata* subsp. *wyomingensis*.

Distribution — *Bryoerythrophyllum columbianum* is a western North America endemic, known from British Columbia, Washington, Oregon, California, and Idaho. In Oregon, *B. columbianum* is reported from Morrow, Umatilla, and Wasco Counties within the Columbia Basin and East Cascades ecoregions.

References with descriptions and/or illustrations — Zander (in FNA 2007d, p. 566), McIntosh (2004), Lawton (1971, p. 96, as *Didymodon columbianus*), Hermann and Lawton (1968, p. 387, as *D. columbianus*).

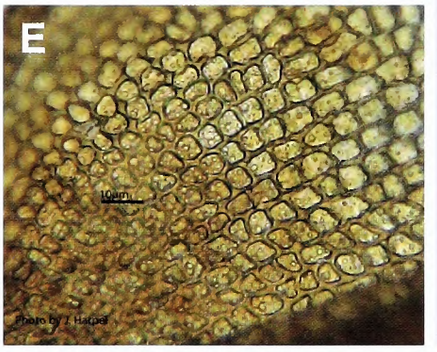
Plate 10. Bryoerythrophyllum columbianum. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Alar and basal cells. G. Stem cross-section. H–I. Leaf cross-sections. (T. McIntosh 4946. UBC)*

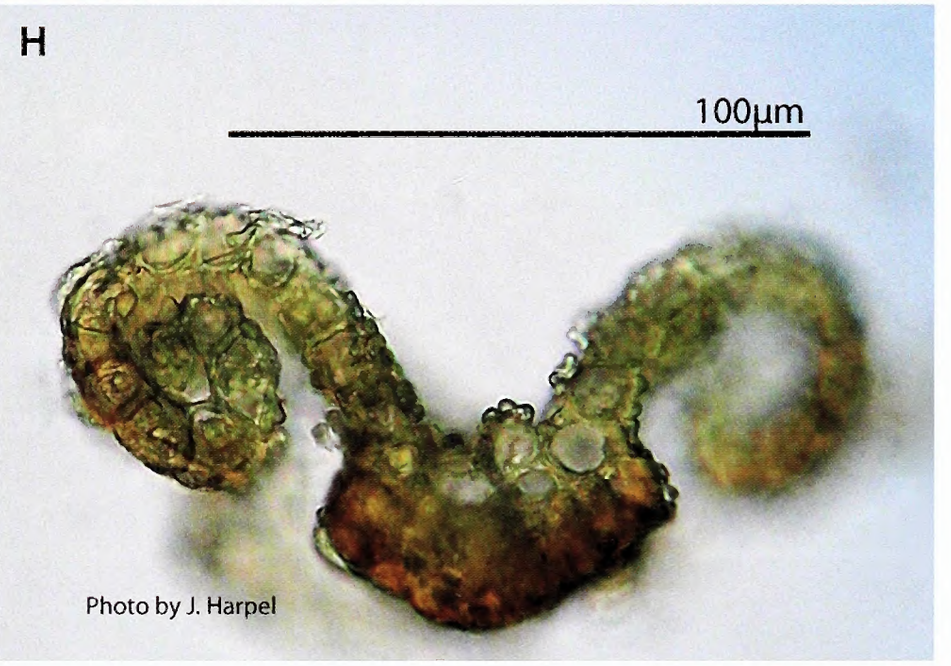

A
1mm

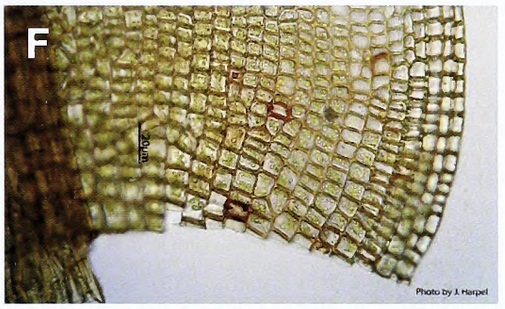

B
1mm
Photo by J. Harpel

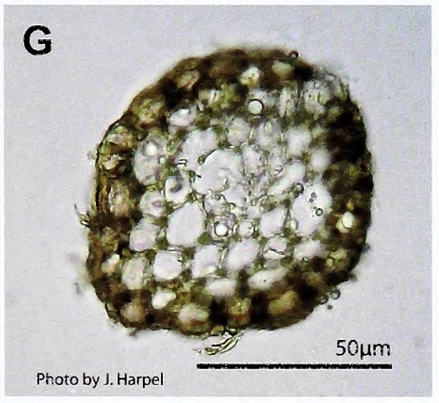

C
500µm
Photo by J. Harpel

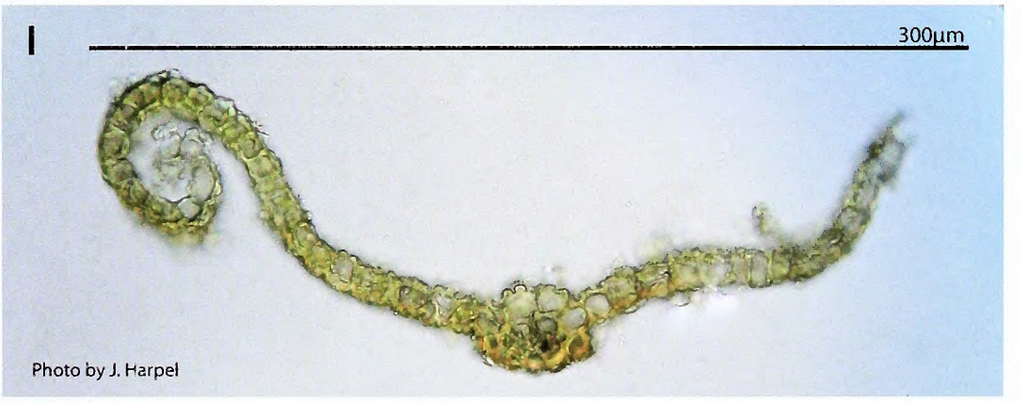

D
300µm
Photo by J. Harpel


E
10µm
Photo by J. Harpel


H
100µm
Photo by J. Harpel


F
Photo by J. Harpel


G
50µm
Photo by J. Harpel


I
300µm
Photo by J. Harpel

Bryum calobryoides J.R. Spence

Recent synonym: none
Common name: beautiful bryum

Summary — An acrocarpous, costate moss with subobicular leaves. Terrestrial.

Diagnostic characteristics — *Bryum calobryoides* is distinguished by its (1) small olive-green to bright green colored plants; (2) imbricate, strongly julaceous shoots; (3) concave, imbricate, ovate to suborbicular leaves; and (4) broadly rounded to acute, cucullate leaf apices.

Technical description

GAMETOPHYTE — **Plants** unbranched, thread-like (julaceous), 5–20 mm long, brittle, bright to dark green near the tip of shoots and brownish toward the base. **Leaves** ovate to suborbicular, 0.2–1.0 mm long, strongly imbricate, not contorted or twisted when dry, strongly concave, often hooded (cucullate) at the apex, not decurrent, apex usually obtuse in upper leaves and acute in lower leaves, often with a short point (apiculus); costa reddish, extending to the middle of leaf or longer, sometimes extending beyond the apex (excurrent) or forked; margins entire, not bordered by differentiated cells, plane above to weakly recurved below; cells rectangular to rhomboidal, 1:1–4:1, the walls thin or sometimes thickened and pitted. **Dioicous**.

SPOROPHYTE — Sporophytes are unknown.

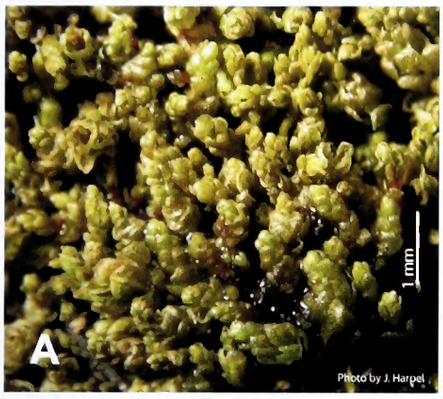
Similar species — *Bryum calobryoides* can be distinguished from other *Bryum* species by the small size (less than 1 cm) and julaceous habit. *Bryum argenteum* and *B. lanatum* plants are silver-green to white and their leaves lack an apiculus.

Ecology — *Bryum calobryoides* forms sods or occurs as individuals among other mosses. It grows on both acid and basic rocks on soil in shaded to exposed boulder fields in montane to alpine meadows, cliffs, and outcrops at 3,000–7,000 foot elevations. Associated bryophytes include *Asterella bolanderi, Claopodium* spp., *Dichodontium olympicum, Encalypta rhaptocarpa, Grimmia anodon, Homalothecium aeneum Kindbergia praelonga, Meiotrichum lyallii, Porella cordaeana, Racomitrium ericoides, Syntrichia ruralis* and *Tortula hoppeana.* Although poorly documented, forest associations probably include *Abies amabilis, Abies concolor; Abies lasiocarpa, Pseudotsuga menziesii* and *Tsuga heterophylla.*

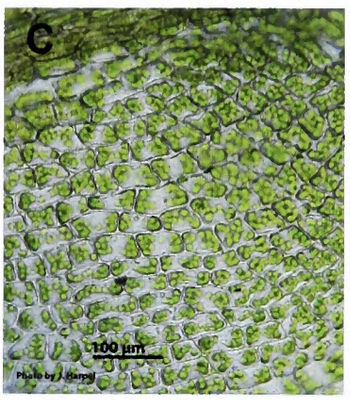
Distribution — *Bryum calobryoides* is endemic to western North America. It is known from British Columbia, Washington, Oregon, California, Idaho, Montana, and Colorado. In Oregon, ORBIC reprts *B. calobryoides* is reported from Curry, Grant, Jackson, Josephine, and Lane Counties within the Coast Range, Blue Mountain, Klamath Mountain and West Cascades ecoregions.

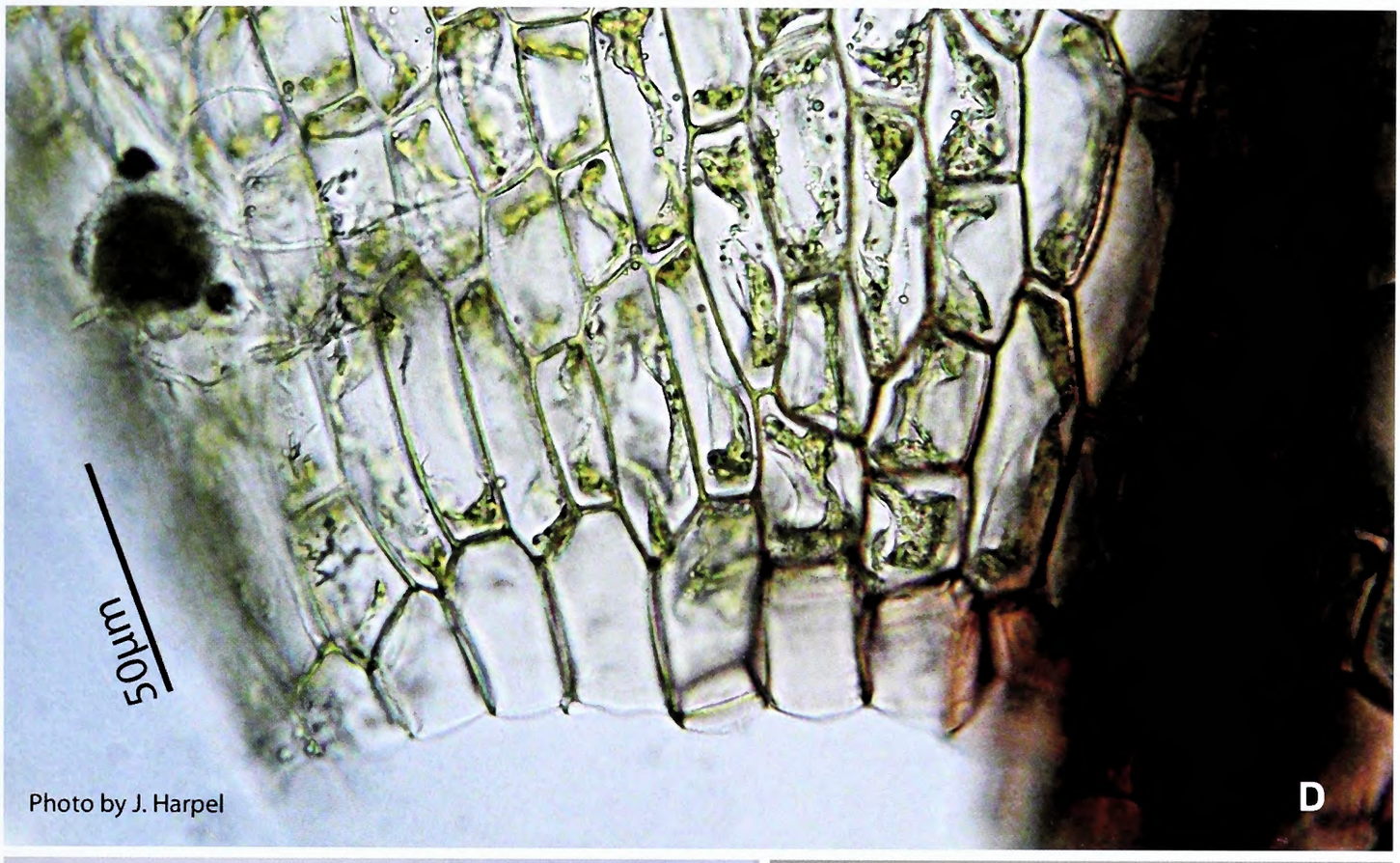
References with descriptions and/or illustrations — Spence (in FNA 2014b, p. 127), Spence (1988, p. 80), Spence (1986, p. 215).

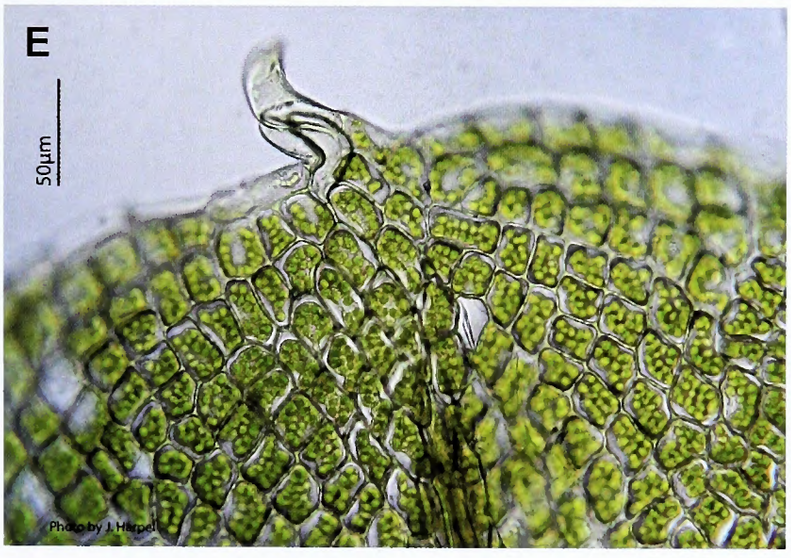
Plate 11. Bryum calobryoides. *A. Moist habitat. B. Leaf. C. Upper medial cells. D. Alar and basal cells. E. Leaf apex. F. Individual plants. (D. Wagner 9918. OSU)*


A
1 mm
Photo by J. Harpel


B
500 µm
Photo by J. Harpel


C
100 µm


50µm
Photo by J. Harpel
D


E
50µm
Photo by J. Harpel


F
1 mm
Photo by J. Harpel

Buxbaumia aphylla Hedwig

Recent synonyms: none
Common names: bug-on-a-stick, hump-backed elf, elf cap moss

Summary — The sporophyte shape and cuticle that curls back from mouth of the capsule are unique. Terrestrial.

Diagnostic characteristics — *Buxbaumia aphylla* is distinguished by its (1) zygomorphic and uniquely shaped sporophyte, (2) glossy capsule with a conspicuous rim, (3) cuticle that curls back from the mouth of the capsule, and (4) lack of visible green gametophyte .

Technical description

GAMETOPHYTE — An annual or perennial from a persistent protonema; yellow-green to dark green, dense and felty. Leafy plants reduced to a tiny cluster of bracts surrounding the gametangia, to 0.5 mm tall.

SPOROPHYTE — **Seta** 3–12 mm long, dark brown, papillose. **Capsules** ovoid, yellow-brown to reddish-brown, glossy, 3–7 mm long, flattened on the dorsal surface, rounded on the ventral surface, sometimes almost as wide, inclined but often nearly horizontal, usually flattened on top and rounded beneath, often with a distinct ridged margin. Peristome pale yellow, papillose, composed of 16 short, unequal teeth. When capsules mature, the papery cuticle separates from the wall of the capsule to peel backward from the mouth, like a scroll of parchment. Sometimes the cuticle remains smooth and does not split or peel at all. **Spores** 6–8 µm.

Similar species — *Buxbaumia viridis* has a cuticle that splits longitudinally along the top of the capsule, peeling back toward the margins, rather than from around the mouth as in *B. aphylla* and *B. piperi*. *Buxbaumia piperi* is similar but is never glossy when mature and the exostome is in 2–3 rows. The exostome in *B. aphylla* is in a single row. In addition, the capsules of *Buxbaumia piperi* and *B. viridis* are usually oriented at a 45° angle from the setae. The capsules of *B. aphylla* are inclined to nearly perpendicular to the setae. The papillose spores of *B. aphylla* are smaller (6–8 µm) than those of *B. piperi* (7–12 µm) and *B. viridis* (8–12 µm).

Ecology — *Buxbaumia aphylla* is a pioneer on dry mineral-poor soil or soil over rock and well-decayed wood in exposed to shaded sites in forests, cutbanks of trails and roads, and recovering burns. In Oregon and Washington, *B. aphylla* sites range in elevation from the lowlands to about 3,900 feet. It is often associated with other soil pioneers such as *Cephaloziella*, *Cladonia*, *Funaria*, *Peltigera* and *Polytrichum*. Forest plant associations include *Abies concolor; Abies magnifica* × *shastensis, Pinus contorta, Pseudotsuga menziesii, Tsuga heterophylla,* and *Tsuga mertensiana. Buxbaumia aphylla* grows in a variety of conditions from open to closed canopy. Forest age class does not seem to be significant. However, it tends to favors drier, more open habitat than that of *B. piperi* and *B. viridis*.

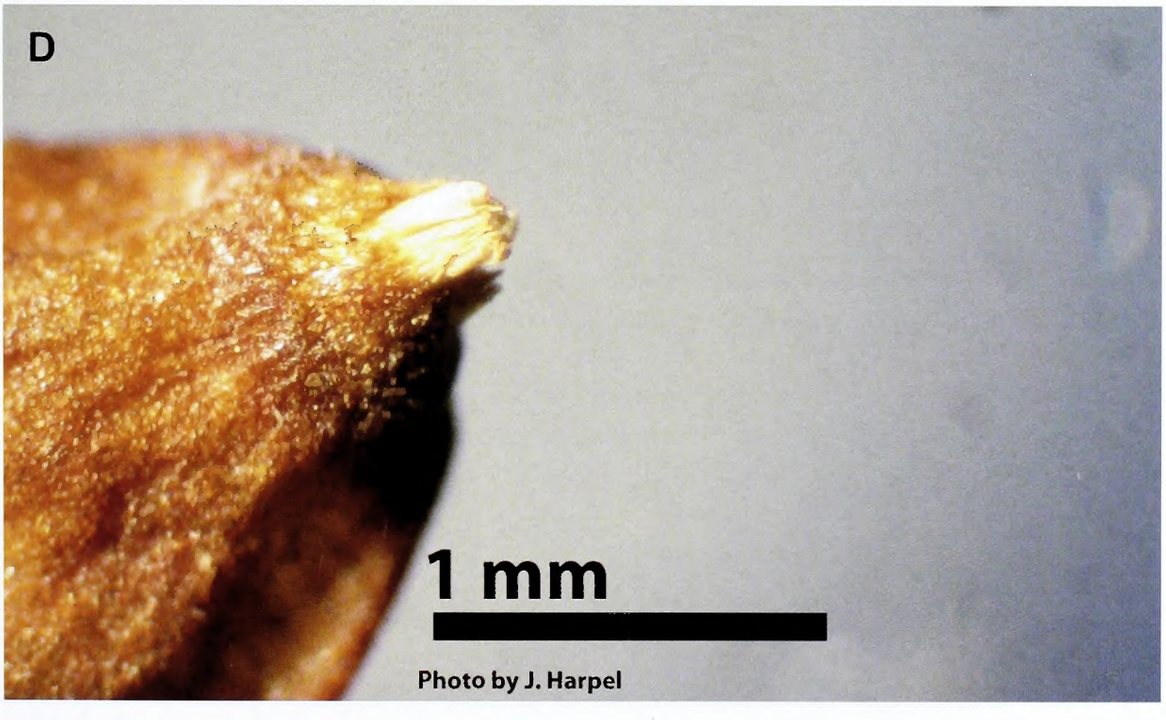
The life history of *Buxbaumia* is better known than many other mosses because of its peculiarity and celebrity status (Hancock and Brassard 1974). The persistent protonema grows and spreads on exposed substrate before sporophytes develop. Leaves are strongly reduced and functionally absent. Photosynthesis is primarily restricted to the persistent protonema and immature green capsules. Protonema may be associated with cyanobacteria and mycorrhizal fungi. Capsules are most easily identified in summer or fall. Plants are ephemeral, documented as appearing up to 15 years after fire but disappearing after a few seasons as competition increases from vascular plants. Spores are wind born but may not travel far from parent plants.

Plate 12. Buxbaumia aphylla. *A. Habitat. B. Individual plant. C. Sporophyte. D. Peristome teeth. (Harpel 32749. Harpel Private.)*


A
Photo by J. Harpel


B
5 mm
Photo by J. Harpel


C
1 mm
Photo by J. Harpel


D
1 mm
Photo by J. Harpel

Distribution — *Buxbaumia aphylla* is known from Eurasia, New Zealand, and North America. In western North America, it is known from Alaska south through British Columbia, Washington, Oregon, California, and east to Alberta, Montana, and Colorado. In Oregon, *B. aphylla* is reported from Deschutes, Douglas, Grant, Josephine, Klamath, Lane, and Union Counties and within the Blue Mountain, Coast Range, East and West Cascades, and Klamath Mountain ecoregions.

References with descriptions and/or illustrations — Schofield (in FNA 2007, p. 119), Crum (2004, p. 543), Crum (1983, p. 362), Ireland (1982, p. 655), Crum and Anderson (1981, p. 1235), Smith (1978, p. 141), Lawton (1971, p. 29), Nyholm (1969, p. 650).

References with photos — Lockhart et al. (2012, p. 293), Atherton et al. (2010, p. 336)

Calliergon richardsonii (Mitten) Kindberg

Recent synonym: none
Common name: Richardson's calliergon moss

Summary — A pleurocarpous moss with ovate leaves and a usually branched costa ending before the apex. Terrestrial.

Diagnostic characteristics — *Calliergon richardsonii* is distinguished by its (1) broadly ovate leaves; (2) short, often branched or forked costa ending just beyond mid-leaf; (3) hyaline, inflated alar cells; (4) lack of red or purple coloration; and (5) distant and spreading leaves below the apex.

Technical description

Gametophyte — **Plants** robust, in loose, soft tufts or mats, green to yellowish-green, up to 12–15 cm tall, irregularly or sometimes subpinnately branched. Stem **leaves** erect to spreading, 1.5–4.3 × 0.7–2.3 mm, cordate-ovate to oblong-ovate, concave, rounded obtuse with rhizoid initials on the dorsal surface sometimes present near the apex; margins entire, plane often inrolled at the apex; costa single, short, 1/2 to 3/4 the leaf, usually forked or branched; upper medial cells linear, smooth, 50–156 µm; alar cells hyaline, abruptly enlarged and forming a distinct group; basal cells sometimes pitted. Branch leaves similar. **Autoicous**.

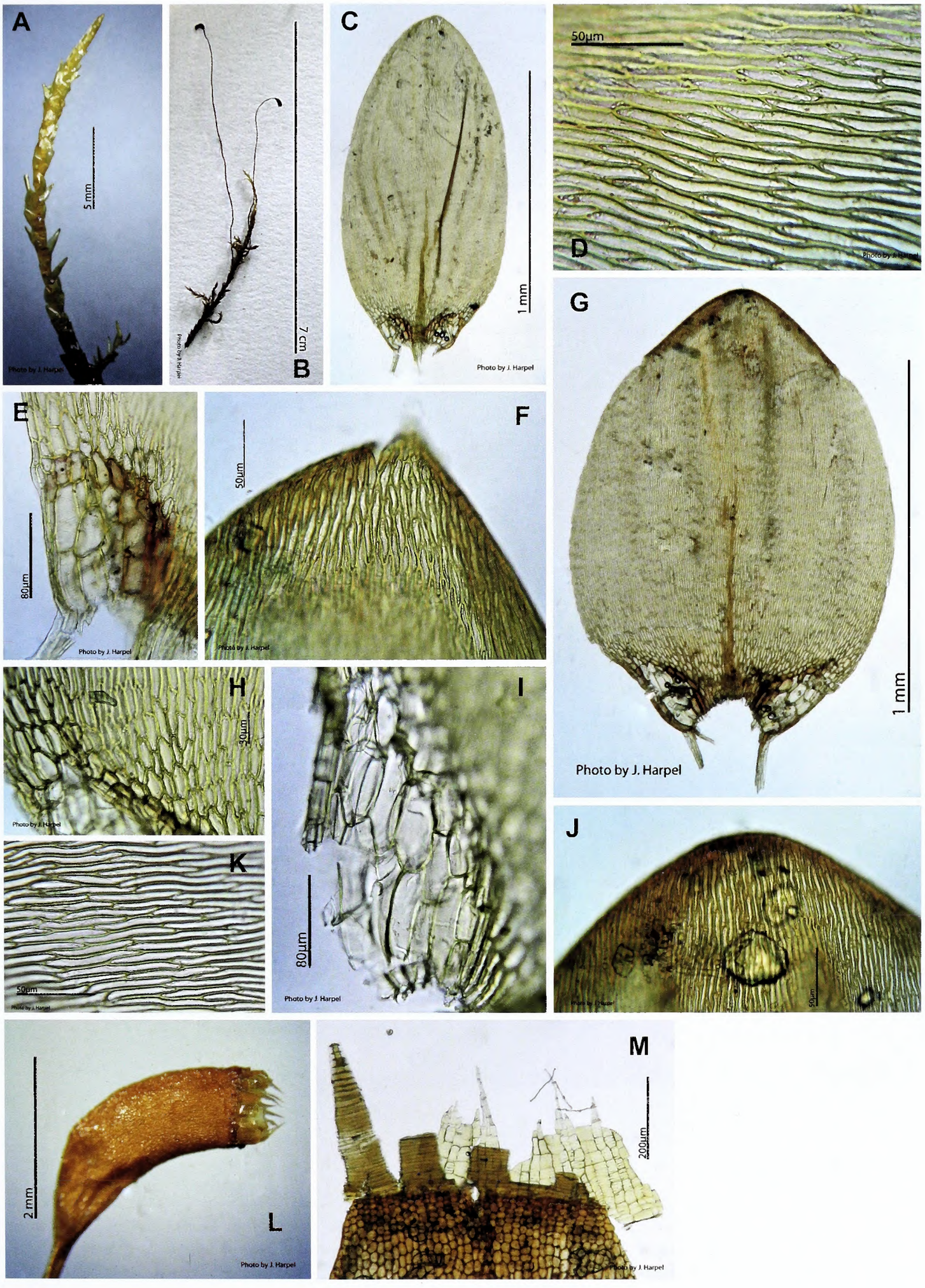
Sporophyte — **Seta** orange-reddish to reddish-brown, 4–6 cm, flexuose. **Capsules** 2.5–3 mm long, curved, oblong-cylindric; annulus lacking. **Spores** 17–31 µm.

Similar species — *Calliergon richardsonii* is easily separated from other *Calliergon* species by its comparatively short, usually branched or forked stem leaf costa. Furthermore, *C. giganteum* has a wider stem leaf costa, and *C. cordifolium* has an indistinctly delimited alar region.

Ecology — *Calliergon richardsonii* is known from bogs, shallow pools, or wet depressions at margins of swamps and similar wetland habitats in arctic and boreal locations. It is known from about 5,100 feet in elevation.

Distribution — *Calliergon richardsonii* is known from Eurasia, Greenland, and North America. In western North America, it is known from Alaska, British Columbia, Alberta, Oregon, Montana, and Wyoming. In Oregon, *C. richardsonii* is reported from Wheeler County in the Blue Mountain ecoregion.

Plate 13. Calliergon richardsonii. *A. Moist individual. B. Dry individual with sporophytes. C. Branch Leaf. D. Branch leaf upper medial cells. E. Branch leaf alar cells. F. Branch leaf apex. G. Stem leaf. H. Stem leaf basal cells. I. Stem leaf alar cells. J. Stem leaf apex. K. Stem leaf upper medial cells. L. Sporophyte. M. Peristome teeth. (G. Mogensen. 77-083. UBC)*


A
5 mm
Photo by J. Harpel
B
7 cm
C
1 mm
Photo by J. Harpel
D
50µm
E
80µm
Photo by J. Harpel
F
50µm
G
1 mm
Photo by J. Harpel
H
30µm
I
80µm
Photo by J. Harpel
J
K
50µm
L
2 mm
Photo by J. Harpel
M
200µm

References with descriptions and/or illustrations — Hedenäs (in FNA 2014, p. 392), Hedenäs (2003, p. 47), Crum and Anderson (1981, p. 1003), Lawton (1971, p. 270), Nyholm (1965, p. 449), Grout (1931, p. 96).

Campylium stellatum (Hedwig) C.E.O. Jensen

Recent synonym: none
Common names: star campylium moss, yellow starry feather-moss

Summary — A pleurocarpous moss with a short to double costa and lanceolate leaves from a cordate base. Terrestrial.

Diagnostic characteristics — *Campylium stellatum* can be distinguished by its (1) large size, (2) ovate-lanceolate leaves with a channeled acumen, (3) usually short double costa, and (4) inflated alar cells.

Technical description

GAMETOPHYTE — **Plants** robust, forming shiny loose or dense mats or tufts, green, yellowish-green to golden, or brownish. **Stems** irregularly branched, ascending to erect. **Leaves** more or less wide-spreading, squarrose to erect-spreading, somewhat contorted when dry, 1.7–2.8 mm × 0.7–1 mm long, base broadly ovate to cordate-ovate, narrowed to a long channeled acumen; margins plane, or involute on the acumen, entire, or rarely serrulate at base; costa none, or short, weak, double or single, 1/4 to 1/3 leaf length; upper medial cells linear, thick walled and pitted near the leaf base; alar cells short-oblong, conspicuous, enlarged and inflated, thick walled, becoming brownish with age. **Dioicous**.

SPOROPHYTE — **Seta** 1.5 to 3 cm. **Capsules** cylindrical curved and horizontal, 5 to 3 mm long; operculum conic to conic-apiculate; annulus deciduous, of 3 rows of large cells. **Spores** 12–14 μm.

Similar species — *Campylium stellatum* can be distinguished from other Pacific Northwest *Campylium* species by its double costa, large leaves (2 mm or longer), abruptly inflated alar cells, lack of paraphylla, and dioicous habit. *Campylium protensum* has creeping stems, sometimes with paraphylla. The channeled leaf tips in *C. stellatum* help separate it from similar mosses with spreading leaves.

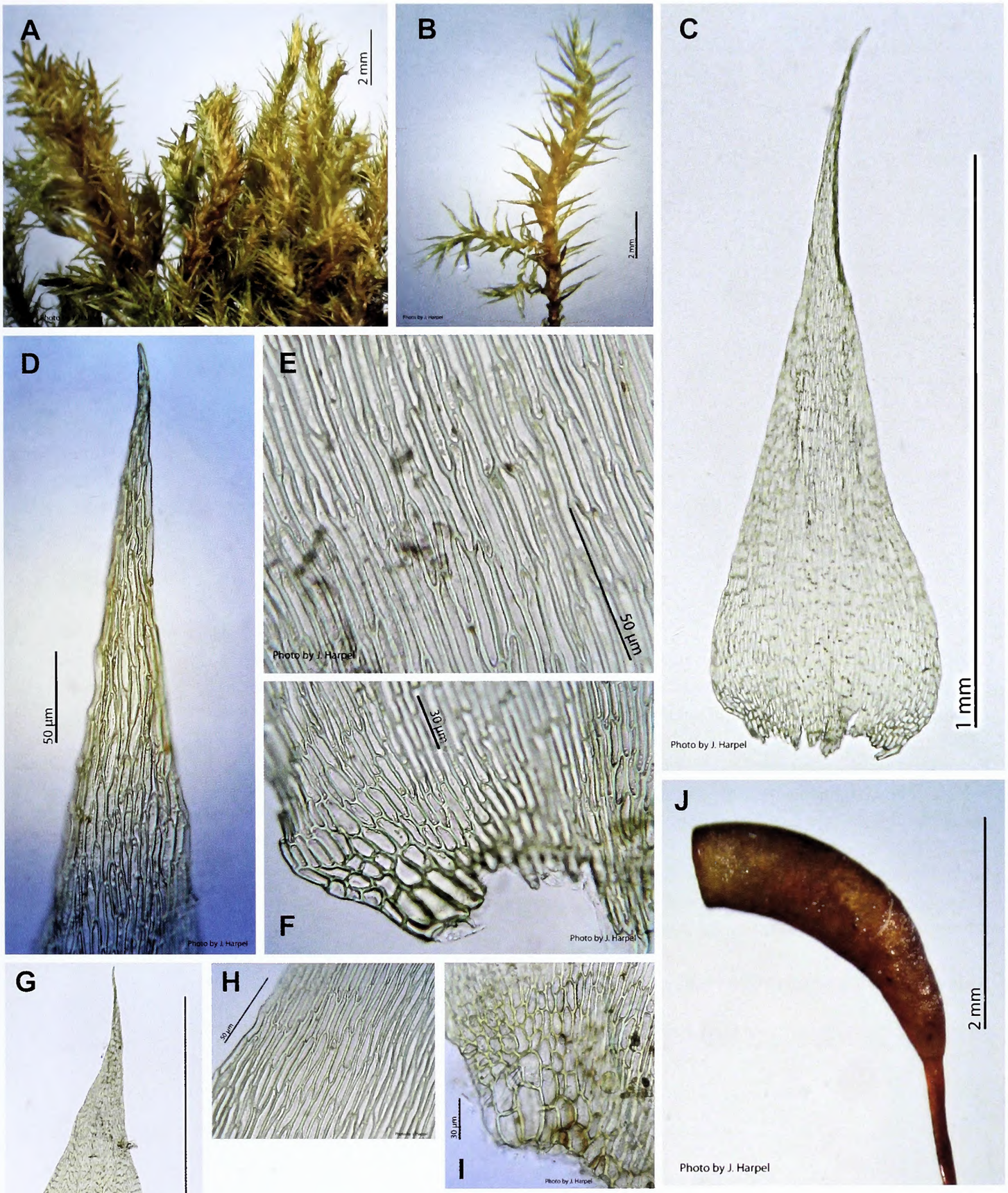
Ecology — *Campylium stellatum* is known from wet soil or humus in open calcareous wetlands, fens, lake and river shores, meadows, roadside ditches, and seepy margins of springs, often in the spray of waterfalls.

Distribution — *Campylium stellatum* is known from Europe, Greenland, and North America. In western North America, it is known from Alaska and Yukon south through British Columbia, Alberta, Washington, Oregon, California, Idaho, Montana, Wyoming, Colorado, and New Mexico. In Oregon, *C. stellatum* is reported from Grant and Jackson counties within the Blue Mountain and Klamath Mountain ecoregions.

References with descriptions and/or illustrations — Hedenäs (in FNA 2014a, p. 289), Crum and Anderson (1981, p. 949), Lawton (1971, p. 275), Nyholm (1965, p. 478), Grout (1931, p. 81).

References with photos — Atherton et al. (2010, p. 709), Malcolm et al. (2009, p. 229).

Plate 14. Campylium stellatum. *A. Moist habitat. B. Individual plant. C. Branch Leaf. D. Branch leaf apex. E. Branch leaf upper medial cells. F. Branch leaf alar and basal cells. G. Stem leaf. H. Stem leaf upper medial cells. I. Stem leaf alar cells. J. Sporophyte. (W. Schofield 116947. UBC)*


A
2 mm
B
2 mm
C
1 mm
Photo by J. Harpel
D
50 µm
Photo by J. Harpel
E
50 µm
Photo by J. Harpel
F
30 µm
Photo by J. Harpel
G
1 mm
H
30 µm
I
30 µm
Photo by J. Harpel
J
2 mm
Photo by J. Harpel

Campylopodiella flagellacea (Müller Hal.) Frahm & Isoviita

Recent synonyms:

Dicranum flagellaceum Müller Hal.

Atractylocarpus flagellaceus (Müller Hal.) Williams

Common name: fragile campylopodiella

Summary — An acrocarpous, costate moss with narrowly lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Campylopodiella flagellacea* is distinguished by its (1) long and narrowed long-setaceous leaves, (2) broad costa filling the leaf base, (3) inflated alar cells, (4) often serrulate apex, and (5) costa with stereid cells above and below the guide cells.

Technical description

GAMETOPHYTE — **Plants** forming yellowish-green, tufts. **Stems** erect, up to 15 mm tall. **Leaves** lanceolate, erect-patent when wet, more or less curled when dry, 1.8–2.3 mm, 5–8 times as long as wide; margins entire, slightly denticulate at the apex; costa excurrent, broad, 1/2 to 2/3 of the leaf, with large dorsal and ventral hyalocysts, a median band of stereids and 2–4 stereids dorsally; alar cells hyaline or brownish, sometimes bistratose, somewhat inflated; basal cells rectangular, in more or less 6 rows; upper medial cells rectangular. **Dioicous**.

SPOROPHYTE — Sporophytes have not been found in North America and are not illustrated or described in North American treatments.

Similar species — *Campylopodiella stenocarpa* is similar but has indistinct alar cells, leaves 10–13 times longer than wide, and basal laminal cells in 15–18 rows. *Campylopus* has acute leaves or a hyaline awn, while *Campylopodiella* leaves are narrowed to a long-setaceous apex.

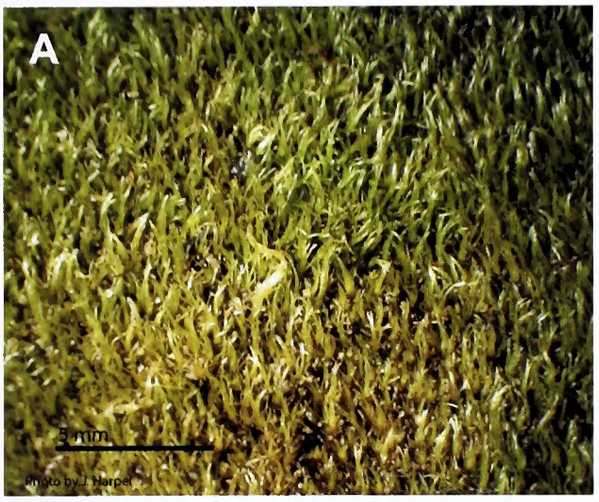
Ecology — In Central and South America, *Campylopodiella flagellacea* is known from peaty soil in pine-oak forests. The California specimen was collected on a metamorphic rock seep in a road bank. Sporophytes have been found only once, in Venezuela.

Distribution — *Campylopodiella flagellacea* is known from North, Central, and South America. In western North America, it is known from Oregon and California. In Oregon, *C. flagellacea* is reported from Jackson County within the Klamath Mountain ecoregion.

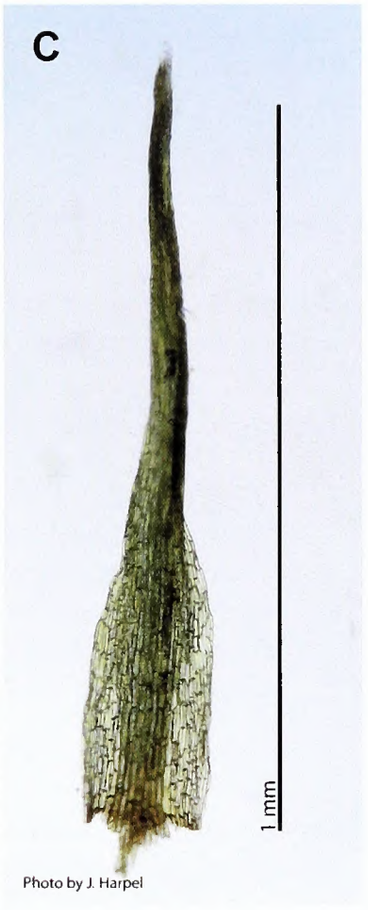
References with descriptions and/or illustrations — Frahm (in FNA 2007, p. 365), Sharp et al. (1994, p. 146).

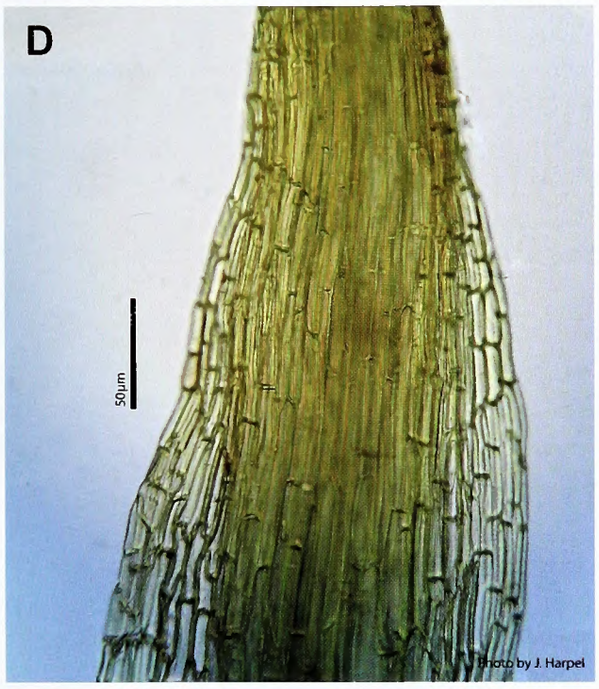
References with photos — Malcolm et al. (2009, p. 110).

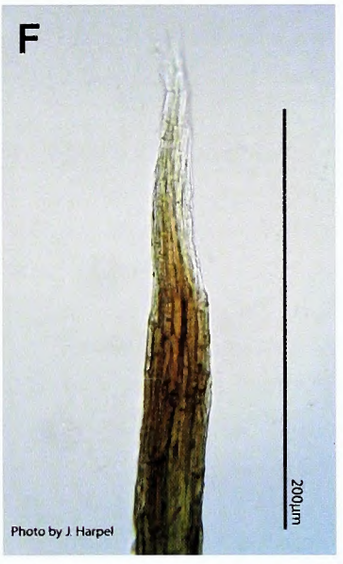
Plate 15. Campylopodiella flagellaceae. *A. Habitat. B. Individual plant. C. Leaf. D. Upper medial cells. E. Alar and basal cells. F. Leaf apex. G. Leaf cross-section. (J. Shevock 17747. CAS)*

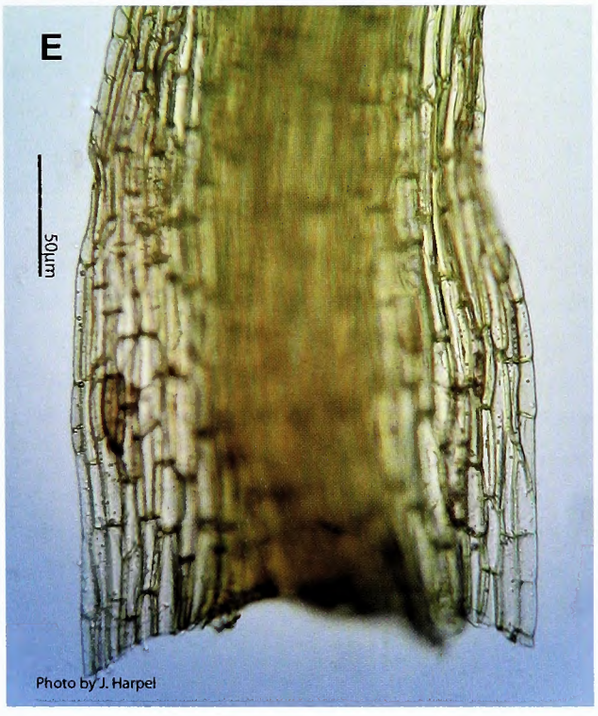

A
5 mm
Photo by J. Harpel

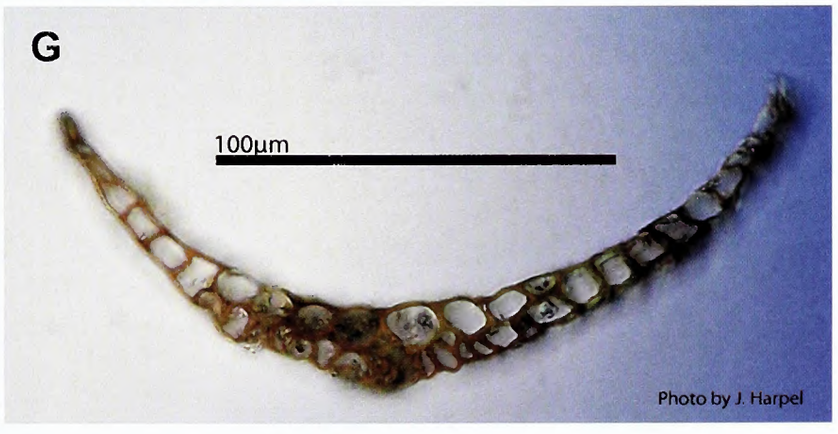

B
9 mm
Photo by J. Harpel


C
1 mm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


F
200µm
Photo by J. Harpel


E
50µm
Photo by J. Harpel


G
100µm
Photo by J. Harpel

Campylopus schmidii (Müller Hal.) A. Jaeger

Recent synonym: *Campylopus aureus* Bosch & Sande La Coste
Common name: golden sand moss

Summary — An acrocarpous, costate, moss with lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Campylopus schmidii* is distinguished by its (1) small, erect plants with stiff, straight leaves with hyaline awns; (2) wide costa filling the leaf base; and (3) costa lacking stereid cells above the guide cells.

Technical description

GAMETOPHYTE — **Plants** erect, 2–5 (8) cm tall, shoots golden-yellow, olive-green to blackish. **Leaves** narrow, straight and imbricate when dry, widest above the base, 5–6 mm long; basal leaf cells thin-walled, often brown; costa smooth on back of leaf, filling 1/2 to 3/4 of blade at base; most leaves with a well-developed hyaline awn at the tip, but awns may be absent in short blackish plants. Stems usually covered below by brown or white minutely papillose rhizoids. Asexual deciduous buds may be produced on the upper most part of the stem. **Dioicous**.

SPOROPHYTE — Sporophytes have not been found on specimens from North America, and plants are all female.

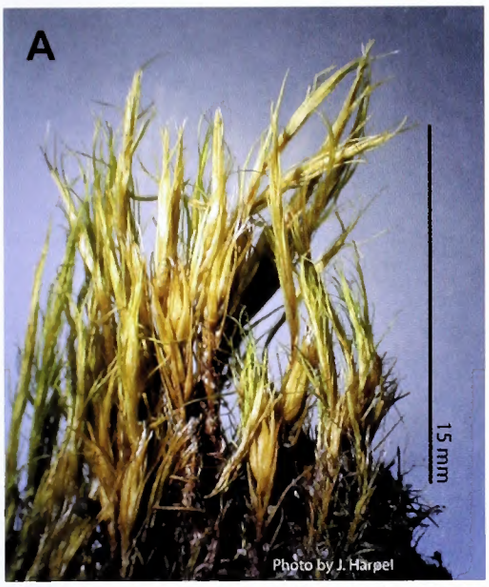
Similar species — *Campylopus introflexus,* a recent immigrant from the southern hemisphere, is spreading throughout coastal western North America. Its reflexed hairpoint is distinctive. *Campylopus subulatus* lacks a haripoint, and *C. atrovirens* has vermicular distal laminal cells and thick-walled basal cells. *Dicranum* has a narrow costa occupying less than1/3 of the leaf base. *Campylopodiella* and *Dicranodontium,* which also have a wide costa filling the leaf base, have leaves narrowed to a long-setaceous apex.

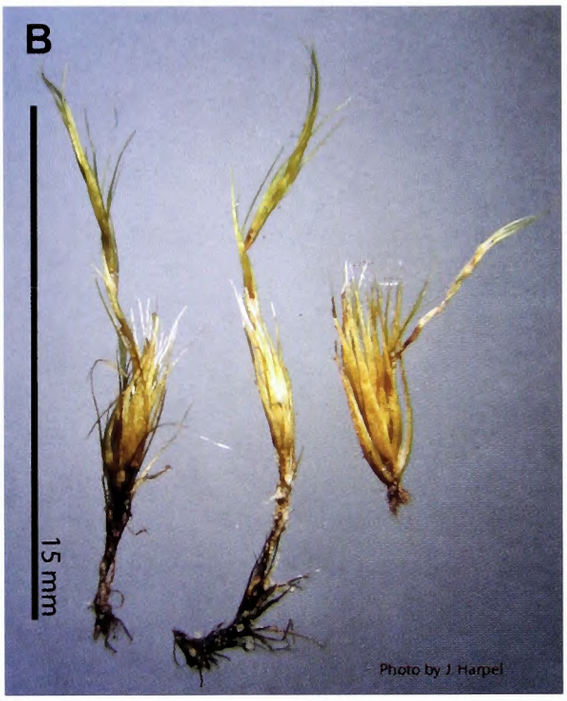
Ecology — *Campylopus schmidii* populations are known from nutrient-poor sandy substrates near the coast and inland in open meadow basalt sheet drainages associated with Oregon white oak. Inland sites associated with Oregon white oak meadows occur on concave topography while the convex surfaces are dominated by *Racomitrium elongatum*. At the Oregon coast, *C. schmidii* forms sods in open stands of *Pinus contorta* var. *contorta* and *Cupressus goveniana* subsp. *pigmaea*, where it grows on shaded to exposed sand around the edges of vernal pools. It has also been found on exposed, seasonally flooded sand deflation plains. Plants, which tolerate flooding in vernal pools, are also drought tolerant. Associated vascular plant species include *Argentina egedii* and *Carex obnupta*. Associated bryophytes include *Cephaloziella*, *Polytrichum piliferum, Racomitrium elongatum, Sphagnum mendocinum* and *Warnstorfia exannulata*.

In the Pacific Northwest, *Campylopus schmidii* populations are unisexual. Capsules have not been found and dispersal is limited to vegetative reproduction. However, *C. schmidii* distribution parallels that of the winter jet stream, and North American populations were probably established by long distance dispersal of spores from Southeast Asia or Hawaii. It is also possible that humans introduced *C. schmidii* to North America, but its occurrence in a number of widely separated sites in Oregon, California, and Mexico suggests several waves of long distance dispersal. The first North American record was documented in Florence, Oregon, in 1933.

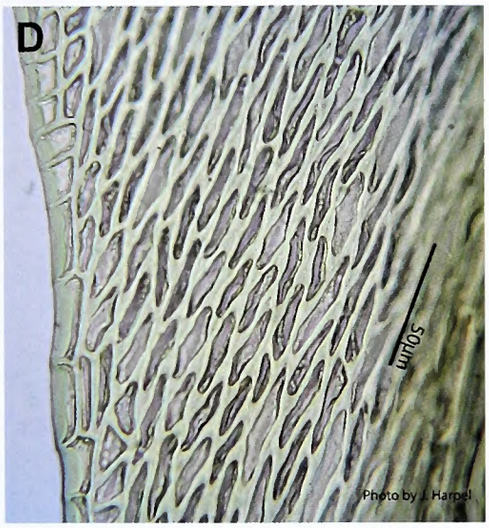
Distribution — *Campylopus schmidii* is known from Asia, Africa, Australia, North America, and Hawaii. In North America, it is known from Oregon, California, and Mexico. In Oregon, *C. schmidii* is known from Douglas, Lane, and Lincoln counties within the Coast Range and Klamath Mountain ecoregions.

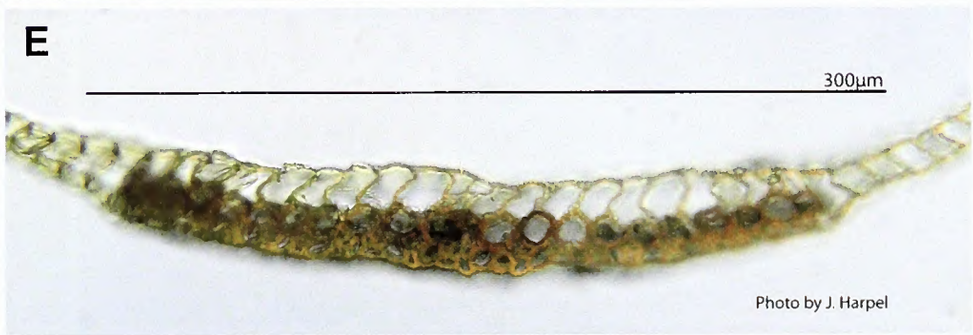
Plate 16. Campylopus schmidii. *A. Habitat. B. Asexual deciduous shoots. C. Leaf. D. Upper medial cells. E–F. Leaf cross sections. G. Leaf apex. H. Alar cells. I. Basal cells. (D. Wagner sn. OSU)*


A
15 mm
Photo by J. Harpel

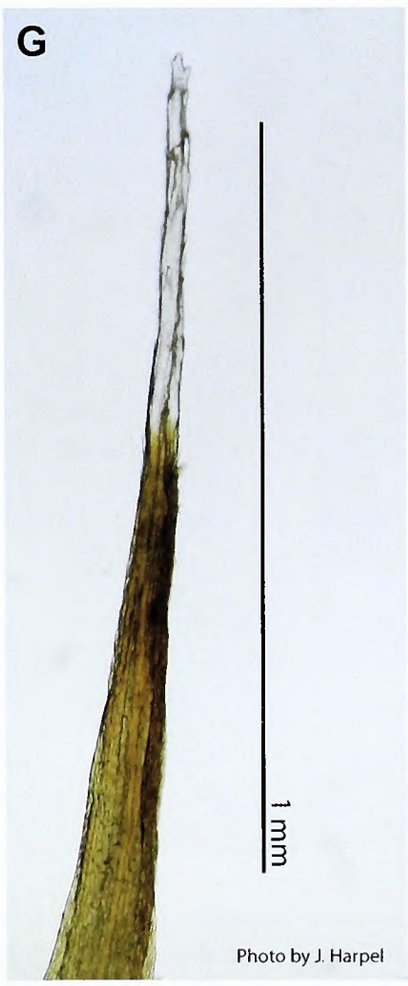

B
15 mm
Photo by J. Harpel

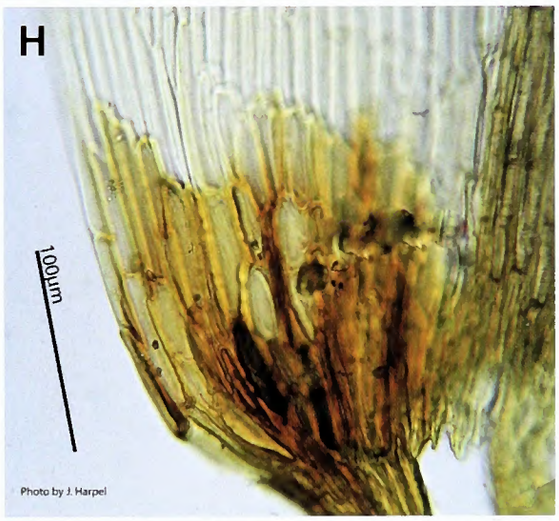

C
5 mm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


E
300µm
Photo by J. Harpel


F
500µm
Photo by J. Harpel


G
1 mm
Photo by J. Harpel


H
100µm
Photo by J. Harpel


I
500µm
Photo by J. Harpel

References with descriptions and/or illustrations — Frahm (in FNA 2007a, p. 373), Christy and Wagner (1996, part VII, p. 21), Frahm (1987, p. 721), Frahm and Mohamed (1987, p. 482), Frahm (1984, p. 165), Frahm (1980, p. 576).

Campylopus subulatus Schimper

Recent synonym: none
Common name: awl-leaved swan-neck moss

Summary — An acrocarpous, costate moss with smooth, lanceolate leaves. Terrestrial

Diagnostic characteristics — *Campylopus subulatus* is distinguished by its (1) wide costa extending 1/3–2/3 the width of the leaf base, (2) plane leaf tips lacking a hair-point, (3) hyaline thin-walled basal laminal cells, (4) leaves widest at leaf base, and (5) not sharply delimited basal and distal laminal cells.

Technical description

GAMETOPHYTE — **Plants** green to yellowish-green in loose (often rigid) slender tufts lacking tomentum, up to 3 cm tall. **Leaves** lanceolate, 3–4 mm, narrowing into a short, straight subula, spreading when wet, appressed when dry; margins entire below, slightly serrate at apex; upper medial cells short, subquadrate; alar cells hardly differentiated; basal laminal cells thin-walled, hyaline, rectangular; costa filling 1/2 to 2/3 of the leaf width, stereids lacking, excurrent but not forming a hairpoint. Asexual reproduction occurs by fragmentation of the apical shoots. **Dioicous**.

SPOROPHYTE — Sporophytes are not known in North America and rare in Europe.

Similar species —*Campylopodiella, Campylopus* and *Dicranodontium* are similar. See *Campylopus schmidii* for additional discussion.

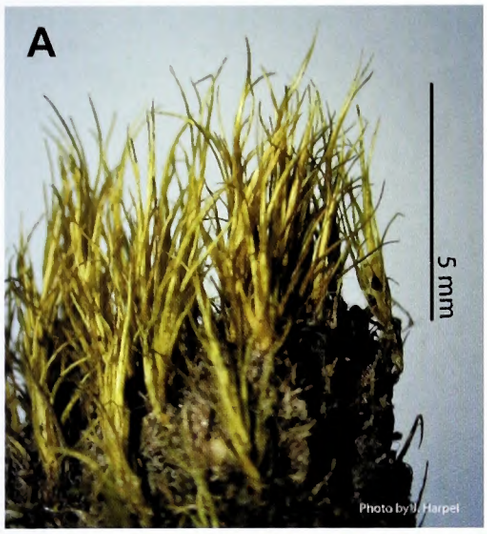
Ecology — According to Frahm and Vitt (1978) *C. subulatus* is a low elevation species with a suboceanic tendency. In California, populations are known from oak woodlands, Douglas-fir forests, and sand dunes with *Pinus contorta* between 240 to 600 foot elevations. Lockhart et al. (2012) suggests, "This is a plant of bare ground in sandy or gravelly places such as track sides and river margins." Schofield (1976) noted, "*C. subulatus* is very rare in British Columbia, where it is known from a few subalpine localities."

Distribution — *Campylopus subulatus* is known from Eurasia and North America. In North America, it has been recorded from British Columbia, Oregon and California. In Oregon, *C. subulatus* is reported in Douglas, Jackson, Josephine and Lincoln counties within the Coast Range and Klamath Mountain ecoregions.

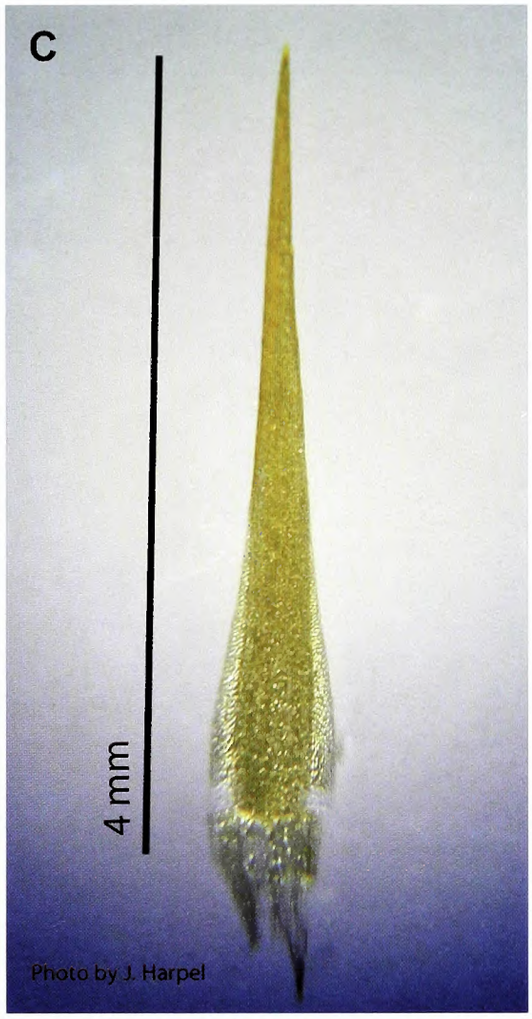
References with descriptions and/or illustrations — Frahm (in FNA 2007a, p. 374), Pedrotti (2001), Frahm (1981), Frahm and Vitt (1978), Nyholm (1954, p. 79).

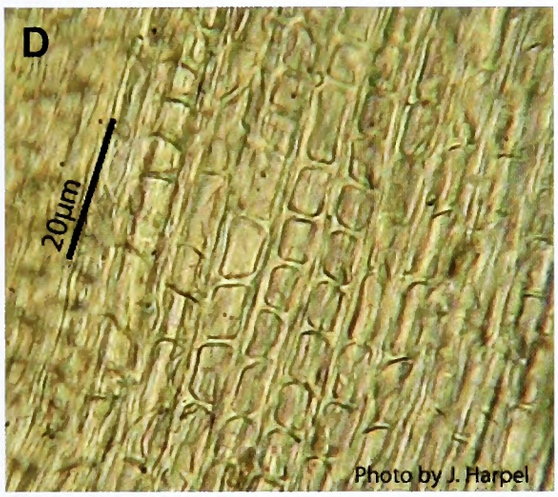
References with photos — Lockhart et al. (2012, p. 381), Atherton et al. (2010, p. 391).

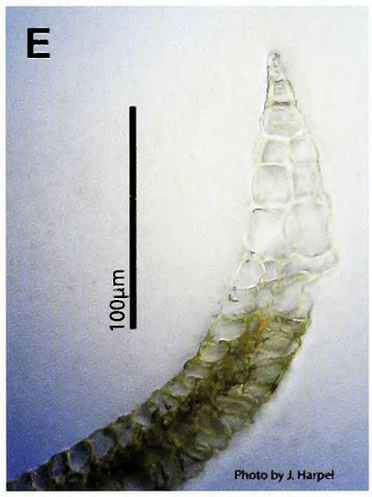
Plate 17. Campylopus subulatus. *A. Habitat. B. Individual plants. C. Leaf. D. Upper medial cells. E–F. Leaf cross-sections. G. Apical cells. H. Leaf apex. I. Basal cells. J. Alar cells. (W. Schofield 69365. UBC)*


A
5 mm
Photo by J. Harpel


B
5 mm
Photo by J. Harpel


C
4 mm
Photo by J. Harpel


D
20µm
Photo by J. Harpel

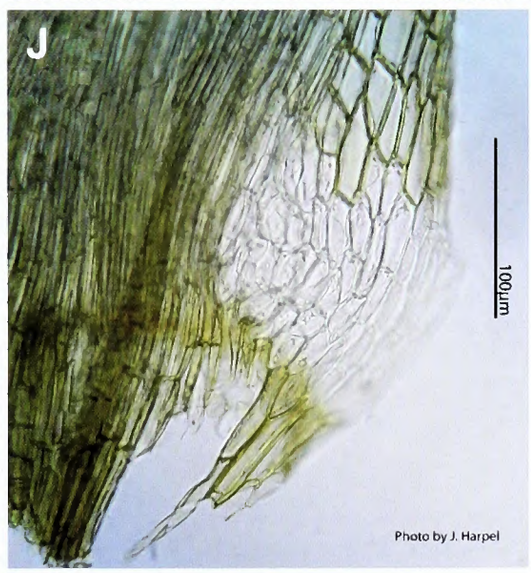

E
100µm
Photo by J. Harpel


F
300µm


G
50µm
Photo by J. Harpel


H
100µm
Photo by J. Harpel


I
100µm
Photo by J. Harpel


J
100µm
Photo by J. Harpel

Conostomum tetragonum (Hedwig) Lindberg

Recent synonym: *Bartramia conostoma* (Smith) Bruch & Schimper
Common names: ribbed mountain moss, helmet moss, conostomum moss

Summary — An acrocarpous, costate, papillose moss with narrow lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Conostomum tetragonum* is distinguished by its (1) narrow closely imbricate erect shoots with leaves in five distinct ranks, (2) dense brown rhizoids on the lower stems, (3) bluish-green color, (4) short cylindric ribbed capsules, (5) peristome teeth united at the tips, and (6) alpine habitat.

Technical description

GAMETOPHYTE — **Plants** in small tufts, 1–3 cm tall, glaucous green to bluish-green. **Stems** covered with rhizoids (radiculose) below, with a strong central strand. **Leaves** 0.8–1.5 mm long, narrowly lanceolate, acute, in 5 rows, erect and imbricate wet or dry; margins plane, serrate above near the apex, slightly revolute near the base; costa ending before the apex, more or less excurrent in upper leaves; upper medial cells rectangular or short-rhomboidal, thick walled, more or less papillose, the papillae formed by projecting cell ends near the apex. Perichaetial leaves larger than the stem leaves; perigonia large, cup shaped. **Dioicous**.

SPOROPHYTE — **Seta** 8–20 mm long, flexuose. **Capsules** asymmetric, oblong or obovoid with a short, thick neck, inclined, ribbed when dry, 2–3 mm long, the mouth oblique; operculum obliquely rostrate; annulus lacking; peristome teeth 16, long and narrow, red to orange, united at the tips. **Spores** 41–52 µm.

Similar species — Its glaucous to bluish-green color and stiff, erect, papillose and imbricate leaves distinguish *Conostomum tetragonum* from other members of the Bartramiaceae (*Bartramia*, *Philonotis*).

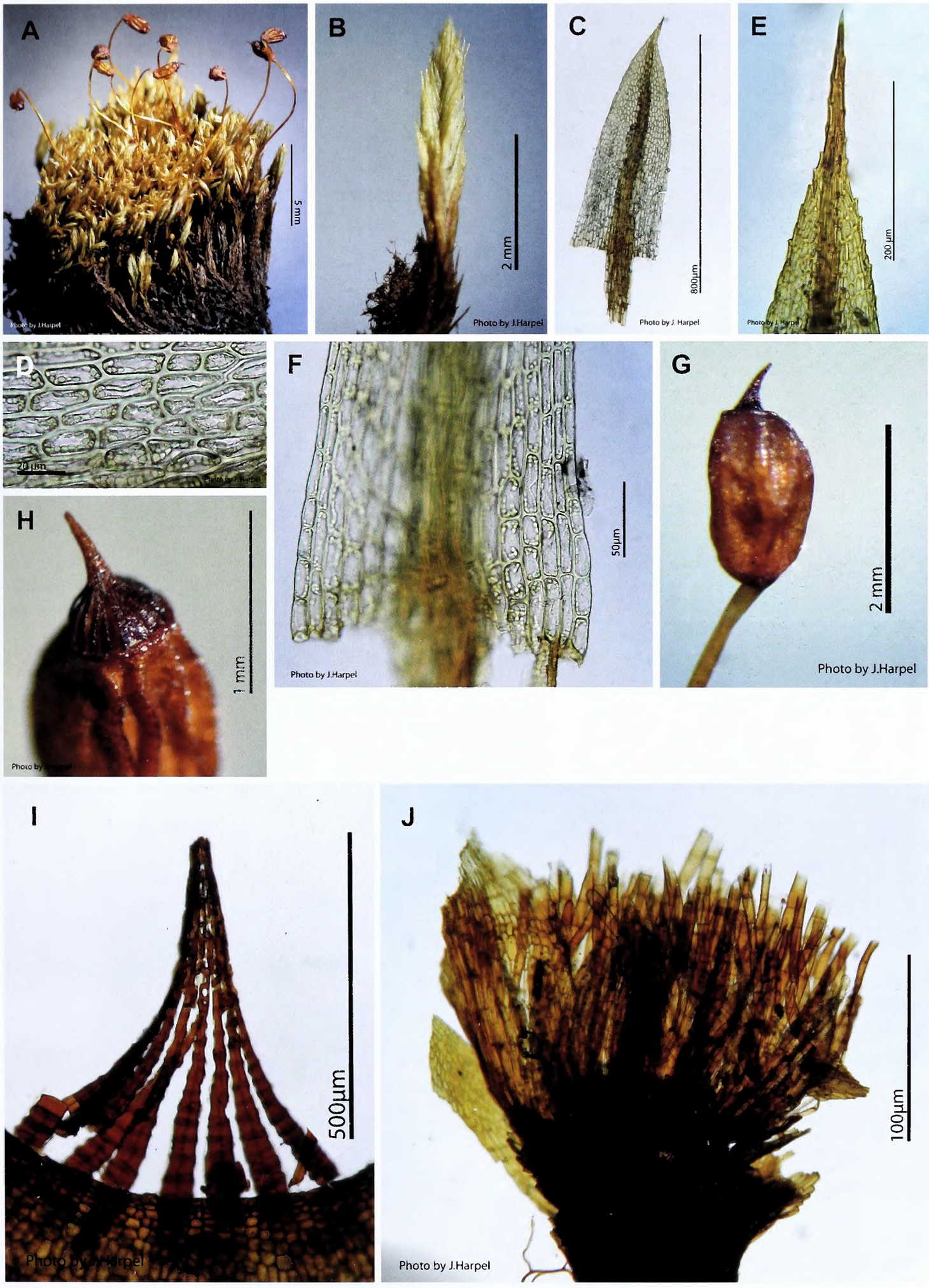
Ecology — *Conostomum tetragonum* occurs as small sods or inconspicuous solitary shoots intermixed with other bryophytes on soil in rock crevices in boulder fields, moraines, and cliff ledges. It is known from subalpine to alpine elevations, often in areas of late snowmelt. On Oregon's Mt. Hood, *Conostomum* occurs above timberline at about 6,500 feet in elevation, and is possibly associated with *Cassiope mertensiana* and *Phyllodoce empetriformis*. Elsewhere in the Pacific Northwest *Conostomum* probably also occurs in *Abies amabilis*, *Abies lasiocarpa*, *Pinus albicaulis* and *Tsuga mertensiana* associations. Lawton (1971) listed an elevation range of 4,500–6,600 feet.

Distribution — *Conostomum tetragonum* is known from Eurasia, Greenland and North America. In western North America, it is known from Alaska, Yukon and south through British Columbia, Washington, Oregon, California, Montana and Nevada. In Oregon, *C. tetragonum* is reported from Deschutes and Hood River counties within the West Cascades ecoregion.

References with descriptions and/or illustrations — Griffin III (in FNA 2014, p. 98), Christy and Wagner (1996; part VII, p. 24), Vitt et al. (1988, p. 80), Crum and Anderson (1981, p. 641), Lawton (1971, p. 209), Nyholm (1960, p. 293), Flowers (1935, p. 154).

References with photos — Atherton et al. (2010, p. 632), Malcolm et al. (2009, p. 198).

Plate 18. Conostomum tetragonum. *A. Dry habitat. B. Individual plant. C. Leaf. D. Upper medial cells. E. Leaf apex. F. Alar and basal cells. G–H. Sporophytes. I. Peristome teeth. J. Perichaetium. (W. Schofield 63444. 7978a. UBC)*


A
5 mm
B
2 mm
Photo by J.Harpel
C
800µm
Photo by J. Harpel
E
200 µm
D
20 µm
F
50µm
Photo by J.Harpel
G
2 mm
Photo by J.Harpel
H
1 mm
I
500µm
J
100µm
Photo by J.Harpel

Cynodontium jenneri (Schimper) Stirton

Recent synonym: *Didymodon jenneri* Schimper
Common name: Jenner's dog-tooth moss

Summary — An acrocarpous, costate moss with narrow lanceolate leaves from an ovate base. Terrestrial.

Diagnostic characteristics — *Cynodontium jenneri* is distinguished by its (1) narrow lanceolate leaves which are crisped when dry, (2) predominantly unistratose margins with occasional bistratose patches, (3) few scattered low papillae or smooth upper cells, and (4) lower shoots with numerous rhizoids.

Technical description

GAMETOPHYTE — **Plants** bright green in dense or lax tufts, up to 4 cm tall. **Leaves** crisped when dry, spreading when moist, narrowly lanceolate, long acuminate, 3–6 mm long, margins plane or recurved about half way up the leaf, unistratose with occasional patches of bistratose cells near the margins; upper medial cells quadrate, unistratose, smooth on both surfaces or often with scattered very low papilla, pellucid, 11–22 µm; basal cells rectangular; alar cells not differentiated; costa ending in or just below the apex. **Autoicous**.

SPOROPHYTE — **Seta** 2–15 mm straight wet or dry. **Capsules** symmetrical, erect, not strumose, annulus deciduous or sometimes partly persistent; peristome long, teeth divided about half way. **Spores** finely papillose, 20 –25 µm.

Similar species — *Cynodontium jenneri* can be distinguished from other *Cynodontium* taxa by its unistratose leaf lamina with bistratose patches on the margins, smooth laminal cells with occasional scattered low papillae, and sessile perigonium. Eckel (2007) notes, "*Cynodontium jenneri* is a tall, luxuriant species with long, flexuose leaves of a dilute yellow color, and pellucid areolation due to the relative scarcity of cell ornamentation (papillae) or distortion (mammillae)." It can be distinguished from other members of the Dicranaceae by having a narrow costa, non-differentiated alar cells, leaves that are crisped and contorted when dry.

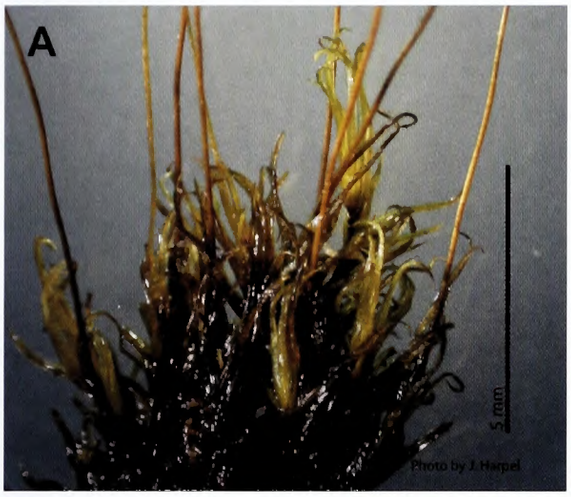
Ecology — According to Schofield (1976) *Cynodontium jenneri* occurs in coastal areas from sea-level to subalpine elevations. The species is known from peaty slopes, shaded rocks, outcrop crevices and shelves, and on humus of cliff terrace slopes. Eckel (2007) suggests species of *Cynodontium* in the strict sense favor siliceous rocks or soil. In addition, it is an oceanic species of Western Europe and the Pacific Northwest. Sporophytes are frequently produced and mature in early summer.

Distribution — *Cynodontium jenneri* is known from Europe and North America. In North America, it is known from Alaska, Yukon, British Columbia, Washington, Oregon, California and Wyoming. In Oregon, *Cynodontium jenneri* is reported from Clatsop County in the Coast Range ecoregion.

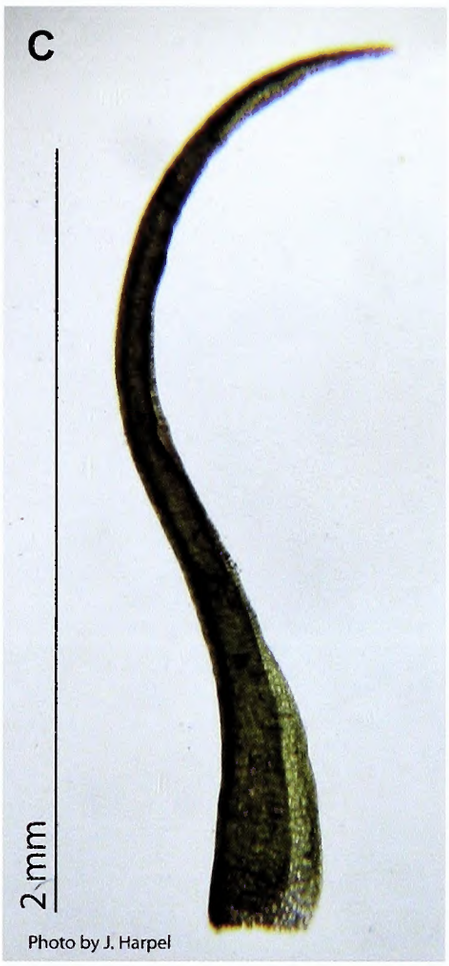
References with descriptions and/or illustrations — Eckel (in FNA 2007 p. 379), Smith (2004, p. 173), Lawton (1971, p. 63), Nyholm (1954, p. 53).

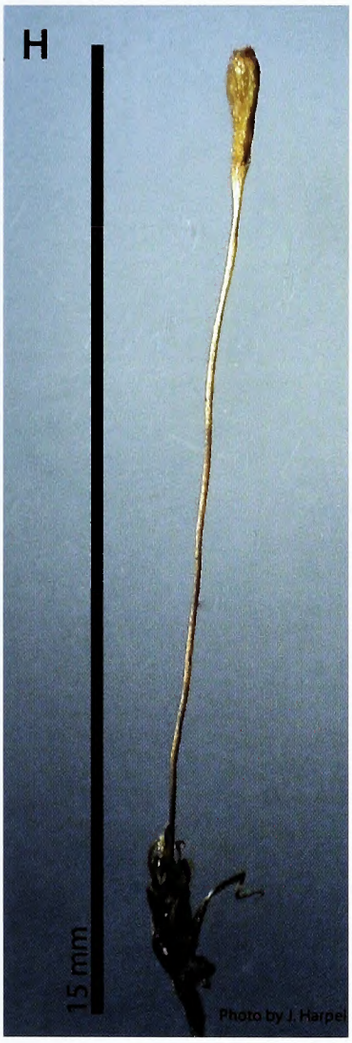
References with photos — Atherton et al. (2010, p. 359), Lockhart et al. (2013, p. 369), Malcolm et al. (2009, p. 99).

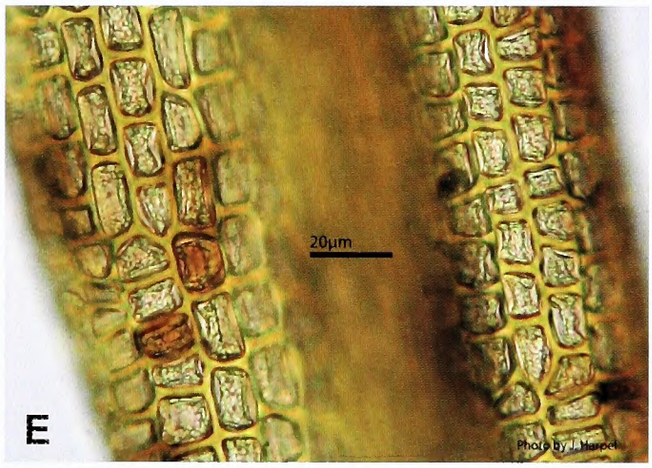
Plate 19. Cynodontium jenneri. *A. Habitat wet. B. Habitat with sporophytes. C. Leaf, D. Leaf apex, E. Upper medial cells, F. Alar and basal cells, G. Leaf cross-section, H–I. Sporophytes. (W. Schofield 6800, UBC)*

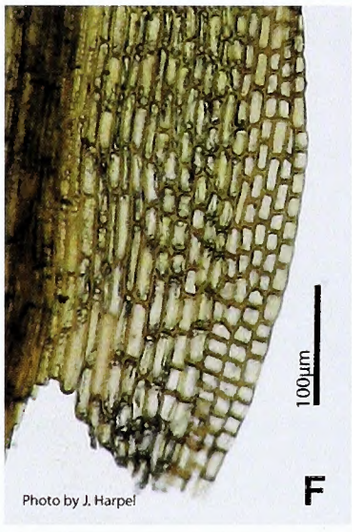

A
5 mm
Photo by J. Harpel


B
10 mm
Photo by J. Harpel

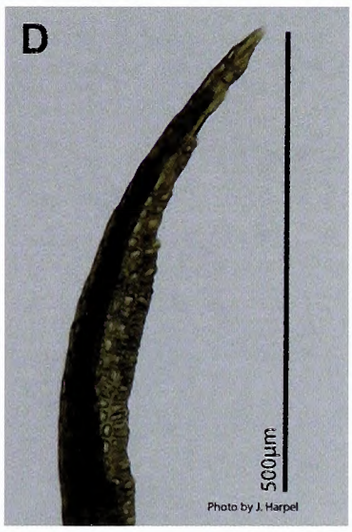

C
2 mm
Photo by J. Harpel


H
15 mm
Photo by J. Harpel


20µm
E
Photo by J. Harpel


100µm
Photo by J. Harpel
F


I
3 mm
Photo by J. Harpel


D
500µm
Photo by J. Harpel


G
200µm
Photo by J. Harpel

Dichodontium olympicum Renauld & Cardot

Recent synonym: none
Common name: Olympic dichodontium moss

Summary — An acrocarpous, costate moss with obong-lanceolate to ligulate leaves. Terrestrial.

Diagnostic characteristics — *Dichodontium olympicum* is distinguished by its (1) ligulate leaves that are bistratose in spots, (2) papillose-serrate leaf margins, (3) unipapillose laminal cells, (4) plane leaf margins, and (5) strumose capsules.

Technical description

GAMETOPHYTE — **Stems** 0.4–0.8 cm high. **Leaves** spreading when moist, somewhat contorted when dry, 1–2.2 mm long, oblong-lanceolate to ligulate, apex rounded-obtuse to obtusely acute; margins plane or incurved, entire or often crenlate by projecting cell ends; lamina sometimes bistratose in spots; upper and median leaf cells more or less isodiametric, 7–10 µm, unipapillose with sharp papillae, the papillae often forked; basal cells longer and smooth or with few papillae. **Autoicous**.

SPOROPHYTE — **Seta** 4–8 mm long. **Capsules** inclined, zygomorphic, strumose, smooth or irregularly wrinkled and shrunken under the mouth when dry, the urn 1–1.4 mm long. Peristome teeth are longitudinally striate except the papillose tips. **Spores** 12–17 µm, smooth or nearly so.

Similar species — The plane leaf margins and strumosa capsules distinguish *Dichodontium olympicum* from *D. pellucidum,* which has margins recurved at the base and a non-strumose capsule. *Dichodontium* can be separated from other members of the Dicranaceae by the non-julaceous leaves, narrow costae, non-differentiated alar cells, leaves that crisp and contorted when dry, and papillose-mammillose leaf cells with a large simple (rarely forked) papilla on each surface.

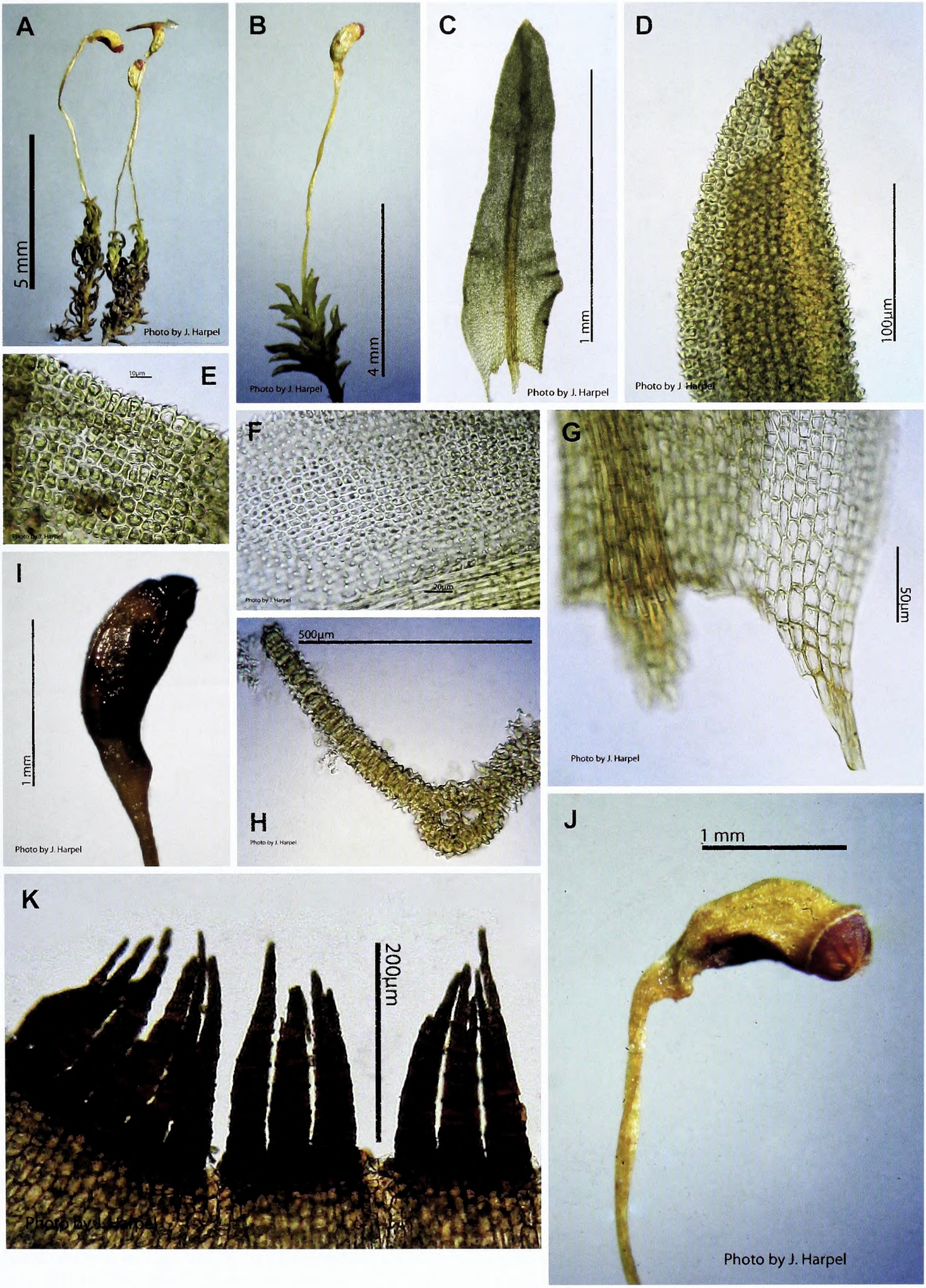
Ecology — *Dichodontium olympicum* is known from subalpine to alpine locations on wet soil or soil over rocks, often near melting snow at elevations ranging from 3,000–6,600 feet. Capsules mature July to October.

Distribution — *Dichodontium olympicum* is endemic to western North America and is known from British Columbia, Washington, Oregon, California, Alberta, Idaho, Montana, and Wyoming. In Oregon, *Dichodontium olympicum* is reported from Grant County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Eckel (in FNA 2007a, p. 384), Lawton (1971, p. 65), Grout (1937, p. 66).

References with photos — Malcolm et al. (2009, p. 100).

Plate 20. Dichodontium olympicum. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Basal cells. G. Alar cells. H. Leaf cross-section. I–J. Sporophytes. K. Peristome teeth. (W. Schofield 74284. UBC)*


A
5 mm
Photo by J. Harpel
B
4 mm
Photo by J. Harpel
C
1 mm
Photo by J. Harpel
D
100µm
Photo by J. Harpel
E
10µm
Photo by J. Harpel
F
20µm
Photo by J. Harpel
G
50µm
Photo by J. Harpel
H
500µm
Photo by J. Harpel
I
1 mm
Photo by J. Harpel
J
1 mm
Photo by J. Harpel
K
200µm

Didymodon eckeliae R.H. Zander

Recent synonyms: none
Common names: Eckelia's Didymodon

Summary — An acrocarpous, costate moss with lanceolate to lanceolate-subulate leaves. Terrestrial.

Diagnostic characteristics — *Didymodon eckeliae* can be distinguished by its (1) broadly scalloped (crenulate) or weakly notched leaf margins, (2) fragile leaf tips, and (3) distal bistratose leaf margins.

Technical description

GAMETOPHYTE — **Plants** forming dark green, to tan cushions. **Stems** up to 1.5 cm long with a central strand. **Leaves** 2–3 mm, appressed, incurved, somewhat twisted when dry, patent to spreading-recurved when moist, long-lanceolate. Costa keeled, and grooved, especially near leaf apex, ending in a short-excurrent mucro of quadrate or irregular, to isodiametric cells. Ventral costal cells quadrate, about 4 cells wide at mid leaf, with 2 layers of guide cells. The leaf apex is somewhat fragile, narrowly acute or narrowly blunt and long-acuminate. Margins bistratose, narrowly recurved in upper 1/3–1/2 of leaf, broadly crenate, sinuose or weakly notched. Leaf base not differentiated to short-oblong. Basal cells weakly differentiated, quadrate to short-rectangular, evenly thickened to thin, not porose. Upper medial cells 7–9 µm wide, (1:1) nearly smooth or with 2–3 simple or bifid papillae per lumen. Asexual reproduction is suspected by fragile leaf tips. The upper laminal cells are yellow-red in KOH. Apparently **dioicous**, perigonia have not been found. Perichaetial leaves differ little from the cauline leaves or with wider bases.

SPOROPHYTE — **Seta** 8–10 (–13) mm long. **Capsules** 2–2.4 mm long, with 32 linear, weakly twisted peristome teeth. **Spores** 8–10 (–13) µm.

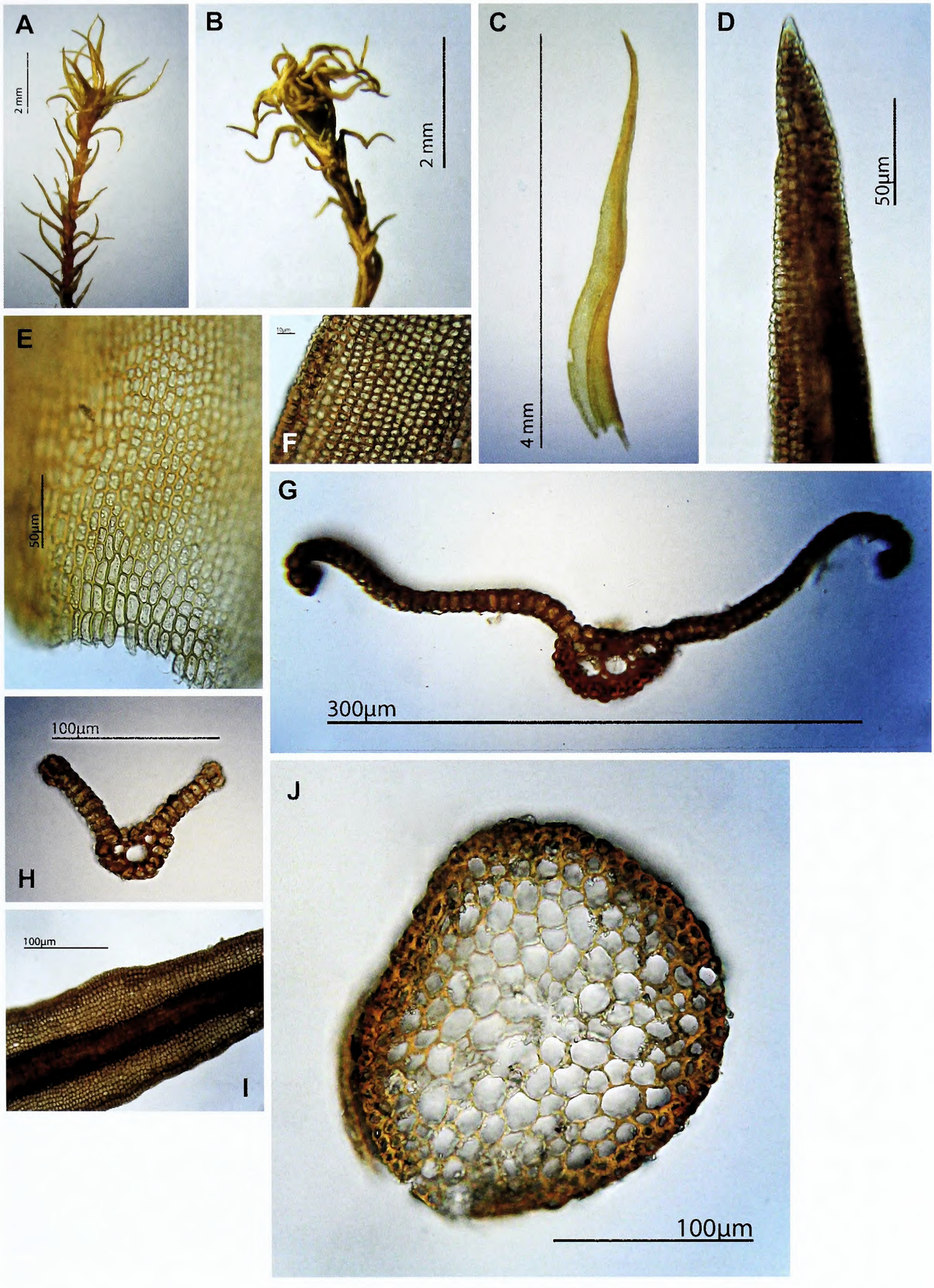
Similar species — *Didymodon eckeliae* is distinguished from other members of the genus by broadly scalloped, crenate or weakly notched, bistratose leaf margins, otherwise similar to *Didymodon vinealis*. However, *D. eckeliae* has a narrow, bistratose leaf margin that extends from the leaf tip to the broadened base. *Didymodon vinealis* is often bistratose in patches along the leaf margin, but not continuous.

Ecology — *Didymodon eckeliae* is found on trunks and bases of trees, soil over rock at moderate elevations.

Distribution — *Didymodon eckeliae* is known from Spain and western North America. In western North America, it is known from British Columbia, Washington, Oregon and California. In Oregon, *D. eckeliae* is reported from Hood River, Lane, Multnomah and Umatilla counties within the Columbia Basin and West Cascades ecoregion.

References with descriptions and/or illustrations — Zander (in FNA 2007e, p. 552), Puche et al. (2006), Zander (2001).

Plate 21. Didymodon eckeliae. *A. Individual plant. wet. B. Individual plant. dry. C. Leaf. D. Leaf apex. E. Alar and basal cells. F. Upper medial cells. G–H. Leaf cross sections. I. Leaf margin. J. Stem cross section. (D. Toren 9542D. CAS)*


A
2 mm
B
2 mm
C
4 mm
D
50µm
E
50µm
F
10µm
G
300µm
H
100µm
I
100µm
J
100µm

Didymodon norrisii R.H.Zander

Recent synonym: none
Common name: Norris's didymodon

Summary — An acrocarpous, costate moss with reflexed lanceolate to ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Didymodon norrisii* is distinguished by its (1) red-brown color, (2) broad mamillose cells, (3) two layers of guide cells (4 in the dorsal and 1–2 in the ventral layer), and (4) leaf base reflexed as a short collar.

Technical description

GAMETOPHYTE — **Plants** red-brown to brick-red or rose-red, sometimes blackish tight tufts. **Stems** 1–1.5 cm, with a central strand, lower leaves often denuded. **Leaves** appressed when dry, spreading but not keeled when wet; ovate to ovate lanceolate, ventral surface broadly concave, occasionally channeled near the apex, 1.2–1.5 mm; margins recurved in the lower 2/3–3/4, minutely crenulate by projecting cell walls; apex acute to short-acuminate, sometimes broken; costa thick, 6–10 cells wide above midleaf, percurrent, strong, often weakly spurred; ventral cells quadrate throughout; guide cells in 2 layers; dorsal laminal cells 9–13 mm wide, 1:1 (–2), often transversly elongate near proximal leaf margins, laminal papillae absent or hemispherical and several per cell, or appearing mammillose. The dorsal laminal cells are deep brick to rose-red in 2% KOH. **Dioicous**. Asexual reproduction by fragile foliose stem tips.

SPOROPHYTE — **Seta** 1–1.4 cm. **Capsules** 1.5–2 mm; peristome apparently absent or rudimentary. **Spores** 10–13 μm.

Similar species — *Didymodon norrisii* is distinguished from other *Didymodon* species by its intact or occasionally broken leaf apices, leaves that are non-keeled when moist and margins not highly recurved, thick costa 6–10 cells wide above mid-leaf, and a rudimentary or lacking peristome. *Barbula* is similar but has clear axillary hairs and elongate ventral costal cells. *Didymodon* has axillary hairs with a brown basal cell and quadrate to short-rectangular costal ventral cells.

Ecology — *Didymodon norrisii* occurs on rock outcrops (calcareous and volcanic) within grasslands near oak and conifer forests in low to moderate elevations (600–4,500 feet). In California, *D. norrisii* has been found on volcanic rock outcrops or rock slabs within open grasslands adjacent to *Quercus douglasii* stands, on moist exposed rocky outcrops in open *Quercus* and chaparral forests, in open grasslands on volcanic rock slabs, on small rocks and pebbles over sheet drainages, and in grasslands associated with conifer and oak transitional forests on pillow basalt rock terraces with serpentine soils. Capsules mature in May.

Distribution — *Didymodon norrisii* is endemic to the Pacific coast of western North America and is known only from British Columbia, Washington, Oregon, and California. In Oregon, *Didymodon norrisii* is reported from Jackson County in the Klamath Mountain ecoregion.

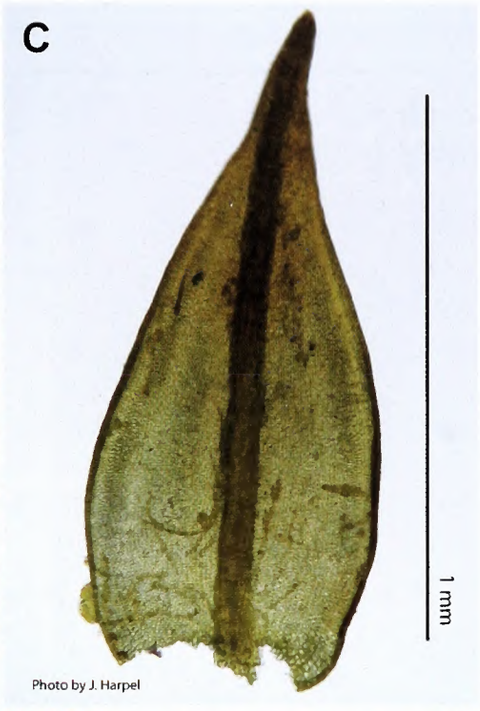
References with descriptions and/or illustrations — Zander (in FNA 2007e, p. 548), Zander (1999).

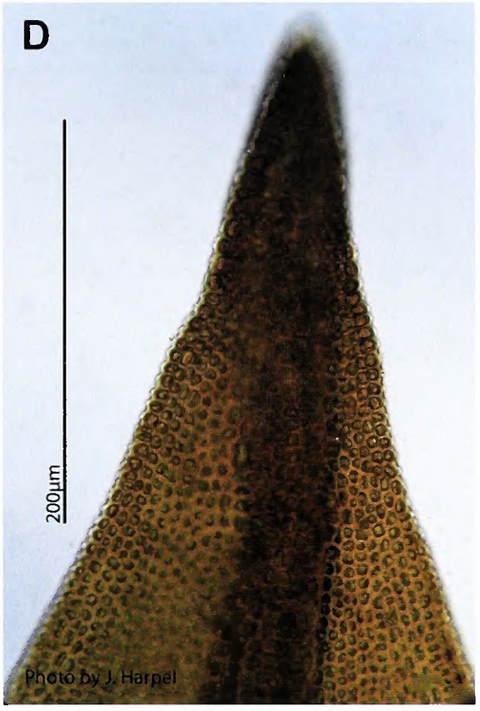
References with photos — Malcolm (2009, p. 125).

Plate 22. Didymodon norrisii. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Alar and basal cells. G–H. Leaf cross-sections. I. Stem cross-section. (D. Toren 7402. CAS)*

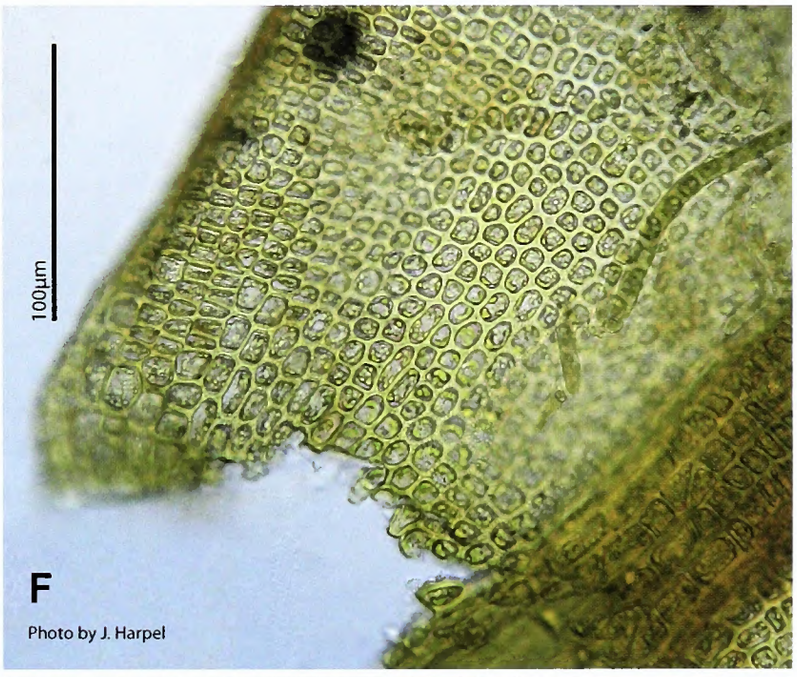

A
2 mm
Photo by J. Harpel

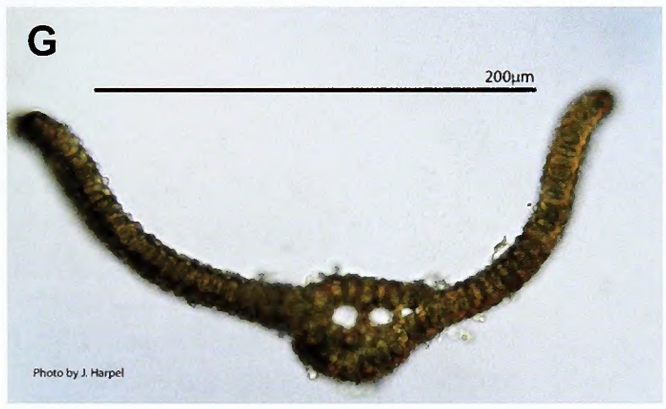

B
Photo by J. Harpel
2 mm

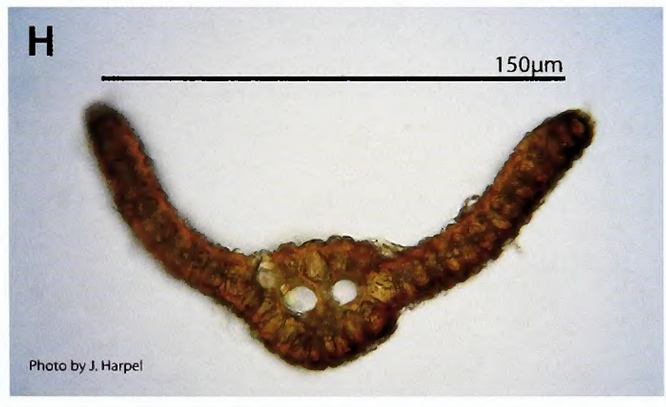

C
1 mm
Photo by J. Harpel


D
200µm
Photo by J. Harpel


E
10µm
Photo by J. Harpel


100µm
F
Photo by J. Harpel


G
200µm
Photo by J. Harpel


H
150µm
Photo by J. Harpel


I
150µm
Photo by J. Harpel

Ditrichum flexicaule (Schwägrichen) Hampe

Recent synonym: *Cynodontium flexiaule* Schwägrichen
Common names: ditrichum moss, bendy ditrichum

Taxonomic note: Morphologially, *Ditrichum flexicaule* is exceedingly variable. While many workers have treated the variation and the described variant taxa as one highly polymorphic species, others have recognized two principal entities, *D. crispatissimum* (=*D. crinale* (Taylor) Kuntze) and *D. flexicaule*. Seppelt, Ireland and Robinson (2007) follow the first interpretation. A comprehensive molecular analysis of the group is needed.

Summary — An acrocarpous, costate moss with lanceolate or subulate leaves. Terrestrial.

Diagnostic characteristics — *Ditrichum flexicaule* can be distinguished by its (1) dense sod-like habit in calcareous habitats, (2) long stems usually matted with rhizoids, and (3) plane or incurved leaf margins.

Technical description

GAMETOPHYTE — **Plants** usually in dense dark green to brownish tufts, more or less matted with rhizoids. Stems are 1–4 cm high, sometimes branching. **Leaves** 1–7 mm long, lanceolate, to subulate from a sheathing base, erect to second, often somewhat contorted when dry; margins entire, or lightly serrate near the apex; costa 1/4–1/3 leaf width at base, subpercurrent to long excurrent, with two stereid bands; upper medial cells smooth, variable, short-rectangular to elongate-rhomboid, rounded or oblong-elliptical, longer near the base; basal marginal cells near the shoulder usually obliquely rhomboidal and lighter in color. **Dioicous**.

SPOROPHYTE — **Seta** dark red, more or less flexuous, 1–3.5 cm long. **Capsules** more or less erect, ovoid to cylindric, smooth, reddish-brown, 1.5–2 mm long; peristome teeth divided to a low basal membrane, red below and hyaline above, spinose-papillose, nodose only at the base. **Spores** 8–12 µm, smooth or finely papillose.

Similar species — *Ditrichum flexicaule* is distinguished from other *Ditrichum* species by the densely tufted, more or less tomentose proximal stems that are 1–4 cm long. Other *Ditrichum* species may have stem tomentum, but only at the extreme base. *Ditrichum* can be distinguished from other genera in the Ditrichaceae by its leaves in more than two rows, lanceolate to subulate leaves, 0.5–4 cm long stems, and a peristomate capsule. *Ceratodon* has recurved margins and a sulcate capsule when dry, while *Ditrichum* has mostly plane margins and a non-sulcate capsule.

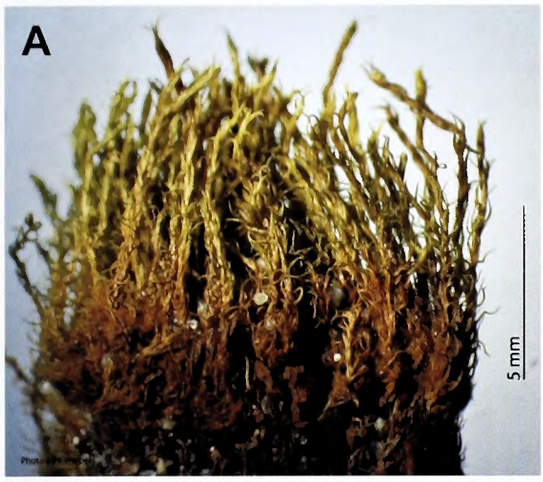
Ecology — *Ditrichum flexicaule* occurs on calcareous rock or soil over rock, especially bluffs, cliffs or crevices or cliffs and soil, usually in dry and exposed locations in lowland to alpine regions. Capsules mature June to July.

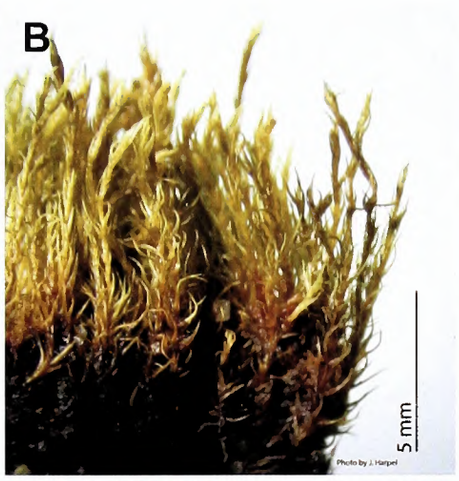
Distribution — *Ditrichum flexicaule* is known from Eurasia, New Zealand, Greenland, and North and Central America. In western North America, it is known from all Canadian provinces and Washington, Oregon, Idaho, Montana, Wyoming, and Colorado. In Oregon, *Ditrichum flexicaule* is reported from Clatsop and Jackson counties within the Coast Range and Klamath Mountain ecoregions.

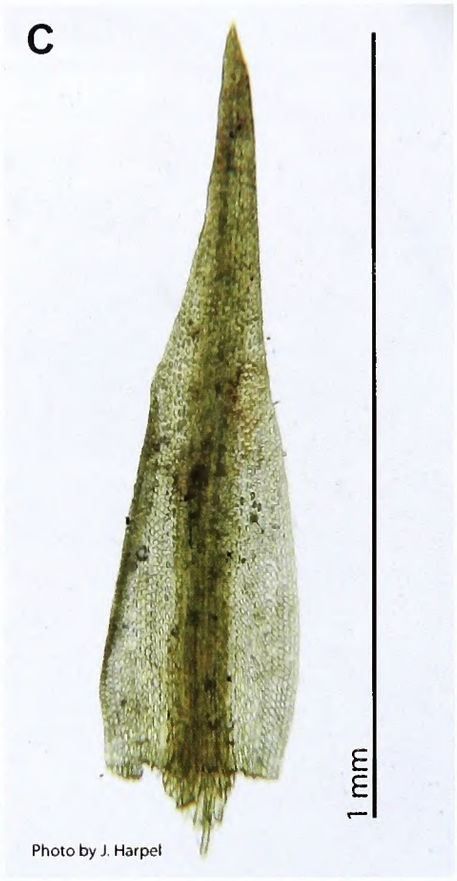
References with descriptions and/or illustrations — Seppelt, Ireland and Robinson (in FNA 2007, p. 452), Lawton (1971, p. 52), Nyholm (1954, p. 28), Grout (1936, p. 46).

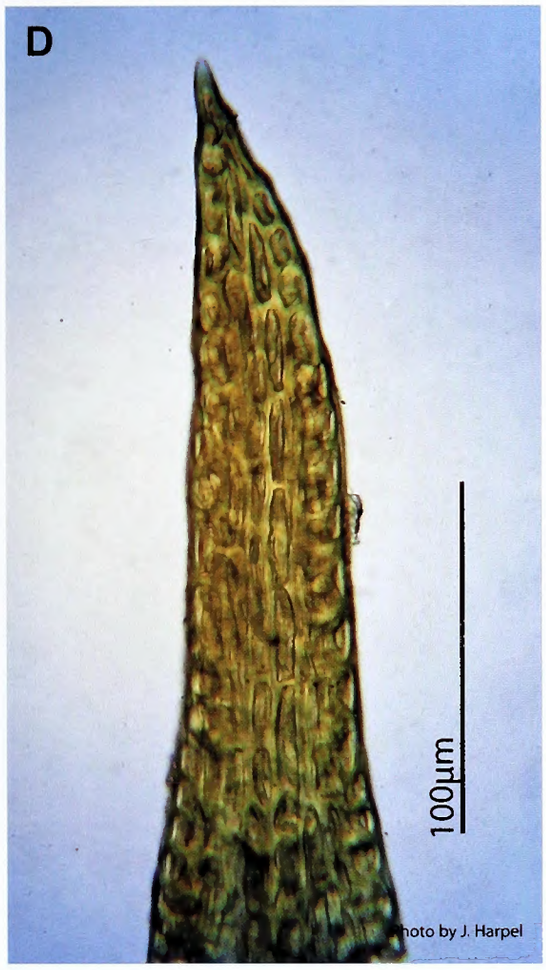
References with photos — Lockhart et al. (2012, p. 364), Atherton et al. (2010, p. 348).

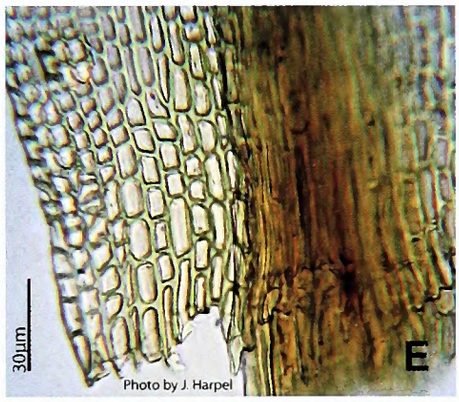
Plate 23. Ditrichum flexicaule. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Leaf apex. E. Alar and basal cells. F. Upper medial cells. (J. Harpel 472. Harpel Private)*

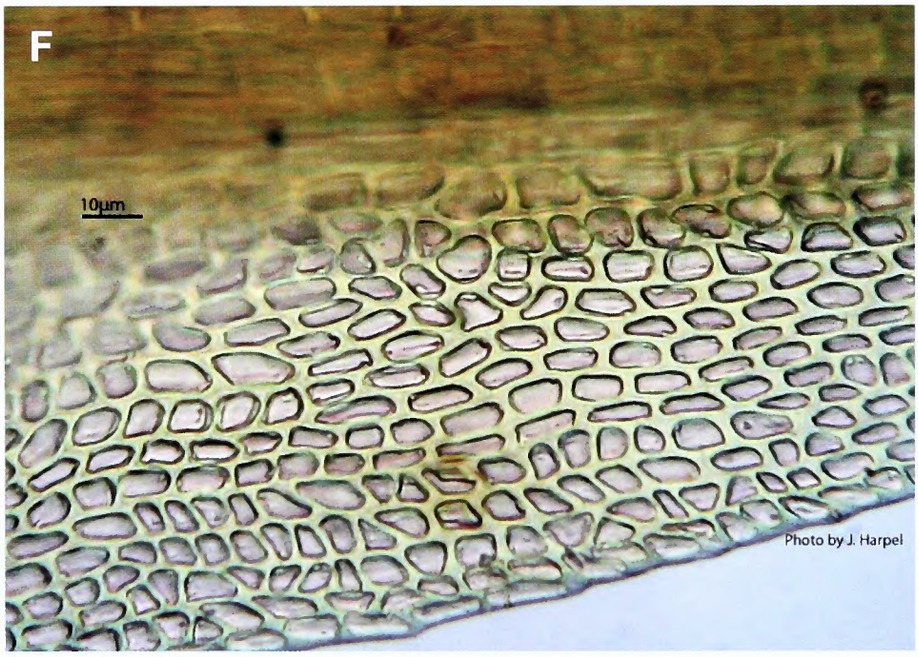

A
5 mm


B
5 mm


C
1 mm
Photo by J. Harpel


D
100µm
hoto by J. Harpel


30µm
E
Photo by J. Harpel


F
10µm
Photo by J. Harpel

Elodium blandowii (F. Weber. & D. Mohr) Eckel

Recent synonym: *Helodium blandowii* (F. Weber. & D. Mohr) Warnstorf
Common names: Blandow's feather moss, Blandow's helodium moss, wetland plume moss

Summary — A pleurocarpous, costate, papillose moss with ovate leaves. Terrestrial.

Diagnostic characteristics — *Elodium blandowii* is distinguished by its (1) presence of a costa, (2) dense, elongate paraphyllia greater than 5:1 (at least at the apex), (3) non-differentiated alar region, (4) laminal papillae, (5) entire to serrulate leaf margins, (6) lack of a central strand, and (7) bog and marsh habitat.

Technical description

GAMETOPHYTE — **Plants** in yellow-green loose tufts, with closely pinnate and plumose branches densely covered with paraphyllia. **Stems** more or less erect. **Leaves** appressed to somewhat crisped when dry. Stem leaves 1.3–1.8 × 0.7–1 mm, broadly ovate, tapering to short-acuminate, abruptly narrowed at the insertion, with paraphyllia on leaf base, decurrent; margins more or less revolute to the apex, serrate with short sharp teeth; costa extending beyond the middle; upper medial cells oblong-fusiform or oblong-rhomboidal, 3–5:1, papillose on the dorsal surface; branch leaves smaller, to about 0.8 mm long, apical cells not papillose. **Autoicous**.

SPOROPHYTE — **Seta** 3–5 cm long, reddish-brown and strongly arcuate and incurved under the capsule mouth when dry. **Capsules** oblong-cylindric, curved with a short neck, urn 3–4 mm long, yellowish-brown becoming reddish-brown in age. Peristome teeth are reddish-brown at the base, becoming pale and finely papillose above. **Spores** 11–15 µm.

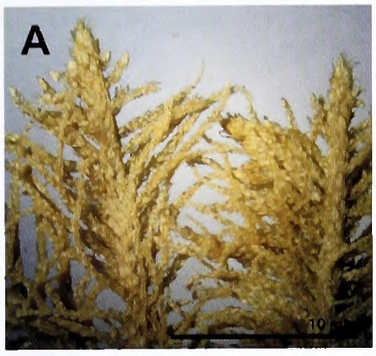
Similar species — *Elodium blandowii* is distinguished from other *Elodium* species by lacking a central strand, its short-acuminate leaf apices and paraphylla that are up to 27 cells long (vs. 7–11 long). *Echinophyllum,* also included in the Helodiaceae, differs from *Elodium* by its dioicous sexual condition, longer stem leaf apical cell, and costae with coarse spinose teeth over the distal half.

Ecology — *Elodium blandowii* forms mats and small hummocks in medium to rich montane fens with calcareous water. It is sometimes found around sedges and shrubs located at the edges of fens or along streamlets in fens. The species has also been noted from hydric soil in open or wooded fens, along streams, swamp edges, wet tree bases, in hummocks in peat and cedar bogs, tundra benches, and creek gravel bars. In Oregon, elevations range from 5,000–6,000 feet and forest types include *Abies amabilis, Abies concolor, Abies magnifica* × *shastensis,* and *Pinus contorta* var. *latifolia* associations. Accompanying vascular species include *Betula glandulosa, Carex limosa, Eleocharis quinqueflora, Salix geyeriana,* and *Scheuchzeria palustris*. Associated bryophytes include *Aulacomnium palustre, Calliergon stramineum, Hamatocaulis vernicosus, Meesia triquetra,* and *Tomenthypnum nitens*. Capsules are rare in the Pacific Northwest. Spores mature in August.

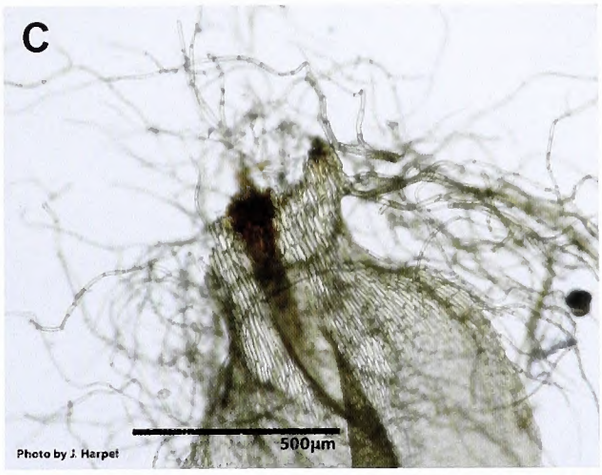
Distribution — *Elodium blandowii* is known from Eurasia, Greenland and North America. In western North America, *E. blandowii* is widespread and is known from every Canadian province and territory and in all western United States except New Mexico. In Oregon, *E. blandowii* is reported from Deschutes, Douglas, Grant, Jackson, Klamath, Umatilla, and Wheeler counties within the Blue Mountain and West Cascades ecoregions.

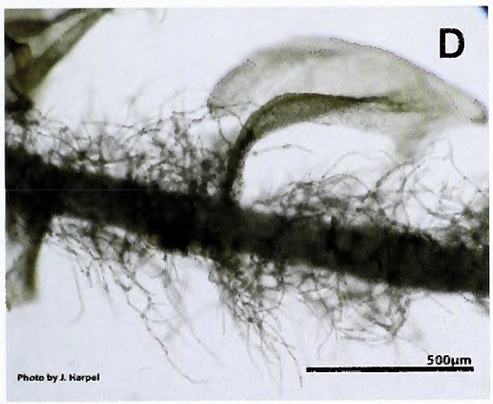
References with descriptions and/or illustrations (cited as *Helotium blandowii* in all except Eckel)— Eckel (in FNA 2014, p. 322), Kelly (2000, p. 53), Christy and Wagner (1996, part VII, p. 34),

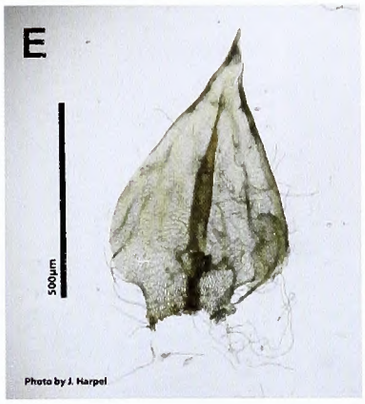
Plate 24. Elodium blandowii. *A. Dry habitat. B. Moist habitat. C.–D. Leaf and stem paraphyllia. E. Stem leaf. F. Stem leaf upper medial cells. G. Branch leaf. H. Branch leaf upper medial cells. I–J. Sporophytes. (G. Yates sn. W. Rolle sn. C. Bird 4782. Harpel Private)*

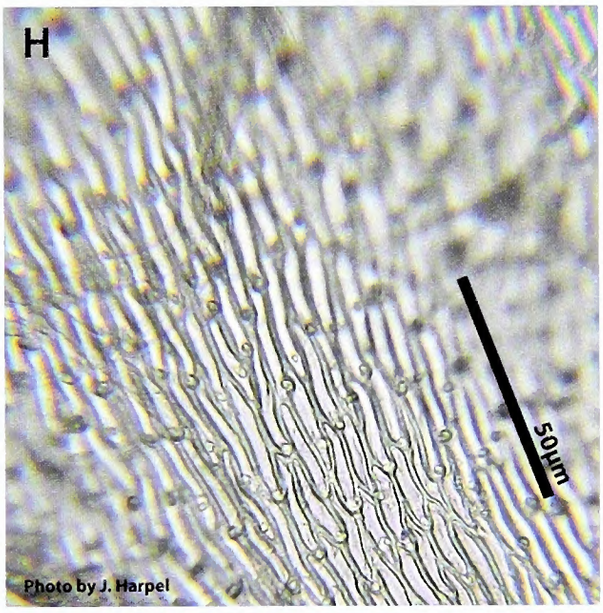

A

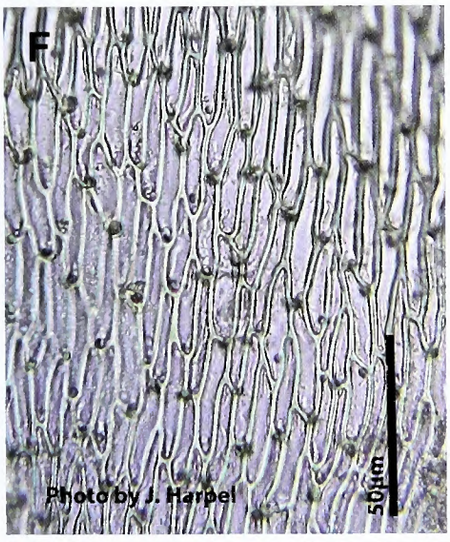

B
10 mm


C
Photo by J. Harpel
500µm


D
500µm
Photo by J. Harpel


E
500µm
Photo by J. Harpel


H
50µm
Photo by J. Harpel


F
50µm
Photo by J. Harpel


G
500µm
Photo by J. Harpel


J
5 mm
Photo by J. Harpel


I
2 mm
Photo by J. Harpel

Johnson et al. (1995, p. 324), Vitt et al. (1988, p. 85), Crum and Anderson (1981, p. 912), Flowers (1973, p. 399), Lawton (1971, p. 261), Nyholm (1960, p. 390), Grout (1934, p. 179).

References with photos — Malcolm et al. (2009, p. 247, as *H. blandowii*).

Encalypta brevicollis (Bruch & Schimper) Åongström

Recent synonyms:

Encalypta longicollis var. *brevicollis* Bruch & Schimper

Encalypta brevicollis subsp. *crumiana* D.G. Horton

Common name: candle snuffer moss

Summary — An acrocarpous, costate moss with oblong spathulate leaves. Terrestrial.

Diagnostic characteristics — *Encalypta brevicollis* is distinguished by its (1) long awn, (2) broad, oblong to narrowly spathulate leaves, (3) whitish peristome, (4) lack of ribs on the capsule, and (5) unique cylindrical calyptra.

Technical description

GAMETOPHYTE — **Stems** 20–25mm, central strand lacking. **Leaves** oblong to narrowly spathulate, 2–6 mm, relatively broad, oblong or obovate, hooded and contorted when dry; laminal cells with straight walls and simple papillae. Leaves keeled with a prominent, shiny green or brown costa that is plainly spiny-papillose on the back toward the tip of the leaf; apices obtuse or broadly acute, hair-pointed, awn short up to 2 mm; margins plane; costa excurrent, awns shorter than leaf lamina; laminal cells 15–20 µm; basal cells rectangular, 20–90 µm, smooth; basal marginal cells differentiated, longer than laminal cells in 8–12 rows. **Autoicous**.

SPOROPHYTE — **Seta** dark red, ranging from 5–16 mm long. **Capsules** exserted, long-cylindric, 1.5–3.5 mm, smooth; exothecial cells rectangular, walls thickened; peristome diplolepideous, not well-developed, teeth irregular, narrowly lanceolate, 0.5 mm, papillose or rarely smooth, erect when wet or dry; endostome segments attached to exostome teeth, papillose, as long as teeth; operculum 2 mm. Calyptra 4–8 mm, lacerate at base, papillose distally. **Spores** 30–40 µm, warty, brown.

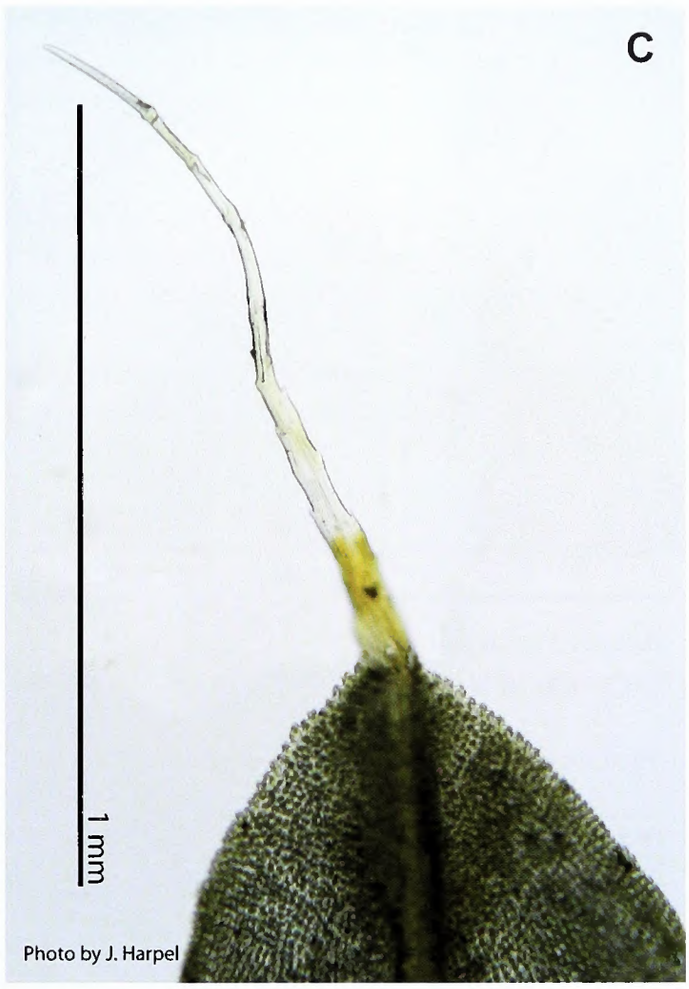
Similar species — The long awn on narrowly spathualate leaves and whitish peristome are distinctive for *Encalypta brevicollis*. In addition, *E. brevicollis* capsules are not ribbed. *Encalypta brevipes* has a short beak on the calyptra and lacks a peristome. Some *Tortula* species also occur in rocky crevices but they have brownish leaves, C-shaped or antler-shaped leaf papillae, and peristome teeth wound up tightly in a distinctive cone. See *E. brevipes* for additional similar species.

Ecology — One Oregon site occurs at 4,400 feet on a large, igneous outcrop on a northwest ridge that is is exposed to marine influences. *Encalypta brevicollis* is restricted to minor crevices and fractures. Some sites have partial local shade. Although bryoflora on the north face generally indicate relatively humid conditions, there is no seep immediately associated with the *E. brevicollis* locations. The Oregon site is fully exposed, although the lower outcrop extends downward into a Douglas-fir and true fir forest. Other bryophytes at this site include *Grimmia montana*, *G. ramondii* and *Racomitrium* spp. Associated vascular plant cover, which is sparse, includes *Cheilanthes gracillima*, *Sedum* sp., and *Selaginella wallacei*. Capsules mature June to July.

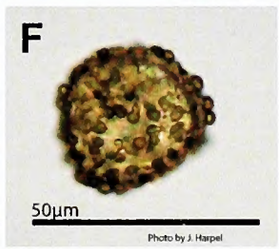
Plate 25. Encalypta brevicollis. *A. Moist individual with sporophyte. B. Leaf. C. Leaf apex. D. Upper medial cells. E. Alar and basal cells. F. Spore. G. Calyptra. (W. Schofield 70275. UBC)*


A
15 mm
Photo by J. Harpel


B
2 mm
Photo by J. Harpel


C
1 mm
Photo by J. Harpel


D
30µm
Photo by J. Harpel


F
50µm
Photo by J. Harpel


G
6 mm
Photo by J. Harpel


500µm
E
Photo by J. Harpel

Horton (1983) described *Encalyptra brevicollis* habitats in general as relatively exposed windswept xeric sites with protected microhabitats with more mesic tendencies than the surrounding macrohabitat. Associated bryophytes include *Amphidium lapponicum, Bartramia ithyphylla, Encalypta ciliata, Polytrichastrum alpinum, Polytrichum piliferum, Racomitrium canescens,* and *R. heterostichum*.

Distribution — *Encalypta brevicollis* is known from Eurasia, Greenland and North America. In western North America, it is known from every Canadian province, Washington and Oregon. In Oregon, *Encalypta brevicollis* is reported from Coos and Curry counties within the Coast Range and Klamath Mountain ecoregions.

References with descriptions and/or illustrations — Magill (in FNA 2007, p. 178), Horton (1983, p. 471 as *Encalypta brevicolla* subsp. *crumiana*), Nyholm (1954, p. 85 as *Encalypta brevicollis*).

Encalypta brevipes Schljakov

Recent synonym: none
Common names: candle snuffer moss, stubby extinguisher moss

Summary — An acrocarpous, costate moss with oblong spathulate leaves. Terrestrial.

Diagnostic characteristics — *Encalypta brevipes* is distinguished by its (1) distinctly awned oval-spathulate leaves, (2) short setae, (3) lack of a peristome, and (4) calyptra with a very short rostrum. If the calyptra is missing, look for cylindrical capsules barely exserted above the leaves with a thick-walled red rim around the mouth of the urn.

Technical description

Gametophyte — **Plants** forming light to dark green tufts, 10–14 mm tall. **Stem** central strand absent. **Leaves** 2–4 mm, broadly oblong to elliptic or spathulate, contorted and incurved when dry, apex rounded; costa excurrent, shiny, dark green, keeled, apiculate to a long hair point; margins plane; upper medial cells 12–14 µm wide, 8–12 µm long, with 3–5 papillae per cell; basal cells rectangular, 60–90 µm, smooth, thickened; basal marginal cells in 10–20 differentiated rows. **Autoicous**.

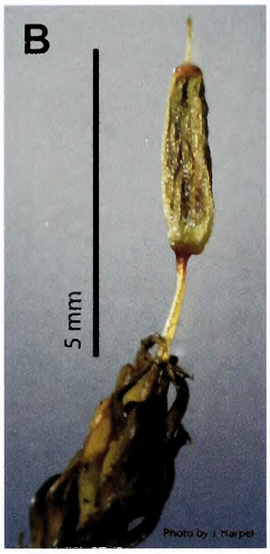
Sporophyte — **Seta** 1–3 mm long, flexuose to erect, red to yellowish-red, strongly ridged. **Capsules** cylindric, 1–3 mm when dry, more or less constricted below the mouth, exserted or emergent, smooth, reddish-yellow with a distinctive red rim; gymnostomous; exothecial cells rectangular, thick walled, to 85 µm; peristome absent. Calyptra 2–5 mm, fringed at base, smooth to weakly papillose. **Spores** 30–50 µm, warted.

Similar species — *Encalypta brevipes* sporophytes have distinctive very short setae that raise the capsules above the leaf awns. In the absence of sporophytes, *E. brevipes* is distinguished by its short awn and lack of peristome. *Encalypta alpina* and *E. spathulata,* also lack peristomes and have distinct awns. *E. alpina* has lanceolate leaves with an acute apex and *E. spathulata* has weakly striate to longitudinally ribbed capsules. Several other *Encalypta* species are similar but either lack a long awn or have a muticous or mucronate apex. See *E. brevicollis* for additional similar species.

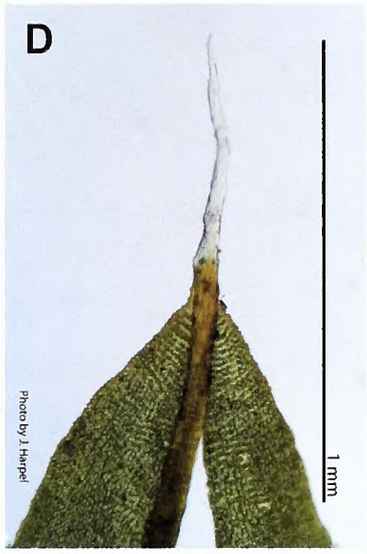
Ecology — *Encalypta brevipes* occurs on soil on rock ledges and in cliff crevices and is reported from both igneous and siliceous substrates (Horton 1983; Hedderson and Brassard 1992). Sites may be subject to frequent

Plate 26. Encalypta brevipes. *A. Moist habitat. B. Dry sporophyte. C. Leaf. D. Leaf apex. E. Alar and basal cells. F. Upper medial cells. G. Calyptra. H. Fringe on base of calyptra. I. Spores. J. Mouth of urn. K. Perigonium. (W. Schofield 68029. UBC)*


A
10 mm
Photo by J. Harpel


B
5 mm
Photo by J. Harpel


C
3 mm
Photo by J. Harpel

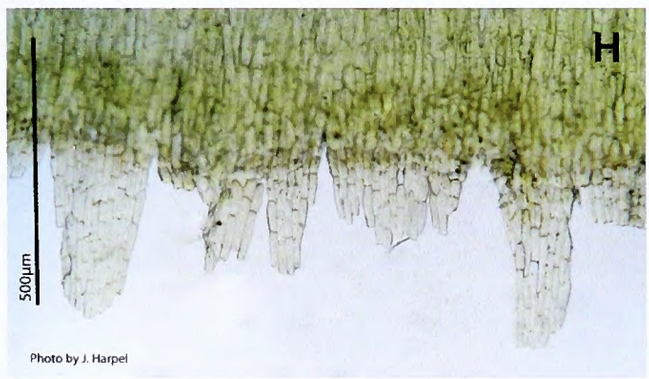

D
1 mm
Photo by J. Harpel

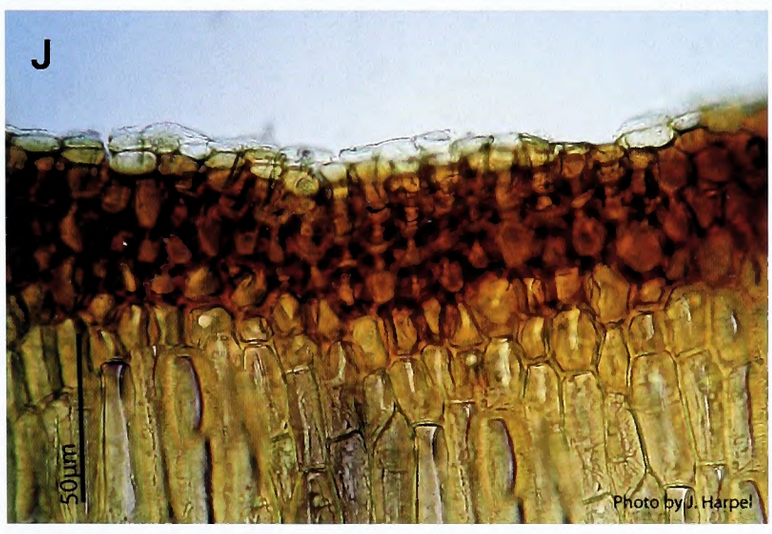

G
5 mm
Photo by J. Harpel


500µm
E
Photo by J. Harpel


F
20µm
Photo by J. Harpel


I
50µm
Photo by J. Harpel


H
500µm
Photo by J. Harpel


J
50µm
Photo by J. Harpel


K
500µm
Photo by J. Harpel

fog. Associated vascular plant species in Oregon include *Cheilanthes gracillima, Selaginella wallacei,* and *Sedum sp.* Associated bryophytes include *Amphidium* sp., *Claopodium bolanderi, Grimmia ramondii, Gymnomitrion* sp., *Polytrichum piliferum, Racomitrium elongatum, R. heterostichum,* and *R. lanuginosum.* Pacific Northwest plant associations include *Abies amabilis, A. lasiocarpa,* and *Tsuga mertensiana.*

Distribution — *Encalypta brevipes* is known from Eurasia, Iceland, and North America. In western North America, it is known from Alaska, Yukon, British Columbia, Washington, and Oregon. In Oregon, *Encalypta brevipes* is reported from Clatsop, Coos, and Curry counties within the Coast Range and Klamath Mountain ecoregions.

References with descriptions and/or illustrations — Magill (in FNA 2007, p. 178), Christy and Wagner (1996; part VII, p. 30), Horton (1983, p. 484), Horton and Murray (1976, p. 323).

Entosthodon californicus (Sullivant & Lesquereux) H.A. Crum & L.E. Anderson

Recent synonym: *Funaria californica* Sullivant & Lesquereux
Common name: California entosthodon

Summary — An ephemeral, acrocarpous, costate moss with ovate leaves. Terrestrial.

Diagnostic characteristics — *Entosthodon californicus* can be distinguished by its (1) ovate-oblong entire leaves, (2) pyriform capsule, (3) cucullate long-beaked calyptra, (4) long, narrow tapering exothecial cells, and (5) double peristome.

Technical description

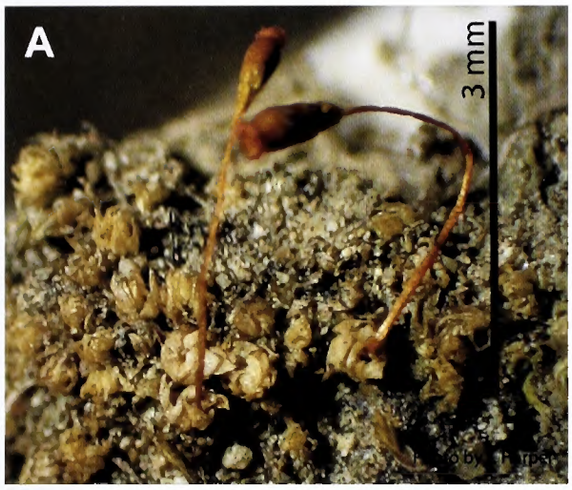
GAMETOPHYTE — **Plants** small, yellow-green, 1–2 mm high. **Leaves** oblong to oblong-ovate, concave up to 1 mm, contorted and crispate when dry; margins entire, not bordered; apex broadly acute to rounded, often with a 1–2 celled apiculus; costa percurrent, ending 4–6 cells before the apex; upper medial cells quadrate; basal cells rectangular. **Autoicous**.

SPOROPHYTE — **Seta** 4–7 mm long. **Capsules** ovoid-pyriform, erect, or slightly zygomorphic, 1.5–2 mm with stomata in a long tapering neck, exothecial cells long, narrow tapering, thickened; annulus wanting; peristome double, papillose at the base; calyptra large, smooth, cucullate, long-beaked and inflated. **Spores** minutely papillose, 15–18 µm.

Similar species — *Entosthodon californicus* can be distinguished from other members of the genus by its pyriform capsules with a well-developed peristome, spores that separate at maturity, leaves with an acute tip, and a strong costa ending just below the apex. *Entosthodon fascicularis* is distinguished from *E. californicus* by its rudimentary or absent peristome and serrulate leaf margins. *Physcomitrium pyriforme* has urn-shaped, broadly pyriform to cupulate sporophytes with a beaked operculum and mitrate calyptra.

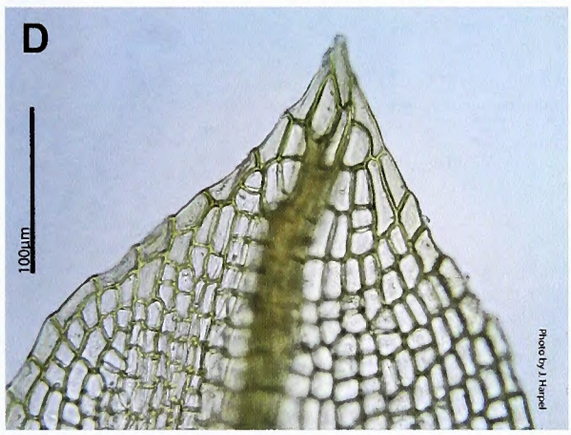
Ecology — *Entosthodon californicus* occurs singly or in small clusters on clay or fine sandy soil in disturbed areas such as ditches, roadsides, vernal pools, and seasonally flooded areas at moderate elevations. It is often mixed in with grasses and may be difficult to see due to its small size. *Entosthodon* is an ephemeral genus that is usually found in early spring. Spores germinate when winter rains commence in the fall, the capsules mature by late winter or early spring and plants dry up and disappear by early summer. Old sporophytes can often be found

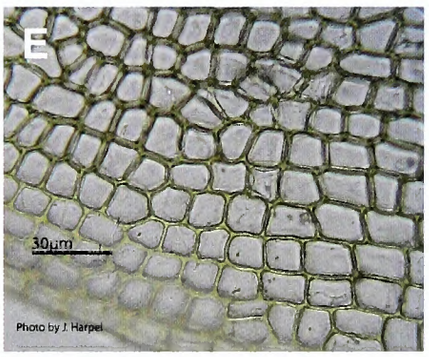
Plate 27. Entosthodon californicus. *A. Dry habitat. B. Dry habitat with sporophyte. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Alar and basal cells. G. Exothecial cells. H. Sporophyte. I. Peristome teeth. J. Operculum. (D. Toren 7001. Toren Private)*

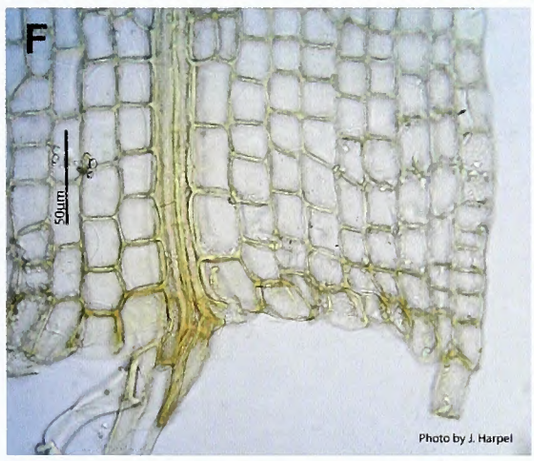

A
3 mm

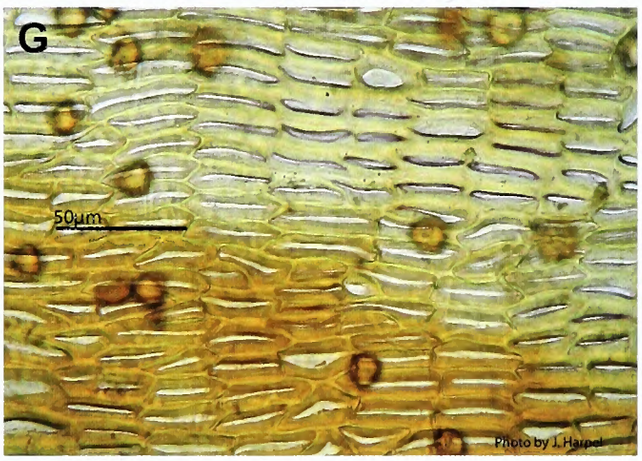

B
5 mm


C
700µm
Photo by J. Harpel

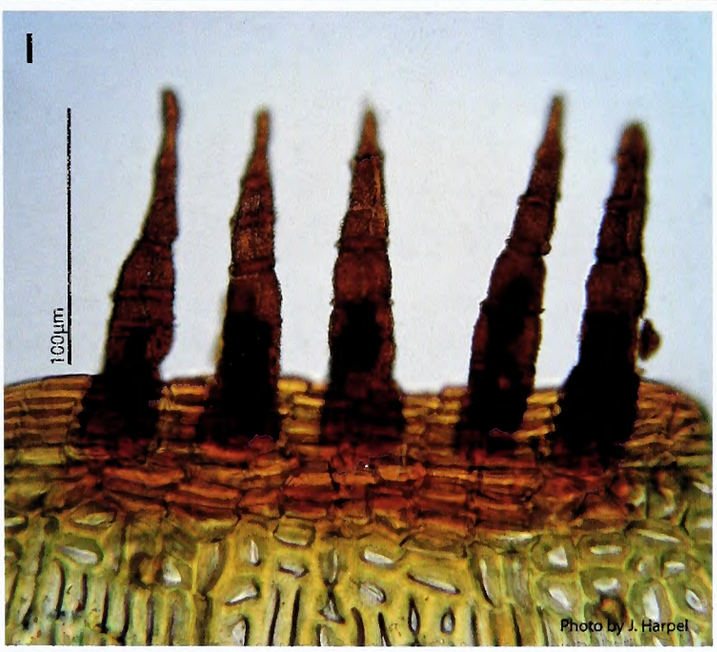

D
100µm

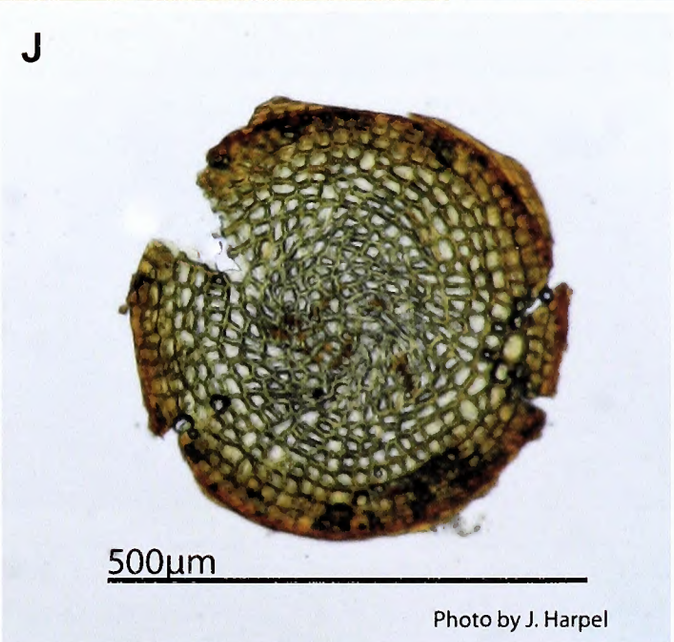

E
30µm
Photo by J. Harpel


F
50µm
Photo by J. Harpel


G
50µm
Photo by J. Harpel


H
2 mm
Photo by J. Harpel


I
100µm
Photo by J. Harpel


J
500µm
Photo by J. Harpel

in mid to late June but usually they have withered. In general, *Entosthodon* is mainly associated with shrub-steppe, or drier climates with pronounced wet and dry seasons.

Distribution — *Entosthodon californicus* is a western North American endemic and known only from Oregon and California. In Oregon, *Entosthodon californicus* is reported from Jackson County located in the Klamath Mountain ecoregion.

References with descriptions and/or illustrations — Miller and Miller (in FNA 2007, p. 185), Lawton (1971, p. 151), Grout (1935, p. 89, as *Fimaria californica*).

References with photos — Malcolm et al. (2009, p. 46).

Entosthodon fascicularis (Hedwig) Müller Hal

Recent synonyms:

Entosthodon leibergii E. Britton

Fimaria fascicularis (Hedwig) Lindberg

Common names: banded cord-moss, entosthodon moss, Hasselquist's hyssop

Summary — An ephemeral, acrocarpous, costate moss with serrate, ovate leaves and smooth leaf cells. Terrestrial.

Diagnostic characteristics — *Entosthodon fascicularis* can be distinguished by its (1) relatively broad and contorted leaves with long flexuose apices and lax cells, (2) pyriform capsule, (3) rudimentary or lack of a peristome, (4) cucullate long-beaked calyptra, and (5) irregular to hexagonal exothecial cells.

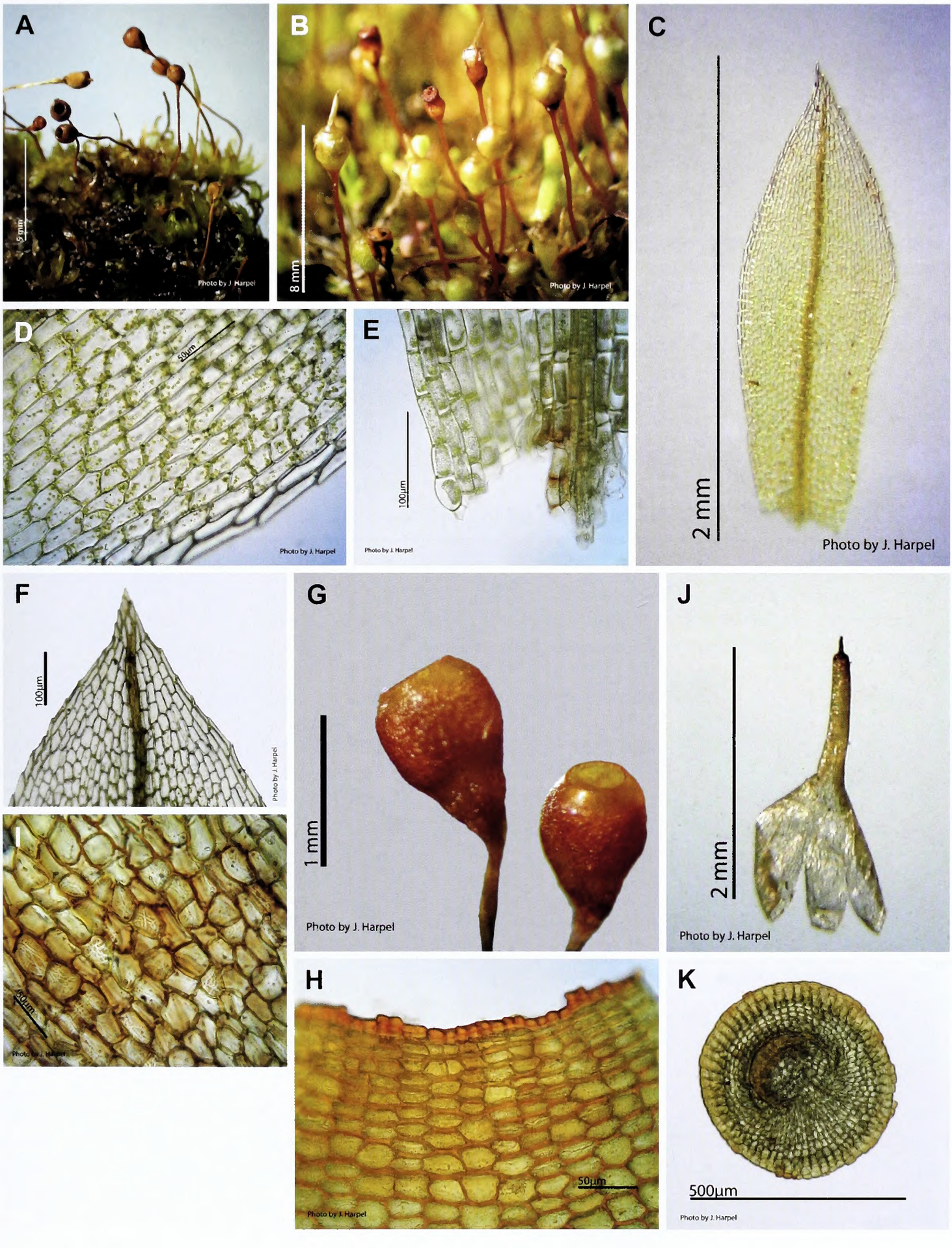
Technical description

Gametophyte — **Plants** 2–7 mm tall, sometimes branched, green to yellow-green, with red rhizoids. **Leaves** 1.5–3 (–5) mm long, ovate to oblong-lanceolate, concave, contorted when dry, apex acuminate and narrowing to a filiform point, the cells thin-walled and rectangular; margins plane with a faint border of longer and narrower cells, weakly serrate or serrulate in the upper half; costa ending below the apex in lower leaves or in the apex (sometimes shortly excurrent) in upper leaves; basal cells rectangular and forming small auricles, upper cells hexagonal and thin-walled. **Autoicous**.

Sporophyte — **Seta** 5–9 (–12) mm long, reddish-brown, straight or flexuose and twisted clockwise. **Capsules** 1–2 mm long, erect and exserted, orange-brown, short-cylindrical to globose, smooth, sometimes slightly contracted under the mouth when dry, the yellowish-green neck shriveled and distinctly narrower than the urn, cells just below the rim quadrate in 1–2 rows, peristome absent or rudimentary. The calyptra is hood-shaped and split on one side (cucullate). The operculum is convex but without a beak. The cells are in spiral rows, those at the edge about half as wide as those in the interior. **Spores** 24–32 µm.

Similar species — *Entosthodon fascicularis* can be distinguished from other *Entosthodon* species by its acute to acuminate leaves, spores that separate at maturity, rudimentary or lacking peristome, costa of distal leaves excurrent or ending near the tip, and irregular to hexagonal medial exothecial cells. See *Ethosthodon californicus* for additional discussion on similar species. Except for the capsules, *E. fascicularis* resembles a miniature *Fimaria*.

Plate 28. Entostodon fascicularis. *A. Moist habitat. B. Whole mount sporophytes. C. Leaf. D. Upper medial cells. E. Alar and basal cells. F. Leaf apex. G. Sporophytes. H. Exothecial cells near mouth of urn. I. Exothecial cells. J. Calyptra. K. Operculum. (J. Harpel 45457. Harpel Private)*


A
5 mm
Photo by J. Harpel
B
8 mm
Photo by J. Harpel
C
2 mm
Photo by J. Harpel
D
50µm
Photo by J. Harpel
E
100µm
Photo by J. Harpel
F
100µm
Photo by J. Harpel
G
1 mm
Photo by J. Harpel
J
2 mm
Photo by J. Harpel
I
50µm
Photo by J. Harpel
H
50µm
Photo by J. Harpel
K
500µm
Photo by J. Harpel

Ecology — *Entosthodon fascicularis* occurs as individual plants or small sods on seasonally wet and exposed soil in seeps or along intermittent streams. It is usually hidden among grasses, other mosses, and litter. Habitats identified by McIntosh (2005) include grasslands, oak savanna, grassy balds, and rock outcrops. In Oregon, sites occur at elevations below 3,000 feet. Associated bryophyte species include *Funaria hygrometrica, Imbribryum miniatum, Racomitrium elongatum,* and *Timmiella crassinervis*. Associated vascular plants include *Lomatium utriculatum, Mimulus guttatus, Orobanche uniflora, Pseudotsuga menziesii, Quercus garryana, Saxifraga oregana, Tsuga heterophylla* and *Veronica* sp. See *Ethosthodon californicus* for additional ecological notes.

Distribution — *Entosthodon fascicularis* is known from Europe, Africa, and North America. In western North America, it is known from British Columbia, Washington, Oregon, California, Idaho, and Arizona. In Oregon, *E. fascicularis* is reported from Jackson and Linn counties within the Klamath Mountain and West Cascades ecoregions.

References with descriptions and/or illustrations — Miller and Miller (in FNA 2007, p. 188), McIntosh (2005), Smith (1978, p. 342 as *Funaria fascicularis*), Lawton (1971, p. 151), Nyholm (1956, p. 172), Grout (1935, p. 82 as *Entosthodon leibergii*).

References with photos — Lockhart et al. (2012, p. 302), Atherton et al. (2010, p. 564), Porley (2005).

Ephemerum crassinervium (Schwägrichen) Hampe

Recent synonyms:

Phascum crassinervium Schwägrichen

Ephemerum crassinervium var. *papillosum* (Austin) Renauld & Cardot

Common names: thick costa earth-moss, emerald dew drops

Summary — An ephemeral, acrocarpous, costate moss with serrate, long lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Ephemerum crassinervium* is distinguished by its (1) small "bud-like" ephemeral habit, (2) presence of a costa, (3) serrate lanceolate leaves, (4) papillose upper laminal cells, and (5) sessile capsule.

Technical description

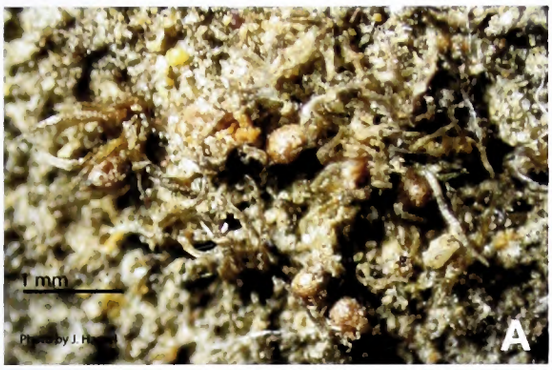
Gametophyte — **Plants** less than 2.5 mm tall, yellowish, scattered to gregarious, protonema sparse. **Leaves** lanceolate, broadly linear or ligulate, more or less narrowed above the shoulder, 0.8–2.5 × 0.15–0.4 mm; margins serrulate or serrate with teeth sometimes recurved; apex acuminate and papillose; costa at the base not always apparent, stronger above, often filling the acumen, percurrent or excurrent, papillose; upper medial cells oblong-rhomboidal, in more or less vertical rows, smooth or slightly papillose; basal cells papillose. **Dioicous**.

Sporophyte — **Seta** lacking. **Capsules** sessile, ovoid, apicluate, cleistocarpous, up to 0.5 mm high; stomata few, scattered throughout the exothecium. **Spores** papillose, 43–120 × 35–80 µm.

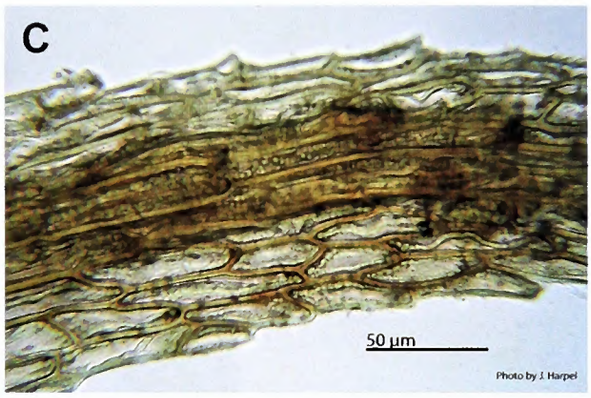
Similar species —*Ephemerum serratum* differs in the absence of a costa, *E. spinulosum* has spinulose to spinose distal laminal cells, and *E. cohaerens* has smooth laminal cells. *Ephemerum crassinervium* var. *crassinervium* is the only variety known from Oregon. The other variety, *Ephemerum crassinervium* var. *texanum* (Grout) Bryan & Anderson, occurs in eastern North America. It has broader linear-lanceolate leaves narrowed from an evident or slightly evident shoulder.

Ecology — *Ephemerum crassinervium* occurs on damp disturbed soil, often in old fields, paths, river banks, or

Plate 29. Ephemerum crassinervium. *A. Moist habitat. B. Leaf. C. Upper medial cells. D. Alar and basal cells. E. Leaf apex. F. Protonemal mat. G–H. Sporophytes. I. Exothecial cells. J. Spores. (J. Christy. 1383. 1291. Christy Private)*


1 mm
A


B
1 mm
Photo by J. Harpel


C
50 µm
Photo by J. Harpel

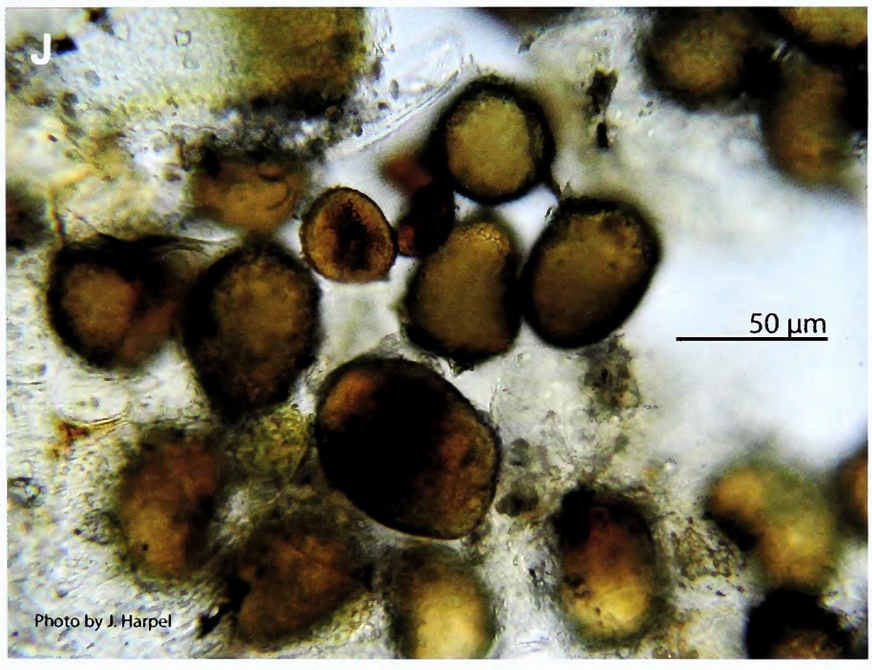

D
50 µm
Photo by J. Harpel

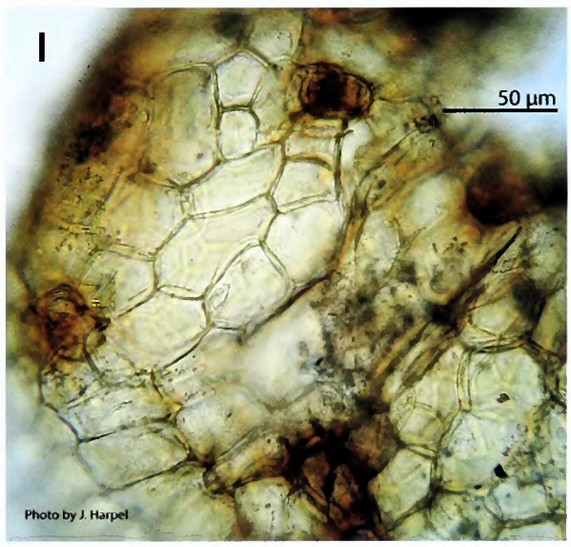

200 µm
F
Photo by J. Harpel


E
100 µm
Photo by J. Harpel


G
1 mm
Photo by J. Harpel


H
1 mm
Photo by J. Harpel


J
50 µm
Photo by J. Harpel


I
50 µm
Photo by J. Harpel

open bare ground. As its name indicates, *Ephemerum* is an ephemeral genus that completes its entire life cycle within a short period of time. While capsules can mature year round, they usually mature between early fall to early spring. The orange-brown spore color suggests that the spores are oil based, which may allow them to remain viable in the soil for a long period of time.

Distribution — *Ephemerum crassinervium* is known from Eurasia, New Zealand, and North America. In western North America, it is known only from Oregon but is well-distributed in the eastern United States and Canadian provinces. In Oregon, *E. crassinervium* is reported from Jackson, Josephine, Lake, and Lane counties within the Klamath Mountain, Northern Basin and Range, and Willamette Valley ecoregions.

References with descriptions and/or illustrations — Bryan (in FNA 2007, p. 651), Crum and Anderson (1981, p. 478), Bryan (1957), Grout (1935, p. 69).

References with photos — Lockhart et al. (2012, p. 402–404 as *E. crassinervium* subsp. *sessile* and *E. crassinervium* subsp. *rutheanum*).

Ephemerum serratum (Hedwig) Hampe

Recent synonym: *Phascum serratum* Hedwig
Common names: serrated earth-moss; emerald dew drops

Summary — An ephemeral, acrocarpous, ecostate moss with serrate, linear lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Ephemerum serratum* is distinguished by its (1) small "bud-like' ephemeral habit, (2) ecostate serrate leaves, (3) stomata only in the base of the urn, and (4) cleistocarpous capsule.

Technical description

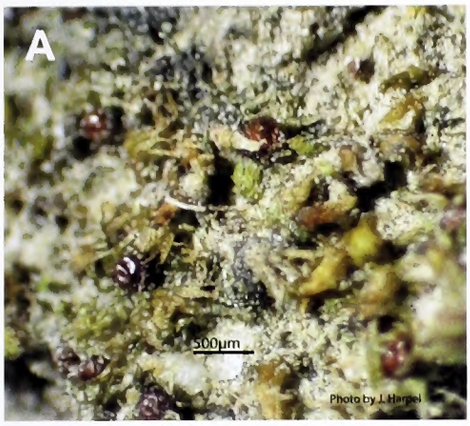
GAMETOPHYTE — **Plants** less than 2 mm tall, pale green to yellow-brown, scattered on a dark green densely matted persistent protonema. **Leaves** linear-lanceolate, 1–1.7 mm long, gradually acuminate, ending in a long, single sharp cell; margins strongly serrate to spinose-dentate in the upper 2/3 portion with teeth recurved, infrequently scarcely serrate; costa absent; upper median cells hexagonal-rhomboidal, lax, smooth. **Dioicous**.

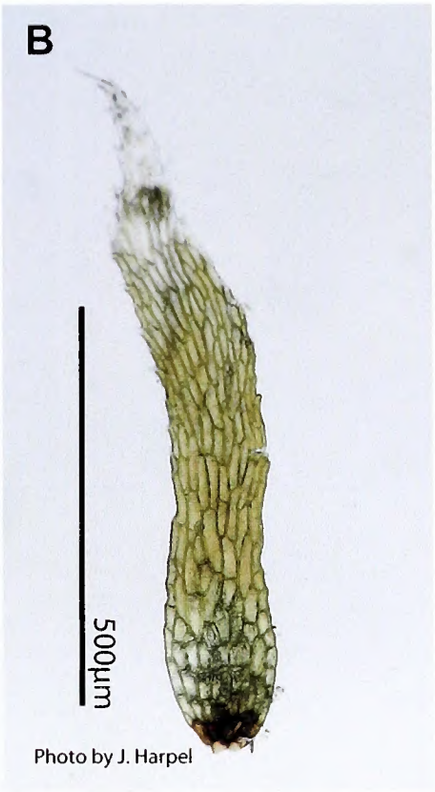
SPOROPHYTE — **Seta** reduced to lacking. **Capsules** sessile, ovoid, apicluate, cleistocarpous, chestnut brown; stomata in the exothecium restricted to the base of the urn. **Spores** spherical or reniform, 55–106 × 27–75 µm, coarsely papillose.

Similar species — *Ephemerum serratum* can be distinguished from all other *Ephemerum* species by its ecostate or very weak costa in the distal two-thirds of the leaf. Leaf serration varies. In general, eastern North American plants tend to have strongly serrated leaves compared to those from Oregon and California. However, less serrated plants have also been found in the east while distinctly serrated plants have been found in the west.

Ecology — *Ephemerum serratum* occurs on damp disturbed soil, often in old fields or pastures and along the edges of ponds. The California occurrences have been recorded on diffusely lit moist soil in tall chaparral (*Adenostoma fasciculatum*), exposed moist soil in a pastured area near a stream, and occasionally shaded and diffusely lit moist soil in an open oak forest. See *Ephemerum crassinervium* for additional notes on *Ephemerum* ecology.

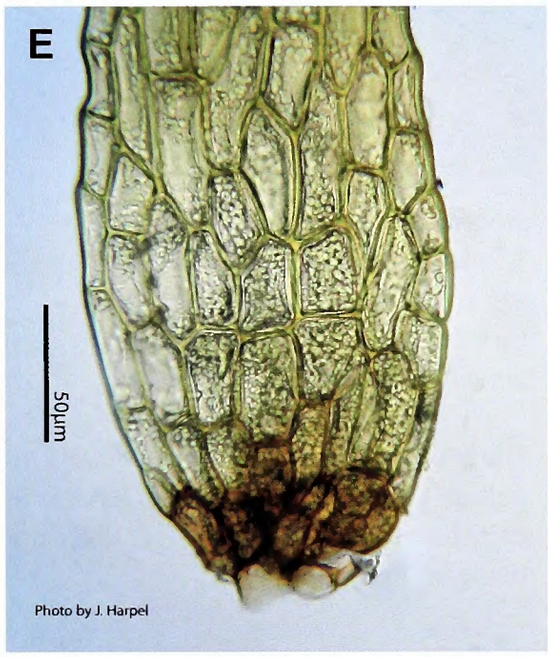
Plate 30. Ephemerum serratum. *A. Dry habitat. B. Leaf. C. Upper medial cells. D. Leaf apex. E. Alar and basal cells. F. Perichaetium in a cluster of leaves. G. Sporophyte. H. Exothecial cells with stomata at the base of the urn. (W. Schofield 29041. UBC)*


A
500µm
Photo by J. Harpel


B
500µm
Photo by J. Harpel

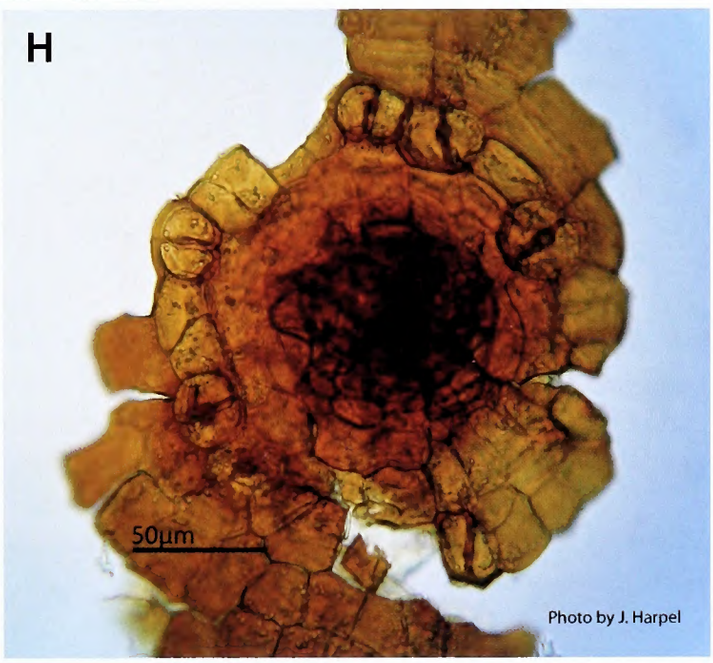

C
50µm
Photo by J. Harpel


D
100µm
Photo by J. Harpel


E
50µm
Photo by J. Harpel


G
500µm
Photo by J. Harpel


F
500µm
Photo by J. Harpel


H
50µm
Photo by J. Harpel

Distribution — *Ephemerum serratum* is known from Eurasia, Africa, New Zealand, and North and South America. In western North America, it is known from Northwest Territories, Oregon, and California. In Oregon, *Ephemerum serratum* is reported from Benton and Lane counties within the Willamette Valley ecoregion.

References with descriptions and/or illustrations — Bryan (in FNA 2007, p. 650), Crum and Anderson (1981, p. 476), Bryan (1957), Nyholm (1956, p. 175), Grout (1935, p. 67).

References with photos — Atherton et al. (2010, p. 504), Malcolm et al. (2009, p. 128), Porley (2008, p. 121).

Eucladium verticillatum (Bridel) Bruch & Schimper

Recent synonyms: none
Common names: tufa moss, whorled tufa-moss, eucladium moss

Summary — An acrocarpous, costate moss with serrations on the lower basal margin of the linear-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Eucladium verticillatum* is distinguished by its (1) dark green sod habit on perennially wet calcareous rocks or seepage, (2) serrate margins on leaf base, (3) enlarged and thin-walled basal cells that contrast sharply with the green papillose laminal cells, (4) costa broad relative to the lamina, and (5) plane leaf margins.

Technical description

Gametophyte — **Plants** erect, 0.5–7 cm tall, often branched, yellow-green to dark green above to yellowish-brown below; often encrusted with white calcium precipitate. **Leaves** 1–2.5 mm long, appressed or incurved-contorted when dry, erect-spreading when wet, linear-lanceolate to linear-subulate, keeled above, acute to apiculate, flat to channeled near the tips; basal cells rectangular to rhomboidal, thin-walled, transparent (hyaline) and smooth, contrasting conspicuously with cells of the blade (lamina) that are subquadrate, thick-walled, and green, with several papillae per cell; margins plane, not bordered, serrate where the leaf narrows at the transition from the hyaline basal cells to the green laminal cells; apex acute to awl-shaped (subulate); costa strong, occupying one-third or more of the leaf base, ending at the tip or excurrent as a short, stout point (mucro) sometimes composed of a sharply pointed transparent cell, the ventral surface of the costa composed of papillose quadrate cells. **Dioicous**.

Sporophyte — **Seta** 7–11 mm, reddish brown, mostly straight. **Capsules** 0.8–2 mm long, erect, reddish-brown, ovoid to cylindrical, slightly ribbed when dry; operculum with a beak up to 0.6 mm long; peristome present or rudimentary. **Spores** 8–14 µm.

Similar species — *Trichostomum* and *Tortella* are similar to *E. verticillatum* but have smooth basal laminal margins. *Gymnostomum* lacks a peristome, has a central strand, occasionally has bistratose areas in the lamina, and often has recurved distal margins. *Hymenostylium,* which may also have distal margin serrations, lacks peristome teeth and has leaf parts with recurved margins.

Ecology — *Eucladium verticillatum* forms dense sods from lowlands to 5,000 foot elevations on perennially wet calcareous rocks, on calcareous seepage from fractures in igneous rocks, and around calcium-rich springs and

Plate 31. Eucladium verticillatum. *A–B. Dry habitat. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Basal cells with marginal teeth. G. Sporophyte. H. Leaf cross-section. I. Stem-cross section. (J. Harpel 2204. UC)*

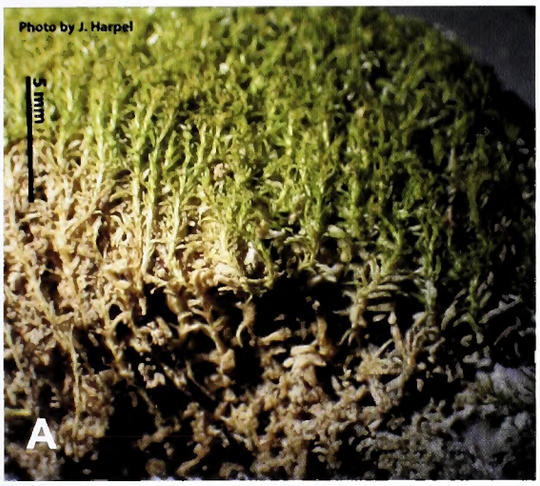
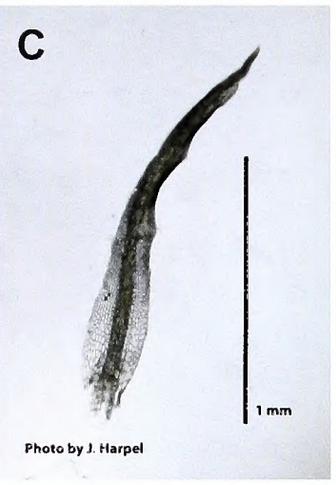
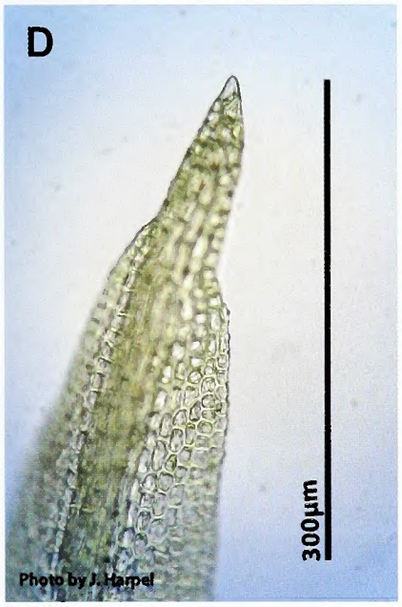
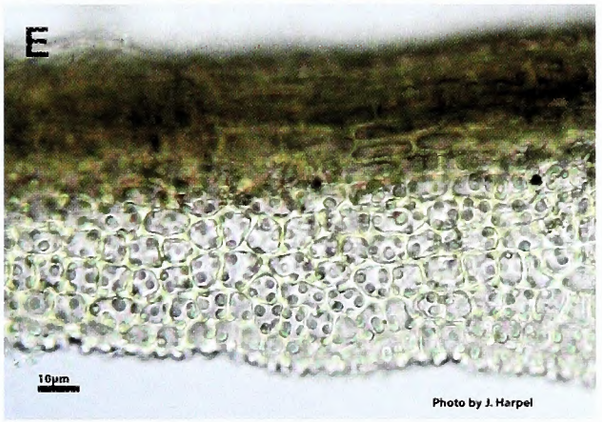


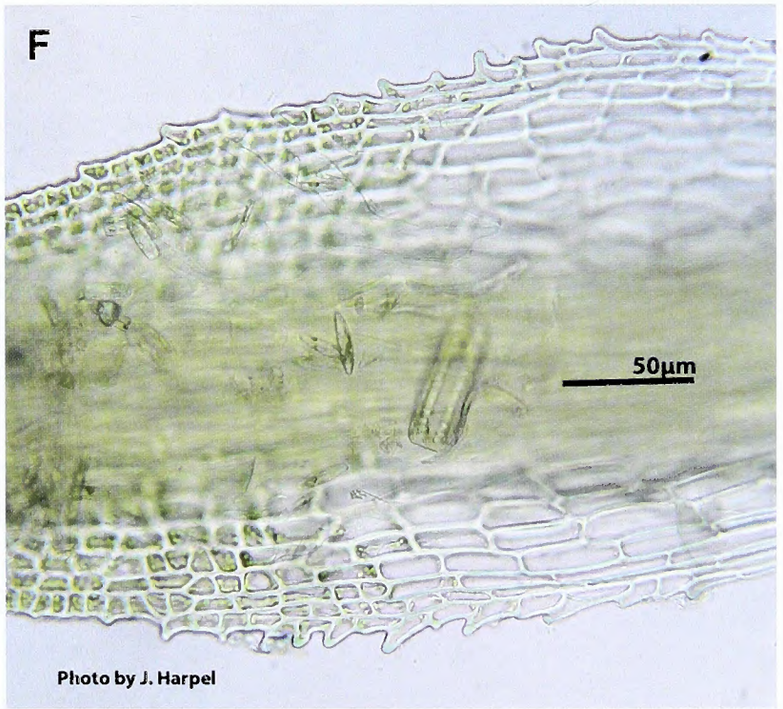
Photo by J. Harpel
5 mm
A

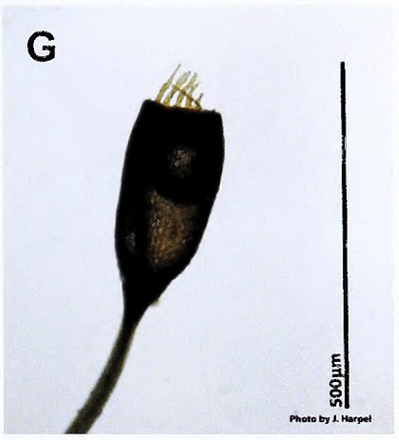

5 mm
B

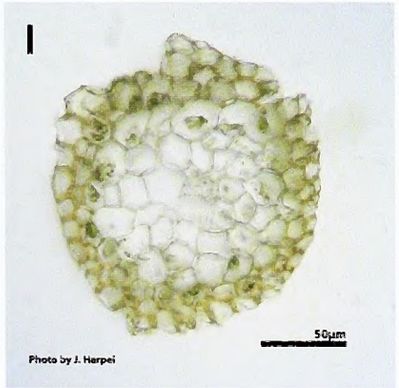

C
1 mm
Photo by J. Harpel

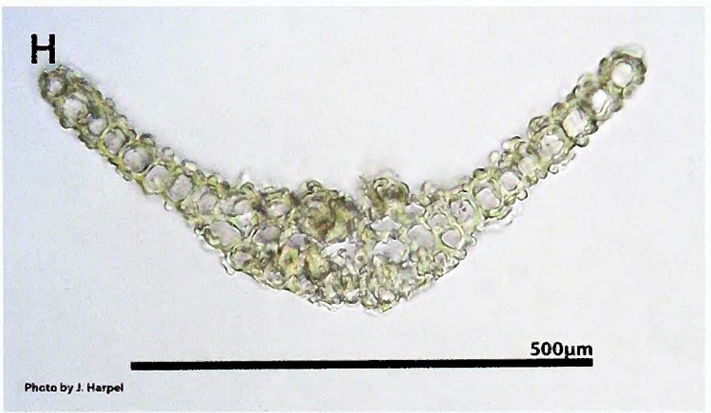

D
300µm
Photo by J. Harpel


E
10µm
Photo by J. Harpel


F
50µm
Photo by J. Harpel


G
500µm
Photo by J. Harpel


I
50µm
Photo by J. Harpel


H
500µm
Photo by J. Harpel

streams where tufa is formed. In Oregon and Washington, *E. verticillatum* occurs mostly on limestone, marble, serpentine, or (occasionally) fractured basalt. One unique Oregon site occurs in a marine tidal zone seep in ceiling fractures of a basalt cave approximately 6 feet above the mean tidal zone. *Eucladium verticillatum* is one of a suite of mosses (*Crumia latifolia, Fissidens grandifrons* and *Gymnostomum* species) largely restricted to wet, carbonate-rich substrates.

Distribution — *Eucladium verticillatum* is known from Eurasia, Africa, and Central and North America. In western North America, it is known from British Columbia, Alberta, Washington, Oregon, California, Idaho, Montana, Nevada, Utah, Colorado, Arizona, and New Mexico. In Oregon, *E. verticillatum* is reported from Jackson, Josephine, and Lincoln counties within the Coast Range and Klamath ecoregions.

References with descriptions and/or illustrations — Eckel (in FNA 2007b, p. 487), Zander (1994, p. 246), Crum and Anderson (1981, p. 281), Smith (1978, p. 274), Flowers (1973, p. 132), Lawton (1971, p. 98).

References with photos — Atherton et al. (2010, p. 420), Malcolm et al. (2009, p. 129).

Fissidens fontanus (Bachelot de la Pylaie) Steudel

Recent synonym: *Octodiceras fontanum* (Bachelot de la Pylaie) Lindberg
Common name: flat fork moss

Summary — An acrocarpous, costate moss with long linear-lanceolate leaves consisting of two vaginant laminae that clasp the stem typical of Fissidentaceae. Aquatic.

Diagnostic characteristics — *Fissidens fontanus* can be distinguished by its (1) long narrow vaginant laminae with unbordered leaves, (2) smooth leaf cells with a costa ending 15–35 cells below the leaf apex, (3) emergent capsule with reduced and usually truncate peristome teeth, and (4) aquatic habitat.

Technical description

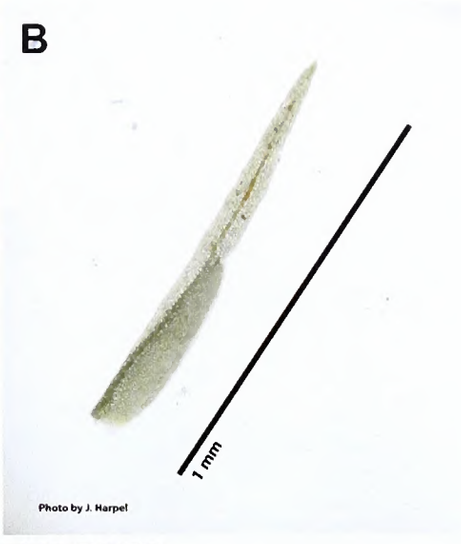
GAMETOPHYTE — **Plants** dark green to brownish-black, light green on leaf tips. **Stems** very branched, flaccid, "feathery", up to 12 or more cm long. **Leaves** lanceolate to linear-lanceolate, somewhate falcate, bluntly acute, up to 6 mm long, usually unistratose or sometimes bistratose near the costa; margins not bordered, entire; costa ending 15–35 cells below the apex; vaginant laminae 1/3–1/2 the leaf length, unequal, minor lamina usually rounded and free distally or narrowed and ending on or near the costa; upper median cells irregularly hexagonal, 12–21 µm, smooth. **Autoicous**.

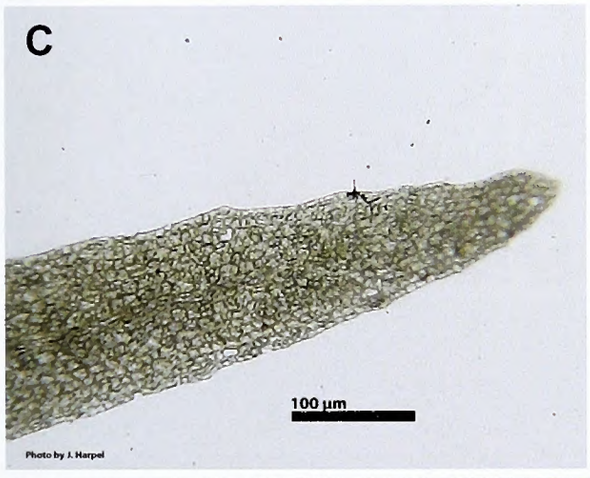
SPOROPHYTE — Inconspicuous, 1–5 per leaf axil, rare to infrequent. **Seta** 0.5–0.6 mm. **Capsules** erect, radially symmetric, about 0.5 mm long; opercula long-rostrate; peristome teeth irregularly divided and ore or less incomplete, papillose; calyptra conic-mitrate, smooth. **Spores** smooth, 18–27 µm.

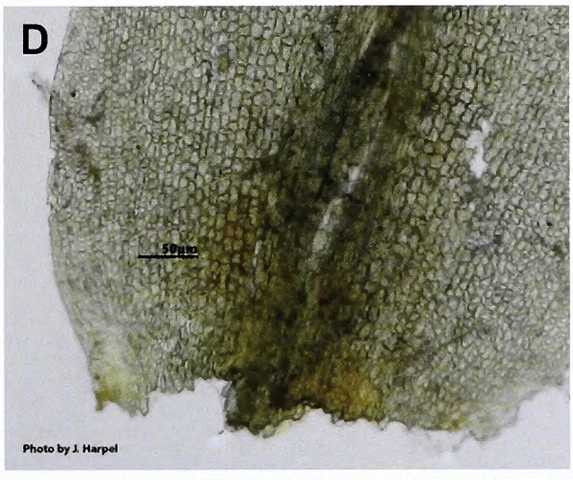
Similar species —*Fissidens fontanus* can be distinguished from other *Fissidens* species by its smooth laminal cells, leaves often ten times longer than wide, a short costa and plants fragile when dry. In addition, because its aquatic habit the leaves are often encrusted with diatoms or organic matter, giving the stems and leaves a blackish appearance. *Fissidens grandifrons* is a large, coarse, rigid aquatic species and an obligate calcicole with multi-stratose laminal cells.

Plate 32. Fissidens fontanus. *A. Moist habitat. B. Leaf. C. Leaf apex. D. Alar and basal cells. E. Leaf cross-section. F. Upper medial cells. (J. Harpel 4817. Harpel Private)*

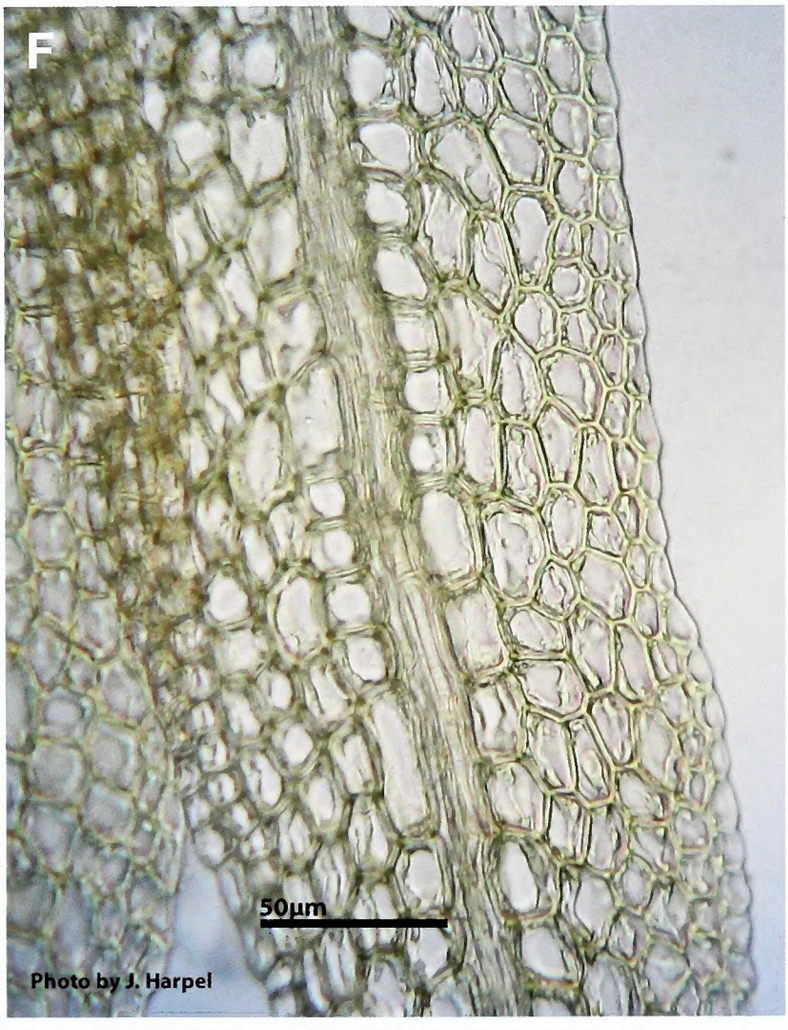

A
10 mm
Photo by J. Harpel


B
1 mm
Photo by J. Harpel


C
100 µm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


E
1 mm
Photo by J. Harpel


F
50µm
Photo by J. Harpel

Ecology — As an aquatic species, *F. fontanus* attaches to rocks, logs, sticks, or may be attached to the bases of trees or shrubs in stagnant or slow moving water or – in areas where the water level fluctuates – it may be attached to the bases of trees and shrubs. A historical (1914) collection of *F. fontanus* from Clackamas County was collected 3–4 feet below the surface of the water from a submerged *Pseudotsuga* stump. Sporophytes are rare to infrequent.

Distribution — *Fissidens fontanus* is known from Europe, Africa, the West Indies, and Central and North America. In western North America, it is known from British Columbia, Washington, Oregon, California, Idaho, Montana, and Arizona. In Oregon, *F. fontanus* is reported from Clackamas, Douglas, and Marion counties within the Willamette Valley ecoregion.

References with descriptions and/or illustrations — Pursell (in FNA 2007, p. 343), Smith (2004, p. 260 as *Octodiceras fontanum*), Sharp et al (1994, p. 79), Crum and Anderson (1981, p. 111), Lawton (1971, p. 46).

References with photos — Lockhart et al. (2012, p. 356), Atherton et al. (2010, p. 418 as *Octodiceras fontanum*), Malcolm et al. (2009, p. 85).

Gemmabryum barnesii (J.B. Wood) J.R. Spence

Recent synonym: *Bryum barnesii* J.B. Wood
Common name: Barnes' bryum

Taxomomic note: *Gemmabryum* species are small and often sterile and can be extremely difficult to identify in the absence of gemmae. This genus exhibits an array of asexual reproductive structures including bulbils, rhizoidal and stem tubers, and filiform rhizoidal gemmae. Sterile collections should be made whenever possible, as fertile material often lacks the diagnostic gemmae.

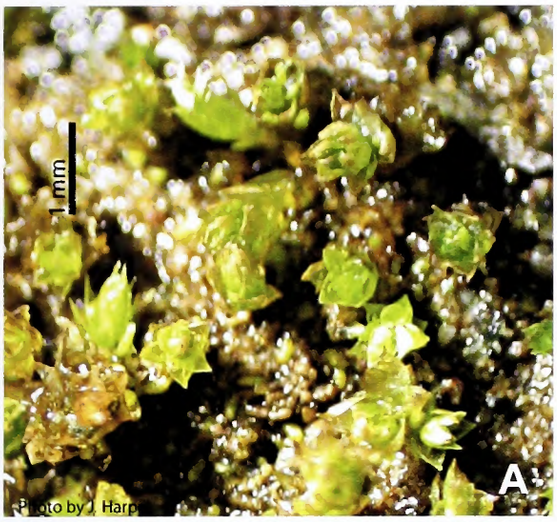
Summary — An acrocarpous, costate moss with imbricate, ovate leaves, usually bearing multiple gemmae in the leaf axils. Terrestrial.

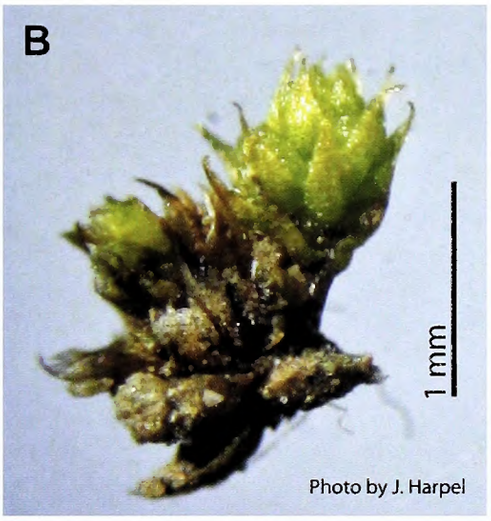
Diagnostic characteristics — *Gemmabryum barnesii* can be distinguished by its (1) 5–25 bulbiform gemmae per leaf axil and (2) obtuse leaf-like 200–450 µm broad primordia.

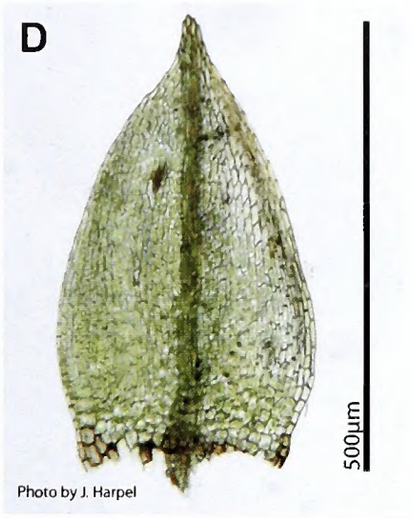
Technical description

GAMETOPHYTE — **Plants** small, in open to dense turfs, green or yellow-green. **Stems** 0.2–1 cm, gemmiform to evenly foliate, innovations and fertile stem leaves somewhat differentiated, innovation leaves smaller. **Leaves** 0.5–1.5 (–2) mm, ovate to ovate-lanceolate, imbricate when dry, erect when wet, weakly concave, not decurrent; margins plane to revolute proximally, apex acute to acuminate, distal margins smooth, limbidium absent; costa strong, percurrent to rarely short in a stout awn; distal and mid-laminal cells rhomboidal to elongate-hexagonal, 8–12 (–16) µm wide, mostly 3–4:1, thin to moderately incrassate, proximal laminal cells abruptly quadrate to short-rectangular, 1–2:1, wider and shorter than more distal cells. Specialized asexual reproduction of leaf axis bulbils, bulbils (1–) 5–25 per axil, green when young, becoming brown with age, cone-shaped, 200–450 µm, with broad obtuse leaf primordia less than 1/3 the length of bulbil and arising from the distal third. **Dioicous**.

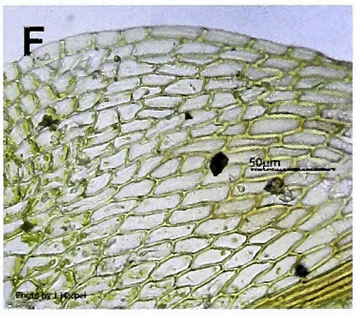
Plate 33. Gemmabryum barnesii. *A–B. Moist habitat. C. Dry habitat. D. Leaf. E. Leaf apex. F. Upper medial cells. G. Alar and basal cells. H. Propagula. (D. Toren. 10165. Toren Private, K. Kellman 7546, CAS)*


A
1 mm
Photo by J. Harpel

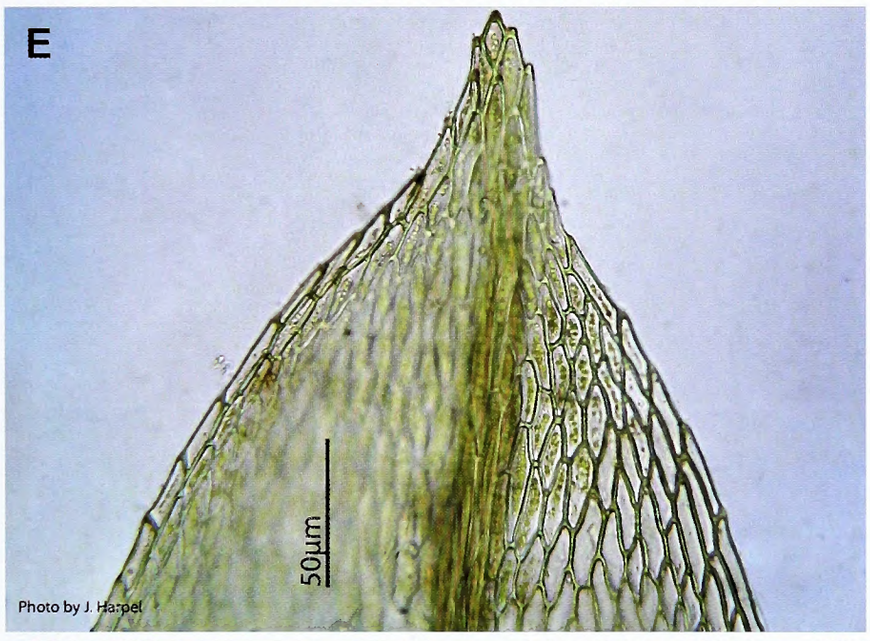

B
1 mm
Photo by J. Harpel

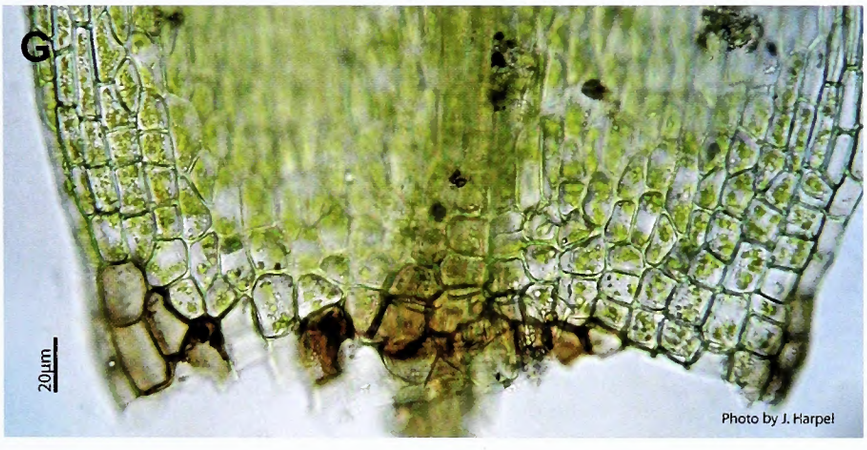

D
500µm
Photo by J. Harpel


C
1 mm


F
50µm


H
300µm
Photo by J. Harpel


E
50µm
Photo by J. Harpel


G
20µm
Photo by J. Harpel

Sporophyte — **Seta** elongate, stout to slender, straight or somewhat flexuose. **Capsules** 1–3 mm, purple-red at maturity, ovate, nodding, apophysis thickened, but not or only weakly rugose; peristome double, endostome high, not adherent to exostome, segments well-developed, perforations ovate, cilia long and appendiculate.

Similar species — Species of *Gemmabrynm* sect. *Gemmabrynm* are characterized by their gemmiform stems with imbricate leaves, presence of leaf axil bulbils, and variably developed peristomes with erect to nodding capsules. The capsule, perhaps the most distinctive feature, is short, ovate, and often with a thickened and rugose apophysis. The size and shape of its bubils and primordia separates *G. barnesii* from other members of the section. The similar *G. dichotomum* has only 1–2 bulbils per axil that are 250–750 µm long.

Ecology — *Gemmabryum barnesii* is typically found on disturbed soil that dries out following winter rains. It occurs at elevations ranging from the lowlands to 3,600 feet in dry to damp soil as well as often in sandy disturbed sites. The species is most common in mediterranean climates along the western North American Pacific coast. Capsules mature from spring to summer (April–July).

Distribution — *Gemmabryum barnesii* is known from Eurasia and North America, and in western North America from British Columbia, Washington, Oregon, California, Utah, and Colorado. In Oregon, *G. barnesii* is reported from Lane County in the Coast Range and Willamette Valley ecoregions.

References with descriptions and/or illustrations — Spence (in FNA 2014c, p. 133).

Grimmia anomala Hampe

Recent synonym: *Grimmia hartmanii* subsp. *anomala* (Hampe) Loeske
Common names: grimmia dry rock moss, mountain forest grimmia

Summary — An acrocarpous, costate moss with obong-lanceolate leaves that bear clusters of gemmae at the apex. Terrestrial.

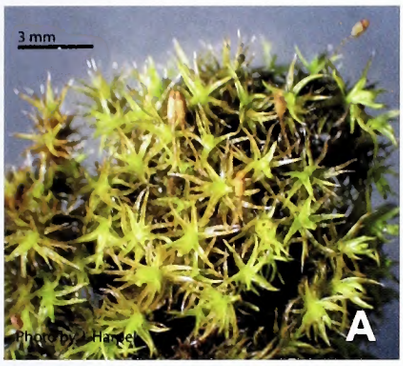
Diagnostic characteristics — *Grimmia anomala* is distinguished by the clusters of round green to yellowish-orange gemmae, which form at the tips of the blunt oblong-lanceolate leaves.

Technical description

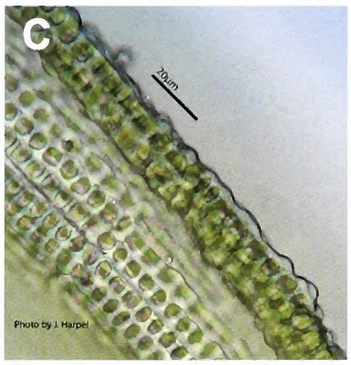
Gametophyte — **Plants** in tufts, 1.5–3.5 cm tall, yellowish-green to blackish below. **Stems** with a central strand. **Leaves** irregularly imbricate oblong-lanceolate, gradually narrowed into a blunt apex, awn absent or very short, 1.5–2.5 × 0.4–0.8 mm, keeled; margins recurved on one or both sides, unistratose; costa projecting on the dorsal side; basal cells quadrate to short-rectangular, straight, thin-walled; basal marginal cells quadrate to short-rectangular with thickened transverse walls, unistratose with occasional bistratose streaks; upper medial cells rounded-quadrate, walls slightly sinuose, thin or thick walled. Gemmae multicellular, yellowish-green to orange in grape-like (globular) clusters attached to hyaline, deformed leaf apices. **Dioicous**.

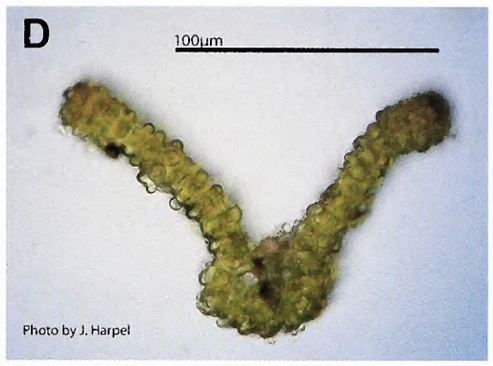
Sporophyte — **Seta** straight to slightly arcuate when moist, 3–5 mm. **Capsules** rare, exserted, brownish, oblong-ovoid, smooth; operculum with a long straight beak, peristome teeth orange, fully developed, smooth proximally, perforated and papillose distally; calyptra mitrate. **Spores** 14 µm.

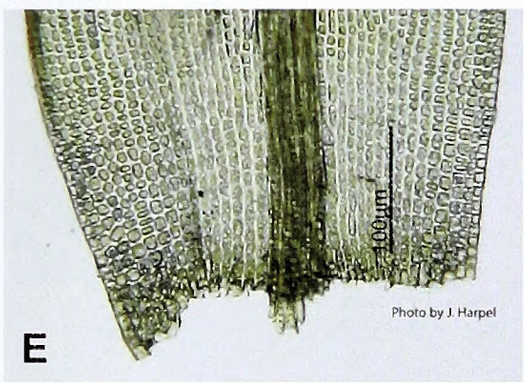
Plate 34. Grimmia anomala. *A. Moist habitat. B. Leaf. C. Marginal leaf cells. D. Leaf cross-section. E. Alar and basal cells. F. Upper medial cells. G. Leaves with propagula. H. Propagula. I. Leaf apex with propagula. J. Leaves with propagula. K. Sporophyte. L. Peristome teeth. M. Stem cross-section. (J. Harpel 48201. Harpel Private)*

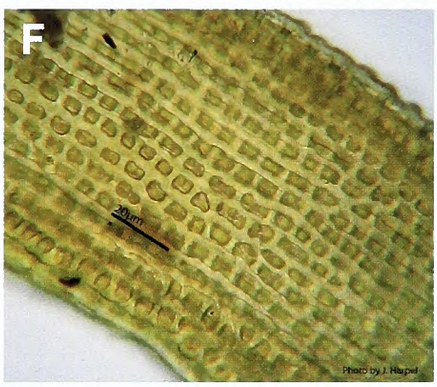

3 mm
A
Photo by J. Harpel


B
1 mm
Photo by J. Harpel

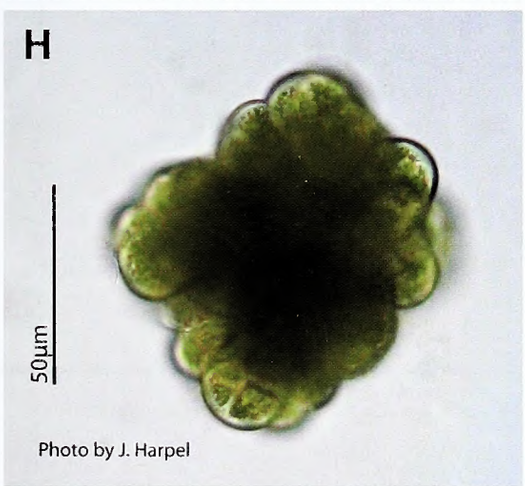

C
20µm
Photo by J. Harpel

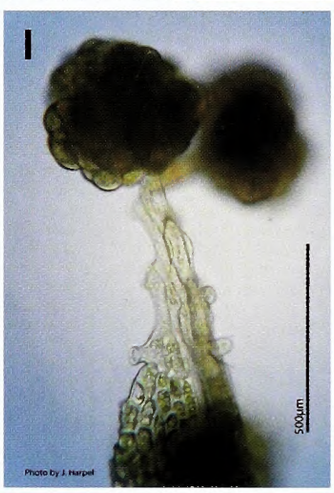

D
100µm
Photo by J. Harpel

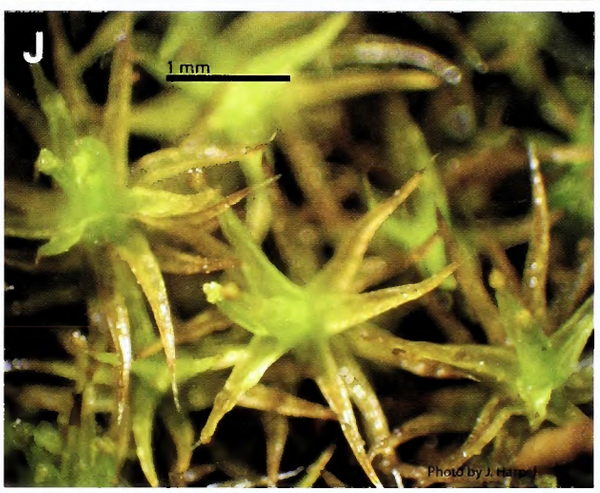

E
100µm
Photo by J. Harpel


F
20µm
Photo by J. Harpel


G
500µm
Photo by J. Harpel

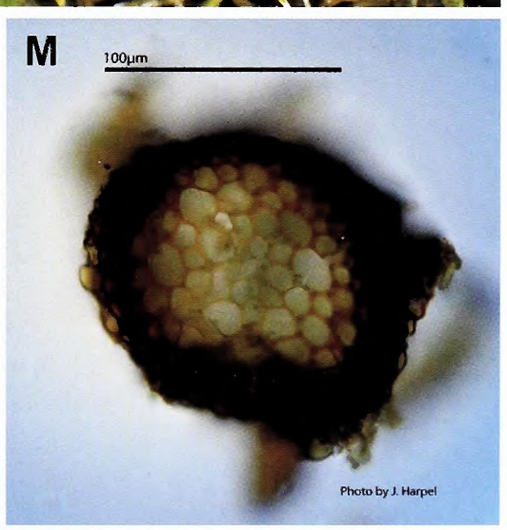

H
50µm
Photo by J. Harpel


I
500µm
Photo by J. Harpel


J
1 mm
Photo by J. Harpel


K
4 mm
Photo by J. Harpel


L
100µm
Photo by J. Harpel


M
100µm
Photo by J. Harpel

Similar species —*Grimmia hartmanii* is similar, but does not occur in the Pacific Northwest. It is a lower-elevation species of shaded mesic forests with acuminate leaf apices, smooth distal cell walls, and lacks a central strand. *Grimmia torquata* is distinguished by its crisped and contorted leaves when dry and often has multicellular gemmae on the back of distal leaves. The genus *Schistidium,* which could be confused with *Grimmia*, is characterized by an overall reddish or orange brown coloration, immersed capsules, erect red (orange) peristome teeth, a columella attached to the operculum, mitrate calyptra, and a straight seta.

Ecology — *Grimmia anomala* forms small cushions on igneous, calcareous, sandstone, limestone, concrete, or serpentine substrates, in shaded or exposed exposures areas at elevations from 600 to 9,000 feet. Forest associated species include *Abies amabilis*, *Abies concolor*, *Pseudotsuga menziesii*, *Quercus garryana* and *Tsuga heterophylla*. In northwestern Oregon, *G. anomala* is known from basalt boulders along transitional habitats such as graminoid meadow and true fir habitats where snow drifts persist late in the spring.

Distribution — *Grimmia anomala* is known from Eurasia, Africa, Greenland, and North and South America. In western North America, it is known from Alaska south through British Columbia, Alberta, Washington, Oregon, California, Idaho, Montana, Utah, Wyoming, and Colorado. In Oregon, *G. anomala* is reported from Benton, Curry, Jackson, Josephine, Klamath, and Lane counties within the Coast Range, Klamath Mountain and West Cascades ecoregions.

References with descriptions and/or illustrations — Hastings and Greven (in FNA 2007, p. 248), Greven (2003, p. 54), Muñoz and Pando (2000, p. 17), Ireland (1982, p. 247), Crum and Anderson (1981, p. 440), Flowers (1973, p. 262 as *G. hartmanii* var. *anomala*), Lawton (1971, p. 128 as *G. hartmanii* var. *anomala*).

References with photos — Lockhart et al. (2012, p. 329), Malcolm et al. (2009, p. 62).

Grimmia donniana Smith

Recent synonym: none
Common name: Donn's dry rock moss

Summary — An acrocarpous, costate moss with oblong-lanceolate and short piliferous leaves. Terrestrial.

Diagnostic characteristics — *Grimmia donniana* is distinguished by its (1) oblong-lanceolate keeled leaves with plane margins, (2) hyaline and more or less uniform basal lamina with long-rectangular thin-walled cells, (3) straight setae, and (4) mitrate calyptrae.

Technical description

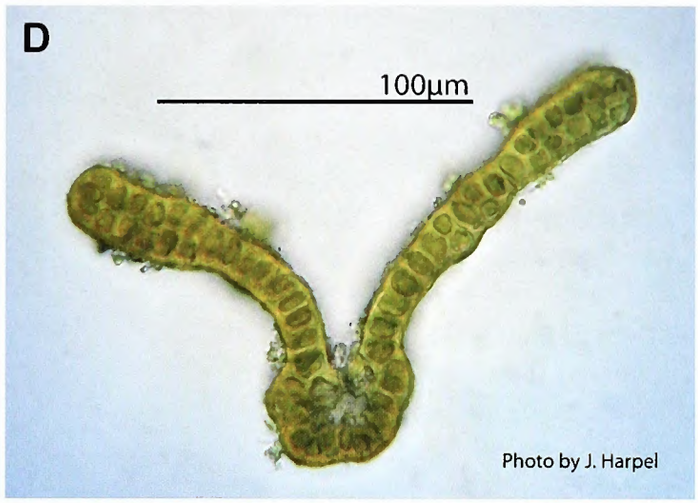
GAMETOPHYTE — **Plants** in dense cushions, dark green to almost black. **Stems** 0.8–1.2 (–1.5) cm, central strand present. **Leaves** oblong-lanceolate, 1–2.2 × 0.3–0.6 mm, keeled, not plicate, margins plane, awn 0.3–1.3 mm, costal transverse section prominent, semicircular; basal juxtacostal laminal cells long-rectangular, straight, thin-walled (rarely somewhat thick-walled); basal marginal laminal cells long-rectangular, straight, thin-walled, typically hyaline; medial laminal cells short-rectangular, sinuose, thick-walled; distal laminal cells commonly bistratose, occasionally only unistratose, not bulging; marginal cells bistratose, not bulging. **Autoicous**.

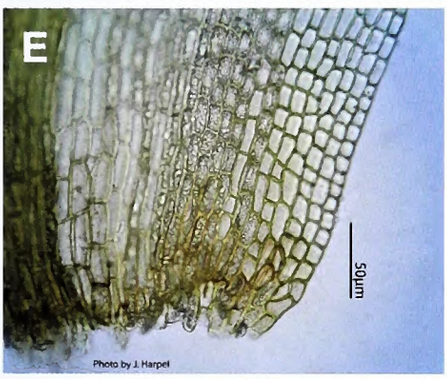
Plate 35. Grimmia donniana. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Leaf cross-section. E. Alar and basal cells. F. Upper medial cells. G. Leaf apex. H–I. Sporophytes. J–K. Peristome teeth. L. Stomata. (R. Hastings. C90.2.276. C. Bird 5287. PMAE)*

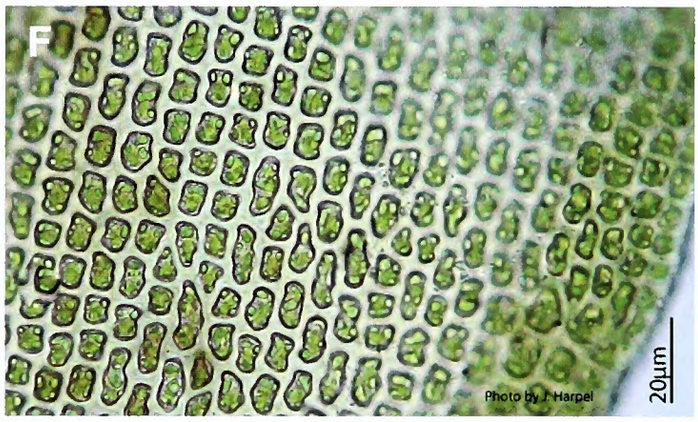

A
Photo by J. Harpel

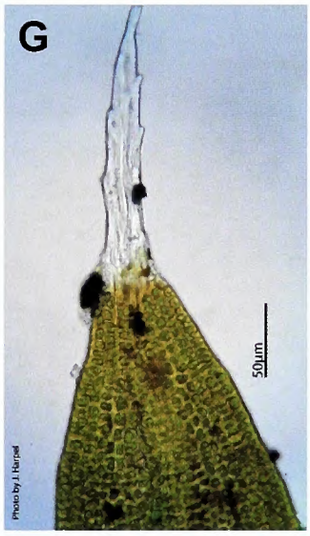

B
2 mm
Photo by J. Harpel

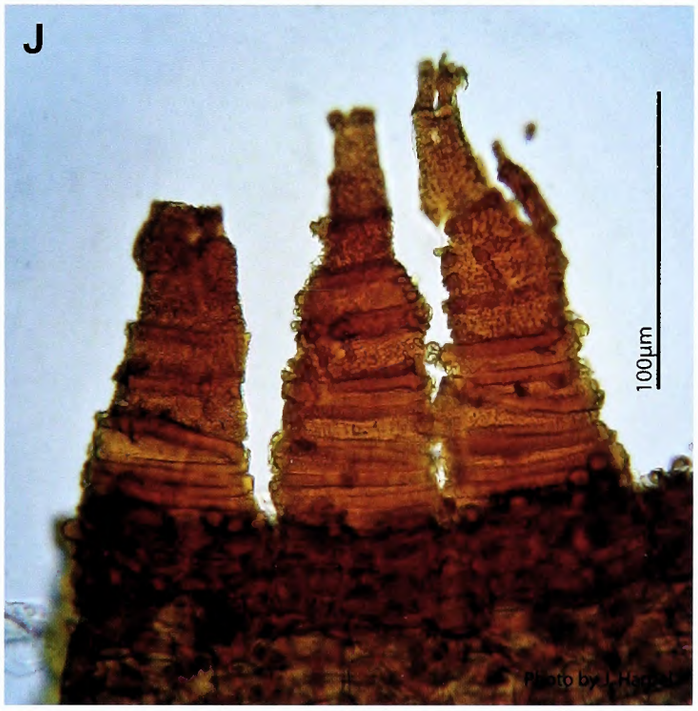

C
1 mm
Photo by J. Harpel


D
100µm
Photo by J. Harpel


E
50µm
Photo by J. Harpel

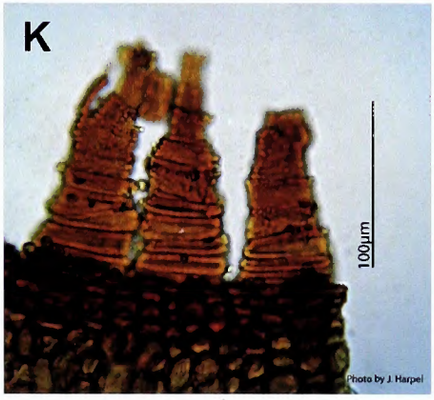

F
20µm
Photo by J. Harpel

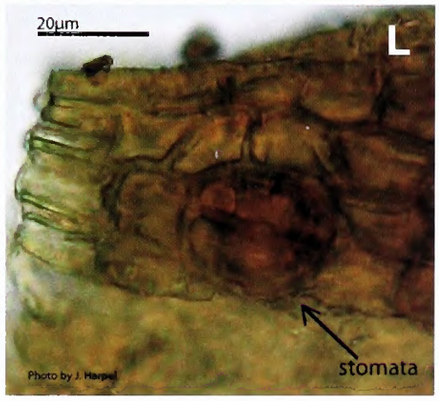

G
50µm
Photo by J. Harpel


J
100µm
Photo by J. Harpel


H
4 mm
Perigonium
Photo by J. Harpel


I
2 mm
Photo by J. Harpel


K
100µm
Photo by J. Harpel


20µm
L
stomata
Photo by J. Harpel

SPOROPHYTE — **Seta** straight, 2–3 mm. **Capsules** usually abundant, exserted, pale yellow-brown, oblong, exothecial cells quadrate, thin-walled, stomata present, annulus of 2 rows of quadrate, thick-walled cells; operculum mammillate to rostellate; peristome fully-developed, perforated in upper half; calyptrae mitrate. **Spores** smooth or nearly so, 6–9 µm.

Similar species — *Grimmia montana* is similar and while the leaves are often incurved distally, they may also have plane margins. *G. montana* is further distinguished by its quadrate to short-rectangular basal marginal cells that have thick end-walls and are rarely hyaline. It is also dioicous and lacks stomata in the capsule. *Grimmia alpestris* also lacks capsule stomata and has quadrate to short-rectangular inner and outer basal cells. *Grimmia sessitana* may also produce leaves with plane margins, but one margin is often recurved. Its basal marginal laminal cells are rectangular, like those of *G. donniana*, but they have thick, rather than thin, walls and typically are not hyaline. The leaf cells of *G. sessitana* are often bulging and mammillose. The calyptrae in *G. alpestris*, *G. montana,* and *G. sessitana* are all cucullate. See *Grimmia anomala* for additional information on similar genera.

Ecology — *Grimmia donniana* is known from exposed acidic, granite and sandstone substrates from forests and tundra at moderate to high elevations (2,400–11,100 feet).

Distribution — *Grimmia donniana* is known from Eurasia, Africa, Greenland, the Antarctic, and South and North America. In western North America, it is known from Alaska, Yukon, Northwest Territories, British Columbia, Alberta, Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Colorado. In Oregon, *G. donniana* is documented from Jackson, Wallowa, and Wasco counties within the Columbia Basin, Blue Mountain, and Klamath Mountain ecoregions. Historical collections have also been reported from Baker, Clackamas, Crook, and Umatilla counties and from within the Cascades ecoregions, but none have been verified.

References with descriptions and/or illustrations — Hastings and Greven (in FNA 2007, p. 236), Greven (2003, p. 90), Muñoz and Pando (2000, p. 25), Flowers (1973, p. 252), Lawton (1971, p. 126), Nyholm (1956, p. 152 as *Grimmia doniana*).

References with photos — Lockhart et al. (2012, p. 319), Atherton et al. (2010, p. 522).

Grimmia lisae De Notaris

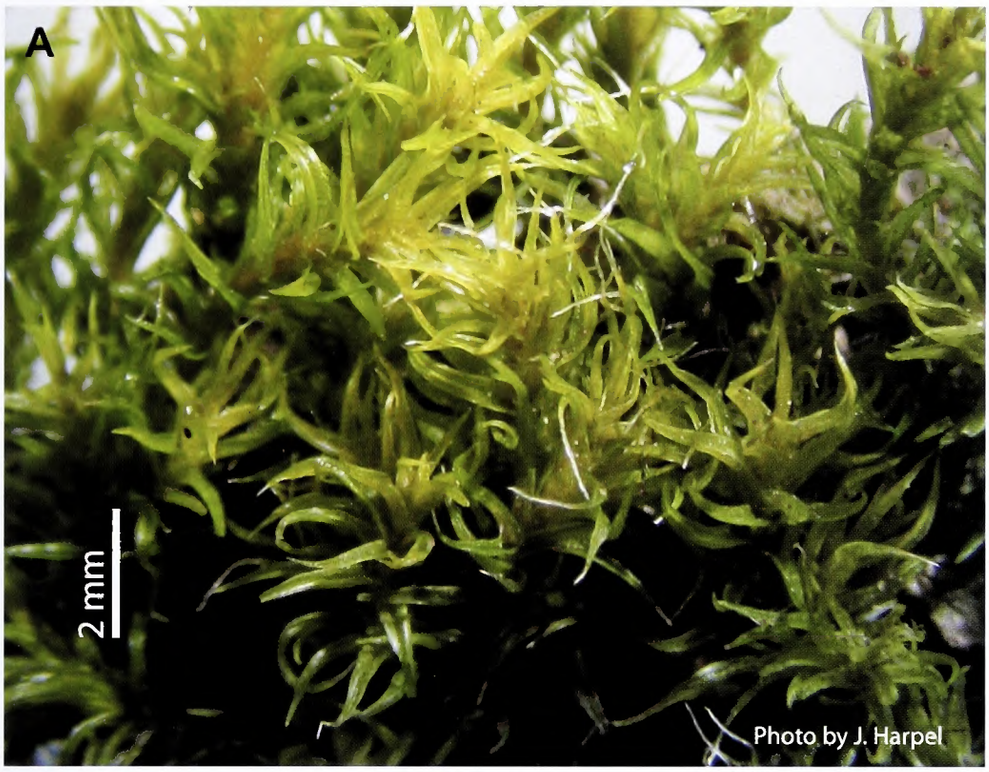
Recent synonyms: none
Common name: Lisa's grimmia

Taxonomic note: *Grimmia lisae*, like *Grimmia trichophylla*, is extremely variable and in the past was frequently described as a new taxon. From western North America alone, *G. lisae* has been described as *G. ancistrodes* Dur. & Mont., *G. arcuatifolia* Kindb., *G. californica* Sull., *G. canadensis* Kindb., *G. flettii* (Holz.) Card., *G. trichophylla* subsp. *lisae* (De Not.) Boulay, and *G. trichophylla* var. *lisae* (De Not.) Bott.

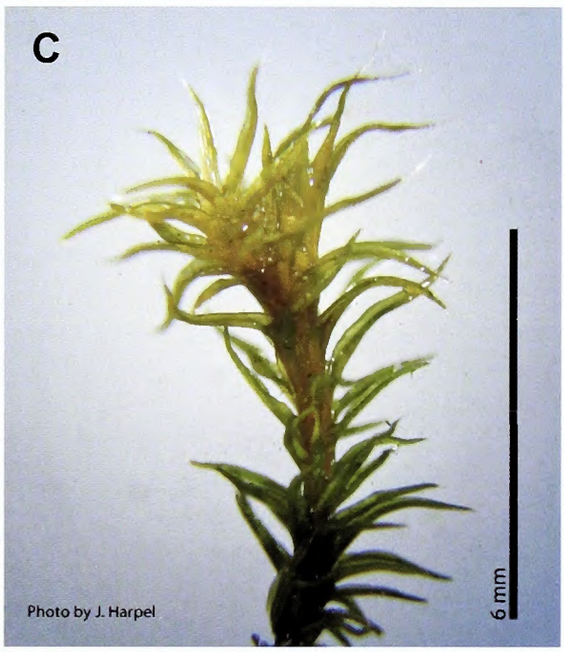
Summary — An acrocarpous, costate moss with broadly lanceolate and keeled leaves. Terrestrial.

Diagnostic characteristics — *Grimmia lisae* is distinguished by its (1) recurved to squarrose leaves when wet, (2) brown ovoid striate shiny capsules on arcuate setae, (3) grass-green mid-leaf areolation with small rounded frequently oblate cells with straight walls, and (4) a central strand present in the stem.

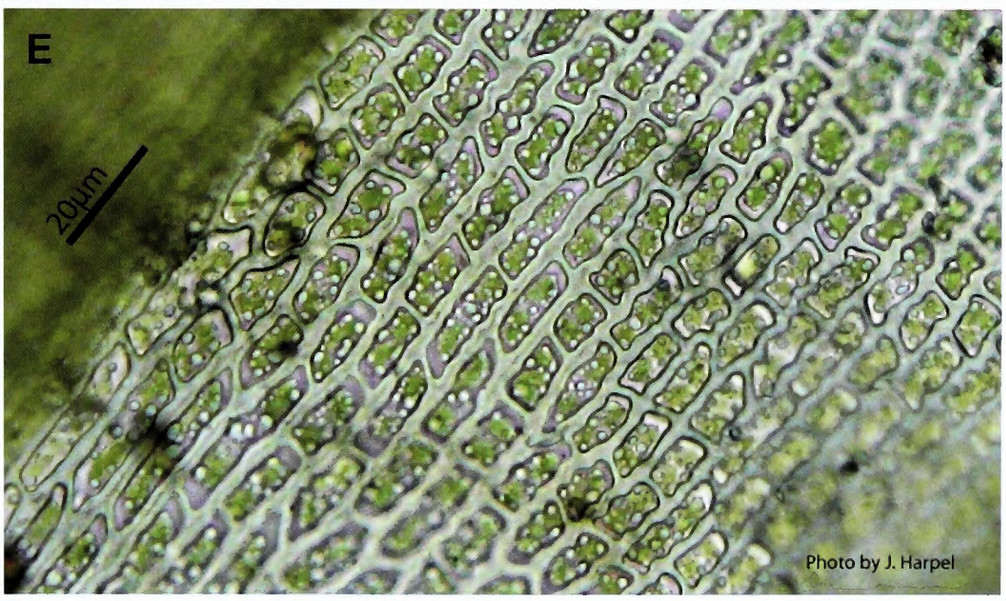
Plate 36a. Grimmia lisae. *A. Moist habitat. B. Dry habitat. C. Individual plant. D. Leaf. E. Basal cells. (D. Toren 7262. CAS)*


A
2 mm
Photo by J. Harpel


B
4 mm
Photo by J. Harpel


C
6 mm
Photo by J. Harpel


D
2 mm
Photo by J. Harpel


E
20µm
Photo by J. Harpel

Technical description

GAMETOPHYTE — **Plants** in dense to loose tufts up to 1–4 cm, olivaeeous, brownish to blackish below. **Stems** with a central strand. **Leaves** broadly lanceolate, tapering to an acute apex, erect and appressed when dry, recurved to squarrose when moist, 1.5–2.5 × 0.4–0.6 mm, keeled; margins bistratose, recurved on one or both side; awns absent to long, stout and denticulate; costa keeled on the dorsal surface, median layer of stereids present; basal cells short-rectangular to occasionally elongate, straight to slightly sinuose, thin to thick-walled, unistratose with bistratose ridges; basal marginal cells quadrate to short-rectangular with thickened transverse walls; upper medial cells oblate to rounded-quadrate, straight, thick-walled. Multicellular gemmae are occasionally clustered in the leaf axils. **Dioicous**.

SPOROPHYTE — **Seta** arcuate, 3–4.5 mm. **Capsules** occasionally present, exserted, ovoid, brown, shiny, weakly striate, exothecial cells thin-walled, annulus present; operculum rostrate, peristome teeth orange, fully-developed to irregularly cleft at apex, papillose; calyptrae mitrate.

Similar species — *Grimmia lisae,* included in the subgenus Rhabdogrimmia, is closely related to *G. trichophylla*, but differs by somewhat shorter and broader leaves that are frequently straight and appressed when dry and recurved to squarrose when moist. Additionally, it is characterized by a mid-leaf areolation with small, rounded, frequently oblate cells with smooth walls. Just like other taxa within the *trichophylla* complex, *G. lisae* is variable in color (yellowish, greenish, brownish, or blackish), size (tiny to robust), and hair-points (muticous, short to long).

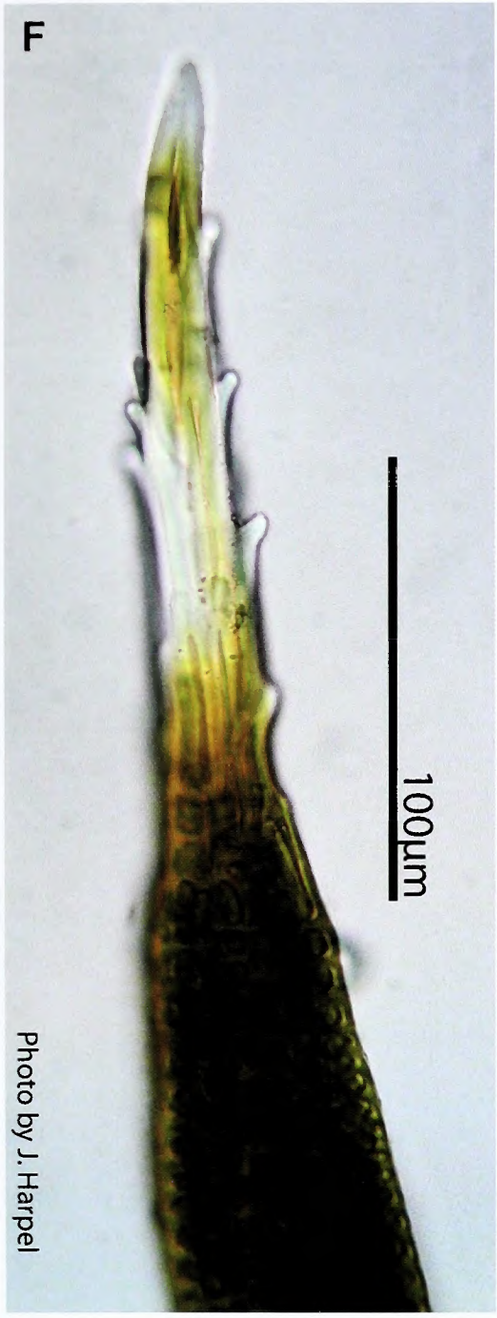
Ecology — *Grimmia lisae* is known from dry acidic to basic rocks at low to moderate (180–3,000 foot) elevations. It is a thermophilous species with a preference for subtropical coastal areas. The northwestern Oregon site occurs on basalt sheet drainage within an open mesic graminoid meadow surrounded by Oregon White Oak (*Quercus garryana*).

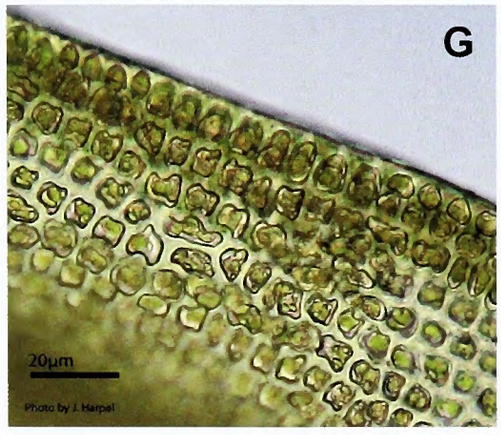
Distribution — *Grimmia lisae* is known from Eurasia, Africa, Hawaii, and North America. In North America, it is known along the Pacific coast from British Columbia south through Washington, Oregon, and California. In Oregon, *G.lisae* is reported from Douglas, Josephine, and Polk counties within the Coast Range and Klamath ecoregions.

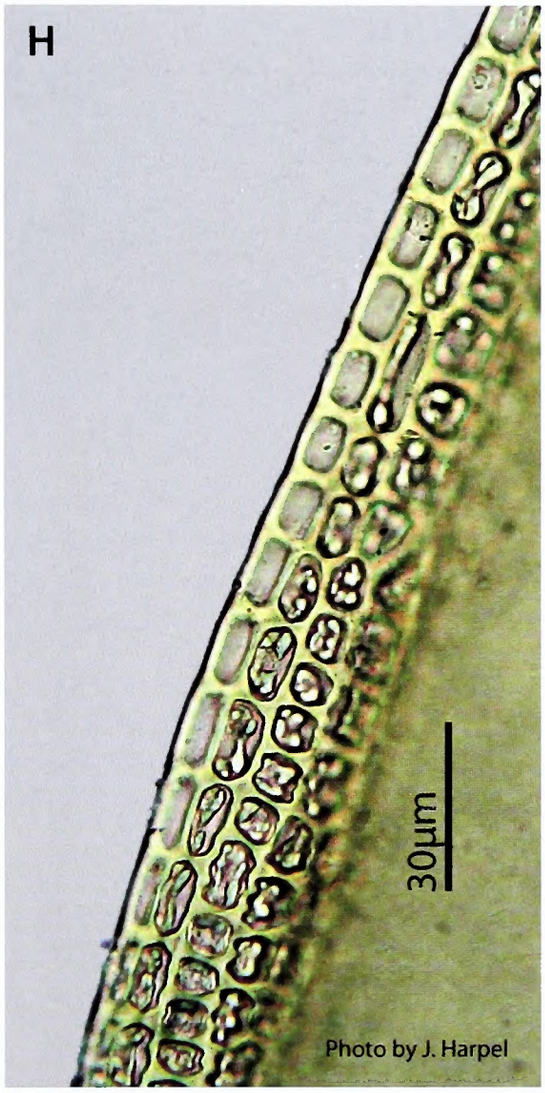
References with descriptions and/or illustrations — Hastings and Greven (in FNA 2007, p. 253), Greven (2003, p. 134), Muñoz and Pando (2000, p. 41).

References with photos — Lockhart et al. (2012, p. 324).

Plate 36b. Grimmia lisae. *F. Leaf apex. G. Upper medial cells. H. Basal leaf margin. I. Alar cells. J. Sporophyte. K. Stomata. (D. Toren 7262. CAS)*

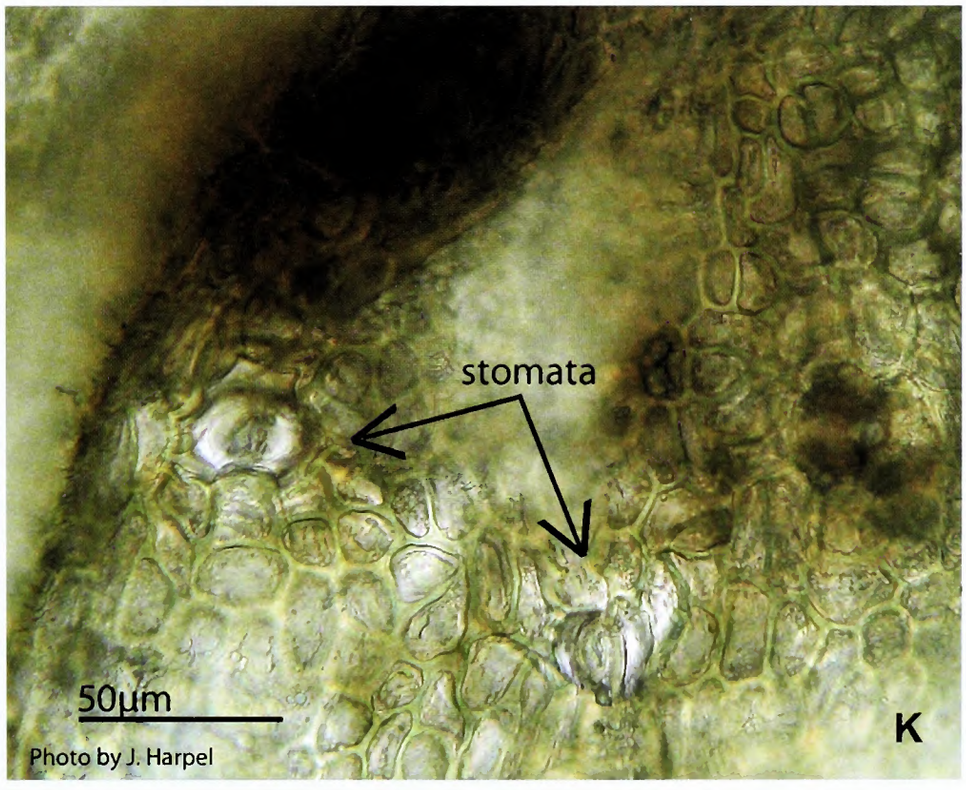

F
100µm
Photo by J. Harpel


G
20µm
Photo by J. Harpel


H
30µm
Photo by J. Harpel


30µm
I
Photo by J. Harpel


J
1 mm
Photo by J. Harpel


stomata
50µm
Photo by J. Harpel
K

Gymnostomum viridulum Bridel

Recent synonyms: none
Common name: Luisier's tufa-moss

Summary — A very small acrocarpous, costate moss with papillose, ovate leaves. Terrestrial.

Diagnostic characteristics — *Gymnostomum viridulum* is distinguished by its (1) short-elliptic or ovate leaves, (2) gemmae in leaf axils, (3) dense turf habit on moist calcareous substrates, and (4) lack of a peristome.

Technical description

GAMETOPHYTE — **Plants** in dense tufts (sometimes loosely cespitose), dark green above. **Leaves** 0.3–0.4 (–0.6) mm, short-elliptic or ovate, occasionally long-elliptic, apex rounded to occasionally broadly acute, rarely apiculate; upper margins unistratose, papillose-crenulate; basal cells 9–10 µm wide, 1:1, papillose; upper ventral costal cells elongate, occasionally short-rectangular. Obovoid gemmae of 4–6 cells usually present in leaf axils. **Dioicous**.

SPOROPHYTE — **Seta** generally 3–6 mm, pale yellow, twisted clockwise. **Capsules** short-cylindric, wide-mouthed, exothecial cells bulging, usually 30–40 µm wide. Peristome teeth absent; opercuum rostrate 11–16 µm, smooth to papillose, brownish; calyptra cucullate. **Spores** 11–16 µm.

Similar species — *Gymnostomum aeruginosum* differs from *G. viridulum* by its loosely cespitose habit, rarely forming a dense tuft, and flat or weakly convex exothecial cells. *Gymnostomum calcareum* lacks gemmae and its cauline leaves are rectangular to elliptic, occasionally ovate. Species of *Barbula* differ in their clear axillary hair cells, and the presence of a peristome. *Didymodon* species have a peristome and axillary hairs with a brownish proximal cell. *Barbula* and *Gymnostomum* laminae yield a yellow to yellow-orange color reaction in KOH, while *Didymodon* laminae yield a red (occasionally red-orange to yellow) reaction.

Ecology — *Gymnostomum viridulum* is known from calcareous substrates or thin soil on limestone rock ledges in seepy, wet rock crevices at moderate elevations (1,500–4,500 feet). Capsules mature spring–fall.

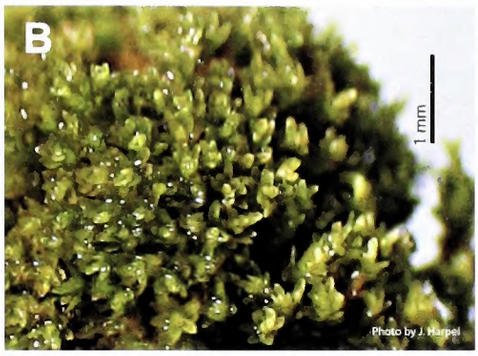
Distribution — *Gymnostomum viridulum* is known from Eurasia, Africa, and western North America only in Oregon, and California where it is reported as locally abundant (Zander and Eckel 2007a). In Oregon, *Gymnostomum viridulum* is reported from Josephine County within the Klamath Mountain ecoregion.

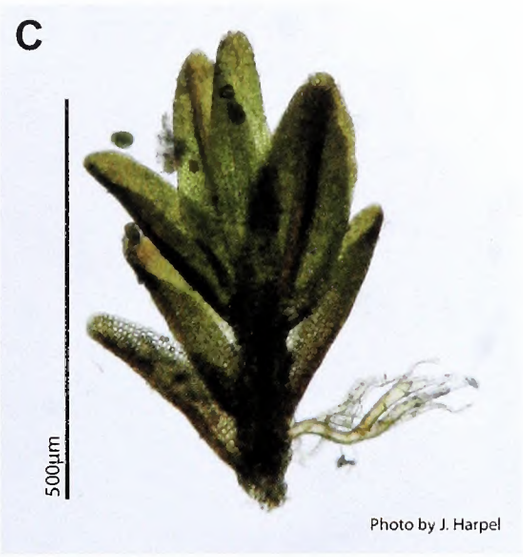
References with descriptions and/or illustrations — Zander and Eckel (in FNA 2007a, p. 537), Zander et al. (2007), Smith (2004, p. 308), Zander (1993, p. 151).

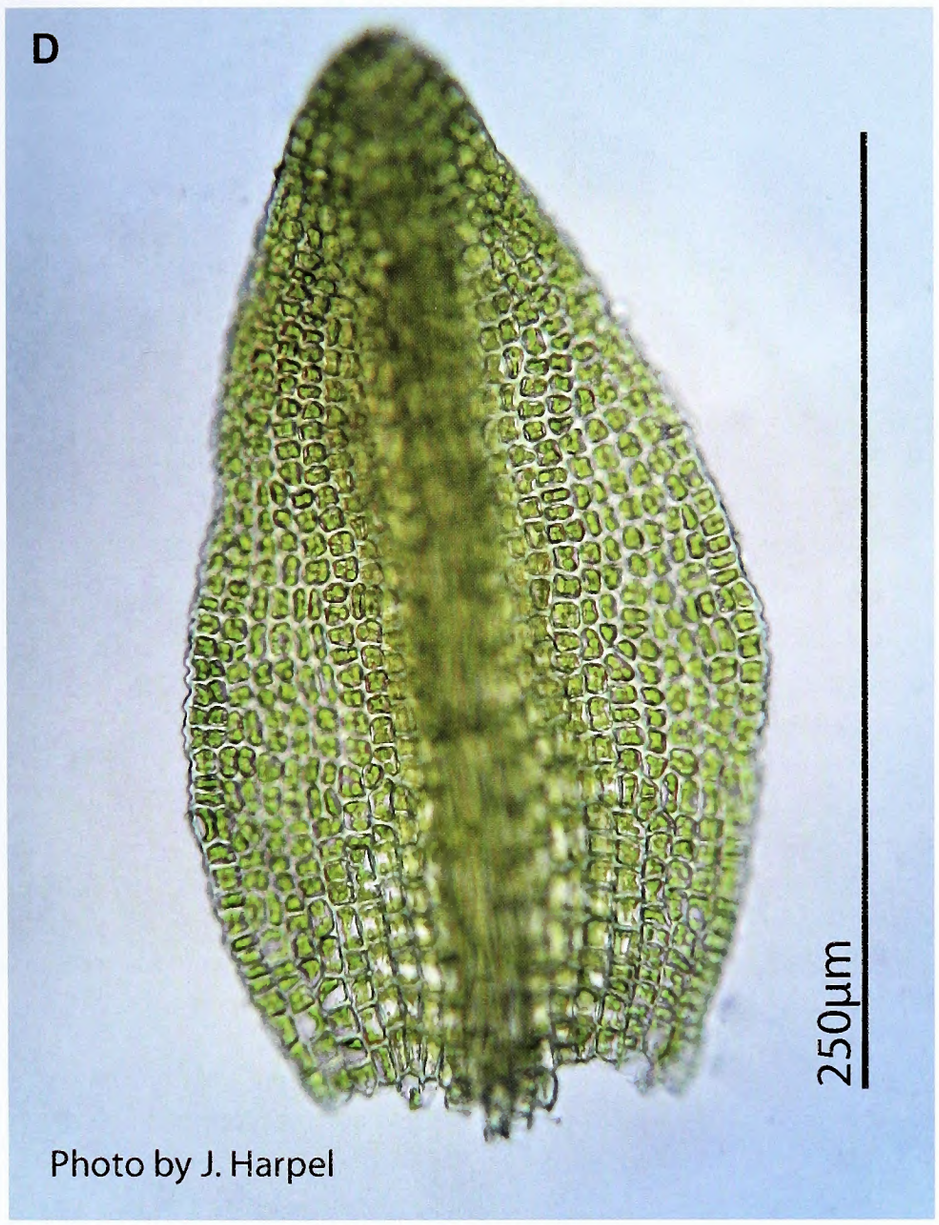
References with photos — Lockhart et al. (2012, p. 398), Atherton et al. (2010, p. 449).

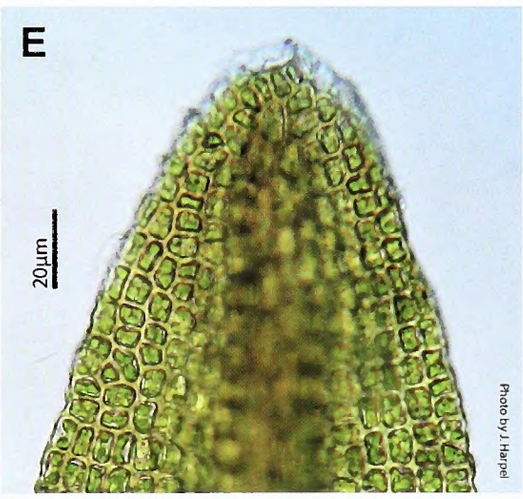
Plate 37. Gymnostomum viridulum. *A. Dry habitat. B. Moist habitat. C. Individual plant. D. Leaf. E. Leaf apex. F. Upper medial cells. G. Leaf cross-section. H. Stem cross-section. I. Propagula. (D. Toren 6866. CAS)*

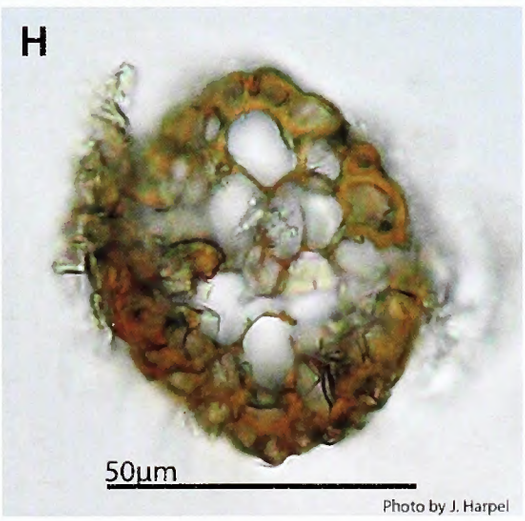

1 mm
A
Photo by J. Harpel

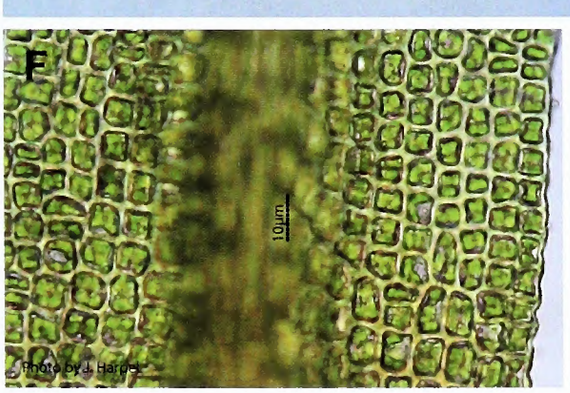

B
1 mm
Photo by J. Harpel


C
500µm
Photo by J. Harpel

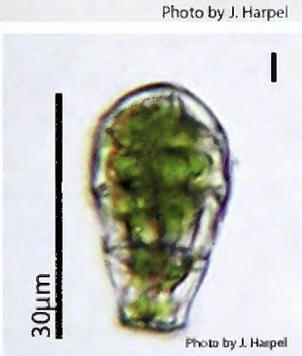

D
250µm
Photo by J. Harpel


E
20µm
Photo by J. Harpel


H
50µm
Photo by J. Harpel


F
10µm
Photo by J. Harpel


80µm
G
Photo by J. Harpel


I
30µm
Photo by J. Harpel

Hygrohypnum alpinum (Lindberg) Loeske

Recent synonyms: none
Common names: alpine brook-moss, alpine hygrohypnum moss

Summary — A pleurocarpous moss with a short double costa and orbicular leaves. Aquatic to semi-aquatic.

Diagnostic characteristics — *Hygrohypnum alpinum* can be distinguished by its (1) orbicular leaves, (2) short double costa, (3) thin-walled and more or less rectangular hyaline alar cells, (4) coarsely papillose perichaetial leaves, and (5) riparian habitat.

Technical description

Gametophyte — **Plants** easily fragmented, forming small loosely woven patches or occasionally larger tight mats, soft and pliable when moist or dry, sometimes stiff and brittle when dry, color varies from pale yellow to brownish yellow-green, sometimes with a translucent sheen. **Stems** up to 5 cm long, branches 1–2 (–3.5) cm long erect to ascending. **Leaves** variable, plane, ruffled or weakly concave, closely spaced or distant either wet or dry, 1.3–1.7 (–2) mm long × 1.2–1.6 mm wide, usually oblong elliptic to orbicular, sometimes ovate to transverse; margins entire, or finely serrate near the apex; costa usually double, often very faint and may reach midleaf, or rarely slender and single and reaching just above midleaf; median leaf cells short fusiform to linear flexuose, (25–) 35–55 (–75) µm long × (4–) 6–7 (–9) µm wide; apical cells shorter; basal cells hyaline or yellowish-brown with age; alar cells usually forming a well-defined rectangular group. **Autoicous**. Perigonial leaves ovate, toothed with 2–4 teeth on acute apex; perichaetial leaves coarsely serrate at apex, coarsely papillose on the dorsal surface.

Sporophyte — **Seta** 8–20 mm long yellowish-red to orangish-red to red, straight when wet, twisted when dry. **Capsules** cylindric, curved and inclined; peristome double, inner teeth finely papillose. **Spores** variable within the same capsule, 12–24 µm.

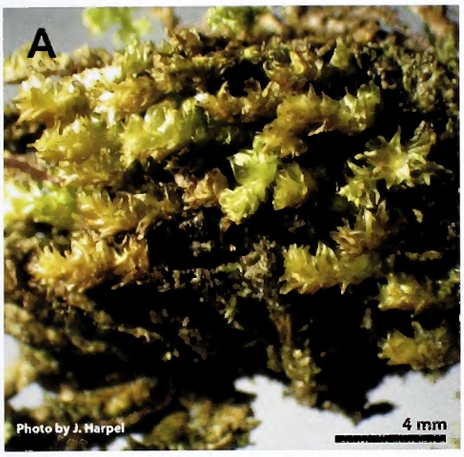
Similar species — *Hygrohypnum alpinum* can be distinguished from other *Hygrohypnum* taxa by its lack of a stem hyalodermis, straight or sometimes second leaves that are broadly ovate and less than 1.5 times wide as long, marginal laminal cells less than 55 µm, and a clearly differentiated alar region. The ruffling of the leaves and dorsal papillae of the inner perichaetial leaves are additionally distinctive. *Hygrohypnum duriusculum* (= *H. dilatatum*) can be separated from *H. alpinum* by its quadrate to short-rectangular clearly pigmented incrassate alar cells and smooth apical laminal cells of the inner perichaetial leaves.

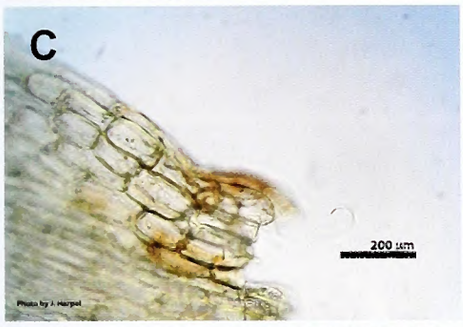
Ecology — *Hygrohypnum alpinum* occurs on large boulders on the banks of or within small swiftly running mountain streams. The species is scattered throughout western North America and appears confined to higher elevations (2,200–11,000 feet) in cold and clean swiftly running mountain streams.

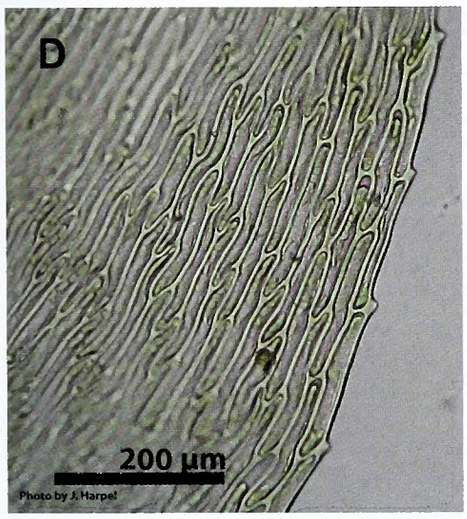
Distribution — *Hygrohypnum alpinum* is known from Europe, Iceland, and North America. In western North America, it has been found from Alaska south through British Columbia, Washington, Oregon, California, Idaho, and Montana. In Oregon, *H. alpinum* is reported from Jackson County within the West Cascades ecoregion.

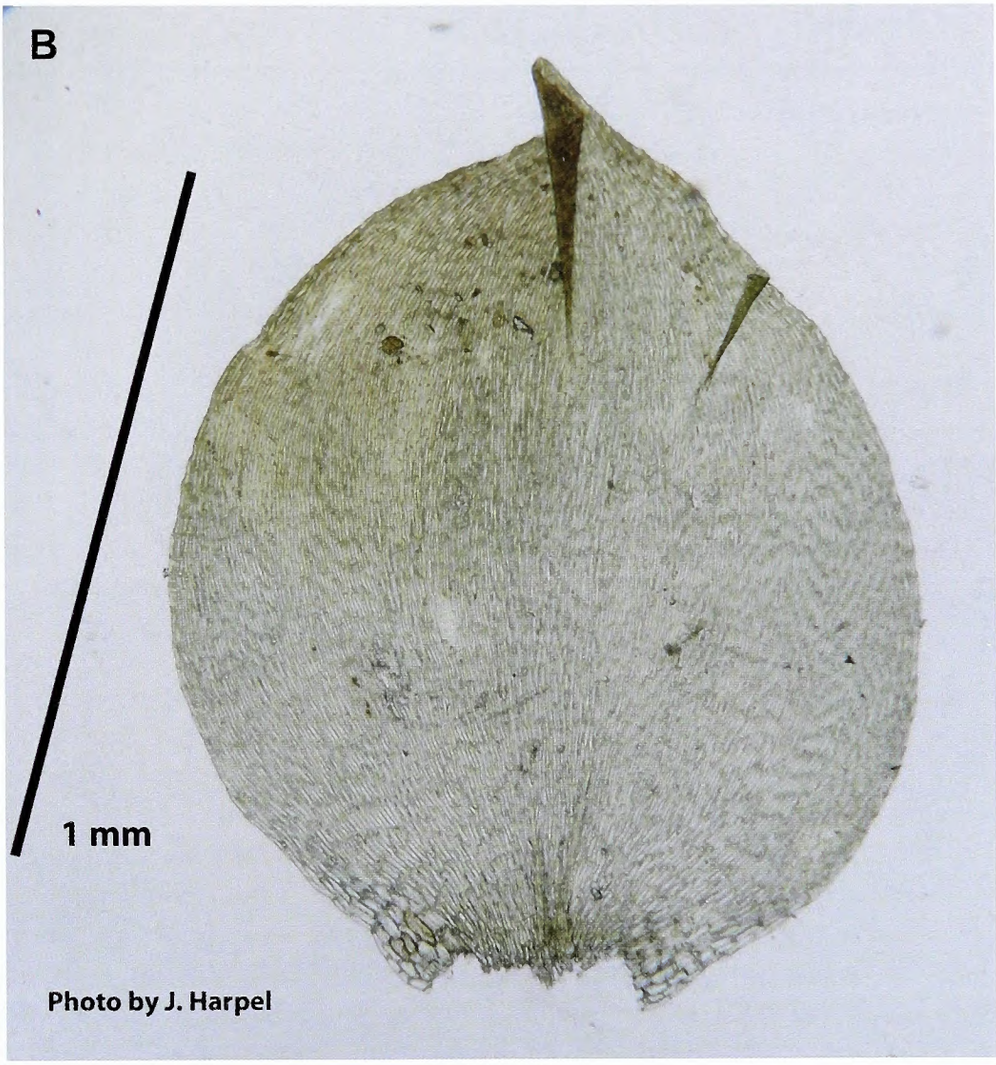
References with descriptions and/or illustrations — Jamieson (in FNA 2014, p. 272), Jamieson (1976), Lawton (1971, p. 283), Nyholm (1965, p. 464).

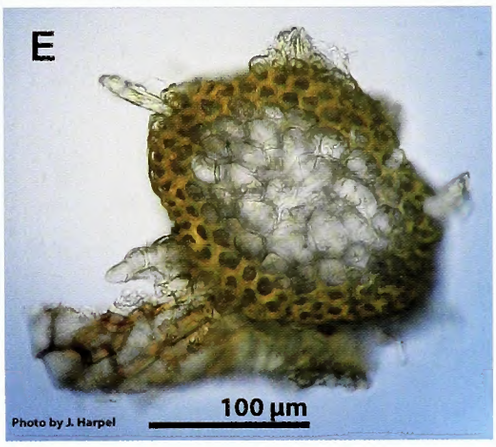
Plate 38. Hygrohypnum alpinum. *A. Moist habitat. B. Leaf. C. Alar cells. D. Upper medial cells. E–F. Stem cross-sections. (D. Jamieson 2877. UBC)*

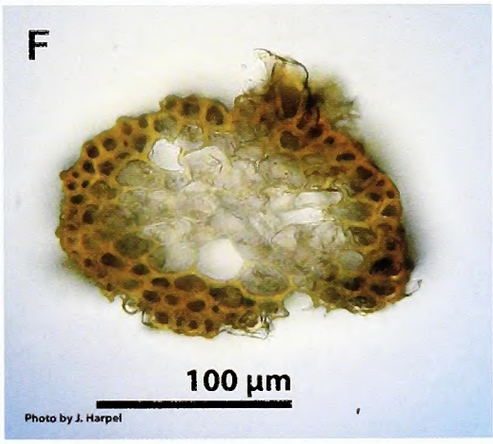

A
Photo by J. Harpel
4 mm


C
200 µm


D
200 µm
Photo by J. Harpel


B
1 mm
Photo by J. Harpel


E
100 µm
Photo by J. Harpel


F
100 µm
Photo by J. Harpel

Hygrohypnum cochleariifolium (Venturi) Brotherus

Recent synonyms:
Hyrgohypnum smithii var. *goulardii* (Schimper) Wijk and Margadant
Hygrohypnum smithii var. *cochlearifolium* (Venturi) Mönkemeyer
Common names: ear leaf hygrohypnum

Summary — A pleurocarpous, double costate moss with concave, ovate leaves. Terrestrial.

Diagnostic characteristics — *Hygrohypnum cochleariifolium* can be distinguished by its (1) deeply concave, cucullate, ovate to ovate elliptic leaves, (2) short and double costa, (3) undifferentiated alar cells, and (4) soft texture.

Technical description

GAMETOPHYTE — **Plants** very soft, dull yellow to yellow-green with conspicuous rusty mottling. It forms loose to tightly woven, easily fragmented patches, which are often coated in mud. **Stems** mostly unbranched or occasionally irregularly branched, up to 1–3 (5) cm. Stem cortical cells small, thick walled and brownish; central strand small, poorly differentiated. **Leaves** variable, crowded to very distant, oblong or oblong-elliptic, sometimes orbicular, (0.5) 0.8–1.2) (1.5) deeply concave to ear shaped (cochleariform). When moist they are loosely imbricate or erect-spreading and tumid. Leaves remain coneave upon drying. Margins recurved in small leaves, usually plane in larger leaves. Apex is usually obtuse or rounded, rarely acute, regularly cucullate. The costa is variable, usually double and short with one branch to mid leaf or sometimes single and short to mid leaf, or ecostate. Alar cells thin walled, undifferentiated or with a few quadrate, short-rectangular cells. Basal cells variable. Upper medial cells short-fusiform, short linear-flexuose, or rhombic. Apical cells are shorter to more rhombic. Marginal cells short, less than 50 µm. Sexual condition is unclear, because plants are usually sterile; perigonial details are unknown.

SPOROPHYTE — **Seta** yellowish to reddish, 1.2–1.6 cm. **Capsules** ovoid or oblong-cylindric, inclined to horizontal, contracted below the mouth and neck when dry.

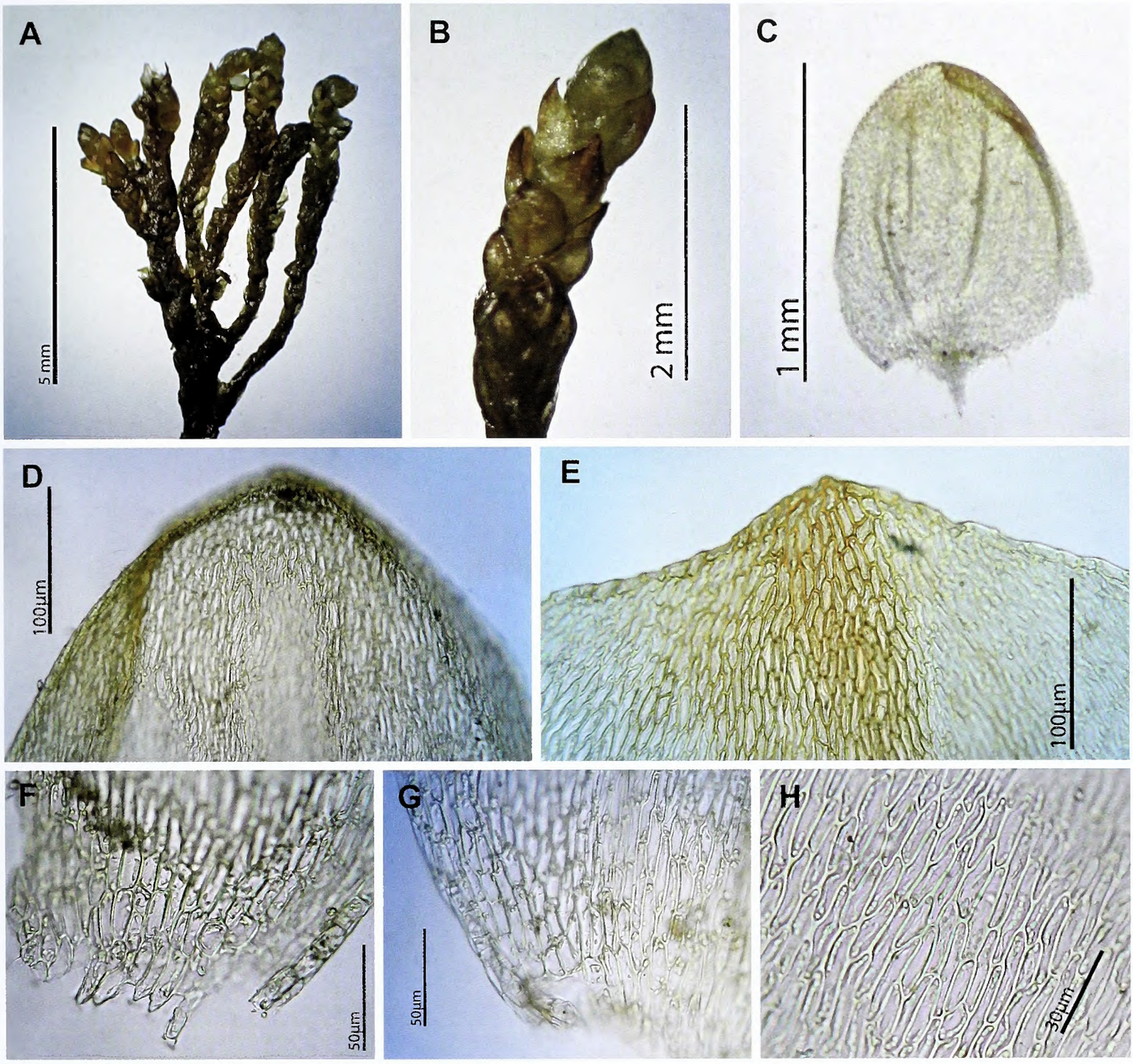
Similar species — *Hygrohypnum cochleariifolium* is distinguished from other members of the genus by the broadly ovate, oblong-ovate or orbicular, deeply concave cuculate leaves.

Ecology — *Hygrohypnum cochleariifolium* grows in loosely woven, easily fragmenting, often silt-clogged patches or small, tightly woven patches on acidic rock in irrigated streams, or shaded, irrigated cliffs and boulders. It occurs at elevations of 3,900 –11,000 feet.

Distribution — *Hygrohypnum cochleariifolium* is known from Europe and North America. In western North America, it is know from Alaska, Yukon, Oregon, Montana, Wyoming and Colorado. In Oregon, *H. cochleariifolium* is reported from Grant County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Jamieson (in FNA 2014, p. 274), Jamieson (1976), Lawton (1971, p. 285, as *Hygrohypnum smithii* var. *goulardii*), Nyholm (1965, p. 462).

Plate 39. Hygrohypnum cochleariifolium. *A. Whole plant. B. Individual branch. C. Leaf. D. Cucullate leaf apex. E. Leaf apex. F–G. Alar and basal cells. H. Upper medial cells. (D. Vitt 13496. UBC)*


A
5 mm
B
2 mm
C
1 mm
D
100µm
E
100µm
F
50µm
G
50µm
H
30µm

Hypnum lindbergii Mitten

Recent synonym: *Calliergonella lindbergii* (Mitten) Hedenäs
Common names: Lindberg's hypnum

Summary — A pleurocarpous, costate moss with falcate-secund leaves. Terrestrial.

Diagnostic characteristics — *Hypnum lindbergii* can be distinguished by its (1) large hyaline cortical cells that remain on the bottom of the leaf when peeled from the stem, (hyaloderm), (2) well defined alar region, and (3) furrowed capsules when dry.

Technical description

GAMETOPHYTE — **Plants** golden green, yellow-green, or pale green, forming mats. **Stems** 1–5 cm, ascending to creeping, irregularly branched or somewhat pinnate, with foliose pseudoparaphylla; central strand well developed. Branches 0.2–2 cm long. **Leaves** 0.5–2 x 0.5–1 mm, falcate-secund (sometimes weakly), oblong-ovate, not or slightly rounded to insertion, often auriculate, tapering gradually to apex. Margins plane, entire or serrate at the apex; acumen slender or broad. Costa short, and double. Upper medial cells linear, basal cells wider, shorter, and porose. Alar cells well defined, large, hyaline, thin-walled, forming 2–4 rows along the margins. **Dioicous**.

SPOROPHYTE — **Seta** reddish, 2.5–4 cm long. **Capsules** inclined, pale brown, cylindric, 2–3 mm long, furrowed when dry. The annulus is bi- or triseriate. The operculum is conic-convex and the endostome cilia are 2–4.

Similar species — The inflated cortical cells (hyaloderm), leaves usually curved to insertion, well-defined alar regions of swollen thin-walled cells, and broad to acute apex of stem leaves usually separate *Hypnum lindbergii* from similar taxa. *Hypnum. pratense* is glossy, has complanate stem leaves, and lacks thin-walled alar cells.

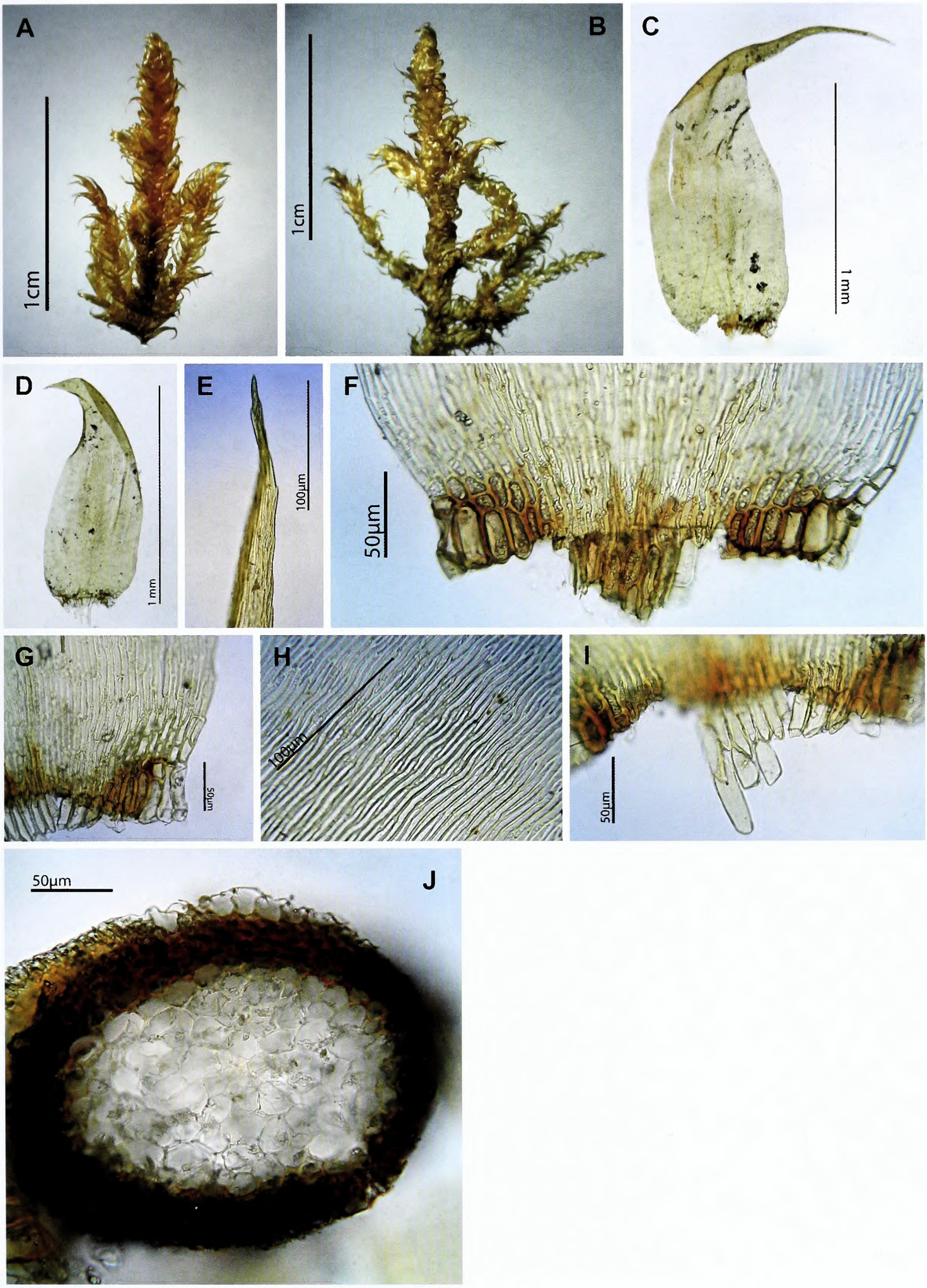
Ecology — *Hypnum lindbergii* is found in open sites on wet soil, rocks, humus, logs, sandy lake and river margins, bogs and swamp forests from 0 to 9,000 feet in elevation.

Distribution — *Hypnum lindbergii* is known from Eurasia, Greenland and most all provinces and states in North America. In western North America, it is known from Alaska south through British Columbia and Alberta to Washington, Oregon, California, Utah, Montana, Wyoming, Colorado, Nevada, Arizona and New Mexico. In Oregon, *H. lindbergii* is reported from Grant, Linn and Multnomah counties within the Blue Mountain and West Cascade ecoregions.

References with descriptions and/or illustrations — Schofield (in FNA 2014, p. 543), Smith (2004, p. 892, as *Calliergonella lindbergii*), Crum (2004, p. 508), Crum and Anderson (1981, p. 1170), Lawton (1971, p. 324), Nyholm (1965, p. 592).

References with photos — Atherton et al. (2010, p. 798, as *Calliergonella lindbergii*).

Plate 40. Hypnum lindbergii. *A. Individual plant, wet B. Individual plant, dry. C. Stem leaf. D. Branch leaf. E. Leaf apex. F. Branch leaf alar and basal cells. G. Stem leaf alar and basal cells. H. Upper medial cells. I. Stem cortical cells on base of leaf. J. Stem cross section. (I. Worley 5410. UBC)*


A
1cm
B
1cm
C
1 mm
D
1 mm
E
100µm
F
50µm
G
50µm
H
100µm
I
50µm
50µm
J

Hypnum pratense Koch

Recent synonyms: none
Common names: meadow hypnum

Summary — A pleurocarpous, costate moss with falcate leaves. Terrestrial.

Diagnostic characteristics — *Hypnum pratense* can be distinguished by its (1) glossy, slightly complanate appearance, with few to no rhizoids, (2) short apical laminal cells, compared to median cells, and (3) large hyaline cortical cells that remain on the bottom of the leaf when peeled from the stem (hyaloderm).

Technical description

GAMETOPHYTE — **Plants** pale to golden green, forming shiny irregularly to unbranched, strongly complanate-foliate creeping mats **Stems** 0.5–1.5 (–3) cm long, green to yellowish green with a strong central strand and foliose pseudoparaphyllia. Branches 0.1–0.3 cm long. **Leaves** 0.5–1.8 x 0.3–0.5 mm, sometimes falcate, weakly secund, ovate, concave, and tapering to a broadly acute apex. The decurrent leaf base is rounded to the insertion. Thin-walled alar cells are somewhat enlarged but not forming a distinct group; margins plane and entire, often serrate at the apex. Costa double and short or ecostate. Upper medial cells linear; basal cells shorter and wider, with porose walls. **Dioicous.**

SPOROPHYTE — **Seta** reddish, 2–4 cm long. **Capsules** inclined to arcuate, pale brown, short-cylindric and 1–2 mm long; annulus bi- or tri-serrate; operculum conic; endostome cilia 2–4.

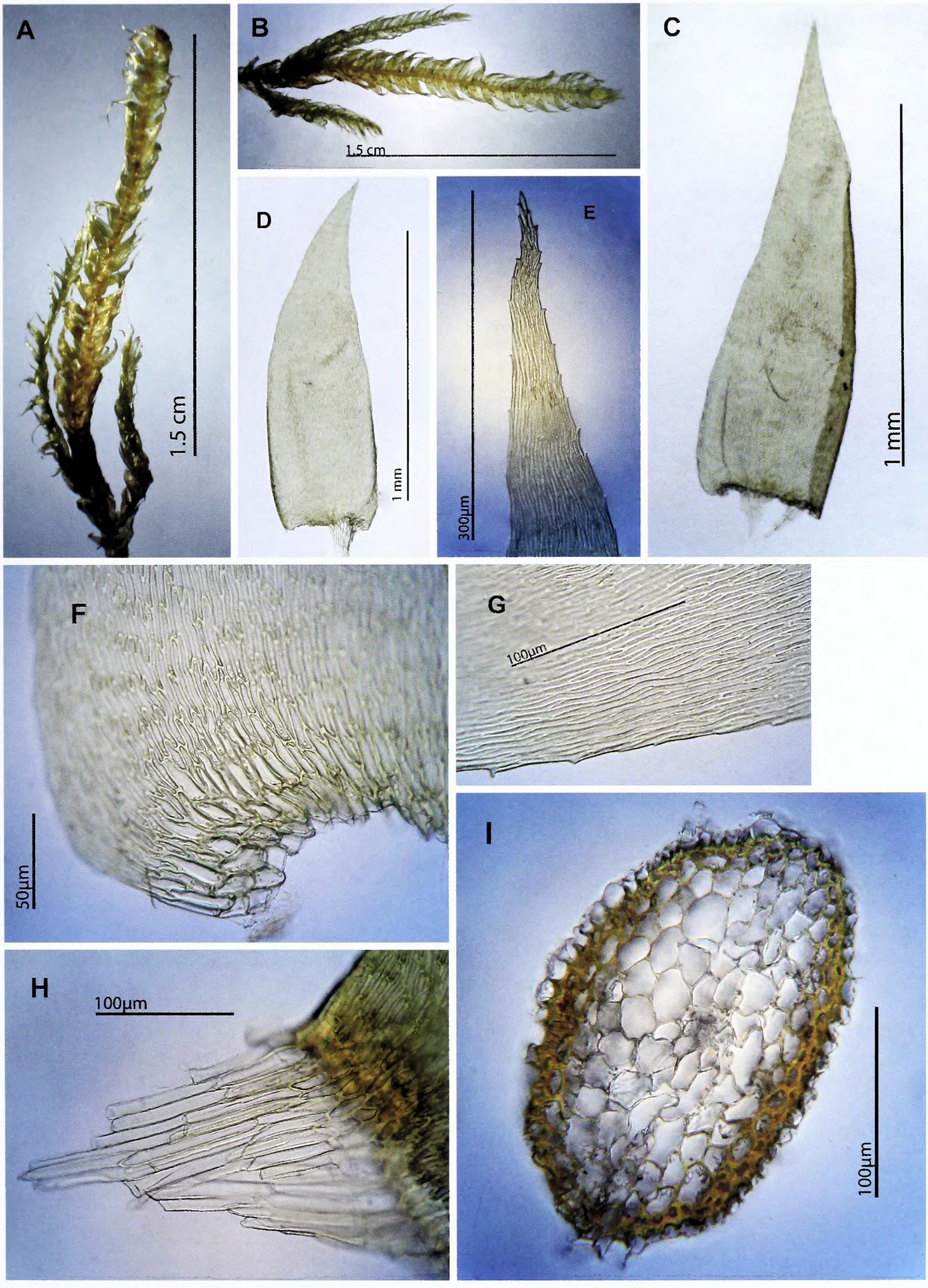
Similar species — *Hypnum pratense* has rounded leaf bases, alar cells that are not strongly inflated and strong glossy complanate appearance which separate it from *Hypnum lindbergii*.

Ecology — *Hypnum pratense* is a temperate to boreal circumpolar species. It is a calciphile, occurring on wet soil or humus in fens, marshes or seeps from 0 to 9,000 feet in elevation. Its locations are scattered largely north of the 35 parallel of latitude, but not frequent in the Arctic. Plants produce sporophytes infrequently in spring and summer, maturing July to August.

Distribution — *Hypnum pratense* is known from Eurasia, Greenland and North America. In western North America, it is known from Alaska, south to British Columbia, Alberta, Oregon, Montana, Wyoming, and Colorado. In Oregon, *H. pratense* is reported from Grant County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Schofield (in FNA 2014, p. 545), Crum (2004, p. 509), Crum and Anderson (1981, p. 1173), Flowers (1973, p. 518), Lawton (1971, p. 325), Nyholm (1965, p. 594).

Plate 41. Hypnum pratense. *A. Individual plant, dry. B. Individual plant, wet. C. Stem leaf. D. Branch leaf. E. Leaf apex. F. Alar and basal cells. G. Upper medial cells. H. Cortical cells on base of leaf. I. Stem cross section. (W. Schofield 110405. UBC)*


A
1.5 cm
B
1.5 cm
C
1 mm
D
1 mm
E
300µm
F
50µm
G
100µm
H
100µm
I
100µm

Iwatsukiella leucotricha (Mitten) W.R. Buck & H.A. Crum

Recent synonyms:
Habrodon pilifer Cardot
Habrodon leucotrichus (Mitten) Persson
Common name: iwatsukiella moss

Summary — A small pleurocarpous, ecostate moss with concave, suborbicular leaves. Epiphytic or (rarely, in Alaska) on rock.

Diagnostic characteristics — *Iwatsukiella leucotricha* can be distinguished by its (1) small size, (2) straight long-piliferous apex, (3) costae that are absent or rudimentary (short and double, ending just above leaf base), and (4) small leaflike structures (foliose pseudoparaphyllia) at the bases of leaf stems.

Technical description

Gametophyte — **Plants** small, slender, creeping yellowish-green mats usually tightly attached to substratum. **Stems** freely branched, prostrate, stoloniferous, foliose pseudoparaphyllia present at base of leaves as tiny leaflike structures. **Leaves** imbricate, slightly reflexed when moist, 0.5–1 × 0.3–0.4 mm, concave, suborbicular to ovate-lanceolate with long-piliferous acumens; costa absent or short and double; margins plane to recurved, entire; medial cells short, thick-walled, rhombic to elliptic, smooth; alar cells not differentiated; stem and branch leaves similar. **Dioicous**.

Sporophyte — **Seta** 4–7 mm. **Capsules** erect, oblong-cylindric or oblong 0.7–1 mm long, and dark-brown. Peristome teeth are linear-lanceolate, up to 0.25 mm long, coarsely papillose above and smooth below. **Spores** 12–30 µm. [*I. leucotricha* capsules have never been found within the continental United States.]

Similar species — *Iwatsukiella* is distinguished from other genera in the Pterigynandraceae (*Heterocladium*, *Myurella, Pterigynandrum*) by the long-piliferous leaf apices, reduced or absent costae, and entire margins. *Iwatsukiella leucotricha* could be confused with *Pseudoleskea stenophylla* or *Ulota megalospora* which occur in similar habitats. However, both species have costae and do not have foliose pseudoparaphylla on their stems.

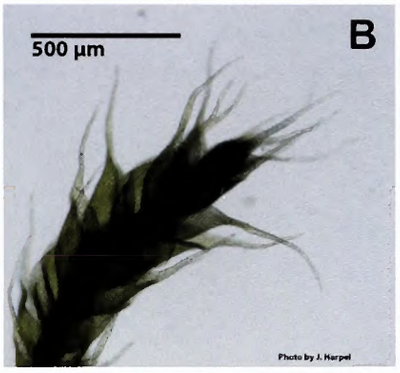
Ecology — *Iwatsukiella leucotricha,* which is usually restricted to the maritime zone, grows on conifer tree trunks, twigs, and branches along exposed fog-drenched high-elevation coastal ridges and (rarely, in Alaska) on rock substrates from the lowlands to 2,900 feet. Common substrates include noble fir, Pacific silver fir, Douglas-fir, western hemlock, and (less frequently) Sitka and red alder. In British Columbia it commonly grows in fens and bogs. *Iwatsukiella leucotricha* typically occurs as fine "threads" mixed in with other bryophytes such as *Dounia ovata*, *Hypnum circinale* and *Ulota megalospora*. Because sporophytes and specialized asexual reproductive structures have never been reported for the species within the Pacific Northwest, it is possible that *Iwatsukiella leucotricha* disperses by gametophytic fragementation.

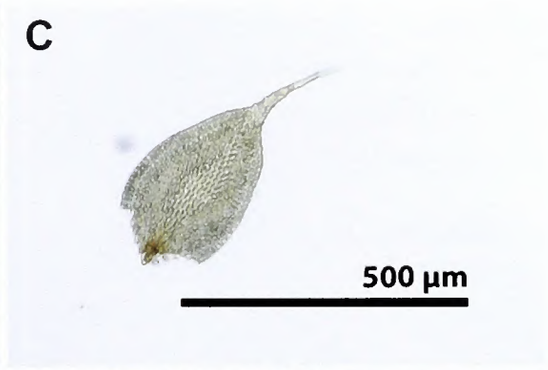
Distribution — *Iwatsukiella leucotricha* is known from Eurasia and North America. In western North America, it is known from Alaska and south in British Columbia, Washington and Oregon. In Oregon, *I. leucotricha* is reported from Clatsop County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Magill (in FNA 2014, p. 367).

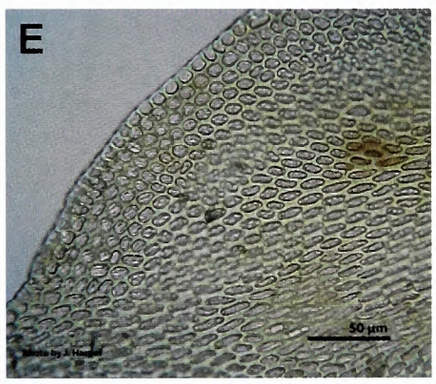
Plate 42. Iwatsukiella leucotricha. *A. Dry habitat. B. Shoot tip. C. Branch Leaf. D. Stem Leaf. E. Upper medial cells. F–G. Sporophytes. H–I. Perigonum. J. Perichaetium. (Harpel 32180, Harpel Private. W. Schofield 98995. UBC)*


A
1 mm
Photo by J. Harpel

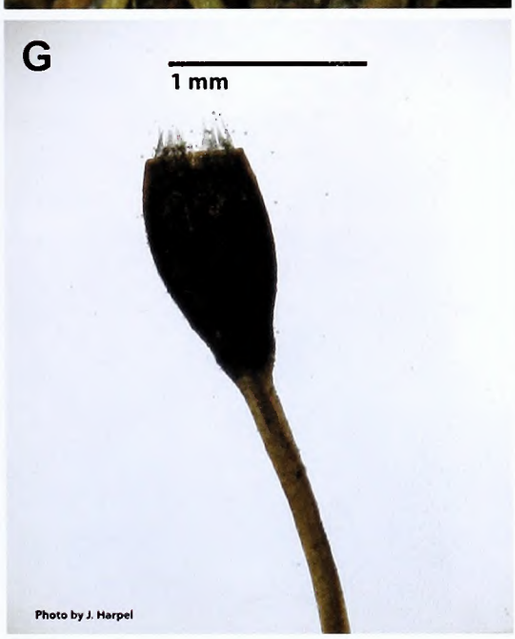

500 µm
B
Photo by J. Harpel

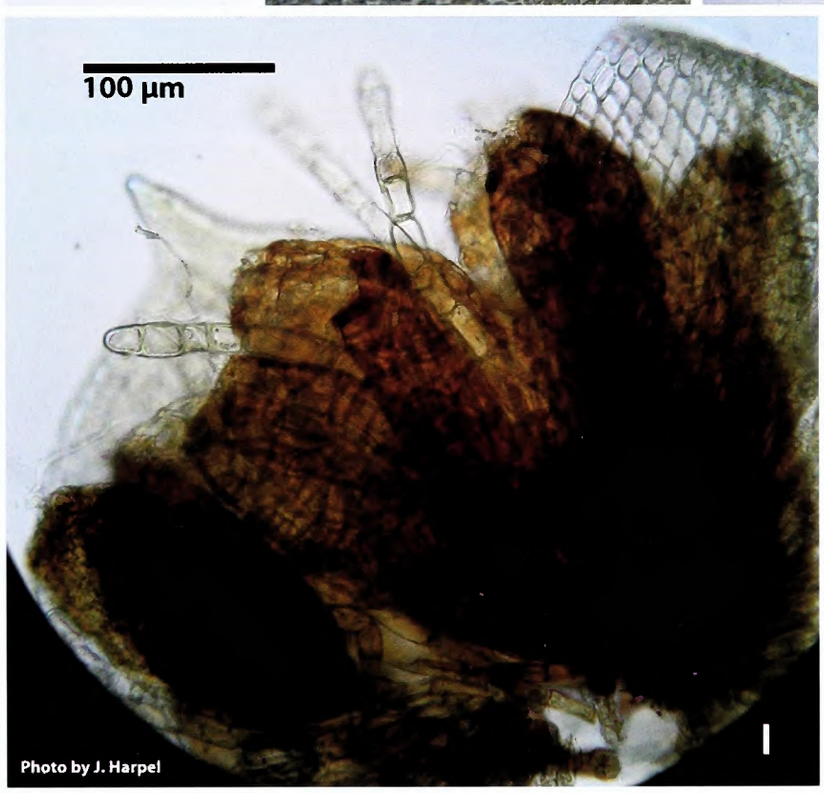

C
500 µm

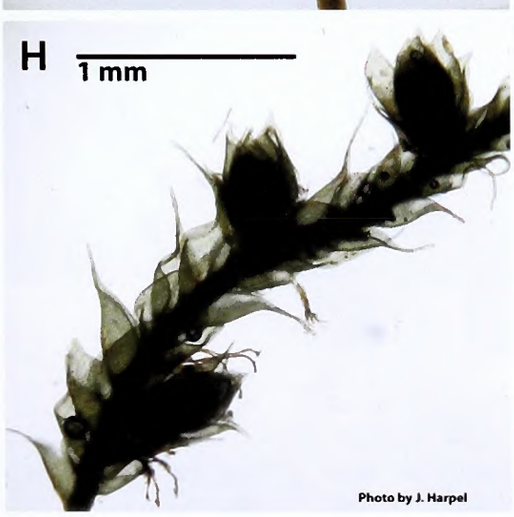

D
500 µm


E
50 µm


F
2 mm
Photo by J. Harpel


G
1 mm
Photo by J. Harpel


100 µm
I
Photo by J. Harpel


H
1 mm
Photo by J. Harpel


J
500 µm
Photo by J. Harpel

Limbella fryei (R.S. Williams) Ochyra

Recent synonym: *Sciaromium fryei* R.S. Williams
Common name: Frye's swamp moss, Fry's limbella

Taxonomic note: *Limbella fryei* is known only from Oregon. *Limbella tricostata* (Sullivant) Müller Hal., (=*Sciaromium tricostatum* (Sullivant) Mitten), the sister species to *Limbella fryei*, is a Hawaiian endemic. When first discovered, the Oregon collections were then thought to represent *Sciaromium tricostatum* (Christy 1980).

Summary — A dendroid, pleurocarpous, costate moss with ovate-lanceolate leaves. Terrestrial to Aquatic.

Diagnostic characteristics — *Limbella fryei* is distinguished by its (1) dendroid habit with dark stems, (2) smooth leaf cells without paraphylla, (3) leaf margins bordered with a thickened band of submarginal cells similar to the costa, (4) serrate leaf margins, and (5) coastal aquatic habitat.

Technical description

GAMETOPHYTE — **Plants** dendroid, yellow-green to dark green, brown below. **Stems** to 7 cm long or longer, branching irregularly, central strand small. **Leaves** somewhat contorted when dry, 2.5–3.4 × 0.6–0.7 mm, ovate-oblong to ovate-lanceolate, acuminate, concave; costa strong, extending to within a few cells of the apex, in cross section of homogeneous thick-walled cells; margins plane, serrate to the base or nearly so, the unistratose 1–2 cell wide margins becoming 2–3 cells wide in the alar regions; margins bordered all around by a band of submarginal cells, the cells thick-walled, elongate, to 95 × 7 µm, at the leaf base the band of about 5 rows of cells in 4–5 layers, toward the apex becoming 1–2 cells wide and bistratose or unistratose, in cross section the cells similar to those of the costa; laminal cells short, irregular, 8–15 µm in diameter, smooth, the walls evenly thickened, more or less uniform throughout the leaf or longer at the base. **Dioicous**.

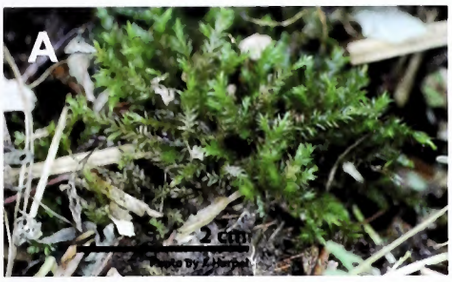
SPOROPHYTE — Sporophytes have never been found.

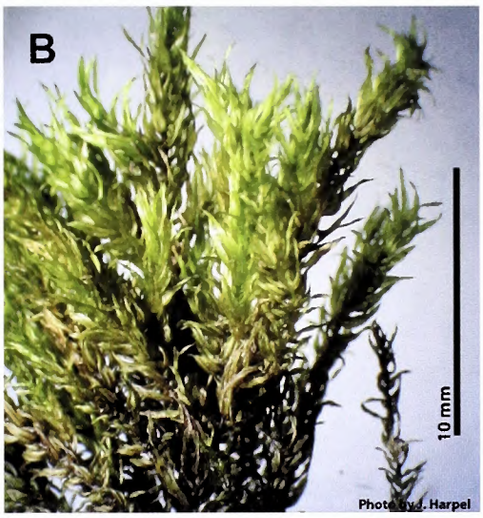
Similar species — *Climacium dendroides*, *Leucolepis acanthoneuron*, *Pleuroziopsis ruthenica*, and *Thamnobryum neckeroides* are similar, but all lack the thickened margins of *Limbella fryei*.

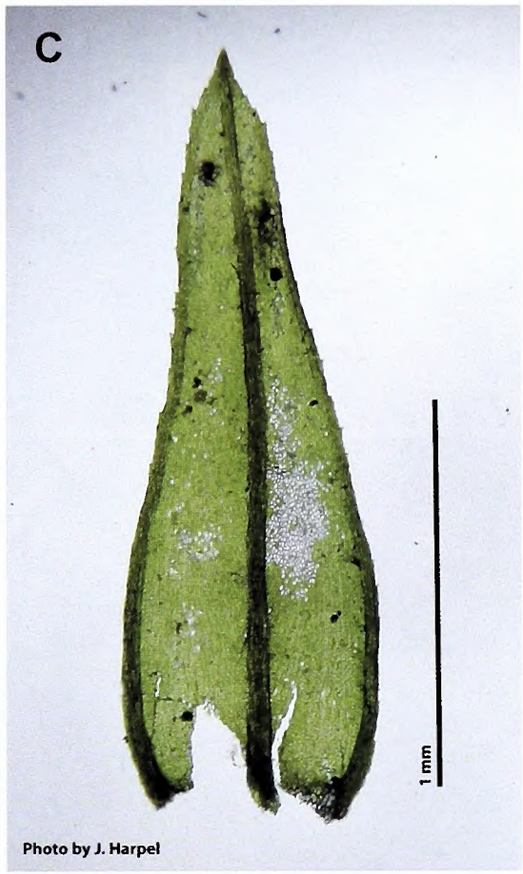
Ecology — *Limbella fryei* forms sods on wet rotten wood, leaf litter, and lower stems of tall shrubs in dense coastal swamps or in open weedy herbaceous vegetation along dune lakeshores. Williams (1932) noted Frye collected the type from, "more or less wet pasture land at Cape Arago, Oregon." *Limbella fryei* may tolerate full exposure but the substrate must be seasonally to perennially wet. All sites occur at 0–200 foot elevations. Populations are unisexual. Capsules have not been found and propagation is likely restricted to vegetative fragmentation.

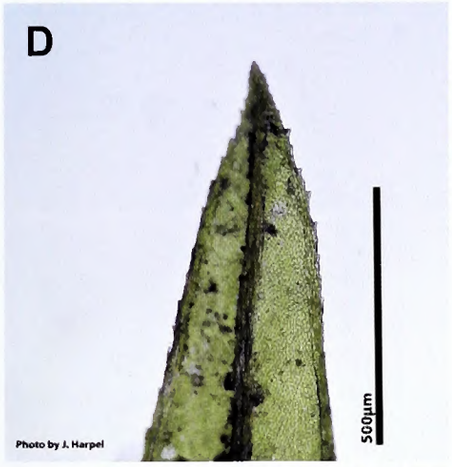
Associated vascular plant species at the open dune lake shore locality include *Carex obnupta*, *Eleocharis* sp., *Potentilla anserina*, and *Potentilla palustris*. Associated bryophytes include *Calliergon cordifolium*, *Calliergonella cuspidata*, *Chiloscyphus pallescens*, *Fissidens* sp., *Fontinalis antipyretica*, *Kindbergia praelonga*, *Ptychostomum pseudotriquetrum*, *Riccardia chamaedryfolia* and *Sphagnum squarrosum*. Associated vaseular plant species at the Oregon dense coastal shrub swamp locality include *Carex obnupta, Lysichiton americanum*, *Pyrus fusca, Salix hookeriana* and *Salix sitchensis*. Associated bryophytes include *Calliergon cordifolium, Chiloscyphus pallescens, Fontinalis antipyretica, Riccardia chamaedryfolia* and *Sphagnum squarrosum*.

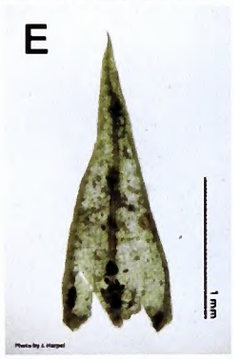
Plate 43. Limbella fryei. *A. Moist habitat. B. Dry habitat. C. Branch leaf. D. Branch leaf apex. E. Stem leaf. F. Stem leaf apex. G. Basal cells. H. Upper medial cells. I–J. Leaf cross-sections. (J. Harpel 47658. Harpel Private)*

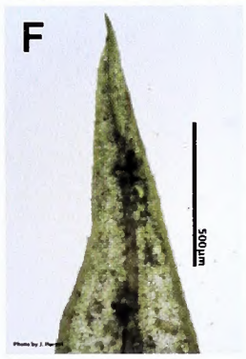

A
2 cm

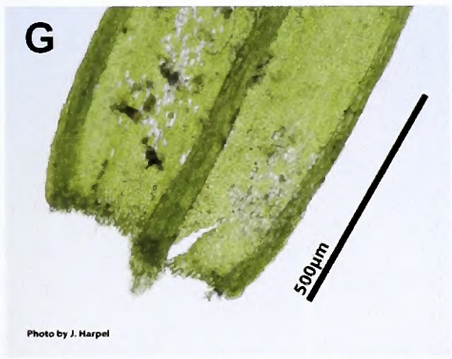

B
10 mm

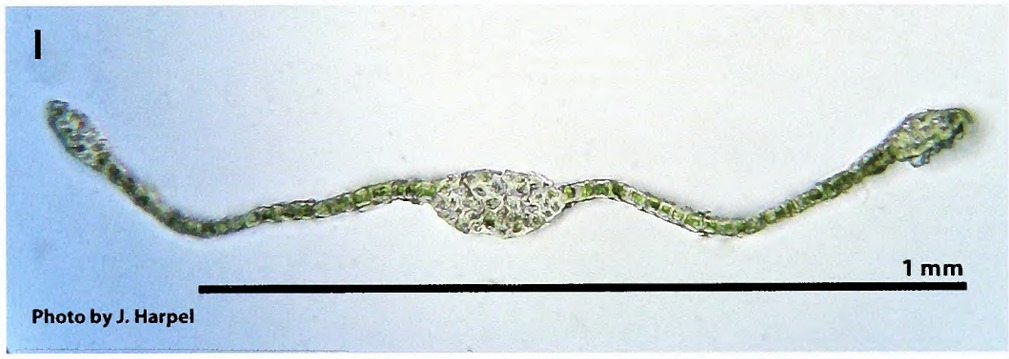

C
1 mm
Photo by J. Harpel

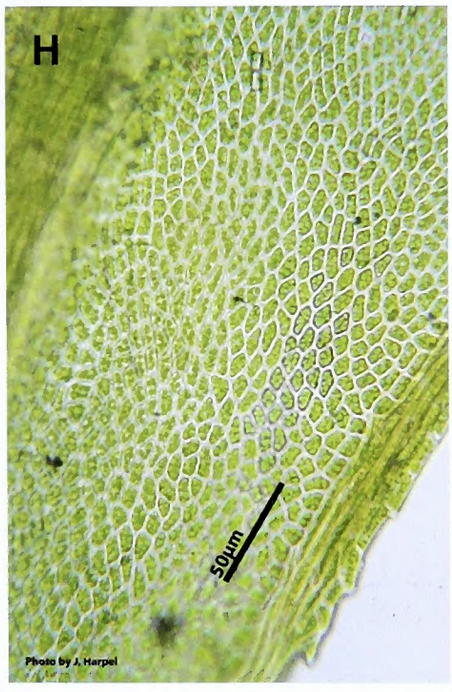

D
500µm
Photo by J. Harpel

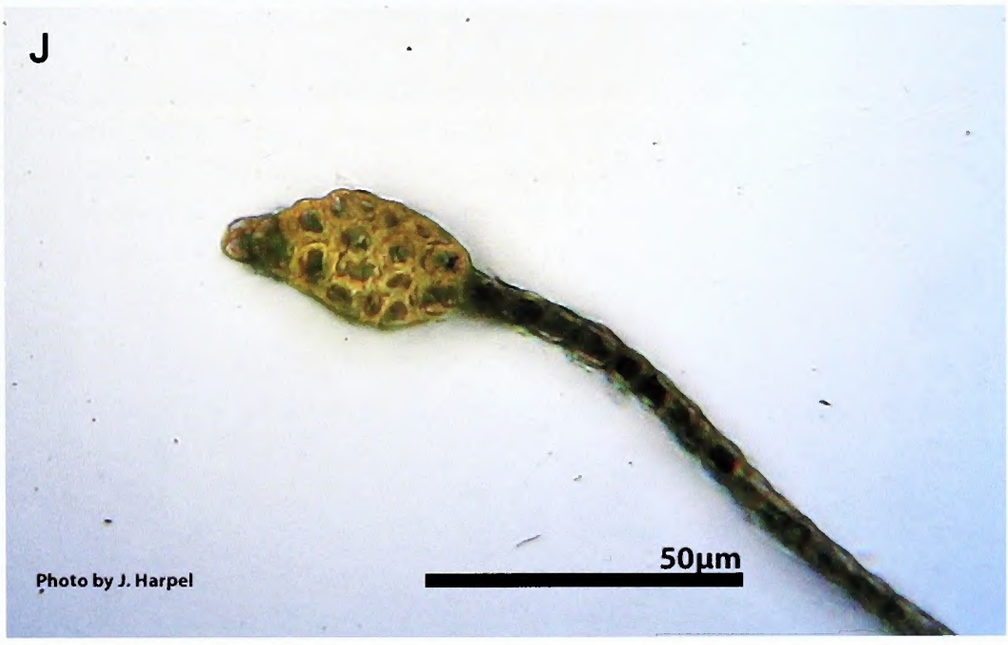

E
1 mm


F
500µm


G
500µm
Photo by J. Harpel


I
1 mm
Photo by J. Harpel


H
50µm
Photo by J. Harpel


J
50µm
Photo by J. Harpel

Distribution — *Limbella fryei* is endemic to western North America and known only from coastal Oregon. In Oregon, *Limbella fryei* is reported from Coos, Curry, and Lane counties within the Coast Range ecoregion.

References with descriptions and/or illustrations — Christy (in FNA 2014, p. 318), Christy and Wagner (1996 part VII, p. 39), Ochyra (1987, p. 477), Christy (1987), Lawton (1971, p. 287 as *Sciaromium tricostatum*), Grout (1934, p. 266 as *Sciaromium fryei*), Williams (1933 as *S. fryei*).

Meesia uliginosa Hedwig

Recent synonyms: none
Common names: meesia moss, broad-nerved hump-moss

Summary — An acrocarpous, broadly costate moss with rounded leaf tips and smooth laminal cells. Terrestrial.

Diagnostic characteristics — *Meesia uliginosa* can be distinguished by its (1) leaves that are not 3–ranked, keeled, or decurrent; (2) strongly recurved margins; (3) broad costa, up to one-half the width of the leaf base; (4) smooth, entire, linear leaves with obtuse, rounded apices; and (5) asymmetrical, curved capsule on a long seta.

Technical description

GAMETOPHYTE — **Plants** 1–5 cm high in dense or loose dark green tufts. **Leaves** more or less contorted when dry, erect when moist, not three-ranked, ligulate to narrowly lanceolate, 2–4 mm; base not decurrent; margins revolute from base to near apex, entire; apex obtuse to rounded; costa strong, broad at the base 1/3 to 2/3 the width of the leaf base ending just before the apex; leaf cross-section with large median cells and smaller outer cells; inner laminal cells larger, walls thinner than marginal cells. Polygamous, but usually **Dioicous.**

SPOROPHYTE — **Seta** 1.5–5 cm long, yellow-brown. **Capsules** reddish-brown, curved, pear-shaped, to 4 mm long including the neck, neck often wrinkled when dry. **Spores** 40–51 μm.

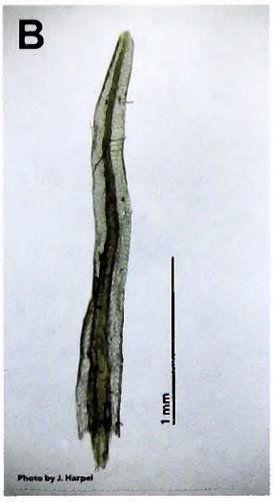
Similar species — *Meesia uliginosa* is distinguished from other *Meesia* taxa by its ligulate to narrowly lanceolate leaves with revolute basal leaf margins. In addition, other members of the genus have three-ranked leaves.

Ecology — *Meesia uliginosa* is one of several "brown mosses" that occur in mineral-rich fens. It grows on saturated soil, usually in full sunlight. Sites occur at 5,000–6,000 foot elevations. Forest types include *Abies amabilis, Abies concolor, Abies magnifica* × *shastensis,* and *Pinus contorta* var. *latifolia.* Associated vascular plants include of *Carex limosa, Eleocharis quinqueflora, Schenchzeria palustris*, and *Triglochin maritimum.* Associated bryophytes are *Aulacomnium palustre, Elodium blandowii, Hamatocaulis vernicosus, Meesia triquetra, Philonotis fontana, Pseudocalliergon trifarium* and *Tomentypnum nitens.*

Distribution — *Meesia uliginosa* is known from boreal and arctic Eurasia, Greenland, and North America. In western North America, it is known from Yukon, Northwest Territories, British Columbia, Alberta, Washington, Oregon, California, and Montana. In Oregon, *M. uliginosa* is reported from Grant and Jackson counties within the Blue Mountain and Klamath Mountain ecoregions.

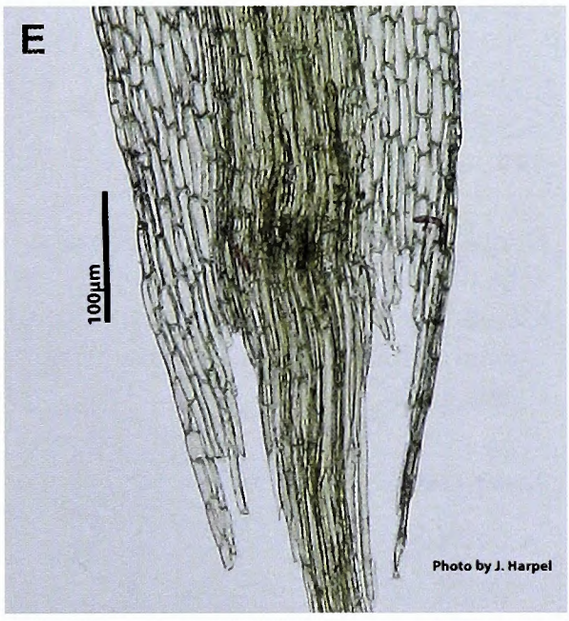
Plate 44. Meesia uliginosa. *A. Habitat. B. Leaf. C. Leaf cross-section. D. Upper medial cells. E. Alar and basal cells. F. Leaf apex. G–I. sporophytes. J–K. Peristome teeth. L. Dry habitat. (J. Harpel 329. Harpel Private; Loring, Sn, OSC)*

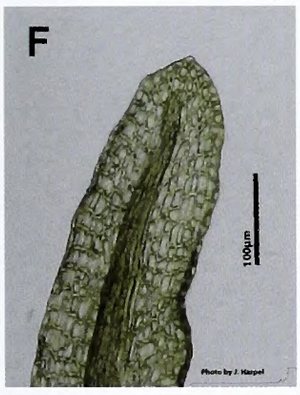

A
Photo by S. Loring

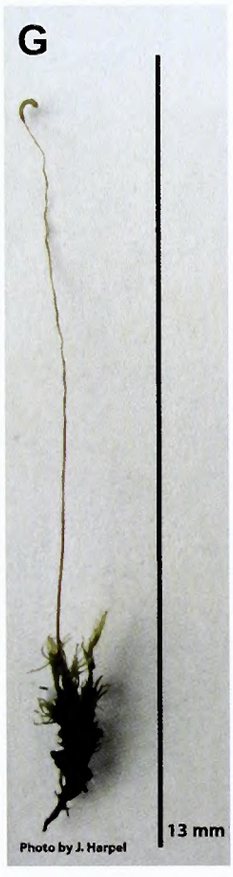

B
1 mm
Photo by J. Harpel


D
100µm
Photo by J. Harpel

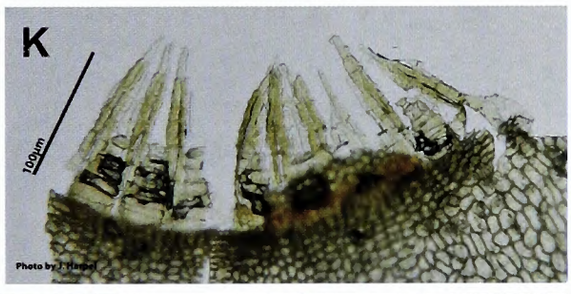

C
250µm
Photo by J. Harpel

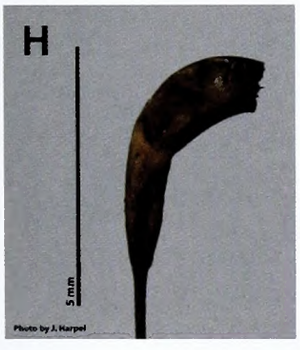

E
100µm
Photo by J. Harpel

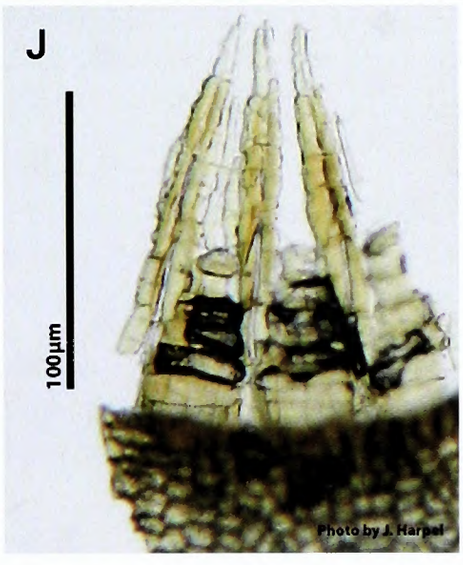

F
100µm
Photo by J. Harpel


G
13 mm
Photo by J. Harpel


3 mm
I
Photo by J. Harpel


K
100µm
Photo by J. Harpel


H
5 mm
Photo by J. Harpel


J
100µm
Photo by J. Harpel


L
10 mm
Photo by J. Harpel

References with descriptions and/or illustrations — Vitt (in FNA 2014, p. 33), Smith (2004, p. 523), Harpel (2003), Ireland (1982, p. 365), Crum and Anderson (1981, p. 626), Smith (1978, p. 451), Lawton (1971, p. 204), Nyholm (1958, p. 284).

References with photos — Lockhart et al. (2012, p. 445), Atherton et al. (2010, p. 574), Malcolm et al. (2009, p. 164).

Micromitrium synoicum (James) Austin

Recent synonyms:
Ephemerum synoicum James
Nanomitrium synoicum (James) Lindberg
Common name: micromitrium moss

Summary — A tiny, ephemeral, acrocarpous, ecostate moss with lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Micromitrium synoicum* can be distinguished by its (1) very small size in ephemeral habitats with receding water, (2) shriveled and contorted leaves when dry, (3) lack of a costa, (4) narrow and long-acuminate dark green leaves with smooth cells, (5) sphaerical immersed capsules with an equatorial line of dehiscence, (6) usually entire leaf margins, (7) one layer of exothecial cells, and (8) lack of stomata.

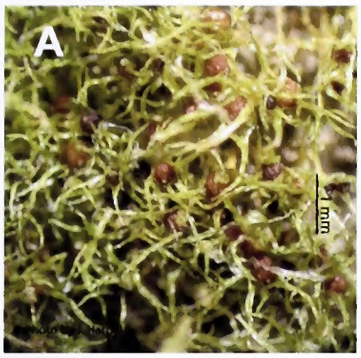
Technical description

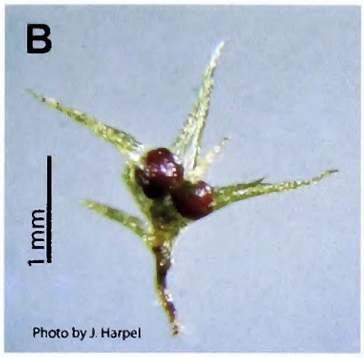
Gametophyte — **Plants** ephemeral, minute, dark green. **Stems** evident, usually 0.2–3.7 mm long. **Leaves** 0.8–1.8 × 0.25 mm, narrowly lanceolate to ovate-lanceolate, crowded toward stem apex, spreading, flexuose when dry, long-acuminate, costa absent, margins entire or rarely serrulate to below the middle, somewhat incurved in the upper 2/3. **Synoicous**.

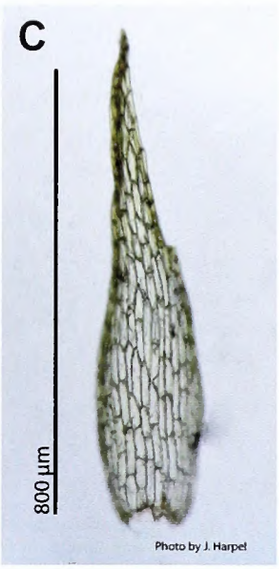
Sporophyte — **Seta** virtually absent. **Capsules** cleistocarpous, single, sessile, spherical, blackish when mature, slightly apiculate, 0.5–0.75 mm in diameter, immersed but evident among the clasping leaf bases, dehiscent in a line around the equator, but line not always obvious. **Spores** 30–40 × 23–33 µm.

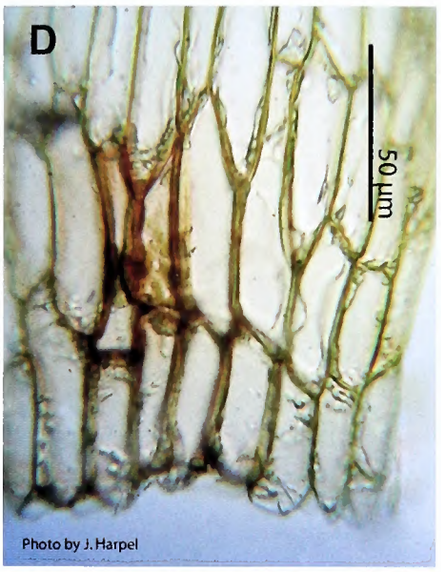
Similar species — *Micromitrium synoicum* differs from other *Micromitrium* species by its lack of stomata in the exothecial cells, smaller spores, and entire leaf margins. *Micromitrium tenerum,* which is most similar, has no evident stems or (rarely) stems only up to 1 mm long, leaves up to 2.4 mm long with plane and usually serrulate margins. *Micromitrium* has a minute calyptra and commonly lacks a costa. *Ephemerum* species have a calyptra covering most of the distal half of the capsule and a well-developed costa. *Physcomitrella patens* has relatively broad and pale spreading leaves. *Physcomitrium immersum* has relatively broad and pale spreading leaves, capsules wider than long, a long-beaked operculum, a persistent calyptra, and an obvious dehiscence line on the capsule. In addition, the capsules look like squashed pies when dry, with the operculum often depressed in the center but the beak still prominent. *Phascum cuspidatum* has pale broad oblong-ovate usually papillose and conspicuously costate leaves that are contorted when dry, enveloping the ovoid to ellipsoid capsule like a clove of garlic. *Pleuridium subulatum* has yellowish narrow (subulate) erect 2–4 mm long leaves, distinctly ellipsoid or ovoid capsules to 0.7 mm long and distinct setae to 1 mm long. *Physcomitrium pyriforme,* which has much larger plants with 10–25 mm tall capsules, relatively broad pale spreading leaves, exserted capsules on setae up to 1 cm long, and grows on drier disturbed sites.

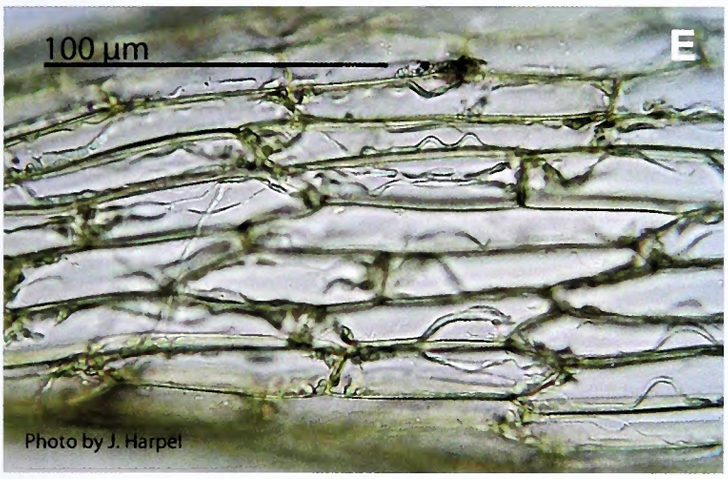
Plate 45. Micromitrium synoicum. *A. Habitat. B. Individual plant with sporophytes. C. Leaf. D. Alar and basal cells. E. Upper medial cells. F. Leaf apex. G. Perigonum. H. Sporophyte with spores. I. Exothecial cells. J. Spores. (J. Christy 8505-1. Christy Private)*

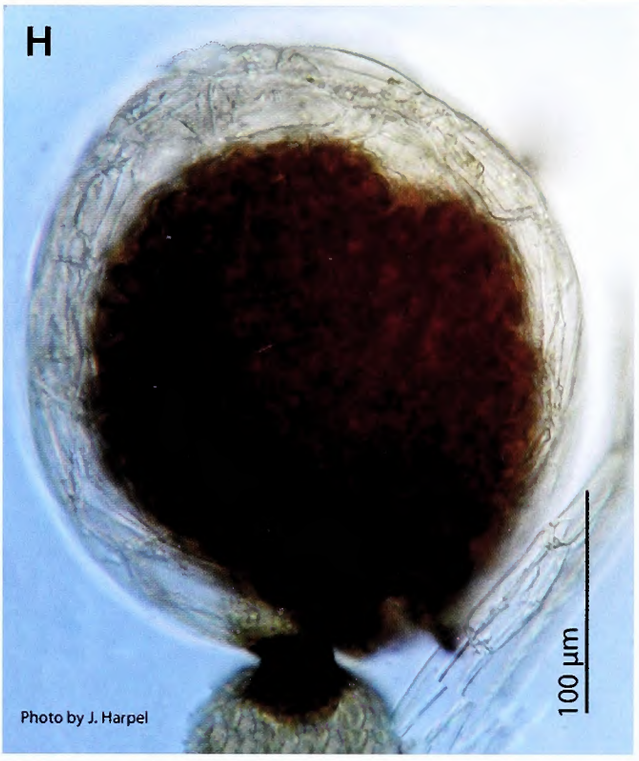

A
1 mm


B
1 mm
Photo by J. Harpel

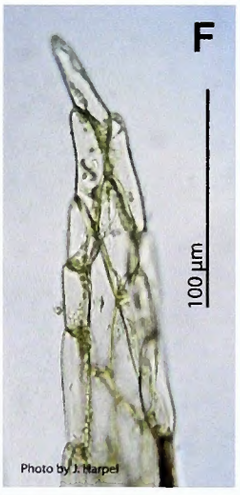

C
800 µm
Photo by J. Harpel

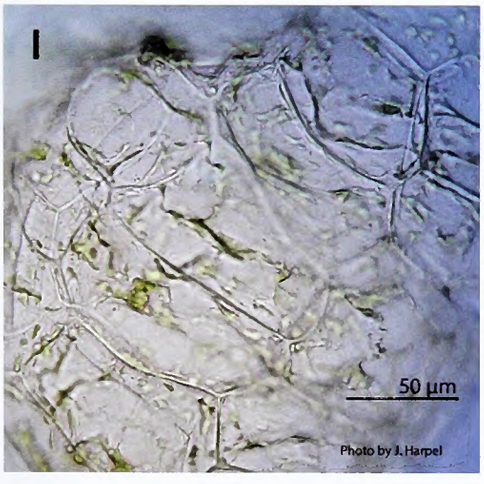

D
50 µm
Photo by J. Harpel


100 µm
E
Photo by J. Harpel


H
100 µm
Photo by J. Harpel


G
100 µm
Photo by J. Harpel


F
100 µm
Photo by J. Harpel


I
50 µm
Photo by J. Harpel


J
20 µm
Photo by J. Harpel

Ecology — *Micromitrium synoicum* is an ephemeral moss that completes its life cycle within three or four months of germination, enabling it to colonize temporary habitats in which competition from other plants is at a minimum. It forms small to extensive turfs on mud in dried-up pools, meadows, ditches, riverbanks, floodplains, or pond edges in October. It is known from elevations below 800 feet. When water levels begin to recede in July, spores germinate to form an extensive felty protonema over damp soil. The protonema forms buds and shoots, and a turf of leafy plants develops as the protonema disappears. Capsules mature in late summer and fall before winter rains inundate the habitat. Associated vascular plants at the Oregon site includes *Crassula aquatica*, *Eleocharis ovata*, *Eragrostis hypnoides*, *Fraxinus oregana*, *Gnaphalium palustre* , *Limosella aquatica*, *Ludwigia palustris*, *Polygonum hydropiperoides*, *Quercus garryana*, *Salix lucida* subsp. *lasiandra*, and *Salix sitchensis*. Associated bryophytes are *Physcomitrium immersum* and *Riccia sorocarpa*.

Distribution — *Micromitrium synoicum* is known from Asia and North America. Although *M. synoicum* is well-distributed in the eastern United States, Oregon contains the only site in western North America. In Oregon, *Micromitrium synoicum* is reported from Benton and Linn counties within the Willamette Valley ecoregion.

References with descriptions and/or illustrations — Bryan (in FNA 2007, p. 648), Crum and Anderson (1981, p. 482), Grout (1935, p. 71 as *Nanomitrium synoicum*).

Mielichhoferia elongata (Hoppe & Hornschuch) Nees & Hornschuch

Recent synonym:
Mielichhoferia mielichhoferiana var. *elongata* (Hoppe & Hornschuch) Wijk & Margadant
Common name: elongate copper moss

Summary — An acrocarpous, costate moss with lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Mielichhoferia elongata* can be distinguished by its (1) dense compact growth habit and whitish or glaucous blue-green color, (2) lax thin-walled leaf cells, (3) habitat on mineral rich substrates (but not always copper), (4) sporophytes borne on short lateral branches, and (5) perichaetial leaves often smaller than the vegetative leaves.

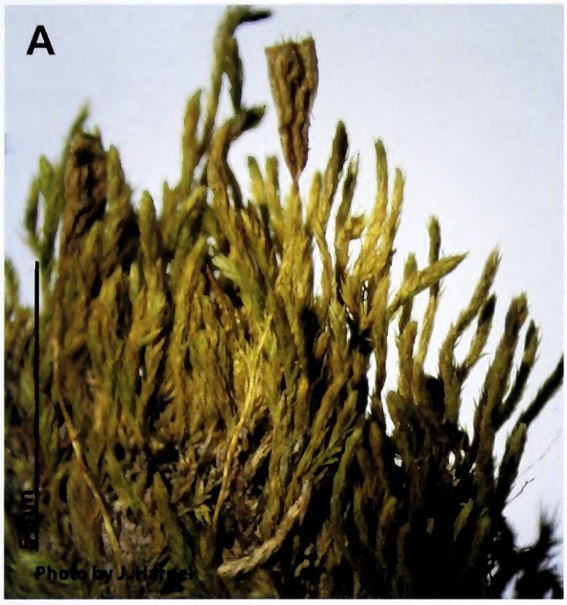
Technical description

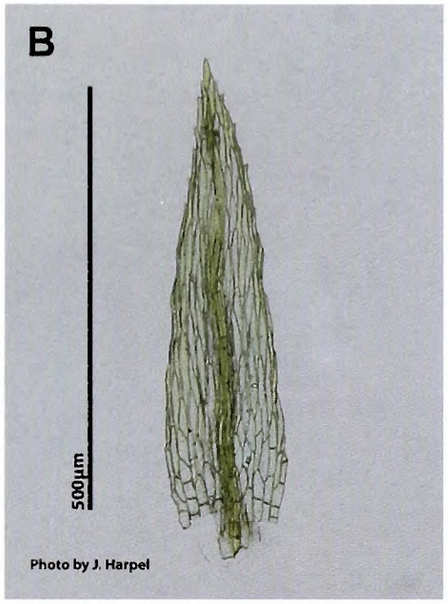
GAMETOPHYTE — **Plants** pale green to glaucous moss forming dense velvety tufts with shoots to 15 mm tall. **Leaves** slightly glossy, erect, imbricate when moist, ovate-lanceolate to rounded-triangular, 0.5–1.0 mm long; apices acute to obtuse; upper medial cells rhomboidal, thin-walled; basal cells longer and wider; costa weak to strong, ending before the apex; margins plane and serrulate above. **Dioicous**.

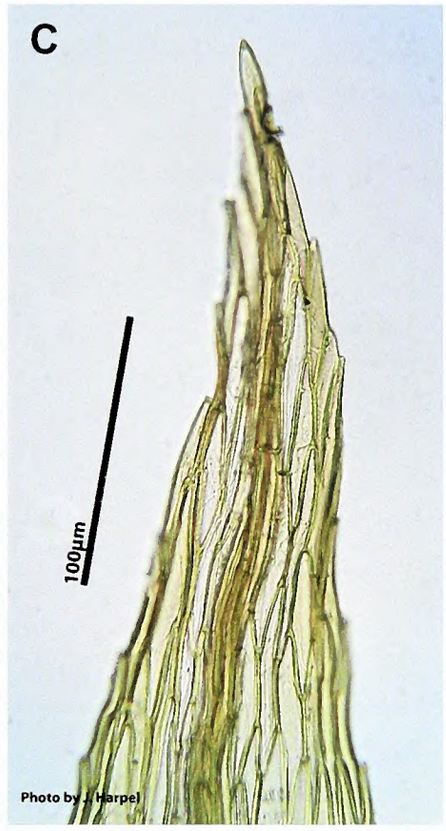
SPOROPHYTE —**Seta** 5–9 mm long. **Capsules** erect or inclined to 20 degrees; peristome double or sometimes rudimentary; exostome hyaline to whitish, triangular; endostome basal membrane rudimentary, adherent to exostome teeth, segments absent. **Spores** 15–22 µm.

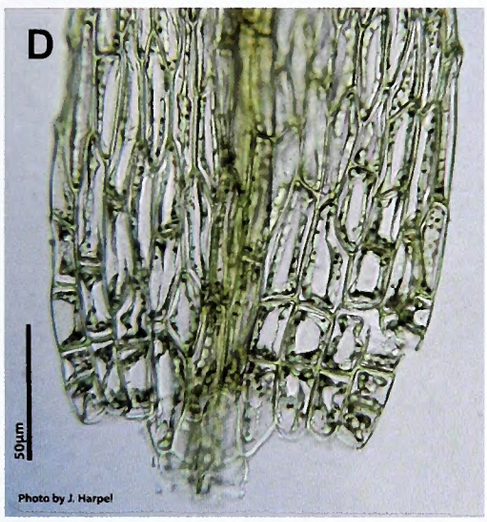
Similar species —*Mielichhoferia mielichhoferiana*, which occurs in similar habitats, can be distinguished from *M. elongata* by its darker green and more elongate-lanceolate dull leaves that have narrower, firm, and hexagonal to rhomboidal laminal cells with thick walls. *Mielichhoferia elongata* might be mistaken for a *Pohlia* species, but the turfs are usually more compact, the plants are smaller and have lateral gametangial buds, and the sporophytes are erect or nearly so.

Plate 46. Mielichhoferia elongata. *A. Habitat. B. Leaf. C. Leaf apex. D. Alar and basal cells. E. Upper medial cells. F.– G. Sporophytes. H. Peristome teeth. I. Perigonium. (D. Toren; "F". Harpel Private)*


A
2 mm
Photo by J. Harpel

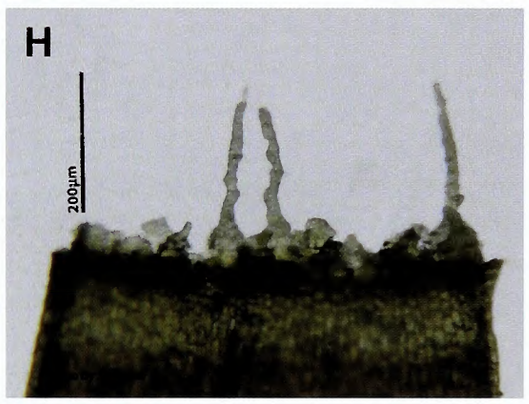

B
500µm
Photo by J. Harpel


C
100µm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


E
100µm


F
10 mm
Photo by J. Harpel


H
200µm


G
2 mm


I
500µm
Photo by J. Harpel

Ecology — *Mielichhoferia elongata* is known mostly from seasonally wet metamorphic rocks containing high concentration of heavy metal ores, especially copper. In England, it is known from unstable, steep shale with a predominately N to NE aspect in cool humid deeply incised gullies with little of no direct sunlight and with a constant seepage of water. It is known to occur at 900–2,700 foot elevations. No other plants occur in the extreme micro-environment.

Distribution — *Mielichhoferia elongata* is known from Eurasia, Africa, and North America. In western North America, it is known from British Columbia, Oregon, California, and Colorado. In Oregon, *M. elongata* is reported from Baker County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Shaw (in FNA 2014, p. 193), Smith (2004, p. 591), Shaw (1994), Nyholm (1958, p. 190).

References with photos — Porley (2013, p. 131), Atherton et al. (2010, p. 601), Malcolm et al. (2009, p. 179).

Mnium blytii Bruch & Schimper

Recent synonyms: none
Common names: Blytt's thyme-moss, Blytt's calcareous moss

Summary — An acrocarpous, costate moss with bordered, ovate leaves. Terrestrial.

Diagnostic characteristics — *Mnium blyttii* can be distinguished by its (1) large ovate leaves with a border of elongate cells, (2) entire to indistinctly toothed leaf margins, (3) non-dendroid habit, and (4) bluish laminal cell color.

Technical description

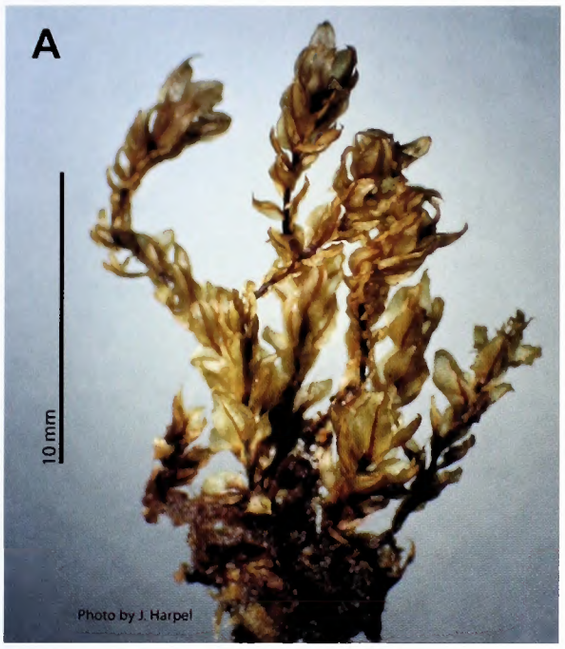
GAMETOPHYTE — **Plants** in small, light to dark green tufts. **Stems** reddish, from 1–6 cm tall matted with reddish brown rhizoids. **Leaves** densely clustered, ovate to elliptic-ovate, 2.5–3.5 mm long, apex, acute or broadly rounded, shortly mucronate; margins bordered with 1–2 rows of long narrow reddish-brown cells, unistratose or bistratose, plane, entire or slightly denticulate with teeth occasionally in pairs in the upper part; costa reddish, ending below the apex; bluish colored median leaf cells quadrate, shortly rectangular, thin-walled, not pitted, 20–35 µm, more or less slightly thickened with rounded angles; basal cells more elongated, oblong. **Dioicous**. Male plants have antheridia in disk-like heads, perigonial bracts ovate. Perichaetial bracts are up to 4.5 mm long, oblong or oblong-ovate, the costa often percurrent.

SPOROPHYTE — **Seta** yellow-brown, 3–5 cm long. **Capsules** horizontal to pendent, ovoid to short-cylindric, slightly zygomorphic, 3–4 mm long; peristome teeth double, papillose. **Spores** 17–22 µm. Sporophytes are rare.

Similar species —*Mnium blyttii* is distinguished from other *Mnium* species by its marginal cells in 1–2 rows, unistratose or bistratose; weakly toothed upper margins; laminal cells bluish colored; and leaves usually 2.5 mm or larger.

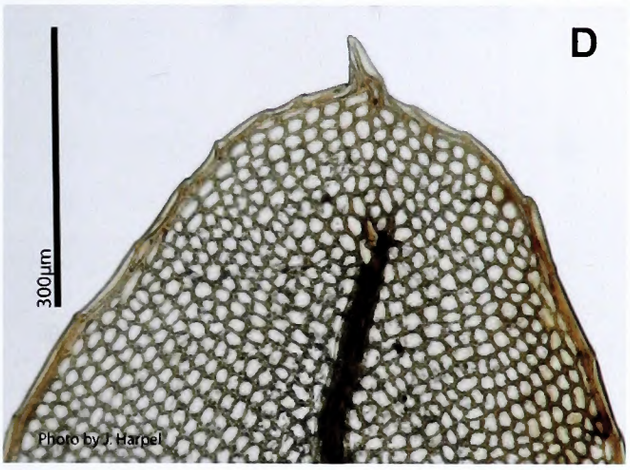
Ecology — *Mnium blyttii* occurs in seepage areas along streamlets in subalpine and alpine areas at 4,500–9,000 foot elevations. Spence (1986) reports *M. blyttii* from basic moist soil in exposed to protected sites in alpine areas.

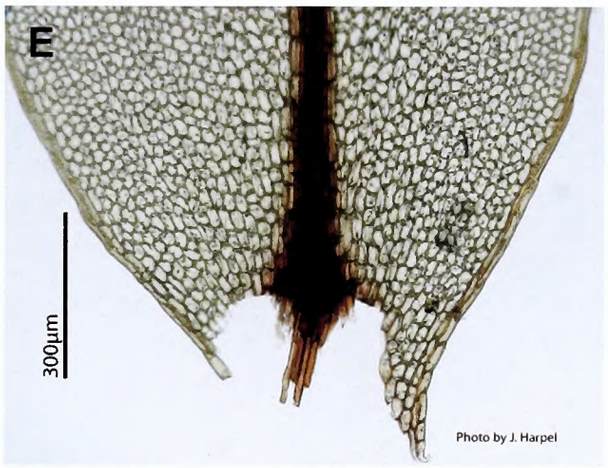
Plate 47. Mnium blytii. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Leaf apex. E. Alar and basal cells. F. Leaf margin. G. Upper medial cells. H. Leaf cross-section. (W. Schofield 19465. UBC)*

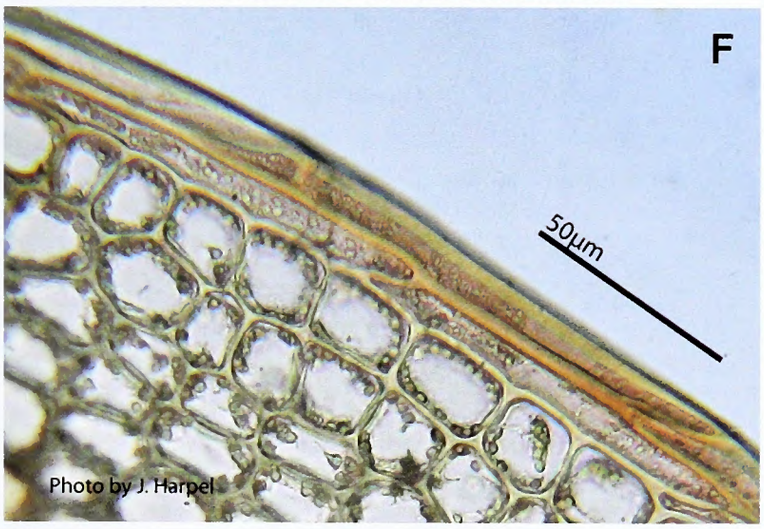

A
10 mm
Photo by J. Harpel

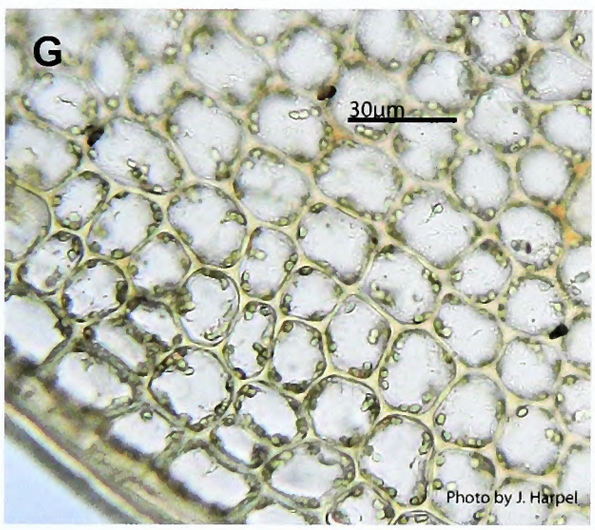

B
10 mm
Photo by J. Harpel

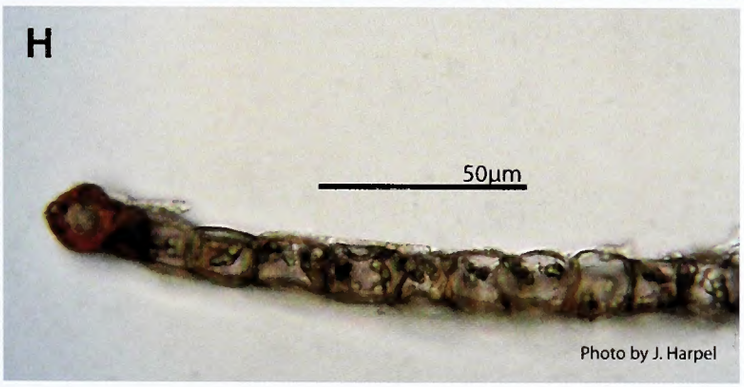

C
2 mm
Photo by J. Harpel


D
300µm
Photo by J. Harpel


E
300µm
Photo by J. Harpel


F
50µm
Photo by J. Harpel


G
30µm
Photo by J. Harpel


H
50µm
Photo by J. Harpel

Habitat data from herbarium records cite on damp soil over rock, on dry soil northern slopes under *Juniperus communis*, along a wet ravine, in an alpine area along a stream at a calcite rock dome, and on a shaded rock ledge of a cave-like recess. Nyholm (1958) states that *M. blyttii* occurs on calcareous, often humus-rich, soil in the mountains. Capsules mature in late summer.

Distribution — *Muium blyttii* is known from Eurasia, Greenland, and North America. In western North America, it is known from Alaska, Yukon, British Columbia, Alberta, Washington, Oregon, California, Idaho, Montana, Utah, Wyoming, Colorado, and New Mexico. In Oregon, *M. blyttii* is reported from Baker, Union, and Wallowa counties within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — McIntosh and Newmaster (in FNA 2014, p. 225), Flowers (1973, p. 386), Lawton (1971, p. 192), Nyholm (1958, p. 262).

Myurella julacea (Schwägrichen) Schimper

Recent synonyms: none
Common name: small mouse-tail moss

Summary — A small glaucous, julaceous pleuricarpous moss with a short and often forked costa with broadly ovate concave leaves. Terrestrial.

Diagnostic characteristics — *Myurella julacea* can be distinguished by its (1) small size, (2) glaucous julaceous habit, (3) obtuse imbricate leaves with a short apiculus, and (4) papillae from projecting cell ends on the dorsal leaf surface.

Technical description

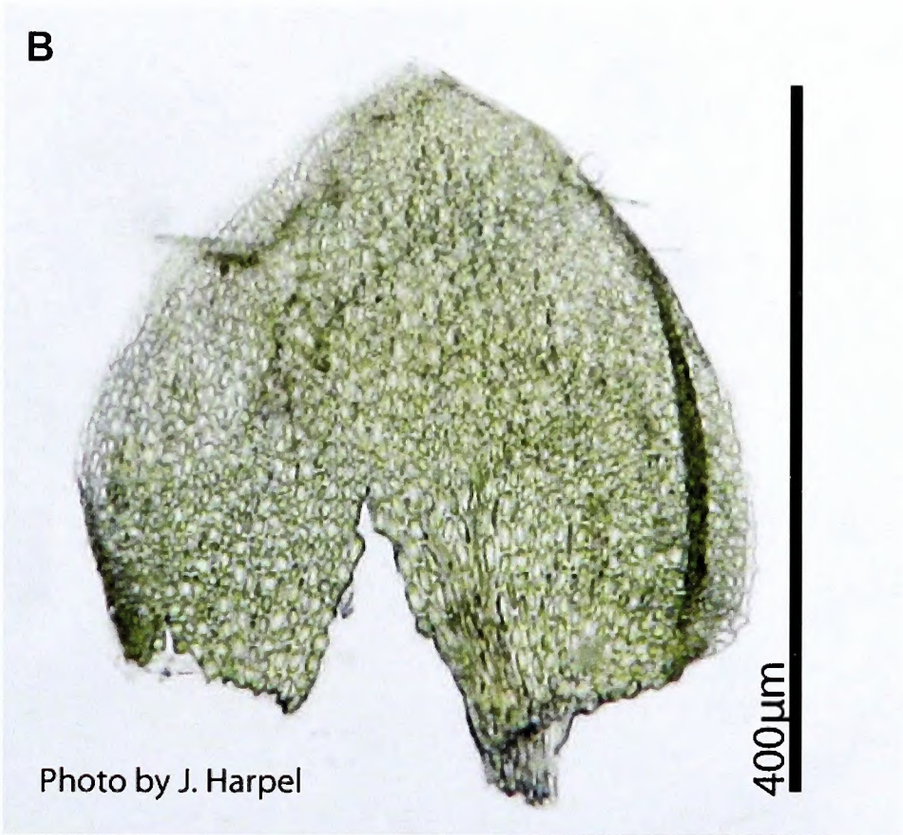
Gametophyte — **Plants** in light or yellowish-green to glaucous tufts or mats. **Stems** 1–3 cm long, julaceous wet or dry. **Leaves** 0.3–0.5 mm rounded-ovate to rounded-obtuse, occasionally short-apiculate; branch leaves usually smaller; margins plane to incurved, serrate to serrulate sometimes entire; alar cells more or less quadrate; costa lacking, faint or sometimes short, single or double; median and upper leaf cells irregular to rhomboidal; basal cell walls somewhat thickened, smooth on the ventral surface, papillose on the dorsal surface by projecting cell ends. **Dioicous**.

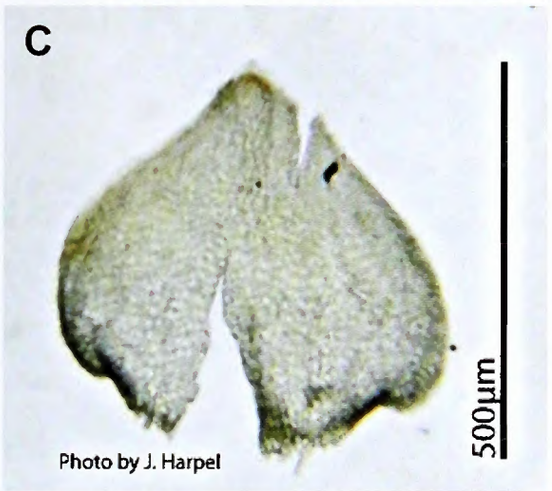
Sporophyte — **Seta** 6–16 mm long. **Capsules** erect or slightly inclined. The urn 1–1.5 mm long, asymmetric; operculum conic; annulus deciduous, of about 2 rows of cells; endostome segments perforate, cilia short, stout, single or often paired. **Spores** smooth or finely roughened, 9–13 µm.

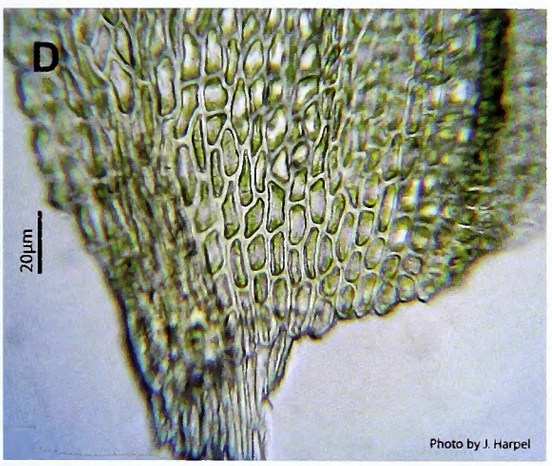
Similar species — *Myurella sibirica* differs in its single papillae on the dorsal laminal cells. *Myurella tenerrima* has distant, erect to spreading leaves, and an acuminate to apiculate leaf apex. *Myurella* species can be distinguished from other Pterigynandraceae by their ovate to broadly ovate apiculate leaves with a short and double or indistinct costa. *Anomobryum julaceum* and *A. corcinnatum* are similar but have a single costa to above mid-leaf and lack papillae.

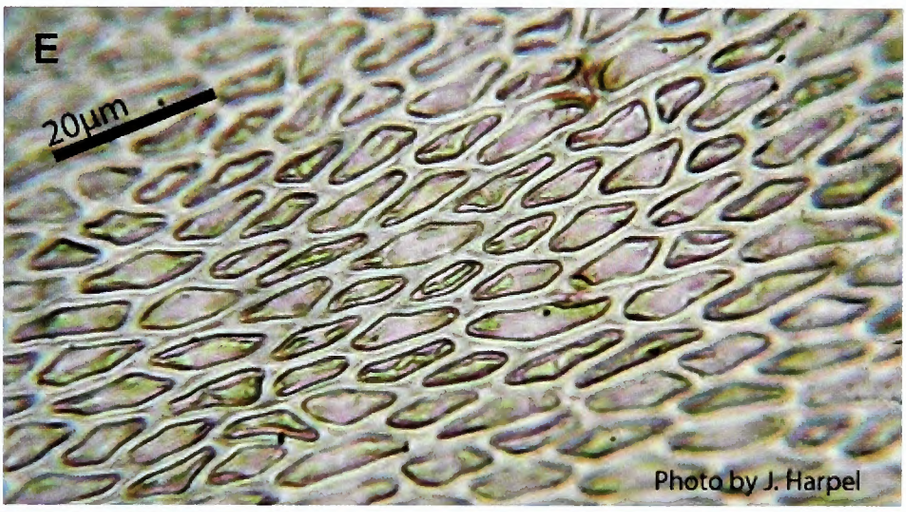
Plate 48. Myurella julacea. *A. Habitat. B–C. Leaves. D. Alar and basal cells. E. Upper medial cells. F. Papillae on dorsal leaf surface. (J. Harpel 49816. Harpel Private)*

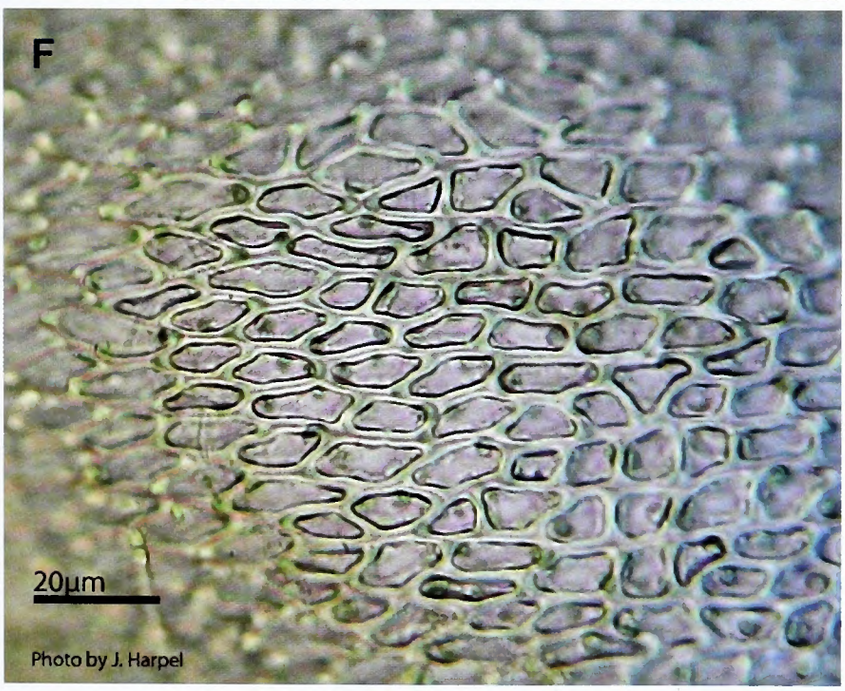

A
2 mm
Photo by J. Harpel


B
Photo by J. Harpel
400µm


C
500µm
Photo by J. Harpel


D
20µm
Photo by J. Harpel


E
20µm
Photo by J. Harpel


F
20µm
Photo by J. Harpel

Lockhart et al. (2012) note that *Myurella julacea* plants with apiculate, strongly toothed leaves and tall conical papillae on the upper leaf surface were formally separated as var. *scabrifolia*, and that the valid name is now var. *ciliata*. Both Smith (2004) and Lockhart et al. (2012) agree that differences are unimportant because the two phenotypes grow together and intergrade.

Ecology — *Myurella julacea* is usually found amongst other bryophytes or as small pure patches in montane crevices in calcareous habitats, seepages, rock crevices, fens, boreal and arctic areas, and montane areas with calcareous rock from lowland to 11,000 foot elevations. In California, *M. julacea* is reported from the crest of the Sierra Nevada Mountains.

Distribution — *Myurella julacea* is known from Eurasia, Iceland, Greenland, Asia, North America, and Antarctica. In western North America, it is known from British Columbia, Alberta, Washington, Oregon, California, Montana, Wyoming, and Colorado. In Oregon, *M. julacea* is reported from Marion County within the West Cascades ecoregion.

References with descriptions and/or illustrations — Vitt (in FNA 2014a, p. 371), Smith (2004, p. 863), Lawton (1971, p. 248).

References with photos — Lockhart et al. (2012, p. 553), Atherton et al. (2010, p. 775), Malcolm et al. (2009, p. 293).

Orthodontium gracile (Wilson) Schwägrichen

Recent synonyms: none
Common name: slender thread-moss

Taxonomic note: Lawton (1971) treated *Orthodontium* in Bryaceae where the genus is distinguished by its linear-setaceous leaves. Eckel (2014a) places the genus under Orthodontiaceae, while noting that the family is currently undergoing rapid revision and is still retained in the Bryaceae by some authors.

Summary — A small acrocarpous, costate moss with narrow linear-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Orthodontium gracile* can be distinguished by its (1) narrow linear-setaceous leaves, (2) lack of a costal stereid band, (3) smooth exostome teeth, (4) subcylindric capsule with a slender neck gradually tapered to the seta, and (5) redwood forest association.

Technical description

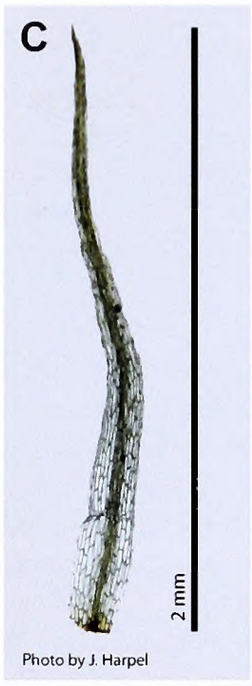
Gametophyte — **Plants** form dense, silky, yellow-green tufts of erect stems which are brown below. **Stems** 0.5–1.2 cm high, often branched. **Leaves** erect-spreading, often flexuose, 1–3 mm long, linear-lanceolate to setaceous, more or less concave; margins plane or partly recurved, entire or rarely faintly denticulate at apex; costa usually ending before the apex, without stereid cells; median leaf cells 100–200 × 8–12 µm, the walls somewhat thickened, shorter at base and apex. **Paroicous**.

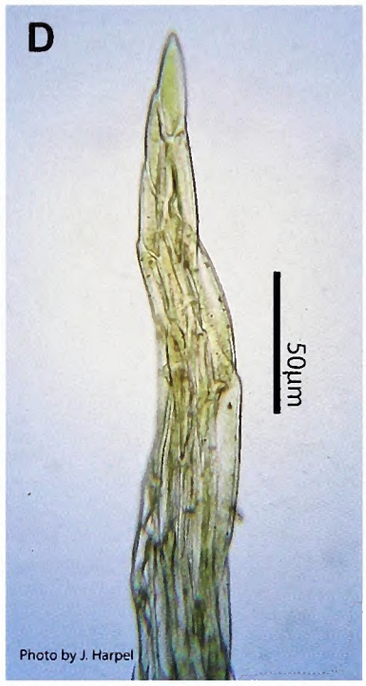
Sporophyte — **Seta** 3–10 mm long. **Capsules** ovoid to oblong-pyriform, long-necked, erect, wrinkled when dry; exostome teeth somewhat wider at base, smooth; endostome basal membrane absent, segments shorter than exostome teeth. **Spores** 11–17 µm.

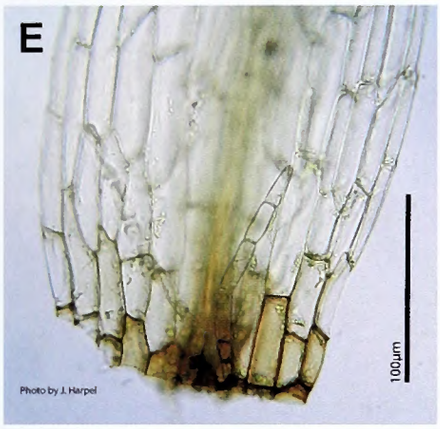
Plate 49. Orthodontium gracile. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Leaf apex. E. Alar and basal cells. F. Upper medial cells. G. Leaf cross-section. H–I. Sporophytes. J. Peristome teeth. (W. Schofield 28896. UBC)*

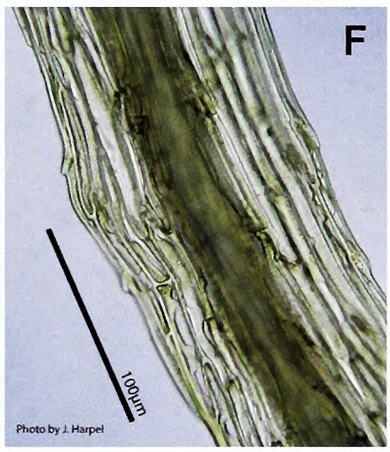

A
2 mm
Photo by J. Harpel

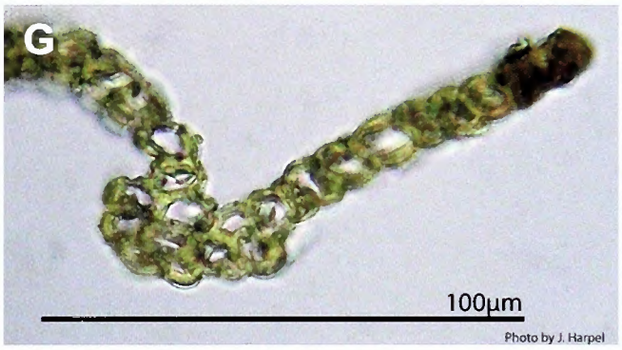

B
5 mm
Photo by J. Harpel


C
2 mm
Photo by J. Harpel

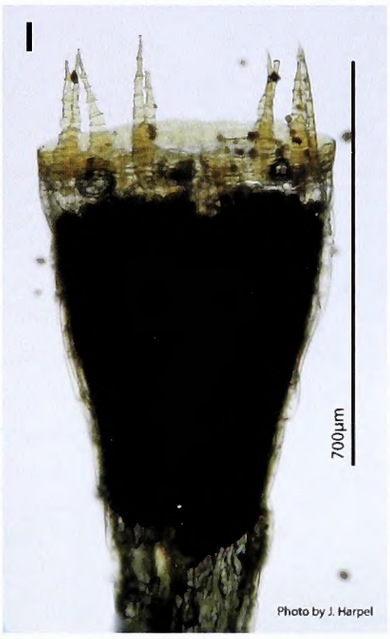

D
50µm
Photo by J. Harpel

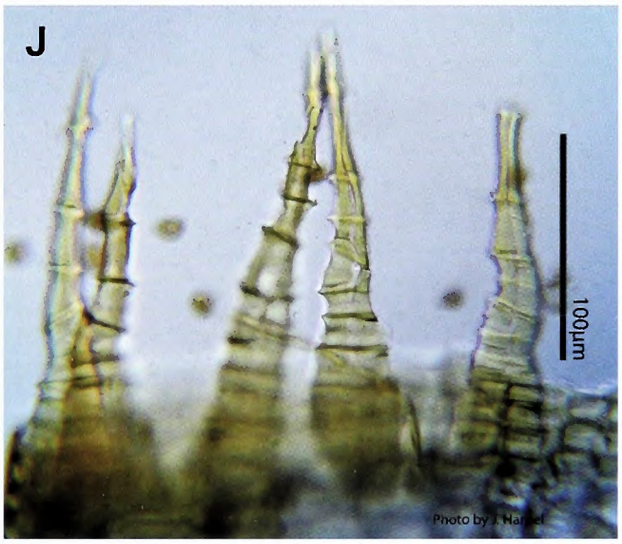

E
100µm
Photo by J. Harpel


F
100µm
Photo by J. Harpel


G
100µm
Photo by J. Harpel


H
2 mm
Photo by J. Harpel


I
700µm
Photo by J. Harpel


J
100µm

Similar species — *Orthodontium pellucens* is similar but has broadly linear leaves at mid-leaf, a costal stereid band, and finely papillose exostome teeth. *Orthodontium gracile* can be confused with members of the Dicranaceae due to its linear-lanceolate and sometimes falcate-secund leaves. According to Christy and Wagner (1996), *Orthodontium* resembles a small *Dicranella* or *Dicranum* that may grow in the same habitat. *Dicranum* is usually larger, has short leaf cells and differentiated, often brown, alar cells, and its capsules are large and asymmetric with short necks. *Dicranella* has short leaf cells and either ribbed or smooth asymmetric capsules. *Leptobryum pyriforme* has a glossy, horizontal to pendent capsule with a perfect peristome.

Ecology — In western North America, *Orthodontium gracile* is known from conifer bark and rotten or charred wood, especially *Sequoia sempervirens* within redwood forests along the Pacific coast. Eckel (2014a) notes, "*Orthodontium* is widespread in tropical and temperate regions and primarily epiphytic on coniferous trees, decaying conifer wood, or in terrestrial habits." Atherton et al. (2010) observes that in Britain *O. gracile* grows on rock and rarely on wood. At present this species has not been found on rock in western North America. *Orthodontium gracile* known elevation range is between 270 and 1,110 feet. Associated bryophyte species include *Anlacomnium androgynum*, *Lepidozia reptans* and *Plagiothecium laetum*.

Distribution — *Orthodontium gracile* is known from Australia, Europe, and North America. In western North America, it is known from Oregon and California. In Oregon, *O. gracile* is reported from Curry County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Eckel (in FNA 2014a, p. 115), Smith (2004, p. 527), Crum (1994, p. 520), Lawton (1971, p. 178).

References with photos — Porley (2013, p. 135), Lockhart et al. (2012, p. 511), Malcolm et al. (2009, p. 221).

Orthodontium pellucens (Hooker) Bruch & Schimper

Recent synonyms: none
Common names: translucent orthodontium, orthodontium moss

Taxonomic note: See *Orthodontium gracile*.

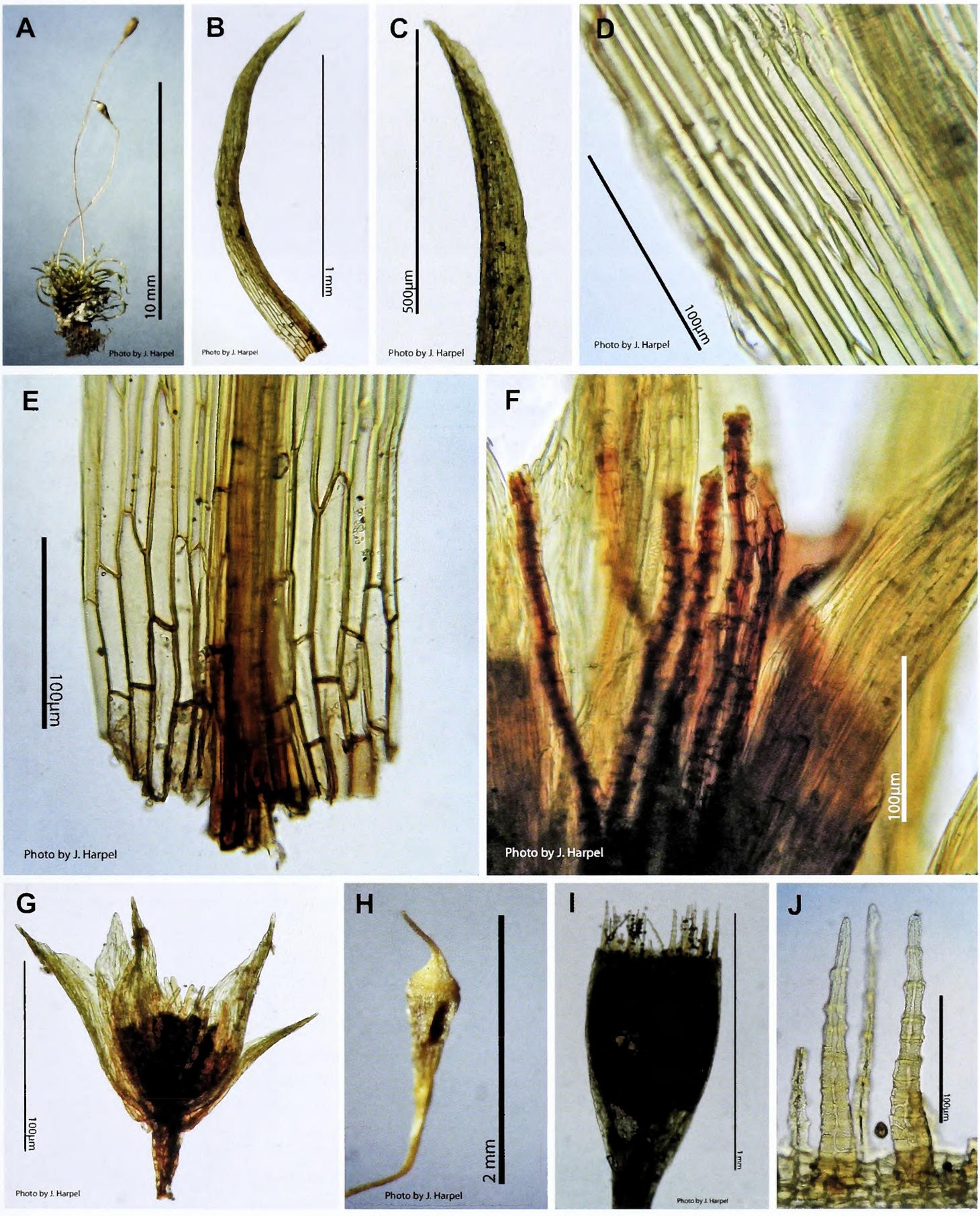
Summary — A small acrocarpous, costate moss with narrow linear-lanceolate leaves. Terrestrial.

Distinctive characteristics — *Orthodontium pellucens* can be distinguished by its (1) narrow, linear-setaceous leaves, (2) presence of a costal stereid band, (3) finely papillose exostome teeth, (4) subcylindric capsule with a slender neck gradually tapered to the seta, and (5) redwood forest association.

Technical description

GAMETOPHYTE — **Plants** erect, yellowish-green above, brown below, in 0.5–1 cm tall tufts. **Stem** central strand weak or absent. **Leaves** 2.5–5 mm long, broadly linear, 0.5 mm wide at mid-leaf, twisted and flexuose to erect-spreading when dry, spreading when moist, keeled; margins plane or in part broadly recurved, sometimes serrulate near the acute apex; costa percurrent or sometimes short-excurrent; alar cells equilateral to short-rectangular, red-brown, in one or two rows, somewhat smaller and thicker than cells above; basal cells oblong-hexagonal; upper medial cells linear to linear-rhomboidal; apical cells short to long rectangular; upper leaf cells broader. **Autoicous**.

Plate 50. Orthodontium pellucens. *A. Habitat. B. Leaf. C. Leaf apex. D. Upper medial cells. E. Alar and basal cells. F. perichaetium. G. Perigonium. H.–I. Sporophytes. J. Peristome teeth. (W. Schofield 47616. UBC)*


A
10 mm
Photo by J. Harpel
B
1 mm
Photo by J. Harpel
C
500µm
Photo by J. Harpel
D
100µm
Photo by J. Harpel
E
100µm
Photo by J. Harpel
F
100µm
Photo by J. Harpel
G
100µm
Photo by J. Harpel
H
2 mm
Photo by J. Harpel
I
1 mm
Photo by J. Harpel
J
100µm

Sporophyte — **Seta** 7–1.4 cm long. **Capsules** 1.5–1.7 mm long, erect, ovoid to pear-shaped (pyriform), tapered to a short neck, irregularly ribbed when dry, brownish-yellow or becoming whitish with age; peristome finely papillose. **Spores** 16–20 µm.

Similar species — *Orthodontium gracile* is similar, but its leaves narrow from the base to the apex. The leaves of *O. pellucens* are broadest near mid-leaf. In addition, *O. gracile* has smooth exostome teeth and lacks a costal stereid band. See *Orthodontium gracile* for additional similar species.

Ecology — In western North America, *Orthodontium pellucens* forms dense cushions or mats on stumps, rotten logs, and bark of living redwood trees. It is confined to redwood groves near Pacific Ocean shores. Sometimes it occurs on charred wood or below gaping wounds in trees. Associated vascular plant species include *Polystichum munitum* and *Sequoia sempervirens*. Associated bryophytes include *Aulacomnium androgynum, Lepidozia reptans, Orthodontium gracile* and *Plagiothecium denticulatum*. *Orthodontium gracile* may have been introduced from Australia, but *O. pellucens* appears to be restricted to the western hemisphere and is probably native. In the southeastern United States, *O. pellucens* occurs in the southern Appalachian and Great Smoky Mountains on soil, rock, rotten wood, and the bark of trees around the 3,600 foot elevation.

Distribution — *Orthodontium pellucens* is known from North America, Central America, South America, and Hawaii. In western North America, it is known from California and Oregon. In Oregon, *O. pellucens* is reported from Curry County in the Coast Range ecoregion.

References with descriptions and/or illustrations — Eckel (in FNA 2014a, p. 115), Crum (1994, p. 520), Crum and Anderson (1981, p. 503), Bartram (1949, p. 154).

Orthotrichum bolanderi Sullivant

Recent synonyms: none
Common name: Bolander's orthotrichum moss

Summary — An acrocarpous, costate moss with ovate-lanceolate, papillose leaves. Terrestrial.

Diagnostic characteristics — *Orthotrichum bolanderi* can be distinguished by its (1) lack of a hyaline awn, (2) plane leaf margins with broad strong costa, (3) bistratose lamina in the upper 2/3 of the leaf, (4) papillose laminal cells, (5) emergent capsule, and (6) superficial stomata in the capsule neck.

Technical description

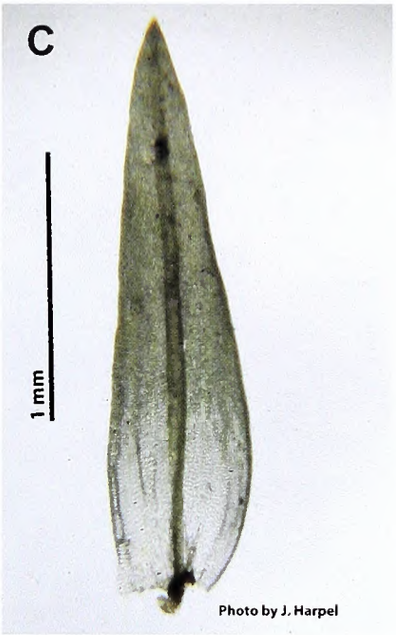
Gametophyte — **Plants** 0.5–4 cm tall, with upturned branches, dark green to brownish-black. **Leaves** 2–3.5 mm long, ovate-lanceolate, the tips obtuse to bluntly acute, stiff erect-appressed and rarely incurved when dry, erect-spreading when moist, with a sheathing base; margins plane, entire; costa broad, ending near the apex; cells papillose, bistratose in the upper 2/3 of the leaf and along the margin, basal cells unistratose. **Goinoautoicous**.

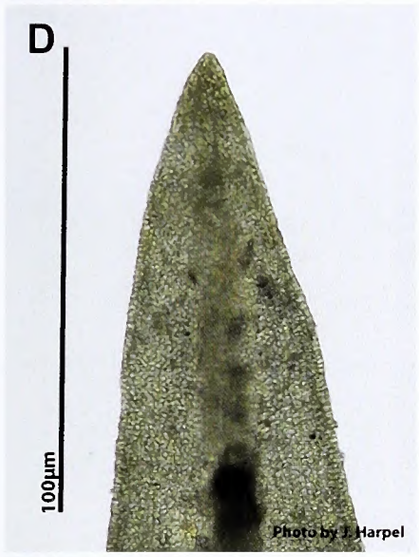
Sporophyte — **Seta** 1–2 mm long. **Capsules** emergent, 1.4–2 mm long, ovoid-oblong to ovoid-cylindric with a long wrinkled neck, contracted below the mouth when dry, 8-ribbed in the upper 1/3; stomata superficial, visible on the inner surface of the capsule; peristome teeth recurved and reflexed along the sides of the capsule below the mouth. Calyptra oblong-conic, smooth, not deeply plicate, with papillose hairs. **Spores** 17–23 µm.

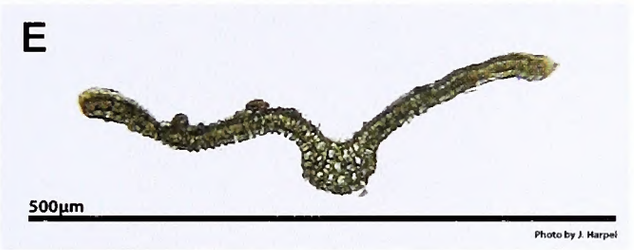
Plate 51. Orthotrichum bolanderi. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Leaf apex. E–F. Leaf cross-sections. G. Alar and basal cells. H. Upper medial cells. I. Sporophyte. J. Superficial stomata. (D. Norris 50785. UBC)*

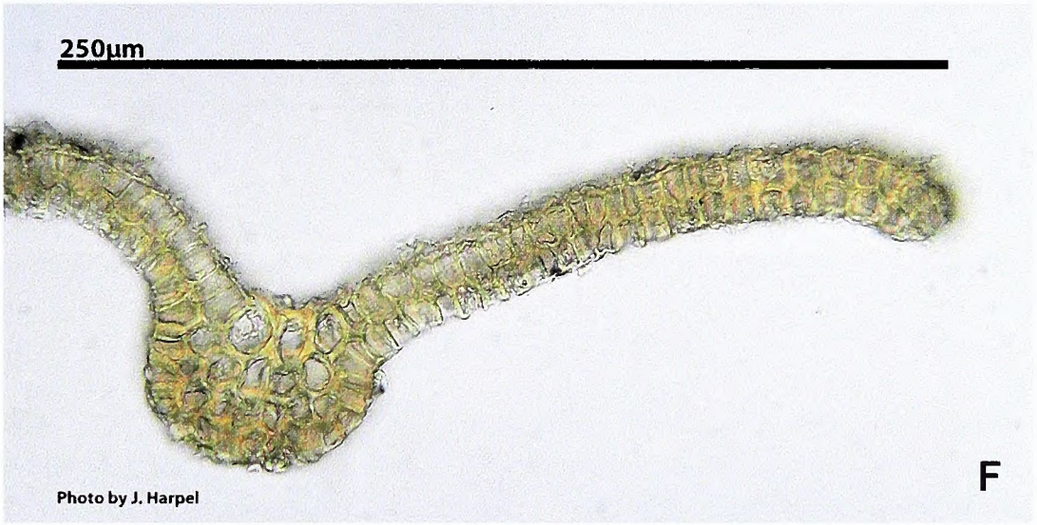

A
10 mm
Photo by J. Harpel

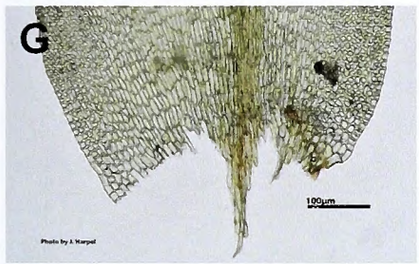

7 mm
B
Photo by J. Harpel

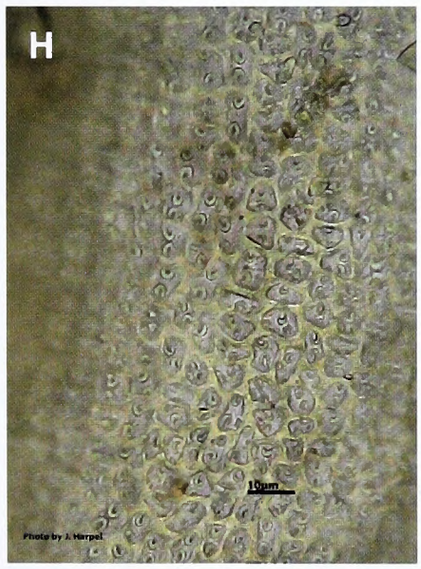

C
1 mm
Photo by J. Harpel

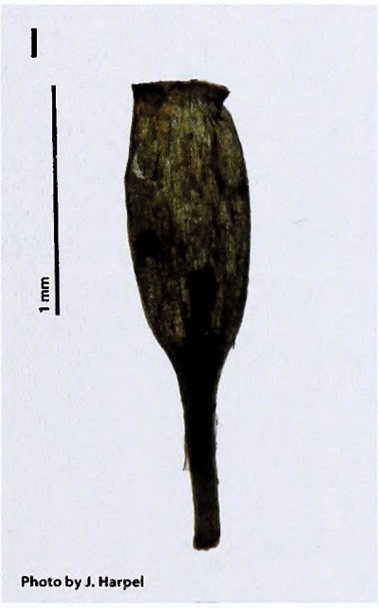

D
100µm
Photo by J. Harpel


E
500µm
Photo by J. Harpel


250µm
Photo by J. Harpel
F


G
100µm
Photo by J. Harpel


H
10µm
Photo by J. Harpel


I
1 mm
Photo by J. Harpel


J
50µm
Photo by J. Harpel

Similar species —*Orthotrichum bolanderi* is the only North American *Orthotrichum* with superficial stomata and bistratose distal laminal cells.

Ecology — *Orthotrichum bolanderi* forms loose spreading mats on dry igneous and sedimentary rocks and cliff faces in filtered to full sunlight. In California it is known from oak woodlands up to the transition to conifer forests. There is little habitat information for *Orthotrichum bolanderi* in Oregon and Washington.

Distribution — *Orthotrichum bolanderi* is endemic to the western North American Pacific coast and is known from Washington, Oregon, California, Mexico, and Guatemala. In Oregon, *Orthotrichum bolanderi* is reported from Jackson County in the Klamath Mountain ecoregion.

References with descriptions and/or illustrations — Vitt (in FNA 2014b, p. 52), Sharp et al. (1994, p. 608), Vitt (1994, p. 608), Vitt (1973).

References with photos — Malcolm et al. (2009, p. 203).

Orthotrichum euryphyllum Venturi

Recent synonym: *Orthotrichum epapillosum* E. Lawton & F.J. Hermann
Common name: orthotrichum moss

Taxonomic note: Vitt (1973) treated *Orthotrichum euryphyllum* as *O. rivulare*.

Summary — An acrocarpous, costate moss with oblong-ligulate leaves. Terrestrial.

Diagnostic characteristics — *Orthotrichum euryphyllum* can be distinguished by its (1) lack of a hyaline awn with broad obtuse leaf apices, (2) recurved to revolute leaf margins, (3) immersed capsule, (4) immersed stomata, and (5) riparian habitat.

Technical description

Gametophyte — **Plants** dark green, reddish-brown to black, 1–3 cm long, branched. **Leaves** 2–3.6 × 1–1.6 mm, oblong, keeled, imbricate, straight or only slightly contorted, unistratose; upper medial cells usually 16–20 µm wide; costa strong, often wavy (sinuose) or forked, ending about 10 cells below the apex; the apex on mature leaves broad, blunt, rounded, and hooded (cucullate), sometimes apiculate on younger leaves, papillae absent; margins entire or sometimes serrulate at apex, and recurved from the base to near the apex. **Goinoautoicous**.

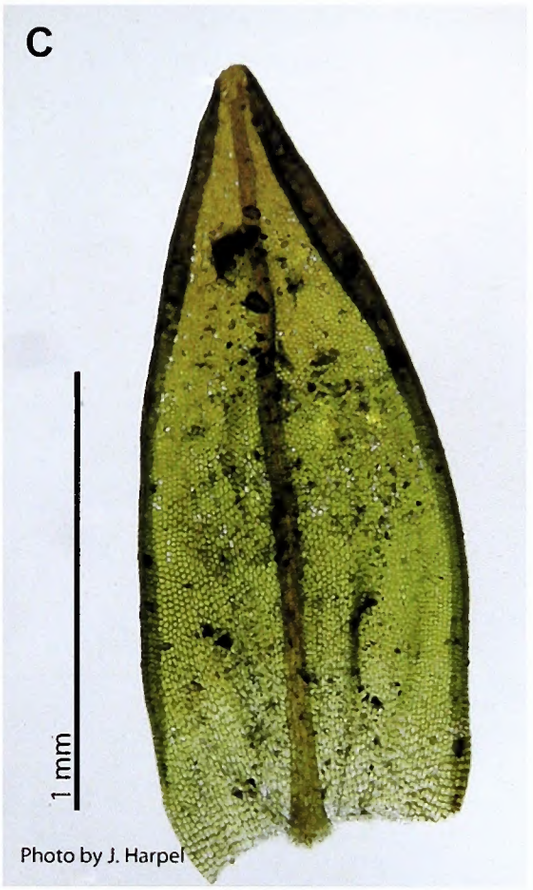
Sporophyte — **Seta** 0.8–1.6 mm long. **Capsules** immersed, oblong to oblong-ovate, strongly 8-ribbed entire length; stomata immersed, partially covered by guard cells; peristome double; prostome sometimes present, low; exostome teeth 8 splitting to 16, erect, loosely reflexed when old, densely papillose-striate; endostome segments well-developed, finely papillose. Calyptra conic-oblong, papillose, naked. **Spores** up to 15 µm.

Similar species — *Orthotrichum rivulare* is similar but is dark green to black, has flat irregularly dentate leaf apices, and upper laminal cells that are rarely wider than 13 µm. *Orthotrichum holzingeri* has similar leaves but has exserted capsules, superficial stomata, and bulging alar cells.

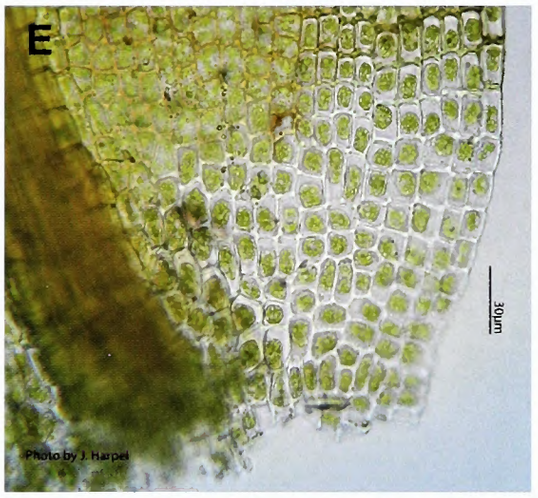
Plate 52. Orthotrichum euryphyllum. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Leaf apex. E. Alar and Basal cells. F. Upper medial cells. G. Sporophytes. H. Immersed stomata. I. Perigonium. (J. Shevock 32504. CAS)*

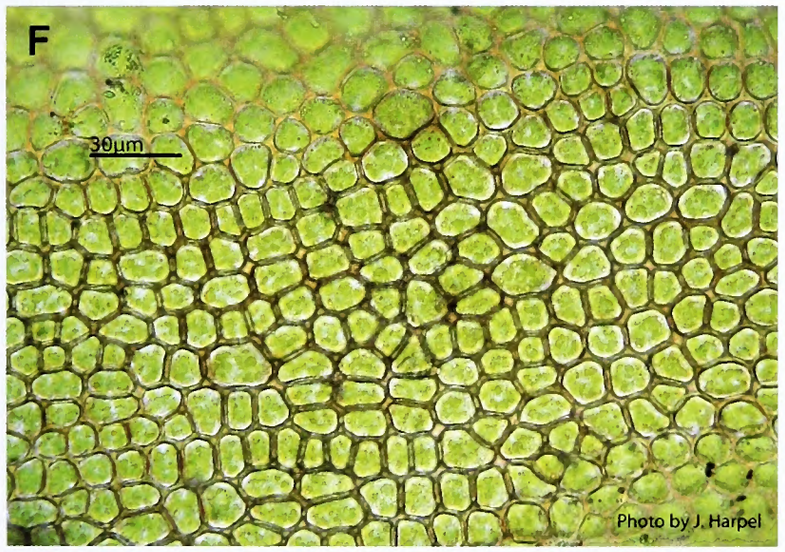

A


B
2 mm

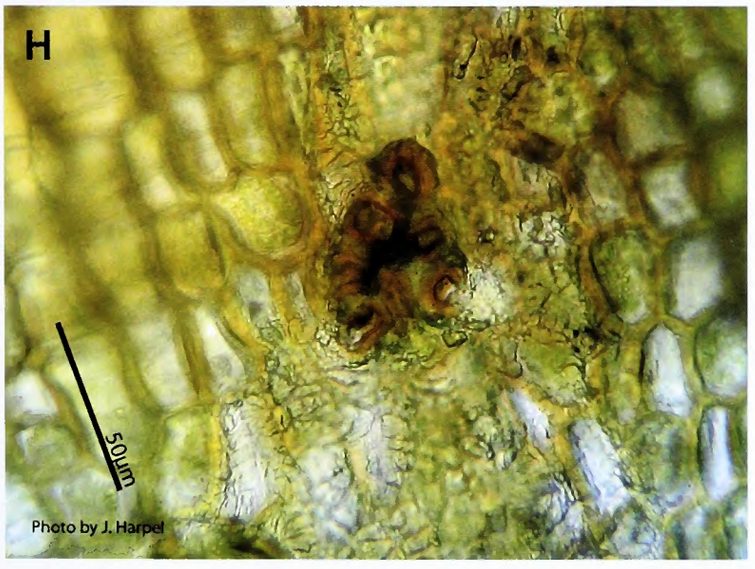

C
1 mm
Photo by J. Harpel

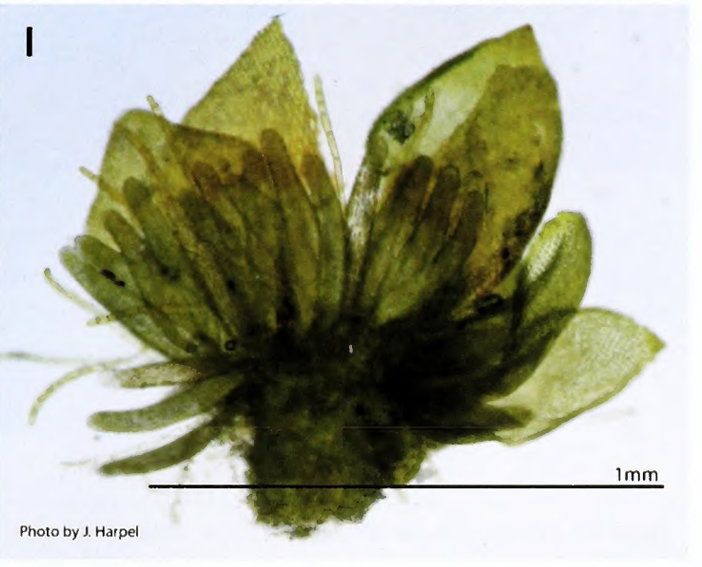

D
1 mm


E
30µm
Photo by J. Harpel


F
30µm
Photo by J. Harpel


G
2 mm
Photo by J. Harpel


H
50µm
Photo by J. Harpel


I
1mm
Photo by J. Harpel

Ecology — *Orthotrichum euryphyllum* forms tightly-packed cushions on basalt rocks around springs and streambeds primarily in dry *Artemisia tridentata, Juniperus occidentalis*, and *Pinus ponderosa* plant associations. Sporophytes are produced in summer and fall.

Distribution — *Orthotrichum euryphyllum* is endemic to western North America and known from British Columbia, Washington, Oregon, California, Idaho, and Montana. In Oregon, *O. euryphyllum* is reported from Grant, Harney, Jackson, and Union counties within the Blue Mountain, Klamath Mountain and Northern Basin and Range ecoregions.

References with descriptions and/or illustrations — Vitt (in FNA 2014b, p. 54), Lewinsky-Haapasaari and Norris (1998), Lawton and Hermann (1973, p. 437 as *Orthotrichum epapillosum*).

References with photos — Malcolm et al. (2009, p. 207).

Orthotrichum hallii Sullivant & Lesquereux

Recent synonyms: none
Common name: Hall's orthotrichum

Summary — An acrocarpous, costate, papillose moss with lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Orthotrichum hallii* can be distinguished by its (1) lack of a hyaline awn, (2) bistratose leaf lamina, (3) papillose and lanceolate leaves, (4) emergent capsule, and (5) immersed stomata.

Technical description

GAMETOPHYTE — **Plants** olive-green to dark green, in 2.5 cm tall tuffs or cushions. **Stems** sometimes branched. **Leaves** lanceolate, acute and more or less obtuse; margins entire, recurved below; lamina bistratose in the upper half, sometimes with unistratose streaks; costa percurrent; upper medial cells irregularly rounded, 9–14 µm, with 1–3 small concial papillae per cell; basal cells rectangular to short-rectangular, quadrate on the margins. **Goinoautoicous**.

SPOROPHYTE — **Seta** 0.5–1.0 mm long. **Capsules** immersed when moist to about 1/2, emergent when dry, oblong, oblong-ovate, stomata immersed in the middle and lower portion of the urn, strongly 8 ribbed one-half to the full length when dry; peristome double, exostome teeth 8, occasionally spilt to 16, incurved when young, spreading or rarely reflexed when old, never erect. Calyptra is oblong, smooth, sparsely to moderately hairy with papillose hairs. **Spores** 10–17µm, coarsely papillose.

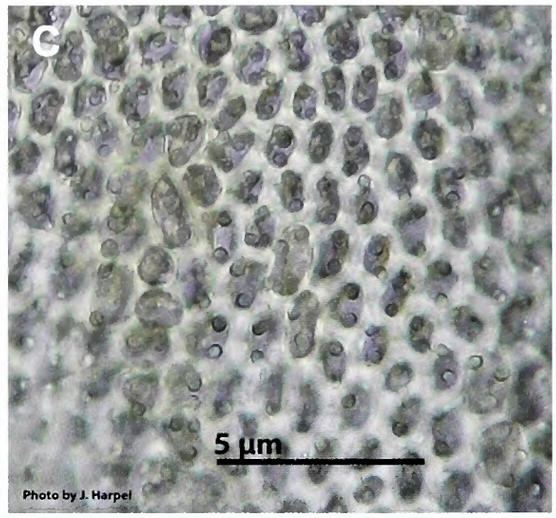
Similar species — *Orthotrichum hallii* is distinguished from other *Orthotrichum* species by its bistratose leaves and emergent 8 ribbed capsules with immersed stomata.

Ecology — *Orthotrichum hallii* occurs on rocks, usually limestone or calcareous sandstone up to 10,000 foot elevations in pine, spruce, or deciduous scrub oak-maple forests. It is occasionally found on granite, quartzite, or basalt and is common on vertical canyon walls and shaded cliff faces in Nevada, Utah, and Colorado. In Washington, *O. hallii* is reported from a rock and concrete retaining wall. It occurs rarely on the trunks of deciduous trees.

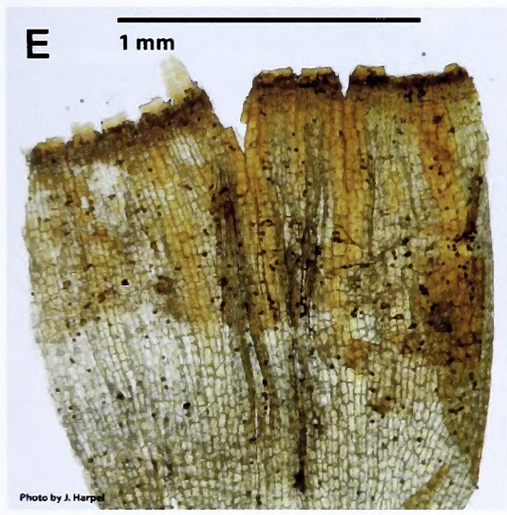
Plate 53. Orthotrichum hallii. *A. Dry habitat. B. Leaf. C. Upper medial cells. D. Leaf cross-section. E. Sporophyte. F. Deeply immersed stomata. G. Peristome tooth. (J. Harpel 4860. 4870. UBC)*

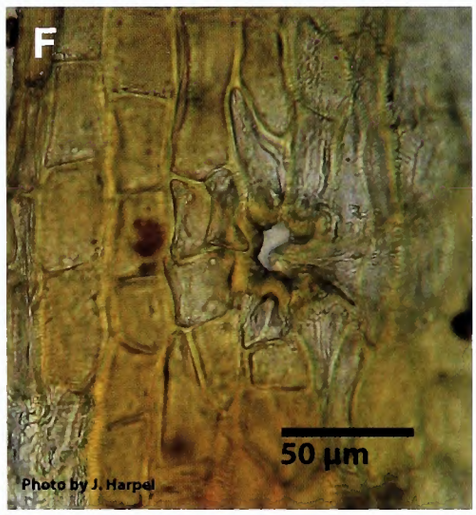

A
1mm
Photo by J. Harpel

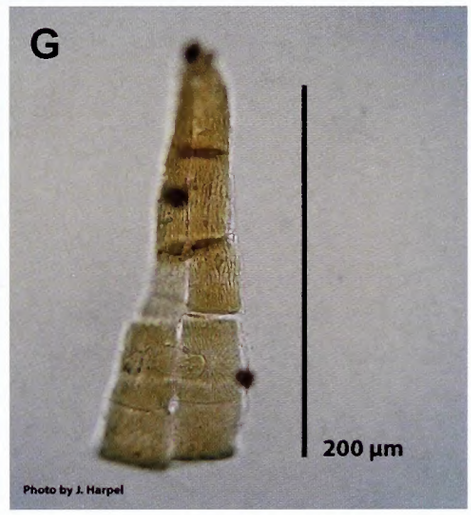

B
1 mm
Photo by J. Harpel


C
5 µm
Photo by J. Harpel


D
500 µm
Photo by J. Harpel


E
1 mm
Photo by J. Harpel


F
50 µm
Photo by J. Harpel


G
200 µm
Photo by J. Harpel

Distribution — *Orthotrichum hallii* is known from Asia and North America. In western North America, it is known from British Columbia, Washington, Oregon, California, Idaho, Montana, South Dakota, Nevada, Utah, Wyoming, Colorado, Arizona, and New Mexico. In Oregon, *O. hallii* is reported from Jackson and Linn counties within the Klamath Mountain and West Cascades ecoregions.

References with descriptions and/or illustrations — Vitt (in FNA 2014b, p. 56), Lewinsky-Haapasaari and Tan (1995), Sharp et al. (1994, p. 610), Vitt (1973, p. 142), Flowers (1973, p. 283), Lawton (1971, p. 221).

Orthotrichum holzingeri Renault & Cardot

Recent synonyms: none
Common name: Holzinger's orthotrichum

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Orthotrichum holzingeri* is distinguished by its (1) lack of a hyline awn, (2) smooth laminal cells (3) exserted capsule, (4) smooth exostome teeth, (5) superficial stomata, and (6) bulging alar cells.

Technical description

Gametophyte — **Plants** dull dark green above, blackish below in tufts 0.5–2 cm tall. **Stems** little branched. **Leaves** imbricate when dry, spreading when moist, 2–3.2 mm long, oblong-lanceolate to ovate-lanceolate, obtuse to broadly acute; margins recurved-revolute to near the apex; costa ending in the apex; upper medial cells smooth, hexagonally-rounded to quadrate, 8–10 µm; basal cells hyaline, rectangular; alar cells inflated and clear. **Gonioautoicous**.

Sporophyte — **Seta** 2–3.2 mm long. **Capsules** exserted, broadly cylindric, 2.5–2.8 mm long, with a tapering neck, ribbed in the upper half when dry; stomata superficial, in the middle of the capsule; operculum conic-apiculate; peristome single, 16 teeth in pairs, erect when dry, not papillose, usually with a short preperistome; endostome short-segmented or lacking. **Spores** finely papillose, 12–16 µm.

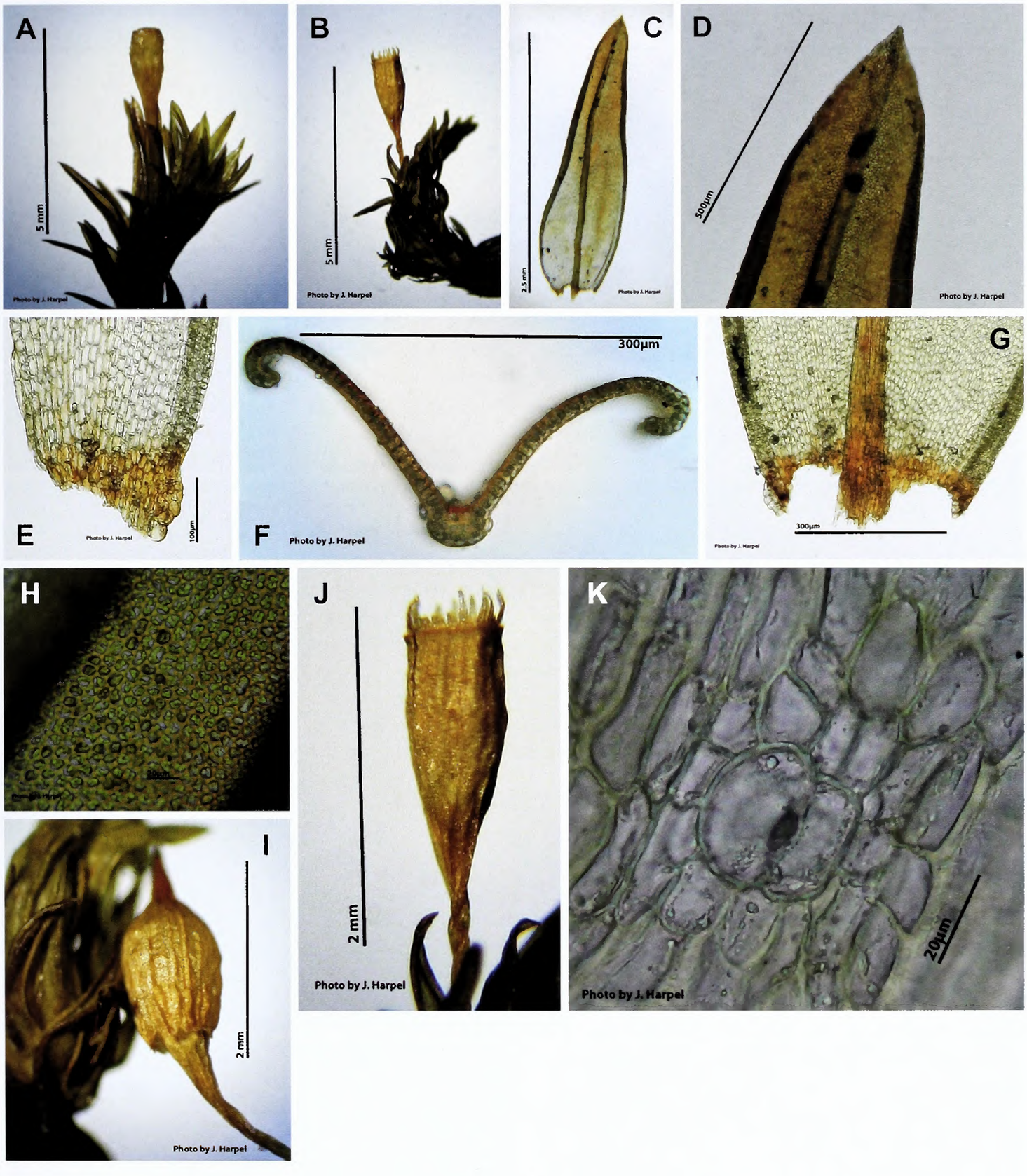
Similar species — The smooth leaf cells, lack of an endostome, naked calyptra, bulging alar cells, and broad obtuse leaves separate *Orthotrichum holzingeri* from *O. laevigatum* and *O. rupestre*. In addition, *O. rivulare* has immersed stomata.

Ecology — *Orthotrichum holzingeri* is known from seasonally wet rocks in small streams of dry montane forests at 3,000–6,000 foot elevations. According to Vitt (1991) *O. holzingeri* is found on vertical calcareous rock surfaces and at the bases of *Salix* bushes just above rock that is frequently inundated by seasonally high water in dry coniferous forests.

Distribution — *Orthotrichum holzingeri* is a western North American endemic known only from Washington, Oregon, California, Idaho, and Wyoming. In Oregon, *O. holzingeri* is reported from Grant, Harney, Jefferson, and Union counties within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Vitt (in FNA 2014b, p. 56), Vitt (1973, p. 101), Lawton (1971, p. 221), Grout (1935, p. 113).

Plate 54. Orthotrichum holzingeri. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Leaf apex. E. Inflated alar cells. F. Leaf cross-section. G. Basal cells. H. Upper medial cells. I. Sporophyte with calyptra. J. Sporophyte. K. Superficial stomata. (D. Norris 94686. UC)*


A
5 mm
B
5 mm
C
2.5 mm
D
500µm
Photo by J. Harpel
E
100µm
F
300µm
Photo by J. Harpel
G
300µm
H
I
2 mm
Photo by J. Harpel
J
2 mm
Photo by J. Harpel
K
20µm
Photo by J. Harpel

Orthotrichum pallens Bruch

Recent synonyms: none
Common name: pale bristle-moss

Summary — An acrocarpous, costate, papillose moss with ovate-lanceolate leaves. Epiphytic and Terrestrial.

Diagnostic characteristics — *Orthotrichum pallens* is distinguished by its (1) lack of a hyline awn, (2) papillose laminal cells, (3) emergent to barely exserted capsules, (4) papillose exostome teeth, and (5) immersed stomata.

Technical description

Gametophyte — **Plants** are yellow-green to olive-green (sometimes dark brown) found in dense to loose 3–10 mm tall tufts. **Leaves** appressed when dry, spreading when moist, 1.5–3.2 mm long, oblong-lanceolate to lanceolate, broadly acute to obtuse; margins recurved to above the middle; costa ending before the apex; upper medial cells 9–14 µm, irregularly-rounded to rounded-hexagonal, thick-walled and papillose with 2 (–3) low conical papillae; basal cells rectangular, hyaline, becoming quadrate at the margin. Gemmae are sometimes present on the leaves. **Cladautoicous**.

Sporophyte — **Seta** 0.2–0.6 mm long. **Capsules** emergent to barely exserted, oblong-cylindric 1.3–2.5 mm long, strongly 8-ribbed and shrunken under the mouth when dry; stomata immersed, barely covered by poorly differentiated subsidiary cells near the middle of the capsule; operculum conic-apiculate; peristome double, exostome teeth finely papillose, reflexed when old; endostome usually 16, eight about as long as the exostome, the alternate ones often shorter or sometimes lacking. Calyptrae not hairy. **Spores** papillose, 10–16 µm.

Similar species — Vitt (1973) states that no other North American *Orthortichum* species has an endostome of 16 segments and stomates that are barely covered by the subsidiary cells. Otherwise, *O. pallens* is distinguished by its narrowly obtuse oblong-lanceolate leaves and a cladautoicous sexual condition.

Ecology — *Orthotrichum pallens* occurs on tree trunks or branches and on dry calcareous or granitic rocks. In western North America, *O. pallens* is found at high elevations in coniferous forests and in the southern boreal zone across Canada.

Distribution — *Orthotrichum pallens* is known from Eurasia and North America. In western North America, it is known from British Columbia, Alberta, Oregon, California, Montana, Utah, Colorado, Arizona, and Mexico. In Oregon, *O. pallens* is reported from Grant and Harney counties within the Blue Mountain ecoregion.

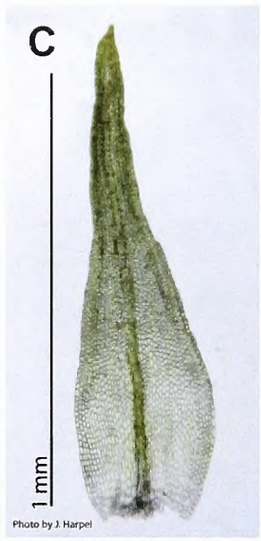
References with descriptions and/or illustrations — Vitt (in FNA 2014b, p. 61), Smith (2004, p. 676), Flowers (1973, p. 292), Lawton (1971, p. 224), Vitt (1973, p. 166), Nyholm (1960, p. 343).

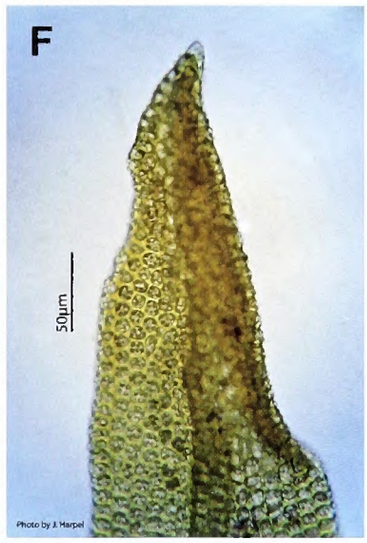
References with photos — Porley (2013, p. 137), Lockhart et al. (2012, p. 451).

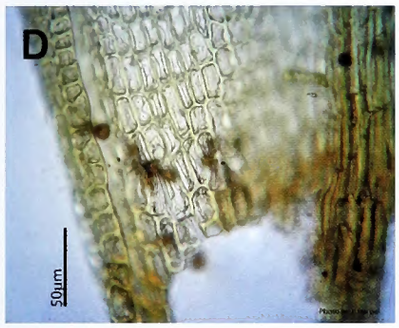
Plate 55. Orthotrichum pallens. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Basal cells. E. Upper medial cells. F. Leaf apex. G. Moist sporophyte. H. Dry sporophyte. I. Partially immersed stomata. J. Peristome teeth. (J. Harpel 37638. Harpel Private)*

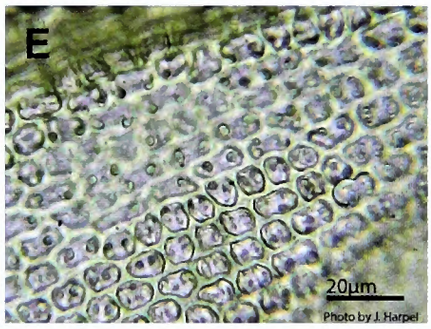

A
2 mm


2 mm
B

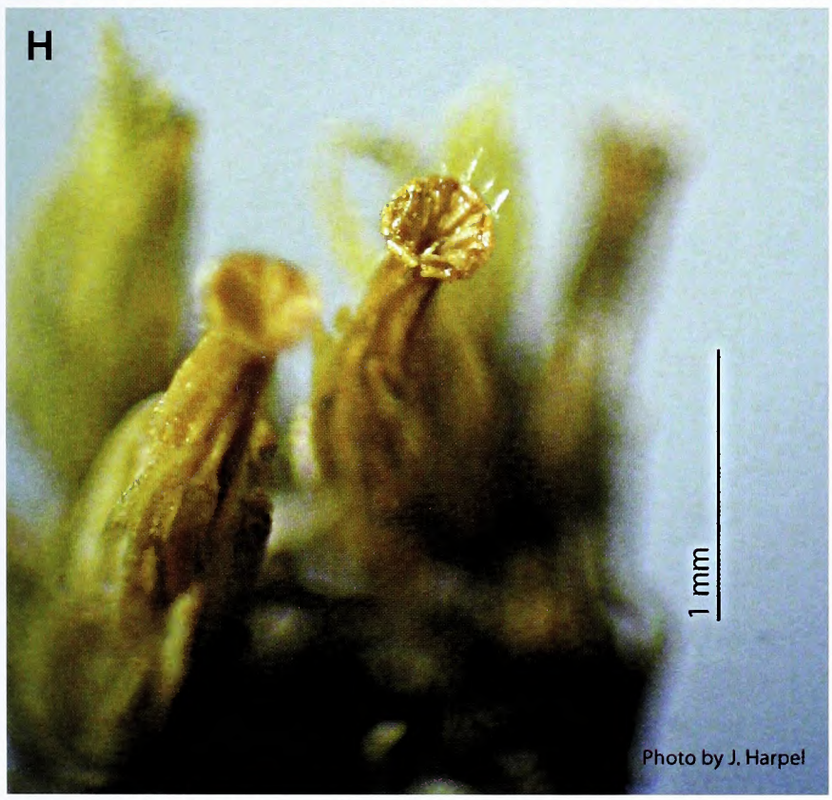

C
1 mm
Photo by J. Harpel

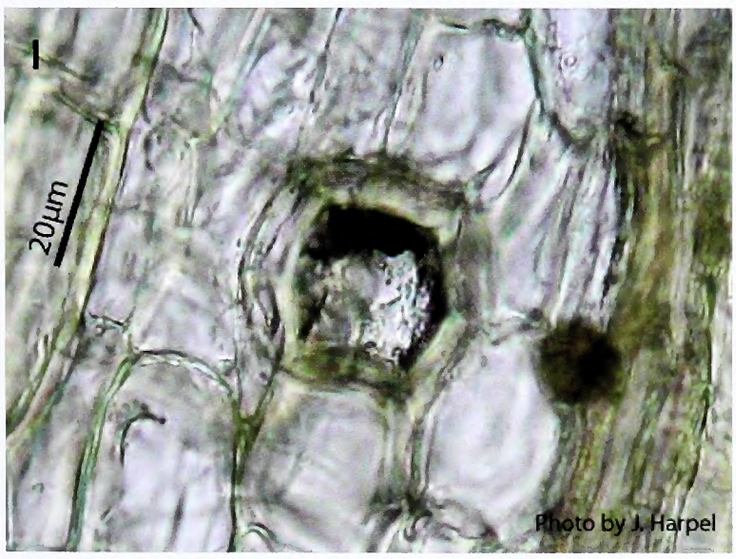

F
50µm
Photo by J. Harpel

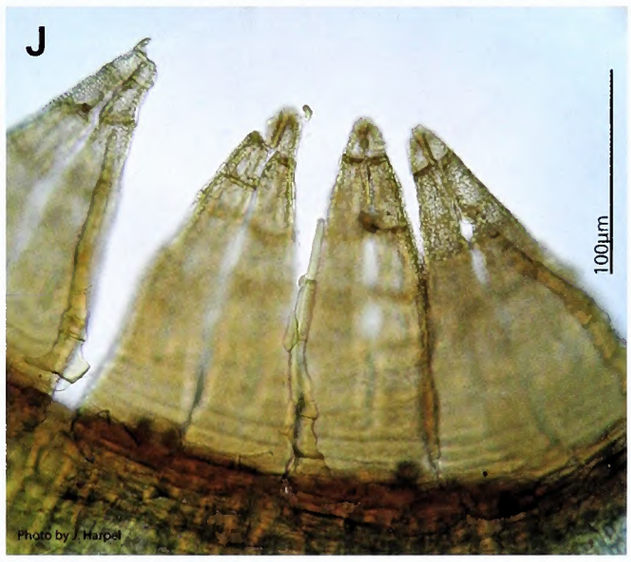

D
50µm


E
20µm
Photo by J. Harpel


G
2 mm
Photo by J. Harpel


H
1 mm
Photo by J. Harpel


I
20µm
Photo by J. Harpel


J
100µm
Photo by J. Harpel

Orthotrichum pellucidum Lindberg

Recent synonyms:
Orthotrichum cupulatum var. *jamesianum* (James) E. Lawton
Orthotrichum jamesianum James
Common name: pellucid orthotrichum

Summary — An acrocarpous, costate moss with papillose, oblong-lanceolate leaves with blunt apices. Terrestrial.

Diagnostic characteristics — *Orthotrichum pellucidum* can be distinguished by its (1) glaucous appearance and lack of hyaline awn, (2) large conic or bifid laminal papillae, (3) emergent capsule, and (4) immersed stomata.

Technical description

Gametophyte — **Plants** dark olive-green, brownish to black, glaucous, in cushions or tufts. **Leaves** stiff, appressed, incurved when dry, spreading when moist, 2.0–2.7 mm long, oblong-lanceolate, apex blunt or obtuse; margins recurved; costa broad, ending well below the apex; upper median cells, rounded-hexagonal to hexagonal-elliptic, thick, incrassate walls, 6–11 μm wide, 1–3 large conical or forked papillae, often giving a glaucous appearance; basal cells short-rectangular to quadrate. **Gonioautoicous**.

Sporophyte — **Seta** 1–1.5 mm long, twisted. **Capsules** half-emergent to shortly exserted, oblong to short-oblong when dry, strongly 8 (rarely 16) ribbed the entire length, stomata deeply immersed, more or less completely covered by subsidiary cells; peristome single papillose-striate to coarsely reticulate-papillose, usually irregularly spilt into16 segments when mature, often missing on old sporophytes; calyptra oblong, smooth, rarely plicate, very hairy with whitish, papillose hairs. **Spores** 10–15 μm.

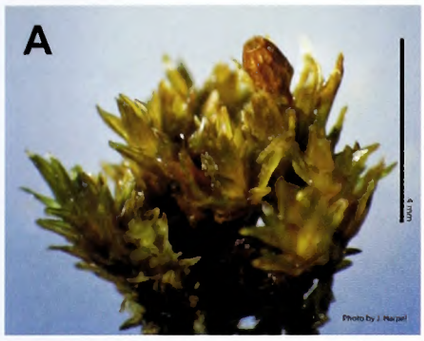
Similar species — Other *Orthotrichum* are similar. *Orthotrichum pellucidum* is distinguished by its blunt lanceolate-oblong leaves that always appear glaucous due to the large bifid papillae of the distal laminal cells.

Ecology — *Orthotrichum pellucidum* is known from calcareous or siliceous boulders and cliff faces in xeric areas with direct sunlight at moderate to high elevations (1,500–9,000 feet). Vitt (1973) describes the species as occurring on calcareous, rarely siliceous boulders and cliff faces in very dry areas, often in full sunlight. Habitat information from herbarium labels from Alberta and British Columbia note non-calcareous bluffs on south side of waterfalls in *Pinus contorta* montane forests and a lime-based outcrop in the forest. Habitat information from Wyoming collections includes limestone canyon walls surrounding a rushing montane stream and large pitted dry limestone boulders in a *Pinus contorta* forest.

Distribution — *Orthotrichum pellucidum* is a western North American endemic known predominantly from the Rocky Mountains. In western North America, it is known from the Northwest Territories, British Columbia, Alberta, Oregon, California, Montana, Utah, Wyoming, Colorado, Nevada, and Arizona. In Oregon, *O. pellucidum* is reported from Baker County in the Blue Mountain ecoregion.

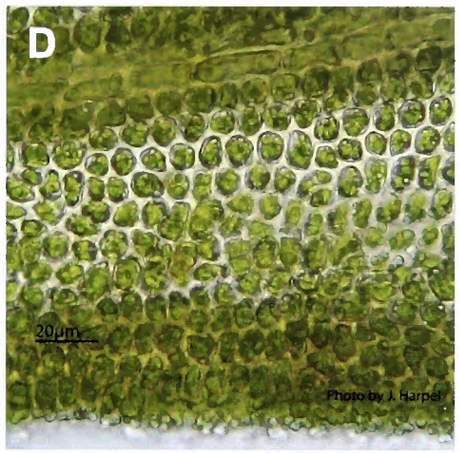
References with descriptions and/or illustrations — Vitt (in FNA 2014b, p. 62), Vitt (1973, p. 138 as *Orthotrichum jamesianum*), Lawton (1971, p. 221 as *Orthotrichum cupulatum* var. *jamesianum*).

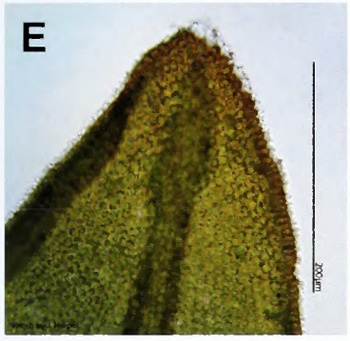
Plate 56. Orthotrichum pellucidum. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Upper medial cells. E. Leaf apex. F. Alar and basal cells. G–H. Leaf cross-section. I. Calyptra. J. Sporophyte. K. Immersed stomata. (W. Schofield 83109. UBC)*

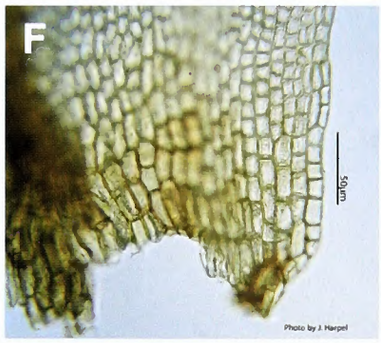

A
Photo by J. Harpel


B
Photo by J. Harpel

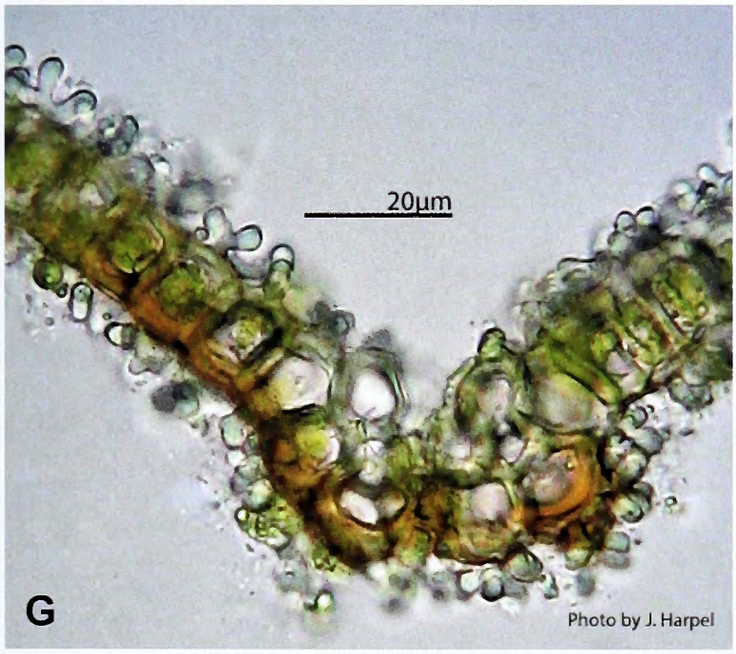

C
1 mm
Photo by J. Harpel


D
20µm
Photo by J. Harpel


E

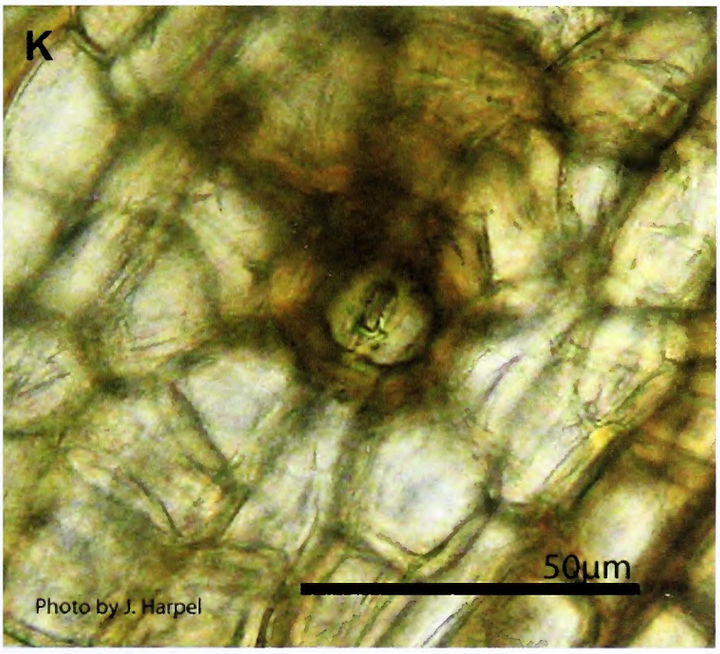

F
50µm
Photo by J. Harpel


H
300µm
Photo by J. Harpel


20µm
G
Photo by J. Harpel


J
1 mm
Photo by J. Harpel


I
1 mm
Photo by J. Harpel


K
50µm
Photo by J. Harpel

Philonotis yezoana Bescherelle & Cardot

Recent synonyms: none
Common name: philonotis moss

Summary — An acrocarpous, costate moss with papillose, ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Philonotis yezoana* is distinguished by its (1) dark green color, (2) short leaf cells with a single central papillae, (3) unistratose leaves, and (4) often subfloral branch whorls on fertile plants.

Technical description

GAMETOPHYTE — **Plants** large, in dense tufts or intermixed with other bryophytes, dark green, rufous proximally. **Stems** 1–3 cm tall, erect, simple or sparingly branched, tomentose near the base. **Leaves** laxly erect-appressed when dry, somewhat incurved and erect-spreading when moist, ovate-lanceolate, 0.8–1.2 mm; margins narrowly revolute basally, plane distally, serrulate throughout, teeth single; apex sometimes acuminate; costa subpercurrent to excurrent, lower surface smooth; laminal cells with one central papillae on both sides (more prominent on the upper side); basal cells subquadrate to quadrate, 15–20 × 8–10 µm; distal cells rectangular, 15–26 × 6–8 µm. Specialized asexual reproduction by slender brood branches in leaf axils. **Dioicous**.

SPOROPHYTE — Sporophytes are unknown in North America. Based on material from Japan; **Seta** 2.5–5 cm long. **Capsules** 2–3 mm long. **Spores** 19–24 µm.

Similar species — Other Bartramiaceae species may be similar. *Plagiopus oederianus* differs by having their leaves in three rows and faintly striate distal laminal cells. *Anacola* species lack a hyalodermis and have a distinct reddish-brown rhizoidal tomentum. *Bartramia* species have bistratose to tristratose leaves, a hyalodermis, and fertile plants lacking a subfloral whorl of branches. The solitary central papilla present on both leaf surfaces of *Philonotis yezoana* is unique within the genus.

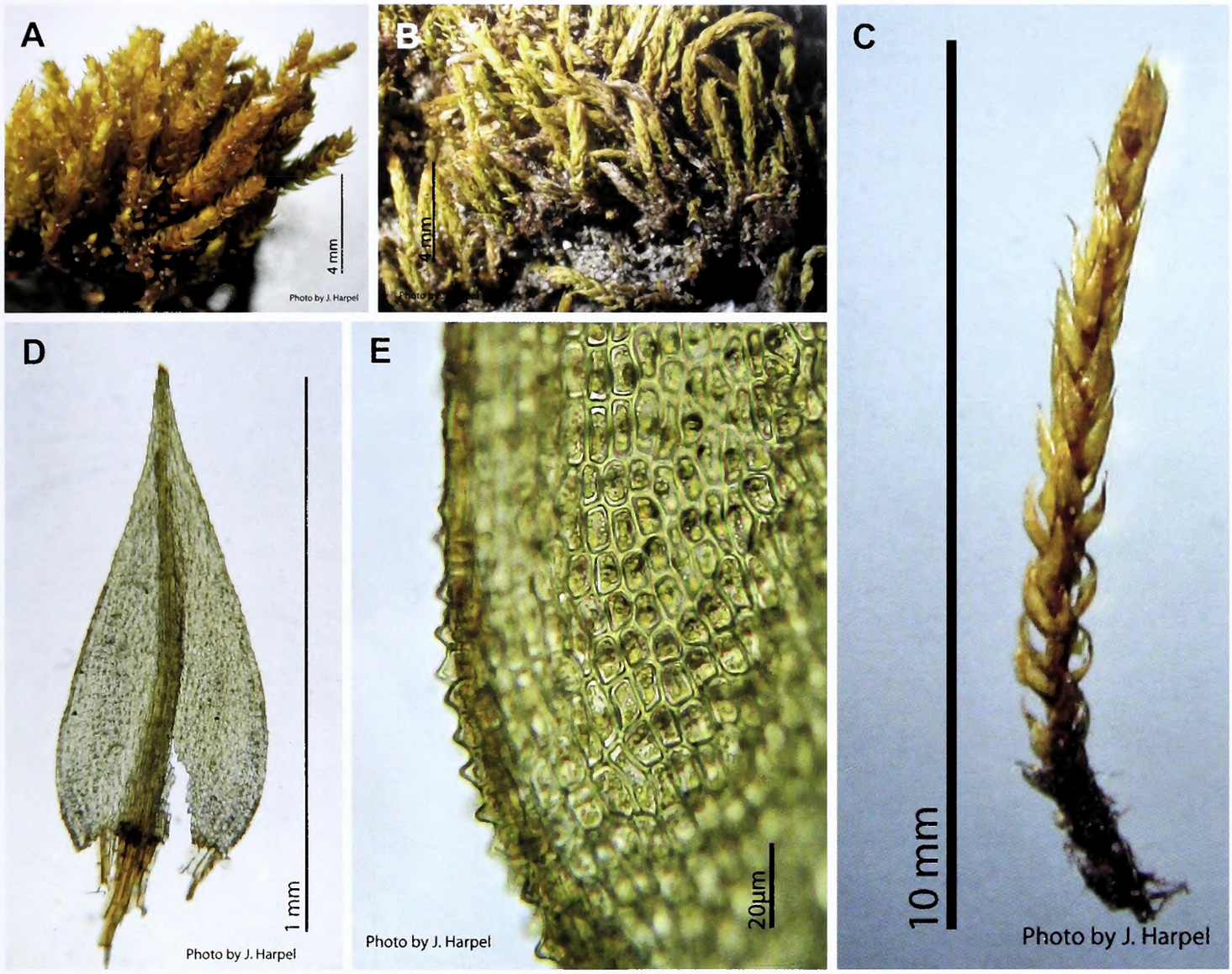
Ecology — *Philonotis yezoana* is found on rocky cliffs in shaded stream gorges and on wet or dry cliffs at 0–5,100 foot elevations.

Distribution — *Philonotis yezoana* is known from Eurasia and North America. In western North America, it is known from Alaska, British Columbia, Washington, Oregon, California, and Montana. In Oregon, *P. yezoana* is reported from Jackson County in the Klamath Mountain ecoregion.

References with descriptions and/or illustrations — Griffin III (in FNA 2014a, p. 107), Crum and Anderson (1981, p. 645).

References with photos — Malcolm et al. (2009, p. 200).

Plate 57. Philonotis yezoana. *A. Moist habitat. B. Dry habitat. C. Individual plant. D. Leaf. E. Recurved basal margin. F. Upper medial cells. G. Alar and basal cells. H. Leaf apex. (J. Harpel 50388. Harpel Private)*


A
4 mm
Photo by J. Harpel
B
4 mm
C
10 mm
Photo by J. Harpel
D
1 mm
Photo by J. Harpel
E
20µm
Photo by J. Harpel
F
20µm
Photo by J. Harpel
G
50µm
Photo by J. Harpel
H
50µm
Photo by J. Harpel

Physcomitrella patens (Hedwig) Bruch & Schrimper

Recent synonyms:

Phascum patens Hedwig

Aphanorrhegma patens (Hedwig) Lindgerg

Common names: physcomitrella moss, spreading earth moss

Summary — An ephemeral, acrocarpous, costate moss with oblong-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Physcomitrella patens* can be distinguished by its (1) small size and ephemeral habit, (2) immersed capsules with no line of dehiscence, (3) broad plane leaves, (4) leaf margins serrulate above the middle, (5) costa ending below the apex, and (6) lax and thin-walled exothecial cells.

Technical description

Gametophyte — **Plants** ephemeral, minute, erect, green to yellowish-green. **Stems** 2–5 mm long, often forked, lower stems evident. **Leaves** pale green, 1.0–3.0 × 0.5–0.8 mm, oblong lanceolate to obovate, spreading, plane to flexuose when dry, broadly acute, laminal cells large and thin-walled; costa extending about 2/3 the length of the leaf; margins serrulate above the middle. **Paroicous**.

Sporophyte — **Seta** erect, up to 0.2 mm. **Capsules** single, sessile, spherical with a small point (apiculus) at summit, 0.5–0.75 mm in diameter, immersed among the leaves, cleistocarpous, rupturing irregularly with no line of dehiscence. Exothecial cells lax and thin-walled. **Spores** 21–33 µm.

Similar species — Most ephemeral mosses are similarly sized but can be separated by leaf characters and capsules. *Ephemerum* and *Micromitrium* are much smaller and have dark, long-acuminate spreading leaves. See *Micromitrium synoicum* for a more detailed discussion of similar species.

Ecology — *Physcomitrella patens* forms small to extensive turfs on beds and banks of seasonal lakes, ponds, and streams at elevations below 500 feet. It grows in partial shade to full exposure. In western North America, its habitats are found in beds of seasonal lakes, ponds, and streams that are inundated with water in winter and spring but exposed by late summer. All known Pacific Northwest populations occur on floodplains and have been collected between September and November.

Distribution — *Physcomitrella patens* is known from Eurasia and North America. In western North America, it is known from British Columbia, Oregon, and California. In Oregon, *P. patens* is reported from Benton and Multnomah counties within the Willamette Valley ecoregion.

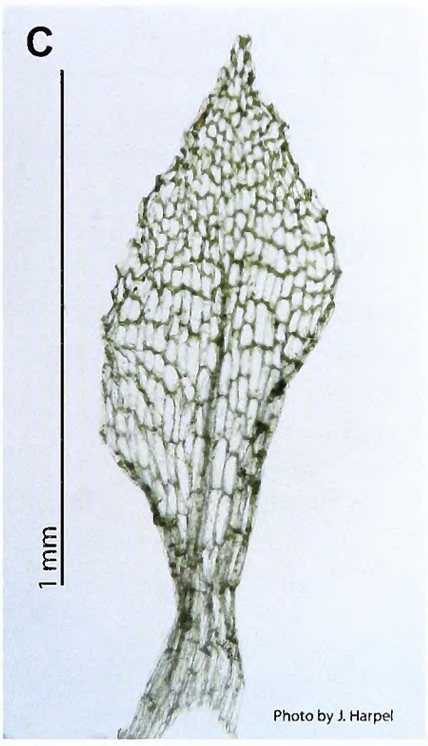
References with descriptions and/or illustrations — Goffinet (in FNA 2007, p. 195), Smith (2004, p. 513), Crum (2004, p. 197), Noguchi (1988, p. 402), Crum (1983, p. 140), Crum and Anderson (1981, p. 456), Smith (1978, p. 346), Tan (1978, p. 561), Nyholm (1956, p. 168).

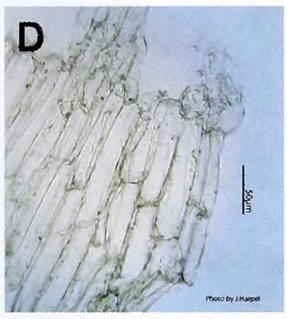
References with photos — Lockhart et al. (2012, p. 304 as *Aphanorrhegma patens*).

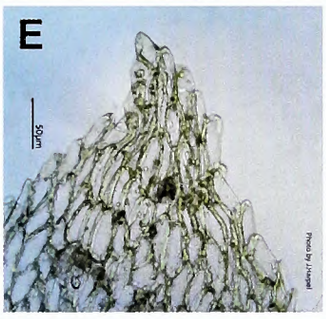
Plate 58. Physcomitrella patens. *A. Moist individual. B. Dry individual. C. Leaf. D. Alar and basal cells. E. Leaf apex. F. Upper medial cells. G–H. Sporophytes. I. Sporophyte releasing spores. J. Exothecial cells. (J. Christy 9013. UBC)*


A
1 mm
Photo by J.Harpel

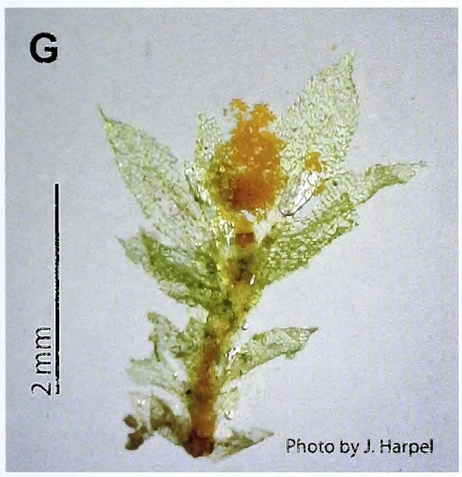

B
1 mm
Photo by J.Harpel

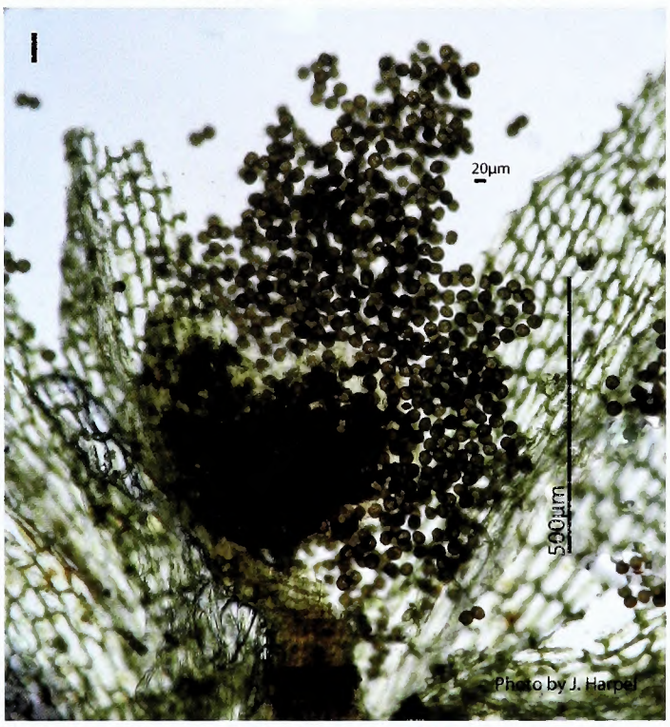

C
1 mm
Photo by J. Harpel


D
50µm

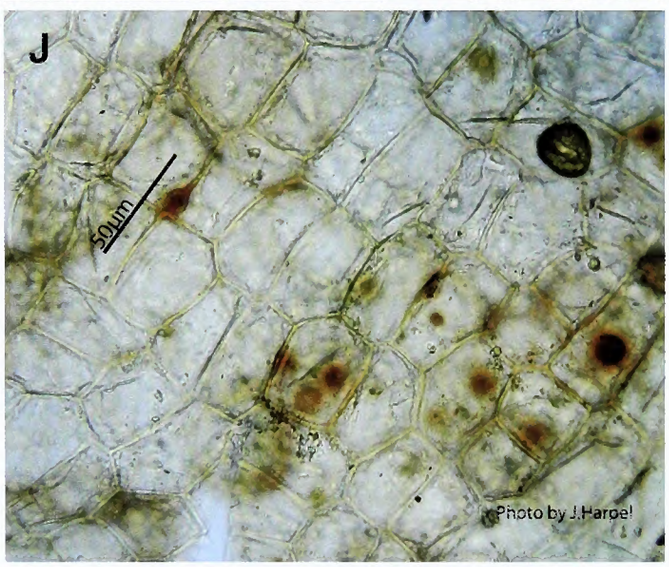

E
50µm


50µm
F


G
2 mm
Photo by J. Harpel


I
20µm
500µm
Photo by J. Harpel


H
1 mm
Photo by J.Harpel


J
50µm
Photo by J.Harpel

Physcomitrium immersum Sullivant

Recent synonyms: none
Common name: immersed bladder-moss

Summary — A small acrocarpous, costate moss with obovate to ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Physcomitrium immersum* can be distinguished by its (1) small size, (2) deeply immersed capsule visible within spreading leaves, and (3) subglobose to globose capsule.

Technical description

GAMETOPHYTE — **Plants** small to minute, 2–3 mm tall. **Leaves** 2–3 mm long, obovate to oblanceolate, or spatulate, acute to acuminate; margins serrate above the middle; costa ending just below the apex; upper median cells oblong-hexagonal, 18–40 µm, somewhat differentiated at the margins, but not forming a distinct border; basal cells rectangular. **Autoicous**.

SPOROPHYTE — **Seta** very short, stout. **Capsules** immersed, subglobose to globose, including the operculum 0.6–1.7 × 0.6–1.3 mm; peristome lacking, dehiscing along a persistent annulus of 1–2 rows of cells. **Spores** densely papillose, 34–38 µm.

Similar species — Other species of *Physcomitrium* have emergent to exserted capsules while *P. immersum* has deeply immersed capsules. McIntosh (2007) comments that this is an easily recognized species based on the capsule shape and immersed position of the sporophyte. See *Micromitrium synoicum* for additional similar ephemeral species.

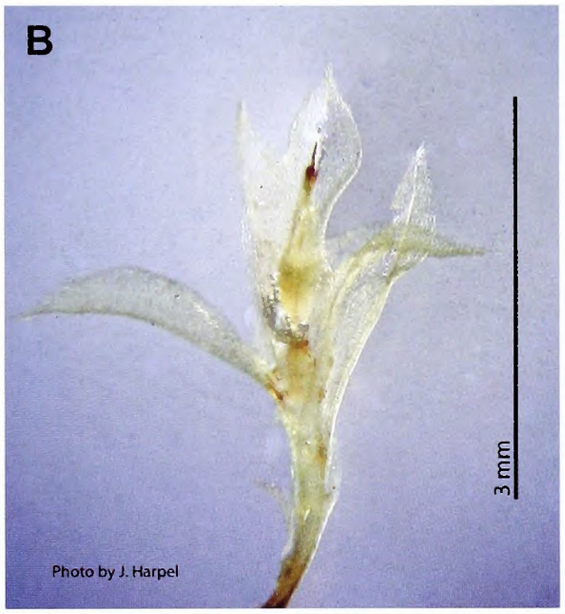
Ecology — *Physcomitrium immersum* occurs on damp soil in floodplains, mud flats, on the banks of streams, bottoms of dried-up reservoirs, and on bare soil of fields and roadsides. Herbarium labels from British Columbia list habitat as damp silt or silty soil along the margins of cultivated and fallow fields. Sporophytes mature in late spring to fall. See *Micromitrium synoicum* for a list of associated species.

Distribution — *Physcomitrium immersum* is known from North and South America. In western North America, it is known from British Columbia, Oregon, and California. In Oregon, *P. immersum* is reported from Benton, Lincoln, and Lane counties within the Coast Range and Willamette Valley ecoregions.

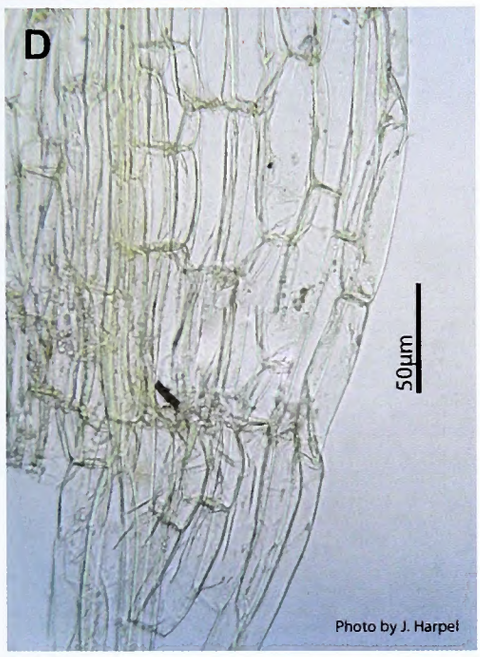
References with descriptions and/or illustrations — McIntosh (in FNA 2007, p. 198), Crum and Anderson (1981, p. 459), Lawton (1971, p. 154).

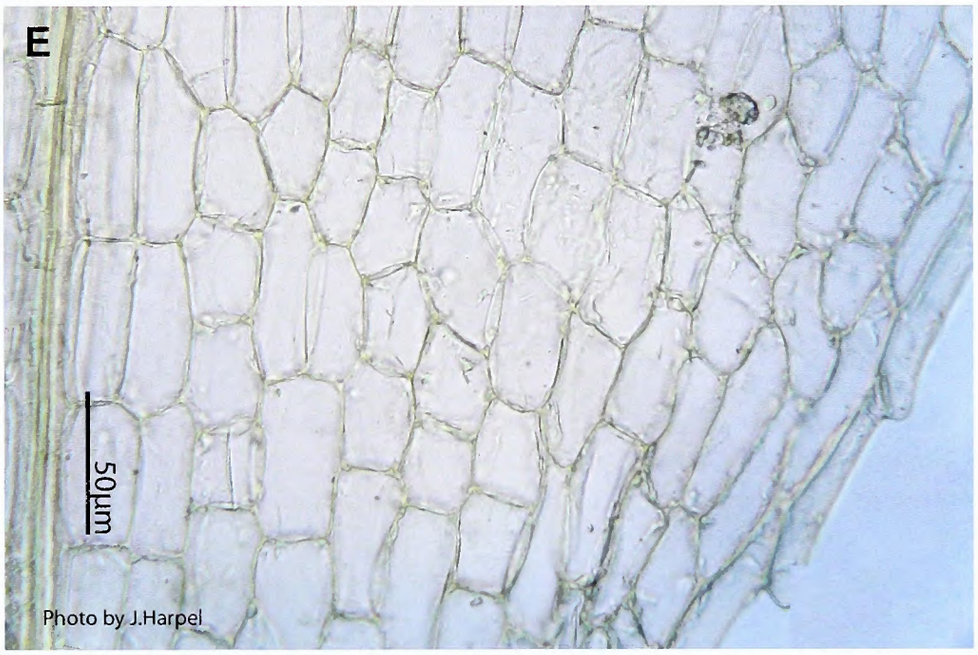
Plate 59. Physcomitrium immersum. *A. Habitat. B. Individual plant. C. Leaf. D. Alar and basal cells. E. Upper medial cells. F. Leaf apex. G. Sporophyte. (J. Christy 8505. 1152. UBC)*

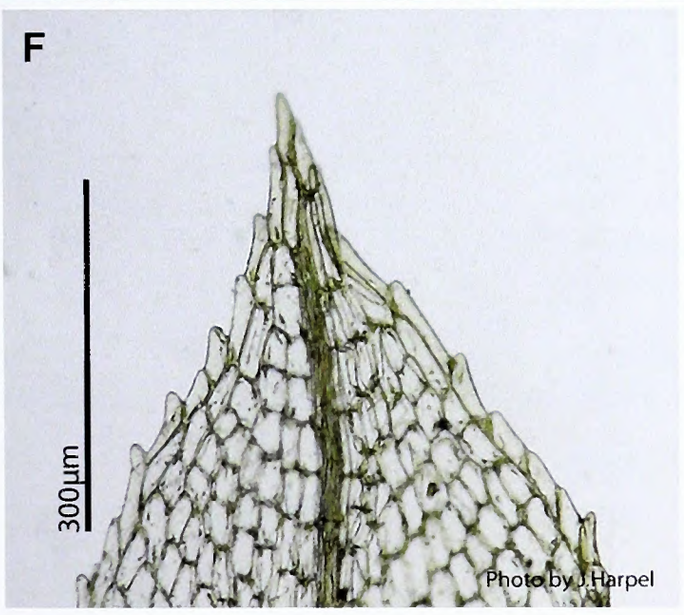

1 mm
Photo by J. Harpel
A

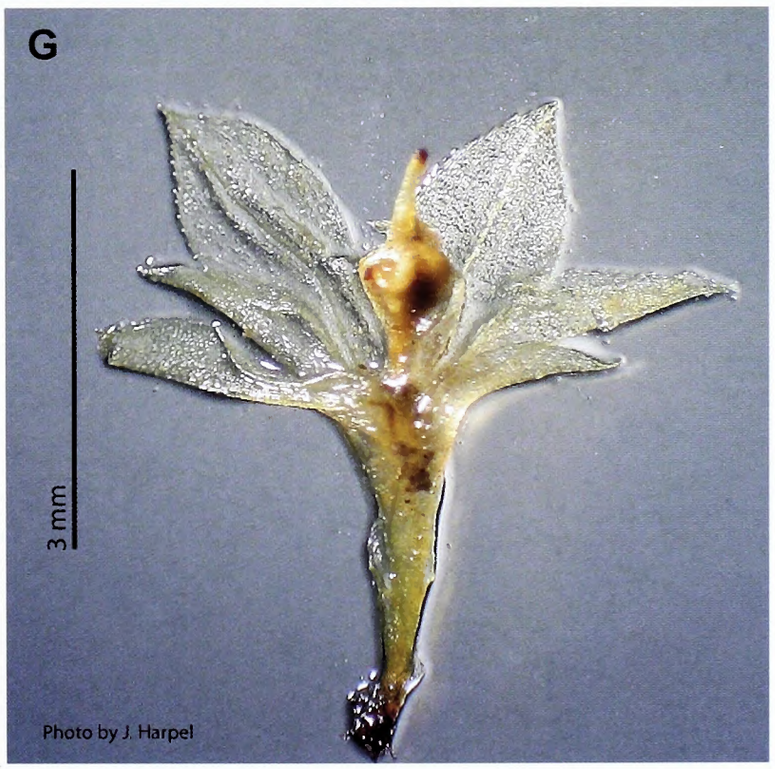

B
3 mm
Photo by J. Harpel


C
1 mm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


E
50µm
Photo by J.Harpel


F
300µm
Photo by J.Harpel


G
3 mm
Photo by J. Harpel

Plagiobryum zierii (Dickerson) Lindberg

Recent synonyms:
Bryum zierii Hedwig
Pohlia zierii (Hedwig) Schwäegrichen
Common name: zierian hump-moss

Summary — An acrocarpous, costate moss with julaceous, oblong-ovate leaves. Terrestrial.

Diagnostic characteristics — *Plagiobryum zierii* is distinguished by its (1) light green to whitish coloration, (2) julaceous imbricate habit with concave ovate leaves, (3) distinctive zygomorphic capsule with a long neck and geniculate seta, (4) spores that shed in tetrads, and (5) plane leaf margins.

Technical description

GAMETOPHYTE — **Plants**, shiny, light green, to silvery or whitish-green above, reddish below, forming soft, dense tufts up to 3 cm tall. **Leaves** imbricate, ovate or broadly oblong-ovate, acute with a recurved apiculus; margins plane, entire; costa reddish ending just below the apex; upper median cells hyaline, thin-walled, oblong-rhombodial, 14–24 µm wide, marginal cells longer, but not forming a distinct border; basal cells shorter, thin-walled. **Dioicous**.

SPOROPHYTE — **Seta** 6–10 mm long, yellow-brown, curved. **Capsules** yellow-brown, 3–5 mm long, zygomorphic, more or less horizontal with an oblique mouth, neck 1–2 times the length of the urn; peristome teeth double, brown to yellowish-brown. **Spores** globose to ovoid, 34–40 µm, more or less finely papillose, often occuring as tetrads at maturity.

Similar species — One other species, *Plagiobryum demissum,* is red to red-brown, but it is not known from Oregon. The larger tufts, lax and thin-walled leaf cells, and distinct long necked capsules separate *Plagiobryum zierii* from *Anomobryum julaceum* and *Bryum argenteum*, two similar julaceous species.

Ecology — *Plagiobryum* is a small genus of arctic-alpine species. It occurs on wet or damp shaded crevices in rock cliffs and on humus over rock cliffs. In eastern North America, it is reported from wet rocks, often in the spray zone of waterfalls. In Oregon, *Plagiobryum zierii* is known from damp, shaded cliff shelves. Crum and Anderson (1981) suggest that this an alpine species. Elevations from the Oregon and Washington collections range between 150 to 4,000 feet.

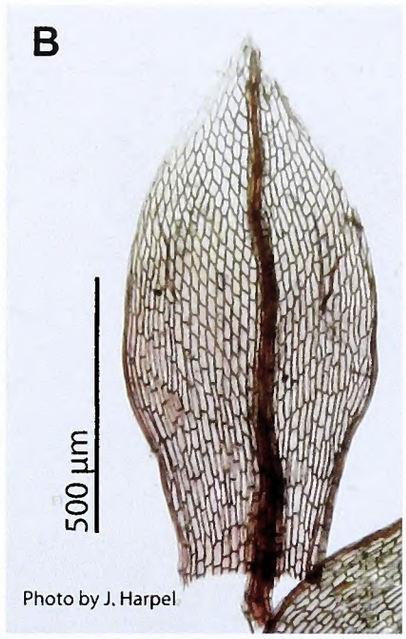
Distribution — *Plagiobryum zierii* is known from Eurasia, Africa, Iceland, Greenland, and North and Central America. In western North America, it is known from Alaska, Yukon, British Columbia, Alberta, Washington, Oregon, Idaho, Montana, Wyoming, and Colorado. In Oregon, *P. zierii* is reported from Clatsop, Linn, and Multnomah counties within the Coast Range and West Cascades ecoregions.

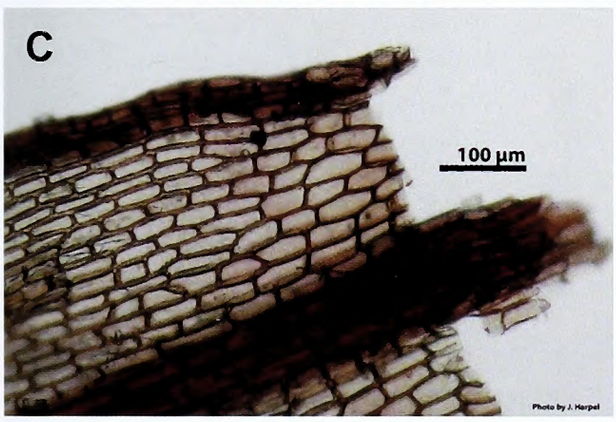
References with descriptions and/or illustrations — Hedderson (in FNA 2014, p. 153), Smith (2004, p. 528), Sharp et al (1994, p. 501), Shaw (1982), Crum and Anderson (1981, p. 535), Lawton (1971, p. 179), Nyholm (1958, p. 212), Dixon (1954, p. 341), Grout (1935, p. 210).

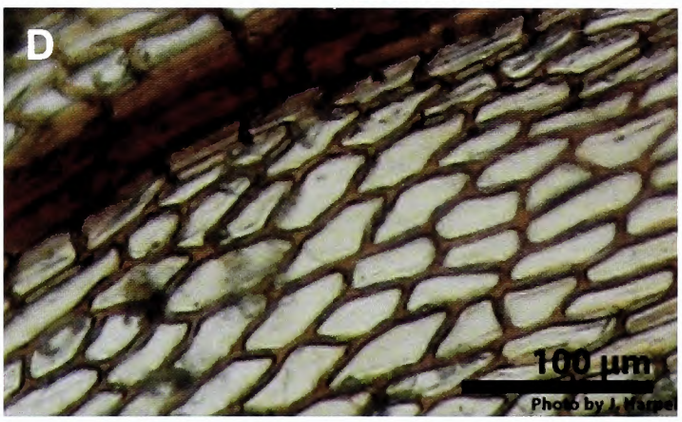
References with photos — Lockhart et al. (2012, p. 469), Atherton et al. (2010, p. 578).

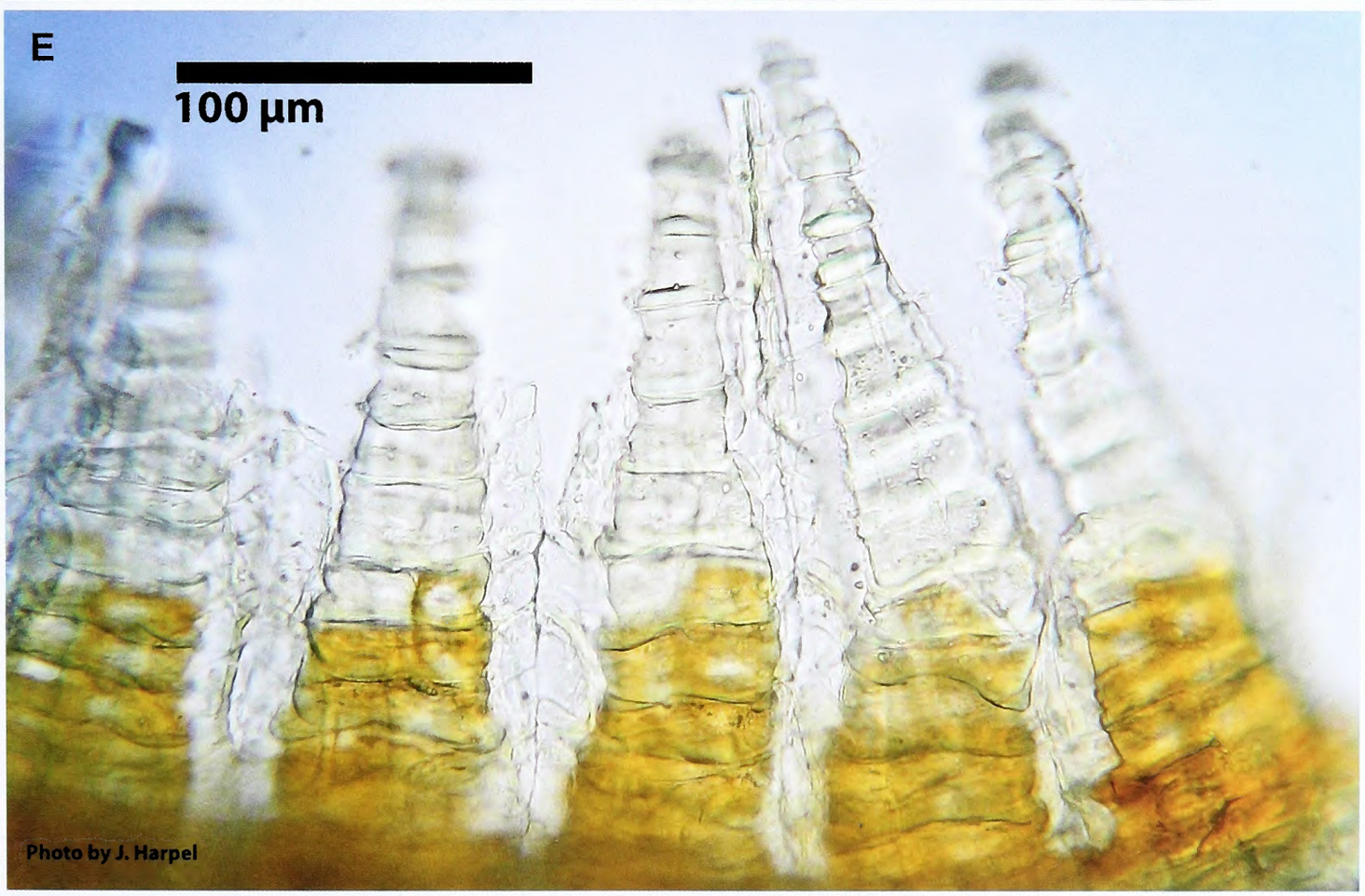
Plate 60. Plagiobryum zierii. *A. Habitat with sporophytes. B. Leaf. C. Alar and basal cells. D. Upper medial cells. E. Peristome teeth. (W. Schofield 106269. UBC)*


A
3 mm
Photo by J. Harpel


B
500 µm
Photo by J. Harpel


C
100 µm


D
100 µm


E
100 µm
Photo by J. Harpel

Plagiopus oederianus (Swartz) H.A. Crum & L.E. Anderson

Recent synonyms:
Bartramia oederiana Swartz
Plagiopus oederi (Bridel) Limpricht
Common name: Oeder's apple-moss

Summary — An acrocarpous, costate moss with linear-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Plagiopus oederianus* can be distinguished by its (1) triangular stems with leaves in 3 rows, (2) linear lanceolate leaves with cuticular ridges, (3) flexuose or crisped leaves when dry, (4) stems covered in brown rhizoids, and (5) strongly ribbed and globose capsule.

Technical description

GAMETOPHYTE — **Plants** in dense, dull green to yellowish-brown tufts up to 10 cm tall. **Stems** more or less covered with brown rhizoids, triangular in cross-section. **Leaves** linear-lanceolate, acute, keeled, 2–3.5 (–5) mm long, erect to spreading when moist, somewhat crisped and contorted when dry; margins unistratose, recurved, coarsely serrate above, smooth below; costa single, percurrent, toothed near the apex on dorsal side; upper median cells quadrate to rectangular, cuticle irregularly roughened in longitudinal lines or ridges appearing as minutely pluri-papillose; basal cells longer and smooth. **Synoicous**.

SPOROPHYTE — **Seta** 7–18 mm long, straight. **Capsules** more or less globose, brown to reddish-brown, zygomorphic, suberect to inclined, strongly ribbed when dry; peristome teeth double, endostome yellow, exostome dark brown. **Spores** coarsely papillose, globose to ellipsoidal, 15–27 µm.

Similar species — Other genera in the Bartramaceae are similar but lack leaves in distinct rows and have papillose upper laminal cells. *Plagiopus* has a triangular stem and the upper laminal cells are weakly striate. See *Philonotis yezoana* for additional similar species.

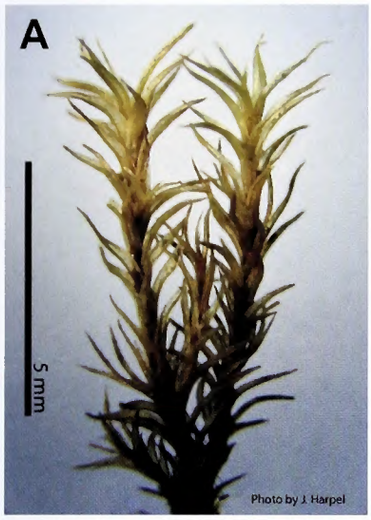
Ecology — *Plagiopus oderianus* occurs on shaded, humid calcareous cliffs and rocks in crevices and on vertical faces. Washington and Oregon herbarium habitat notes list *P. oderianus* as occurring on limestone bluffs, the wet faces of basalt bluffs, and on wet rocks. Lawton (1971) noted that *P. oederianus* was found from lowland to 5,700 foot elevations.

Distribution — *Plagiopus oderianus* is known from Eurasia, Greenland, North America, and Hawaii. In western North America, it is known from Alaska, British Columbia, Alberta, Washington, Oregon, Idaho, Montana, and Colorado. In Oregon, *P. oderianus* is reported from Multnomah County within the West Cascades ecoregion.

References with descriptions and/or illustrations — Griffin III (in FNA 2014b, p. 99), Ireland (1982), Crum and Anderson (1981, p. 636 as *Plagiopus oederiana*), Lawton (1971, p. 212 as *Plagiopus oederi*), Nyholm (1960, p. 301 as *P. oederi*), Dixon (1954, p. 314 as *Bartramia oederi*), Grout (1935, p. 157 as *Plagiopus oederi*).

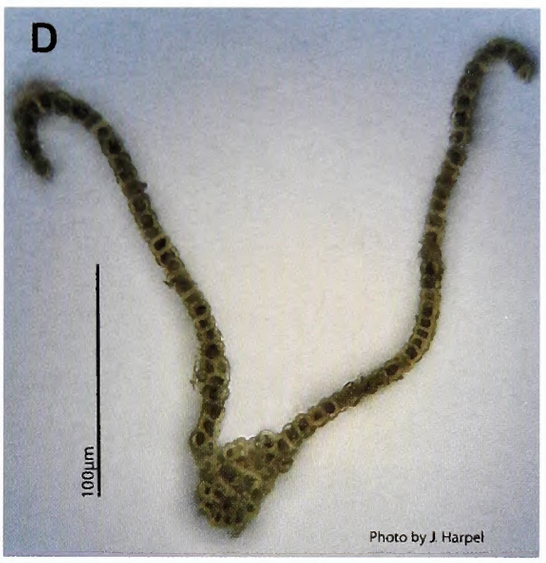
References with photos — Lockhart et al. (2012, p. 459), Atherton et al. (2010, p. 628).

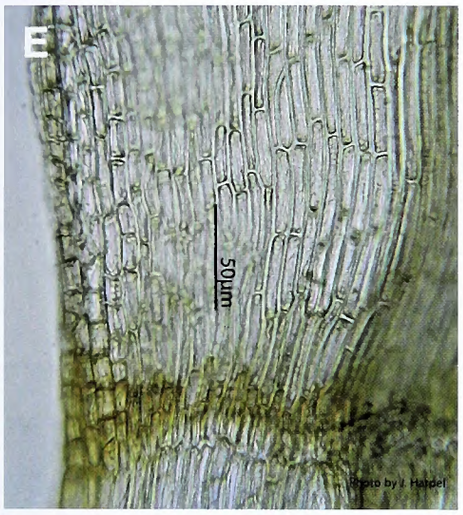
Plate 61. Plagiopus oederianus. *A. Moist habitat. B. Dry habitat with sporophyte. C. Leaf. D. Leaf cross-section. E. Alar and basal cells. F. Upper medial cells. G. Leaf apex. H. Moist urn. I. Dry urn. J. Stem-cross section. (J. Harpel 3742. Harpel Private)*

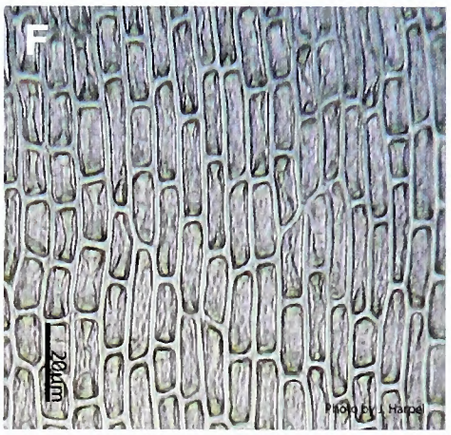

A
5 mm
Photo by J. Harpel

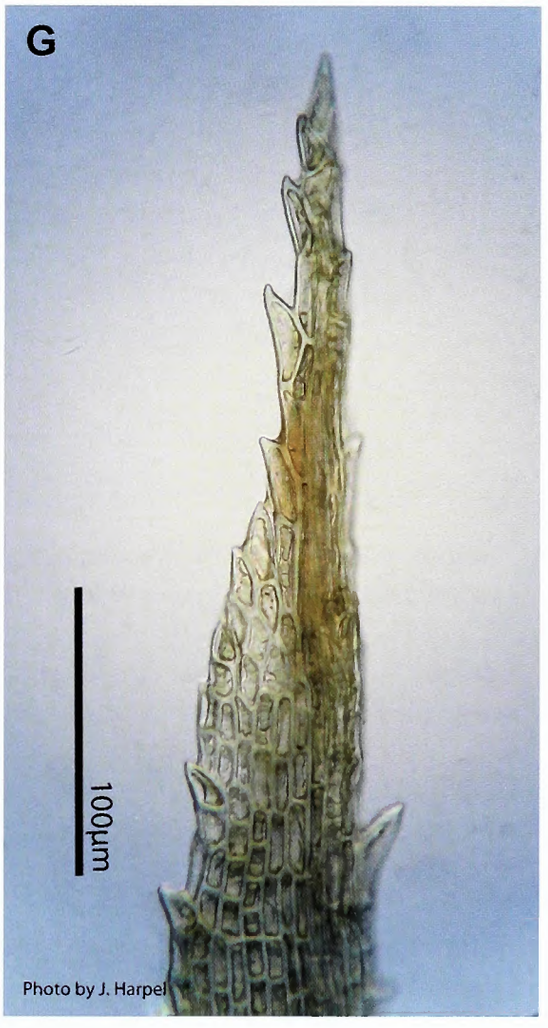

B
10 mm
Photo by J. Harpel


C
3 mm
Photo by J. Harpel


D
100µm
Photo by J. Harpel

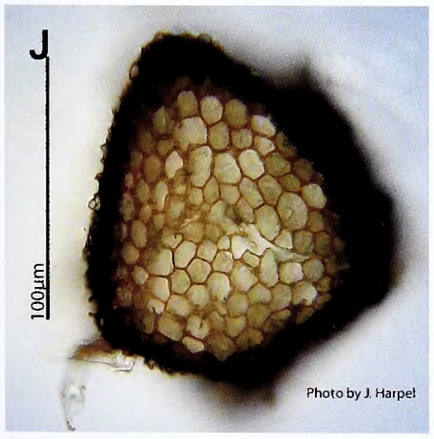

E
50µm
Photo by J. Harpel


F
20µm
Photo by J. Harpel


G
100µm
Photo by J. Harpel


H
2 mm
Photo by J. Harpel


I
2 mm
Photo by J. Harpel


J
100µm
Photo by J. Harpel

Plagiothecium cavifolium (Bridel) Z. Iwatsuki

Recent synonyms:
Plagiothecium roseanum Schimper
Plagiothecium sylvaticum (Bridel) Schimper
Common name: round silk-moss

Summary — A pleurocarpous moss with concave, ovate-lanceolate leaves with a short, forked costa. Terrestrial.

Diagnostic characteristics — *Plagiothecium cavifolium* can be distinguished by its (1) julaceous symmetric (or nearly so) leaves, (2) strongly decurrent concave leaves, (3) acute to short-acuminate leaf apices, (4) short and often branched costa, and (5) non-auriculate decurrent alar cells.

Technical description

GAMETOPHYTE —**Plants** in shiny, yellowish to golden or bright green mats. **Stems** and branches crowded, ascending, and terete-foliate or (less often) prostrate and loosely and irregularly complanate-foliate; decurrencies narrow, triangular, not bulging as auricles, consisting of rectangular cells. **Leaves** typically crowded and erect or remote and irregularly complanate, and somewhat contorted when dry, usually concave, 1.5–3 mm long, symmetric, ovate-lanceolate to oblong-ovate, abruptly narrowed to a short, acute often recurved apex or gradually narrowed to a short or long acumen; margins often narrowly revolute near the base, sometimes nearly to the apex, entire or sparsely serrulate at the tip; costa with 1 branch usually to 1/3–1/2 the leaf length; cells long-rhomboidal. Small, cylindric gemmae (propagula) sometimes present in axillary clusters on leaves. **Dioicous**.

SPOROPHYTE — **Seta** 9–20mm long. C**apsules** suberect and symmetric or somewhat inclined and more or less asymmetric, 1.5–2.5 mm long, smooth. **Spores** 9–13 µm. Lawton (1971) commented, "rarely fruiting".

Similar species — *Plagiothecium cavifolium* is distinguished from other *Plagothecium* species by its rectangular alar cells with concave leaves with plane to narrowly recurved leaf margins with an acute or slender acuminate apex.

Ecology — *Plagiothecium cavifolium* is found on moist basic rock ledges in the mountains, shaded humic soils or sometimes on rotten wood or tree bases, usually in hardwood forests.

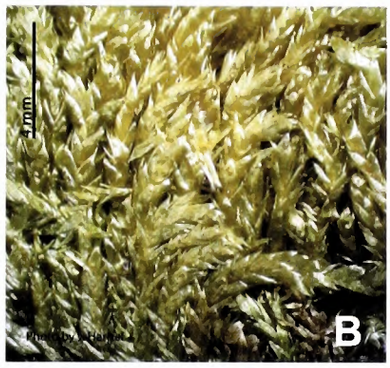
Distribution — *Plagiothecium cavifolium* is known Eurasia, Iceland, Greenland, and North America. In western North America, it is known from British Columbia, Washington, Oregon, California, and Colorado. In Oregon, *P. cavifolium* is reported from Clatsop, Lane, and Multnomah counties within the Coast Range and West Cascades ecoregions.

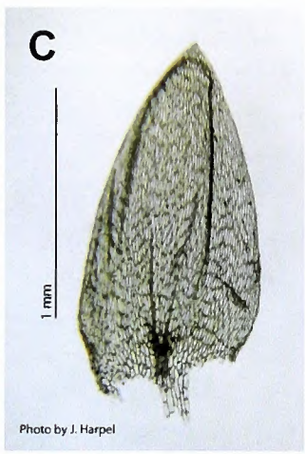
References with descriptions and/or illustrations — Ireland (in FNA 2014, p. 486), Smith (2004, p. 876), Crum (2004, p. 480), Crum and Anderson (1981, p. 1098), Lawton (1971, p. 319 as *P. roseanum*).

References with photos — Lockhart et al. (2012, p. 561), Atherton et al. (2010, p. 783).

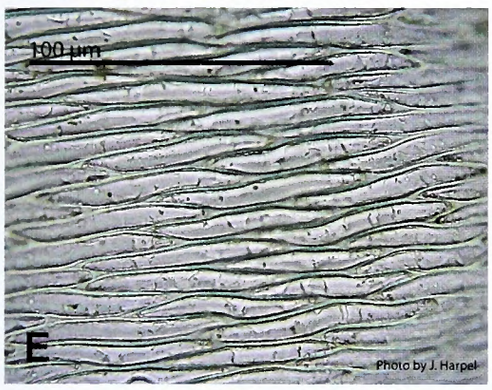
Plate 62. Plagiothecium cavifolium. *A. Moist habitat. B. Dry habitat. C. Stem leaf. D. Branch leaf. E. Upper medial cells. F.Leaf apex. G. Alar and basal cells. H–I. Sporophytes. J. Operculum. K. Peristome teeth. (W. Schofield 21729.78977. UBC)*

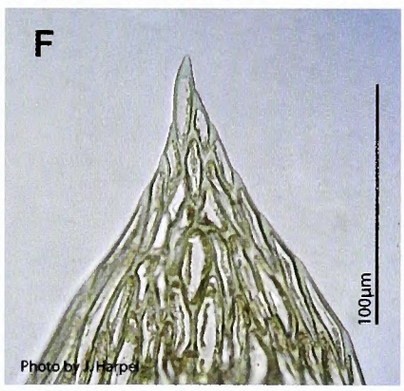

A
4 mm
Photo by J. Harpel

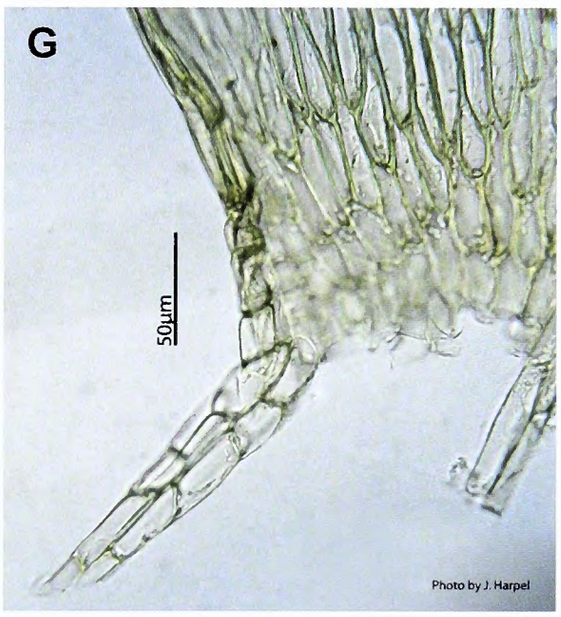

B
4 mm


C
1 mm
Photo by J. Harpel

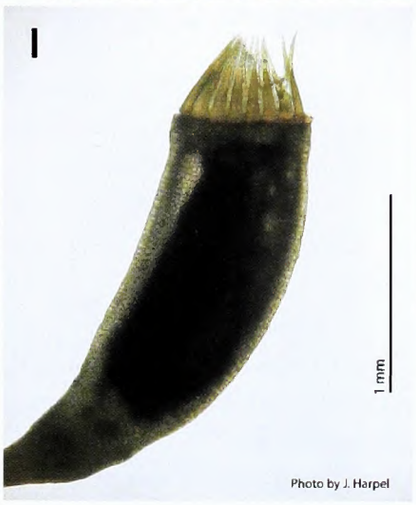

D
500 µm
Photo by J. Harpel

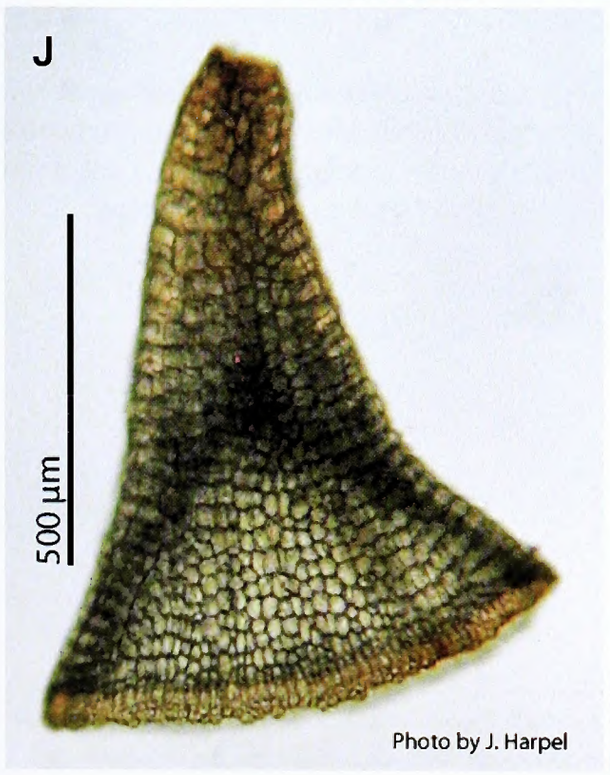

100 µm
E
Photo by J. Harpel

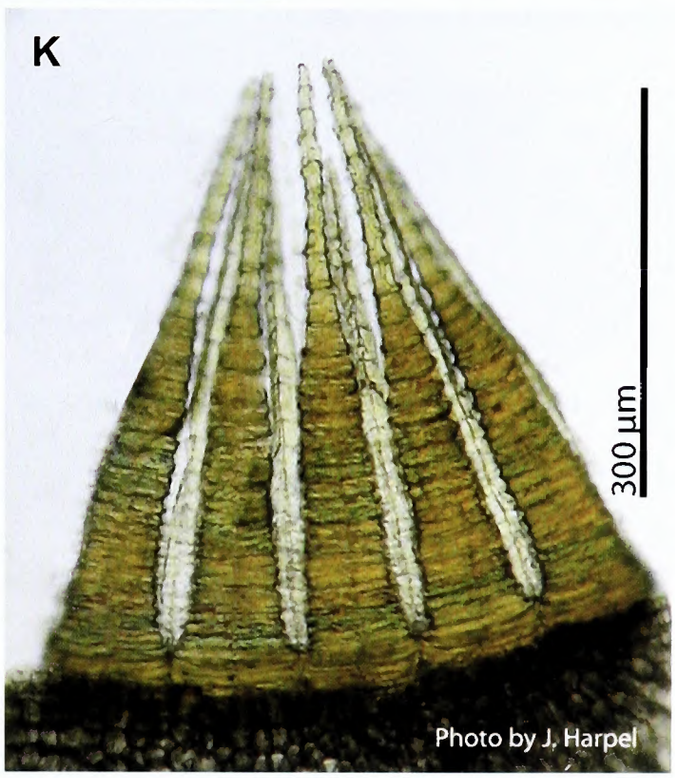

F
100µm
Photo by J. Harpel


G
50µm
Photo by J. Harpel


H
3 mm
Photo by J. Harpel


I
1 mm
Photo by J. Harpel


J
500 µm
Photo by J. Harpel


K
300 µm
Photo by J. Harpel

Plagiothecium piliferum (Swartz) Schimper

Recent synonyms: none
Common name: hair silk-moss

Summary — A pleurocarpous moss with complanate, ovate-lanceolate leaves with a short, forked costa. Terrestrial.

Diagnostic characteristics — *Plagiothecium piliferum* can be distinguished by its (1) complanate habit, (2) concave ovate-lanceolate leaves, (3) decurrent leaves, and (4) long acuminate leaf apices that are often twisted and contorted away from the stem.

Technical description

Gametophyte — **Plants** light green to yellow-green, glossy, forming dense mats up to 6 cm long. **Stems** and branches prostrate, complanate to subjulaceous. **Leaves** appressed, 0.8–2 × 0.4–0.8 mm, oblong-ovate, usually concave, not undulate, symmetric, abruptly contracted to a long, filiform, flexuose acumen, sometimes 1/3 the length of the leaf; margins usually narrowly recurved almost to the apex, entire, or minutely serrulate at the tip; costa short, double or lacking; leaf cells smooth; basal cells with pitted walls; decurrent alar cells triangular in 2 vertical rows terminating at the base in a single cell. **Autoicous**.

Sporophyte — **Seta** reddish-yellow, 0.8–1.5 cm long. **Capsules** cylindric, 0.4–0.7 mm long, erect or slightly inclined, smooth or slightly wrinkled when dry; peristiome teeth double, finely papillose below, coarsely papillose above. **Spores** 12–14 µm, finely papillose.

Similar species — *Plagiothecium piliferum* is distinguished from other *Plagiothecium* species by its concave, decurrent, long piliferous leaves with rectangular alar cells.

Ecology — *Plagiothecium piliferum* occurs on trunks of trees (especially on *Alnus rubra*), moist humid cliffs, and rocks along streams. Schofield (1976) commented that *P. piliferum* occurs throughout the southern half of British Columbia from sea level to subalpine elevations. In the Oregon Coastal Mountains *P. piliferum* occurs on large basalt boulders and cliff faces beneath a closed conifer canopy within the western hemlock plant association, between 1,200–3,000 feet in elevation.

Distribution — *Plagiothecium piliferum* is known from Eurasia, Greenland, and North America. In western North America, it is known from Alaska, Northwest Territories, British Columbia, Washington, Oregon, California, Idaho, and Montana. In Oregon, *P. piliferum* is reported from Benton, Clatsop, Douglas, Jackson, Josephine, Lane, Linn, Polk, and Tillamook counties within the Coast Range, Klamath Mountain, and West Cascades ecoregions.

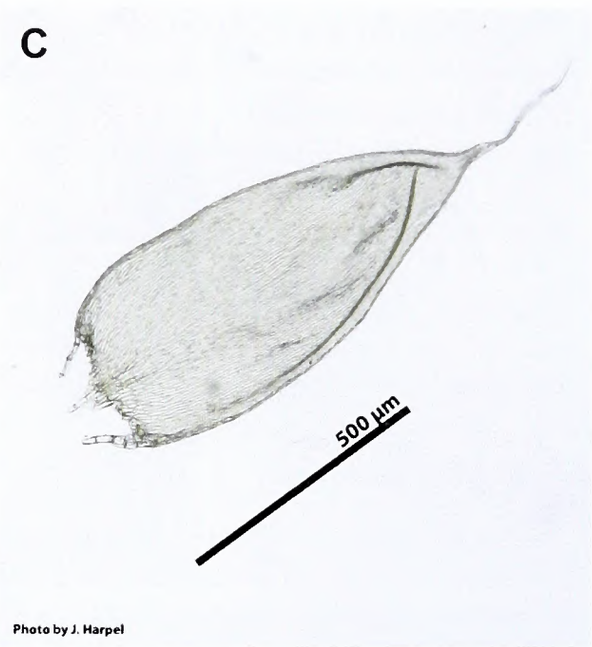
References with descriptions and/or illustrations — Ireland (in FNA 2014, p. 485), Smith (2004, p. 868), Lawton (1971, p. 318), Nyholm (1965, p. 635), Dixon (1954, p. 481), Grout (1932, p. 159).

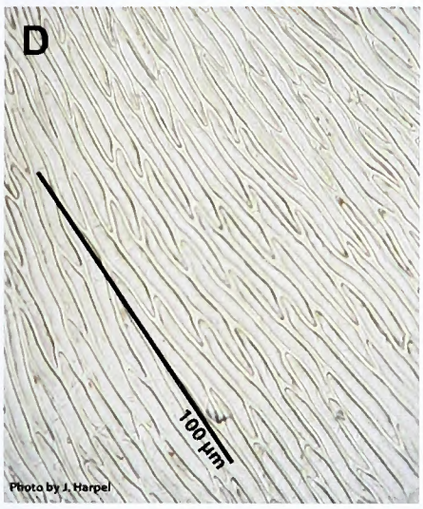
References with photos — Malcolm et al. (2009, p. 300).

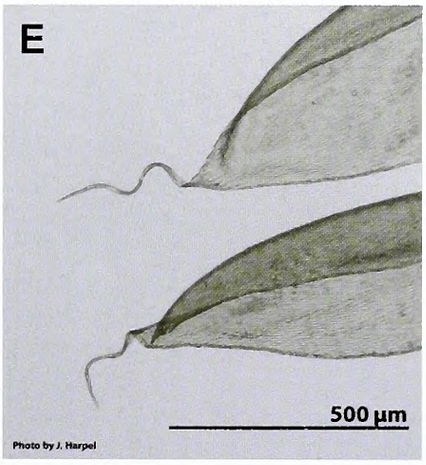
Plate 63. Plagiothecium piliferum. *A. Habitat. B. Individual plant. C. Leaf. D. Upper medial cells. E. Leaf apex's. F. Alar and basal cells. G. Perigonum and perichaetium. H. Sporophyte. I. Operculum. (J. Harpel 17472. Harpel Private)*

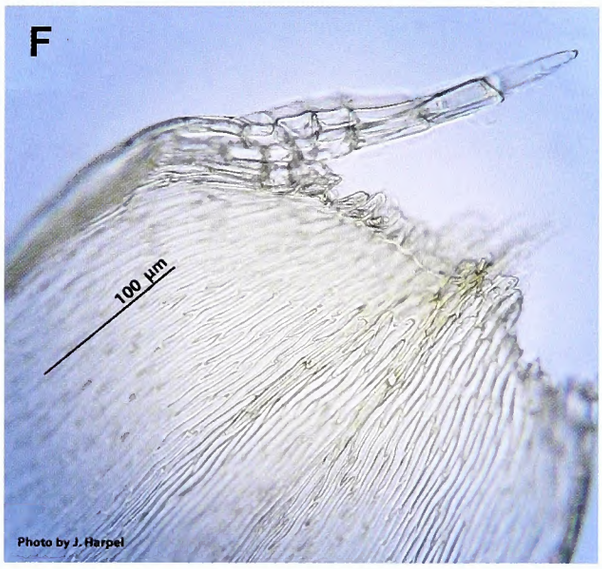

A
2 mm

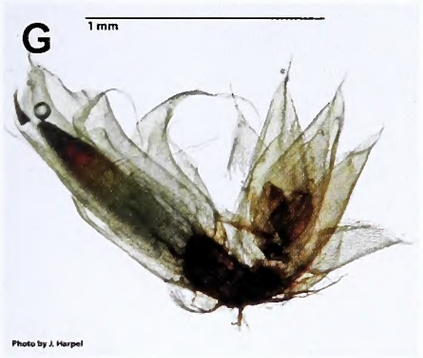

B
1 mm
Photo by J. Harpel

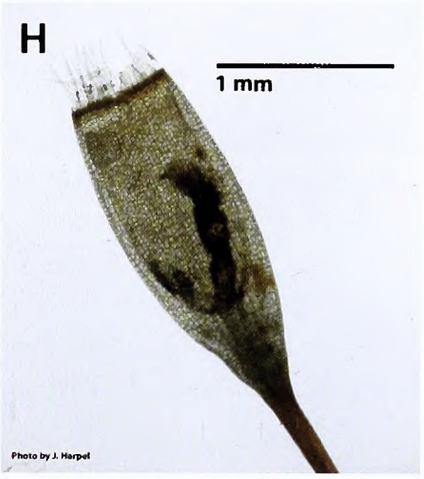

C
500 µm
Photo by J. Harpel

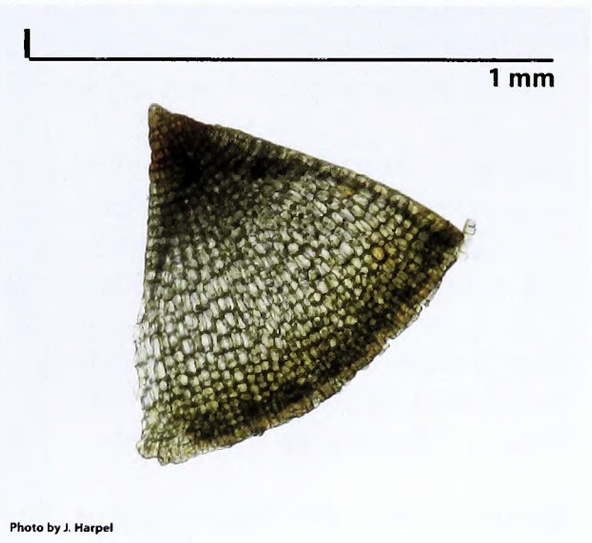

D
100 µm
Photo by J. Harpel


E
500 µm
Photo by J. Harpel


F
100 µm
Photo by J. Harpel


G
1 mm
Photo by J. Harpel


H
1 mm
Photo by J. Harpel


I
1 mm
Photo by J. Harpel

Pohlia bolanderi (Lesquereux) Brotherus

Recent synonyms: none
Common name: Bolander's thread-moss

Summary — An acrocarpous, costate moss with ovate-lanceolate, serrulate leaves. Terrestrial.

Diagnostic characteristics — *Pohlia bolanderi* can be distinguished by its (1) lack of axillary gemmae, (2) plane leaf margins, (3) serrulate to serrate leaf apex, (4) dioicous sexual condition, (5) lack of decurrent leaves, and (6) cylindric capsules inclined 35–90° from vertical.

Technical description

Gametophyte — **Plants** small to medium-size, somewhat shiny green or sometimes pale whitish. **Stems** 0.3–1.5 cm. **Leaves** 0.8–1.6 mm, erect, more or less spreading, lanceolate to narrowly ovate-lanceolate, acute; margins serrulate to serrate in the upper 1/3; costa subpercurrent or percurrent; upper medial cells linear-rhomboidal, 55–100 µm, thin-walled. **Dioicous**.

Sporophyte — **Seta** straw colored to orange-brown. **Capsules** inclined 35–90° from vertical, straw colored to orange-brown, slenderly pyriform, neck about one-half to one times the length of the urn; exothecial cells elongate-rectangular, walls straight; stomata superficial; operculum conic; exostome teeth yellow to yellow-brown, acute-triangular, pitted basally, coarsely papillose above; endostome hyaline; basal membrane 1/4 to 1/2 times the exostome length, segments narrowly keeled, narrowly perforate to entire, cilia absent to rudimentary. **Spores** 16–26 µm, distinctly roughened.

Similar species — *Pohlia* can be distinguished from *Mielichhoferia* by its double peristome and terminal perichaetia, while *Epipterygium* is distinguished by its slightly complanate leaves and dorsal leaves in 1–3 rows that are smaller than the lateral leaves. *Pohlia bolanderi* is separated from *P. longicollis* by its smaller overall size and relatively broader leaves, less coarsely serrate leaves, and dioicous condition (*P. longicollis* is paroicous). Shaw (in FNA 2014) notes that *Pohlia bolanderi* variety *seriata* is characterized by whitish, ranked leaves and could be confused with *Conostomum tetragonum*.

Pohlia can be distinguished from *Bryum* sensu lato, by its longer median leaf cells (5:1) or (if shorter) its erect capsule, leaves never bordered, and a costa ending before the apex to procurrent (never excurrent).

Ecology — According to Shaw (1982a), *P. bolanderi* occurs on dry soil in alpine and subalpine areas and occasionally along streams in high montane to alpine areas. Habitat information from Oregon and Washington herbarium labels, which list 5,400–7,000 foot elevations, cite base of cliffs and boulders in an open lava field on a western slope, thin dry soil over rock, dry shaded rock, dry soil in a graminoid meadow, and dry exposed soil in alpine tundra.

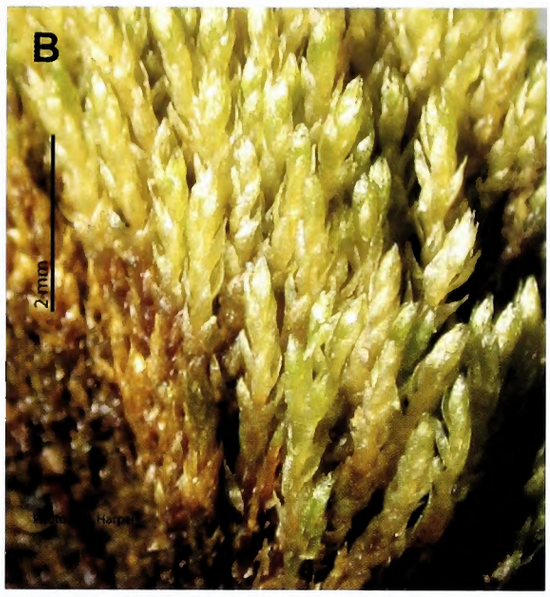
Distribution — *Pohlia bolanderi* is known from Eurasia and North America. In western North America, it is known from Alaska, British Columbia, Washington, Oregon, California, Colorado, Utah, Nevada, and New Mexico. In Oregon, *P. bolanderi* is reported from Clackamas, Jackson and Lane counties within the West Cascades ecoregion.

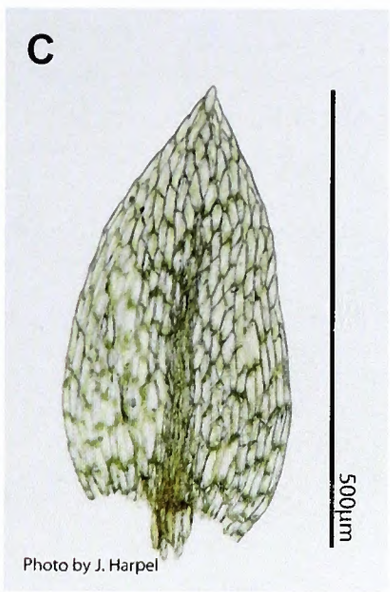
References with descriptions and/or illustrations — Shaw (in FNA 2014a, p. 198), Rams et al. (2004), Lawton (1971, p. 185 as *Pohlia longicolla*).

References with photos — Malcolm et al. (2009, p. 186).

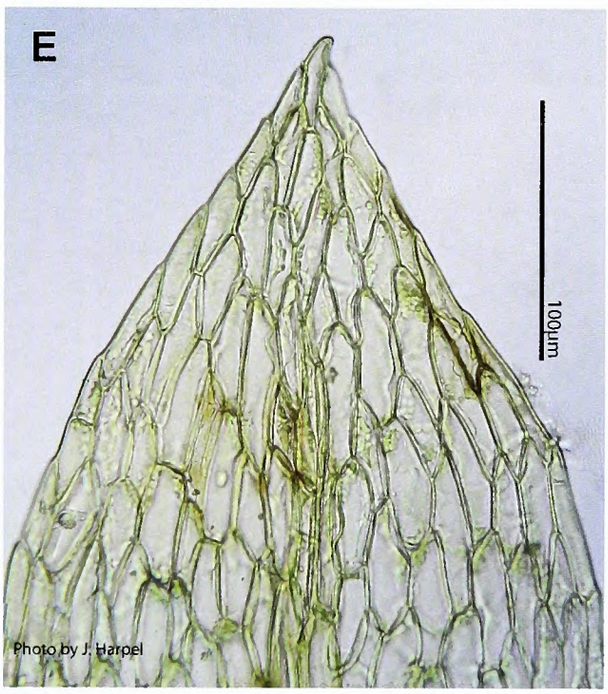
Plate 64. Pohlia bolanderi. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Upper medial cells. E. Leaf apex. F. Alar and basal cells. (J. Spence 2434. UBC)*

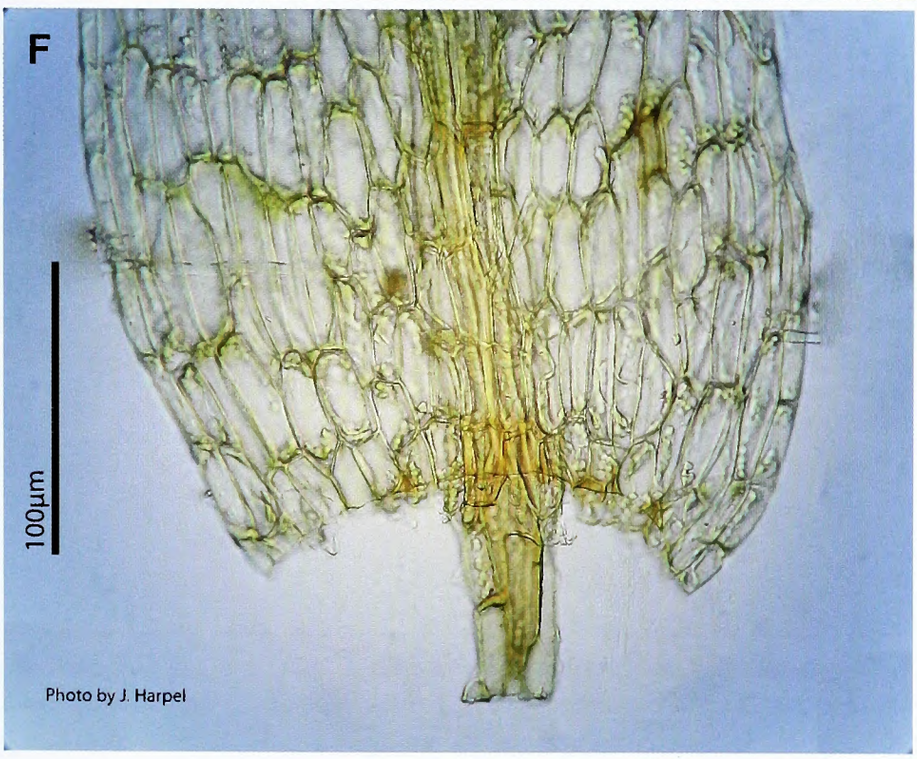

A
2 mm
Photo by J. Harpel


B
2 mm


C
500µm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


E
100µm
Photo by J. Harpel


F
100µm
Photo by J. Harpel

Pohlia cardotii (Renauld) Brotherus

Recent synonyms: none
Common name: Cardot's pohlia moss

Summary — An acrocarpous, costate moss with ovate-lanceolate often serrulate leaves. Terrestrial.

Diagnostic characteristics — *Pohlia cardotii* can be distinguished by its (1) strongly recurved to revolute leaf margins, (2) more or less porose thick cell walls, (3) broad costa base, (4) lack of gemmae (5) erect capsules, and (6) alpine habitat.

Technical description

Gametophyte — **Plants** 1–10 (–25) mm tall, branched or unbranched, dull green to yellow-green and brown below. **Stems** matted with rhizoids. **Leaves** 0.6–1.5 mm long, crowded and imbricate when dry, erect to erect-spreading when wet, ovate to ovate-lanceolate, the tips acute to obtuse; margins strongly recurved, serrulate or entire near apex; costa strong, wide at the base and filling 1/3 or more of leaf base; upper cells of midleaf short-rhombic or irregularly rounded and with thickened more or less porose walls; basal cells rectangular; gemmae not present. **Dioicous**.

Sporophyte — **Seta** up 15 mm long, reddish-brown, flexuose or bent. **Capsules** 2–3 mm long, dark brown, erect, symmetric, narrowly pear-shaped (pyriform), neck nearly as long as the capsule. **Spores** 14–19 µm, finely roughened.

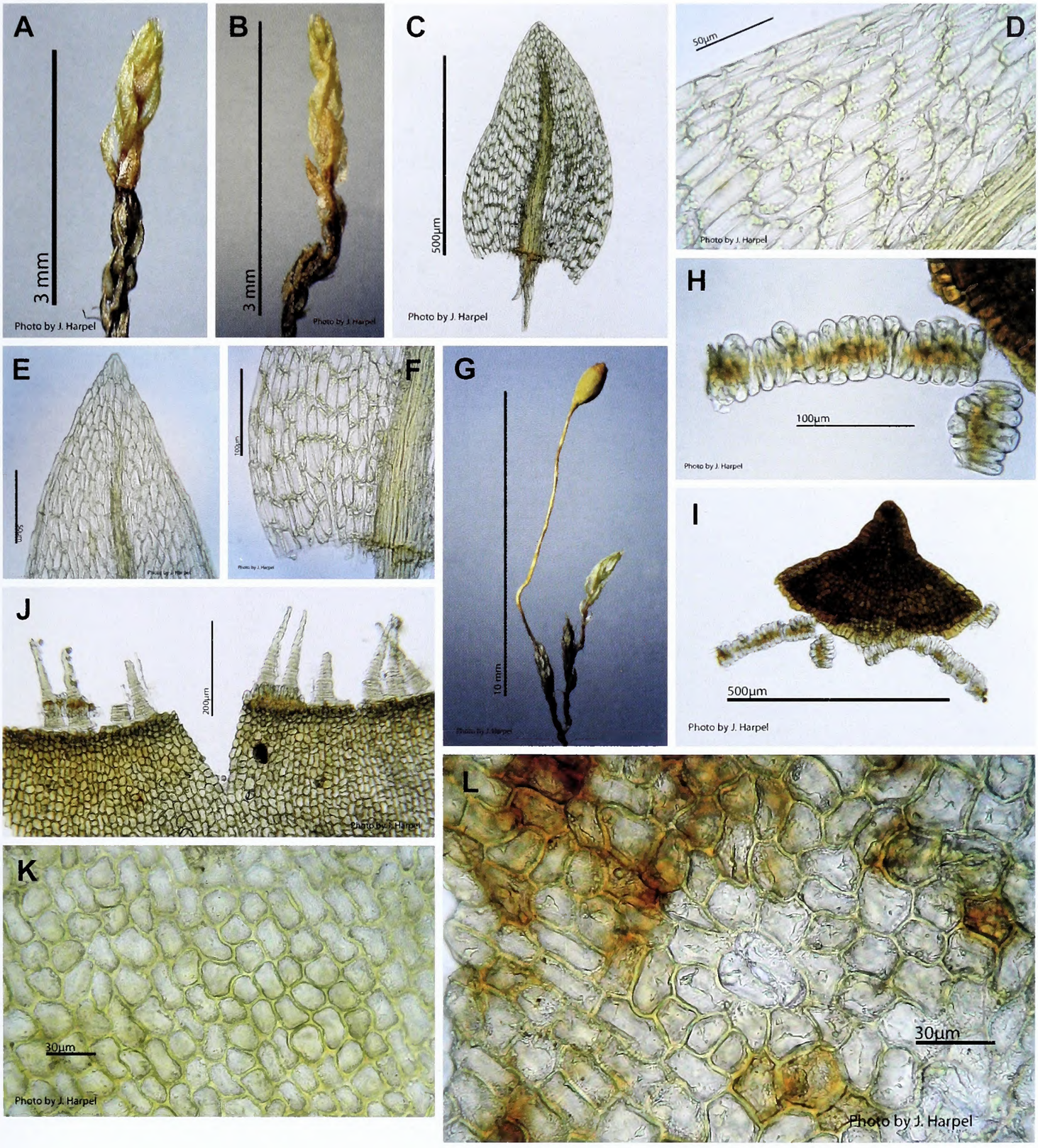
Similar species — *Pohlia cardotii* can be distinguished from other *Pohlia* species by its lack of gemmae, recurved leaf margins, and ovate-lanceolate leaves. *Pholia crudoides* is similar but has narrow and long lanceolate leaves and thin, non-porose cell walls. See *Pohlia bolanderi* for additional similar species.

Ecology — *Pohlia cardotii* forms deep turfs or is mixed with other mosses on wet soil or along snowmelt streamlets in subalpine and alpine habitats; it is sometimes locally abundant. Elevations range from 6,000–8,000 feet. Shaw (2014) calls *P. cardotii* a "rare alpine species." On Mt. Hood, *Pohlia cardotii* occurs at or above timberline at about 6,500 ft elevation, where the plant association is probably *Cassiope mertensiana* or *Phyllodoce empetriformis*.

Distribution — *Pohlia cardotii* is known from Eurasia and North America. In western North America, it is known from Alaska, British Columbia, Washington, Oregon, and California. In Oregon, *P. cardotii* is reported from Clackamas and Lane counties within the West Cascades ecoregion.

References with descriptions and/or illustrations — Shaw (in FNA, 2014a, p. 202), Lawton (1971, p. 182), Andrews (1935, p. 190).

Plate 65. Pohlia cardotii. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Upper medial cells. E. Leaf apex. F. Alar and basal cells. G. Sporophyte. H. Annulus. I. Operculum and annulus. J. Peristome teeth. K. Exothecial cells. L. Superficial stomata. (W. Schofield 75741. UBC)*


A
3 mm
Photo by J. Harpel
B
3 mm
C
500µm
Photo by J. Harpel
D
50µm
Photo by J. Harpel
E
F
100µm
G
10 mm
H
100µm
Photo by J. Harpel
I
500µm
Photo by J. Harpel
J
200µm
K
30µm
Photo by J. Harpel
L
30µm
Photo by J. Harpel

Pohlia ludwigii (Sprengel) Brotherus

Recent synonyms: none
Common name: Ludwig's thread-moss

Summary — An acrocarpous, costate moss with decurrent, ovate-lanceolate often serrate leaves. Terrestrial.

Diagnostic characteristics — *Pohlia ludwigii* can be distinguished by its (1) pinkish-green color, (2) broadly ovate-lanceolate leaves, (3) long decurrent leaves, (4) lack of gemmae, (5) dioicous habit, (6) inclined and pyriform capsules, and (7) alpine habitat.

Technical description

Gametophyte — **Plants** dull green to pinkish-green forming deep turfs up to 1 cm tall. **Leaves** appressed when dry, 1.5–2.0 (–2.6) mm long, ovate to ovate-lanceolate, bluntly acute; concave, strongly decurrent; margins recurved in the upper part, entire, serrate at the apex; costa reddish at base, ending before the apex; upper medial cells elongate-rhomboidal, 16–24 µm wide. **Dioicous**.

Sporophyte — **Seta** orange-brown. **Capsules** more or less pendulous, broadly pyriform, stomata superficial, peristome teeth double, yellow to brown, coarsely papillose. **Spores** 14–21 µm, roughened.

Similar species — *Bryum weigelii* is a red to pinkish colored species that also has long decurrent leaves and grows in similar habitats. It can be separated from *P. ludwigii* by its shorter upper medial cells, bordered margin, and leaves more widely spaced down the stem. See *Pohlia bolanderi* for additional similar species.

Ecology — *Pohlia ludwigii* generally occurs on rich moist snowmelt areas in arctic or subalpine regions or on soil and banks by streams or rock edges in areas with late snowmelt. Washington sites range from 4,600 to over 7,000 feet in elevation. Both Shaw (2014) and Lawton (1971) regarded *P. ludwigii* as a rare alpine species.

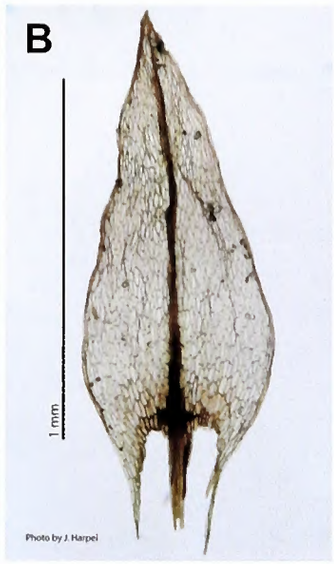
Distribution — *Pohlia ludwigii* is known from Eurasia, Iceland, Greenland, and North America. In western North America, it is known from Alaska, Northwest Territories, British Columbia, Washington, Oregon, California, Montana, Wyoming, Colorado, and Arizona. In Oregon, *P. ludwigii* is reported from Linn County in the West Cascades ecoregion.

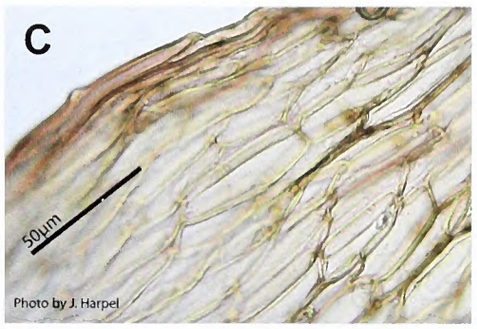
References with descriptions and/or illustrations — Shaw (in FNA 2014a, p. 201), Smith (2004, p. 609), Lawton (1971, p. 186), Nyholm (1958, p. 199).

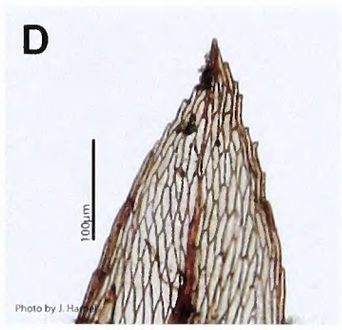
References with photos — Atherton et al. (2010, p. 608).

Plate 66. Pohlia ludwigii. *A. Individual plant. B. Leaf. C. Upper medial cells. D. Leaf apex. E. Alar and basal cells. F. Sporophyte. G. Superficial stomata. H. Exothecial cells. I–J. Peristome teeth. (W. Schofield 74200. UBC)*


A
5 mm
Photo by J. Harpel

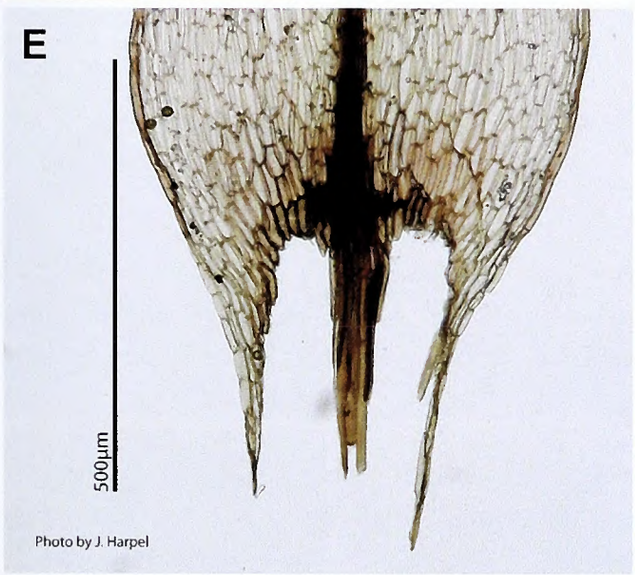

B
1 mm
Photo by J. Harpel


C
50µm
Photo by J. Harpel

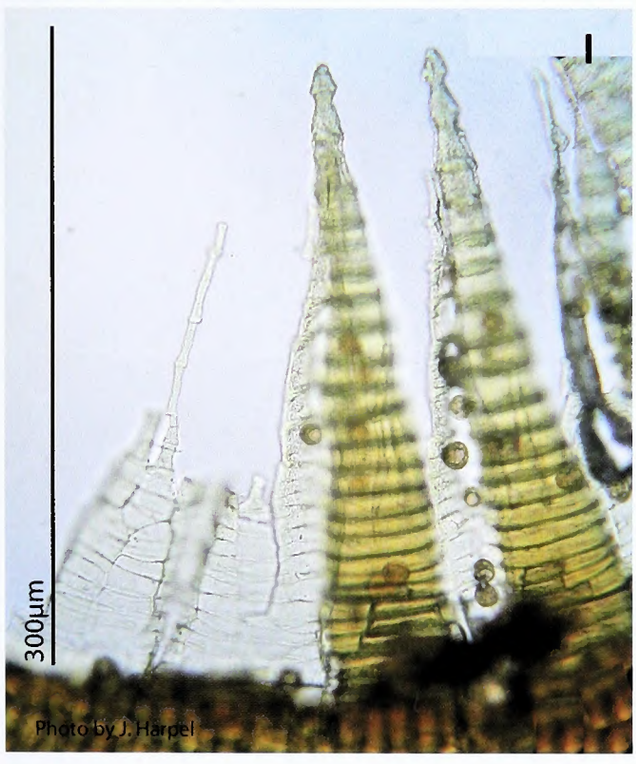

D
100µm

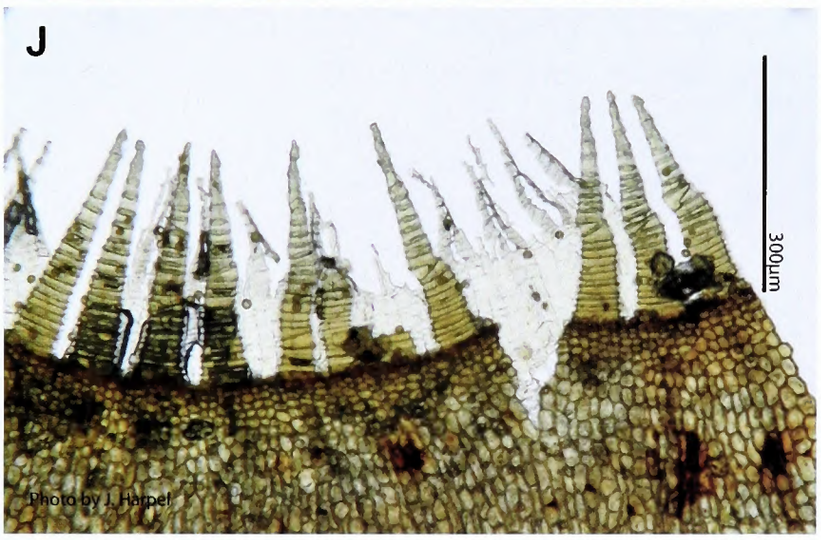

F
500µm
Photo by J. Harpel


G
50µm
Photo by J. Harpel


E
500µm
Photo by J. Harpel


H
50µm
Photo by J. Harpel


I
300µm
Photo by J. Harpel


J
300µm
Photo by J. Harpel

Pohlia obtusifolia (Villars) L.F. Koch

Recent synonyms: none
Common name: blunt-leaved thread-moss

Summary — An acrocarpous, costate moss with ovate-lanceolate often serrate leaves. Terrestrial.

Diagnostic characteristics — *Pohlia obtusifolia* is distinguished by its (1) lack of axillary gemmae, (2) plane leaf margins, (3) cucullate leaf apices, (4) paroicous sexual condition, (5) lax, hexagonal, thin-walled median cells, and (6) weakly cucullate leaves.

Technical description

Gametophyte — **Plants** small, dull light green to brownish below, forming tufts up to 1 cm tall. **Leaves** ovate-lanceolate, bluntly acute, 0.7–1.4 mm long; margins more or less recurved, plane, serrate at the apex; upper medial cells broadly rhombic, 30–55 (–70) µm long, 12–16 (–20) µm wide, lax, thin-walled; costa ending well below the apex. **Paroicous**.

Sporophyte — **Seta** 1–3 cm long, yellow-brown. **Capsules** pendent, elongate-pyriform 2.0–3.5 mm long; peristome teeth yellow, double, coarsely papillose above. **Spores** 17–25 µm, roughened.

Similar species — *Pohlia nutans* and *P. cruda* could be confused with *P. obtusifolia*. However, *P. obtusifolia* is distinguished by leaf shape, paroicous inflorescence, and lax, thin-walled cells. *Pohlia drummondii* is similar but the stems tend to be less intensely red, the laminal cells are broader and thin-walled, and it is dioicous. See *Pohlia bolanderi* for additional similar species.

Ecology — *Pohlia obtusifolia* typically occurs on moist rich soil in snowmelt areas or on wet rocks adjacent to streams within the alpine and subalpine zones. Plants with sporophytes are small, but sterile colonies at high elevations form deeper cushions. Capsules mature June to August.

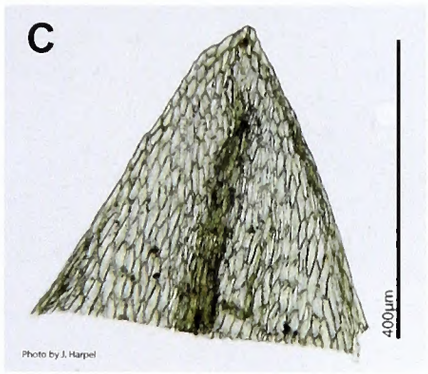
Distribution — *Pohlia obtusifolia* is known from Eurasia, Greenland, and North America. In western North America, it occurs in Alaska, Yukon, Northwest Territories, British Columbia, Alberta, Washington, Oregon, California, Montana, Wyoming, Colorado, Utah, and Nevada. In Oregon, *P. obtusifolia* is reported from Jackson County in the West Cascades ecoregion.

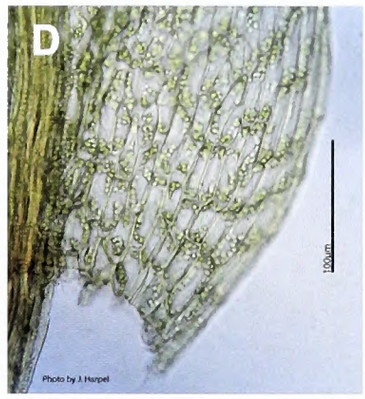
References with descriptions and/or illustrations — Shaw (in FNA 2014a, p. 200), Lawton (1971, p. 187).

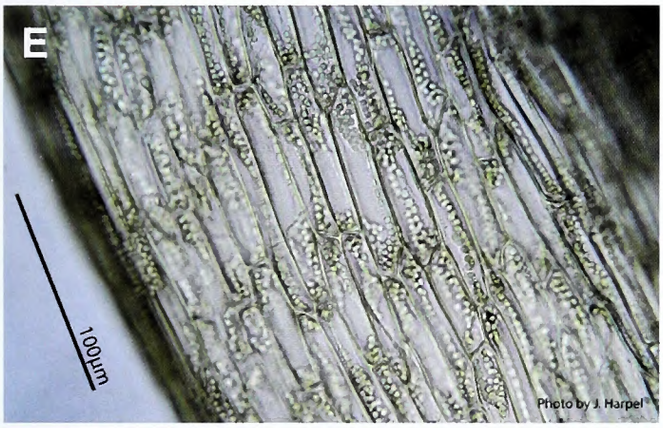
Plate 67. Pohlia obtusifolia. *A. Individual. B. Leaf. C. Leaf apex. D. Alar and basal cells. E. Upper medial cells. F. Antheridia and archegonia (paroicous). G. Sporophyte. H–I. Peristome teeth. J. Stomata. K. Exothecial cells. (J. Spence 2449. UBC)*


A
3 mm
Photo by J. Harpel


B
1 mm
Photo by J. Harpel

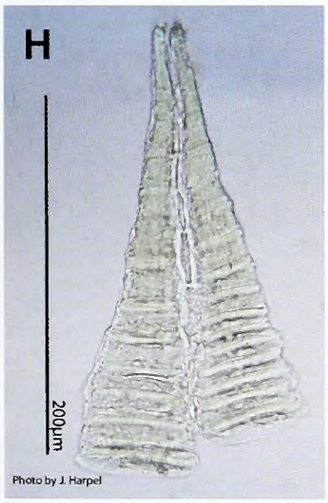

C
400µm
Photo by J. Harpel

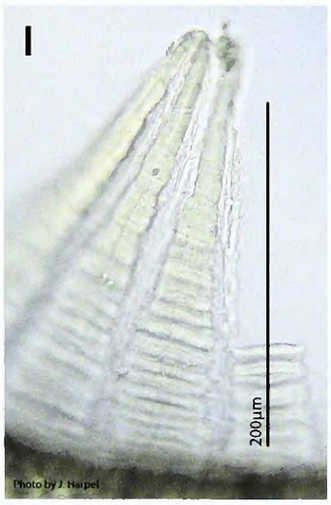

D
100µm
Photo by J. Harpel

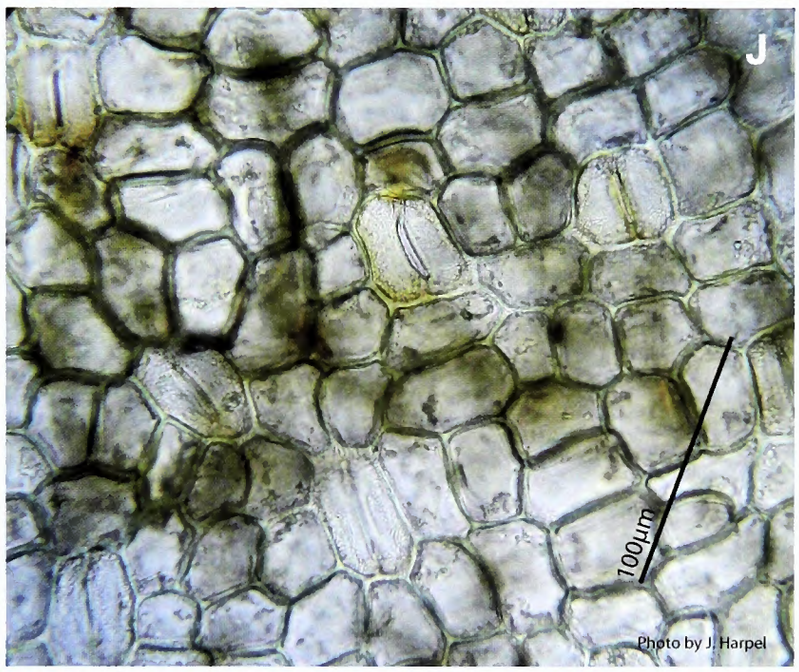

E
100µm
Photo by J. Harpel

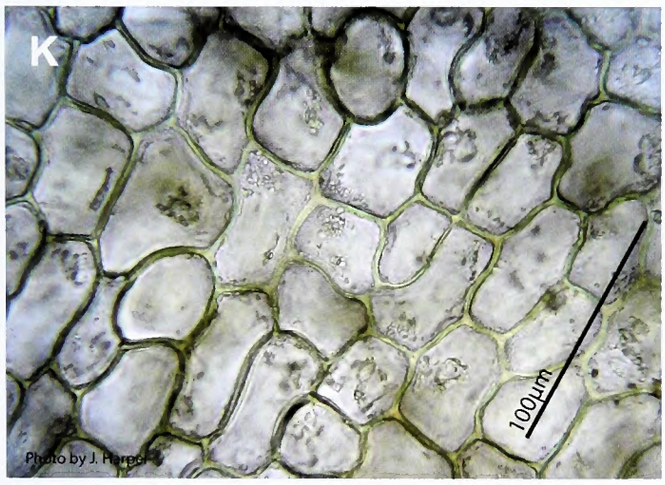

F
500µm
Photo by J. Harpel


G
3 mm
Photo by J. Harpel


H
200µm
Photo by J. Harpel


I
200µm
Photo by J. Harpel


J
100µm
Photo by J. Harpel


K
100µm
Photo by J. Harpel

Pohlia tundra A.J. Shaw

Recent synonyms: none
Common names: tundra thread-moss, tundra pohlia moss

Summary — An acrocarpous, costate moss with entire to toothed lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Pohlia tundra* can be distinguished by its (1) glossy surface and green to light green color, (2) 2–8 linear, elongate axillary gemmae extending beyond the leaves, and (3) sub-alpine to alpine habitat.

Technical description

GAMETOPHYTE — **Plants** glossy, compact, 2–5 (–15) mm tall, glossy green to light green, small to compact medium tufts. **Leaves** 0.9–1.5 mm long, lanceolate to ovate-lanceolate, erect to spreading, acute at the tips, not keeled, decurrent in dwarf plants; margins plane to reflexed, serrate to serrulate in the upper 1/3; costa ending below the apex or percurrent; leaf cells rectangular or rhombic, sometimes vermicular, thin-walled; basal cells rectangular or rhombic, quadrate where attached to the stem. Axillary gemmae elongate, extending beyond the leaves, yellow, pink, or green, produced in abundant and conspicuous clusters in uppermost leaf axils, more than 300 µm long, narrowly cylindrical at base with 2–6 well-developed blade-like (laminate) leaf primordial. **Dioicous**.

SPOROPHYTE — **Seta** 1–1.5 cm long, orange to orange-red. **Capsules** nodding, short to elongated and pear-shaped (pyriform), with a neck. **Spores** finely roughened, 16–23 µm.

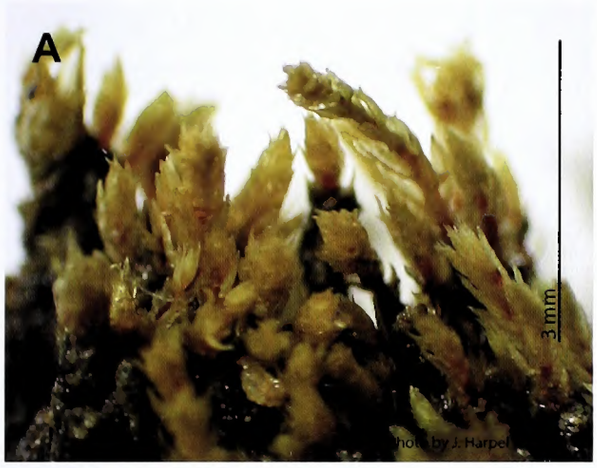
Similar species — *Pohlia drummondii* produces single axillary bulbiform gemmae that are cherry-red to blackish when dry, while *P. tundra* has numerous yellow, pink or green axillary gemmae. Sterile specimens of these two species may be impossible to separate without gemmae. *Pohlia proligera* plants are also glossy but have oblong-linear to linear-vermicular gemmae. *Pohlia annotina* and *P. camptotrachela* plants are not glossy. See *Pohlia bolanderi* for additional information.

Ecology — *Pohlia tundra* forms dense, compact sods 2–3 mm tall or mixed with other mosses on wet acid soil (pH 5.0–6.0; Shaw 1981a) or along snowmelt streamlets in subalpine and alpine habitats. It occurs less frequently on road and trail banks below the tree line where it is usually mixed with other mosses and is sometimes abundant. Elevations range from 6,000–8,000 feet. Plant associations include *Abies amabilis*, *Abies lasiocarpa*, *Cassiope mertensiana*, *Phyllodoce empetriformis*, *Pinus albicaulis* and *Tsuga mertensiana*.

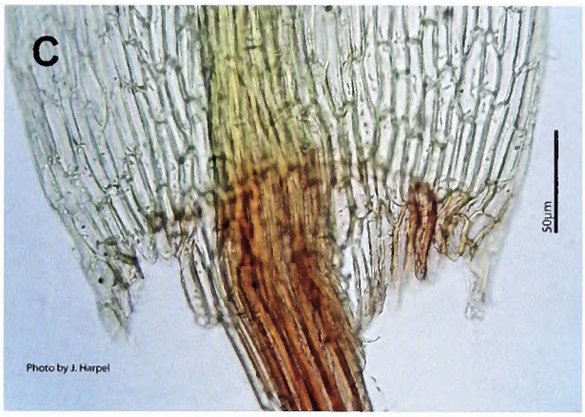
Distribution — *Pohlia tundra* is known from Europe, Greenland, and North America. In western North America, it is known from Alaska, British Columbia, Washington, Oregon, California, Idaho, Montana, Utah, Wyoming, Colorado, Arizona, and New Mexico. In Oregon, *P. tundra* is reported from Clackamas and Jackson counties in the West Cascades ecoregion.

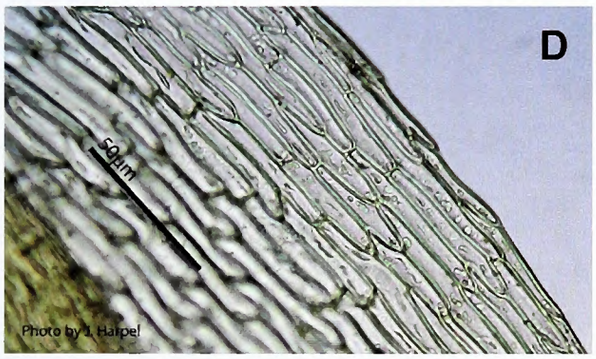
References with descriptions and/or illustrations — Shaw (in FNA 2014a, p. 204), Shaw (1981a, p. 65), Shaw (1981b, p. 47).

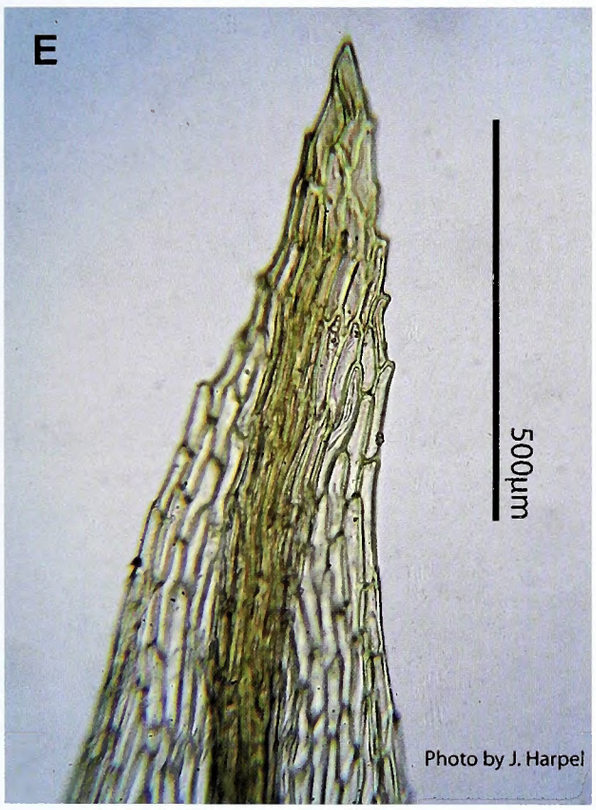
Plate 68. Pohlia tundra. *A. Moist habitat. B. Leaf. C. Alar and basal cells. D. Upper medial cells. E. Leaf apex. F. Perigonium. (J. Shaw 2595. UBC)*


A
3 mm


B
1 mm
Photo by J. Harpel


C
50µm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


E
500µm
Photo by J. Harpel


F
500µm
Photo by J. Harpel

Polytrichastrum sexangulare (Bridel) G.L. Smith **var. *sexangulare***

Recent synonym: *Polytrichum sexangulare* Bridel
Common name: northern haircap

Summary — An acrocarpous, costate moss with lamellae on sheathing, lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Polytrichastrum sexangulare* var. *sexangulare* can be distinguished by its (1) sheathing, lanceolate leaves with 20 or more rows of lamellae on the upper surface, (2) entire or obscurely denticulate marginal lamina, (3) inflexed leaves with cucullate leaf apices lacking an awn, (4) alpine to subalpine habitat, (5) stem cortical cells thin-walled, (6) straight seta, (7) subglobose, angled capsule, and (8) 50–64 slender peristome teeth, of equal size.

Technical description

GAMETOPHYTE — **Plants** small to medium, wiry, dark green to reddish-brown. **Stem** cortical cells thin-walled. **Leaves** 3–7 mm long, lanceolate from an ovate sheathing base; apex obtusely cucullate, often strongly curved toward one side (second); costa percurrent or mucronate; margins strongly involute, entire; lamellae 25–28, 5–7 cells high, ovate to pyriform apical cells larger than cells below, smooth to minutely papillose. **Dioicous**.

SPOROPHYTE — **Seta** 1.7–1.8 cm, straight. **Capsules** brown, horizontal, short-cylindric to ovoid, to subglobose, bluntly (4–) 5–6 angled; peristome teeth 50–64, slender, short triangular and equal sized. **Spores** 16–18 µm, smooth.

Similar species — *Polytrichastrum sexangulare* is separated from other species in the family on the basis of its cucullate apex, lack of lamellar papillae, and entire to obscurely denticulate marginal lamina. The more common *P. alpinum* may grow near *P. sexangulare* but differs in leaf shape, lack of hooded leaf tips, and rounded capsules. *Timmia austriaca* is also similar but lacks costal lamellae and is coarsely toothed. *Oligotrichum hercyicum* is usually smaller, orange-red, and with fewer lamellae. *Polytrichastrum sexangulare* var. *sexangulare* is similar to *P. sexangulare* var. *vulcanicum* when sterile but can be separated by its thin-walled stem cortical cells, straight seta, short-cylindrical ovoid to subglobose 4–6 angled capsule, and 50–64 slender peristome of teeth of uniform size.

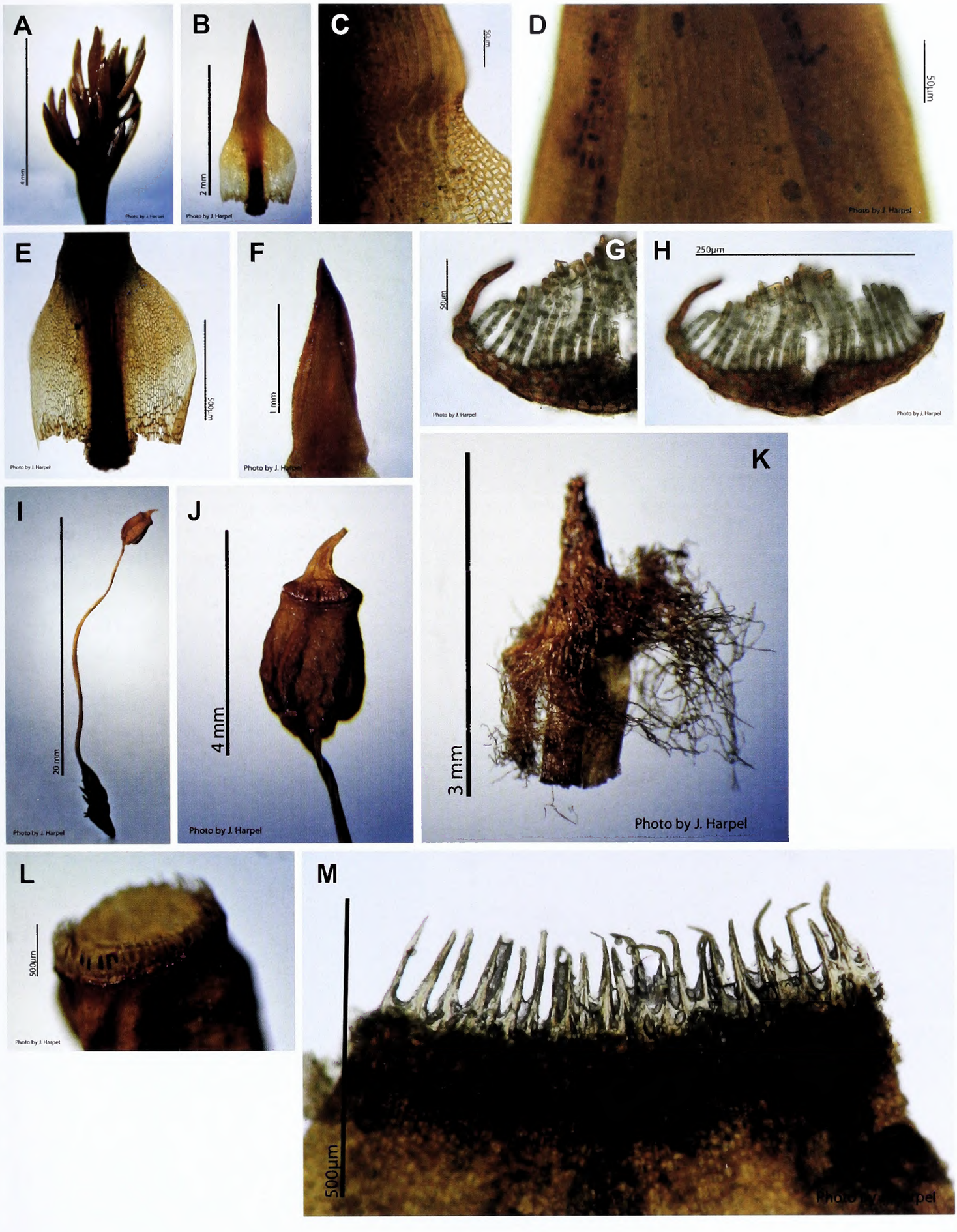
Ecology — *Polytrichastrum sexangulare* var. *sexangulare* occurs on damp gravelly soil and rocks next to snowmelt streams and areas with late summer snow melt in alpine to subalpine areas. Lawton (1971) noted that *P. sexangulare* occurs on soil in the mountains from 4,200 to over 11,000 feet.

Distribution — *Polytrichastrum sexangulare* var. *sexangulare* is known from Eurasia, Iceland, Greenland, and North America. In western North America, it is known from Alaska, Yukon, Northwest Territories, British Columbia, Nunavut, Alberta, Washington, Oregon, California, Montana, Colorado, Utah, and Wyoming. In Oregon, *Polytrichastrum sexangulare* var. *sexangulare* is known from Clackamas, Deschutes and Lane counties within the West Cascades ecoregion.

References with descriptions and/or illustrations — Smith Merrill (in FNA 2007, p. 129), Smith (2004, p. 125), Lawton (1971, p. 42 as *Polytrichum sexangulare*).

References with photos — Atherton et al. (2010, p. 321), Malcolm et al. (2009, p. 36).

Plate 69. Polytrichastrum sexangulare var. sexangulare. *A. Individual. B. Leaf. C.–D. Upper medial cells. E. Alar and basal cells. F. Leaf apex. G–H. Leaf cross-sections. I–J. Sporophyte. K. Calyptra. L–M. Peristome teeth. (J.A. Allen 78. WTU)*


A
4 mm
B
2 mm
C
50µm
D
50µm
E
500µm
F
1 mm
G
50µm
H
250µm
I
20 mm
J
4 mm
K
3 mm
Photo by J. Harpel
L
500µm
M
500µm

Polytrichastrum sexangulare var. *vulcanium* (C.E.O. Jensen) G.L. Smith

Recent synonyms:

Polytrichum sphaerothecium (Bescherelle) Müller Hal.
Polytrichum sexangulare var. *vulcanicum* C.E.O. Jensen
Polytrichum norvegicum var. *vulcanicum* (C.E.O. Jensen) Podpěra
Pogonatum sphaerothecium Bescherelle

Common name: dwarf rock haircap

Summary — An acrocarpous, costate moss with lamellae on sheathing, lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Polytrichastrum sexangulare* var. *vulcanicum* can be distinguished by its (1) sheathing, lanceolate leaves with 20 or more rows of lamellae on the upper surface, (2) entire marginal lamina, (3) inflexed leaves with cucullate leaf apices lacking an awn, (4) alpine to subalpine habitat, (5) stem cortical cells thick-walled, (6) thick and curved seta, (7) subglobose, terete capsule, and (8) 32 peristome teeth of unequal size.

Technical description

GAMETOPHYTE — **Plants** erect, 1–2 cm long, dark brown to blackish. **Stems** have 4–6 layers of thick-walled cortical cells. **Leaves** 3–6 mm long, lanceolate with an often ill defined sheathing base, loosely imbricate, thick and fleshy, green to orange-brown to blackish, incurved to flexuose when dry, hooded at the tip; the upper (ventral) side of the leaves covered with parallel ranks of lamellae, 5–10 cells tall extending from leaf base to apex; leaf margins thin and transparent (hyaline), 2–6 cells wide, folded inward and covering the lamellae. **Dioicous**.

SPOROPHYTE — **Seta** curved 5–6 mm long. **Capsules** inclined to nodding, blackish, globose to ovoid or elliptical, wrinkled but not angled, barely exserted beyond leaves; peristome teeth 32 attenuate, unequal in size. **Spores** 16–18 µm.

Similar species — *Polytrichastrum sexangulare* var. *vulcanicum* differs from *P. sexangulare* var. *sexangulare* by its growth on igneous substrates, thick-walled cortical cells, curved and rather thick seta, terete to subglobose capsule, and 32 peristome teeth of unequal size. See *P. sexangulare* var. *sexangulare* for a discussion of similar species.

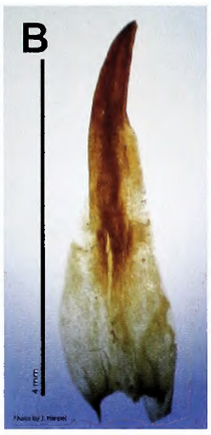
Ecology — *Polytrichastrum sexangulare* var. *vulcanicum* forms green to brown sods on igneous rocks in exposed or sheltered subalpine to alpine location. In Oregon, the variety occurs at or above timberline at about 6,500 ft elevation, where the plant association is likely *Cassiope mertensiana* or *Phyllodoce empetriformis*.

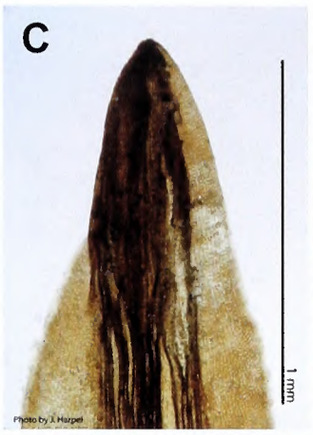
Distribution — *Polytrichastrum sexangulare* var. *vulcanicum* is known from Asia, Iceland, and North America. In western North America, it is known from Alaska, British Columbia, Washington, Oregon, and California. In Oregon, *P. sexangulare* var. *vulcanicum* is reported from Hood River County within the West Cascades ecoregion.

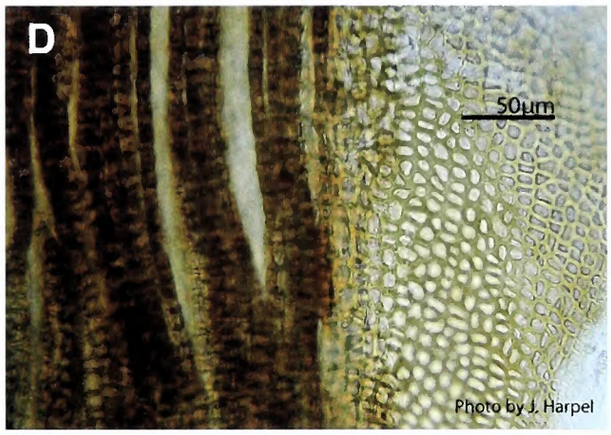
References with descriptions and/or illustrations — Smith Merrill (in FNA 2007, p. 129), Christy and Wagner (1996, part VII, p. 50 as *Polytrichum sphaerothecium*), Noguchi (1987, p. 36 as *Pogonatum sphaerothecium*), Osada (1965, p. 178), Lawton (1971, p. 42 as *Polytrichum sphaerothecium*), Nyholm (1969, p. 681), Brotherus (1909, p. 691).

Plate 70. Polytrichastrum sexangulare var. vulcanium. *A. Dry habitat. B. Leaf. C. Leaf apex. D. Upper medial cells. E. Alar and basal cells. F. Leaf cross-section. G. Calyptra. H–J. Sporophytes. K–L. Peristome teeth. (S. Talbot CHAIC-125. UBC)*

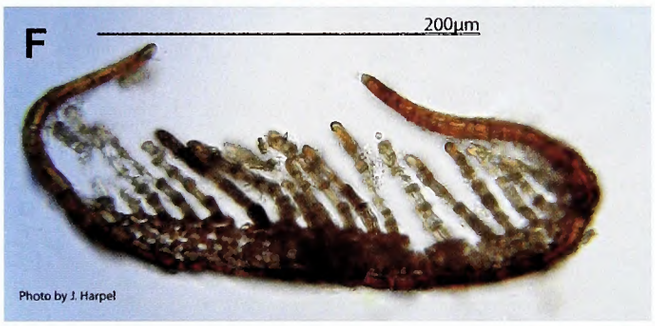

A
4 mm
Photo by J. Harpel


B
4 mm


C
1 mm


D
50µm
Photo by J. Harpel


E
300µm
Photo by J. Harpel

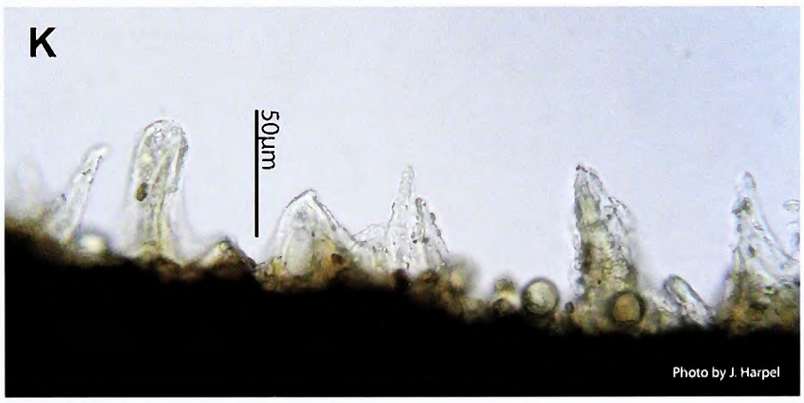

F
200µm
Photo by J. Harpel

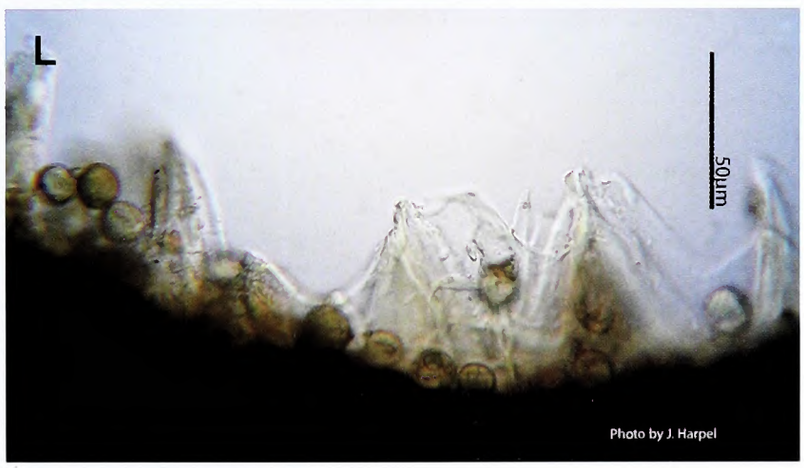

G
4 mm
Photo by J. Harpel


H
3 mm
Photo by J. Harpel


I
3 mm


J
3 mm
Photo by J. Harpel


K
50µm
Photo by J. Harpel


L
50µm
Photo by J. Harpel

Polytrichum strictum Bridel

Recent synonym: *Polytrichum juniperinum* var. *affine* (Funck) Bridel
Common names: hummock haircap, slender haircap, narrow-leaved haircap, strict haircap

Summary — An acrocarpous, costate moss with lamellae on sheathing, lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Polytrichum strictum* can be distinguished by its (1) broad, membranous, marginal lamina that are sharply inflexed and overlap to enclose lamellae, (2) short brownish or bicolored awn, (3) leaves differentiated into sheath and blade, (4) densely whitish tomentose stems, (5) cubic capsules, and (6) fen habitat.

Technical description

GAMETOPHYTE — **Plants** erect, 1–10 (–20) cm tall, mostly unbranched. **Stems** between the leaves densely covered with whitish to light brown wooly tomentum. **Leaves** (2–) 4–6 (–8) mm long, awl-shaped, green, bluish-green to reddish brown with reddish-brown tips, stiffly appressed when dry, erect-spreading when moist, the upper (ventral) leaves covered with parallel ranks of tissue (lamellae) 5–8 cells tall that extend from leaf base to apex. Leaf margins entire, membranous, transparent (hyaline), folded inward, and covering the lamellae. **Dioicous**.

SPOROPHYTE — **Seta** brown, 2–4 (–6) cm long. **Capsules** brown, 2–3 (–5) mm long, square in cross-section. Peristome is membranous like the head of a drum and not composed of teeth. **Spores** 7–9 (–15) µm.

Similar species — *Polytrichum strictum* is the only *Polytrichum* growing on *Sphagnum* hummocks that has overlapping leaf margins that cover the lamellae. The overlapping leaf margins can be seen with a hand lens as a fine line running down the center of the ventral leaf surface. *Polytrichum juniperinum* looks similar to *P. strictum* but lacks the whitish wooly tomentum on the stem and grows on dry exposed mineral soil or sand. In western North America, *Polytrichum commune,* which is also often found mixed with *Sphagnum*, is distinguished by its toothed leaves and non-infolded margins that allow the lamellae to be plainly visible from above. In addition, *P. commune* has a notched lamellae apical cell.

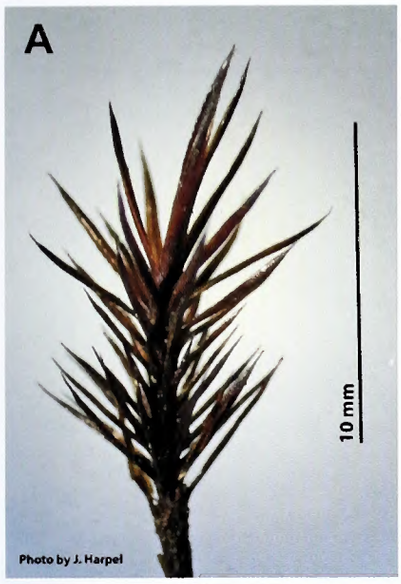
Ecology — *Polytrichum strictum* can be scattered individually or form loose turfs on organic soils, particularly on top of *Sphagnum* hummocks, in coastal and montane bogs and fens. It is also known from moist alpine tundra and on rotten stumps in wet spruce forests. Associated vascular plant species include *Carex* spp., *Ledum glandulosum,* and *Vaccinium oxycoccos*. Associated mosses include *Aulacomnium palustre, Pohlia nutans,* and *Sphagnum* spp.

Distribution — *Polytrichum strictum* is known from Eurasia, Iceland, Greenland, Antarctica, and South and North America; in North America, it is known from most Canadian provinces and 28 U.S.A. states. In the western United States, it is known from Washington, Oregon, California, Montana, Wyoming, Utah, and Colorado. In Oregon, *P. strictum* is reported from Clatsop County within the Coast Range ecoregion.

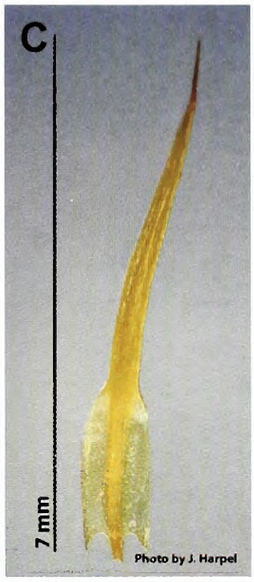
References with descriptions and/or illustrations — Smith Merrill (in FNA 2007a, p. 139), Christy and Wagner (1996, part VII, p. 52), Vitt et al. (1988, p. 57), Ireland (1982, p. 683), Crum and Anderson (1981, p. 1272), Lawton (1971, p. 42), Frye (1937, p. 127), Frye (1910, p. 325).

References with photos — Antherton et al. (2010, p. 326).

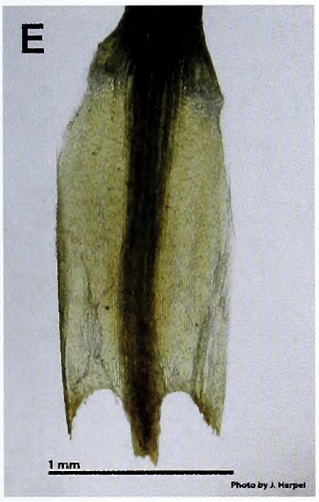
Plate 71. Polytrichum strictum. *A. Moist individual. B. Dry individual. C. Leaf. D. Upper medial cells. E. Alar and basal cells. F. Leaf apex. G–H. Leaf cross-sections. I. Sporophyte. J. Perigonum. K. Calyptra. L. Tomentose stem. (J. Harpel 345. Harpel Private)*

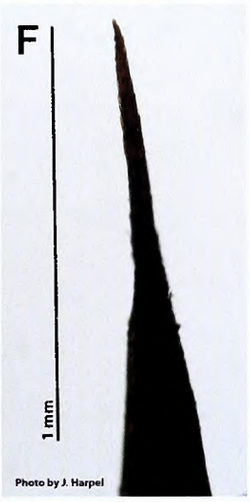

A
10 mm
Photo by J. Harpel

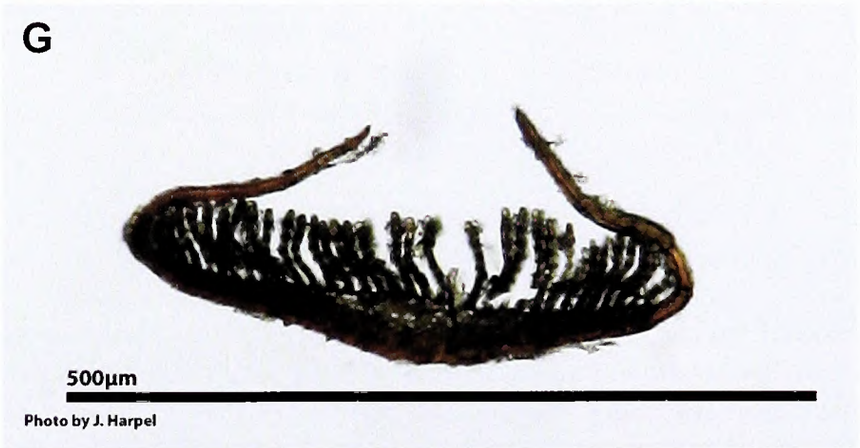

B
8 mm


C
7 mm
Photo by J. Harpel


D
500µm
Photo by J. Harpel

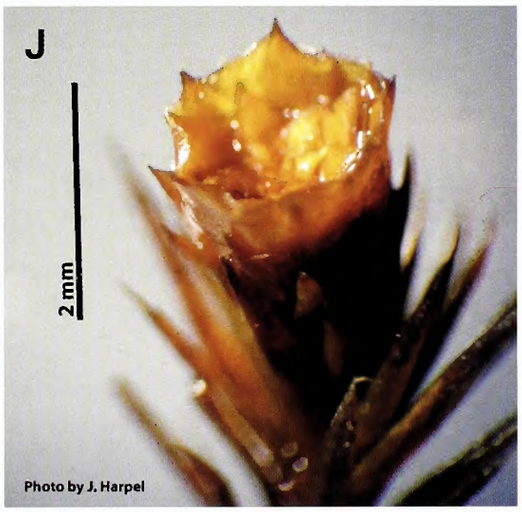

E
1 mm
Photo by J. Harpel


F
1 mm
Photo by J. Harpel


G
500µm
Photo by J. Harpel


H
100µm
Photo by J. Harpel


I
3 mm
Photo by J. Harpel


J
2 mm
Photo by J. Harpel


K
7 mm
Photo by J. Harpel


5 mm
L
Photo by J. Harpel

Pseudephemerum nitidum (Hedwig) Loeske

Recent synonym: *Phascum nitidum* Hedwig
Common name: delicate earth-moss

Taxonomic note: Yip (2007) places *Pseudephemerum* in the family Ditrichaceae based on chromosome number (n=13).

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Pseudephemerum nitidum* can be distinguished by its (1) small size (1–2 mm tall), (2) plane margins with costa ending before the apex, (3) smooth leaf cells, (4) serrulate leaf apices, and (5) immersed cleistocarpous capsule.

Technical description

GAMETOPHYTE — **Plants** very small, generally below 2 (rarely up to 5) mm tall, forming scattered pale green to yellowish-brown patches; rhizoidal tubers rarely occur. **Leaves** lanceolate from an ovate base, 1.8 mm long, erect-spreading; margins plane, entire, serrulate at the apex; costa ending below the apex; upper medial cells lax, thin-walled, rectangular to narrowly rectangular, 10–15 µm wide. **Synoicous**.

SPOROPHYTE — **Seta** short, about 0.2 mm long. **Capsules** pale brown, immersed, 0.3–0.4 mm, ovoid with a short point; cleistocarpous. **Spores** 20–32 µm, sub-spherical to oval.

Similar species — According to Yip (2007) *Pohlia*, *Bryum,* and *Leptobryum,* which could be confused with *Pseudephemerum nitidum*, are separated by their rough papillose rhizoids. *Pleuridium* species are similar but have erect-spreading or appressed, oblong to lanceolate leaves with subulate to acuminate tips. *Ceratodon* and *Ditrichum* have peristomate capsules and longer stems (0.5–4 cm).

Ecology — *Pseudephemerum nitidum* occurs on damp clay or silty soil at low to moderate elevations. Herbarium habitat notes from the only two North American sites specify silt hummocks in grassy areas near a riverbank and old mole mounds in grasslands with partial shade to full sun exposure. Associated vascular plants species cited were *Horkelia* and *Lomatium* with an algal soil crust at the 341 foot elevation. According to Schofield (1976) and Smith (2004) sporophytes are common. In England, sporophytes are produced throughout the year but are more common in late summer and autumn (Smith 2004). Yip (1998) mentions that axillary archegonia and mature sporophytes generally persist on older parts of the stem and appear lateral when new shoots develop. Arts and Risse (1991) state rhizoidal tubers, which are very rare, may serve as a dispersal mechanism for this species. Capsules mature in November.

Distribution — *Pseudephemerum nitidum* is known from Eurasia, Africa, Madagascar, Tasmania, New Zealand, and South and North America. In western North America, it is only known from two locations, British Columbia and Oregon. In Oregon, *P. nitidum* is reported from Lane County in the Willamette Valley ecoregion.

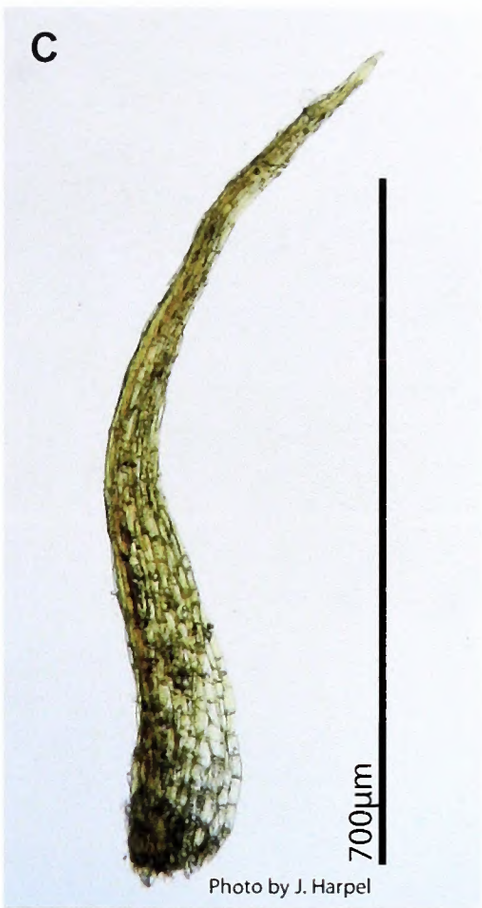
References with descriptions and/or illustrations — Yip (in FNA 2007, p. 467), Yip (2005), Smith (2004, p. 148), Yip (1998), Lawton (1971, p. 83), Nyholm (1954, p. 41).

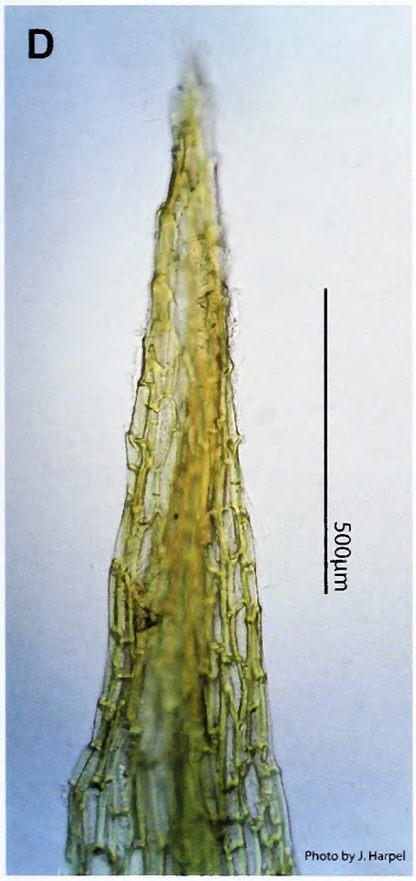
References with photos — Porley (2008, p. 90).

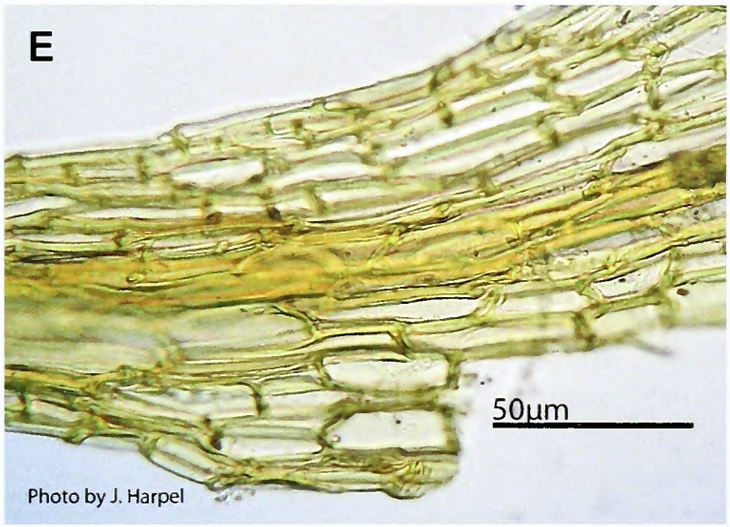
Plate 72. Pseudephemerum nitidum. *A–B. Moist individuals. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Alar and basal cells. G. Leaf cross-section. (J. Christy 1593. UBC)*

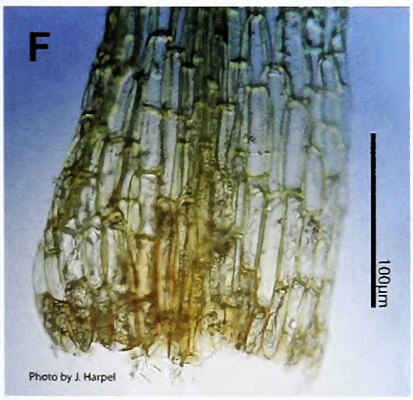

A
1 mm
Photo by J. Harpel


B
1 mm
Photo by J. Harpel


C
700µm
Photo by J. Harpel


D
500µm
Photo by J. Harpel


E
50µm
Photo by J. Harpel


F
100µm
Photo by J. Harpel


G
100µm
Photo by J. Harpel

Pseudocalliergon trifarium (F. Weber & D. Mohr) Loeske

Recent synonyms:
Calliergon trifarium (F. Weber & D. Mohr) Kindberg
Drepanocladus trifarius (F. Weber & D. Mohr) Brotherus
Common names: blunt water moss, worm moss, calliergon moss

Summary — A pleurocarpous, costate moss with imbricate, concave, broadly ovate leaves. Terrestrial.

Diagnostic characteristics — *Pseudocalliergon trifarium* can be distinguished by its (1) julaceous, unbranched shoot habit, (2) broadly rounded concave ovate leaves longer than 1 mm, (3) single costa ending before the apex, (4) inflated alar cells with incrassate cell walls, (5) lack of a hyalodermis, (6) lack of paraphyllia, and (7) calcareous bog or fen habitat.

Technical description

Gametophyte — **Plants** 4–16 cm long, turgid, green to yellowish or golden-brown, shiny when dry, in loose strands or mats, usually mixed in with other mosses. **Stems** unbranched or sometimes irregularly branched. **Leaves** tightly appressed, 1.80–2.24 mm long, broadly ovate, concave, apex rounded; margins entire; costa single, slender, sometimes double or forked over 1/3–2/3 the leaf length. Upper medial cells smooth, oblong-linear, shorter at the apex; alar cells oblong, more or less differentiated; basal cells quadrate to rectangular along the margin. **Dioicous**.

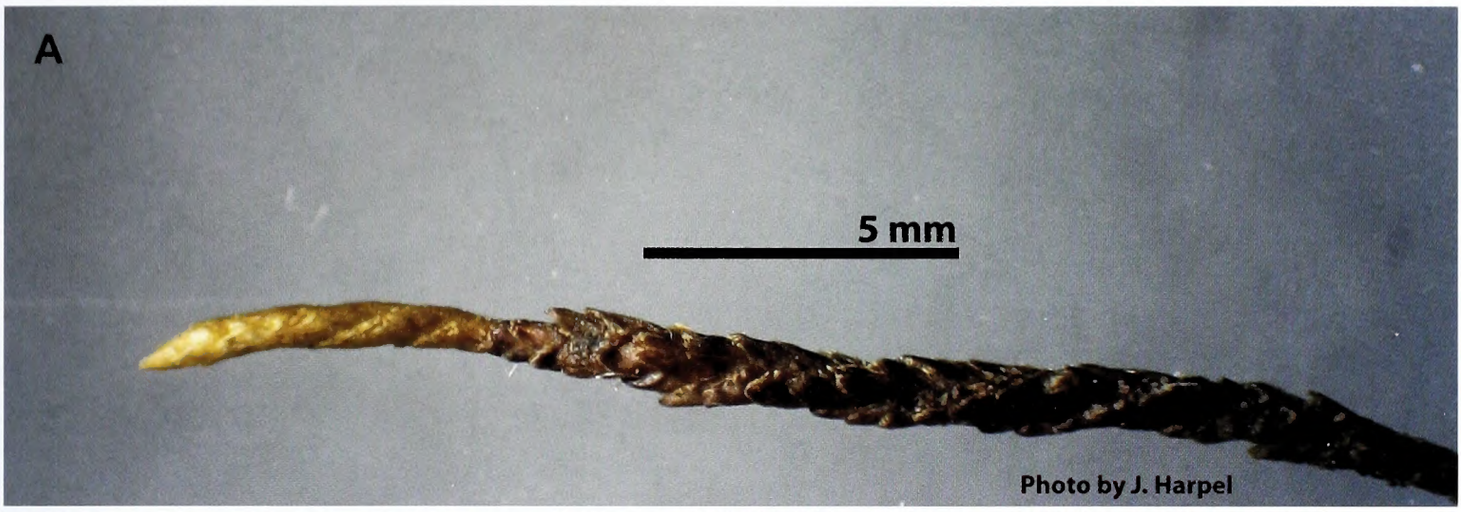
Sporophyte — Sporophytes have not been seen in North American collections.

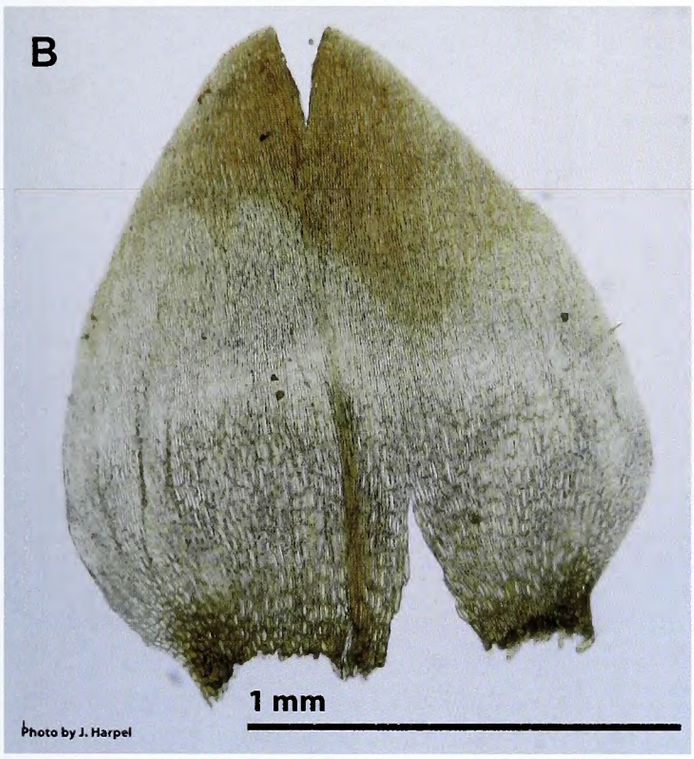
Similar species —*Calliergon cordifolium* differs in its overall green color, irregularly pinnately branches, blunt shoot tips with larger and more spreading leaves, and sprawling mats that lack erect shoots. *Calliergonella cuspidata* can be distinguished by its green overall color, irregularly pinnately branched habit, and conspicuously pointed shoot and branch tips. *Drepanocladus* is also similar but is usually found in nutrient rich habitats (in contrast to the nutrient poor habitats of *Pseudocalliergon*). Molecular data suggest that the *Pseudocalliergon* species are nested within *Drepanocladus* (Hedenäs and Rosborg 2008).

Ecology — *Pseudocalliergon trifarium* usually occurs as single shoots often inconspicuously intermixed with other bryophytes in lime rich montane fens, where it grows submerged to emergent in pools, in pools that dry up in late summer, or on saturated ground, usually in full sunlight. In Oregon, it is also known from rock with trickling water, spray zones of waterfalls from low to 5,000–6,000 foot elevations. Forest associations include *Abies amabilis, Abies concolor, Abies magnifica* × *shastensis,* and *Pinus contorta* var. *latifolia*. Associated vascular plants include *Carex limosa, Eleocharis quinqueflora, Scheuchzeria palustris*, and *Triglochin maritimum*. Associated bryophyte species include *Elodium blandowii, Hamatocaulis vernicosus, Meesia triquetra,*and *Tomentypnum nitens*. Hedenäs and Miller (2014) note that shoots of *Pseudocalliergon trifarium* frequently divide into segments that correspond with growing seasons. In the proximal (spring) portion of each segment the leaves are smaller and more strongly imbricate than distally in the same segment. The transition between the differently sized leaves is gradual within each segment, whereas the transition between segments is sudden.

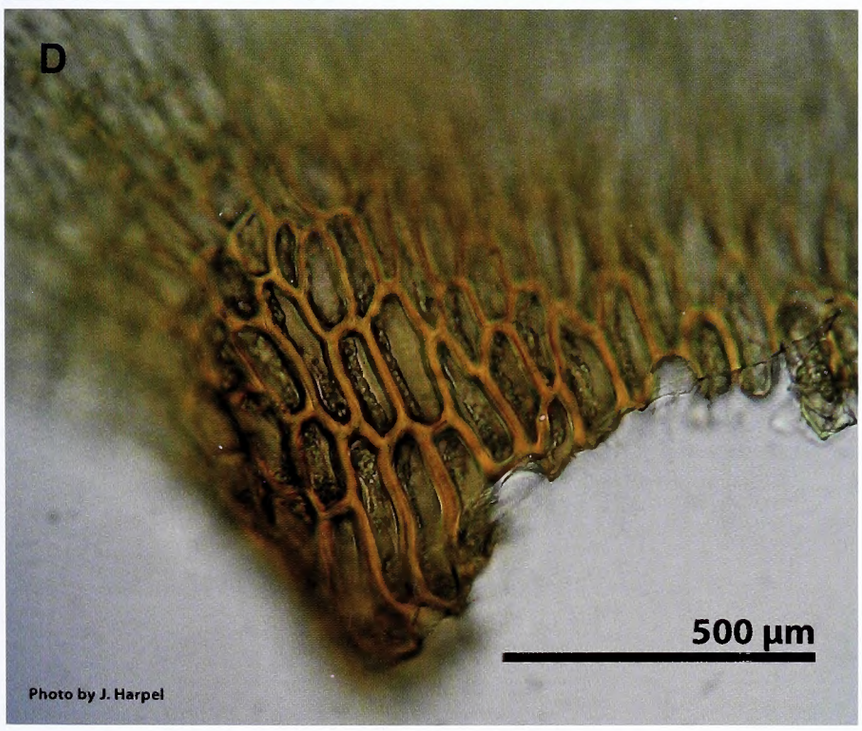
Distribution — *Pseudocalliergon trifarium* is known from Eurasia, Iceland, Greenland, and South and North America. In western North America, it is known from Alaska, Northwest Territories, British Columbia, Alberta, Washington, Oregon, California, and Montana. In Oregon, *P. trifarium* is reported from Deschutes, Klamath and Lake counties within the East and West Cascades ecoregions.

Plate 73. Pseudocalliergon trifarium. *A. Individual. B. Leaf. C. Upper medial cells. D. Alar cells. (S. Commings sn. UBC)*


A
5 mm
Photo by J. Harpel


B
1 mm
Photo by J. Harpel


C
100 µm
Photo by J. Harpel


D
500 µm
Photo by J. Harpel

References with descriptions and/or illustrations — Hedenäs and Miller (in FNA 2014, p. 300), Christy and Wagner (1996, part VII, p. 19), Vitt et al. (1988, p. 88), Crum and Anderson (1981, p. 1010), Smith (1978, p. 578), Lawton (1971, p. 272), Nyholm (1965), Grout (1931, p. 99).

References with photos — Lockhart et al. (2012, p. 528), Atherton et al. (2010, p. 727).

Pseudocrossidium hornschuchianum (Schultz) R.H. Zander

Recent synonym: *Barbula hornschuchiana* Schultz
Common names: Hornschuch's pseudocrossidium moss, Hornschuch's beard-moss

Summary — An acrocarpous, costate moss with papillose, short lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Pseudocrossidium hornschuchianum* can be distinguished by its (1) distinctly papillose and lanceolate leaves with a long mucro or short awn, (2) convex ventral costa with 2 guide cells, (3) lamina that turn yellow or orange (with occasional red spots) in KOH, and (4) clear axillary hair cells.

Technical description

Gametophyte — **Plants** green, scattered or in patches up to 3–15 mm high, leaves spirally twisted when dry, erect when wet. **Leaves** 1–1.5 mm long, ovate-deltoid to short-lanceolate, narrowed at the apex; margin in upper leaf extremely revolute (twice revolute); costa stout, with 2–3 guide cells, excurrent as a mucro or short awn; upper medial cells 10–13 µm, quadrate, papillose; basal cells rectangular; clear axillary hair cells. **Dioicous**.

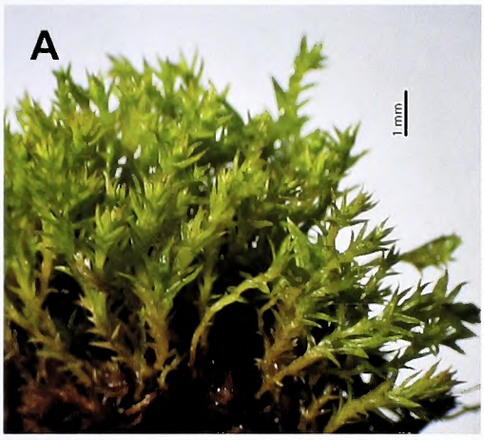
Sporophyte — **Seta** up to 1 cm, orange-red. **Capsules** ellipsoid, about 1.7 mm long; operculum long obliquely rostrate; peristome of 32 long filaments spirally coiled, **Spores** essentially smooth, 8–10 µm.

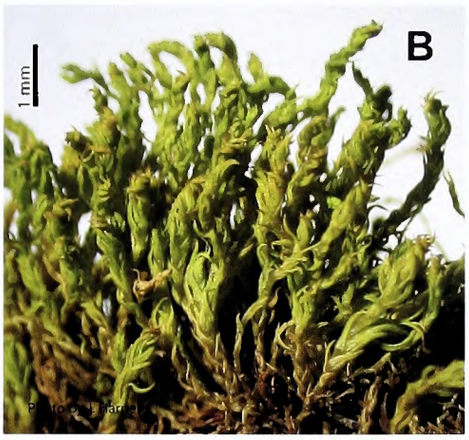
Similar species —Species of *Pseudocrossidium* are characterized by ovate to elliptic leaves, rather small distal laminal cells, the small or absent adaxial costal stereid band, the crescent-shaped dorsal stereid band, and laminal cells that turn yellow or orange (with occasional red spots) in KOH. *Pseudocrossidium crinitum* is similar but differs from *P. hornschuchianum* in its rounded obtuse leaves at the base of the awn and ventral concave costa with 4 guide cells. *Pseudocrossidium obtusulum* and *P. replicatum* are separated by their apiculate to short-mucronate leaves. *Pseudocrossidium* is distinguished from *Didymodon* by having clear axillary hair cells. *Bryoerythrophyllum* distal laminal cells are flat in section and usually turn a definite red in KOH, while *Pseudocrossidium* distal laminal cells in section are strongly convex to bulging on both sides.

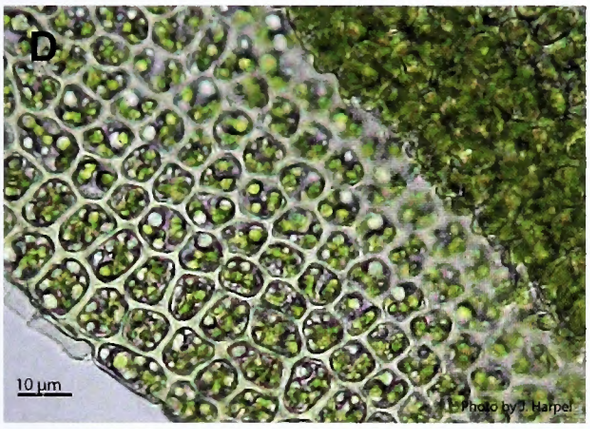
Ecology — *Pseudocrossidium hornschuchianum* is known from the lowlands up to 2,100 feet in elevation from limestone, compacted soil, or stony ground at the edge of paths or on thin soil, lawns, gardens, or rock outcrops. It is also reported to associate with ornamental cultivation. The Oregon site occurs in a natural setting on a ridge, and was collected with sporophytes. Both male and female plants are present in British Columbia, although at different locations, and the Oregon specimen was fruiting.

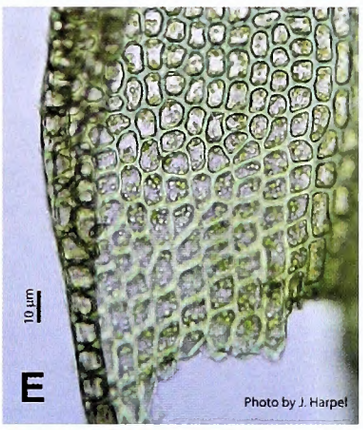
Distribution — *Pseudocrossidium hornschuchianum* is known from Eurasia, Australia, Africa, and North America. In western North America, it is known only British Columbia and Oregon. In Oregon, *P. hornschuchianum* is reported from Jackson County in the Klamath Mountain ecoregion.

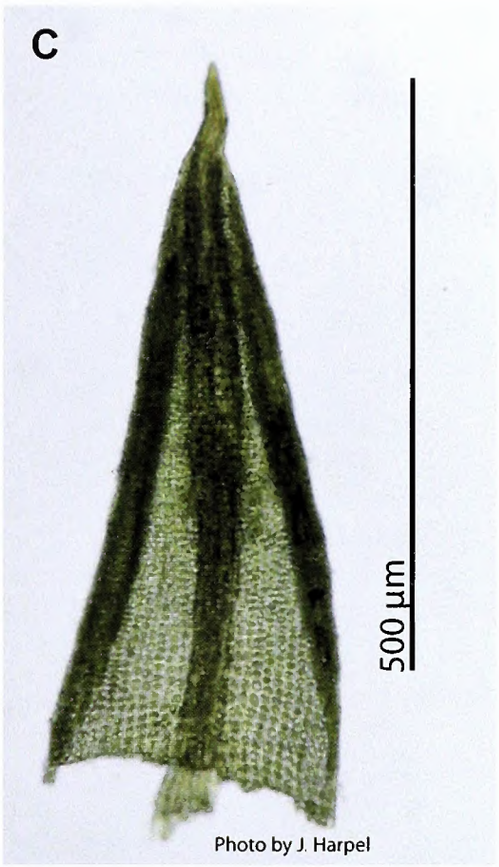
Plate 74. Pseudocrossidium hornschuchianum. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Upper medial cells. E. Alar and basal cells. F. Leaf apex. G. Leaf cross-section. (S. Joya. 1252. UBC)*

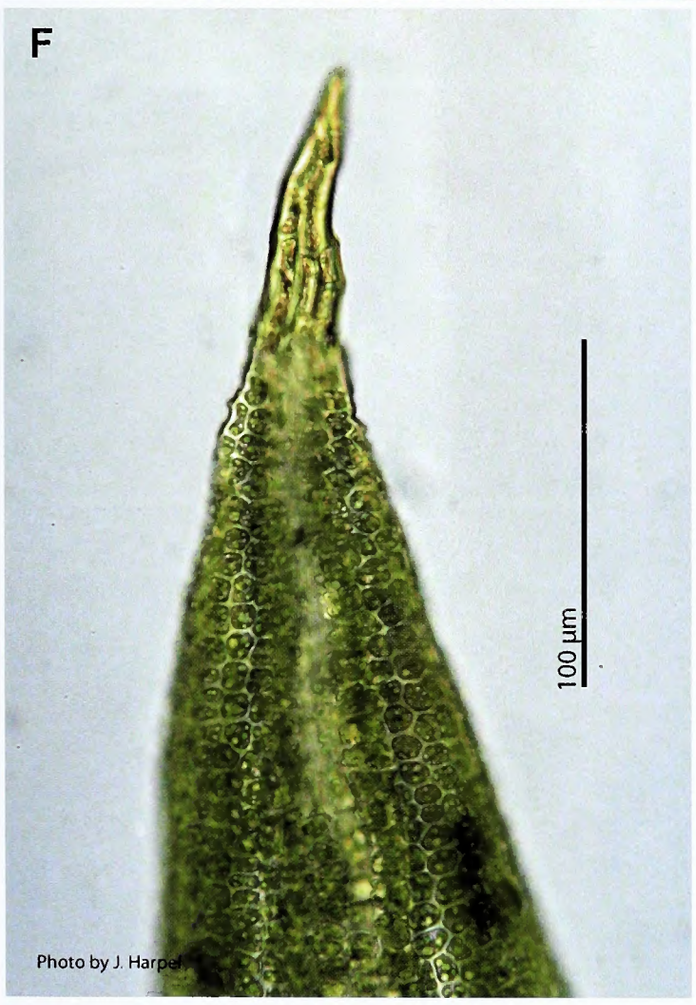

A
1 mm

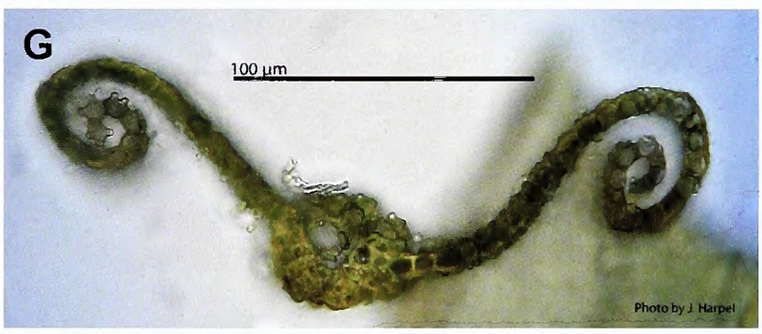

B
1 mm


D
10 µm
Photo by J. Harpel


E
10 µm
Photo by J. Harpel


C
500 µm
Photo by J. Harpel


F
100 µm
Photo by J. Harpel


G
100 µm
Photo by J. Harpel

References with descriptions and/or illustrations — Zander (in FNA 2007f, p. 572), Smith (2004, p. 295), Zander (1993, p. 116), Dixon (1954, p. 217 as *Barbula hornschuchiana*).

References with photos — Atherton et al. (2010, p. 440).

Pseudoleskeella serpentinensis P.S. Wilson & D.H. Norris

Recent synonyms: none
Common name: serpentine pseudoleskeella moss

Taxonomic note: Molecular data has shown *Pseudoleskeella serpentinensis* is not related to other *Pseudoleskeella* species and appears more closely related to *Heterocladium*. In addition, some taxonomists place *Pseudoleskeella* in the family Thuidiaceae. Lawton (1971) recognized *P. serpentinensis*, but referred it to *P. catenulata* (a European species). She included it in her key but did not provide illustrations or descriptions for the species.

Summary — A pleurocarpous moss with a short or forked costa with short ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Pseudoleskeella serpentinensis* can be distinguished by its (1) red-purple overall color when dry, (2) julaceous stems and branches that are not chain-like (catenulate) when dry, (3) small (< 1.5 mm long) stem leaves that lack a hairpoint, (4) lack of paraphylla and papillae, (5) weakly plicate leaves, (6) serrulate distal leaf margins, and (7) serpentine habitat.

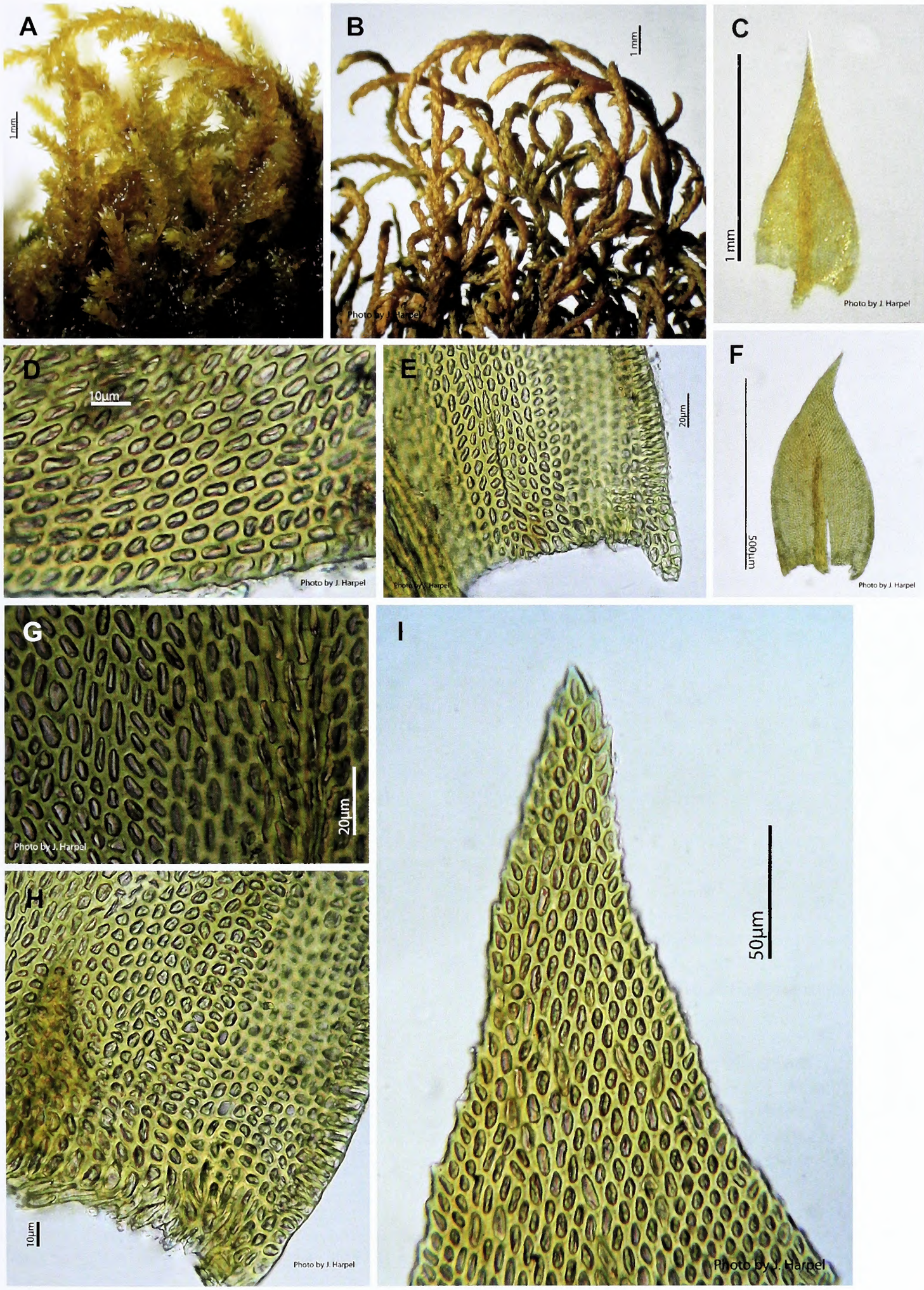
Technical description

GAMETOPHYTE — **Plants** green or often reddish-brown, forming thin loose mats. **Stems** 2–5 cm long, branched, loosely appressed to the substratum, occasionally flagelliform; paraphyllia few to none. **Leaves** not chain like when dry. Stem leaves broadly ovate, more or less acuminate, weakly concave, 0.45–0.6 mm long; margins recurved in lower half and entire, more or less serrate at the apex; upper medial cells smooth, oval to rhomboidal 6–8 (–12) µm; costa extremely variable, usually short and double, or forked, rarely single or lacking. Branch leaves smaller, 0.3–0.6 mm, ovate to ovate-lanceolate, acuminate; margins entire, serrate at apex; medial cells, smooth or often papillose near the tips of young leaves with a single papilla per cell; alar cells quadrate to transversely elongate. **Dioicous**.

SPOROPHYTE — Sporophytes unknown.

Similar species — *Pseudoleskeella serpentinensis* is endemic to serpentine areas and *P. tectorum* is restricted to calcareous rocks. In addition, *P. tectorum* has more or less catenulate stem leaves when dry and a short, double costa. *Pseudoleskeella serpentinensis* is distinguished from other *Pseudoleskeella* species by its loosely appressed, not catenulate, ovate-lanceolate stem leaves, overall reddish-green color, and weakly plicate leaves. *Pseudoleskea* species have paraphylla or, if lacking paraphylla, differ in their pitted basal laminal cell walls. *Leskeella* species have costae that extend beyond the mid-leaf and erect branches.

Plate 75. Pseudoleskeella serpentinensis. *A. Moist habitat. B. Dry habitat. C. Stem leaf. D. Stem leaf upper medial cells. E. Stem leaf alar and basal cells. F. Branch leaves. G. Branch leaf upper medial cells. H. Branch Leaf alar and basal cells. I. Leaf apex. (W. Schofield 16984. UBC)*


A
1mm
B
1 mm
Photo by J. Harpel
C
1 mm
Photo by J. Harpel
D
10µm
Photo by J. Harpel
E
20µm
Photo by J. Harpel
F
500µm
Photo by J. Harpel
G
20µm
Photo by J. Harpel
H
10µm
Photo by J. Harpel
I
50µm
Photo by J. Harpel

Ecology — *Pseudoleskeella serpentinensis* is known from serpentine soil and rock usually along streams and rivulets at 150–3,000 foot elevations. Plants growing in full sunlight are red-purple when dry. *Pseudoleskeella serpentinensis* is known only from sterile and female plants.

Distribution — *Pseudoleskeella serpentinensis* is endemic to western North America, where it is known only from Oregon and California. In Oregon, *P. serpentinensis* is reported from Curry, Douglas and Josephine counties within the Klamath Mountain ecoregion.

References with descriptions and/or illustrations — Spence (in FNA 2014d, p. 364), Wilson and Norris (1998, p. 391).

References with photos — Malcolm et al. (2009, p. 255).

Pseudoleskeella tectorum (Funk) Kindberg

Recent synonym:
Pseudoleskea tectorum (Funck) Schimper
Leskeella tectorum (A. Braun) I. Hagen
Common name: rooftop pseudoleskeella moss

Summary — A pleurocarpous moss with a short or forked costa with short ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Pseudoleskeella tectorum* can be distinguished by its (1) chain-like (catenulate), small sized leaves, (2) weak, usually double costa, (3) quadrate alar cells in rows, and (4) stems tightly appressed to its substrate.

Technical description

Gametophyte — **Plants** with mats tightly attached to the substratum, dark olive-green or rarely yellow-green. **Stems** branched. **Leaves** of stem 0.45–1.2 mm long, ovate, acuminate, more or less chain like when dry, erect, spreading when wet; margins plane, narrowly recurved in the lower half, more or less serrate near the apex; upper medial cells 7–9 µm, irregularly rounded, smooth, occasionally bulging-papillose on the dorsal surface; costa variable, double or single, sometimes absent. Branch leaves ovate to suborbicular 0.4–0.8 mm. **Dioicous**.

Sporophyte — **Seta** 1–2 mm, red-brown, straight to flexuose. **Capsules** 1.5–2.5 (–3) mm, inclined, brown, subcylindric, asymmetrical. **Spores** 10–18 µm.

Similar species — *Pseudoleskeella tectorum* can be distinguished from other *Pseudoleskeella* species by its dark green appressed mats, catenulate leaves, and weak and often double costa. *Claopodium* species also have catenulate leaves but the costa extends to mid-leaf or longer and the cells are papillose. See *Pseudoleskeella serpentinensis* for additional notes on similar species.

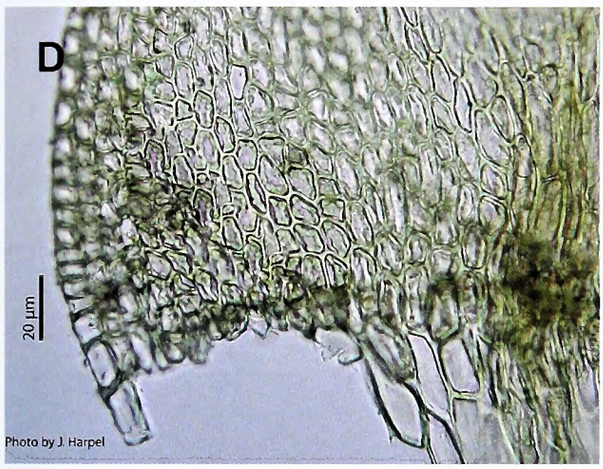
Ecology — *Pseudoleskeella tectorum* occurs on shaded rock (usually calcareous) or in dry open and exposed locations, occasionally on logs or soil from low elevations to 12,000 feet. Weber and Wittmann (2007) observed that in Colorado *P. tectorum* is probably the most common species in the genus, occurring on fairly dry sites in forests. Spence (in FNA, 2014d) notes that thin mats of *P. tectorum* can become quite extensive over time, covering the faces and overhangs of shaded boulders and cliffs. Lawton (1971) noted that capsules are rarely produced, but were found on material from Montana. Flowers (1973) also observed that capsules are rare but

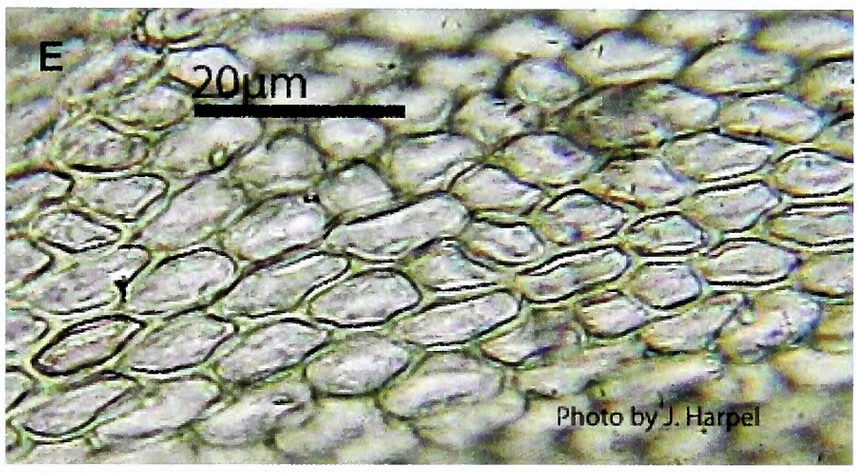
Plate 76. Pseudoleskeella tectorum. *A. Moist habitat. B. Dry habitat. C. Stem leaf. D. Stem leaf alar and basal cells. E. Stem leaf upper medial cells. F. Stem leaf apex. G. Branch leaf. H. Branch leaf alar and basal cells. I. Branch leaf upper medial cells. J. Branch leaf apex. (W. Schofield 95200. UBC)*

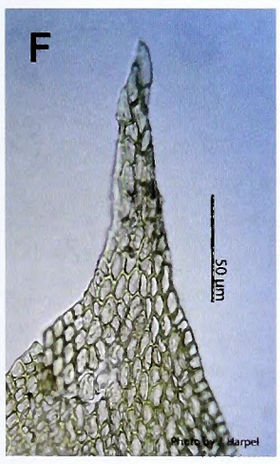

A
2 mm
Photo by J. Harpel

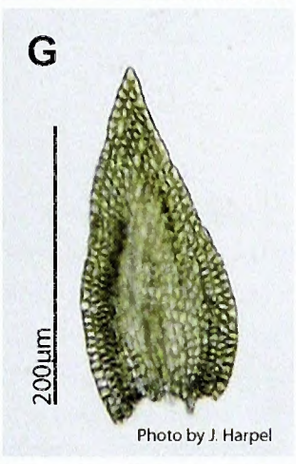

B
2 mm

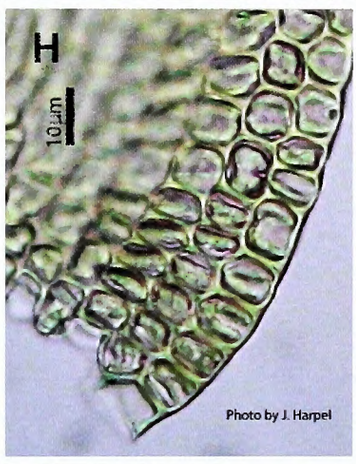

C
100 µm
Photo by J. Harpel

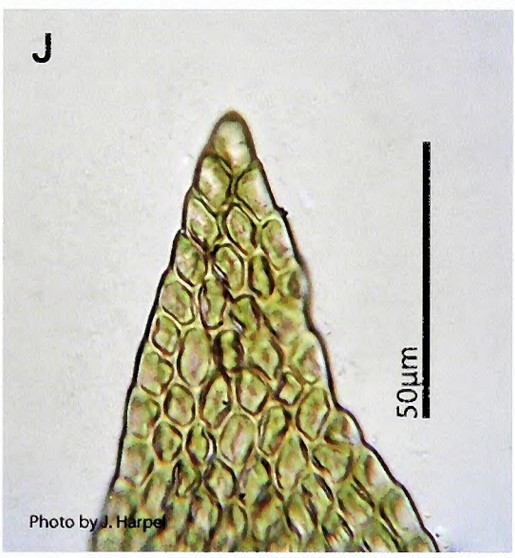

D
20 µm
Photo by J. Harpel

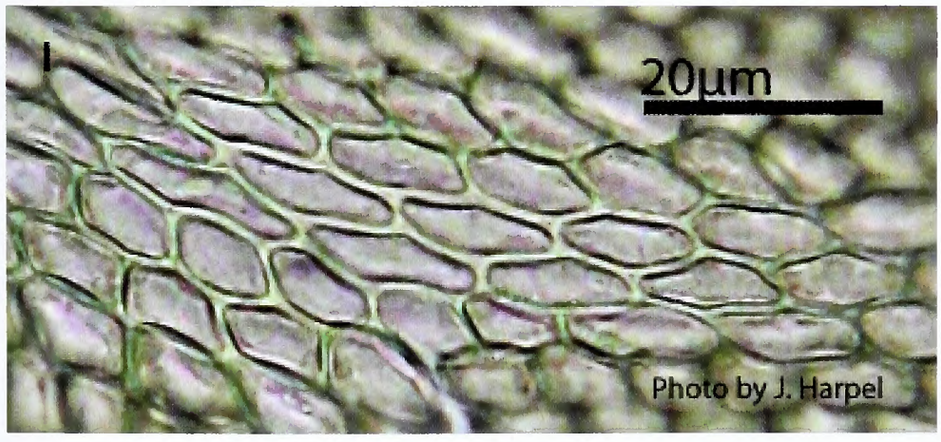

E
20µm
Photo by J. Harpel


F
50 µm


G
200µm
Photo by J. Harpel


H
10µm
Photo by J. Harpel


J
50µm
Photo by J. Harpel


I
20µm
Photo by J. Harpel

when present the spores mature in July. Crum and Anderson (1981) suggested that *P. tectorum* sporophytes had not been found in North America.

Distribution — *Pseudoleskeella tectorum* is known from Europe, Asia, Greenland, and North America. In western North America, it is known from Alaska, Yukon, Northwest Territories, British Columbia, Alberta, Washington, Oregon, California, Idaho, Montana, Utah, Wyoming, Colorado, Nevada, Arizona, and New Mexico. In Oregon, *P. tectorum* is reported from Grant and Klamath counties within the Blue Mountain and East Cascades ecoregions.

References with descriptions and/or illustrations — Spence (in FNA 2014d, p. 365), Crum and Anderson (1981, p. 879), Wilson and Norris (1998, p. 391), Flowers (1973, p. 410 as *Leskeella tectorum*), Lawton (1971, p. 258 as *Leskeella tectorum*), Nyholm (1960, p. 396).

References with photos — Malcolm et al. (2009, p. 256).

Ptilium crista-castrensis (Hedwig) De Notaris

Recent synonym: *Hypnum crista-castrensis* Hedwig
Common names: ostrich-plume feather-moss

Summary — A pleurocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Ptilium crista-castrensis* can be distinguished by its (1) Large size, flat oblong-triangular pinnate fronds with hooked tips, (2) strongly falcate-secund leaves, (3) lack of papillae, and (4) plicate leaves.

Technical description

Gametophyte — **Plants** plumose, dark green to golden, shiny in loose mats, 3.5–11 cm tall. **Stems** with foliose pseudoparaphyllia; suberect to ascending, regularly pinnate, forming flat, oblong-triangular fronds that are hooked or rolled at the tips; hyaloderm lacking. A weak central strand is present. **Leaves:** Stem leaves 2–3 mm long, squarrose, broadly ovate and strongly plicate; costa lacking or short and double; margins plane, serrate above. Branch leaves 1.2–2 mm long, circinate and second, oblong-lanceolate, slenderly long-accuminate and plicate; costa short and double; margins plane, with a sharply serrulate, acuminate apex. Upper medial cells long-linear; basal cells shorter, incrassante and porose. Alar cells are rectangular or quadrate, thin walled in inconspicuous groups. **Dioicous**. Perichaetial leaves lanceolate with a subulate apex.

Sporophyte — **Seta** red-brown, 2–3 cm long. **Capsules** red-brown, 1.5–2 mm long; operculum apiculate; exostome teeth are red-brown and lanceolate; endostome pale yellow; spores 12- 16 µm.

Similar species — *Ptilium* is easily distinguished from *Hypnum*. The plants have extremely plicate, circinate leaves that curve proximally, toward the base of the main stem, not ventrally to the underside of the stem as those in *Hypnum*. Although *Hypnum subimponens* can often form pinnate, golden fronds, the hooked or rolled leaf tips and foliose pseudoparaphyllia separate *Ptilium* from this species.

Ecology — *Ptilium crista-castrensis* occurs in coniferous forest floors, tundra, peatlands, and deciduous forests in temperate, boreal, and subarctic regions from 0 to 6,000 feet in elevation.

Plate 77. Ptilium crista-castrensis. *A. Individual plant. B. Close up of hooked branch leaves. C. Stem leaf. D. Branch leaf. E. Leaf apex. F. Basal cells. G. Alar cells. H. Upper medial cells. I. Capsule. J. Sporophyte. K. Pseudoparaphyllia. (Harpel 481. 52181. Harpel Priv.)*

A
1.5 cm
B
1 mm
C
500µm
D
500µm
E
500µm
F
50µm
H
50µm
G
50µm
I
2 mm
J
4 cm
K
200µm

Distribution — *Ptilium crista-castrensis* is known from Eurasia, Greenland and North America. In western North America, it is know from Alaska south through most all Canadian provinces, Washington, Oregon, Idaho, Montana, Wyoming, and Colorado. In Oregon, *P. crista-castrensis* is reported from Union County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Schofield (in FNA 2014a, p. 563), Smith (2004, p. 916), Crum, (2004, p. 521), Crum and Anderson (1981, p. 1204), Nyholm (1965, p. 597).

References with photos — Lockhart et al. (2012, p. 546), Atherton et al. (2010, p. 811).

Ptychostomum cyclophyllum (Schwäegrichen) J.R. Spence

Recent synonym: *Bryum cyclophyllum* (Schwäegrichen) Bruch & Schimper
Common name: sub-rotund ptychostomum

Summary — An acrocarpous, costate moss with ovate to elliptic leaves. Terrestrial.

Diagnostic characteristics — *Ptychostomum cyclophyllum* can be distinguished by its (1) bright green coloration lacking any red tints, (2) stems usually longer than 3 cm, (3) weakly decurrent leaves, (4) broadly ovate to orbicular leaves with rounded apices, (5) short costa ending before the leaf apex, (6) dioicous sexual condition, (7) leaf margins bistratose in streaks (often obscure), and (8) 14–16 µm spores.

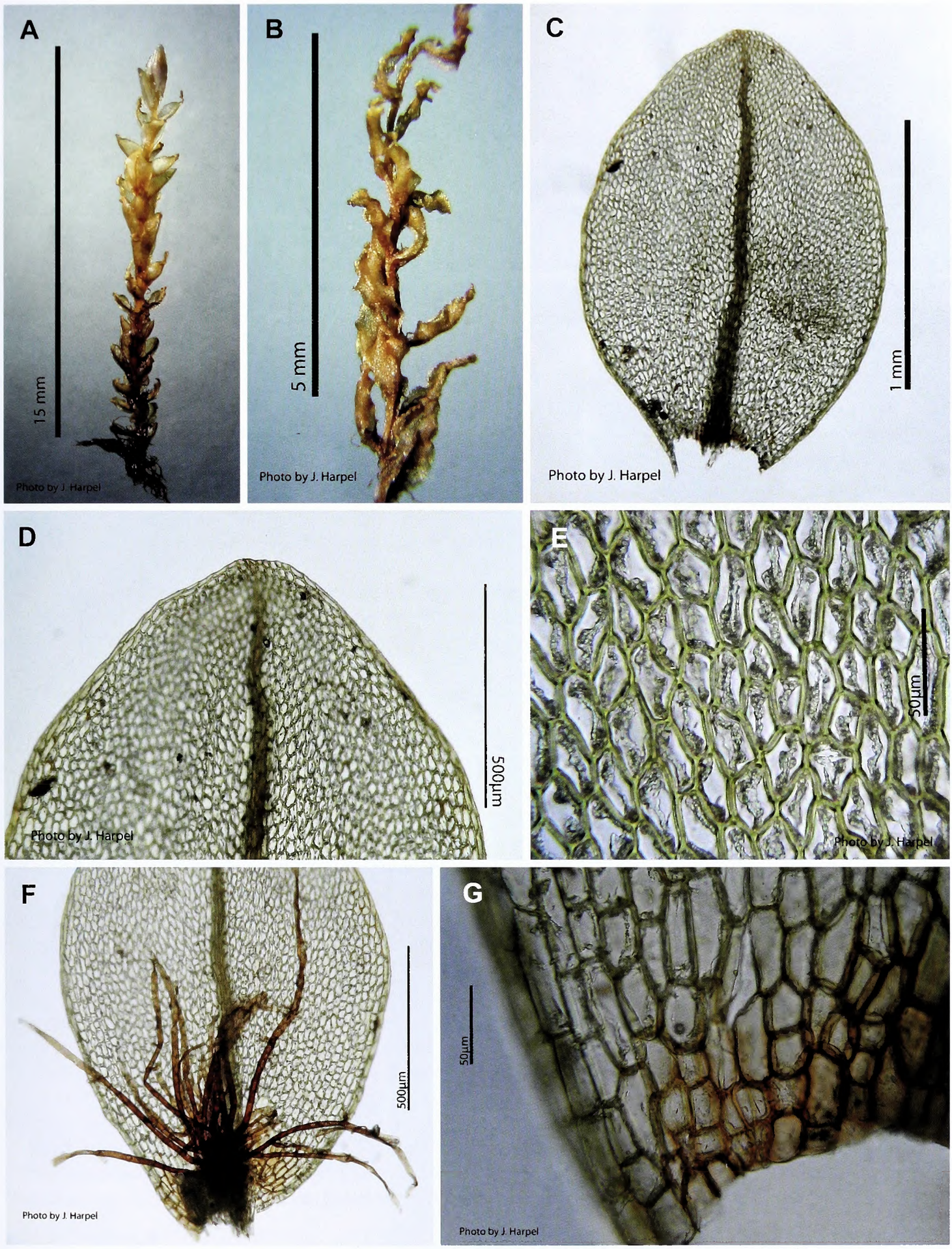
Technical description

Gametophyte — **Plants** in loose tufts, pale-green to yellowish, up to 3 cm high with few to many rhizoids. **Leaves** oblong-ovate to elliptic, 0.5–3 mm long, with a broadly rounded-obtuse apex, somewhat contorted to strongly shrunken when dry; margins plane, entire, rarely slightly recurved below; costa ending below the apex; upper median cells shortly oblong-rhomboidal, 36–60 µm long, thin-walled or occasionally slightly thickened; marginal cells of 1–2 rows, narrower and longer forming an indistinct border. Filamentous branched propagula may occur on the stem in or near leaf axils. **Dioicous**.

Sporophyte — **Seta** 2–3 cm long. **Capsules** pendent, elongate-obovoid; operculum convex-conic, apiculate; peristome teeth yellowish; endostome basal membrane high, cilia appendiculate. **Spores** smooth, 16–18 µm.

Similar species — *Anomobryum* and *Bryum* species have stems usually shorter than 1 cm and julaceous shoots and leaves less than 1 mm long. *Gemmabryum* species generally have rhizoidal tubers or leaf axil bulbils. *Imbribryum* species generally have strongly imbricate leaves. *Rosulabryum* species generally have rosulate stems, concolorous leaf apices, symmetric capsules, and spherical rhizoidal tubers when present. *Plagiobryum* species have distinctive zygomorphic capsules. *Ptychostomum* species have unusual colored cell sap within the lumens of laminal cells, usually in the lower portions of the leaf. *Ptychostomum* is divided into two similar subgenera. Subgenus *Cladodium* has reddish leaf bases, a distinct to indistinct limbidium, unistratose leaf margins, and pink and inflated subalar cells. Subgenus *Ptychostomum* generally has a green leaf base, indistinct limbidium, partial bistratose leaf margin, and lacks inflated and pink subalar cells. *Ptychostomum cyclophyllum,* which is included in subgenus *Ptychostomum*, is distinguished by its broadly ovate to orbicular, blunt, more or less flat leaves that are strongly shrunken when dry.

Plate 78. Ptychostomum cyclophyllum. *A. Moist individual. B. Dry individual. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Leaf with rhizoids at the base. G. Alar and basal cells. (G. Agadmanyan sn. UBC)*


A
15 mm
Photo by J. Harpel
B
5 mm
Photo by J. Harpel
C
1 mm
Photo by J. Harpel
D
500µm
Photo by J. Harpel
E
50µm
Photo by J. Harpel
F
500µm
Photo by J. Harpel
G
50µm
Photo by J. Harpel

Ecology —Spence (1988) noted that *Ptychostomum cyclophyllum* occurs on wet soil at low elevations up to 9,000 feet. It has been recorded from wet soil along the edge of ditches or among tree roots subject to inundation, in a wet seepage area beside a gravel runway, on a wet silty-clay area of muskeg, on tundra, and near a stream in a black spruce stand.

Distribution — *Ptychostomum cyclophyllum* is known from Eurasia, and North America. In western North America, it is known from Alaska, Yukon, Northwest Territories, British Columbia, Alberta, Washington, Oregon, California, Montana, Wyoming, Utah, Colorado, Arizona, and New Mexico. In Oregon, *P. cyclophyllum* is reported from Jackson County within the West Cascades ecoregion.

References with descriptions and/or illustrations — Spence (in FNA 2014e, p. 171), Nougchi (1988), Smith (2004, p. 547 as *Bryum cyclophyllum*), Crum and Anderson (1981, p. 553 as *B. cyclophyllum*), Lawton (1971, p. 169 as *B. cyclophyllum*).

Ptychostomum pacificum J.R. Spence & Shevock

Recent synonyms: none
Common name: Pacific ptychostomum

Summary — An acrocarpous, costate, moss with broadly ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Ptychostomum pacificum* can be distinguished by its (1) medium to large size, (2) proximal leaf margin that is bistratose in streaks, (3) strongly contorted and spirally twisted leaves when dry, (4) mostly percurrent or shorter costa, (5) proximally recurved leaf margin, (6) strong limbidium, and (7) fen habit.

Technical description

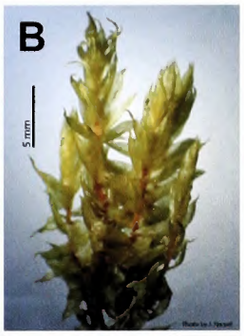
Gametophyte — **Plants** are medium to robust, in dense or open turfs, green or yellow-green. **Stems** 2–12 cm, red-brown, lacking a central strand, evenly foliate to somewhat crowded distally, often strongly covered in rhizoids. **Leaves** narrowly to broadly ovate-lanceolate to ovate, 3–5 mm, somewhat enlarged towards the stem apex, weakly concave distally, leaves below becoming strongly concave and sometimes cucullate, weakly to moderately keeled, yellow-green to bright green, becoming blackish to red-brown when old, strongly contorted when dry, distally spirally twisted, erect-spreading to spreading when wet, not or weakly decurrent; apex acute to acuminate, often colored golden-brown; margins revolute to mid-leaf, smooth to weakly serrulate distally; costa brown to red-brown, strong, not reaching the apex to percurrent, rarely very short excurrent in a stout serrulate awn; limbidium strong, 2–4 rows, yellowish, partly bistratose below; alar cells not differentiated. Gemmae lacking. **Dioicous**.

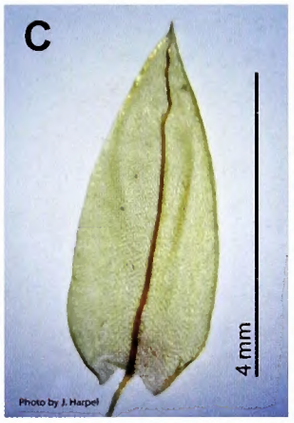
Sporophyte — **Seta** 2–4 cm long, red-brown to yellow. **Capsules** nodding, pyriform, elongate cylindric to clavate 3–4 mm, brown, symmetric, mouth brown to red-brown, somewhat constricted when mature below mouth; exothecial cells irregularly elongate; peristome well-developed, exostome teeth yellow. **Spores** 12–16 µm.

Similar species — *Ptychostomum pacificum* is included in *P.* subg. *Ptychostomum*, based on its bistratose leaf margins that occur in streaks but not always apparent, strong limbidium, and non-differentiated alar cells. It is most similar to *P. schleicheri* and *P. turbinatum* but also mimics large specimens of *P. pseudotriquetrum*. *Ptychostomum schleicheri* is also robust but is characterized by its broad uncontorted yellowish leaves, broad

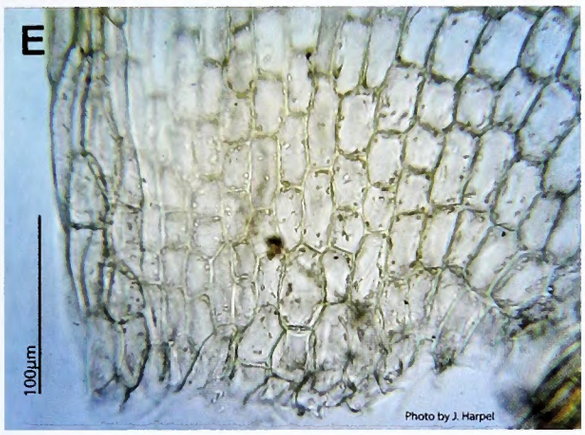
Plate 79. Ptychostomum pacificum. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Upper medial cells. E. Alar and basal cells. F. Leaf apex. G. Leaf marginal cells. H–J. Leaf cross-sections. K. Stem cross-section. (J. Shevock 18383. D. Wagner m2308. CAS)*

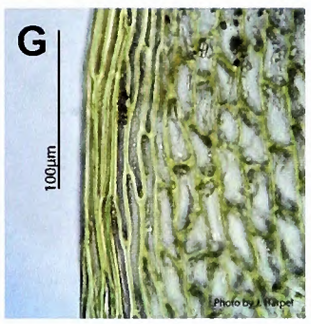

A
5 mm

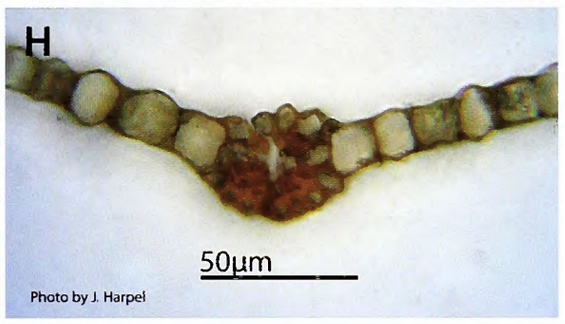

B
5 mm

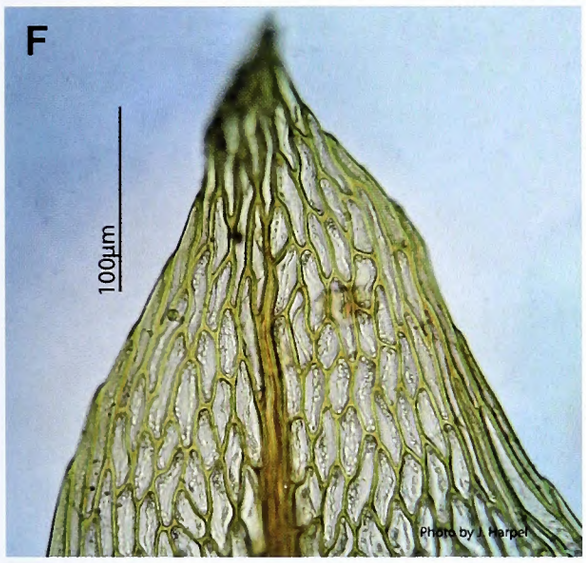

C
4 mm
Photo by J. Harpel

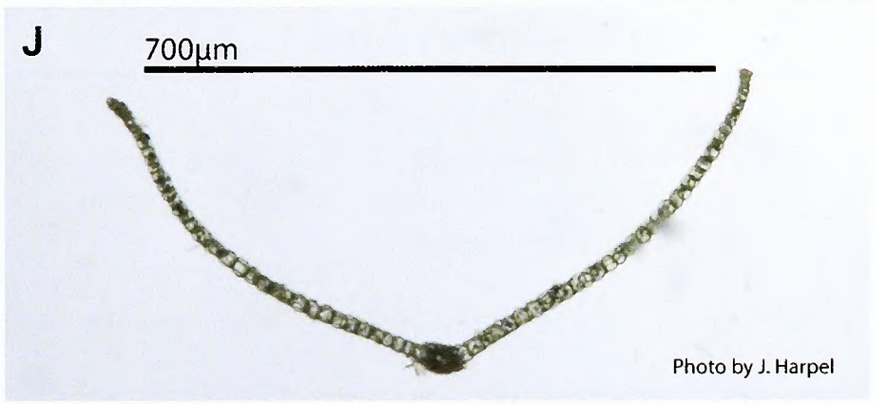

D
50µm
Photo by J. Harpel


E
100µm
Photo by J. Harpel

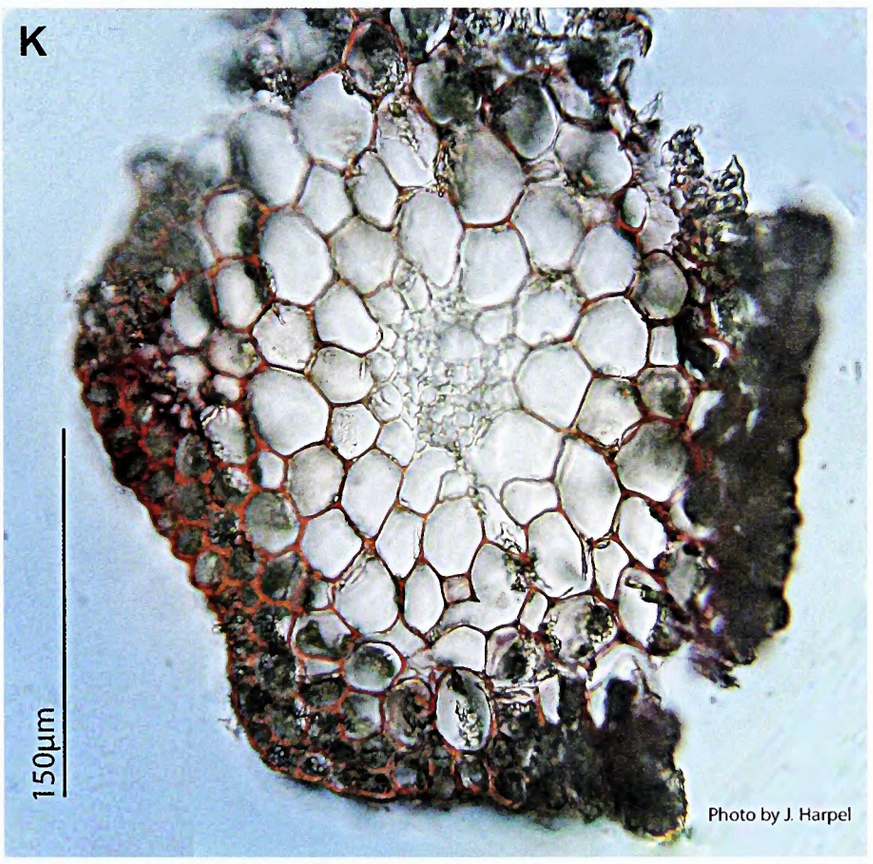

G
100µm
Photo by J. Harpel


H
50µm
Photo by J. Harpel


F
100µm
Photo by J. Harpel


J
700µm
Photo by J. Harpel


I
50µm
Photo by J. Harpel


K
150µm
Photo by J. Harpel

laminal cells, and turbinate capsules. *Ptychostomum turbinatum* has broadly turninate capsules, a plane leaf margin, and a usually short-excurrent costa and is a smaller plant, 3–4 cm long with leaves up to 4 mm. *Ptychostomum pseudotriquetrum* has stongly decurrent leaves, short-excurrent costae, shorter proximal lamina cells, and a unistratose limbidium. *Ptychostomum pacificum* colonies are reminiscent of *Rhizomnium pseudopunctatum* in stature and mat growth. However, *Ptychostomum pacificum* is more yellow-green and upon inspection is not a member of the Mniaceae. See *Ptychostomum cyclophyllum* for additional similar species.

Ecology — *Ptychostomum pacificum* is restricted to perennial wet fen habitats within coniferous forests primarily dominated by *Abies concolor*, *Abies magnifica* and *Pinus contorta*. Associated bryophytes include *Aulacomnium palustre*, *Drepanocladus aduncus*, *Meesia triquetra*, *Philonotis* sp, and *Sphagnum* spp. Sites range in elevation from 4,465 to 9,300 feet.

Distribution — *Ptychostomum pacificum* is endemic to western North America and known only from Oregon, California, and Nevada. In Oregon, *P. pacificum* is reported from Douglas, Jackson, Josephine, and Lane counties within the West Cascades and Klamath Mountains ecoregions.

References with descriptions and/or illustrations — Spence and Shevock (2012).

Racomitrium brevipes Kindberg

Recent synonyms:

Bucklandiella brevipes (Kindberg) Bednarek-Ochyra & Ochyra

Racomitrium sudeticum f. *brevipes* (Kindberg) E. Lawton

Common name: Racomitrium moss

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characters— *Racomitrium brevipes* is distinguished by its (1) basal cells that are thick-walled with sinuose lateral walls, (2) leaves with a hair-point, (3) thick-walled marginal alar cells, (4) bistratose leaf margin, and (5) pseudopapillose laminal cells.

Technical description

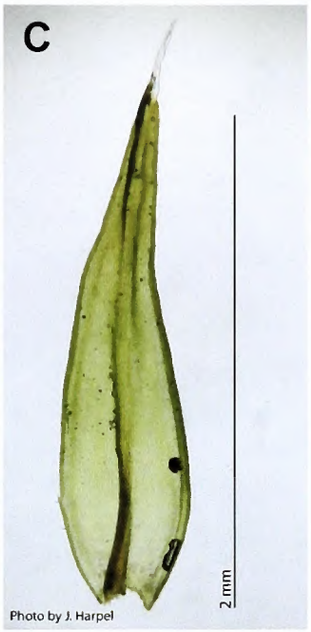
Gametophyte — **Plants** olive-green, to grayish, large and coarse, rigid, forming loose tufts or mats up to 3–5 (–7) cm tall. **Stems** more or less irregularly branched (rarely subpinnate), erect-appressed when dry, erect-patent when moist. **Leaves** lanceolate, rigid, slightly to distinctly falcate, 2.5–3.0 mm long and ending in a strongly denticulate and spinulose 0.4–1.1 mm long hairpoint; margins broadly recurved on one side, narrowly recurved on the other; lamina bistratose in the upper half, occasionally with unistratose patches; costa stout, broad, percurrent; upper medial cells short to isodiametric; basal cells elongate with slightly sinuose thick-walled marginal cells; all cells strongly nodulose with pseudopapillose walls; alar cells slightly differentiated, often forming a small yellowish group. **Dioicous**.

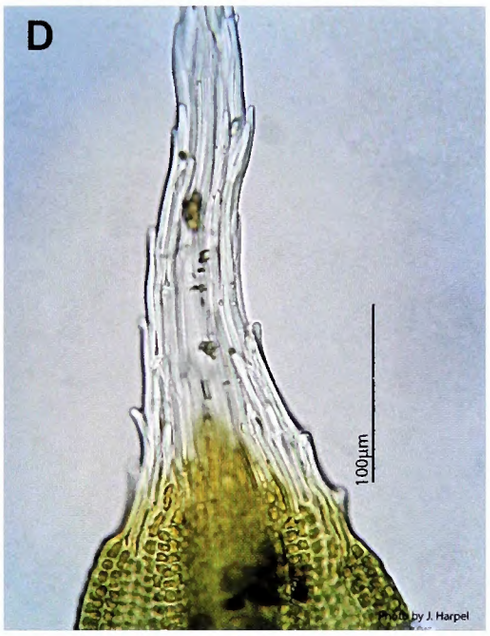
Sporophyte — **Seta** brown, 2.5–5.5 mm. **Capsules** brown, oblong-cylindric, 1.3–1.9 × 0.6 mm, wrinkled when dry; peristome teeth yellow-brown, more or less divided into 2 (3) parts, irregularly papillose from a low basal membrane, 10–15 µm high. **Spores** 14–17 µm.

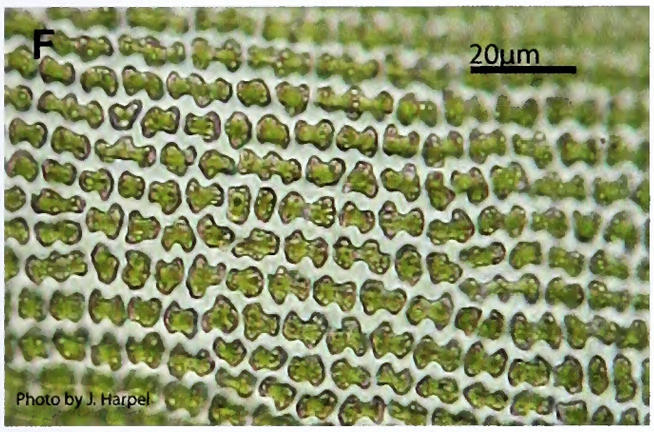
Plate 80. Racomitrium brevipes. *A. Moist habitat. B. Dry habitat. C. Leaf. D–E. Leaf apex. F. Upper medial cells. G. Basal cells. H. Leaf cross-section. I. Sporophyte. (R. Exeter 895. Exeter Private)*

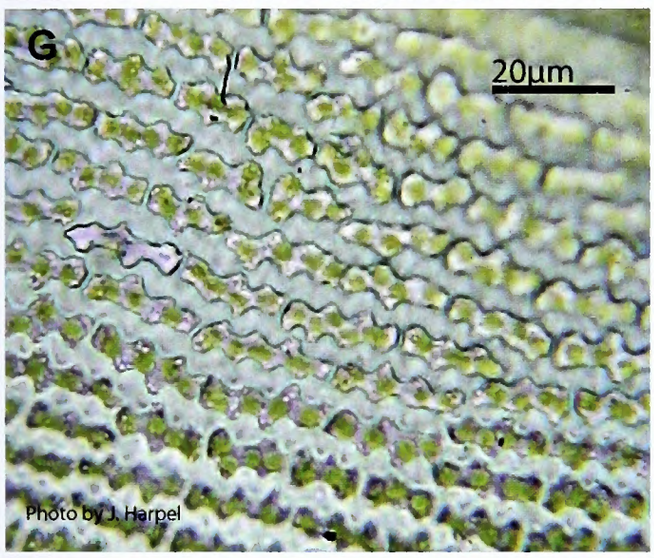

A
5 mm
Photo by J. Harpel

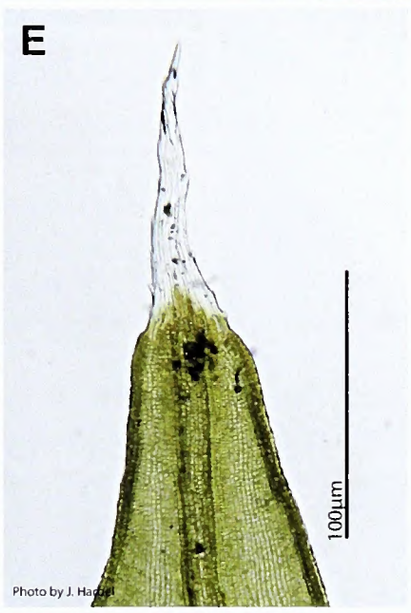

B
5 mm

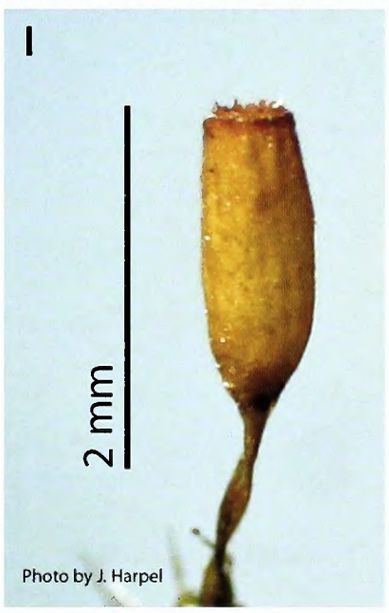

C
2 mm
Photo by J. Harpel


D
100µm


F
20µm
Photo by J. Harpel


G
20µm
Photo by J. Harpel


E
100µm
Photo by J. Harpel


I
2 mm
Photo by J. Harpel


H
200µm
Photo by J. Harpel

Similar species — *Racomitrium occidentale* is similar but has a costal groove in the distal portion of the leaf. *Racomitrium macounii* and *R. sudeticum* have a compact costa that is 3–4 cells wide on the ventral surface. *Racomitrium obesum* leaf cells are smooth to only moderately pseudopapillose.

Ecology — *Racomitrium brevipes* is known from dry and exposed acidic rocks from 60–7,100 foot elevations. In the Oregon Coast Range Mountains (Marys Peak), it is known at 4,000 feet from south facing slopes on basalt on the edge of graminoid meadows and noble fir (*Abies procera*) forests.

Distribution — *Racomitrium brevipes* is endemic to western North America and known from Alaska, British Columbia, Washington, Oregon, California, and Montana. In Oregon, *R. brevipes* is reported from Benton, Clackamas, Douglas, Grant, Jackson, and Multnomah counties within the Blue Mountain, Coast Range, Klamath Mountain, and West Cascades ecoregions. Historical collections have also been reported from Hood River, Lane, and Union counties, but none have been verified.

References with descriptions and/or illustrations — Bednarek-Ochyra and Ochyra (in FNA 2007, p. 281 as *Bucklandiella brevipes*), Wagner (2007), Frisvoll (1988, p. 50), Lawton (1971, p. 147 as *Racomitrium sudeticum* f. *brevipes*).

Racomitrium depressum Lesquereux

Recent synonyms: *Codriophorus depressus* (Lesquereux) Bednarek-Ochyra & Ochyra
Common name: racomitrium moss

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characters—*Racomitrium depressum* can be distinguished by its (1) muticous leaves, (2) setae with a left handed twist, (3) thick-walled basal cells with sinuose lateral walls, (4), weakly differentiated alar cells, (5) smooth leaf margins at the apex, (6) broad ligulate leaves, and (7) a strong costa extending almost to the leaf tip.

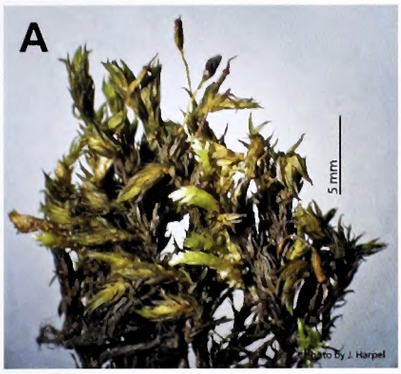
Technical description

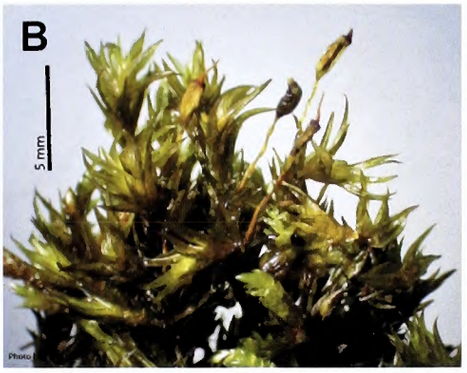
Gametophyte — **Plants** olive-green, brownish to nearly black, 4–10 (–13) cm long, simple or branched. **Leaves** ovate-lanceolate, concave, erect, unistratose, usually 3–4 × 1–1.5 mm, loosely imbricate when dry, apex acute to obtuse; margins mostly entire or with a few blunt teeth at the apex, recurved 2/3–3/4 the length of the leaf on one or both sides. Leaf cells smooth or faintly papillose; alar cells not differentiated. Costa on back (dorsal) side of leaf broad and flattened, 1–1.5 mm wide at base extending to the leaf apex but not prolonged as an awn.

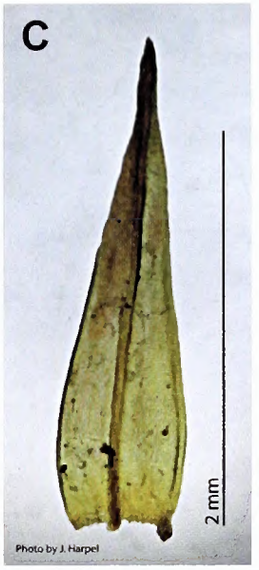
Sporophyte — **Seta** brown, 4.5–7 mm, with a left handed twist. **Capsules** brown to reddish-brown, symmetric or slightly curved and gibbous, obloid to cylindric, 1.8–3 mm; peristome teeth, lanceolate, reddish or yellowish-brown, finely papillose to nearly smooth basally, densely low-papillose distally, deeply bifid or tripartite down for two thirds of their length. **Spores** (10–) 12–15 (–17) µm.

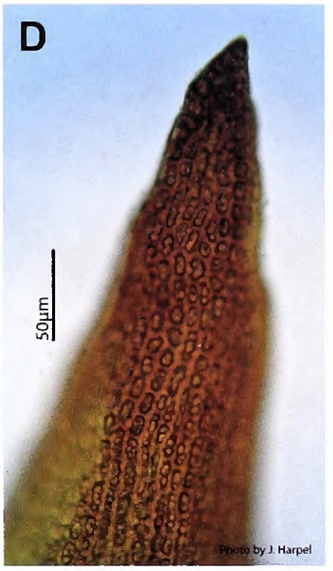
Similar species — *Racomitrium aciculare* differs in its broadly rounded (lingulate) leaves with a coarsely toothed apex, leaf cells distinctly papillose over the lumen, and a narrow costa that is rounded at back of the leaf. *Racomitrium norrisii* is similar to *R. aciculare* except that it is smaller and has smaller papillae that are located over the cell walls instead of the lumen and its leaves have thickened bistratose margins. *Racomitrium pacificum* has a narrow costa that is rounded at the back of the leaf.

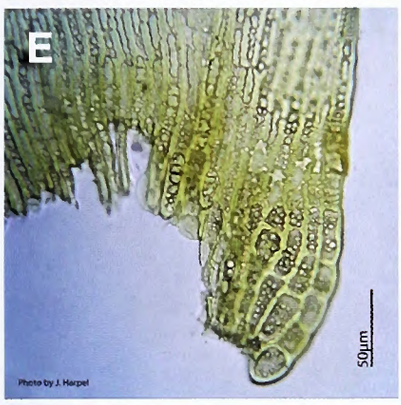
Plate 81. Racomitrium depressum. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Leaf apex. E. Alar and basal cells. F. Upper medial cells. G.– H. Leaf cross-sections. I–J. Sporophytes. K–L. Peristome teeth (R. Exeter 940. Exeter Private)*

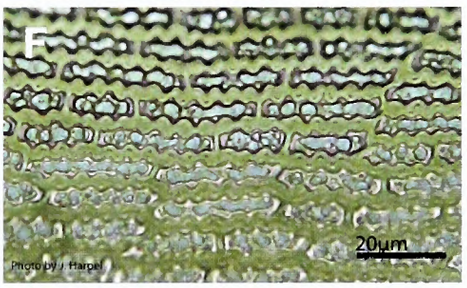

A
5 mm

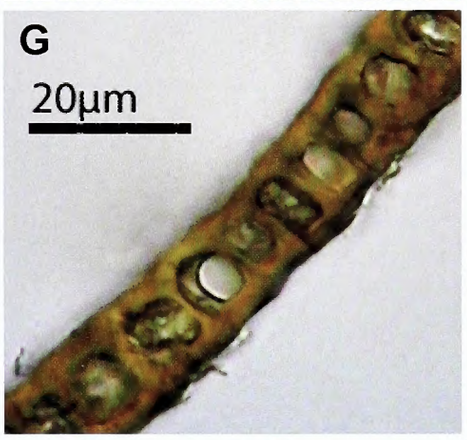

B
5 mm

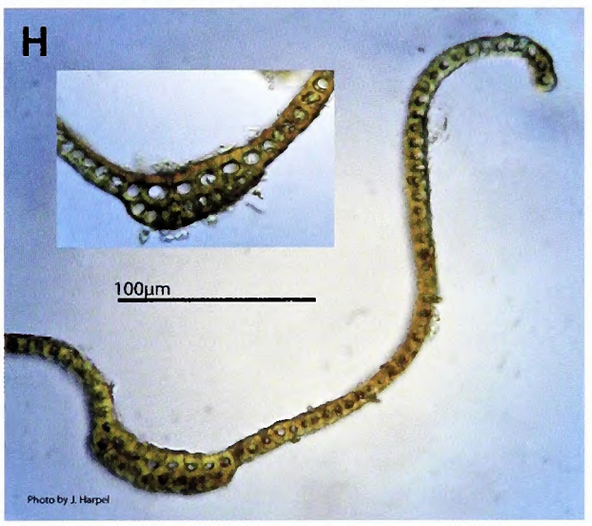

C
2 mm
Photo by J. Harpel


D
50µm
Photo by J. Harpel


E
50µm
Photo by J. Harpel

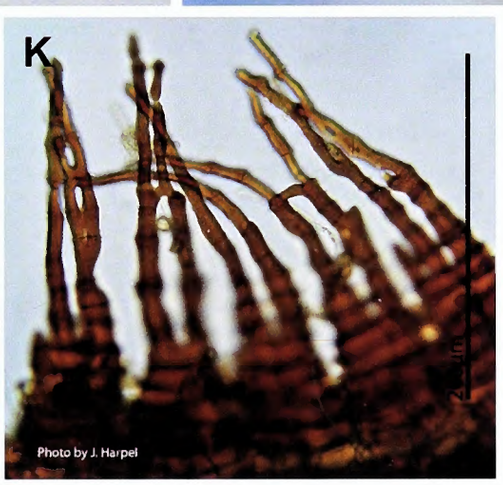

F
20µm
Photo by J. Harpel

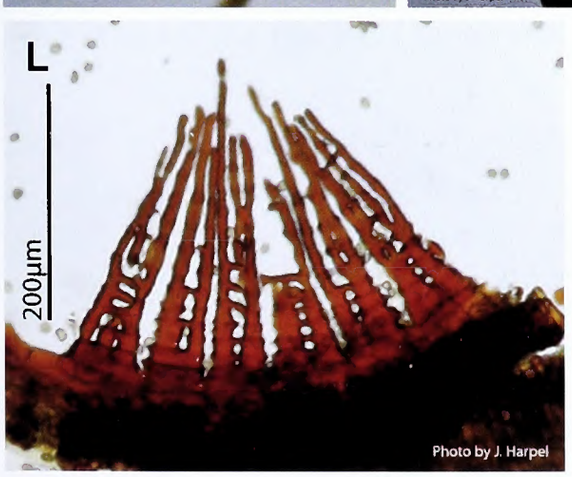

G
20µm


H
100µm
Photo by J. Harpel


I
3 mm
Photo by J. Harpel


J
9 mm
Photo by J. Harpel


K
Photo by J. Harpel


L
200µm
Photo by J. Harpel

Ecology — *Racomitrium depressum* forms mats on rocks in perennial or intermittent streams and in the spray zone of waterfalls between 400 and 8,400 foot elevations. Habitats are subject to scour during peak flows. Bednarek-Ochrya and Ochyra (2006) stress its occurrence in intermittent streams and other seasonally wet habitats that dry out by midsummer in montane to subalpine habitats. Forest types include *Abies concolor*, *Abies magnifica* × *shastensis*, *Pinus jeffreyi, Pinus ponderosa, Pseudotsuga menziesii*, *Quercus* spp., *Tsuga heterophylla*, and *Tsuga mertensiana* associations.

Distribution — *Racomitrium depressum* is endemic to western North America and is known from Oregon, California, and Nevada. In Oregon, *R. depressum* is reported from Jackson County within the West Cascades ecoregion.

References with descriptions and/or illustrations — Bednarek-Ochyra and Ochyra (in FNA 2007, p. 300 as *Codriophorus depressus*), Wagner (2007), Bednarek-Ochyra (2006, p. 152), Frisvoll (1988, p. 106), Jones (1933, p. 53), Frye (1917, plate 23).

References with photos — Malcolm et al. (2009, p. 57).

Racomitrium molle Cardot

Recent synonyms: *Codriophorus mollis* (Cardot) Bednarek-Ochyra & Ochyra
Common name: Racomitrium moss

Summary — An acrocarpous, costate moss with broadly ligulate-lanceolate leaves. Terrestrial.

Diagnostic characters — *Racomitrium molle* can be distinguished by its (1) muticous leaves, (2) setae with a left handed twist, (3) thick-walled basal cells with sinuose lateral walls, (4) weakly differentiated alar cells, (5) leaf margins smooth at apex, (6) broad ligulate leaves, and (7) spurred or forked costa extending 1/2–3/4 the length of the leaf.

Technical description

Gametophyte — **Plant** color variable, ranging from olivaceous, brown, golden-yellow, to blackish-brown; robust, in dense or loose to cohesive tufts or patches. **Stems** curved-ascending to erect, appressed to the substratum, 1–7 (–10) cm tall. **Leaves** broadly lingulate or elliptical to oblong with a broadly rounded obtuse apex, more or less cucullate, not or slightly decurrent; margins unistratose, entire, plane, bluntly erose-dentate or sinuate at the apex; basal margins recurved on one side, rare both sides; costa single spurred and forked at the apex; upper medial cells unistratose, isodiametric, rounded-quadrate to shortly rectangular; basal cells longer; alar cells somewhat swollen and shortly decurrent. **Dioicous**.

Sporophyte — **Seta** dark brown to black with age, fairly stout, 4–9 mm long. **Capsules** light to dark brown, obloid to shortly cylindric, 1.2–2 × 0.7–0.8 mm; peristome teeth lanceolate, reddish-brown, densely covered with sharp papillae throughout, divided nearly to the base or often imperfectly into 3 cylindrical rather unequal parts. **Spores** (13–) 17–20 µm.

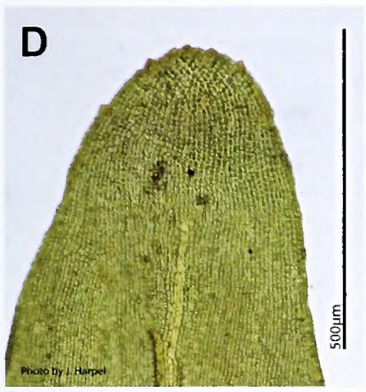
Similar species — According to Bednarek-Ochyra (2006), the most diagnostic character that identifies *R. molle* is its slender, commonly spurred and regularly forked costa apex. Other muticous racomitriums could be confused with *R. molle*. *Racomitrium acicularis* and *R. norrisii* leaves have distinctly dentate apices. *Racomitrium depressum* has a strong costa nearly filling the leaf tip, and *R. pacificum* has thick walled alar cells that are quadrate to short rectangular and usually distinctly auriculate.

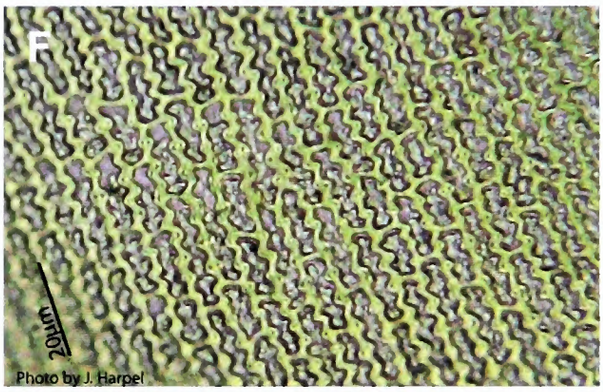
Plate 82. Racomitrium molle. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Leaf apex. E. Alar and Basal cells. F. Upper medial cells. G. Leaf forked costa. (W. Schofield 101537. UBC)*


A
5 mm
Photo by J. Harpel


B
5 mm
Photo by J. Harpel


C
1 mm
Photo by J. Harpel


D
500µm
Photo by J. Harpel


F
20µm
Photo by J. Harpel


E
50µm
Photo by J. Harpel


G
200µm
Photo by J. Harpel

Ecology — *Racomitrium molle* is known from wet cliffs; dripping rocks; splashed or periodically flooded boulders, stones, and outcrops in creek beds; margins of aquatic habitats; seepy sloping outcrops on roadsides; and thin soil over moist rock ledges in full sunlight to diffusely lit and shaded sites on both acidic and basic substrates. Sites are scattered at 0–6,000 foot elevations throughout coastal coniferous forests and subalpine meadows and bogs.

Distribution — *Racomitrium molle* is known from Asia and North and South America. In western North America, it is known from Alaska, British Columbia, Washington, Oregon, and California. In Oregon, *R. molle* is reported from Jackson and Klamath counties and within the West Cascades ecoregion.

References with descriptions and/or illustrations — Ochyra and Bednarek-Ochyra (in FNA 2007, p. 298 as *Codriophorus mollis*), Wagner (2007), Bednarek-Ochyra (2006, p. 95).

Racomitrium pygmaeum Frisvoll

Recent synonym: *Niphotrichum pygmaeum* (Frisvoll) Bednarek-Ochyra and Ochyra
Common names: pygmy racomitrium

Summary — An acrocarpous, costate, papillose moss with ovate-lanceolate to triangular leaves. Terrestrial.

Diagnostic characteristics — *Racomitrium pygmaeum* can be distinguished by its (1) small size with leaves 1.5 to 1.8 mm long, (2) thick-walled, sinuose lateral cell walls, (3) tall, conical papillae over the lumen of laminal cells, (4) awns lacking papillae to faintly papillose at the base, and (5) moderate to high elevation habit.

Technical description

Gametophyte — **Plants** olivaceous to greenish yellow, forming mats. **Stems** 0.5–1.8 (–2.5) cm, ascending, subpinnately or occasionally pinnately branched to almost unbranched, usually covered in rhizoids. **Leaves** ovate-lanceolate, 1.5–1.8 x 0.5–0.6 mm, imbricate, not or slightly altered when dry, erect-spreading to weakly recurved when moist. Margins recurved near the apex, not or only weakly at the base. Awn erect-flexuose, farily long on the upper leaves, rarely muticous, usually denticulate, not decurrent and indistinctly papillose at the base or epapillose. Costa percurrent, unbranched and sharply delimited in the lower part. Upper medial cells short, opaque, sinuose, coarsely and densely papillose. Basal cells rectangular, papillose with large papillae above and epapillose in the lower 2–3 rows. Alar cells mostly subquadrate to short-rectangular and pellucid in 3–5 (–6) rows, not or little inflated with thickened cross walls. Supra-alar cells thin-walled, often moderately elongate, esinuose.

Sporophyte — Unknown.

Similar species — *Racomitrium pygmaeum* is distinguished from other members of the genus by the presence of tall, conical papillae situated over the lumina of laminal cells, recurved leaf margins and small size, (leaves 1.5–1.8 mm long). The closely related, *Racomitrium muticum* leaf margins are recurved 1/2 to 3/4 the way up the leaf tip and have slightly larger leaves, 1.8–2.5 mm. *Racomitrium elongatum* and *R. ericoides* have larger leaves, 2–3 mm. In addition, *R. ericoides* and *R. elongatum* alar cells form a distinctly inflated group with mostly coarsely papillose awns. *Racomitrium canescens* has a distinctly branched costa.

Ecology — *Racomitrium pygmaeum* occurs in dry and open acidic ground in alpine heaths from 5,700 to7,500 feet in elevation. It is the rarest member of the genus.

Plate 83. Racomitrium pygmaeum. *A. Individual plant, dry. B. Individual plant, wet. C–D. Leaves. E. Leaf apex. F. Alar and basal cells. G. Upper medial cells. H. Leaf cross section. I. Basal leaf marginal cells. (B. Tan 77-1111. 77-1800. UBC)*

A
5 mm
B
5 mm
C
1 mm
D
1 mm
E
200µm
F
50µm
20µm
G
H
100µm
I
50µm

Distribution — *Racomitrium pygmaeum* is a western North American endemic where it is known from British Columbia, Washington and Oregon. In Oregon, *R. pygmaeum* is reported from Clackamas County within the West Cascade ecoregion.

References with descriptions and/or illustrations — Ochyra and Bednarek-Ochyra (in FNA 2007, p. 290, as *Niphotrichum pygmaeum*), Frisvoll (1983).

Racomitrium ryszardii Bednarek-Ochyra

Recent synonym: *Codriophorus ryszardii* (Bednarek-Ochyra) Bednarek-Ochyrya & Ochyra
Common name: Ryszard's racomitrium moss

Taxonomic note: All previous North American records for *Racomitrium aquaticum* (Bridel) Bridel have been referred to *Racomitrium ryszardii*. *Racomitrium aquaticum* is restricted to the Old World (Benarek-Ochyra 2000; Ochyra and Benarek-Ochyra 2006). Because of long-standing taxonomic confusion with *Racomitrium aquaticum* (now excluded from North America), descriptions and illustrations of *R. ryszardii* given in pre-2000 references may be based in part on European descriptions of *R. aquaticum* and not on actual observations of North American plants.

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characters— *Racomitrium ryszrdii* can be distinguished by its (1) muticous leaves, (2) setae with a left handed twist, (3) thick-walled basal cells with sinuose lateral walls, (4) weakly differentiated alar cells, (5) leaf tip margins with a few very small, rolling teeth, and (6) narrow lanceolate leaves.

Technical description

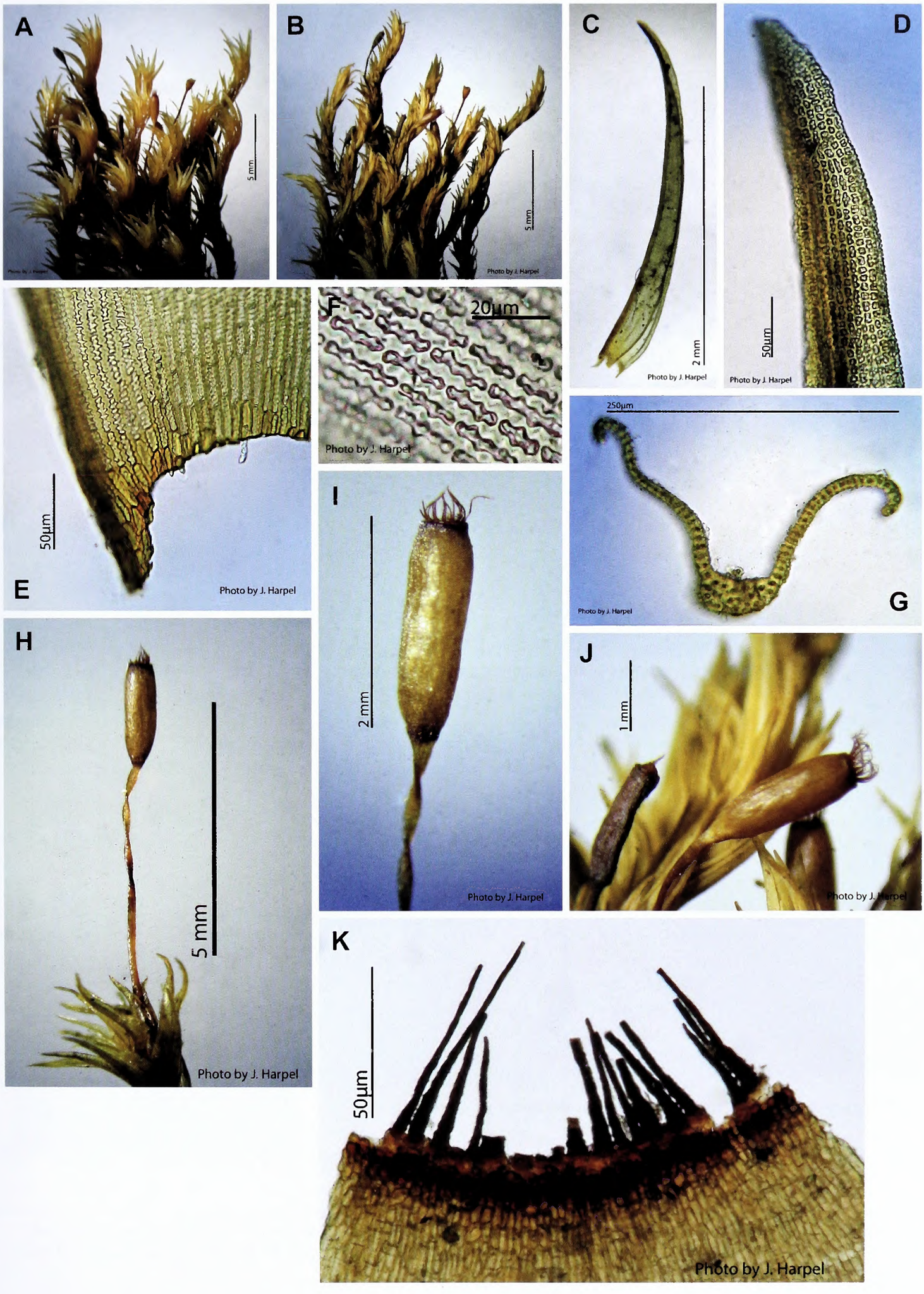
Gametophyte — **Plants** trailing to erect, 1–10 cm long, branched irregularly. **Leaves** green, yellow-green to blackish below, linear-lanceolate, straight or curved at shoot tips, imbricate when dry, 2–4 mm long, 0.4–1 mm wide, tapered to a rounded, roughened tip; margins entire, recurved, lacking row(s) of large thin-walled cells at base; costa forming a prominent keel at back of leaf, extending nearly to leaf tip and never forming an awn; leaf cells multipapillose, the cell walls sinuose-wavy. **Dioicous**.

Sporophyte — **Seta** 4–8 mm long with a left hand twist when dry. **Capsules** 2–3 mm long, cylindrical; peristome teeth 0.6–0.8 mm long. **Spores** 6–10 μm.

Similar species — *Racomitrium varium* is similar, but can be distinguished by distinct awns that are usually present on some leaves and a lower marginal border of 10–20 elongate to rectangular cells in the alar and supra alar regions. Of the other muticous racomitriums that could be confused with *R. ryszardii*, *R. acicularis* and *R. norrisii* have leaves with distinctly dentate apices, *R.depressum* and *R. molle* have ligulate leaves, and *R. pacificum* has thick walled alar cells that are quadrate to short rectangular and usually distinctly auriculate. *Grimmia ramondii* has prominent costal ridges on the back of the costa, (visible with a hand lens), only slightly sinuous cell walls, and setae with a right handed twist when dry.

Ecology — *Racomitrium ryszardii,* which is reported at 0–6,500 foot elevations, often forms mats on shaded moist rocks and cliffs along shady streams or in forests, often in the splash zone but never aquatic. Northwestern Oregon sites occur in true fir plant associations, often on shaded or partially exposed ditchline boulders.

Plate 84. Racomitrium ryszardii. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Leaf apex. E. Alar and basal cells. F. Upper medial cells. G. Leaf cross-section. H–J. Sporophytes. K. Peristome teeth. (J. Harpel 16051. M. Hutten 9474. Harpel Private. Hutten Private).*


A
5 mm
B
5 mm
Photo by J. Harpel
C
2 mm
Photo by J. Harpel
D
50µm
Photo by J. Harpel
E
50µm
Photo by J. Harpel
F
20µm
Photo by J. Harpel
I
2 mm
Photo by J. Harpel
250µm
Photo by J. Harpel
G
H
5 mm
Photo by J. Harpel
J
1 mm
Photo by J. Harpel
K
50µm
Photo by J. Harpel

Associated forest associations include *Abies amabilis*, *A. procera*, *Picea sitchensis*, *Pseudotsuga menziesii*, and *Tsuga heterophylla*. Sporophytes are produced in summer and fall.

Distribution — *Racomitrium ryszardii* is endemic to western North America where it is known from Alaska, British Columbia, Washington, and Oregon. In Oregon, *R. ryszardii* is reported from Lincoln and Multnomah counties within the Coast Range and West Cascades ecoregions.

References with descriptions and/or illustrations — Bednarek-Ochyra and Ochyra (in FNA 2007, p. 301 as *Codriophorus ryszardii*), Bednarek-Ochyra (2006, p. 134), Bednarek-Ochyra (2000, p. 247), Wagner (2007), Lawton (1971, p. 142 as *R. aquaticum*).

Rhytidiadelphus subpinnatus (Lindberg) T.J. Koponen

Recent synonyms: none
Common name: scarce turf moss

Summary — A large pleurocarpous, short costate moss with ovate-triangular leaves. Terrestrial.

Diagnostic characters— *Rhytidiadelphus subpinnatus* can be distinguished by its (1) non-plicate leaves; (2) distinct, thin-walled and non-porose alar cells; (3) short or double costa that extends to one-third of the leaf; (4) stem leaves that are uncrowded with the stem visible between leaves; and (5) moist and usually shaded habitat.

Technical description

Gametophyte — **Plants** large, soft, 2–4 mm wide (across leafy stem) and up to 15 cm long. **Stems** irregularly branched to pinnate; branches commonly to 20 mm. **Leaves** on the stem not crowded (stem visible between leaves) except at tip, erect-spreading to squarrose, broadly ovate-triangular, not plicate or rugose, 2.3–4.2 × 1.1–2 mm; base not or scarcely sheathing, broadly rounded to the insertion; apex abruptly narrowed to a long, channeled acumen; costa extending to 1/3 leaf; median cells 40–75 × 5–7 µm, smooth; alar cells distinct, shorter and wider than basal cells with thin, nonporose walls. Branch leaves ovate to lanceolate, 1.3–2.8 × 0.4–1.3 mm. **Dioicous**.

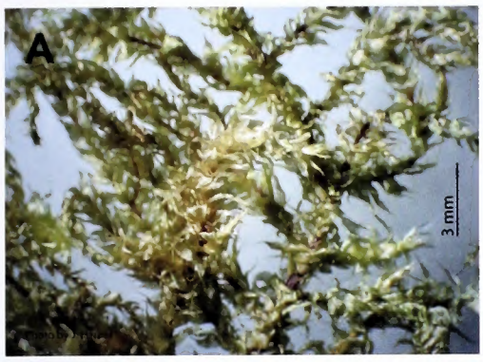
Sporophyte — **Seta** elongate, smooth usually 20 mm or less. **Capsules** ovoid, 1–2.2 mm. **Spores** 11–17 µm.

Similar species — Both *Rhytidiadelphus loreus* and *R. triquetrus* differ in their plicate leaves and non-differentiated alar cells. The similar *R. squarrosus* has leaves that are more crowded concealing the stem and generally occurs in well-drained open to partly shaded sites or in grassy disturbed habitats. Vanderpoorten et al. (2003) noted that *R. subpinnatus* can be further morphologically distinguished from *R. squarrosus* by its mostly prostrate and regularly branched habit, triangular to cordate stem leaf base, a 2–3 stratose stem cortex, narrow median leaf laminal cells that are 45–80 × 5–7 µm, an endostome basal membrane usually less than 38% of total endostome height, and setae that are frequently shorter than 20 mm.

Ecology — *Rhytidiadelphus subpinnatus* is known from damp to wet soil, humus, logs, and rocks in swamps and moist forests, often along streams and in the spray of waterfalls.

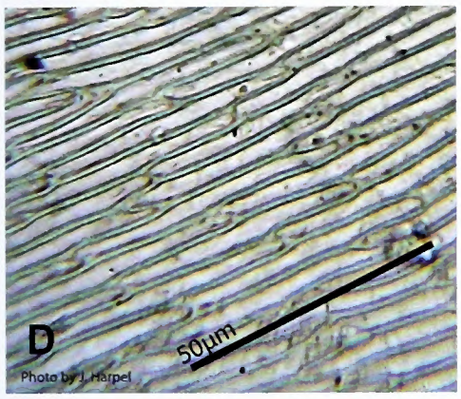
Distribution — *Rhytidiadelphus subpinnatus* is known from Eurasia and North America, and in western North

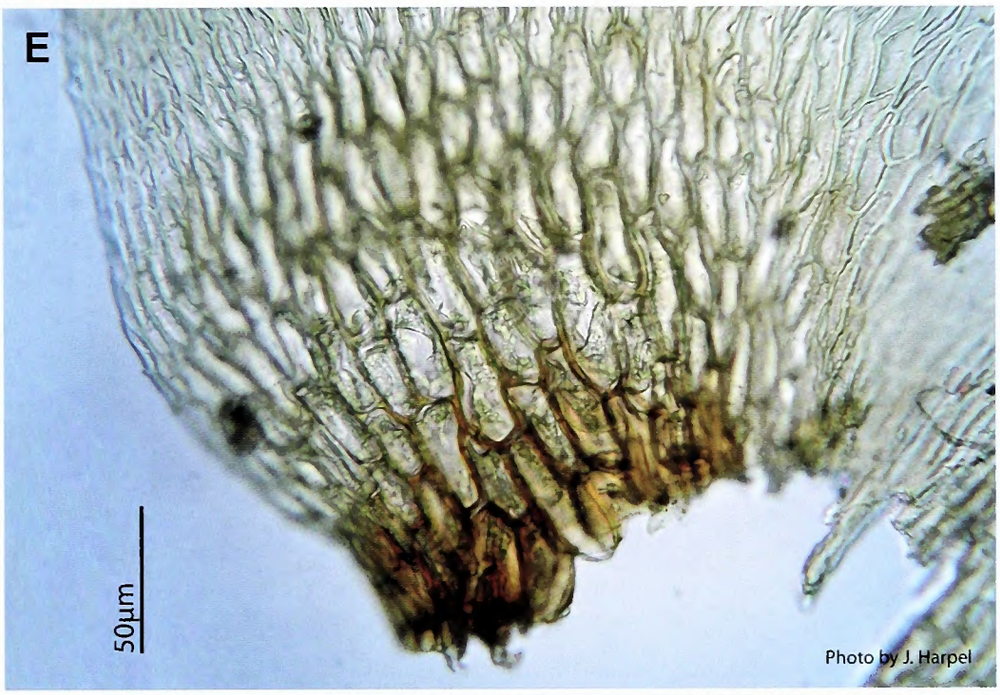
Plate 85. Rhytidiadelphus subpinnatus. *A. Dry habitat. B. Moist habitat. C. Stem leaf. D. Stem leaf upper medial cells. E. Stem leaf alar and basal cells. F. Branch leaf. G. Branch leaf upper medial cells. H. Branch leaf alar and basal cells. (J. Harpel 47222. Harpel Private)*

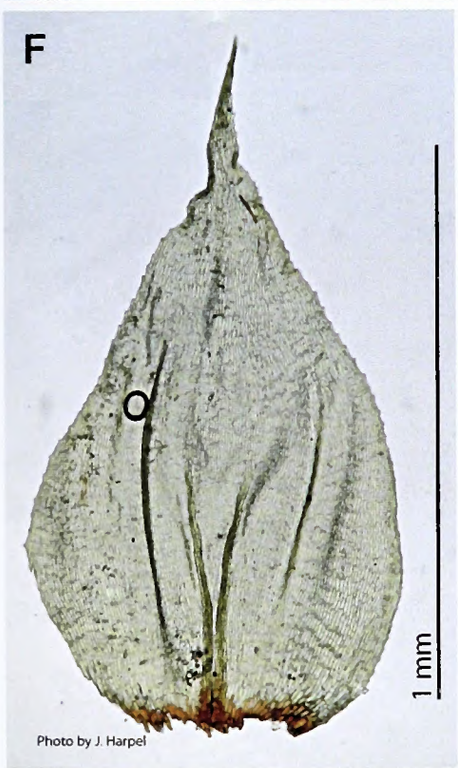

A
3 mm

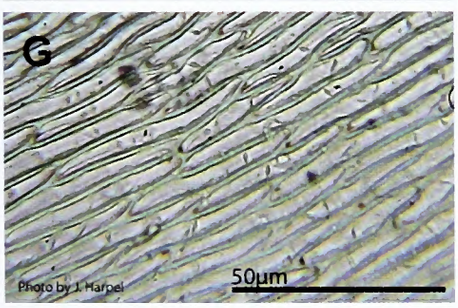

B
3 mm
Photo by J. Harpel


C
Photo by J. Harpel
1 mm


D
50µm
Photo by J. Harpel


E
50µm
Photo by J. Harpel


F
1 mm
Photo by J. Harpel


G
50µm
Photo by J. Harpel


H
50µm
Photo by J. Harpel

America from Alaska, Yukon, Northwest Territories, British Columbia, Alberta, Washington, Oregon, Idaho, and Montana. In Oregon, *R. subpinnatus* is reported from Clatsop, Douglas, Lane, Lincoln, Linn, Marion, and Multnomah counties within the Coast Range and West Cascades ecoregions.

References with descriptions and/or illustrations — Rohrer (in FNA 2014, p. 333), Smith (2004, p. 927), Crum (2004, p. 532), Crum and Anderson (1981, p. 1203).

References with photos — Lockhart et al. (2012, p. 551), Atherton et al. (2010, p. 819).

Rhytidium rugosum (Hedwig) Kindberg

Recent synonyms: none
Common names: crumpled-leaf moss, pipecleaner moss, droop-branch moss, beruffled moss, wrinkle-leaved feather moss

Summary — A pleurocarpous, costate moss with imbricate, broadly ovate-lanceolate leaves. Terrestrial.

Diagnostic characters — *Rhytidium rugosum* can be distinguished by its (1) large size; (2) lack of paraphyllia (pseudoparaphylla may be present); (3) rugulose, plicate, often secund leaves; (4) strong single costa; and (5) papillose cells.

Technical description

GAMETOPHYTE — **Plants** often large, green, yellow-green to golden-brown when old, in loose somewhat shiny mats, 3–9 cm high. **Stems** prostrate 6–10 cm long, sparsely to irregularly branched, often hooked at the ends, paraphyllia lacking, pseudoparaphyllia sometimes present. **Leaves** 3–4 mm, broadly ovate-lanceolate, acuminate, more or less secund, rugose, plicate; margins recurved, serrate in upper half; costa single, strong to above mid-leaf or sometimes forked; upper medial cells linear-flexuose, lightly thick-walled, pitted, papillose by projecting cell ends; basal cells shorter and broader, the walls thick and pitted; alar cells quadrate, thick walled and pitted. **Dioicous**.

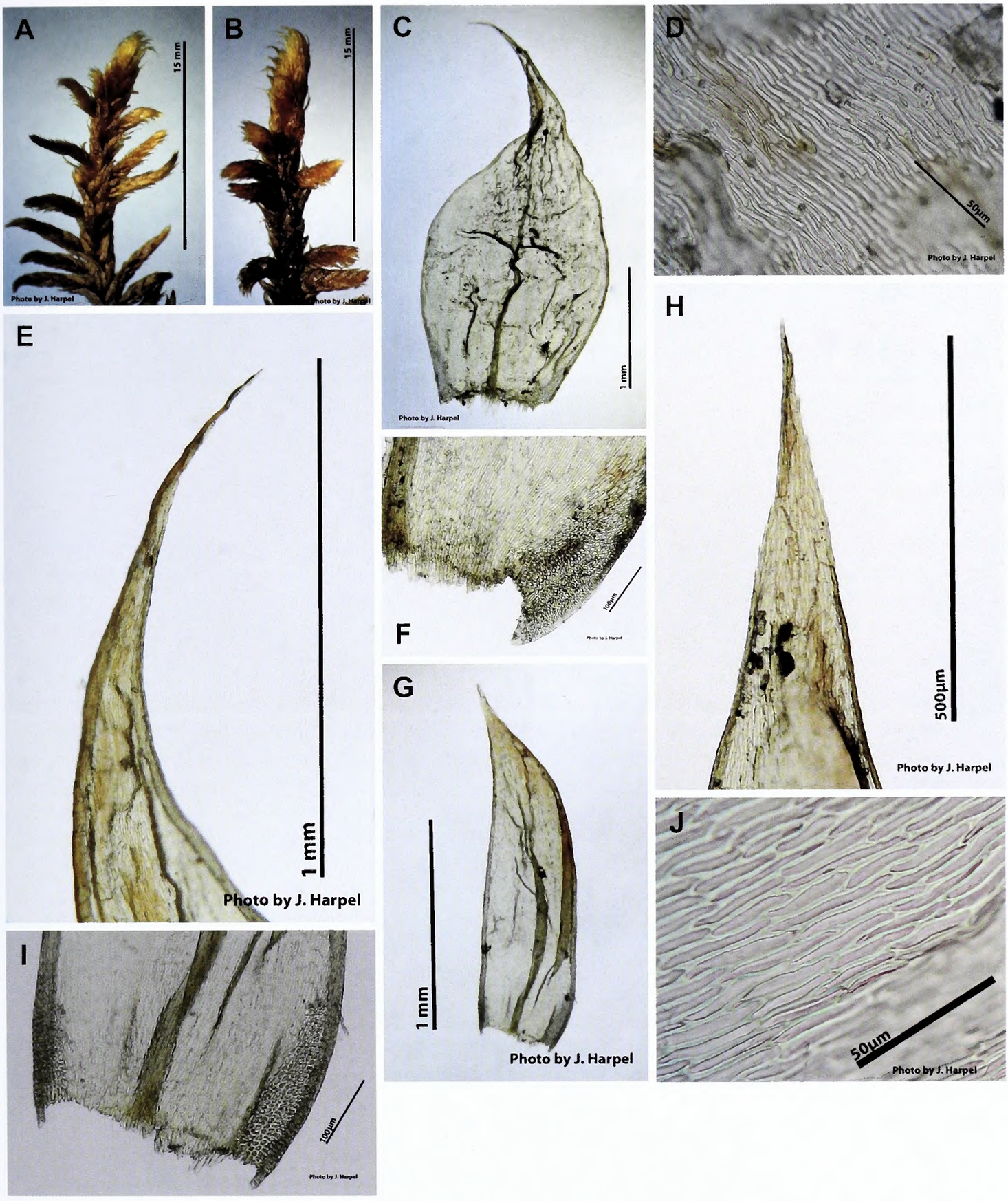
SPOROPHYTE — **Seta** 1.3–3 cm long. **Capsules** inclined to horizontal, curved, smooth, more or less cylindric, the urn 2–2.5 mm long; peristome perfect. **Spores** 10–17 µm.

Similar species — *Rhytidiadelphus* and *Rhytidiopsis* species have a short, often double, costa. *Rhytidiopsis robusta* is additionally distinguished by the presence of paraphyllia. *Homalothecium megaptilum* is neither rugose nor secund.

Ecology — *Rhytidium rugosum* occurs mostly on rock or on a thin layer of soil or humus overlying rock, especially of calcareous and basic substrates (Rohrer 1999), and in the Pacific Northwest is known from basalt. The moss is commonly found on exposed rock ledges, rocky slopes, or bluffs, or in semi-open dry forests or tundra (much less commonly on moist sites). In Oregon, it is known from mid- to high elevations west of the Cascade Mountain crest on sites often subject to fog penetration. Associated vascular plant species include *Sedum, Selaginella,* other rock garden species, and the moss *Racomitrium elongatum*. *Rhytidium rugosum* has been reported at 300–11,500 foot elevations. According to Crum and Anderson (1981), it rarely produces sporophytes.

Distribution — *Rhytidium rugosum* is known from Eurasia, Greenland, Iceland, North America, Mexico, and Central and South America. In western North America, it is known from Alaska, Yukon, Northwest Territories,

Plate 86. Rhytidium rugosum. *A. Dry habitat. B. Moist habitat. C. Stem leaf. D. Stem leaf upper medial cells. E. Stem leaf apex. F. Stem leaf alar and basal cells. G. Branch leaf. H. Branch leaf apex. I. Branch leaf alar and basal cells. J. Branch leaf upper medial cells. (W. Schofield 66065. UBC)*


A
15 mm
Photo by J. Harpel
B
15 mm
C
1 mm
Photo by J. Harpel
D
50µm
Photo by J. Harpel
E
1 mm
Photo by J. Harpel
F
100µm
G
1 mm
Photo by J. Harpel
H
500µm
Photo by J. Harpel
I
100µm
Photo by J. Harpel
J
50µm
Photo by J. Harpel

British Columbia, Alberta, Washington, Oregon, Montana, Wyoming, Colorado, Arizona, and New Mexico. In Oregon, *R. rugosum* is reported from Clatsop County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Rohrer (in FNA 2014a, p. 339), Holyoak (2005), Smith (2004, p. 923), Christy and Wagner (1996, part VII, p. 62), Johnson et al. (1995, p. 298), Peterson (1994, p. 1062), Schofield (1992), MacKinnon et al. (1992, p. 300), Vitt et al. (1988, p. 110), Ireland (1982, p. 638), Crum and Anderson (1981, p. 1209), Smith (1978, p. 662), Lawton (1971, p. 331), Nyholm (1965, p. 603), Grout (1932, p. 115), Brotherus (1909, p. 1058), Grout (1903, p. 269).

References with photos — Lockhart et al. (2012, p. 552), Atherton et al. (2010, p. 814).

Rosulabryum gemmascens (Kindberg) J.R. Spence

Recent synonym: *Bryum gemmascens* Kindberg
Common name: bryum moss

Summary — An acrocarpous, costate moss with ovate to obovate leaves. Terrestrial.

Diagnostic characters— *Rosulabryum gemmascens* can be distinguished by its (1) absent to rare filiform gemmae, (2) rosulate habit, (3) crimson to red rhizoidal tubers, (4) small (< 2 mm long) leaves, (5) absent to weak limbidium (6) entire to weakly serrulate distal leaf margins, and (7) dioicous habit.

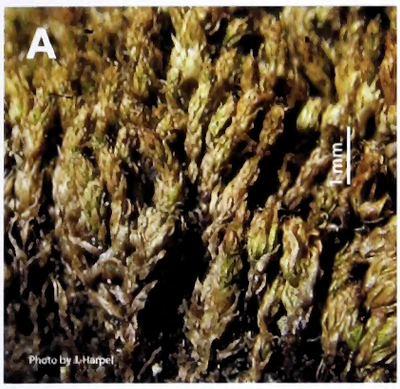
Technical description

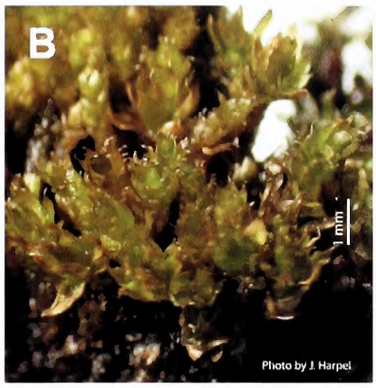
Gametophyte — **Plants** small, in open to dense low turfs, green or brown to red-green. **Stems** short 0.5–2 cm, distinctly singly rosulate, innovations elongate and evenly foliate. **Leaves** of two types: fertile rosettes and innovations; Rosette leaves broadly ovate to obovate, 1–2.5 mm, irregularly twisted to contorted when dry, erect-spreading when wet, flat, not decurrent; margins recurved to midleaf, smooth or weakly serrulate in distal 1/3 of margin; limbidium absent or when present weak and single-rowed; apex acute; costa variable, not reaching the apex to excurrent forming a slender, moderately long, colored or hyaline awn, irregularly twisted when dry; distal and median laminal cells thin-walled, long-rhomboidal 12–20 µm wide, (3–5:1), walls thin, porose; proximal cells long-rectangular in rosette leaves. Innovation leaves broadly lanceolate to ovate, somewhat twisted to weakly imbricate when dry, concave, 0.5–1.5 mm, red-brown, with a short awn that is colored to sometimes hyaline. Specialized asexual reproduction of filiform gemmae in distal leaf axils rarely present, brown, finely papillose; rhizoidal tubers (60–) 100–200 µm, orange-red to red. However, the defining key to *R. gemmascens* (Spence 2014f) describes the tubers as red-brown to brown. **Dioicous**.

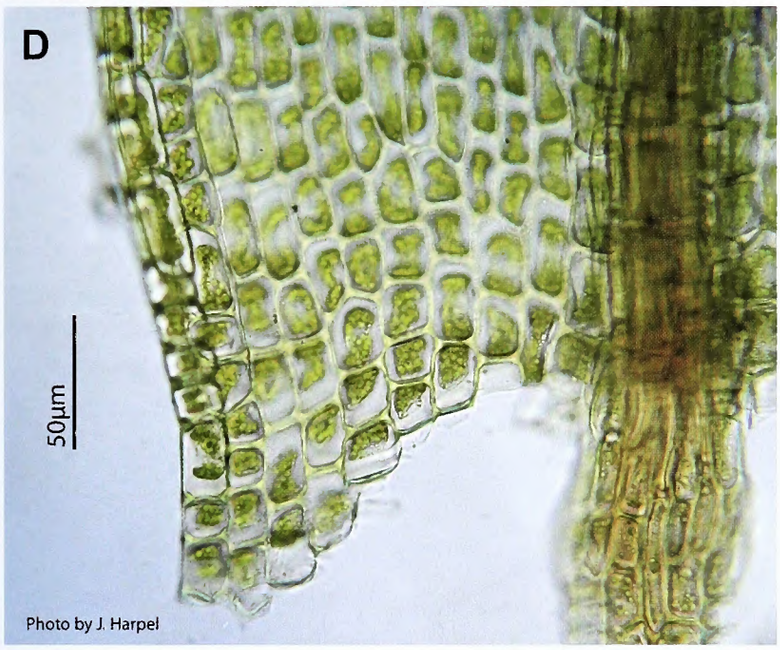
Sporophyte — **Seta** usually 1 (–3) cm long, elongate, straight. **Capsules** cylindric, symmetric, brown to red-brown, 2–5 mm, inclined to nodding. **Spores** 8–20 µm, shed singly.

Similar species —Other *Rosulabryum* are similar and have rosulate stems, concolorous leaf apices, and symmetrical capsules. When present, rhizoidal tubers are spheric and the endostome is papillose. *Rosulabryum gemmascens* is closely related to *R. capillare*, but differs in its orange-red tubers, unusual evenly foliate red-brown innovations, leaves that are not spirally twisted around the stem, when dry and a very weak or absent limbidium with almost smooth distal margins.

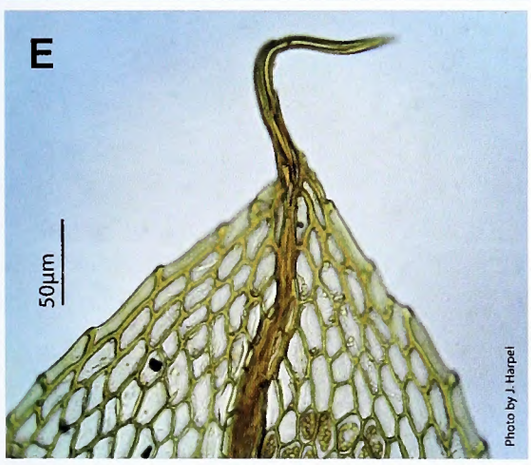
Plate 87. Rosulabryum gemmascens. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Alar and basal cells. E. Leaf apex. F. Upper medial cells. G. Sporophyte and operculum. H. Peristome teeth. (W. Schofield. 81394. UBC)*

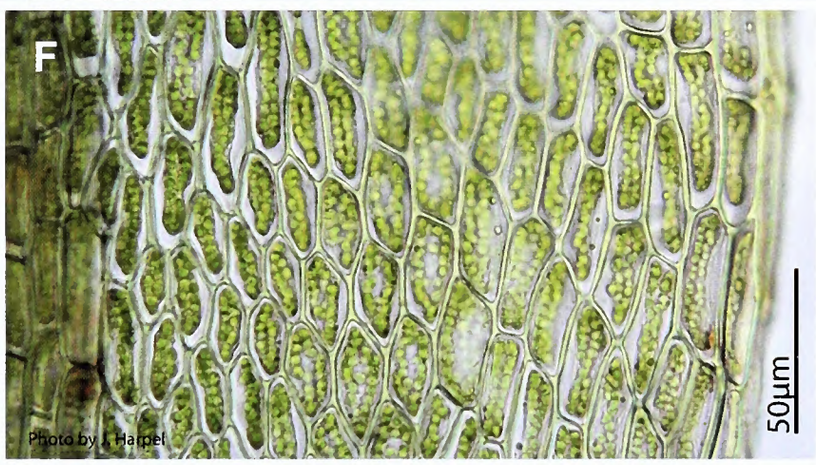

A
1 mm
Photo by J. Harpel

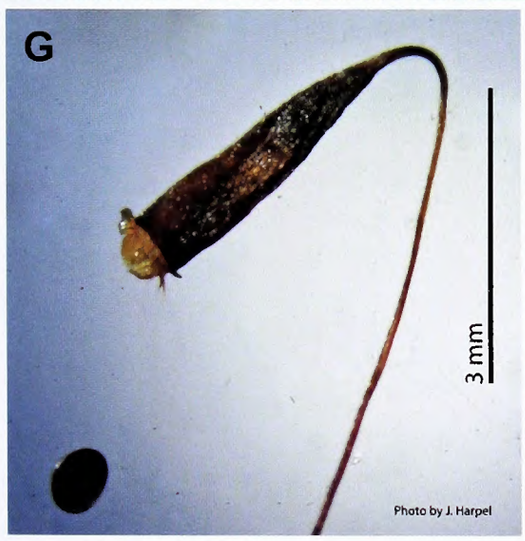

B
1 mm
Photo by J. Harpel

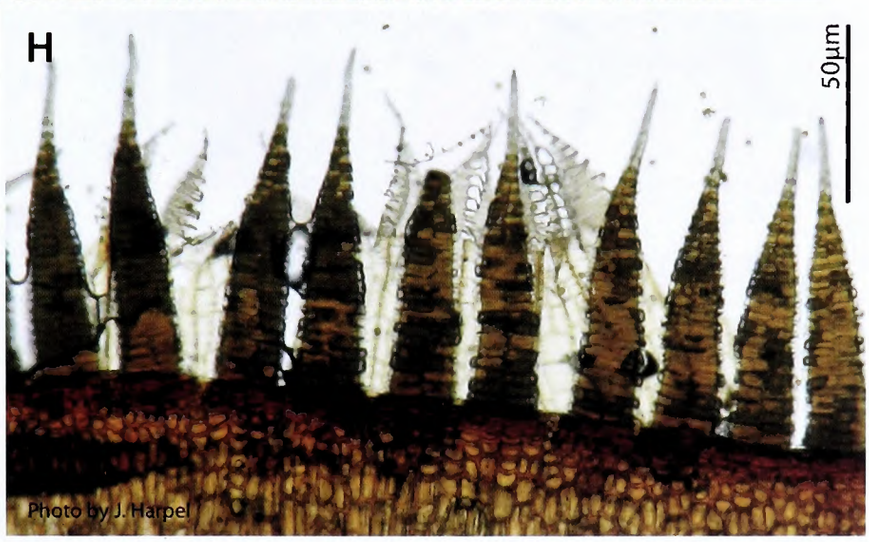

D
50µm
Photo by J. Harpel


C
1 mm
Photo by J. Harpel


E
50µm
Photo by J. Harpel


F
50µm
Photo by J. Harpel


G
3 mm
Photo by J. Harpel


H
50µm
Photo by J. Harpel

Ecology — *Rosulabryum gemmascens* is known from the lowland to 3,000 foot elevations on exposed to shaded soil, soil over rock, and rotting wood. Sporophytes mature April to June.

Distribution — *Rosulabryum gemmascens* is endemic to western North America and known from British Columbia, Washington, Oregon, and California. In Oregon, *R. gemmascens* is reported from Linn and Umatilla counties within the Columbia Basin and West Cascades ecoregions.

References with descriptions and/or illustrations — Spence (in FNA 2014f, p. 183).

Schistidium cinclidodonteum (Müller Hal.) B. Bremer

Recent synonyms:
Grimmia cinclidodontea Müller Hal.
Grimmia pacifica Lawton
Common name: schistidium moss

Taxonomic note: Jones (1933) and Flowers (1973) should not be consulted for *S. cinclidodonteum* because Jones treated the species as a synonym of *S. atrichum* (= *Grimmia atricha*) while Flowers (1973) confused *S. cinclidodonteum* with *S. occidentale*.

Summary — An acrocarpous, costate moss with linear-lanceolate leaves. Terrestrial.

Diagnostic characters— *Schistidium cinclidodonteum* can be distinguished by its (1) long, often linear-lanceolate, falcate leaves; (2) apiculate leaves; (3) immersed cupulate capsules lacking stomata; (4) bistratose upper margins and lamina with multistratose strips extending toward the base; (5) lack of a stereid band in costal cross sections; and (6) moist, streamside habitat.

Technical description

Gametophyte — **Plants** robust, (1–) 3–7 (–8) cm long, olive-green to blackish, profusely branched. **Leaves** rigid, (1.4–) 3.5–6 mm, sickle-shaped (falcate) sometimes all pointing in the same direction (secund) when wet, straight and imbricate when dry, linear-lanceolate to ovate-lanceolate, weakly keeled to concave, the cells smooth but thick-walled and mostly bistratose or tristratose in the upper half with strips of bistratose cells next to each side of the costa and extending to the leaf base; margins entire and plane or slightly recurved; costa broad and flat, of 5–9 layers of cells and up to 180 µm wide at the leaf base, ending at a rounded and fleshy leaf tip or rarely extending as a very short awn.

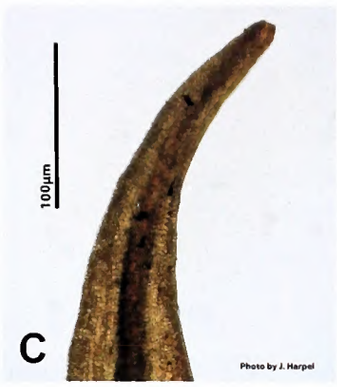
Sporophyte — **Seta** 0.3–0.6 mm, straight. **Capsules** immersed in the leaves, clustered, 1.3–1.8 (–2.5) mm long, reddish brown, ovoid or short cylindric, with a dark rim; peristome teeth red, finely papillose, strongly perforated. **Spores** 8–13 µm, smooth. **Autoicous**.

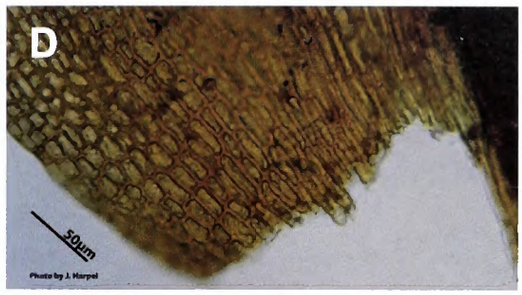
Similar species — *Schistidium* species are distinguished from other taxa in the Grimmiaceae by a columella that is usually attached to the operculum, with both deciduous together. Capsules are immersed to emergent with a small calyptra covering only the operculum and often with orangish peristome teeth. The similar *S. occidentale* differs by most leaves unistratose except at the margins, where they may be bistratose. *Schistidium maritimum,*

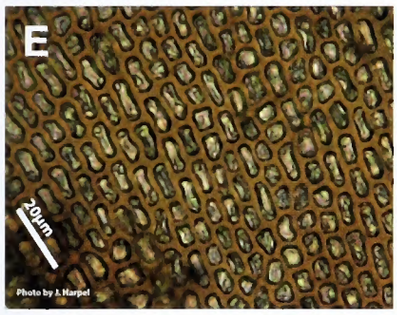
Plate 88. Schistidium cinclidodonteum. *A. Dry habitat. B. Leaf. C. Leaf apex. D. Alar and basal cells. E. Upper medial cells. F–I. Leaf cross-sections. J. Sporphyte. K. Peristome. (J. Harpel 1131. Harpel Private)*


A
3 mm
Photo by J. Harpel

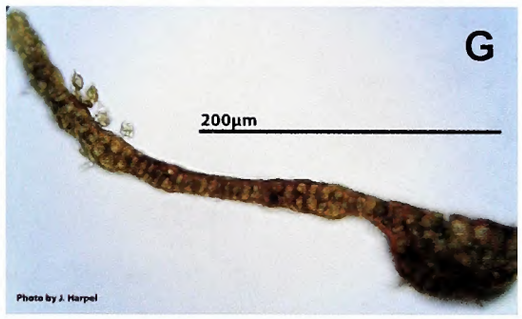

B
1 mm
Photo by J. Harpel

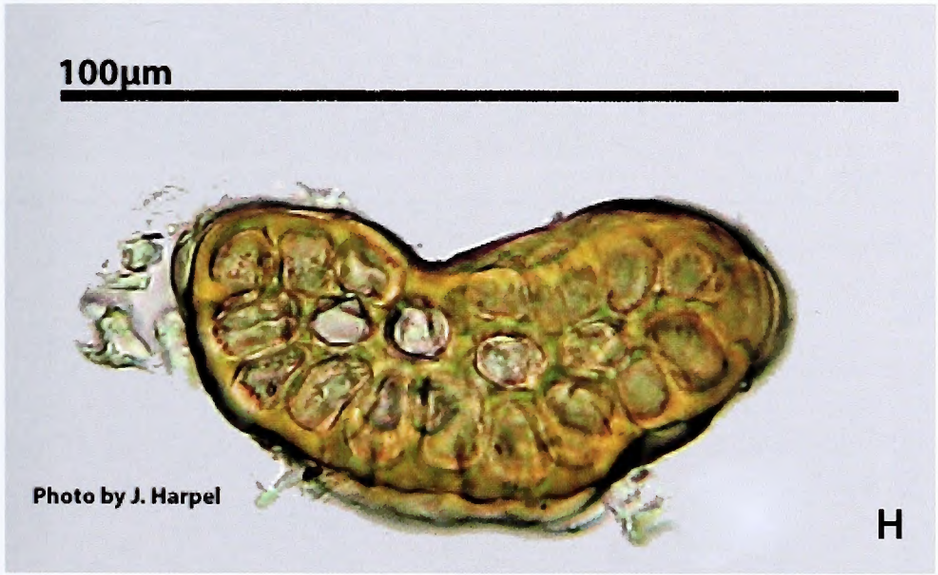

C
100µm
Photo by J. Harpel

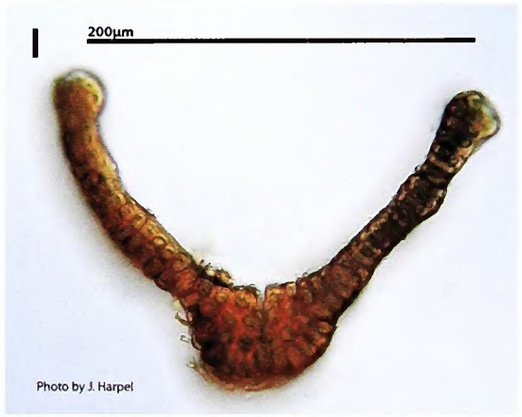

D
50µm
Photo by J. Harpel

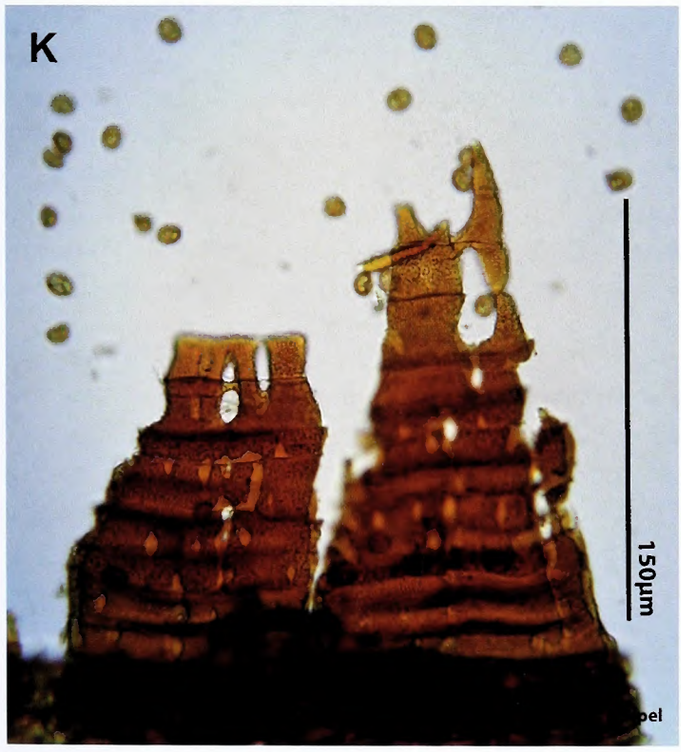

E
20µm
Photo by J. Harpel


500µm
F
Photo by J. Harpel


G
200µm
Photo by J. Harpel


100µm
Photo by J. Harpel
H


I
200µm
Photo by J. Harpel


K
150µm


J
2 mm
Photo by J. Harpel

which also has a bistratose distal lamina, has costal stereid bands and grows only along the coast with oceanic influences. Most other *Schistidium* species are distinctly awned.

Ecology — *Schistidium cinclidodonteum* forms large loose to dense sods on wet or dry rocks or on soil in crevices of rocks and boulders, often along intermittent streams, at elevations of 5,000 to 10,500 feet. Habitats may include *Abies amabilis, A. grandis, A. lasiocarpa, Pinus ponderosa* and *Tsuga mertensiana*. At higher elevations *Schistidium cinclidodonteum* may occur in *Cassiope mertensiana, Pinus albicaulis* and *Phyllodoce empetriformis* associations.

Distribution — *Schistidium cinclidodonteum* is known from Europe and North America. In western North America, it is known from Washington, Oregon, California, Idaho, and Nevada. In Oregon *S. cinclidodonteum* is reported from Grant, Harney, Jackson, Klamath and Union counties within the Blue Mountain, East Cascades, and Klamath Mountain ecoregions.

References with descriptions and/or illustrations — McIntosh (in FNA 2007b, p. 214), Bremer (1980), Lawton (1979, p. 276 as *Grimmia pacifica*), Lawton (1971, p. 136 as *Grimmia cinclidodontea*), Robinson and Hermann (1964, p. 170 as *Grimmia cinclidodontea*).

References with photos — Malcolm et al. (2009, p. 76).

Schistidium flaccidum (De Notaris) Ochyra

Recent synonym: *Grimmia flaccida* (De Notaris) Lindberg
Common names: goblet grimmia, goblet schistidium

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characters— *Schistidium flaccidum* can be distinguished by its (1) rudimentary peristome, (2) bright red capsule rim, (3) mamillate operculum, and (4) distinctly plicate perichaetial leaves.

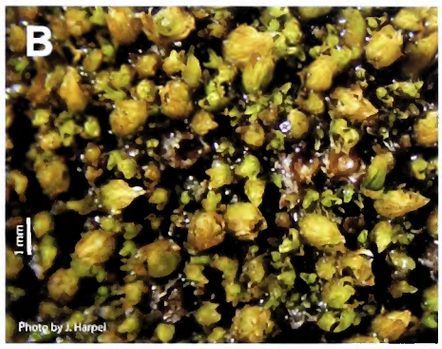
Technical description

Gametophyte — **Plants** in dense, often hoary cushions, olivaceous, light brown to green. **Stems** branched, 0.5–2 cm long, central strand indistinct. **Leaves** 1.3–1.9 (–2.4) mm, narrowly ovate-lanceolate to broadly ovate-triangular, acute, erect or weakly curved when dry, strongly keeled above; margins smooth, recurved to just before the apex, bistratose with unistratose patches in the central portion, unistratose in the basal area; costa excurrent, rarely percurrent, 0.15–0.85 mm, flattened, finely denticulate, straight or flexuose, more or less decurrent; upper medial cells ovate to shortly oblong, smooth, more or less sinuose, 7–9 (–10) µm wide; basal marginal cells square to short-rectangular, transverse walls more or less thicker than longitudinal walls, forming an alar group. **Autoicous**.

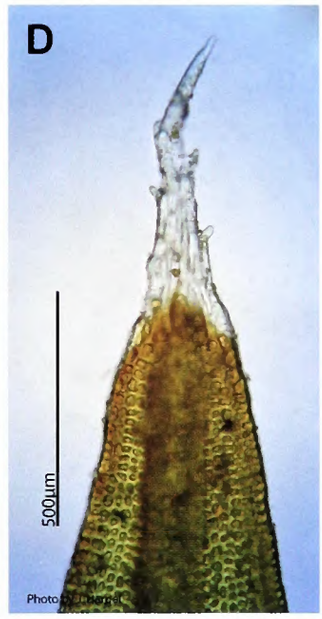
Sporophyte — **Seta** short, 0.05–0.13 mm, straight, pale yellow. **Capsules** orange-brown or yellow-brown, cup-shaped, 0.6–0.9 mm, with a conspicuous bright red rim; exothecial cells thin-walled, irregularly angular above, more rectangular below with 3–6 small, obscure stomata; peristome absent or rudimentary, consisting of basal segments, to 30 µm, yellowish or orange-red, papillose. **Spores** 8–10 µm, granulose to verruculose.

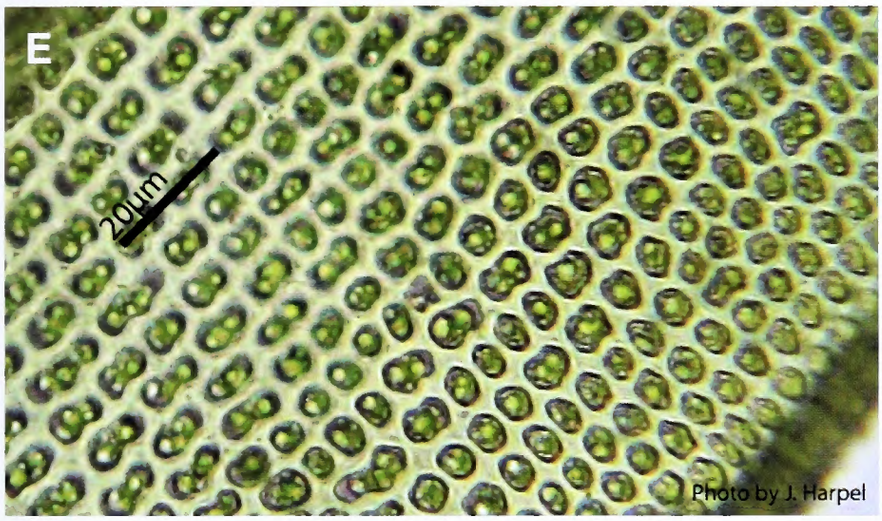
Plate 89. Schistidium flaccidum. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Leaf apex. E. Upper medial cells. F. Alar and basal cells. G. Stem cross-section. H. Sporphyte. I. Peristome teeth. (W. Schofield 83400. UBC)*

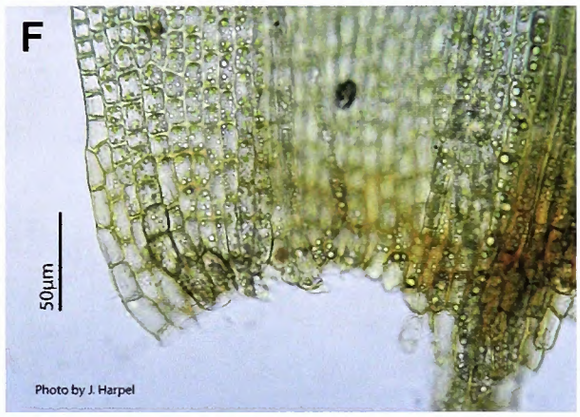

A
1 mm

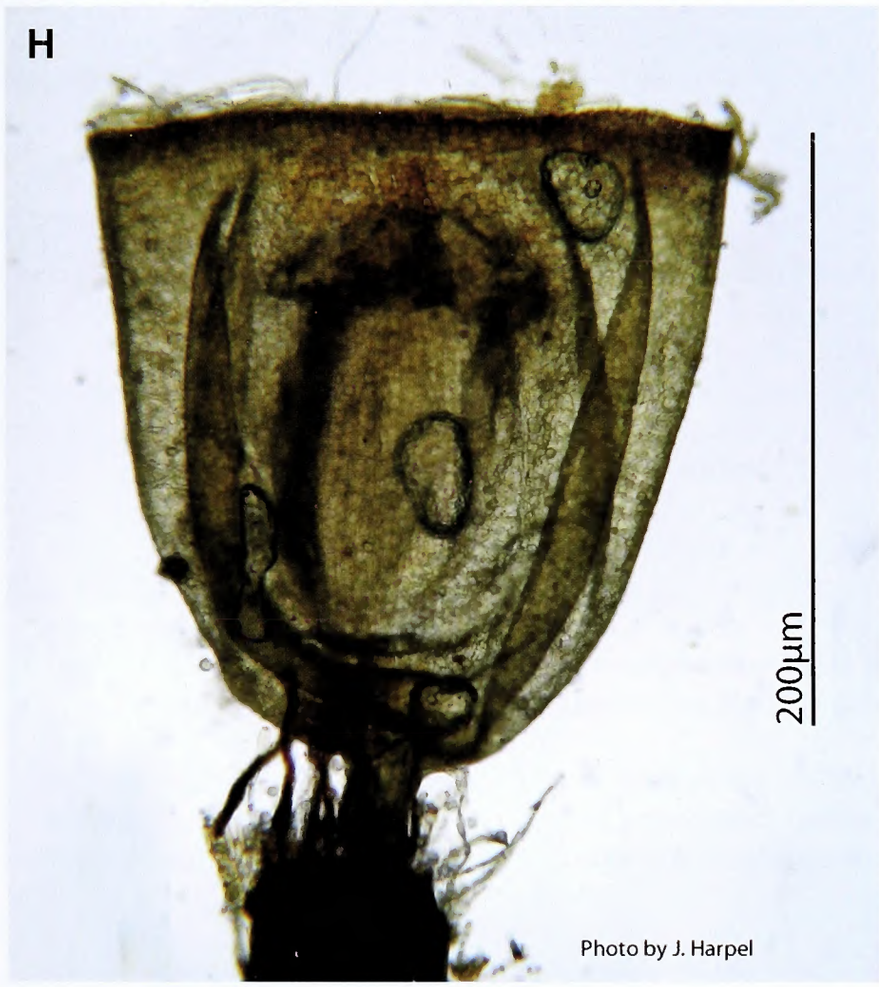

B
1 mm
Photo by J. Harpel

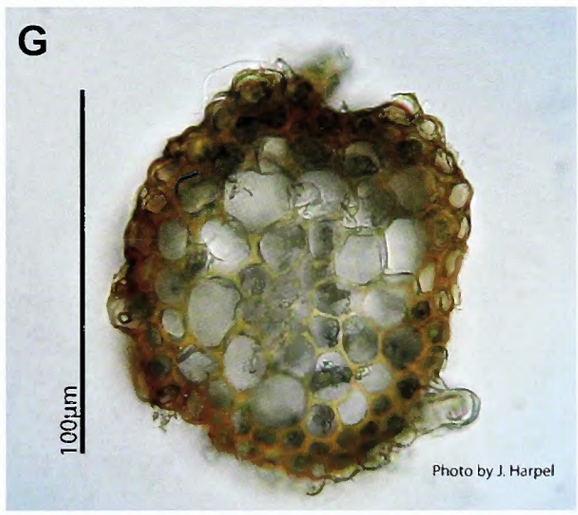

C
1 mm
Photo by J. Harpel

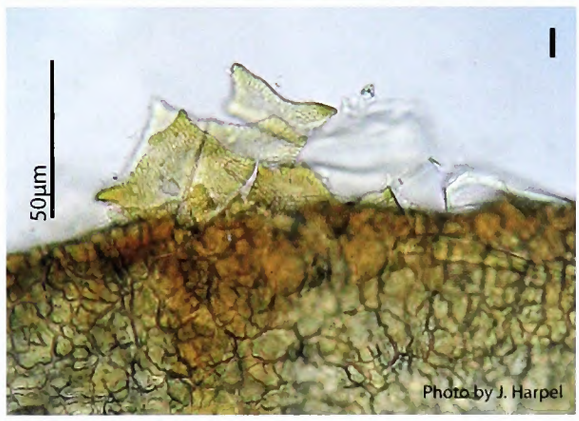

D
500µm


E
20µm
Photo by J. Harpel


F
50µm
Photo by J. Harpel


H
200µm
Photo by J. Harpel


G
100µm
Photo by J. Harpel


I
50µm
Photo by J. Harpel

Similar species — *Schistidium tenerum* is similar to *S. flaccidum* but is dioicus and generally smaller, with smaller leaves. *Schistidium strictum* has leaves with at least a few papillae on the dorsal surface. See *Schistidium cinclidodonteum* for additional information.

Ecology — *Schistidium flaccidum* is reported from rock in open to shaded habitats at 4,500–9,600 foot elevations.

Distribution — *Schistidium flaccidum* is known from Eurasia, Africa, the Atlantic and Pacific Islands, and North America. In western North America it is known from Alberta, Washington, Oregon, Idaho, Colorado, and Nevada. In Oregon, *S. flaccidum* is reported from Harney, Lake and Malheur counties within the Blue Mountain and Northern Basin and Range ecoregions.

References with descriptions and/or illustrations — McIntosh (in FNA 2007b, p. 216), Blom (1995), Lawton (1973, p. 137, as *Grimmia flaccida*).

Schistidium heterophyllum (Kindberg) T.T. McIntosh

Recent synonym: *Grimmia heterophylla* Kindberg
Common name: varied leaf schistidium

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characters— *Schistidium heterophyllum* can be distinguished by its (1) imbricate, concave, and long-awned leaves; (2) plane or incurved leaf margins; (3) bistratose distal lamina; (4) ease by which plants fragment into individual stems; and (5) dioicous habit.

Technical description

GAMETOPHYTE — **Plants** in open to compact tufts or mats that are fragile and break apart easily, olivaceous, brownish-green, to blackish. **Stems** 1–2.5 (–4) cm, with a distinct central strand. **Leaves** (0.8–) 1.6–2.4 (–3) mm, ovate-lanceolate to ovate-triangular, keeled above, concave below, erect, rarely curved, usually imbricate when dry, bistratose above; margins plane or erect, more or less incurved, smooth, unistratose or bistratose; apices acute or slightly obtuse; costa usually excurrent, often long decurrent, spinulose-denticulate or almost smooth, usually straight; upper medial cells 5–6 (–8) µm, quadrate, ovate to short-rectangular, smooth, straight or weakly sinuose; basal marginal cells short-rectangular or quadrate, transverse walls more or less thicker than longitudinal walls, trigonous. **Dioicous**.

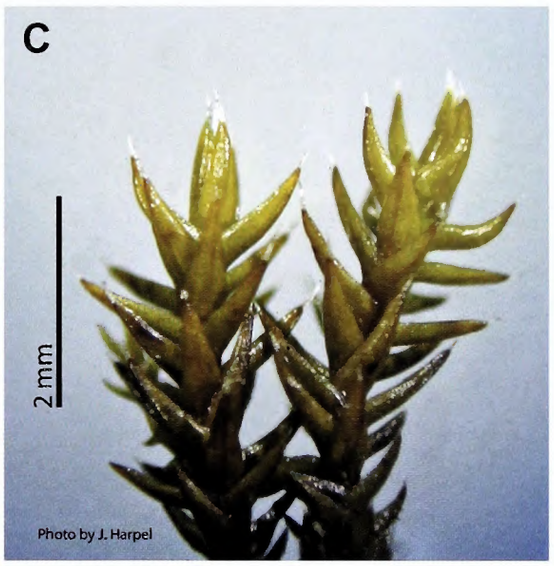
SPOROPHYTE — **Seta** straight, shorter than the capsules. **Capsules** 0.8–1.1 mm, short-cylindric or cup-shaped, dark reddish-brown; exothecial cells isodiametric or oblate, usually thin-walled; stomata present; peristome spreading, red, finely papillose, strongly perforated. **Spores** 10–13 µm, finely papillose.

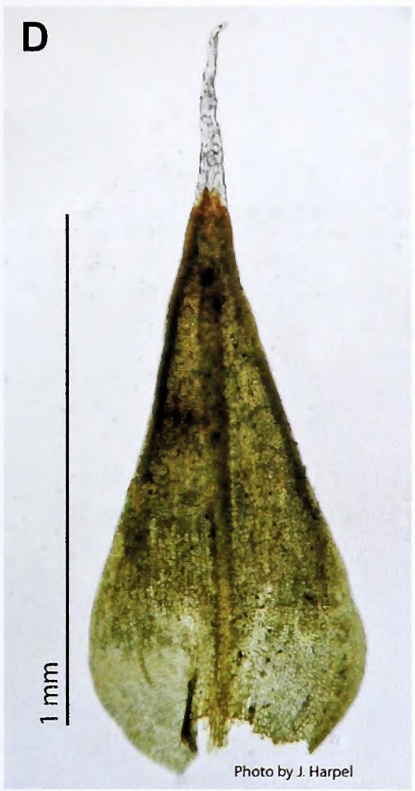
Similar species — *Schistidium tenerum* is smaller, has ovate-triangular leaves that are mostly less than 1.5 mm, an unevenly bistratose distal lamina, and leaf margins that are recurved. The similar *Grimmia laevigata* has a flat costa that is only weakly raised above the surface of the lamina and is usually larger. See *Schistidium cinclidodonteum* for additional information.

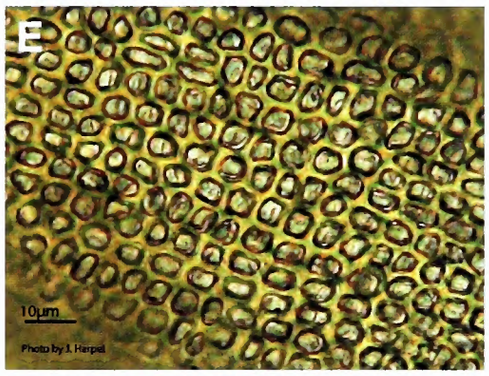
Plate 90. Schistidium heterophyllum. *A. Moist habitat. B. Dry habitat. C. Individual. D. Leaf. E. Upper medial cells. F. Basal cells. G. Alar cells. H–I. Leaf apex. J. Leaf cross-section. (T. McIntosh 7651. UBC)*

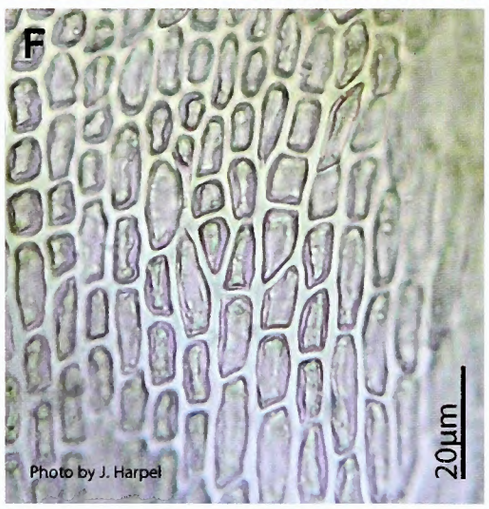

A
1mm

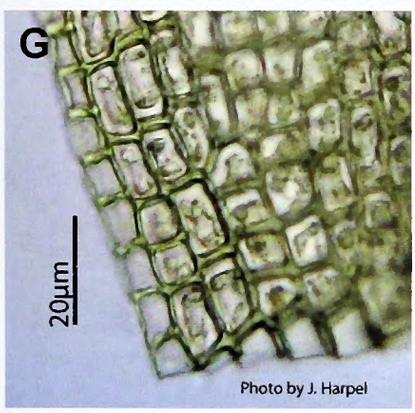

B
1mm

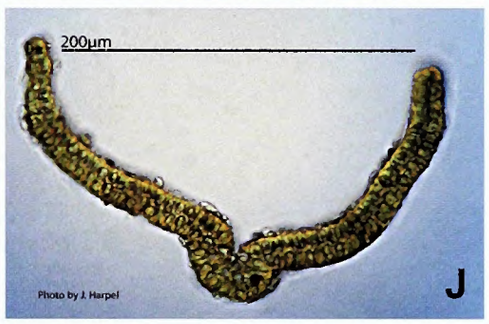

C
2 mm
Photo by J. Harpel

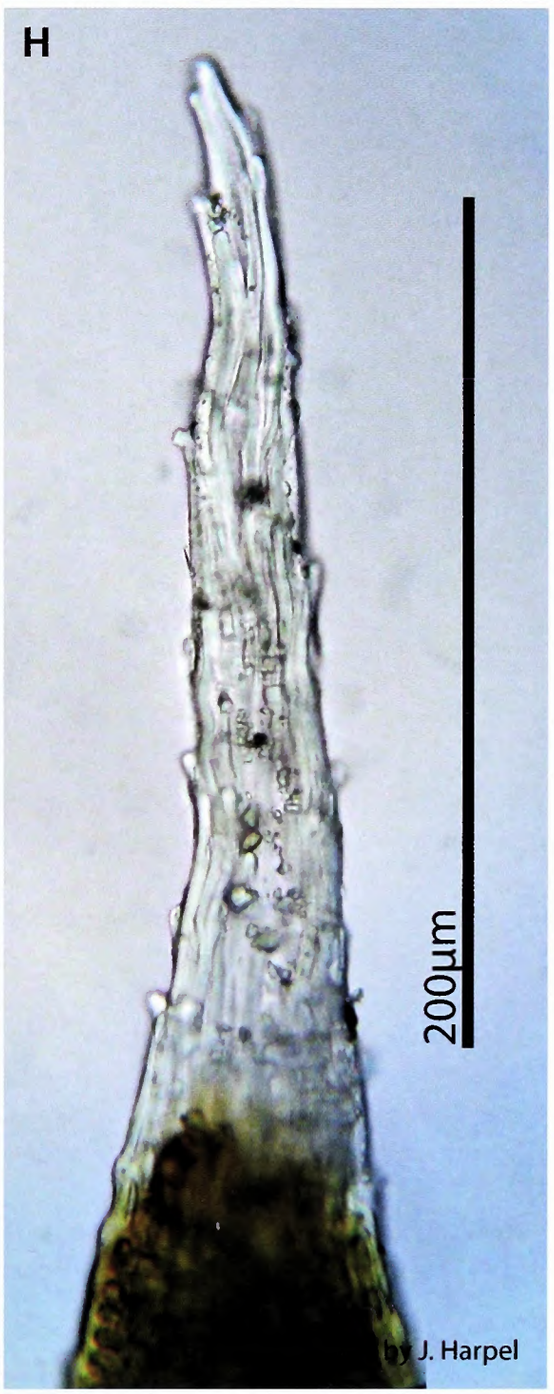

D
1 mm
Photo by J. Harpel

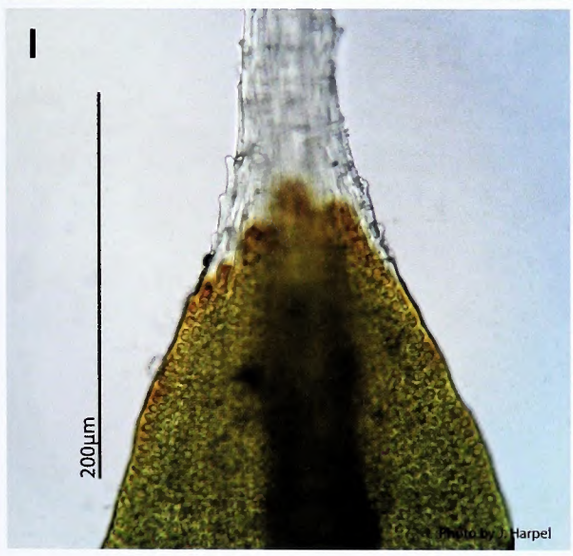

E
10µm
Photo by J. Harpel


F
20µm
Photo by J. Harpel


G
20µm
Photo by J. Harpel


200µm
Photo by J. Harpel
J


H
200µm
by J. Harpel


I
200µm
Photo by J. Harpel

Ecology — *Schistidium heterophyllum* is known from rock in open to shaded habitats from 900 to 3,600 feet in elevation. Capsules mature late spring to early summer.

Distribution — *Schistidium heterophyllum* is endemic to western North America. It is known from British Columbia, Washington, Oregon and Idaho. In Oregon, *S. heterophyllum* is reported from Deschutes, Grant, Harney, Union and Wasco counties within the Blue Mountain and Columbia Basin ecoregions.

References with descriptions and/or illustrations — McIntosh (in FNA 2007b, p. 219), Lawton (1971, p. 137 as *Grimmia heterophylla*).

Schistidium tenerum (J.E. Zetterstedt) Nyholm

Recent synonym: *Grimmia tenera* J.E. Zetterstedt
Common name: slender schistidium

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characters— *Schistidium tenerum* is distinguished by its (1) small size with leaves less than 1.5 mm; (2) long, flexuose, spiny, decurrent awns; (3) recurved leaf margins; (4) distal lamina with uneven bistratose patches, (5) plants that easily fragment into individual stems; and (6) dioicous sexual condition.

Technical description

GAMETOPHYTE — **Plants** dark green to brownish-green, hoary above, in dense, compact, fragile tufts or cushions up to 2 (–4) cm tall. **Leaves** lanceolate to ovate-lancoeolate, 0.9–1.5 (–1.8) mm, concave; margins recurved, entire; apex acute, upper leaves ending in a short or long (1 mm) spinulose-denticulate hairpoint; costa ending just below the apex; upper medial cells quadrate to irregularly rounded to short-rectangular, 5–8 µm; lamina, unistratose below, often bistratose patches above; basal cells often elongated more or less indistinctly sinuose. **Dioicous**.

SPOROPHYTE — **Seta** straight, twisted 0.4–0.6 mm. **Capsules** deeply immersed, dark reddish to orange-brown, ovoid with a wide mouth; peristome orange to light brown, papillose, strongly perforated. **Spores** 10–14 µm, smooth to verruculose.

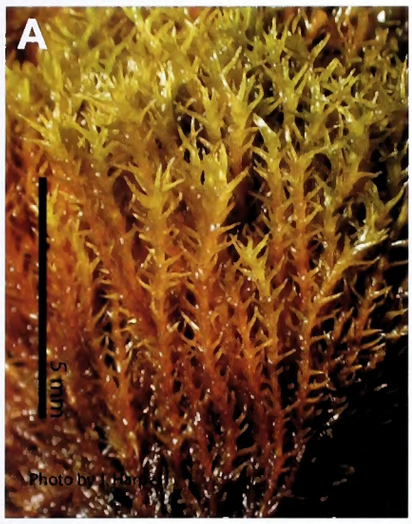
Similar species —The similar *S. heterophyllum* differs by its recurved leaf margins, flexuose awn and ovate-triangular leaves that are less than 1.5 mm. See *S. cinclidodontenm* for additional information.

Ecology — *Schistidium tenerum* occurs on exposed, dry rock outcrops and on moist shaded soil in crevices on rock outcrops at 5,700–6,700 foot elevations. Sporophytes (which are rare) mature in late spring to early summer.

Distribution — *Schistidium tenerum* is known from Eurasia, Greenland, and North America. In western North America, it occurs from Alaska, British Columbia, Alberta, Washington, Oregon, California, Montana, Colorado, and Wyoming. In Oregon, *S. tenerum* is reported from Grant, Harney, and Josephine counties within the Blue Mountain and Klamath Mountain ecoregions.

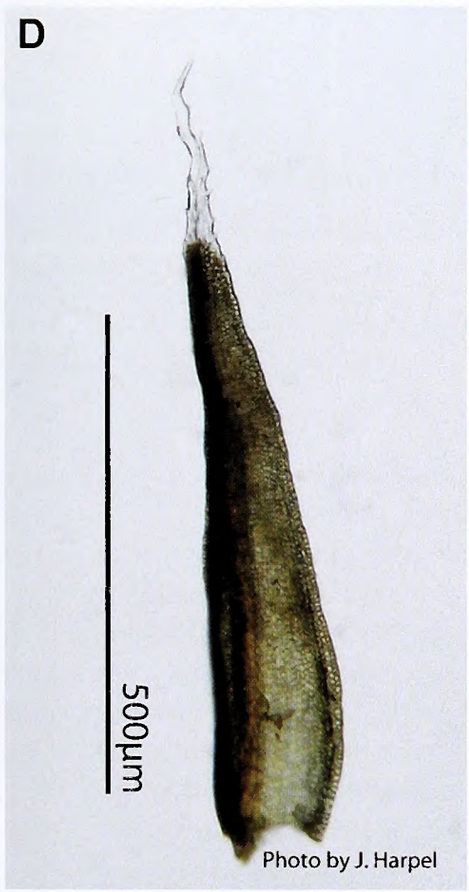
References with descriptions and/or illustrations — McIntosh (in FNA 2007b, p. 224), Bremer (1980), Lawton (1971, p. 139 as *Grimmia tenera*), Ireland (1964), Nyholm (1956).

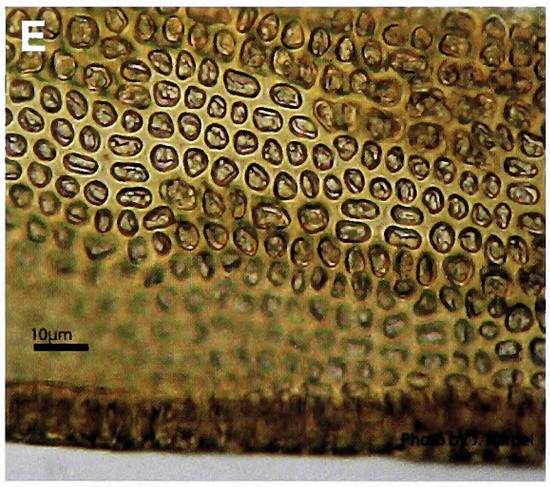
Plate 91. Schistidium tenerum. *A. Moist habitat. B. Dry habitat. C. Individual plant. D. Leaf. E. Upper medial cells. F. Alar and basal cells. G. Leaf apex. H. Leaf cross-sections. (F. M. Boas 1097. UBC)*

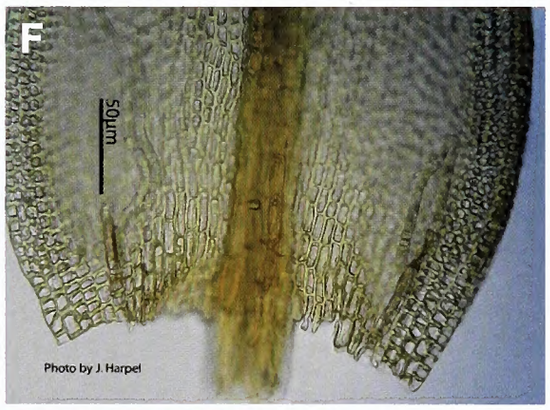

A
5 mm

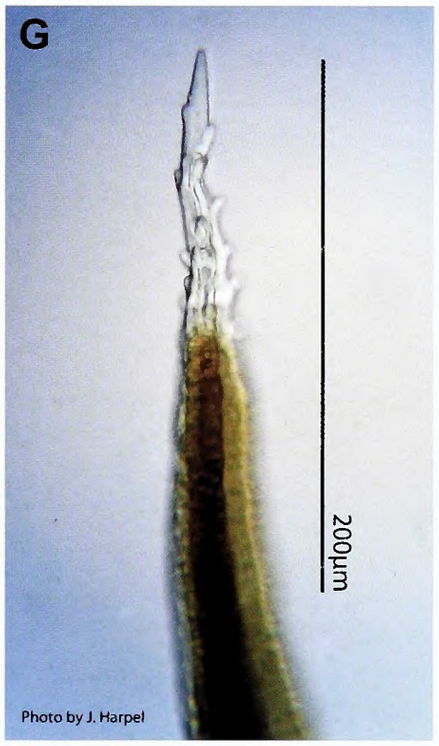

B
2 mm
Photo by J. Harpel


C
3 mm
Photo by J. Harpel


D
500µm
Photo by J. Harpel


E
10µm


F
50µm
Photo by J. Harpel


G
200µm
Photo by J. Harpel


H
100µm
50µm
Photo by J. Harpel

Scouleria marginata E. Britton

Recent synonyms: none
Common names: marginate splashzone moss, margined streamside moss

Summary — An acrocarpous, costate moss with ligulate leaves. Aquatic to semi-aquatic.

Diagnostic characters— *Scouleria marginata* is distinguished by its (1) unistratose lamina with thick multistratose margins, (2) lack of peristome teeth, and (3) spherical capsule with an exserted operculum on a thickened columella.

Technical description

GAMETOPHYTE — **Plants** form dense, dark green to blackish-green tufts. **Stems** to 10 cm long, usually not more than 6 cm. **Leaves** lingulate, concave, tapering to a rounded, obtuse apex, 3–3.5 (–4) × 1–1.3 mm; margins multistratose and consisting of larger diameter cells surrounding the few smaller diameter stereid cells, toothed or entire; costa ending just before the apex; lamina unistratose or partly bistratose above; upper leaf cells 9–15 µm in diameter, the walls strongly thickened; alar cells yellow, quadrate, irregular, or 2:1, the walls thick; basal cells on either side of the costa usually elongate, the walls rather thin; submarginal cells elongate, clearly set off, yellow and with very thick cells. **Dioicous**.

SPOROPHYTE — **Seta** short, 1/2 to 1/3 the length of the capsule. **Capsules** glossy black with age; columella when dry appearing longitudinally ribbed, when wet expanding and becoming stoutly cylindrical or ovoid; peristome absent. **Spores** 30–55 µm.

Similar species — *Scouleria aquatica* could be confused with *S. marginata*, and both species often grow intermixed or separately in adjacent patches. The primary distinguishing character (which can often be seen with a hand lens) is that in *S. marginata* thick-walled marginal cells form a distinct band around the edge of the leaf whereas *S. aquatica* often has bistratose marginal cells but never a band of thick "rope-like" cells along the margin. In addition, *S. marginata* lacks peristome teeth, which are present in *S. aquatica*. This character is often difficult to determine in the field because the peristome teeth are fragile and usually eroded or missing. The recently described *S. siskiyouensis* Shevock and Norris (2014) has a peristome and is primarily bistratose across the median laminal regions but cells on the border are unistratose, and *S. marginata* is unistratose across the lamina with multistratose margins. *Scouleria aquatica* is generally smaller than *S. siskiyouensis* with a more rounded leaf apex. Current populations of *S. siskiyouensis* are restricted to southwestern Oregon in the coast range ecoregion.

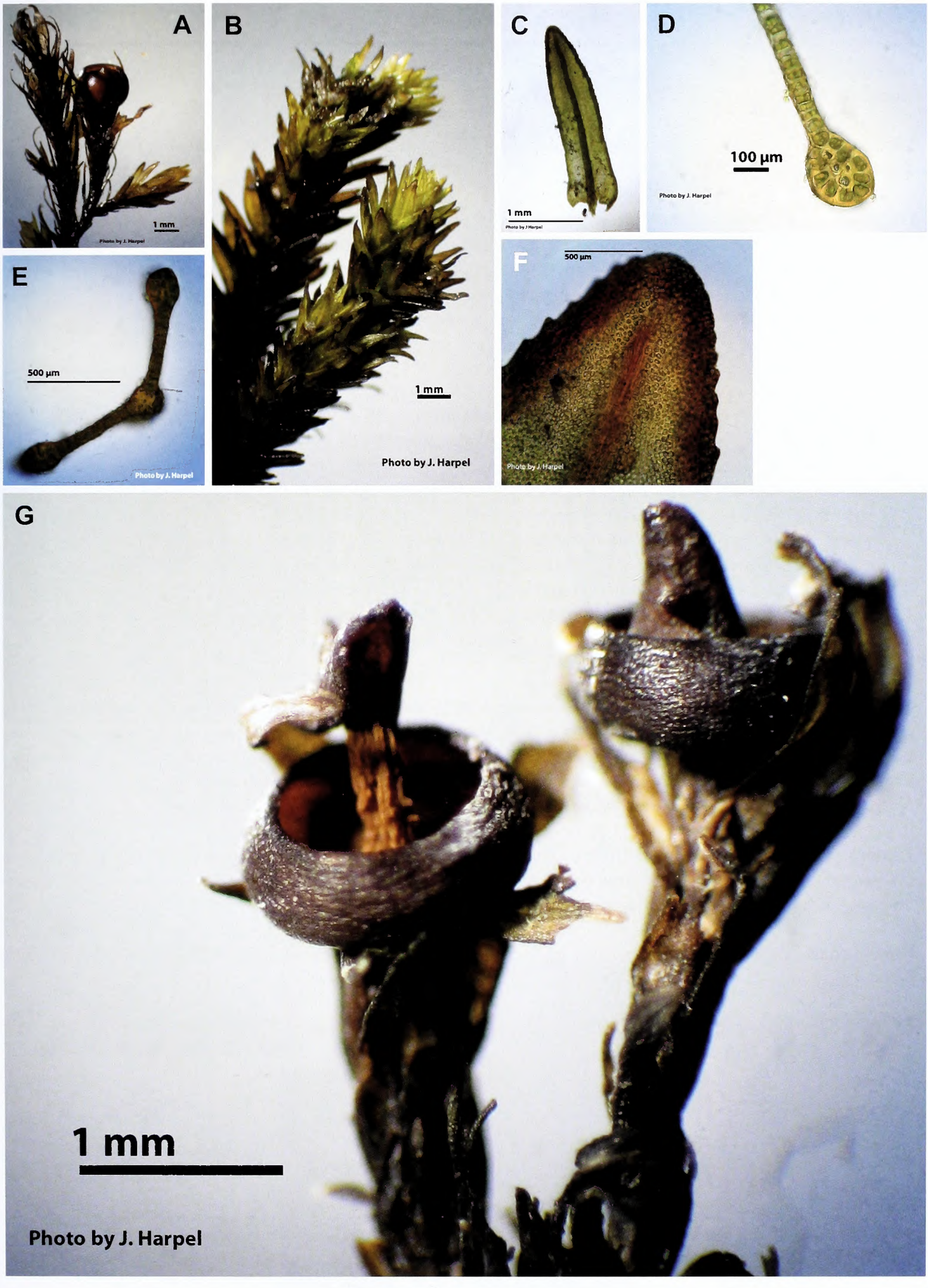
Ecology — *Scouleria marginata* occurs on exposed to submerged bedrock or large boulders, volcanic or granitic substrates in streams or rivers from sea level to 5,400 feet in elevation.

Distribution — *Scouleria marginata* is a western North American endemic where it is known from British Columbia, Washington, Oregon, California, Idaho, and Montana. In Oregon, *Scouleria marginata* is reported from Clackamas, Douglas, Jackson, and Wheeler counties within the Blue Mountain, Klamath Mountain, and West Cascades ecoregions.

References with descriptions and/or illustrations — Churchill (in FNA 2007, p. 313), Lawton (1971, p. 149).

References with photos — Malcolm et al. (2009, p. 54).

Plate 92. Scouleria marginata. *A. Dry habitat. B. Moist habitat. C. Leaf. D–E. Leaf cross-sections. F. Leaf apex. G. Sporphytes. (J. Harpel 15234. Harpel Private)*


A
1 mm
B
1 mm
Photo by J. Harpel
C
1 mm
D
100 µm
Photo by J. Harpel
E
500 µm
Photo by J. Harpel
F
500 µm
Photo by J. Harpel
G
1 mm
Photo by J. Harpel

Sphagnum oregonense R.E. Andrus

Recent synonyms: none
Common name: Oregon sphagnum

Summary — *Sphagnum* is distinct morphologically from all other mosses and segregated in its own class, the Sphagnopsida. Aquatic.

Diagnostic characters— *Sphagnum oregonense* is distinguished by its (1) small to medium size, (2) flat to concave branch leaves that are not noticeably cucullate, (3) branch leaves without resorption furrows; (4) plants with a moderately developed terminal bud, (5) branch leaf chlorophyllose cells equally wide toward both concave and convex leaf surfaces, (6) stem cortex in one layer or irregularly in two layers, and (7) branch leaf hyaline cell pores not in continuous commissural rows with some scattered over the cell lumen.

Technical description

GAMETOPHYTE — **Plants** 1–5 cm long with a moderately well-defined head (capitulum), green to light brown. **Stem** cortex a single layer of enlarged thin-walled cells, some of which have faint wall thinning (incipient pores) at one end. **Leaves:** Stem leaves lingulate, 1–1.2 mm long, apex entire or erose, hyaline cells fibrillose and porose apically but lacking cross walls; branches in fascicles of two spreading and two pendant branches. Branch leaves 1.4–1.6 mm long, ovate-lanceolate, straight or mostly curved in one direction (secund), weakly undulate, often recurved in the capitulum; chlorophyll cells elliptic to rectangular in section and exposed equally on both leaf surfaces or slightly more exposed on the convex surface; hyaline cells on the convex surface with up to 5 small, round faint pores per cell (best seen with heavy staining), the pores remote from the margins of the cells (commissures), and hyaline cells on the concave surface without pores.

SPOROPHYTE — Sporophytes have never been found.

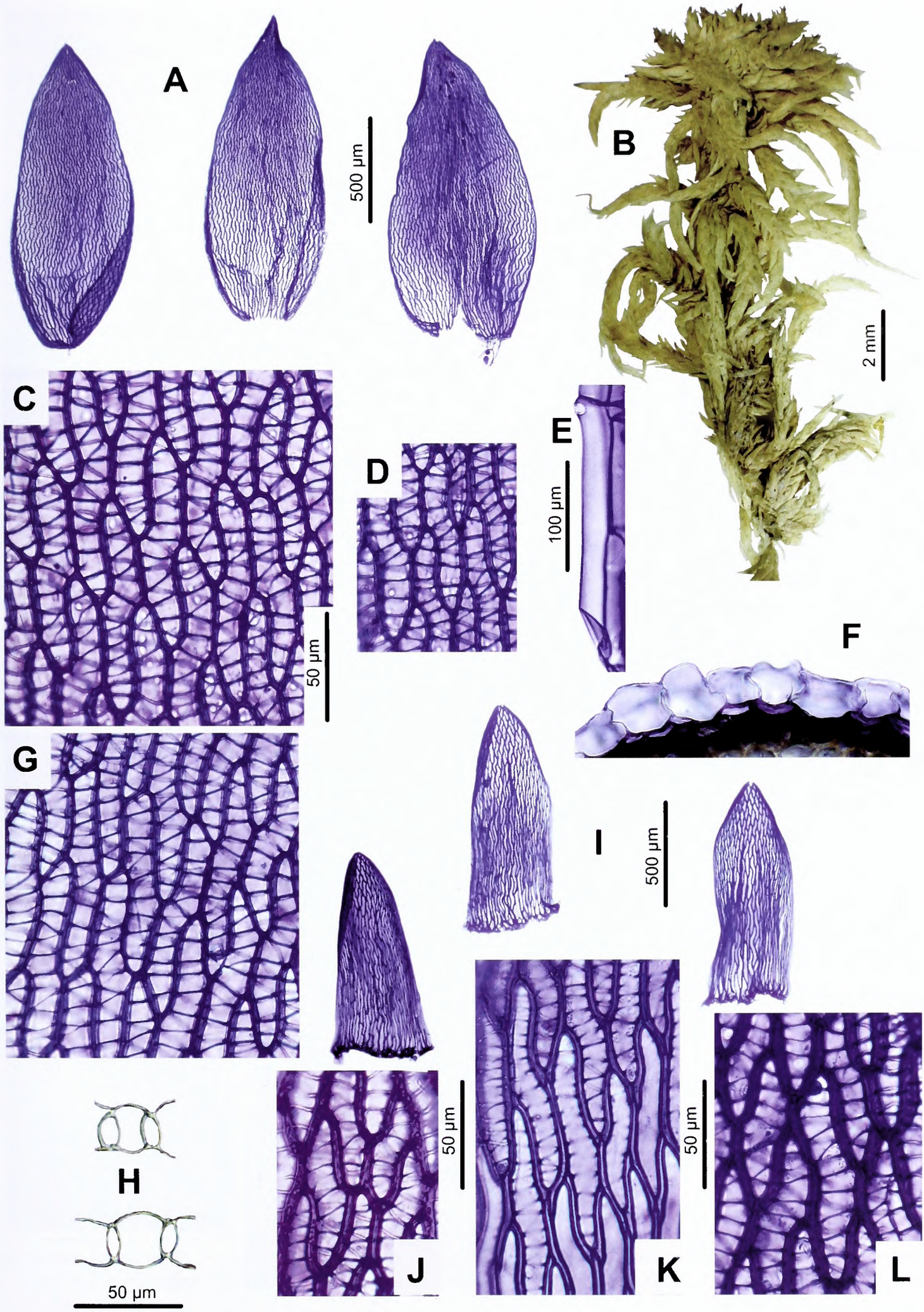
Similar species — The similar *Sphagnum miyabeanum* [*S. subsecundum* misapplied], which also has a one-layered or irregularly two-layered stem cortex, is separated by its branch leaf hyaline cell pores in continuous commissural rows, in contrast to *S. oregonense* with fewer pores not in continuous commissural rows (some scattered over the cell lumen). Otherwise similar to *S. contortum, S. miyabeanum* and *S. oregonense,* and *S. platyphyllum* and are distinguished by their 2–3 layers of enlarged cortical cells on the stems.

Ecology — *Sphagnum oregonense* forms loose mats or lawns in montane fens. Associated species include *Calliergon cordifolium, Campylium polygamum, Carex* spp., and *Meesia triquetra.* The single known *Sphagnum oregonense* site is at 4,800 feet in a mixed forest of *Abies amabilis, Abies lasiocarpa*, and *Pinus contorta.*

Distribution — *Sphagnum oregonense* is endemic to western North America and known only from the Oregon type locality in Lane County within the West Cascades ecoregion (ORBIC).

References with descriptions and/or illustrations — McQueen and Andrus (in FNA 2007, p. 82), Andrus (2007).

Plate 93. Sphagnum oregonense. *A. Branch leaves. B. Habit of dried plant. C–D. Outer surfaces of branch Leaf cells. E. Retort cell. F. Stem cross-section. G. Inner surface of branch leaf cells. H. Branch leaf cross-sections. I. Stem leaves. J–K. Outer surface of Stem leaves. L. Inner surface of stem leaf. (J. Christy 1717. NY)*


A
500 µm
B
2 mm
C
50 µm
D
E
100 µm
F
G
I
500 µm
H
50 µm
J
50 µm
K
50 µm
L

Splachnum ampullaceum Hedwig

Recent synonyms: none
Common names: purple-vased stink moss, small capsule dung moss

Summary — An acrocarpous, costate moss with oblanceolate leaves. Terrestrial.

Diagnostic characters— *Splachnum ampullaceum* is distinguished by its (1) habitat on dung and decaying carcasses, usually in wetlands; (2) hypophysis distinctly wider than the urn; and (3) leaves with sharp teeth to the middle.

Technical description

Gametophyte — **Plants** light green or yellow-green, in loose and more or less shiny tufts, 1–2 (–4) cm high. **Stems** simple or forked. **Leaves** 3.5–5 mm long, more or less crowded at stem tips, long-lanceolate to narrowly oblong-obovate, apex slender-acuminate; margins deeply spinose-dentate above, not bordered; costa disappearing in the acumen just before the apex. **Dioicous**.

Sporophyte — **Seta** is 0.3–6 cm long, flexuose, red or violet. **Capsules** generally abundant and conspicuous when present, yellow-brown above, 1–1.2 mm long, subtended by a much larger (3 × 6 mm) dark reddish-brown to violet, vase-shaped or top-shaped swollen hypophysis; peristome pale brown to orange-brown, united in pairs. **Spores** subspherical, 7–9.5 µm.

Similar species — *Splachnum* species produce unique capsules and are easily distinguished when fertile. *Splachnum ampullaceum* is the most common sphagnum in boreal North America. Sterile plants could be mistaken for a *Bryum* or one if its segregate genera. However, its deeply spinose-dentate leaf margins and swollen hypophysis are distinctive.

Ecology — *Splachnum ampullaceum* forms green sods on decomposed herbivore dung or dung-enriched soil in peatlands or other wetlands. The known site in Oregon occurs at 5,000 feet, although Hutten et al. (2005) reported it in Olympic National Park from as low as 500 feet. Oregon sites are located in fens dominated by *Eleocharis quinquefolia, Hamatocaulis vernicosus*, and *Pinus contorta* var. *latifolia*. *Splachnum ampullaceum* tends to out-compete *Tetraplodon mnioides* in wet habitats, indicating that wetlands are optimal habitat for this species (Studlar and Byers 2007).

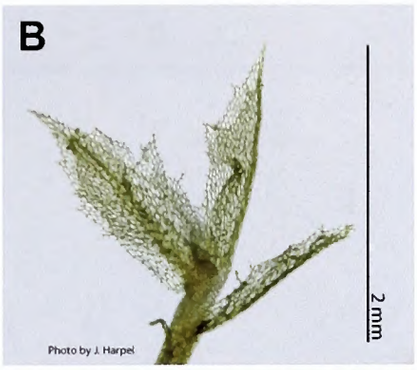
Distribution — *Splachnum ampullaceum* is known from Europe, Asia, Greenland, and North America. In western North America, it is known from Alaska, Yukon, Northwest Territories, British Columbia, Alberta, Washington, and Oregon. In Oregon, *S. ampullaceum* is reported from Klamath County in the East Cascades ecoregion.

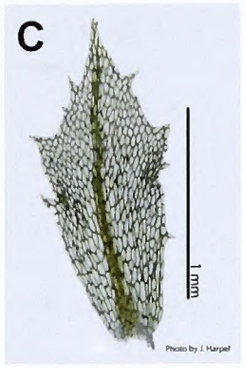
References with descriptions and/or illustrations — Marino (in FNA 2014, p. 25), Crum (2004, p. 211), Christy and Wagner (1996, p. VII–70), Noguchi (1988, p. 419), Crum (1983, p. 150), Crum and Anderson (1981, p. 496), Lawton (1971, p. 157), Nyholm (1956, p. 187), Sayre (1935, p. 101), Grout (1903, p. 188).

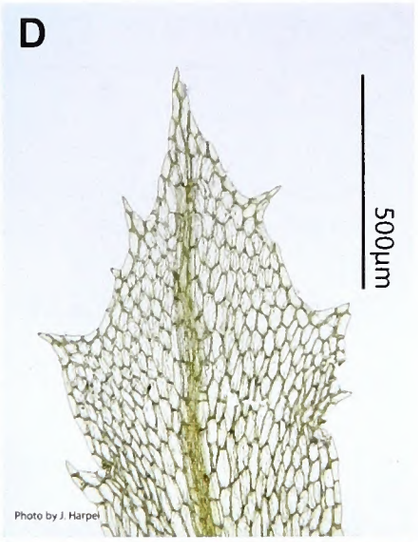
References with photos — Atherton et al. (2010, p. 571).

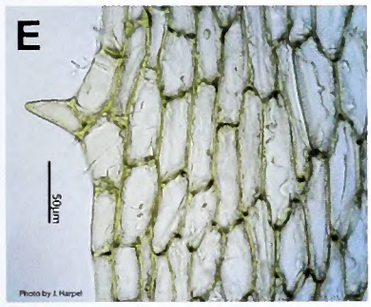
Plate 94. Splachnum ampullaceum. *A. Dry habitat. B. Moist individual plant. C–D. Leaves. E. Upper medial cells. F. Leaf apex. G. Alar and basal cells. H. Perigonium. I–J. Sporophytes. K. Stomata. L. Peristome. (G. Straley 2828. UBC)*


A
4 cm
Photo by J. Harpel

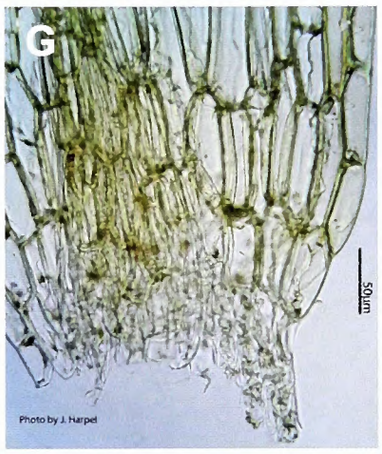

B
2 mm
Photo by J. Harpel

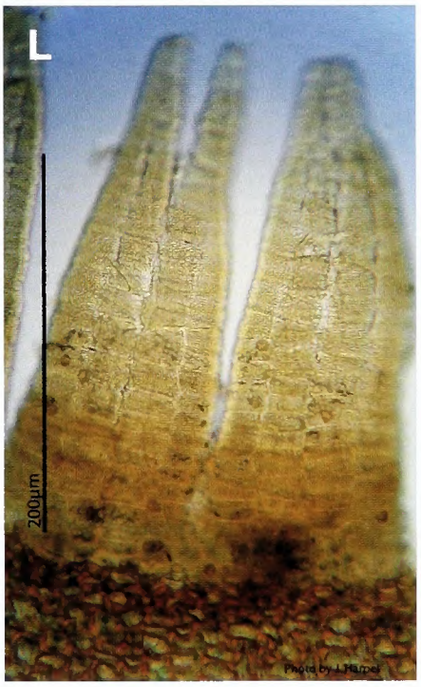

C
1 mm
Photo by J. Harpel


D
500µm
Photo by J. Harpel

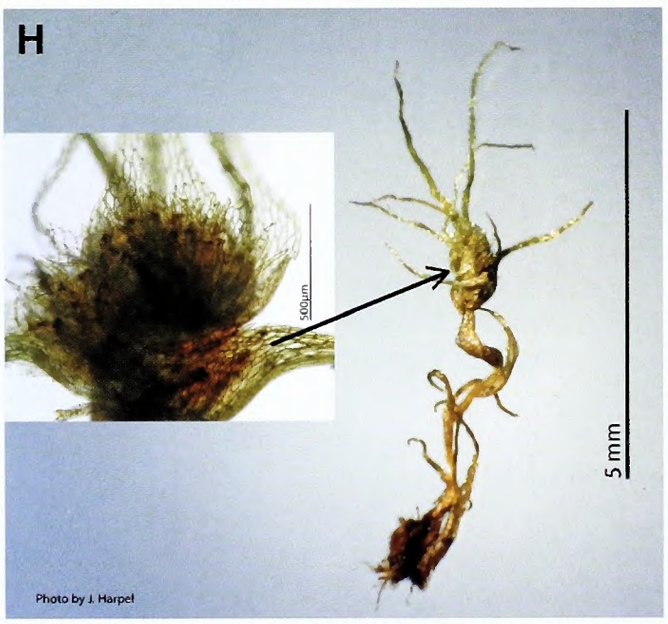

E
50µm
Photo by J. Harpel

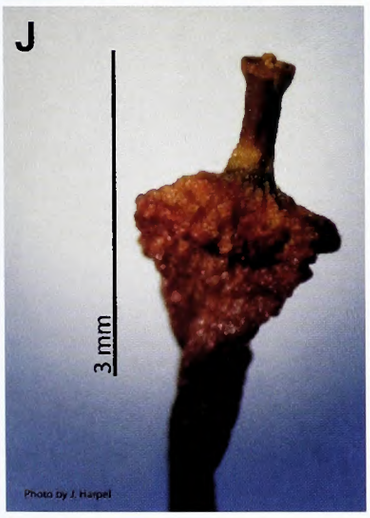

F
50µm

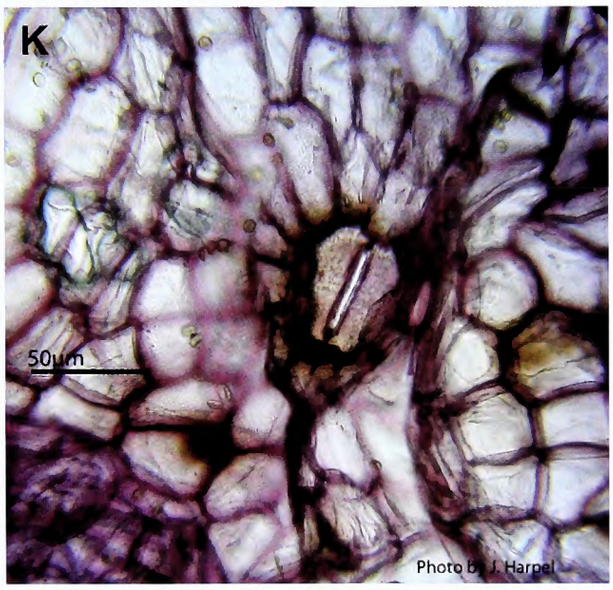

G
50µm
Photo by J. Harpel


L
200µm
Photo by J. Harpel


I
3 mm
Photo by J. Harpel


H
500µm
5 mm
Photo by J. Harpel


J
3 mm
Photo by J. Harpel


K
50µm
Photo by J. Harpel

Splachnum sphaericum Hedwig

Recent synonyms:
Splachnum ovatum Hedwig
Splachnum pendunculatum ssp. *sphaericum* Lindberg
Common names: round-fruited collar-moss, dung moss

Summary — An acrocarpos, costate moss with smooth, obovate leaves. Terrestrial.

Diagnostic characteristics — *Splachnum sphaericum* can be distinguished by its (1) habit on dung or decaying plant and animal matter, (2) capsule neck (hypophysis) as long as, and slightly wider than the capsule, (3) ovate to obovate leaves that are abruptly acuminate or apiculate and often toothed, and (4) very long seta.

Technical description

GAMETOPHYTE — **Plants** light green or yellow-green in soft, somewhat shiny tufts, 5–30 mm tall. **Leaves** 2.5–3.5 mm long, broadly obovate and somewhat crowded at the tip of the stem; margins yellowish, in 1–2 indistinct rows, entire or slightly serrulate above; leaf apex abruptly short to long-acuminate and has shorter cells than the laminal cells. Costa very broad at the base, narrow above, disappears in the acumen just before the apex. Upper medial cells rhomboid-hexagonal, 20–30 µm wide; apical cells longer than wide. **Dioicous**.

SPOROPHYTE — **Seta** 1.5–14 cm long, flexuose, yellow, becoming reddish. **Capsule** (1) 2–2.5 (4) mm long, urn orange-red; hypophysis (apophysis) spherical or shortly obovid, slightly wider than the urn, greenish becoming dark purplish-red or blackish, and wrinkled when dry. Operculum hemispheric and apiculate; peristome teeth orange-brown, fused in pairs and inserted below the mouth. **Spores** 7–13 µm, spheric, yellow-green.

Similar species — *Splachnum sphaericum* is separated from other species of *Splachnum* by a hypophysis that is slightly wider than the urn, and broadly obovate, narrowly acuminate leaves. Immature sporophytes of other North American species of *Splachnum* resemble the mature sporophytes of *S. sphaericum*. Sterile collections of *S. sphaericum* can be separated from *Tetraplodon minoides* and *S. ampullaceum* by its shortly pointed leaves, narrow shorter apical cells and more or less entire leaf margins.

Ecology — *Splachnum sphaericum* occurs on dung of large herbivores on muskeg or bog habitats at low to high elevations. The capsules mature in the summer months.

Distribution — *Splachnum sphaericum* is known from Eurasia and North America. In western North America, it is know from Alaska and western Canadian provinces south into Washington, Oregon, Montana, Wyoming and Colorado. In Oregon, *S. sphaericum* is reported from Grant County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Marino (in FNA 2014, p. 27), Smith (2004, p. 518), Crum (2004, p. 211), Crum and Anderson (1981, p. 499), Lawton (1971, p. 158), Nyholm (1956, p. 187, as *Splachnum ovatum*), Grout (1939, p. 10, as *S. ovatum*).

References with photos — Atherton et al. (2010, p. 570).

Plate 95. Splachnum sphaericum. *A. Individual plant. B. Leaf. C. Leaf apex. D. Alar and basal cells. E. Upper medial cells. F. Sporophyte, wet. G. Sporophyte, dry. H. Perigonium. (B. Tan. 77-1704. W. Schofield 101984. 113285. UBC)*

A
2 mm
B
1 mm
C
500µm
D
100µm
E
50µm
F
2 mm
G
2 mm
H
2 mm

Tayloria serrata (Hedwig) Bruch & Schimper

Recent synonym: *Splachnum serratum* Hedwig
Common names: broad-leaved stink moss, serrate dung moss

Summary — An acrocarpous costate moss with obovate leaves. Terrestrial.

Diagnostic characters— *Tayloria serrata* can be distinguished by its (1) habitat on dung and humus rich in organic material, (2) unbordered obovate to oblong-obovate leaves with an acuminate tip, (3) serrate leaf margin, and (4) eight reflexed peristome teeth often splitting into 16 when older.

Technical description

Gametophyte — **Plants** in loose, clear green tufts about 0.5–3 cm, more or less covered in rhizoids, infrequently branched. **Leaves** loosely erect, somewhat contorted when dry, imbricate to spreading when wet, 2–5 × 1–1.5 mm, obovate to oblong-obovate, tapering proximally, acuminate or acute, sometimes obtuse; apex often reflexed; margins plane and toothed distally, entire and usually recurved proximally; costa ending before the apex. Specialized asexual reproduction by brood bodies sometimes produced on rhizoids. **Autoicous** (sometimes **dioicous**).

Sporophyte — **Seta** 1–3 cm, yellow to dark red or brown, flexuose, more or less stout. **Capsules** cylindric, 2.5–5 mm including the apophysis; urn oblong-cylindric, 1–2 mm when dry, brown or red-brown, gradually narrowed to a somewhat darker apophysis about as long as the urn or up to twice as long; numerous stomata scattered throughout the hypophyses; columella somewhat exserted; annulus none; operculum hemispheric, sometimes bluntly apiculate or short-rostrate; eight peristome teeth inserted proximal to the mouth, in pairs or splitting into 16, dark red or red-brown, reflexed when dry, densely papillose. Calyptra smooth, naked, constricted proximally. **Spores** 9–12 µm.

Similar species — Other species of *Tayloria* have blunt rounded leaf tips or bordered leaves. Sterile leafy plants of *Tayloria* are similar to the leafy shoots found in *Funaria* species, except that *Funaria* usually has small marginal teeth that are restricted to the apical region and usually grows only on mineral substrates. Sterile leafy plants can also be mistaken for *Brymm* or one if its segregate genera, but they lack conspicuous teeth on the leaf margins and have bordered leaves. *Tetraplodon mnioides* has entire lanceolate leaves.

Ecology — *Tayloria serrata* forms green sods on old dung, rotten wood, or on dung-enriched soil on right-of-ways or trails in dry to moist coniferous forests of various age classes including early seral, and in wetlands. *Tayloria serrata* has a broader ecological tolerance than *Splachnum* or *Tetraplodon*. Associated vascular plants include *Abies* spp., *Calocedrus decurrens, Pinus ponderosa, Pseudotsuga menziesii, Quercus garryana,* and *Tsuga* spp. associations at elevations from 15 feet (Hutten et al. 2005) to 5,000 feet. Many *Tayloria serrata* records from western North America are prior to 1910, suggesting that *T. serrata* was more common due to the greater amount of horse and cow manure along roads and trails in days before the automobile. Small or remnant *T. serrata* populations are often found growing with *Tetraplodon mnioides* on coyote dung in northwestern Oregon. In these cases, *Tetraplodon* might out-compete *Tayloria*. In southern Oregon (Medford), *Tayloria serrata* has been reported as one of the first moss species to colonize dung.

Distribution — *Tayloria serrata* is known from Europe and North America. In western North America, it is known from Alaska, British Columbia, Alberta, Washington, Oregon, California, Alberta, Idaho, and Montana.

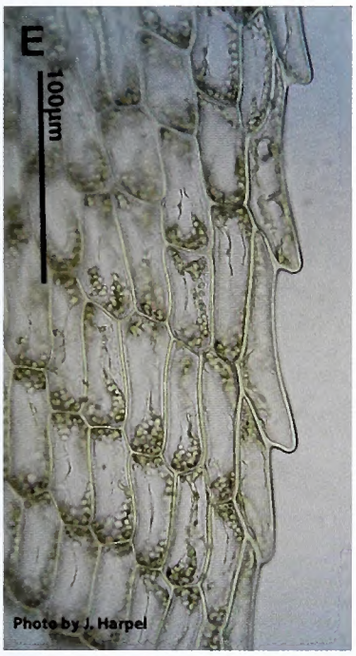
Plate 96. Tayloria serrata. *A. Dry habitat. B. Moist individual plant. C–D. Leaves. E. Leaf marginal cells. F. Alar and basal cells. G. Leaf apex. H. Upper medial cells. I–K. Sporphytes. L. Peristome teeth. (J. Harpel. 2512. 17485. Harpel Private)*

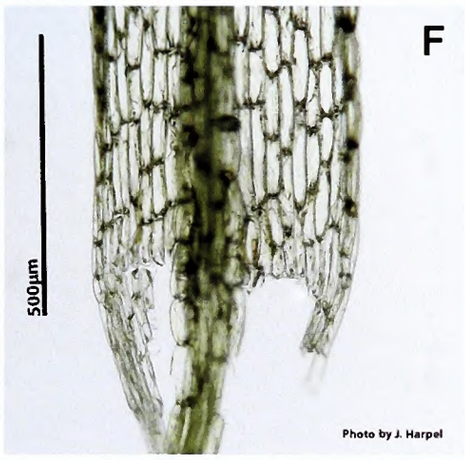

A
12µm
Photo by J. Harpel

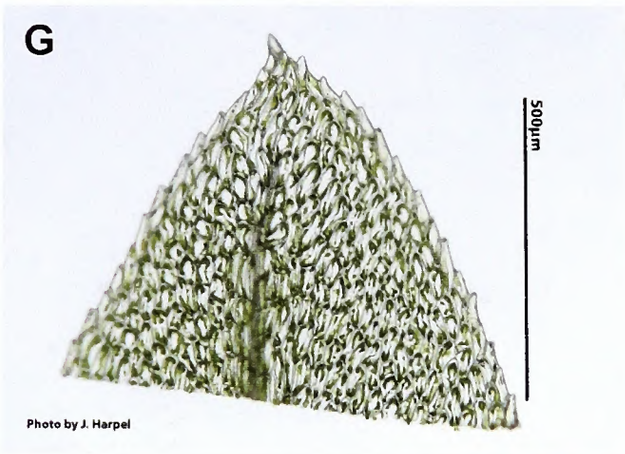

B
5 mm
Photo by J. Harpel

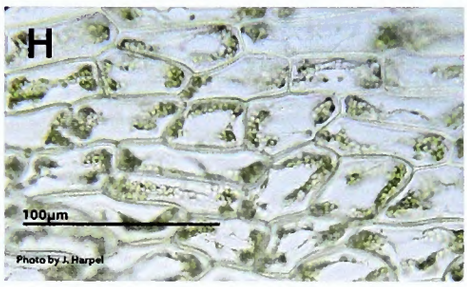

C


D
1 mm
Photo by J. Harpel


E
100µm
Photo by J. Harpel

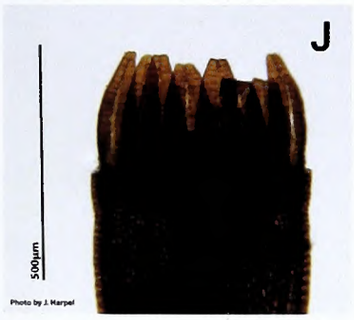

F
500µm
Photo by J. Harpel

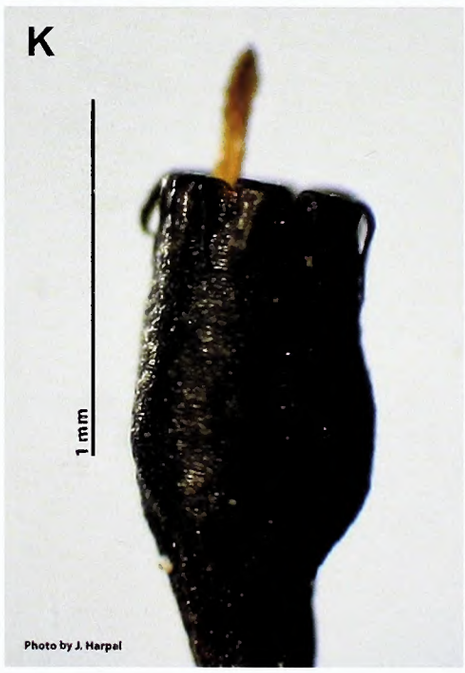

G
500µm
Photo by J. Harpel


H
100µm
Photo by J. Harpel


I
3 mm
Photo by J. Harpel


L
300µm
Photo by J. Harpel


J
500µm
Photo by J. Harpel


K
1 mm
Photo by J. Harpel

In Oregon, *T. serrata* is reported from Clackamas, Douglas, Jackson, Josephine, Lane, Lincoln and Linn counties within the Coast Range, Klamath Mountain, West Cascades, and Willamette Valley ecoregions.

References with descriptions and/or illustrations — Marino (in FNA 2014a, p. 18), Christy and Wagner (1996, part VII p. 73), Crum and Anderson (1981, p. 486), Lawton (1971, p. 160), Nyholm (1956, p. 180), Sayre (1935, p. 95).

Tetraphis geniculata Girgensohn

Recent synonyms: none
Common name: tetraphis moss

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characters— *Tetraphis geniculata* is distinguished by its (1) four peristome teeth, and (2) bent setae that are papillose on the upper half.

Technical description

GAMETOPHYTE — **Plants** forming small green to brownish-yellow tufts, 7–15 mm tall, slightly contorted when dry. **Leaves** ovate, acute, 1–2 mm long with a costa ending before the apex. Median leaf cells round to hexagonal, thick-walled, smooth, 8–18 µm long. Cup-like structures commonly produced on the top of a sterile shoot, containing numerous multi-cellular disc-shaped asexual gemmae that are dispersed by splashing water. **Autoicous**.

SPOROPHYTE — **Seta** 7–17 mm, erect, geniculate, cells smooth and spiraled below the bend, cells straight and papillose by projecting cell ends above the bend, twisted when dry. **Capsules** narrowly cylindric, yellow-brown, 1.5–3.0 mm long with four large peristome teeth that sometimes split in the middle, giving the appearance of more than four teeth. **Spores** 13–16 µm.

Similar species — Although gametophytic characteristics do not separate *Tetraphis geniculata* from *T. pellucida,* the bent setae of *T. geniculata* are diagnostic.

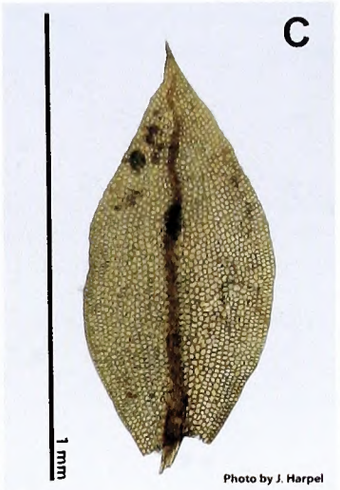
Ecology — *Tetraphis geniculata* often occurs on the cut, broken ends, or splintered lower sides of large rotted logs or stumps and occasionally on peaty banks in moist coniferous forests from sea level to subalpine elevations. It often occurs as "pure" populations or mixed in with *T. pellucida*. In western North America, it is known from large well-decayed logs in old-growth stands of *Picea sitchensis*, *Tsuga heterophylla*, and *Pseudotsuga menziesii*. It has also been found with residual conifers in *Alnus rubra*, *Populus trichocarpa*, and *Acer macrophyllum* stands. The overstory tends to be closed. Capsules mature spring-early summer. Lawton (1971) noted that asexual reproductive structures are not commonly found in *T. geniculata*, but Crum and Anderson (1981) indicated that they do occur; recent field experience has shown that they are frequently found within the Pacific Northwest.

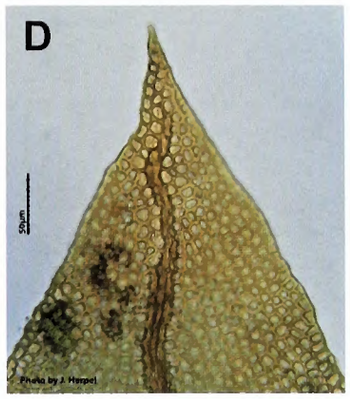
Distribution — *Tetraphis geniculata* is known from Asia and western North America where it is known from Alaska, Yukon, British Columbia, Washington, Oregon, and Idaho. In Oregon, *T. geniculata* is documented in Clackamas, Hood River, and Tillamook counties from the Coast Range and West Cascades ecoregion. It has also been reported within and near the Valley-of-the-Giants recreation area (Lincoln and Polk counties), but these reports need confirmation or additional study.

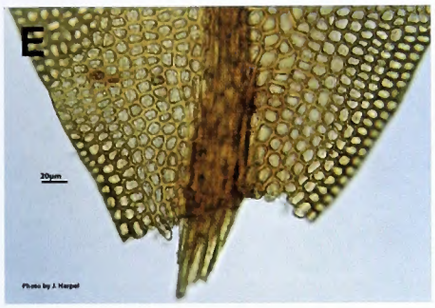
Plate 97. Tetraphis geniculata. *A. Dry habitat with bent sporophytes. B. Moist habitat. C. Leaf. D. Leaf apex. E. Alar and basal cells. F. Upper medial cells. G. Gemmae "cup" on a vegetative shoot. H. Discoid gemmae. I. Papillose seta. J. Peristome teeth. K. Sporphyte. L. Calyptra. (J. Harpel 16442. Harpel Private)*

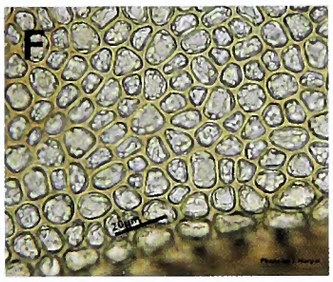

A
15 mm
Photo by J. Harpel

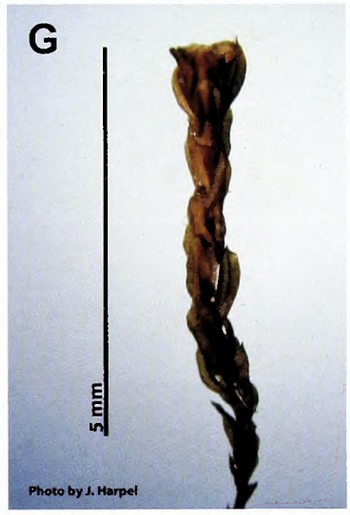

B
5 mm


C
1 mm
Photo by J. Harpel


D
50µm
Photo by J. Harpel

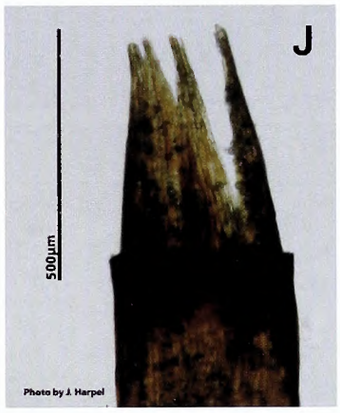

E
20µm
Photo by J. Harpel

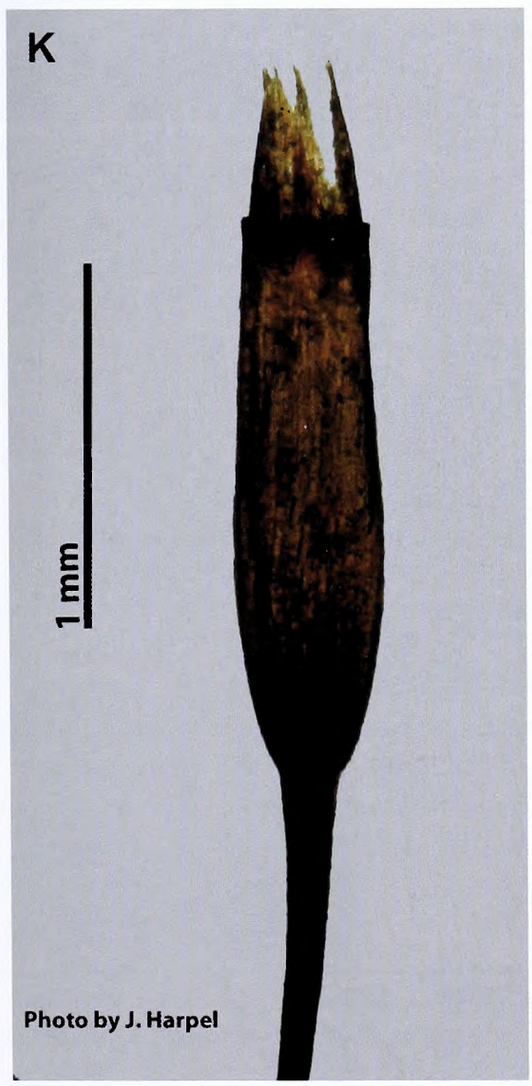

F
20µm


G
5 mm
Photo by J. Harpel


H
100µm
Photo by J. Harpel


I
50µm
Photo by J. Harpel


J
500µm
Photo by J. Harpel


K
1 mm
Photo by J. Harpel


L
3 mm
Photo by J. Harpel

References with descriptions and/or illustrations — Harpel (in FNA 2007, p. 112), Crum and Anderson (1981, p. 1243), Crum (2004, p. 550), Lawton, (1971, p. 27).

Tetraplodon mnioides (Hedwig) Bruch & Schimper

Recent synonyms: none
Common name: black-fruited stink moss, entire leaf nitrogen moss, fuzzy poop moss

Summary — An acrocarpous, costate moss with oblong-lanceolate leaves. Terrestrial.

Diagnostic characters— *Tetraplodon mnioides* can be distinguished by its (1) habitat on well-decayed dung, old bones, and owl pellets; (2) oblong-lanceolate leaves with entire margins; (3) cylindrical capsules with a hypophysis; (4) yellow to red seta and dark red to blackish capsule with yellow peristome teeth.

Technical description

Gametophyte — **Plants** in dense light green or yellow-green tufts, 1–4 (–8) cm. **Leaves** crowded, erect, somewhat contorted when dry, 1–2 × 3–5 mm, concave, entire, oblong-ovate, abruptly narrowing to a more or less long often yellowish subula; costa vanishing in the subula; upper cells rectangular and oblong-hexagonal. **Autoicous**.

Sporophyte — **Seta** stout, not twisted, straw-colored, usually becoming dark red with age, 1–5 cm. **Capsules** red, becoming dark or almost black, urn 1–1.5 mm, apophysis distally somewhat wider than the urn, gradually tapered to the seta, somewhat longer than or about twice as long as the urn, 2–3.5 mm, sometimes lighter than the urn but becoming the same color or darker, somewhat wrinkled longitudinally when dry; stomata large, numerous, on hypophysis; annulus poorly developed; operculum bluntly conic; calyptra short, conic-mitrate. **Spores** 9–12 µm.

Similar species — *Tetraplodon angustatus* has narrow toothed leaves and setae only 2–9 (–10) mm long. *Tayloria serrata* has obovate toothed leaves and the tissue below the capsules is usually shrunken and narrower than the capsules.

Ecology — *Tetraplodon mnioides* is the most common member of the genus. It forms stiff densely packed sods on carnivore dung (in Oregon usually coyote) or soil and rotten wood enriched by animal material. *Tetraplodon mnioides* is often located in right-of-ways or trails in dry to moist young to old coniferous forests or in peatlands. Pacific Northwest plant associations include *Abies procera*, *Picea sitchensis, Pseudotsuga menziesii,* and *Tsuga heterophylla* forests, and fens dominated by *Carex aquatilis* var. *dives* and *Vaccinium uliginosum.* Elevations range from near sea level (Hutten et al. 2005) to 3,500 feet. *Tetraplodon mnioides* has a broader ecological tolerance than *Splachnum* and out-competes *Splachnum* in drier habitats, indicating uplands are its optimal habitat (Studlar and Byers 2007). In northwestern Oregon, *T. mnioides* is often found on extensive mats of *Racomitrium elongatum* in and along roadsides or quarries or on exposed basalt cliffs in forested habitats at elevations generally over 2,000 feet. *Tetraplodon* specimens from the southern part of the range are reported as smaller than northern material.

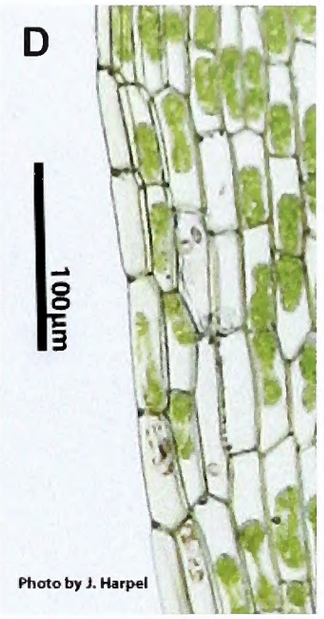
Distribution — *Tetraplodon mnioides* is known from Eurasia, Greenland, and North America. In western North America, it is known from Alaska, Yukon, Northwest Territories, British Columbia, Alberta, Washington, and Oregon. In Oregon, *T. mnioides* is reported from Benton, Clackamas, Douglas, Lane, Lincoln, Linn, Marion, and Polk counties within the Coast Range and West Cascades ecoregions.

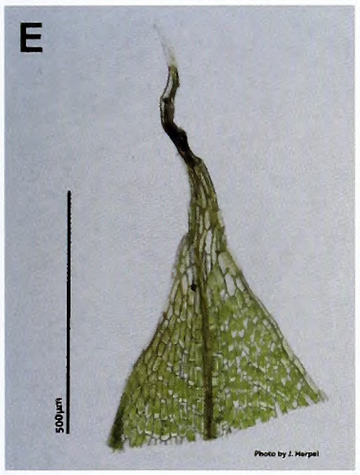
Plate 98. Tetraplodon mnioides. *A. Moist habitat. B. Moist individual plant. C. Leaf. D. Leaf marginal cells. E. Leaf apex. F. Alar and basal cells. G. Upper medial cells. H. Dry sporophyte. I–J. Moist sporophyte. K. Peristome teeth. L. Stomata. (R. Exeter sn. Harpel Private, Exeter Private)*

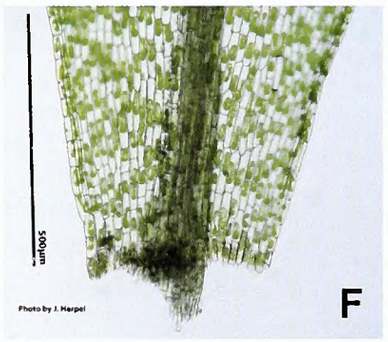

A

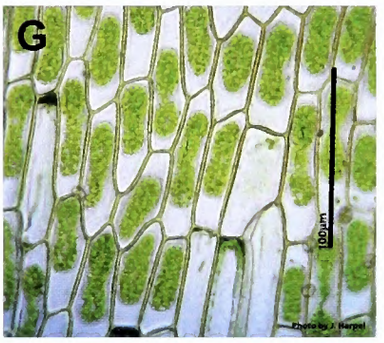

B
5 mm
Photo by J. Harpel


C
1 mm
Photo by J. Harpel

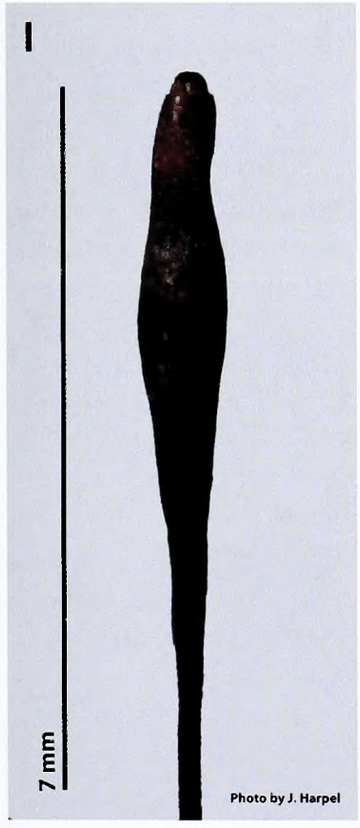

D
100µm
Photo by J. Harpel


E
500µm
Photo by J. Harpel

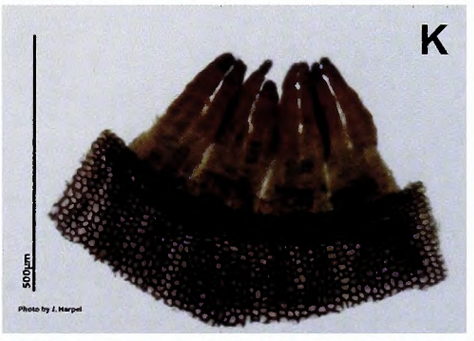

500µm
Photo by J. Harpel
F


G
100µm
Photo by J. Harpel


H
4 mm
Photo by J. Harpel


I
7 mm
Photo by J. Harpel


J
1 mm
Photo by J. Harpel


K
500µm
Photo by J. Harpel


L
50µm
Photo by J. Harpel

References with descriptions and/or illustrations — Marino (in FNA 2014b, p. 23), Smith (2004, p. 516), Christy and Wagner (1996, part VII, p. 79), Schofield (1992, p. 286), Noguchi (1988, p. 417), Crum and Anderson (1981, p. 491), Lawton (1971, p. 161), Nyholm (1956, p. 184), Sayre (1935, p. 98), Grout (1903, p. 189).

References with photos — Atherton et al. (2010, p. 569).

Thamnobryum neckeroides (Hooker) E. Lawton

Recent synonym: *Thamnobryum leibergii* (E. Britton) Nieuwland
Common name: Necker's thamnobryum

Summary — A pleurocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characters— *Thamnobryum neckeroides* can be distinguished by its (1) dendroid habit; (2) single, stout, subpercurrent costa; (3) distinctly concave, keeled, ovate-lanceolate leaves; and (4) rounded to broadly rounded leaf apex with coarse teeth.

Technical description

Gametophyte — **Plants** green to dark grayish-green, small to large, rhizomatous creeping stems up to 13 cm tall, more or less dendroid, frondose branches 1–5 cm long, often flagelliform, occasionally with small paraphyllia or pseudoparaphyllia. **Leaves** on the stem broadly ovate to triangular, serrate at the apex; branch leaves ovate-lanceolate, strongly concave; margins plane, coarsely toothed at apex; costa strong at base, toothed at the back above, ending before the apex; median leaf cells short, sometimes rhomboidal, thick walled; basal cells long, narrow; alar cells quadrate to rectangular, not strongly differentiated; flagellate branch leaves smaller with a shorter costa. **Dioicous**.

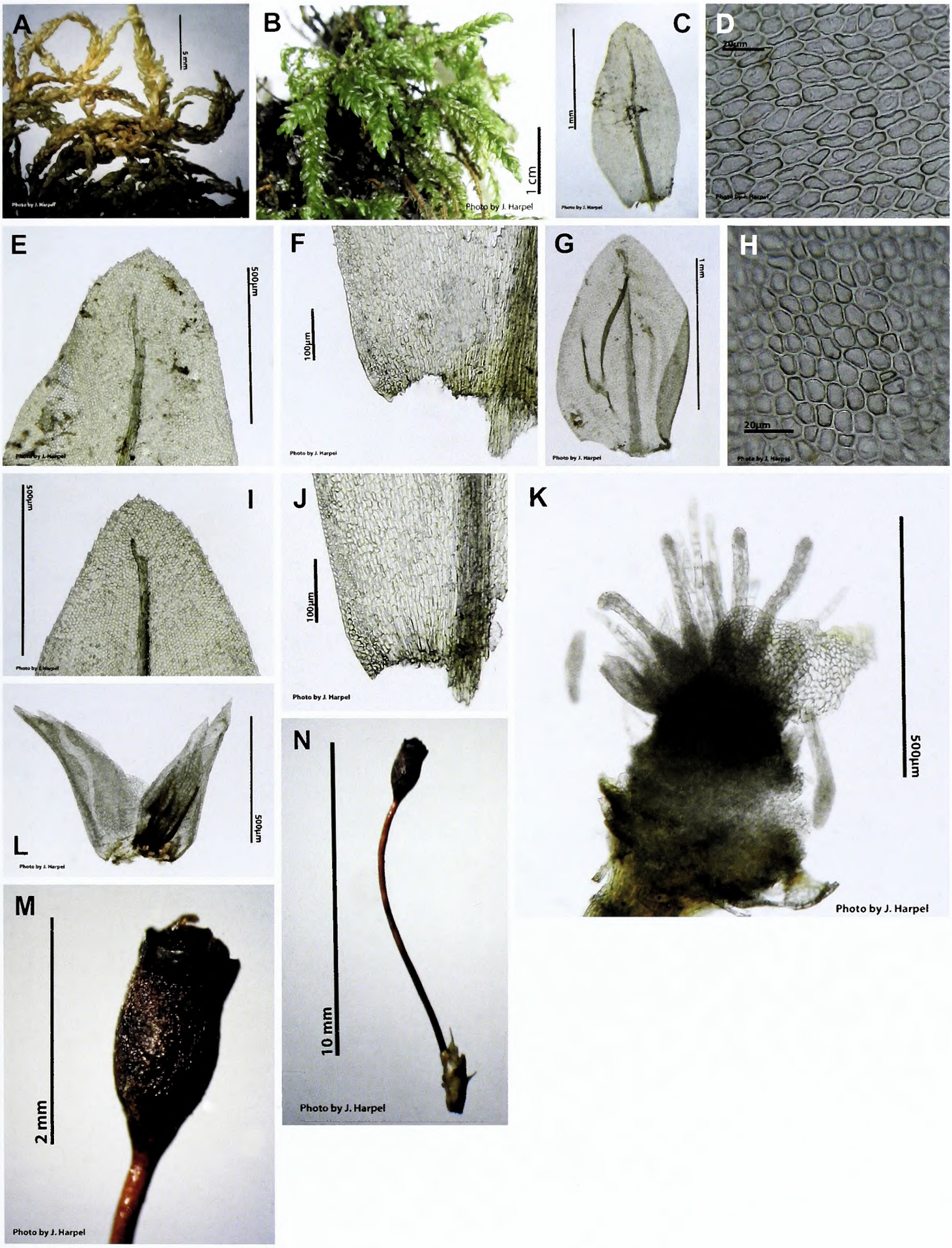
Sporophyte — **Seta** up to 1 cm long, erect, curved or bent. **Capsules** radially symmetric, contracted under the mouth when dry; peristome double; exostome teeth 16, papillose above; endostome papillose, appendiculate. **Spores** smooth or nearly so, 10–12 µm.

Similar species —*Thamnobryum* is unique in its non-complanate leaves, toothed apices, and spinose costal tip. *Leucolepis acanthoneura* is separated from *Thamnobryum neckeroides* by its dendroid growth form and long branching rhizoids on the stem. *Climacium dendroides* has abundant paraphyllia on the stem.

Ecology — *Thamnobryum neckeroides* has been collected from both rocks and trees (*Acer macrophyllum* and *Alnus rubra*). It is often found at the base of humid cliffs and boulder faces, especially near watercourses in shaded, damp locations in mixed Douglas-fir and western hemlock forest. According to Lawton (1971) *T. neckeroides* occurs from the lowlands up to 6,600 feet in elevation.

Distribution — *Thamnobryum neckeroides* is known from Eurasia, New Zealand, and North America. In western North America, it is known from Alaska, British Columbia, Alberta, Washington, Oregon, California, Idaho, and Montana. In Oregon, *T. neckeroides* is reported from Douglas, Josephine, Klamath, Lane, Lincoln, Linn, and Multnomah counties and within the Klamath Mountain and West Cascades ecoregions.

Plate 99. Thamnobryum neckeroides. *A. Dry habitat. B. Moist habitat. C. Stem Leaf. D. Stem leaf upper medial cells. E. Stem leaf apex. F. Stem leaf alar and basal cells. G. Branch leaf. H. Branch leaf upper medial cells. I. Branch leaf apex. J. Branch leaf alar and basal cells. K. Perigonum. L. Perichaetium. M–N. Sporophytes. (H. Brabazon. Ut-HB-01. WTU)*


A
5 mm
B
1 cm
Photo by J. Harpel
C
1mm
D
20µm
E
500µm
F
100µm
G
1mm
H
20µm
I
500µm
J
100µm
Photo by J. Harpel
K
500µm
Photo by J. Harpel
L
500µm
M
2 mm
Photo by J. Harpel
N
10 mm
Photo by J. Harpel

References with descriptions and/or illustrations — Jesús (in FNA 2014, p. 615), Mastracci (2003), Lawton (1971, p. 245).

References with photos — Malcolm et al. (2009, p. 310).

Tomentypnum nitens (Hedwig) Loeske

Recent synonyms:
Homalothecium nitens (Hedwig) H. Robinson
Camptothecium nitens (Hedwig) Schimper
Common names: tomentypnum moss, wooly feather moss

Nomenclatural note: *Tomenthypnum* is a variant spelling that has been frequently used for the genus. Faubert (2014) follows the original published spelling of the generic name.

Summary — A pleurocarpous costate moss with lanceolate-triangular leaves. Terrestrial.

Diagnostic characters — *Tomentypnum nitens* can be distinguished by its (1) large size, (2) golden-brown or yellow-green color, (3) stems matted with rhizoids, (4) calcareous fen habitat, and (5) long slender distinctly plicate leaves.

Technical description

Gametophyte — **Plants** 5–15 cm tall, ascending or stiffly erect, robust and often glossy when dry, yellowish-green to golden-brown, pinnate branching and crowded. **Stems** densely felted with brown rhizoids in 1–2 transverse rows just below the leaf insertion on the stem leaf proximal dorsal costal surface. **Leaves** 3–4 mm long, erect-spreading, sometimes all pointed in the same direction (secund), lanceolate-triangular, tapering to a long narrow apex, strongly pleated or wrinkled longitudinally (plicate); stem and branch leaves similar, sometimes sprouting rhizoids from the back of the costa; margins entire or sinuose, plane or narrowly recurved; costa slender, extending 3/4 or 4/5 the length of the leaf, without spines; upper leaf cells long and narrow, thick-walled, smooth, basal cells porose; alar cells not differentiated in a group. **Dioicous**.

Sporophyte — **Seta** 2–5 cm, reddish, smooth. **Capsules** uncommon, 2–3 mm, orange-brown, horizontal, curved, short and thick, contracted under the mouth when dry. **Spores** 12–18 µm.

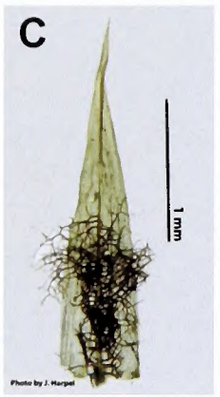
Similar species — *Tomentypnum nitens* is unique with its straight, plicate, triangular leaves and growth restricted to fens. *Tomentypnum falcifolium* usually occurs in *Sphagnum*-dominated vegetation and has falcate-secund leaves that are often twisted distally. *Cratoneuron filicinum* produces rhizoids only on the stems, has sparse paraphyllia and ovate-trianglular leaves with well-developed alar cells.

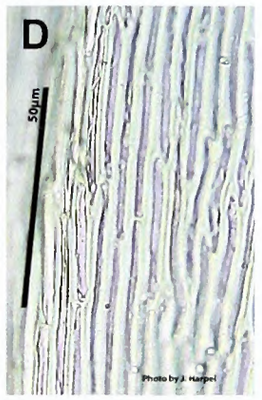
Ecology — *Tomentypnum nitens* forms loose or dense sods or intermixes with other bryophytes in medium to rich montane fens between 5,000–6,000 feet in elevation where it favors slightly elevated sites such as logs, stumps, or hummocks formed by *Betula glandulosa* and *Vaccinium uliginosum*. It is one of the more conspicuous of several so-called "brown moss" species that occur in mineral-rich fens. In western North America, *T. nitens* is known from forested plant associations that include *Abies amabilis, Abies concolor, Abies lasiocarpa,* and *Pinus contorta* var. *latifolia*. Additional associated vascular plants species include *Carex aquatilis* var. *dives, Carex limosa,*

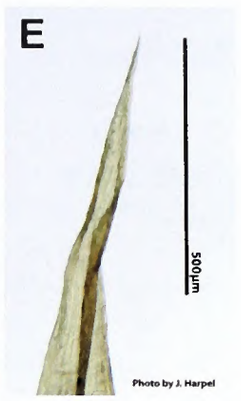
Plate 100. Tomentypnum nitens. *A. Habitat. B. Moist individual plant. C. Stem leaf. D. Stem leaf upper medial cells. E. Stem leaf apex. F. Stem alar and basal cells. G. Branch leaf. H. Branch leaf upper medial cells. I. Branch leaf apex. J. Branch leaf alar and basal cells. K. Stem rhizoids. (J. Harpel. 417. Harpel Private. S. Loring sn. OSC)*


A

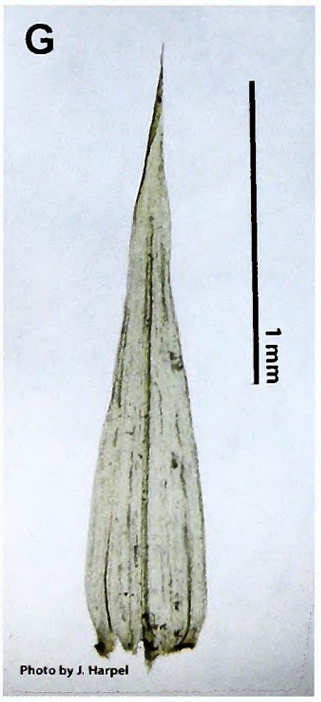

B
15 mm

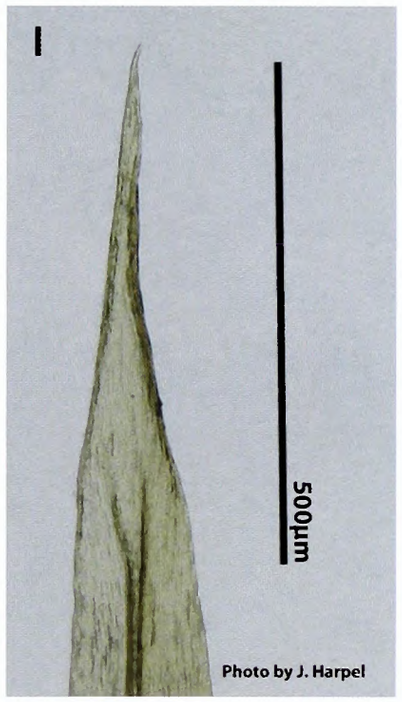

C
1 mm

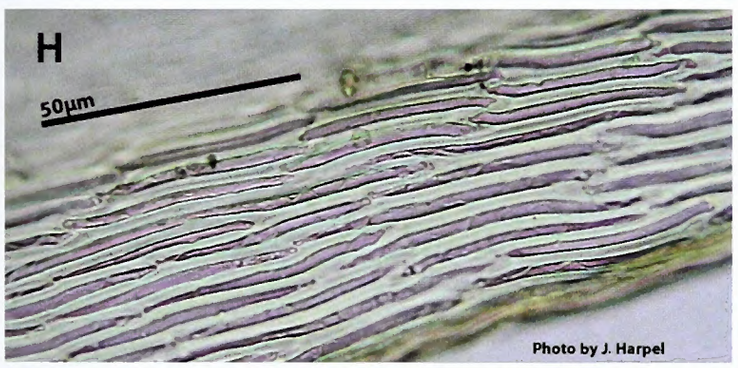

D
50µm
Photo by J. Harpel


E
500µm
Photo by J. Harpel

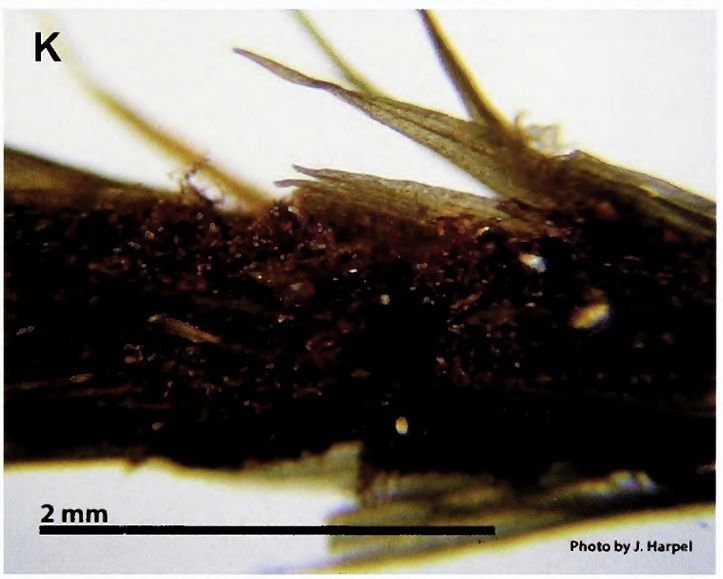

200µm
F
Photo by J. Harpel


G
1 mm
Photo by J. Harpel


I
500µm
Photo by J. Harpel


H
50µm
Photo by J. Harpel


J
200µm
Photo by J. Harpel


K
2 mm
Photo by J. Harpel

Eleocharis quinqueflora, Schenchzeria palustris, and *Triglochin maritimum*. Associated bryophyte species include *Elodium blandowii, Hamatocaulis vernicosus, Meesia triquetra* and *Pseudocalliergon trifarium*.

Distribution — *Tomentypnum nitens* is known from Eurasia, Greenland, the Atlantic and Pacific Islands, and North America. In western North America, it is known from Alaska, Yukon, Northwest Territories, British Columbia, Alberta, Washington, Oregon, California, Idaho, Montana, Utah, Wyoming, Colorado, and New Mexico. In Oregon, *T. nitens* is reported from Deschutes, Douglas, Grant, Jackson, Klamath, Lake, Lane, and Wheeler counties within the Blue Mountain and East and West Cascades ecoregions.

References with descriptions and/or illustrations — Faubert (in FNA 2014, p. 311), Bosanquet (2007), Smith (2004, p. 793), Schofield (1992, p. 292), Vitt et al. (1988, p. 96), Ireland (1982, p. 536), Crum and Anderson (1981, p. 1015), Smith (1978, p. 589 as *Homalothecium nitens*), Flowers (1973, p. 457), Lawton (1971, p. 306 as *Homalothecium nitens*), Nyholm (1965, p. 564), Grout (1928, p. 58 as *Camptothecium nitens*).

References with photos — Porley (2013, p. 181), Lockhart et al. (2012, p. 524), Atherton et al. (2010, p. 725), Malcolm et al. (2009, p. 276).

Tortella fragilis (Hooker & Wilson) Limpricht

Recent synonyms: none
Common name: brittle crisp-moss

Summary — An acrocarpous, costate moss with linear-lanceolate leaves. Terrestrial.

Diagnostic characters— *Tortella fragilis* can be distinguished by its (1) hyaline leaf basal cells forming a distinct "V" between the margin and the costa, (2) broken leaf tips, (3) coarsely tomentose stems, (4) lack of a central strand in the stem, and (5) bistratose upper leaf lamina.

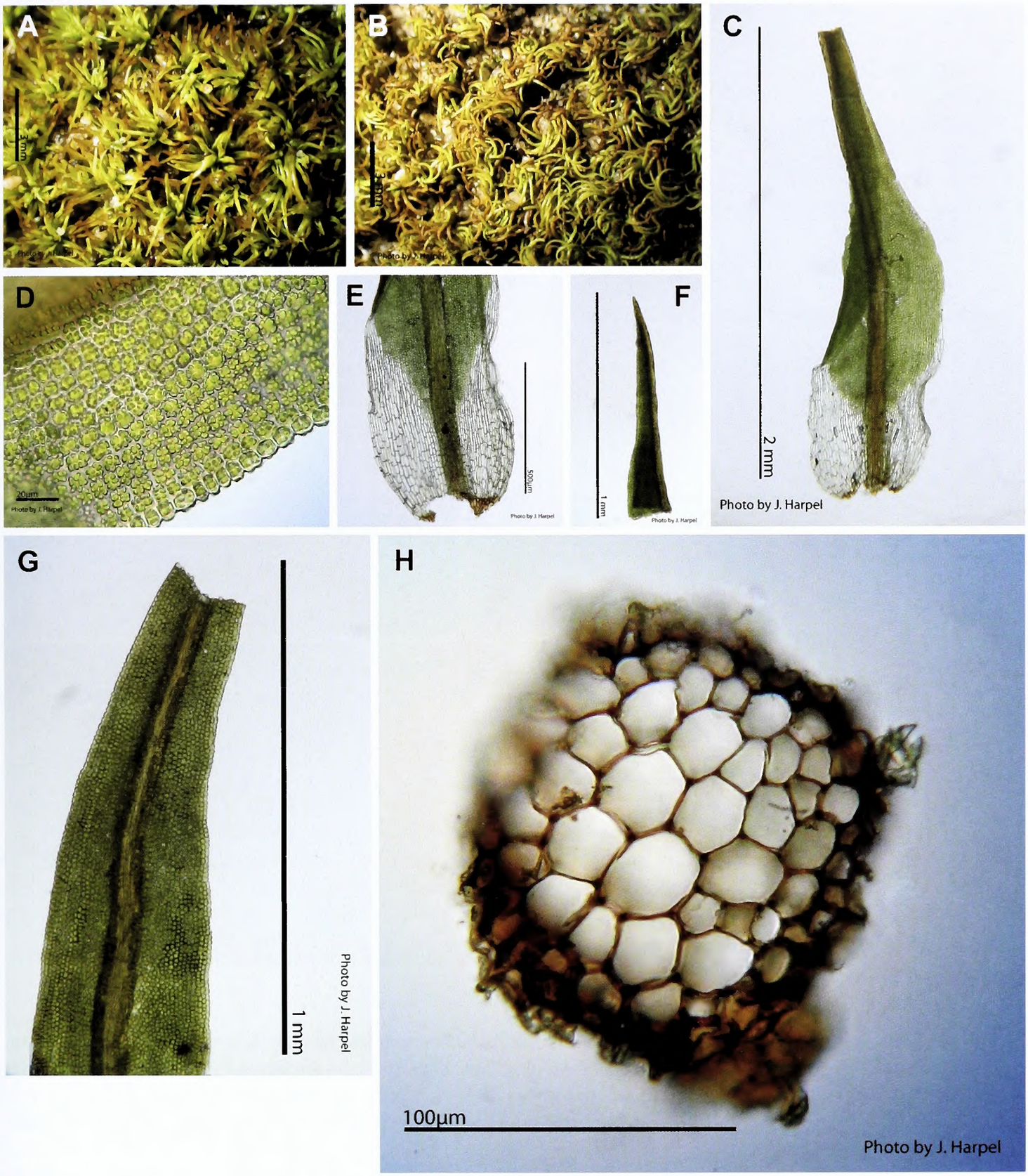
Technical description

GAMETOPHYTE — **Plants** dark green to yellowish-brown, in dense tufts up to 5 cm tall. **Stems** lacking a central strand. **Leaves** firm, coarse, rigid, erect-incurved, slightly contorted when dry, erect and spreading when moist, linear-lanceolate from a sheathing base, 4–5 mm long ending in a subulate apex; apex fragile (tips usually broken off); margins plane or inflexed, bistratose in the upper leaf; costa short-excurrent as a mucro; upper medial cells hexagonal, papillose, 7–11 µm; basal cells hyaline, smooth, elongate, extending up the leaf margins to form a "V" shape with elongated clear marginal cells. **Dioicous**.

SPOROPHYTE — **Seta** 15–20 mm long. **Capsules** 1.8–3 mm long, peristome teeth long, spirally wound together. **Spores** 8–12 µm, smooth to slightly roughened.

Similar species —*Tortula* and *Syntrichia* usually have oblong to spathulate leaves. *Tortella tortuosa* has strongly contorted leaves when dry and does not end in a long, linear fragile tip. *Tortella alpicola* also has fragile leaf tips, but has a central strand. *Weissia* and *Trichostomum* are similar, but in general, the few hyaline basal cells extend only a short way up the margins and do not form a distinct "V".

Plate 101. Tortella fragilis. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Upper medial cells. E. Alar and basal cells. F–G. Leaf apex. H. Stem cross-section. (J. Harpel 47643. Harpel Private)*


A
3 mm
B
3 mm
C
2 mm
Photo by J. Harpel
D
20µm
Photo by J. Harpel
E
500µm
Photo by J. Harpel
F
1 mm
Photo by J. Harpel
G
1 mm
Photo by J. Harpel
H
100µm
Photo by J. Harpel

Ecology — *Tortella fragilis* is known from acid or calcareous rock but is usually considered a calciphile. It occurs in seepages, cliff crevices and ledges in maritime habitats, logs or peaty humus along streams, fens, cedar swamps, open lakeshore sands, tundra, alpine and willow bogs, dry prairies, or occasionally exposed locations on dry soil from lowland to 10,500 foot elevations. According to Eckel (2007c) capsules are uncommon but when present they mature in the June. The fragile leaf tips are easily broken, providing a source of asexual reproduction.

Distribution — *Tortella fragilis* is known from Eurasia, Africa, Greenland, Iceland, New Zealand, Australia, Antarctica, and North America. In western North America, it is known from Alaska, Yukon, British Columbia, Alberta, Washington, Oregon, California, Montana, Wyoming, Colorado, and Nevada. In Oregon, *T. fragilis* is reported from Jackson and Lincoln counties within the Coast Range and West Cascades ecoregions.

References with descriptions and/or illustrations — Eckel (in FNA 2007c, p. 507), Crum (2004, p. 143), Eckel (1998, p. 26), Sharp et al. (1994, p. 341), Zander (1993, p. 102), Crum and Anderson (1981, p. 310), Lawton (1971, p. 105), Nyholm (1956, p. 138).

Tortella tortuosa (Hedwig) Limpricht

Recent synonyms: none
Common name: frizzled crisp-moss

Summary — An acrocarpous costate moss with linear-lanceolate leaves. Terrestrial.

Diagnostic characters— *Tortella tortuosa* can be distinguished by its (1) hyaline leaf basal cells forming a distinct "V" between the margin and the costa, (2) tomentose stems, (3) lack of broken leaf tips, and (4) strongly crisped and contorted leaves with spirally curled leaf tips when dry.

Technical description

GAMETOPHYTE — **Plants** strongly crisped and contorted when dry, green to yellowish-green, forming tufts or cushions up to 6 cm tall. **Leaves** plane to canaliculate, linear-lanceolate, 2–6 mm long; apex acute, spirally curled when dry; margins undulate; costa excurrent as an entire or serrulate point; upper median cells quadrate-hexagonal, 7–10 µm, papillose; basal cells elongate, clear, forming a distinct "V" along the margin to about midleaf. **Dioicous**.

SPOROPHYTE — **Seta** 15–20 mm long. **Capsules** 1.8–33 mm long; peristome teeth long, spirally twisted together. **Spores** 8–11µm, smooth to finely papillose.

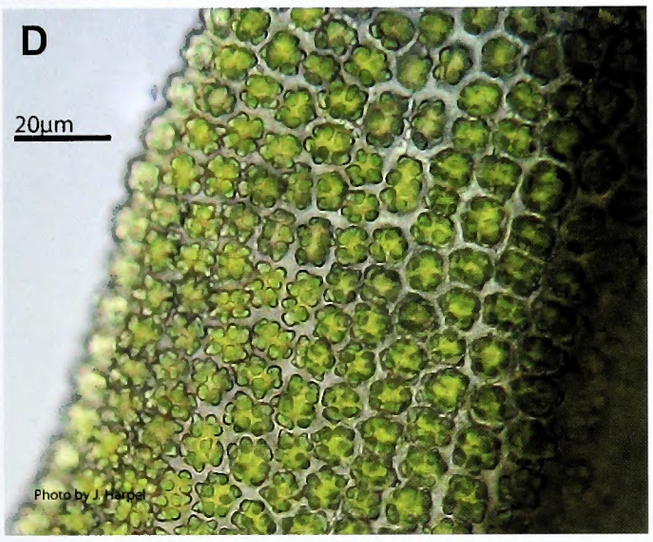
Similar species — *Tortella fragilis* differs in that it usually has broken leaf tips and is not strongly crisped when dry. *Tortella tortuosa* var. *fragilifolia* also has broken leaf tips, but Crum and Anderson (1981) felt that this variety could not be confused with *T. fragilis* because the leaves of *T. fragilis* are generally not strongly crisped and spirally twisted when dry. See *Tortella fragilis* and *Trichostomum tenuirostre* for additional information on similar species.

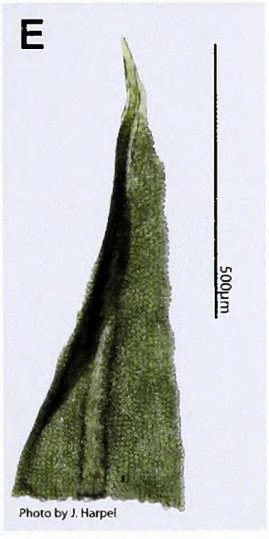
Ecology — *Tortella tortuosa* is a calciphile that grows on rock or occasionally on dry soil in exposed or shaded rock crevices from lowland to alpine habitats. It is also known from boulders, ledges, peaty soil, decayed wood, wet or dry slopes, and in northern regions from wet tundra.

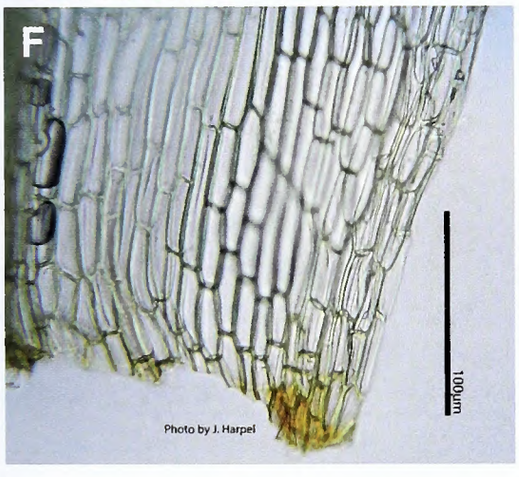
Plate 102. Tortella tortuosa. *A. Dry habitat. B. Moist habitat. C. Leaf. D. Upper medial cells. E. Leaf apex. F–G. Alar and basal cells. H. Stem cross-section. (J. Harpel 47608. Harpel Private)*

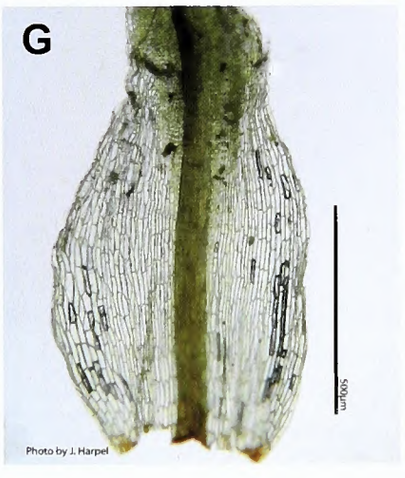

A


B
Photo by J. Harpel

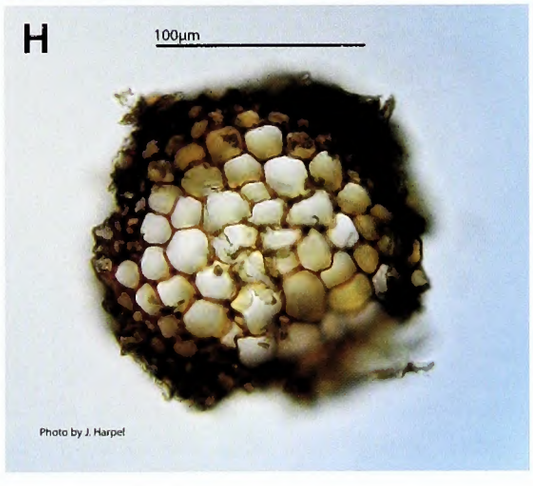

D
20µm
Photo by J. Harpel


E
500µm
Photo by J. Harpel


F
100µm
Photo by J. Harpel


G
500µm
Photo by J. Harpel


C
4 mm
Photo by J. Harpel


H
100µm
Photo by J. Harpel

Distribution — *Tortella tortuosa* is known from Eurasia, Africa, Greenland, and North America, where it is known from most provinces and states with the exception of the southeastern United States. In Oregon, *T. tortuosa* is reported from Baker, Clatsop, and Josephine counties within the Blue Mountain, Coast Range, and Klamath Mountain ecoregions.

References with descriptions and/or illustrations — Eckel (in FNA 2007c, p. 504), Crum (2004, p. 143) Eckel (1998, p. 16), Sharp et al. (1994, p. 237), Zander (1993, p. 103), Crum and Anderson (1981, p. 310) Lawton (1971, p. 106), Nyholm (1956, p. 139).

References with photos — Malcolm et al. (2009, p. 151).

Tortula inermis (Bridel) Montagne

Recent synonyms:
Syntrichia subulata var. *inermis* Bridel
Syntrichia inermis (Bridel) Bruch
Common names: tortula moss

Summary — An acrocarpous, costate moss with ligulate leaves. Terrestrial.

Diagnostic characteristics — *Tortula inermis* can be distinguished by its (1) short mucronate, non-bordered leaves, (2) strongly spirally twisted leaves when dry, (3) strongly recurved leaf margins, and (4) peristome teeth that are twisted more than one turn.

Technical description

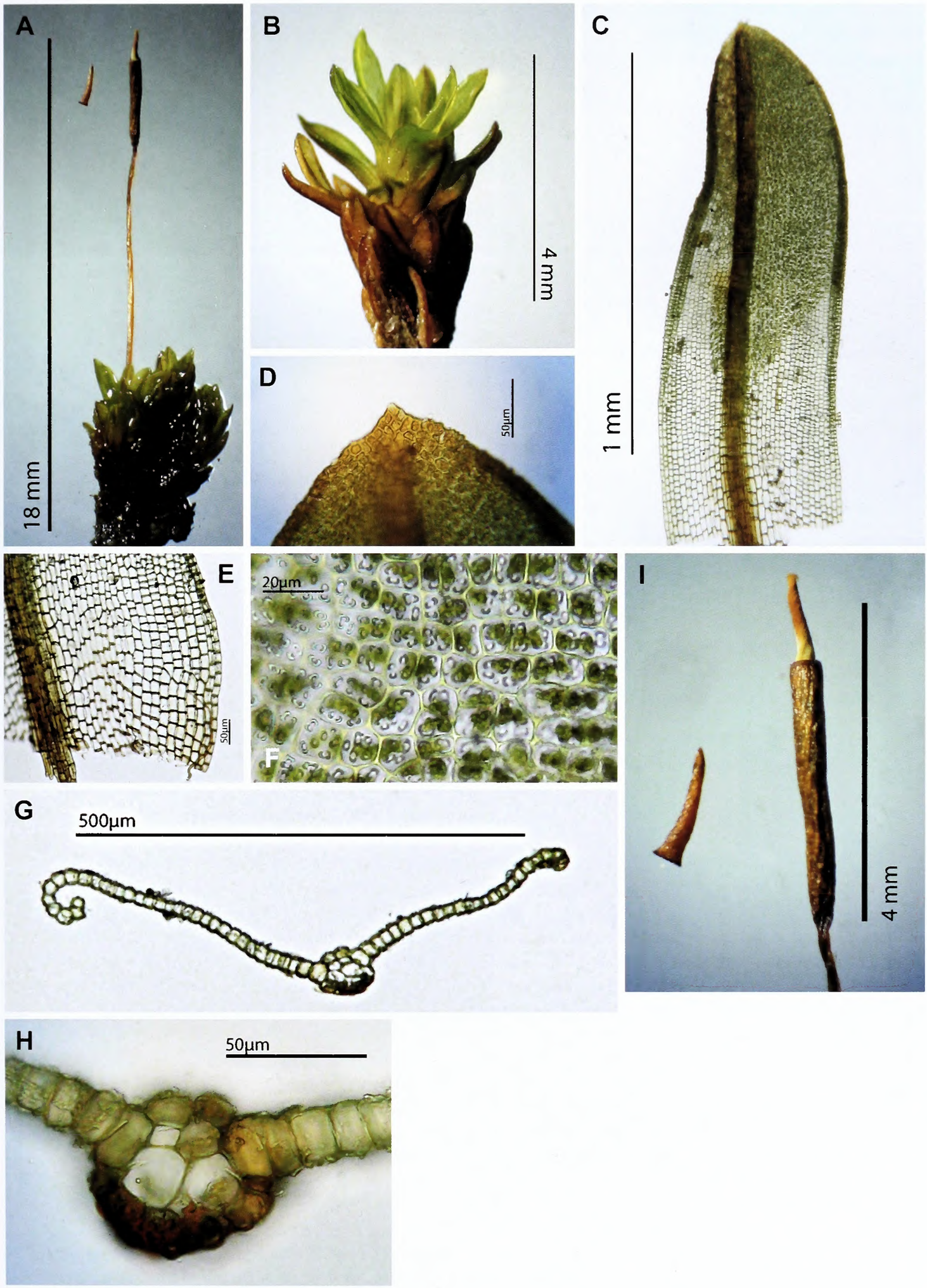
Gametophyte — **Plants** 5–10 mm tall, yellow-green to brownish below, as scattered individuals or in tufts. **Leaves** 2–3.5 mm long, lingulate, apex rounded-acute, apiculate to short mucronate, folded and spirally twisted and slightly contorted when dry. Margins strongly recurved from base to near the apex and not bordered. Costa strong with large guide cells and rounded stereids, percurrent or excurrent as a short mucro or apiculus. Upper medial cells irregularly rounded-hexagonal, (12–) 15–18 µm wide, 1:1, strongly papillose with 4–5 bifid or c-shaped papillae. Basal cells rectangular, smooth and hyaline, becoming narrower at the margins. Alar cells undifferentiated. **Autoicous**.

Sporophyte — **Seta** 10–20 mm long. **Capsules** 3.5–4.5 mm long, stegocarpic, not systylius, cylindric, erect and nearly straight. Peristome 1–1.5 mm long, strongly twisted in more than one turn; basal membrane 300–600 µm; operculum 1.3–1.6 (–2) mm, reddish. **Spores** 11–15 µm, spheric and finely papillose.

Similar species — *Tortula inermis* is similar to *Syntrichia* with its ligulate, apiculate leaves and strong costa, but the plant is yellow or orange in KOH. The costal section reveals a rounded stereid band. *Tortula mucronifolia* has smooth or nearly smooth leaf cells and weak or often absent marginal border. *Tortula subulata* has a strong marginal border.

Ecology — *Tortula inermis* capsules mature in spring. It is found on soil and rock up to 6,000 feet in elevation.

Plate 103. Tortula inermis. *A. Individual plant with sporophyte. B. Individual plant. C. Leaf. D. Leaf apex. E. Alar and basal cells. F. Upper medial cells. G–H. Leaf cross section. I. Sporophyte. (J. Shevock 13229. 19072. CAS)*


A
18 mm
B
4 mm
C
1 mm
D
50µm
E
50µm
20µm
F
I
4 mm
G
500µm
H
50µm

Distribution — *Tortula inermis* is known from Eurasia, North Africa and North America. In western North America it is know from Oregon, California, Utah, Wyoming, Arizona and Baja California. In Oregon, *T. inermis* is reported from Umatilla County within the Columbia Basin ecoregion.

References with descriptions and/or illustrations — Zander and Eckel (in FNA 2007b, p. 600), Weber and Wittmann (2007, p. 133), Sharp et al. (1994, p. 329), Lawton (1971, p. 109), Grout (1939, p. 237).

Tortula mucronifolia Schwägrichen

Recent synonyms: none
Common name: mucron leaf tortula moss

Summary — An acrocarpous, costate moss with oblong leaves. Terrestrial.

Diagnostic characters— *Tortula mucronifolia* can be distinguished by its (1) leaf lacking a marginal border or with a weak border of long rectangular cells, (2) smooth leaf cells, (3) leaves with a mucronate to short awn, (4) long and twisted peristome, and (5) recurved proximal leaf margins.

Technical description

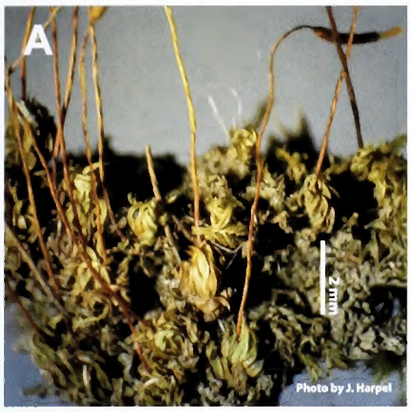
GAMETOPHYTE — **Plants** dark green, 2–3 mm wide, to 1 cm long but usually less than 5 mm. **Leaves** 2–5 × 0.6–1.5 mm, tightly clustered, keeled, contorted and infolded when dry and spreading when moist, oblong to oblong-obovate, blunt at apex except for short point formed by excurrent costa, unistratose in section; costa strong, conspicuous and shiny on the leaf backs, exceeding the apex to form a short, distinct yellowish point (mucro); margins entire, recurved in lower 1/2 to 2/3 and plane above, not bordered or bordered only in the lower part by elongate cells; upper leaf cells 15–21 (–28) µm, usually smooth but rarely with low papillae; basal cells longer than upper cells but not forming a conspicuous differentiated group. **Autoicous**.

SPOROPHYTE — **Seta** 8–15 mm long. **Capsules** frequent, erect and straight, 3–5 mm long; peristome teeth twisted into a cone. **Spores** 12–18 µm

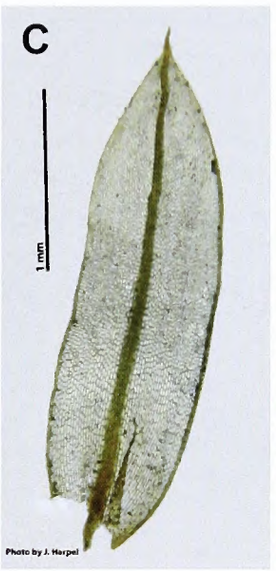
Similar species — *Tortula mucronifolia* is distinguished from *Tortula* species by its weak to absent leaf border, smooth laminal cells, mucronate leaf tip, long and twisted peristome teeth, and a recurved leaf margin at the base. *Tortula* species are generally delicate in appearance and light green with smooth awns with a costa that has a rounded to semicircular dorsal stereid band in cross-section. In addition, *Tortula* lamina turns yellow in 2% KOH. *Syntrichia* species are generally coarser in habit, dark green to red-orange with smooth to serrulate awns and with a dorsal stereid band that is lunate in cross-section and with a lamina that turns orange to red in KOH. *Tortella* has a characteristic V-shaped area of hyaline basal cells in the leaf base. According to Zander and Eckel (2007b), *T. mucronifolia* is quite close to *Tortula subulata,* but the smooth laminal cells and absent or weakly developed border separates the two species. Intermediates may be found where the two species ranges overlap.

Ecology —Although *Tortula mucronifolia* is reported as a calciphile, it is also known from acidic rocks in the Pacific Northwest. It forms small turfs or cushions on soil, tree roots, and sheltered ledges and crevices of rock outcrops and cliffs from low elevations to 8,100 feet. It is known to occur on rocky outcrops in *Abies concolor* and *Abies magnifica* × *shastensis* forests in southwestern Oregon. In southeastern Oregon it is known from a riparian forest of *Betula occidentalis, Populus trichocarpa,* and *Populus tremuloides*.

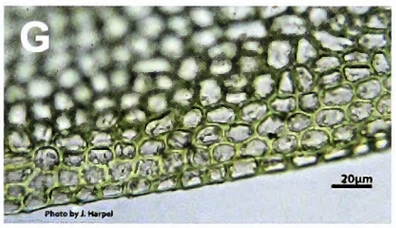
Plate 104. Tortula mucronifolia. *A. Dry habitat. B. Moist individual. C. Leaf. D. Alar and basal cells. E. Leaf apex. F. Upper medial cells. G. Leaf margin. H–J. Leaf cross-section. K–L. Sporophyte. (C. Bird 3973. Harpel Private)*

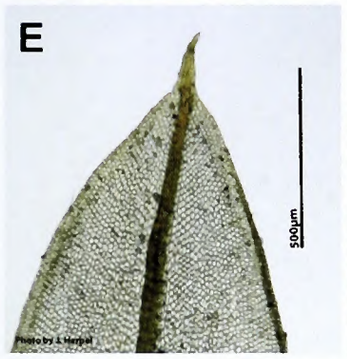

A
2 mm
Photo by J. Harpel

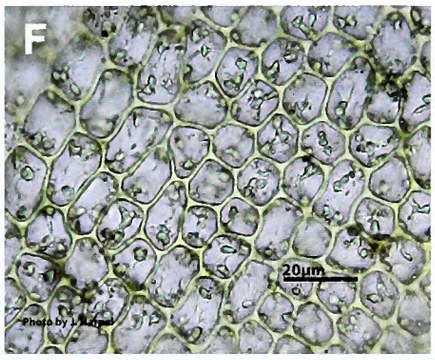

B
3 mm
Photo by J. Harpel

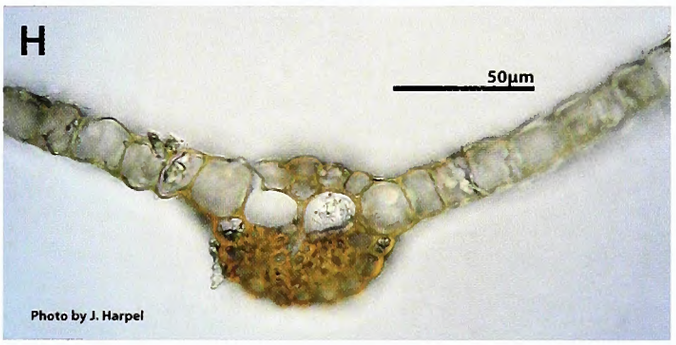

C
1 mm
Photo by J. Harpel

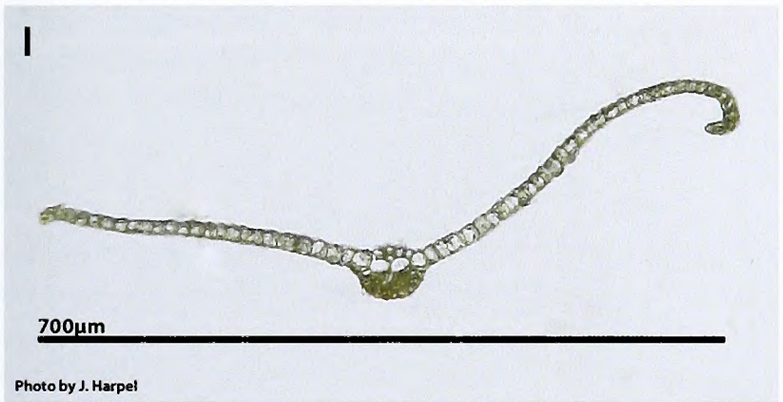

D
200µm
Photo by J. Harpel


G
20µm
Photo by J. Harpel

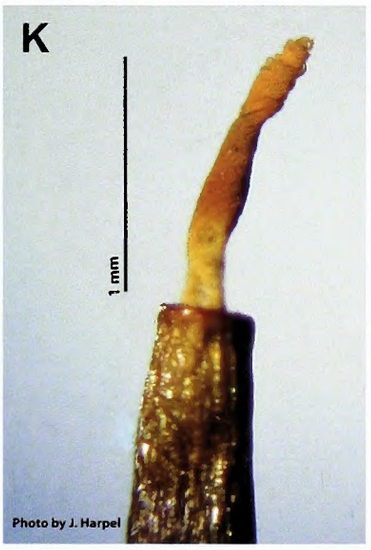

E
500µm
Photo by J. Harpel


F
20µm
Photo by J. Harpel


H
50µm
Photo by J. Harpel


I
700µm
Photo by J. Harpel


J
10µm
Photo by J. Harpel


K
1 mm
Photo by J. Harpel


L
5 mm
Photo by J. Harpel

Distribution — *Tortula mucronifolia* is known from Eurasia, Africa, New Zealand, and North America. In North America, it is known from most provinces and states except for the Gulf Coast in the southeastern United States. In Oregon, *T. mucronifolia* is reported from Harney, Jackson, and Wheeler counties within the Blue Mountain, Northern Basin and Range, and Klamath Mountain ecoregions.

References with descriptions and/or illustrations — Zander and Eckel (in FNA 2007b, p. 601), Crum (2004, p. 165), Sharp et al. (1994, p. 325), Zander (1993, p. 228), Crum (1983, p. 122), Crum and Anderson (1981, p. 395), Ireland (1982, p. 240), Lawton (1971, p. 110), Nyholm (1956, p. 112).

Tortula protobryoides R.H. Zander

Recent synonyms:
Phascum bryoides Dickerson
Pottia bryoides (Dickerson) Mitten
Protobryum bryoides (Dickerson) J. Guerra and M.J. Cano
Common names: tall pottia

Summary — An acrocarpous, costate moss with ligulate leaves, ephemeral. Terrestrial.

Diagnostic characteristics — *Tortula protobryoides* can be distinguished by its (1) non-bordered, short awned, papillose leaves, (2) peristome that is attached to the inside of the indehiscent operculum, and (3) ephemeral habit.

Technical description

Gametophyte — **Plants** 2–5 mm tall, green or brownish, growing as isolated shoots or in small patches or tufts. **Stems** with a central strand. **Leaves** ovate to oblong-lanceolate, with a broadly acute to rounded apex that is mucronate to short-awned; margins revolute in the middle 2/3–3/4 of the leaf, entire, weakly bordered with (2–) 4 rows of thick-walled, smooth or less-papillose cells. Costa excurrent, and lacks an adaxial pad of cells; ventral coastal cells quadrate to short-rectangular, papillose; dorsal coastal cells elongate, smooth, with 2 rows of guide cells and a large stereid band. Upper medial cells 12–24 µm wide, quadrate, smooth to slightly papillose with 4–6 simple papillae. Basal cells 35µm wide, 2–3:1. **Autoicous**.

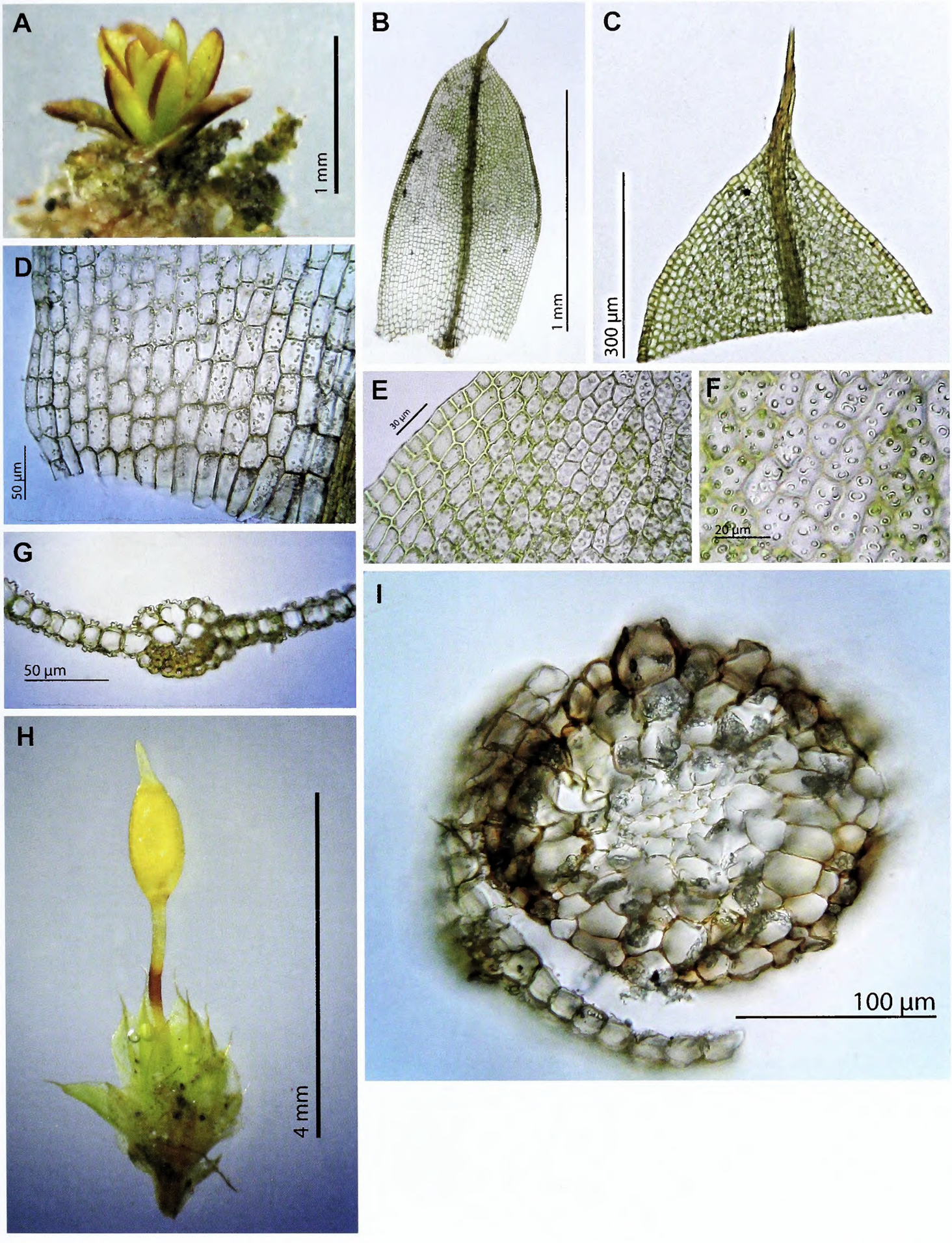
Sporophyte — **Seta** 2–4 mm long. **Capsules** cleistocarpous, 1.7 mm long, broadly cylindric, usually slightly asymmetric; operculum defined by a row of quadrate cells, not deciduous. Peristome rudimentary to linear, adherent to the inside of the operculum. **Spores** 20–25 µm, spheric with densely low papillae.

Similar species — *Tortula protobryoides* can be separated from *Tortula acaulon* and *Phascum cuspidatum*, two similar species by its exserted capsules and the dense papillae on the upper medial cells.

Ecology — *Tortula protobryoides* is found at low elevations on soil. Capsules mature in the winter and spring. In Britain, it is an ephemeral winter annual on exposed basic soil, often in arable field communities or bare patches in calcareous grasslands at low elevations.

Distribution — *Tortula protobryoides* is known from Eurasia and North America. In western North America, it is know from British Columbia, Oregon, California, Arizona and Baja California. In Oregon, *T. protobryoides* is reported from Umatilla County within the Columbia Basin ecoregion.

Plate 105. Tortula protobryoides. *A. Individual plant. B. Leaf. C. Leaf apex. D. Alar and basal cells. E–F. Upper medial cells. G. Leaf cross section. H. Sporophyte. I. Stem cross section. (Wilson 4314. SFV)*


A
1 mm
B
1 mm
C
300 µm
D
50 µm
E
30 µm
F
20 µm
G
50 µm
H
4 mm
I
100 µm

References with descriptions and/or illustrations —Lockhart et al. (2012, p. 429), Zander and Eckel (in FNA 2007b, p. 592), Weber and Wittmann (2007, p. 134), Smith (2004, p. 362, as *Protobrynm bryoides*), Zander (1993, p. 228. Sharp et al (1994. P. 377 as *Pottia bryoides*).

References with photos — Atherton et al. (2010, p. 485, as *Protobrynm bryoides*).

Trematodon asanoi Tuzibe

Recent synonyms:
Trematodon boasii W.B. Schofield
Trematodon semitortidens Sakurai
Common name: Asano's trematodon moss

Taxonomic note: Iwatsuki and Suzuki (2006) reported that *Trematodon boasii* from the Pacific Northwest is identical to *T. asanoi* from Japan. *Trematodon asanoi* has priority over *T. boasii*.

Summary — An acrocarpous, costate moss with lanceolate leaves. Terrestrial.

Diagnostic characters— *Trematodon asanoi* can be distinguished by its (1) small (≤ 2 mm) leaves, (2) short (1–4 mm) seta, (3) capsule neck slightly longer than the urn, (4) undivided peristome teeth, and (5) subalpine habitat.

Technical description

GAMETOPHYTE — **Plants** very small, green or yellow-green, glossy. **Stems** 1–4 mm tall, usually unbranched. **Leaves** straight and erect to erect spreading, 0.8–2 (–4) mm long (sometimes longer), more or less abruptly narrowed from a sheathing base to an awn about 1 mm long, imbricate and flexuose but not much contorted when dry; costa excurrent, in cross-section lacking stereid bands in the lower leaf and with a single poorly developed band in the upper part. **Autoicous**.

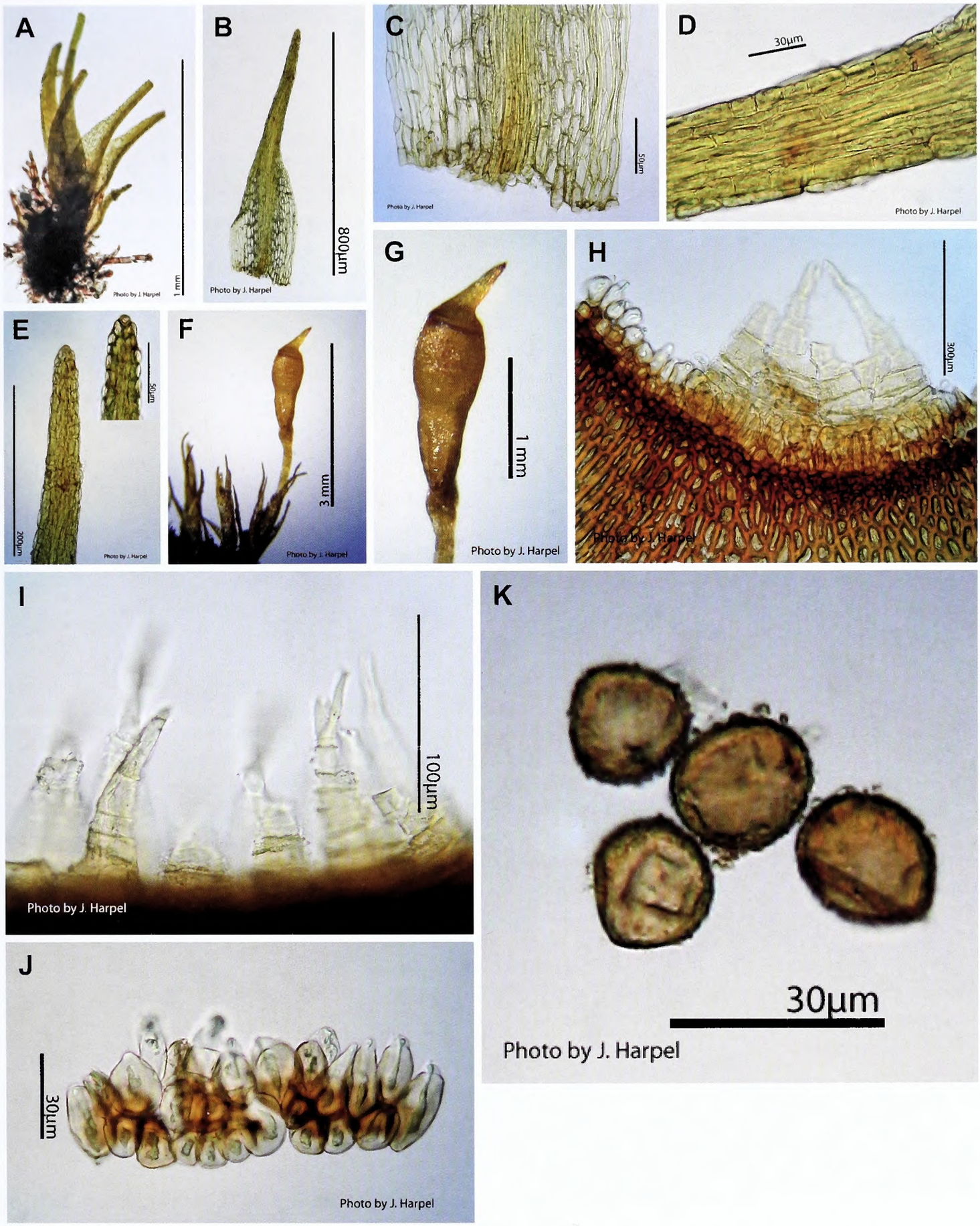
SPOROPHYTE — **Seta** yellow, 1–4 mm long, flexuose. **Capsules** usually numerous, erect, reddish-brown, 0.5–1 mm long and 0.5 mm wide, with a yellowish neck slightly longer than the urn; peristome well-developed; capsule lid (operculum) with a distinct beak; calyptra cucullate. **Spores** 20–30 µm, papillose.

Similar species — *Trematodon montanus* is similar but has a shorter seta, the capsule neck is shorter than the urn, the leaf apices are entire and the fragile peristome teeth are undivided. Other *Trematodon* species have longer setae and peristome teeth that are split. The similar *Bruchia bolanderi,* which occurs in the same habitat, differs in its beige or grayish capsule shaped like an inverted pear and lack of a peristome. Genera of the Bruchiaceae (*Bruchia* and *Trematodon*) are characterized by a well-developed capsule neck.

Ecology — *Trematodon asanoi* forms loose mats on moist bare soil along the edges of trails, streams, and ponds in the subalpine zone. Soils usually have some organic content and are irrigated by melting late-season snowbeds. Habitats are thought to include *Abies amabilis, Abies lasiocarpa, Cassiope mertensiana, Phyllodoce empetriformis* and *Tsnga mertensiana.*

Distribution — *Trematodon asanoi* is known from Asia and North America. In western North America, it is known from British Columbia, Oregon, and California. In Oregon, *T. asanoi* is reported from Lane County within the West Cascades ecoregion.

Plate 106. Trematodon asanoi. *A. Habitat. B. Leaf. C. Alar and basal cells. D. Upper medial cells. E. Leaf apex. F– G. Sporophytes. H.– I. Peristome teeth. J. Annulus. K. Spores. (W. Schofield 32990. UBC)*


A
1 mm
Photo by J. Harpel
B
800µm
Photo by J. Harpel
C
50µm
Photo by J. Harpel
D
30µm
Photo by J. Harpel
E
50µm
200µm
Photo by J. Harpel
F
3 mm
Photo by J. Harpel
G
1 mm
Photo by J. Harpel
H
300µm
Photo by J. Harpel
I
100µm
Photo by J. Harpel
J
30µm
Photo by J. Harpel
K
30µm
Photo by J. Harpel

References with descriptions and/or illustrations — Zander (in FNA 2007g, p. 438 as *Trematodon boasii*), Iwatsuki and Suzuki (2006), Christy and Wagner (1996, part VII, p. 82 as *Trematodon boasii*), Noguchi (1987, p. 138 as *T. semitortideus*), Lawton (1971, p. 84 as *T. boasii*), Schofield (1966, p. 203).

Trichostomum crispulum Bruch

Recent synonyms: none
Common name: curly crisp moss

Summary — An acrocarpous, costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characters— *Trichostomum crispulum* is distinguished by its (1) plane leaf margins, (2) ovate to ovate-lanceolate leaves, (3) stem with a strong central strand, (4) pluripapillose laminal cells, (5) cucullate apex, and (6) subpercurrent to percurrent costa ending in an apiculus.

Technical description

GAMETOPHYTE — **Plants** yellowish-green to dark green, in tufts or patches, sometimes blackish below. **Stems** rounded-pentagonal in cross section, 0.5–4.0 cm tall. **Leaves** keeled, ovate to ovate-lanceolate or long-lanceolate, distal margins erect, entire, not bordered; apex blunt to rounded acute, cucullate; basal cells differentiated across leaf base as an 'U', commonly running up margins as a very narrow band of smooth cells, not distinctly enlarged submarginally; upper laminal cells pluripapillose with low papillae; mucro conic, of 3–6 cells. **Dioicous**.

SPOROPHYTE — Reproductive structures (perichaetium) have only been found in North America north of Mexico.

Similar species — *Weissia* is usually monoicous, has involute or rarely incuved leaf margins with upper laminal cells that bulge more on the ventral than dorsal side. The cucullate leaf apex and often brown colored costa of *Trichostomum crispulum* are helpful in separating the two. Zander (2007) explains that *Trichostomum* differ from similar *Barbula* by the shorter peristomes and plane leaf margins, and from *Tortella* by the differentiated basal cells spread evenly across the leaf or occasionally extending up the margins in 1–3 rows. *Tortella* has basal cells differentiated into a V-shape. In addition, *Barbula* and *Tortella* have twisted peristome teeth. Other *Trichostomum* species are separated by the shape of the undifferentiated basal alar cells, shape of stem cross sections, lanceolate to ligulate leaf shape, and dioicous vs. autoicous sexual condition.

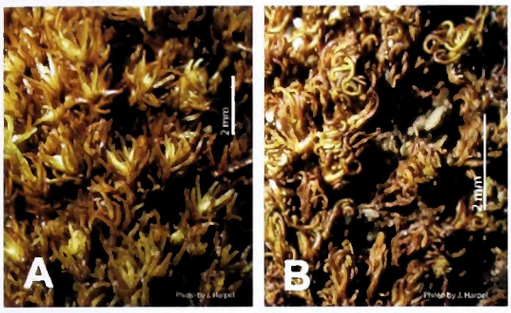
Ecology — *Trichostomum crispulum* is found on igneous and basic rock, soil or silt within tundra, and cliff habitats. It is known in Britain and Ireland on shaded or unshaded calcareous rock ledges, on damp floors of quarries, in wall crevices, on calcareous dunes, and on stream banks.

Distribution — *Trichostomum crispulum* is known from Eurasia, Africa, Greenland, the Atlantic and Pacific Islands, and Central and North America. In western North America, it is documented from Alaska, Yukon, Northwest Territories, Oregon, California, Arizona, and is reported as common in Mexico. In Oregon, *T. crispulum* is reported from Jackson, Lane, and Linn counties within the Klamath Mountain and West Cascades ecoregions.

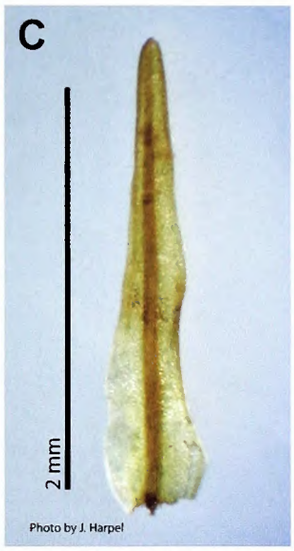
References with descriptions and/or illustrations — Zander (in FNA 2007, p. 493), Smith (2004, p. 287), Sharp et al. (1994, p. 232), Zander (1993, p. 86), Nyholm (1956, p. 134).

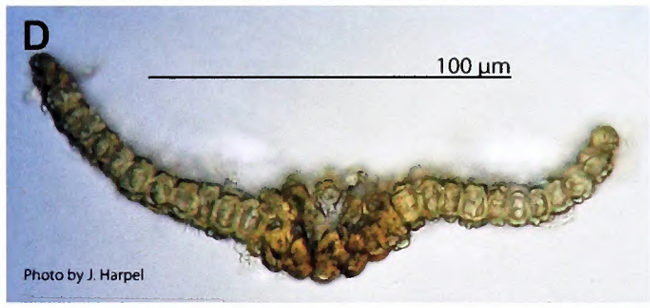
References with photos — Atherton et al. (2010, p. 434).

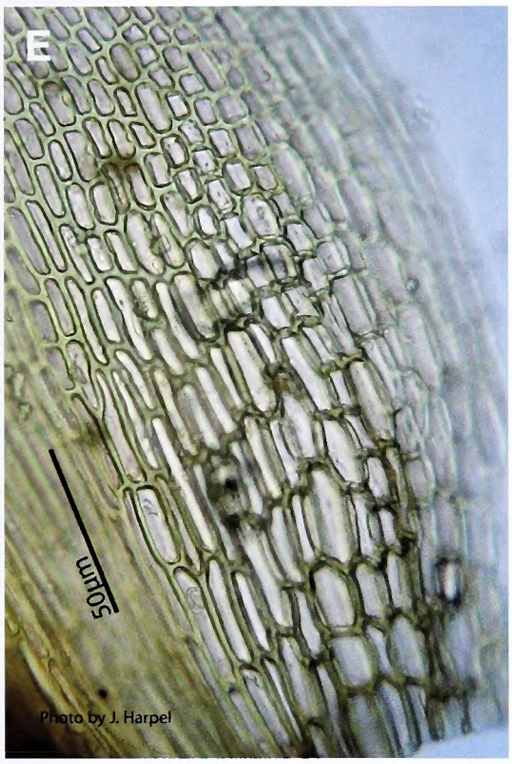
Plate 107. Trichostomum crispulum. *A. Moist habitat. B. Dry habitat. C. Leaf. D. Leaf cross-section. E. Basal cells. F. Leaf apex. G. Alar cells. H. Upper medial cells. I. Stem cross-section. (A. Crundwell sn. C. Townsend sn. UBC)*

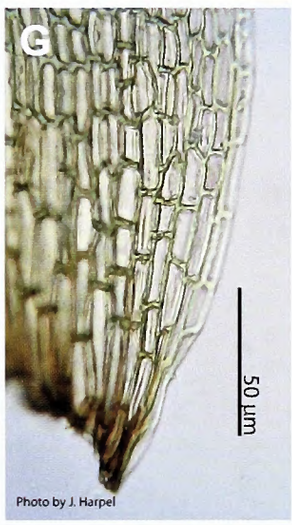

A
2 mm

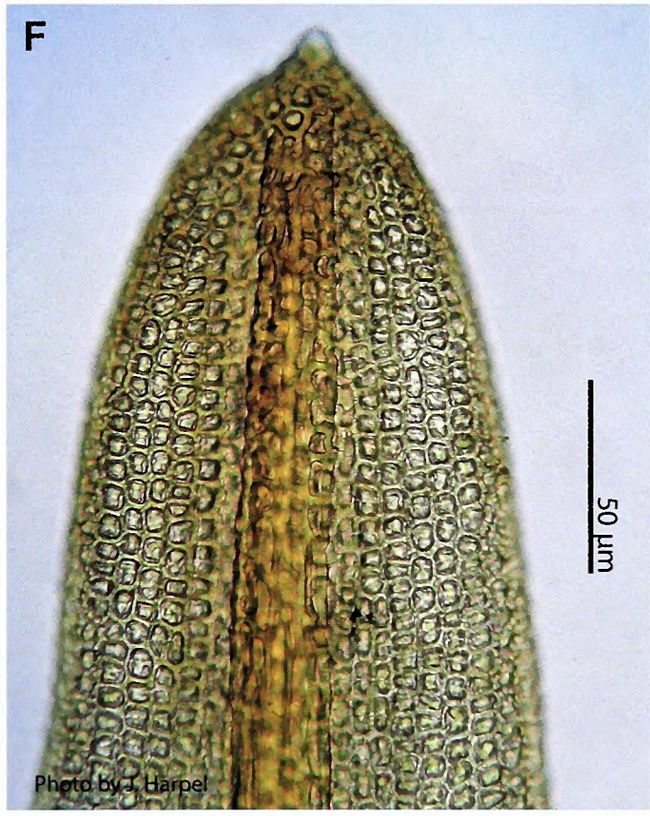
B
2 mm

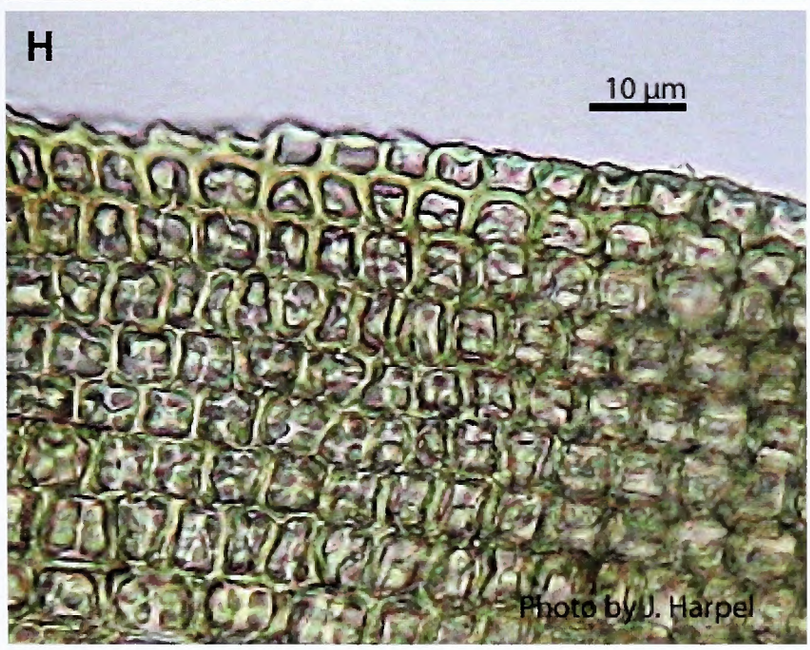

C
2 mm
Photo by J. Harpel

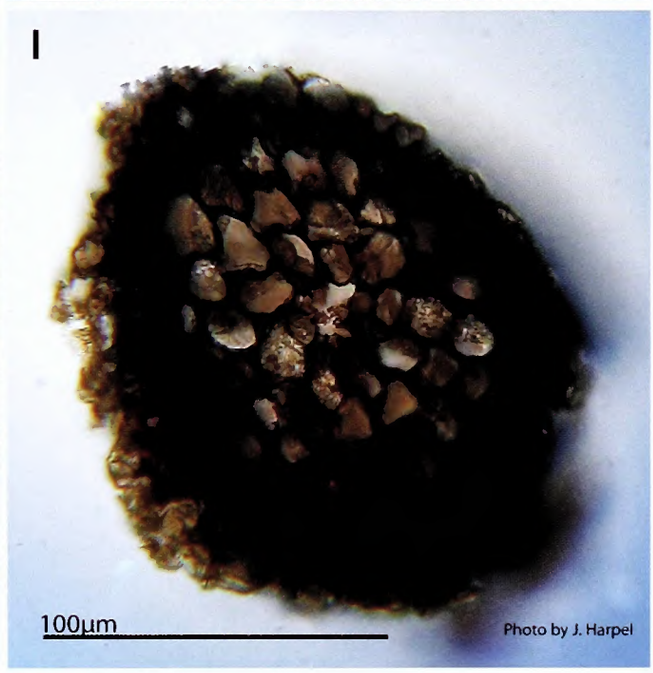

D
100 µm
Photo by J. Harpel


E
50µm
Photo by J. Harpel


G
50 µm
Photo by J. Harpel


F
50 µm
Photo by J. Harpel


H
10 µm
Photo by J. Harpel


I
100µm
Photo by J. Harpel

Trichostomum tenuirostre (Hooker & Taylor) Lindberg var. *tenuirostre*

Recent synonym: *Oxystegus tenuirostris* (Hooker & Taylor) A.J.E. Smith
Common name: narrow-fruited crisp-moss

Summary — An acrocarpous costate moss with linear-lanceolate leaves. Terrestrial.

Diagnostic characters— *Trichostomum tenuirostre* var. *tenuirostre* is distinguished by its (1) lack of gemmae, (2) plane lanceolate to linear lanceolate leaves, (3) rounded pentagonal stem in cross-section, (4) entire to blunt toothed leaf margins, (5) pluripapillose laminal cells, and (6) dioicous sexual condition.

Technical description

GAMETOPHYTE — **Plants** in yellow to brownish loose or dense tufts, up to 3 cm tall. **Stems** usually with a large and distinct central strand. **Leaves** twisted when dry, oblong-lanceolate to narrowly linear-lanceolate, apex acute, apiculate, 1–3 more or less coarse teeth, fragile, often broken or torn; costa glossy, prominent, ending in the apex; margins plane, wavy, or undulate, entire, with more or less marginal papillae; upper median cells 7–10 µm, quadrate to irregularly isodiametric, thick walled, 3–8 small papillae per cell; basal cells shortly rectangular to elongate-oblong, hyaline to reddish, smooth, with a single line of hyaline cells often extending up along the margin. **Dioicous**.

SPOROPHYTE — **Seta** 7–11 mm long. **Capsules** cylindric, 1.2–1.6 mm long, peristome teeth irregularly bifid, more or less papillose. **Spores** 9–13 µm.

Similar species — *Trichostomum* species are generally larger than *Weissia* species and have margins that are plane, not incurved as in *Weissia*. *Trichostomum tenuirostre* var. *gemmiparum,* known from Mexico and Missouri, is distinguished by the presence of gemmae.

Ecology — *Trichostomum tenuirostre* occurs on damp to moist soil, soil over rock, peaty banks, humid cliffs, dry sandstone crevices, and wet granitic boulders in riparian systems. This species may require damp or wet shaded sites. According to Schofield (1976), in British Columbia *T. tenuirostre* occurs from near sea level to subalpine elevations; Lawton (1971) noted that it is found in the lowlands up to 9,000 (rarely to 13,500) feet in elevation.

Distribution — *Trichostomum tenuirostre* is known from Eurasia, Africa, the Indian Ocean Islands, Hawaii, New Zealand, Australia, and South, Central, and North America. In western North America, it is documented in Alaska, Northwest Territories, British Columbia, Alberta, Washington, Oregon, California, Montana, Colorado, and Arizona. In Oregon, *T. tenuirostre* is reported from Clatsop, Jackson, and Lane counties within the Coast Range, Klamath Mountain, and West Cascades ecoregions.

References with descriptions and/or illustrations — Zander (in FNA 2007h, p. 490), Smith (2004, p. 288), Sharp et al. (1994, p. 233), Zander (1993, p. 86), Crum and Anderson (1981, p. 301), Flowers (1973, p. 134), Lawton (1971, p. 114).

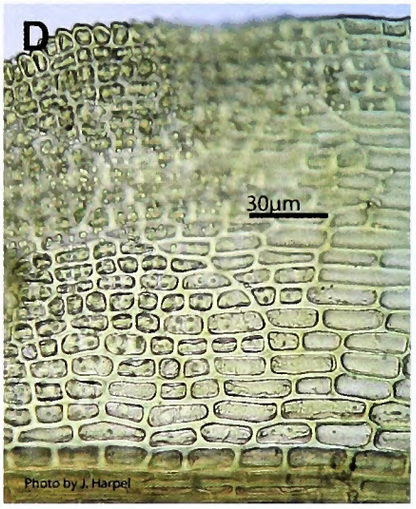
References with photos — Atherton et al. (2010, p. 435).

Plate 108. Trichostomum tenuirostre var. tenuirostre. *A. Dry habitat. B. Moist individual plant. C. Leaf. D. Basal cells. E. Alar and basal cells. F. Leaf apex. G. Upper medial cells. H. Leaf cross-section. I. Perichaetium. J. Stem cross-section. (R. Ireland 18449. S. Talbot SAN001-22. UBC)*

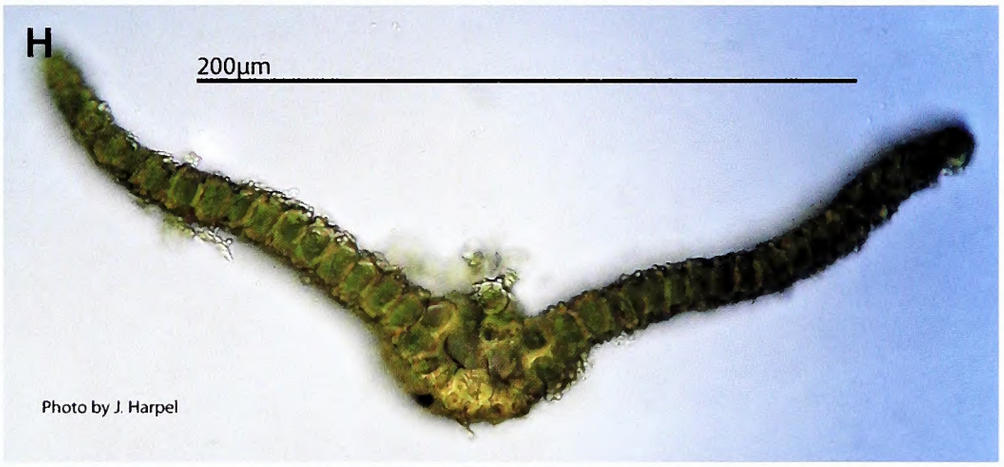

A
2 mm

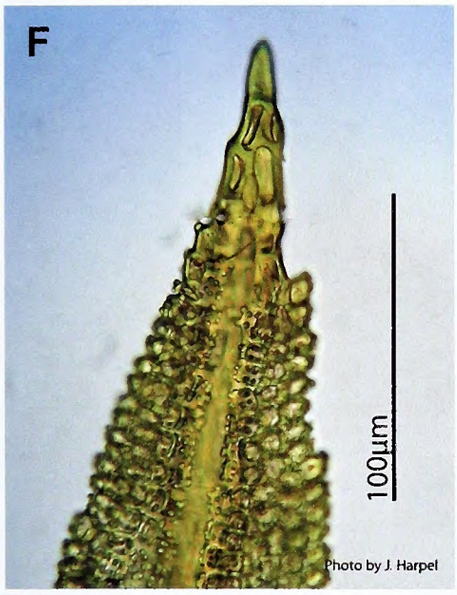

B
2 mm
Photo by J. Harpel


C
2 mm


D
30µm
Photo by J. Harpel

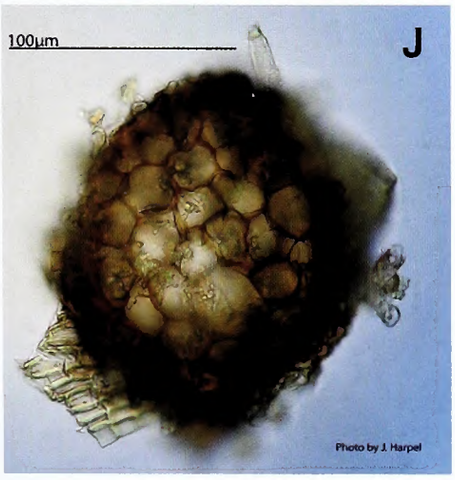

E
50µm
Photo by J. Harpel


H
200µm
Photo by J. Harpel


F
100µm
Photo by J. Harpel


I
500µm
Photo by J. Harpel


G
10µm
Photo by J. Harpel


100µm
J
Photo by J. Harpel

Triquetrella californica (Lesquereux) Grout

Recent synonyms: none
Common names: three-ranked knob moss, California triquetrella moss

Summary — An acrocarpous costate moss with ovate-lanceolate leaves. Terrestrial.

Diagnostic characteristics — *Triquetrella californica* can be distinguished by its (1) ovate short acuminate leaves, (2) wet leaves spiraling up the stem in three distinct rows, (3) leaf cells with tall and often forked papillae, and (4) proximal cells more weakly differentiated than medial cells.

Technical description

GAMETOPHYTE — **Plants** ascending or trailing. **Stems** 1–3 cm long, branched irregularly, the branches threadlike, 0.5–0.75 mm wide, in cross-section rounded-triangular to rounded-pentagonal. **Leaves** yellow-green to yellowish-brown, decurrent, straight and imbricate when dry, with flexuose tips, lanceolate; when wet erect-spreading to squarrose in three longitudinal rows, the rows straight or spiraling up the stem (not obvious on dry plants); costa prominent at the back of leaves; margins of leaves conspicuously recurved and crenulate due to projecting papillae; leaf cells rounded, thick-walled, with tall, often forked papillae; lamina turning orange to yellowish orange in 2% KOH. **Dioicous**.

SPOROPHYTE — Sporophytes unknown in western North America.

Similar species —Zander (2007i) distinguishes *T. californica* from the similar *Didymodon ferrugineus* by its triangular stem, sharply crenulate distal leaf margins arising from projecting papillae, and tall papillae that branch from the base in distal medial laminal cells.

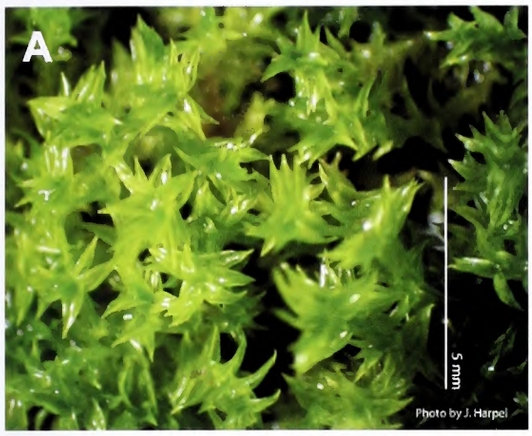
Ecology — *Triquetrella californica* forms loose mats on exposed to shaded soil, rocks, sand, or gravel in dry or moist habitats. It has been reported from trails, roadsides, picnic areas, playgrounds, and rock outcrops from sea level to ~1,600 foot elevations within 10 miles of the Pacific Ocean (Stark 1980; Shevock and Toren 2001; Norris and Shevock 2004a, 2004b). Plant associations include *Picea sitchensis*, *Pinus contorta* var. *contorta, Sequoia sempervirens* and grasslands at the north end of its range to dense chaparral on north-facing slopes at the southern end (Stark 1980). Associated lichen and bryophytes include *Cladonia spp.* and *Racomitrium heterostichum.*

Distribution — *Triquetrella californica* is endemic to western North America and known from a few sites near the eastern Pacific coast in Oregon and California. In Oregon, *T. californica* is reported from Curry County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Zander (in FNA 2007i, p. 581), Christy and Wagner (1996, part VII, p. 87), Zander (1993, p. 120), Casas et al. (1993, p. 126), Zander (1980, p. 230), Grout (1938, p. 170).

References with photos — Malcolm et al. (2009, p. 159).

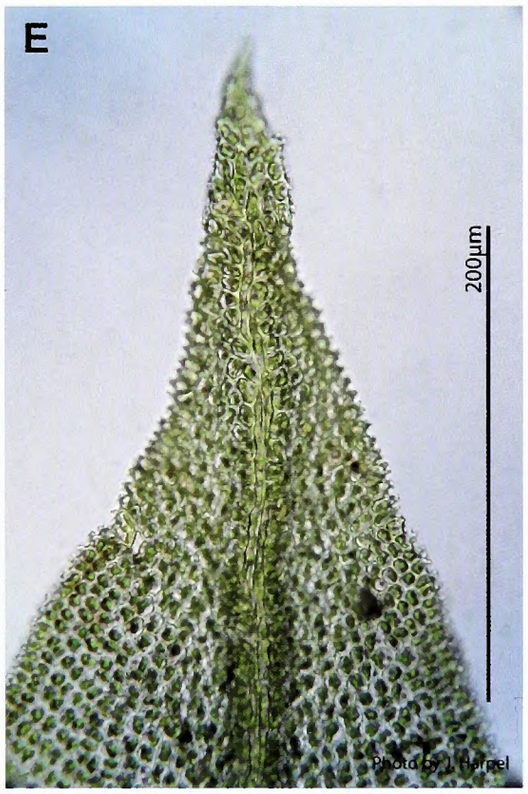
Plate 109. Triquetrella californica. *A. Moist habitat. B. Moist individual plant. C. Dry habitat. D. Leaf. E. Leaf apex. F. Upper medial cells. G. Alar and basal cells. H–I. Leaf cross-sections. J. Stem cross-section. (J. Harpel 47810. Harpel Private)*

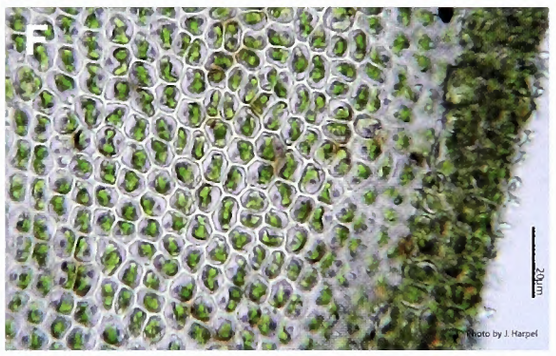

A
5 mm
Photo by J. Harpel

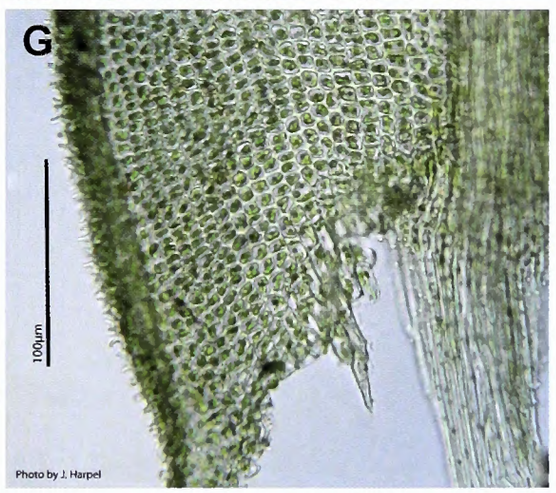

B
5 mm
Photo by J. Harpel

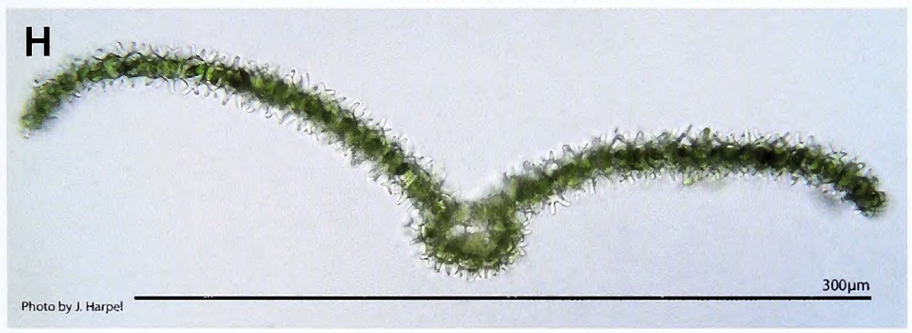

5 mm
Photo by J. Harpel
C

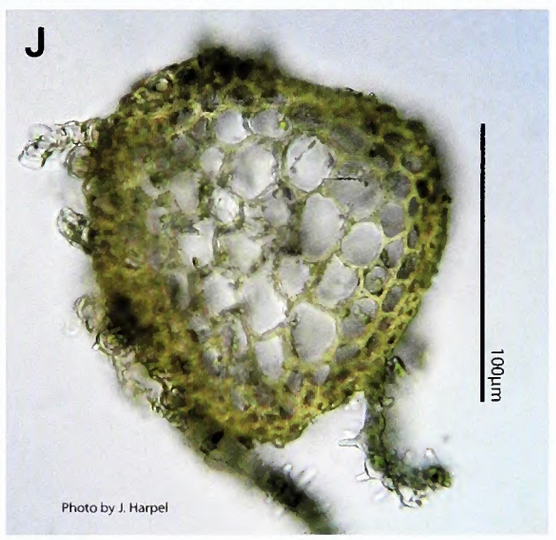

D
1 mm
Photo by J. Harpel


E
200µm
Photo by J. Harpel


F
20µm
Photo by J. Harpel

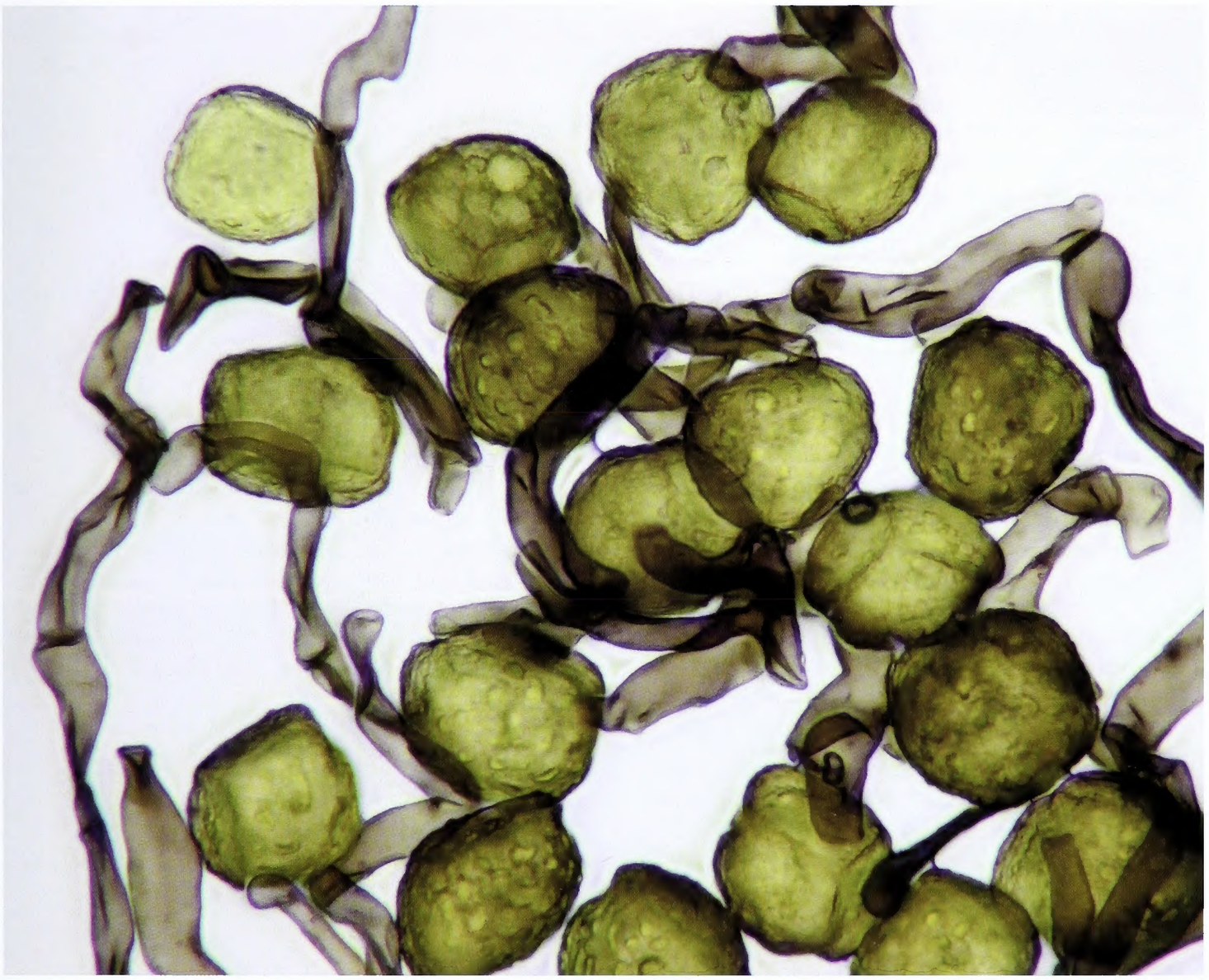

G
100µm
Photo by J. Harpel


H
300µm
Photo by J. Harpel


J
100µm
Photo by J. Harpel


I
200µm
Photo by J. Harpel

DIVISION Anthocerotophyta: Hornworts



Phymatoceros phymatodes (M. Howe) R.J. Duff et al.

Recent synonyms:
Phymatoceros bulbiculosus (Brotherus) Stotler et al.
Anthoceros bulbiculosus Brotherus
Anthoceros phymatodes M. Howe
Common name: tuberous hornwort

Taxonomic note: The name given by Stotler, Doyle, and Crandall-Stotler assumes that the material from western North America is conspecific with a European taxon. However, Duff et al. (2007) believe ours is distinct and recognize Howe's specific epithet for the Pacific coast plants, *Phymatoceros phymatodes* (Howe) Duff, Villarreal, Cargill, & Renzaglia.

Summary — A hornwort with a ribbon-like thallus; solitary chloroplasts per cell; stipitate, ventral tubers; homogeneous tissues; elongated cylindrical sporophytes that mature gradually from the tip down and eventually split into two twisted thread-like valves. The spores are yellow when young, maturing to fuscous brown or black. Terrestrial.

Diagnostic Characters: *Phymatoceros phymatodes* is the only hornwort in western North America with stalked tubers arising from the bottom of the thallus. The tubers are numerous, yellow-green, maturing golden-brown and impossible to miss once a plant is lifted from the substrate.

Technical description

HORNWORT. **Plants** thalloid, dark green, frequently and irregularly branched; cells containing solitary chloroplasts that vary from angular to spindle shaped, to rounded, to dumbbell shaped. Female plants up to 2.5 mm wide, somewhat grayish green, often with slightly raised wing margins; stalked ventral tubers developing early on female thalli without sporophytes. Male plants smaller, generally less than 1 mm wide; after developing a cluster of antheridia, becoming vegetative and developing long stalked, ventral tubers.

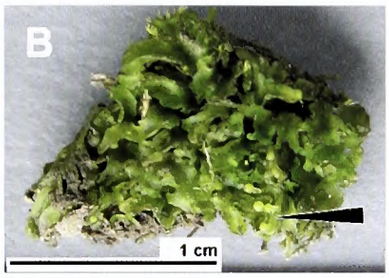
Dioicous. Sporophytes when present are short, less than 2 cm tall, straight to slightly curved, changing from green to orange to dark brown or blackish as they mature. **Spores** yellow when young, dark brownish-black when mature.

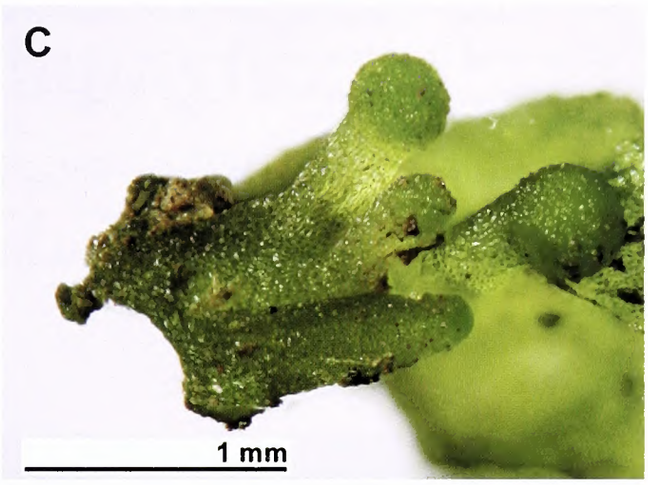
Similar species — Other hornworts are superficially similar but all regional species lack the stalked, ventral tubers. Note that *Phaeoceros pearsonii* has lateral tuberous thickenings on its thalli, but these are not stalked and are not hidden beneath the thallus.

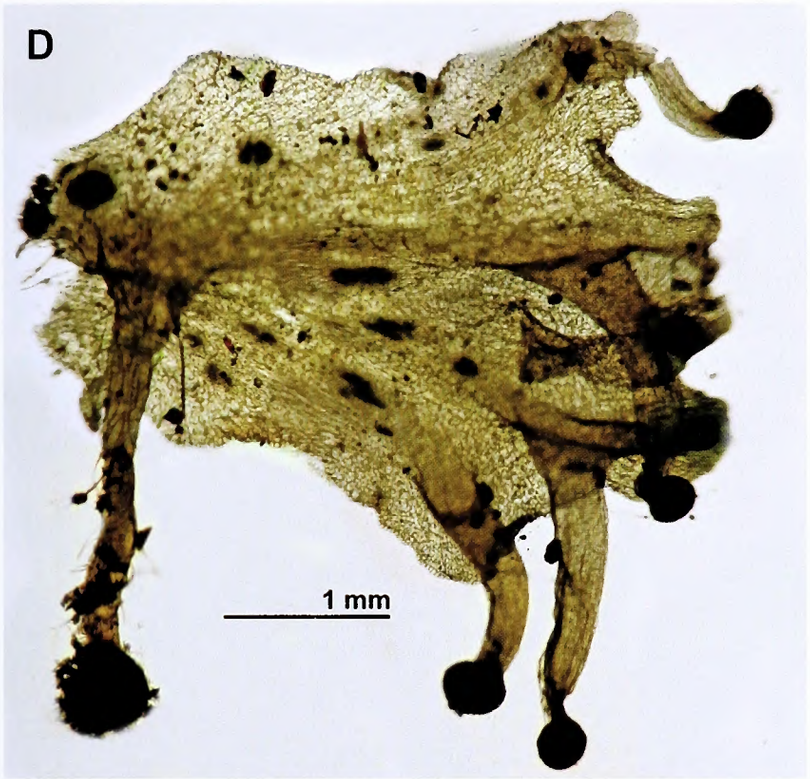
Ecology — *Phymatoceros phymatodes* grows on bare mineral soil (riparian banks, road and trail-sides, sloping meadows) that remains moist until late spring or summer. The Coos county site occurs in a grass dominated meadow (less than 1 acre), within a coniferous forest. The meadow is situated on a south-facing slope of a secondary mid-slope ridge which originates from a prominent north-south oriented ridge within a Douglas fir forest. This site is steep, with up to 80 percent slopes, and has shallow, fragile soils with small sheet drainage areas of exposed bedrock or thin soil over bedrock. The perimeters of the meadows are bordered by poison oak, indicating much drier conditions. Vascular plants within the meadow include: *Mimulus alsinoides, Mimulus guttatus, Nemophila menziesii* and grasses. Bryophytes within the meadow include: *Asterella, Cephaloziella, Fossombronia, Imbribrynm miniatum, Phaeoceros, Riccia*, and *Weissia*. Similar meadows dominated by *Racomitrium elongatum* may prove to be too dry. *Phymatoceros phymatodes* occurs from near sea level up to 2,100 feet (Doyle and Stotler 2006, as *P. bulbiculosus*) in elevation.

Plate 110. Phymatoceros phymatodes. *A. Fresh thalli. B. Fresh thalli with stalked tubers. C. Stalked tubers. D. Stalked tubers on dried specimen. E. Habitat. (A,B,C: Sperling B10-JS-03. DHW; D: Kellman 4330. CAS; E: Wagner m2970, field photo)*


A
1 cm


B
1 cm


C
1 mm


D
1 mm


E

Distribution — *Phymatoceros phymatodes* is known from western North America in Oregon, California, Mexico, and Arizona. In Oregon, *P. phymatodes* is reported from Coos, Curry, Douglas, and Lane counties within the Coast Range and Willamette Valley ecoregions.

References with descriptions and/or illustrations — Frye and Clark (1947, p. 936 as *Anthoceros phymatodes*).

References with photos — Wagner (2014), Wagner (2011a).

DIVISION Marchantiophyta: Thalloid liverworts

Asterella bolanderi (Austin) Underwood

Recent synonyms: none
Common name: Bolander's asterella

Summary — A ribbon-like thalloid liverwort with several chloroplasts per cell and *Opuntia*-like segments. Terrestrial.

Diagnostic characters: *Asterella bolanderi* is distinguished by its (1) thalloid habit with little dichotomous branching, (2) sex organs developing on small lateral branches, (3) Conic or hemispheric female receptacles, (3) presence of a pseudoperianth,(4) lack of trigones on upper epidermis, and (5) simple epidermal pores.

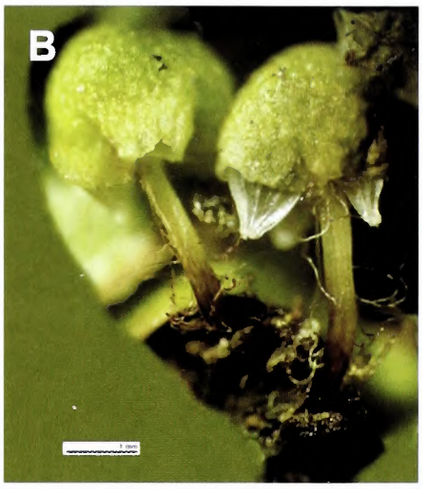
Technical description

THALLOID LIVERWORT. **Plants** medium-small and strongly xeromorphic. Thalli (2) 2.5–4.5 (5) mm wide, to 8–20 (40) mm long, green dorsally with ventral surface and margins broadly purplish black or claret-red, the margins usually more or less ascending in moist plants, in drying strongly incurved and dorsally connivent. Thalli strongly costate ventrally, 25–35 cells high, canaliculate-concave dorsally, very sparingly furcate (forked), occasionally ligulate to linear-ligulate but mostly branching by ventral-intercalary branches and by apical innovations, the thalli then growing by means of a series of *Opuntia*-like, frequently cuneate (wedge-shaped) innovations. Thallus margins very thin, strongly crispate and lobulate, undulate, dorsal epidermis of more or less firm-walled cells, sometimes with very small trigones, nearly smooth but with rather distinctly elevated pores; scattered oil bodies present. Pores surrounded by rings of cells whose radial walls are slightly thickened. Aerenchyma layer compact, the primary chambers considerably subdivided. Costa high medially, soon thinning out, the ascending lateral margins thin, membraneous; ventral surface of costa densely invested with colorless rhizoids. Ventral scales lunate-ovate to broadly ovate, marginal slime papillae ephemeral, inconspicuous; oil bodies present, about 15–30, isolated or occasionally in groups of 2– several; appendages 1 (2), not or feebly constricted at base, subulate to narrowly lanceolate, acuminate and entire to obscurely crenulate; cells about 30–40 × 70–80 µm in appendate base.

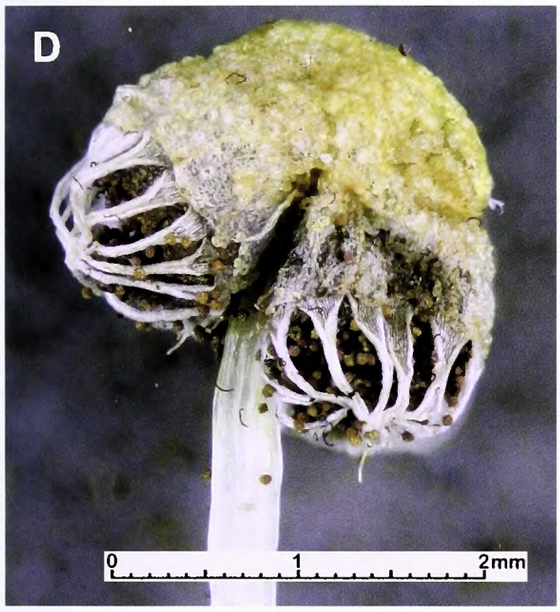
Autoicous. Androecia mostly on very small, stipitate, subclavate to trumpet-shaped branches, devoid of marginal paleae (membranous or chaff-like bract), bearing about ten low antheridial ostioles; androecial branches not or only sporadically innovating distally and then elongating. Sometimes androecial branch more expanded, the stipitate base then abruptly expanded into a short oblong, concave thallus, the distal portion producing an androecium with 10 to 15 ostioles. Female receptacle normally on weak, stipitate but distally expanded ventral branches from the costa. Female peduncle 1–3 cm high, more or less purplish or brown-purple, at least below, with a ring of small, lanceolate paleae at base (mostly visible on young, sessile gynoecial branches), with a few scattered linear paleae of stipe and a small cluster at the apex. Disk up to 4 mm in diameter, virtually smooth or the air chamabers inflated to form convex or low dome-shaped projections, rugose when dry; lobes normally 4, short but distinct, obliquel pendulous, the central sector hemispherical to low and bluntly conoidal. Pseudoperianth whitish or purple-tinged, the lanceolate divisions connate at the apex. Capsule with the lid dehiscing in fragments. Spores yellowish to brown, usually 65 –110 µm in diameter; wing margins sinuous, 8–12 µm wide, thin and translucent; entire outer spore layer of spore wall minutely granulate-punctate or granulate-vermiculate; distal face with coarse, well defined areolae, about 12–20 µm in diameter; areolae bounding wing margin about 13–16, the radial meshes extending onto wing margin; central sector of spore with about 10–12 well-demarcated, similar areolae; inner faces with similar areolae. Elaters yellowish to brown; about 8–12 × 160–220 µm, the blunt ends more or less tapered, the spirals 2 (3) medially, the ends 1 (2)-spiral.

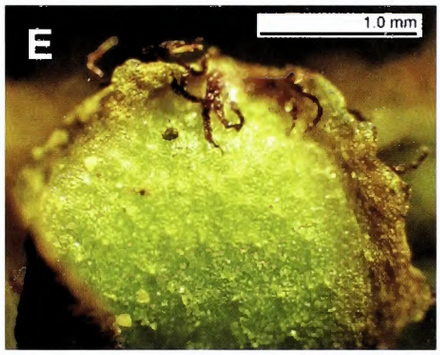
Plate 111. Asterella bolanderi. *A. Mature plants in field. B. Young carpocephala. C— D. Mature carpocephala shedding spores. E. Thallus apex, with scale appendages showing. F. Ventral scales on underside of thallus apex. G. Ventral scales, detail. H. Epidermal pore. I. Thallus section, pitted ventral tissue. J. Spores and elaters. (A—C, D, I: Wagner m2983. DHW; B: Wagner m1231. DHW; E—H: Wagner m1231b DHW; J: Wagner 3081. OSC)*

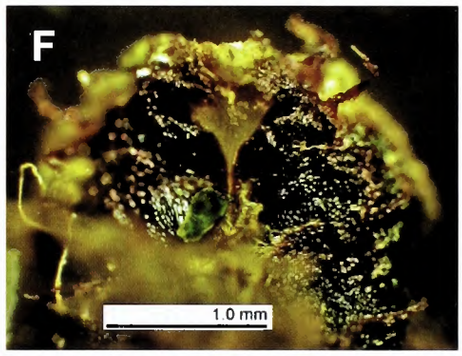

A


B

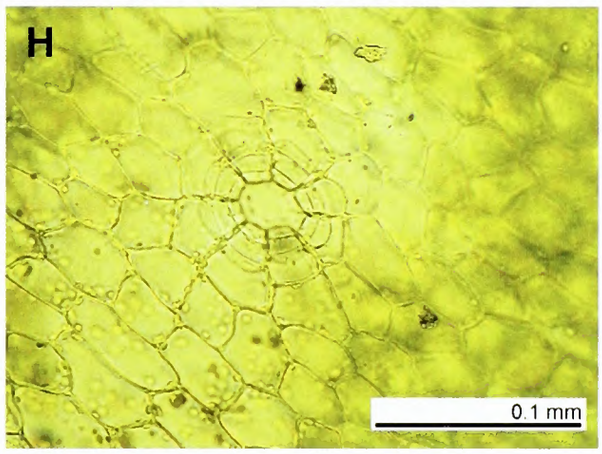

C
2 mm

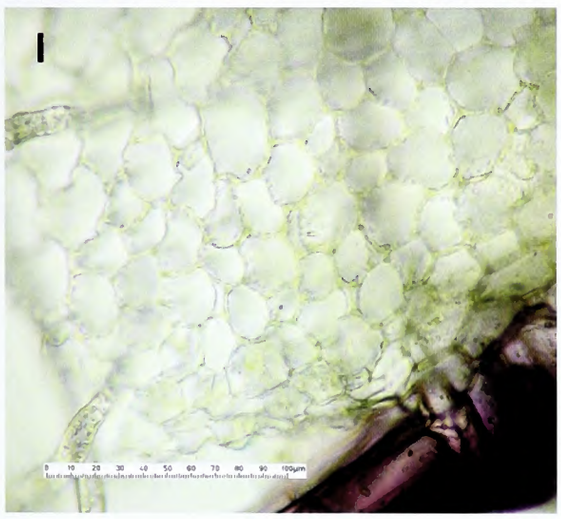

D
0
1
2mm

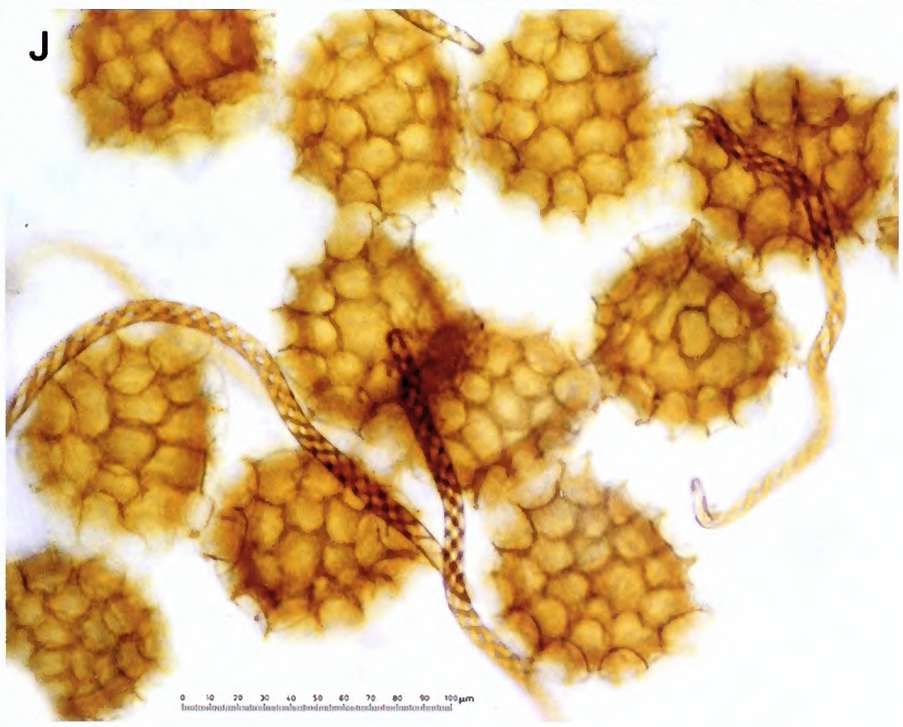

E
1.0 mm


F
1.0 mm


G


H
0.1 mm


I


J

Similar species — The presence of frequent, short, intercalary branches (both antheridial pads and carpocephala develop on small lateral branches), and paucity of dichotomous branching distinguishes this species from others of the genus. *Reboulia hemisphaerica* is similar, but has large, often bulging trigones on cells of the upper epidermis.

Ecology — *Asterella bolanderi* is known from soil on lightly shaded to exposed banks. Capsules mature from March to May.

Distribution — Asterella bolanderi is a western North American endemic, known from Oregon and California where it is reportedly widespread. In Oregon, A. bolanderi is reported from Curry and Lake counties within the Klamath Mountains and Northern Basin and Range ecoregions.

References with descriptions and/or illustrations — Schuster (1992, p. 243), Frye and Clark (1937, p. 82).

Reference with photos — Wagner (2014).

Cryptomitrium tenerum (Hooker) Austin

Recent synonyms: none
Common name: flying saucer liverwort

Summary — A ribbon-like thalloid liverwort with several chloroplasts per cell and heterogenous thallus tissues. Terrestrial.

Diagnostic characters: *Cryptomitrium tenerum* is distinguished by its (1) thalloid habit, (2) small size and habitat on bare soil, (3) receptacles that are hemispheric when young but spread out into flat discs when mature, and (4) spherical sporangium opening by a distinct operculum.

Technical description

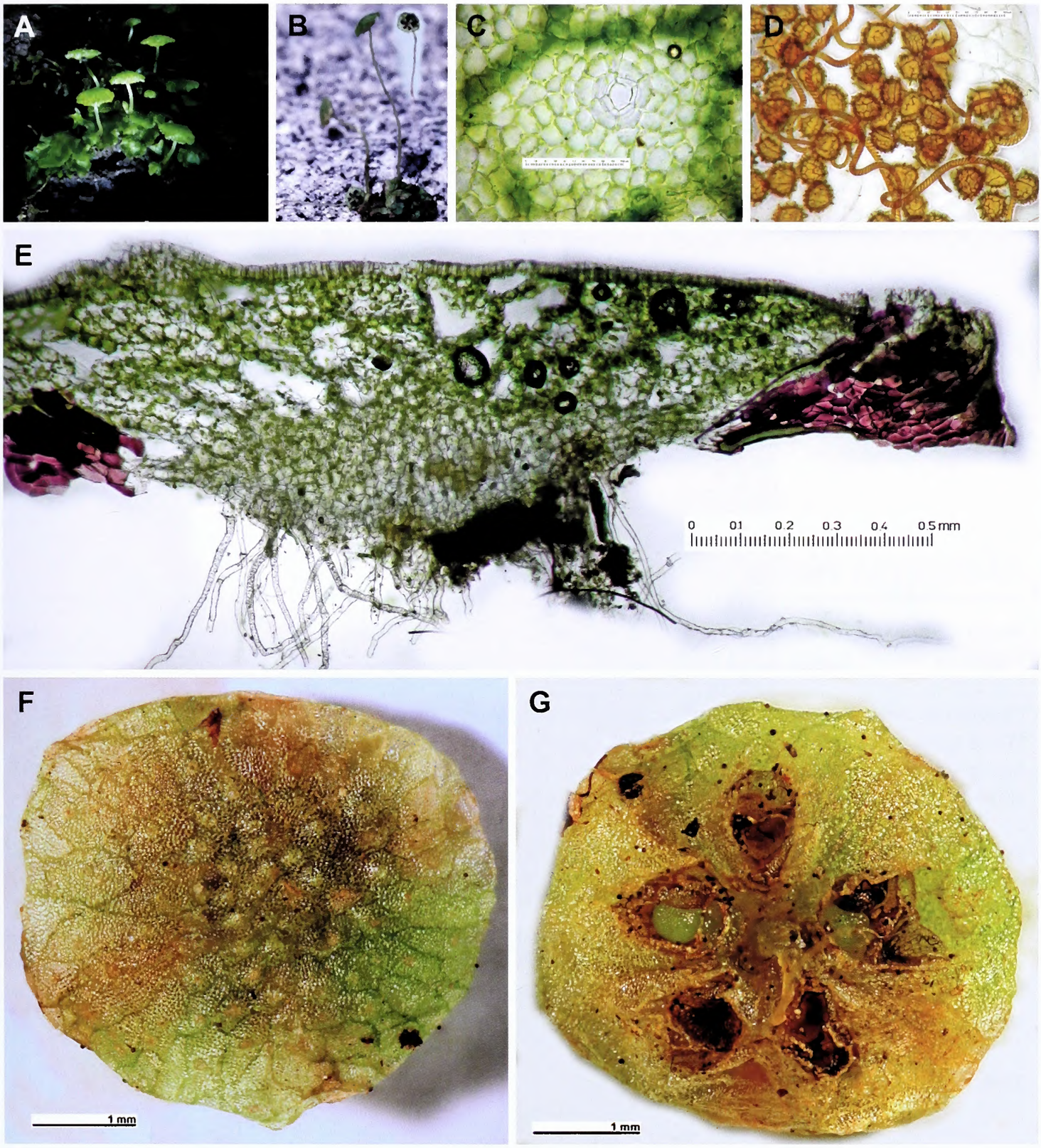
THALLOID LIVERWORT. **Plants** pale green on dorsal surface, thin and delicate, 0.5–1.5 cm long, 3–10 mm wide, dichotomously branched; margins undulate and upcurved when dry; dorsal surface with pattern of irregular polygons, pores to air chambers inconspicuous, epidermal cells without thickenings at corners (trigones); ventral surface dark purple and shiny at margins, green medially; ventral scales small, dark purple, poorly developed at maturity; oil bodies occasional, scattered in isolated cells. Gemmae lacking.

Paroicous. Male ostioles (tubular neck with opening of the antheridial cavity) sessile, posterior to archegoniophores. Archegoniophore elongating after fertilization to 1.5–3 cm tall, somewhat grooved, transparent to brownish purple at base. Carpocephalum a circular disc to 5 mm in diameter, convex, hemispheric when very young but expanding to a flat, crenulate or irregularly undulate margined disc as it develops, then becoming rounded and puffy below as sporangia mature. Sporangia 3–7 per receptacle, spherical, brown, with very short setae, opening by a distinct operculum.

Similar species — Other medium-sized thalloid liverworts such as *Asterella*, *Mannia*, and *Reboulia* all have thicker thalli and lobed receptacles.

Ecology — *Cryptomitrium tenerum* occurs in Mediterranean climates with cool wet winters and dry summers and forms small to locally extensive mats on bare and usually shaded humid soil on hillsides, rock outcrops, and

Plate 112. Cryptomitrium tenerum. *A.– B. Moist habitat. C. Thallus pore. D. Spores and elaters. E. Thallus cross-section F. Carpocephalum top. G. Carpocephalum bottom. (A: Wagner s.n. field photo; B: Wagner 3086. ORE; C–G: Wagner m2399. OSC.)*


A
B
C
D
E
0 01 0.2 0.3 0.4 0.5mm
F
1 mm
G
1 mm

streambanks. In Oregon, *C. tenerum* is known from between sea level and 1,000 feet in elevation and in California usually below 2,500 feet, although known from sites up to 3,900 feet. Root balls and cutbanks are favored forest habitats, with forest types ranging from *Abies amabilis, Pseudotsuga menziesii*, and *Tsuga heterophylla* associations. *Cryptomitrium tenerum* is reportedly a calciphile (Doyle and Stotler 2006). Some habitat disturbance is probably necessary to maintain open conditions and reduce competition from vascular plants. Wild fires are suspected to play a role in maintaining habitat. Capsules develop in late winter to early spring, depending on elevation. It is a poor competitor with vascular plants and populations tend to disappear as succession progresses.

Distribution — *Cryptomitrium tenerum* is known from Asia and North and South America. In western North America, it is known from Oregon, California, and Mexico. In Oregon, *C. tenerum* is reported from Curry County within the Klamath Mountain ecoregion.

References with descriptions and/or illustrations — Doyle and Stotler (2006, p. 104), Wilson (2005), Schofield (2002, p. 93), Frye and Clark (1937, p. 69), Clark and Frye (1928, p. 16), Evans (1923, p. 46).

Reference with photos — Wagner (2014).

Metzgeria violacea (Acherius) Dumortier

Recent synonym: *Metzgeria fruticulosa* (Dickson) A. Evans
Common names: nubbly dainty ribbons, whiskered veilwort

Taxonomic note: Recent work indicates that most specimens previously named *Metzgeria temperata* from Oregon, Washington, and California actually represent *Metzgeria violacea* (= *M. fruticulosa*). *Metzgeria temperata* was segregated from *M. fruticulosa* by Kuwahara (1976) and may be present in the Pacific Northwest, but there are currently no confirmed reports. Historic records of *M. temperata* from Oregon have not been verified.

Summary — A small ribbon-like thalloid liverwort with several chloroplasts per cell. The thallus is unistratose except for the well-defined midrib and is usually epiphytic on stems of shrubs or small trees.

Diagnostic characters: *Metzgeria violacea* is distinguished by its (1) translucent yellow-green to green thalli when fresh, turning bluish when dry (blue color poorly developed in regional material), (2) dichotomously branched thalli, (3) mostly single marginal hairs, and (4) rounded plate-like gemmae produced on both margins and costae of erect attenuate branch tips.

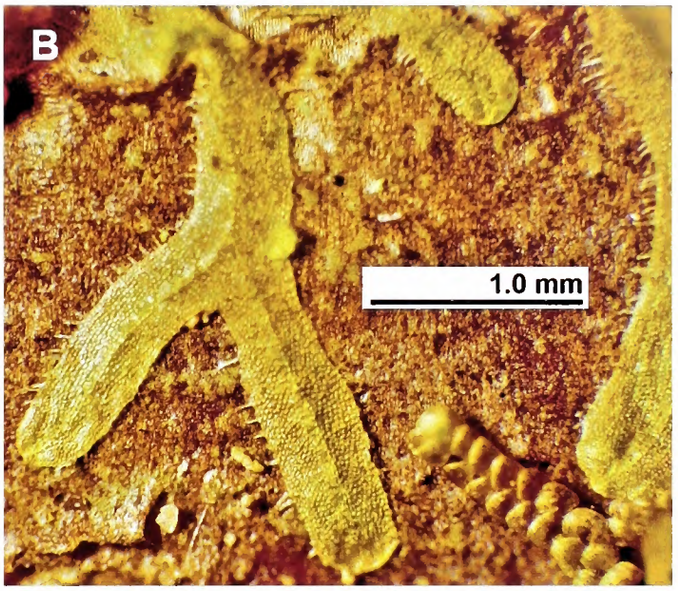
Technical description

THALLOID LIVERWORT. **Plants** delicate, translucent yellow-green to green when fresh, often turning bluish or turquoise after several months of drying; thallus 0.5–1.6 mm wide and 0.4–1.5 cm long, dichotomously branched; branches tapering to narrowed tips, with recurved margins and conspicuous midribs (costae); costae of branches usually with 2 rows of cells on dorsal surface and 2–4 rows on ventral surface, but sometimes 3–6 rows of cells on both surfaces; hairs (cilia) on branch margins usually single but sometimes paired. Gemmae produced from the margins and costae of branch tips that arise at right angles to the prostrate thallus; usually abundant, multicellular, ovate to round.

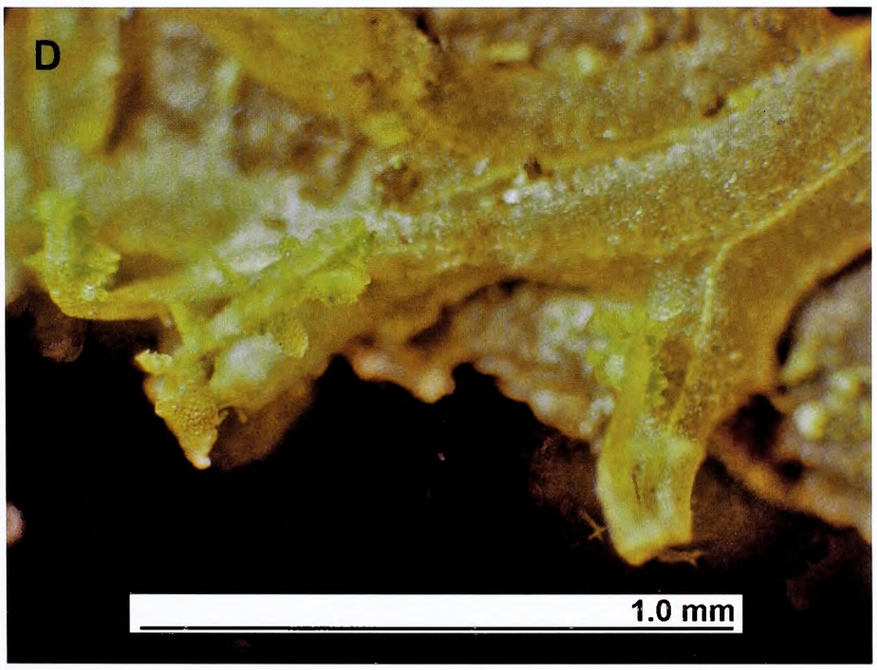
Dioicous. Sex organs produced on the ventral surface of the thallus. Rare.

Plate 113. Metzgeria violacea. *A. Habitat. B. Thallus. C. Thallus with gemmae on substrate. D. Gemmiphore tips. (A: Wagner m2428. DHW; B, D: Wagner m1614. DHW; C. Wagner m1584. DHW)*


A
approx. 1 cm


B
1.0 mm


C
1.0 mm


D
1.0 mm

Similar species — *Metzgeria conjugata* thalli are longer (1.5–3 cm) and turn yellowish to whitish-green (not bluish) when dry. The branches do not taper toward the tip. Branch costae have 2–3 rows of cells on the dorsal suface and 2–5 rows on the ventral surface. Marginal hairs are paired and gemmae are lacking. *Metzgeria temperata* thalli are longer (1.5–2.5 cm) and taper toward the tips and turn yellowish to whitish-green when dry, rarely bluish at the branch tips. Branch costae have 2–3 rows of cells on both surfaces. Marginal hairs are single or occasionally paired. Gemmae are produced from branch margins, but not the costae.

Ecology — *Metzgeria violacea* forms mats or mixes with other bryophytes on trunks of trees and shrubs in coastal rainforests. Rarely found on rotting wood or igneous rocks, it is usually found in cool, moist riparian areas or shaded north-facing talus slopes and outcrops and in full shaded to partial sun habitats. It is scarce to locally abundant. In the Pacific Northwest, elevations range from sea level to 1,000 feet. Forest associations include *Picea sitchensis* and *Tsuga heterophylla*.

Distribution — *Metzgeria violacea* is known from Eurasia and North America. Its known distribution is unclear because of the long confusion with *Metzgeria conjugata* and *M. temperata*. However, in western North America, *M. violacea* is confirmed from Alaska to Washington, Oregon, and California. In Oregon, *Metzgeria violacea* is reported from Coos, Lane, Lincoln, and Tillamook counties within the Coast Range ecoregion.

References with descriptions and/or illustrations — Hutten et al. (2001, p. 77 as *Metzgeria temperata*), Paton (1999, p. 549 as *Metzgeria fruticulosa*), Christy and Wagner (1996, part V p. 37 as *M. temperata*), Smith (1990, p. 306 as *Metzgeria fruticulosa*), Schuster (1992, p. 747 as *M. fruticulosa*), Arnell (1956, p. 20 as *M. fruticulosa*), Frye and Clark (1937, p. 136 as *M. furcata* var. *fruticulosa*).

References with photos — Wagner (2014).

Peltolepis quadrata (Sauter) Müller (of Freiberg)

Recent synonym: *Peltolepis grandis* (Lindberg) Lindberg
Common name: shieldscale liverwort

Summary — A ribbon-like thalloid liverwort with several chloroplasts per cell and heterogeneous thallus tissues. Terrestrial.

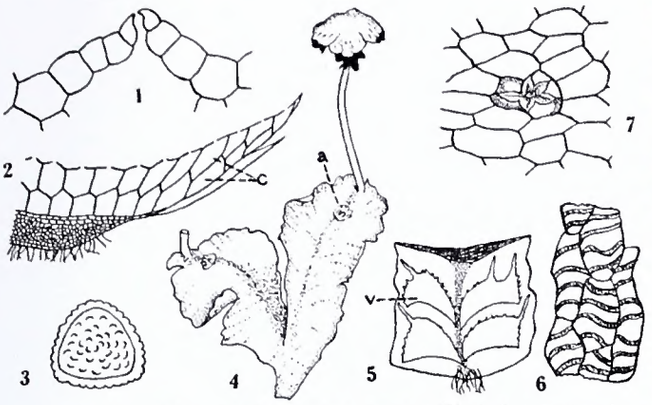
Diagnostic characters: *Peltolepis quadrata* is distinguished by its (1) medium-sized light green somewhat translucent thallus, (2) upturned, reddish or purplish thallus margins with non-protruding ventral scales, (3) receptacle stalks with linear furrows and greenish to purplish at the base, and (4) deeply lobed carpocephalum with inflated lobes.

Technical description

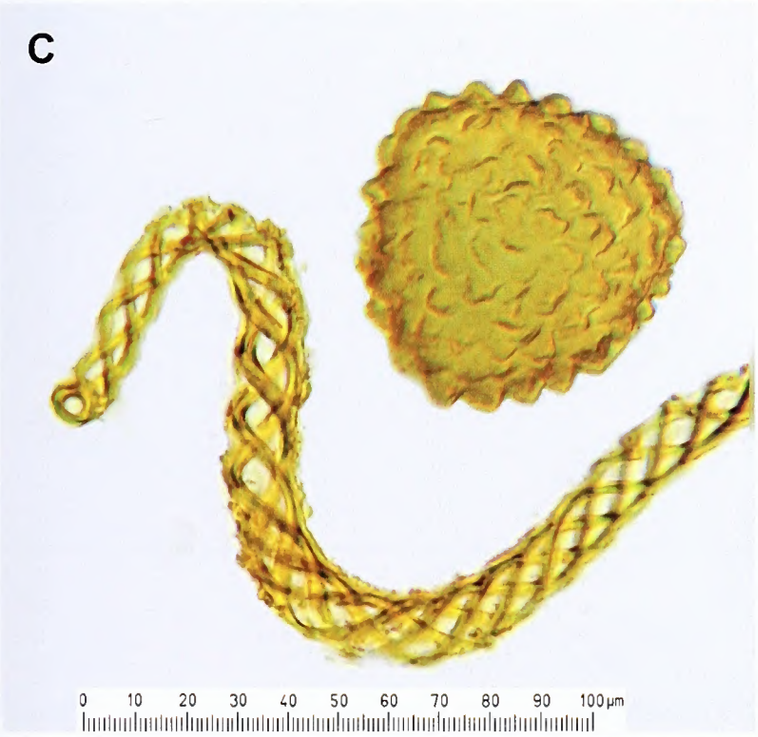
THALLOID LIVERWORT. **Plants** bright to dark green, translucent, fleshy but not firm, 3–7 mm wide and 1–2 cm long; margins usually reddish or purplish, upturned. Dorsal surface patterned with irregular polygons. Pores to the air chambers conspicuous and stellate but not overly bulging or elevated. Epidermal cells with indistinctly thickened walls at corners (trigones) and with or without oil bodies. Ventral surface convex; ventral scales whitish to purplish, bluntly elongate-triangular (lingulate) and not obviously exposed along the margins. Gemmae none.

Paroicous. Stalk of receptacle 5–10 (–15) mm long, pale green to purplish at base, without basal scales, with two linear furrows. Carpocephalum pale green or purplish, convex, about 3 mm wide, deeply (4–) 5–6 (–8)

Plate 114. Peltolepis quadrata. *A. Habit drawing. B. Capsule wall. C. Spore and elater. D. Spores. (A. Schofield 2009, p. 166, used with permission; B–D: Wagner 8198. OSC)*



Peltolepis grandis. 1, Vertical section of pore, x 150. 2, Cross section of thallus, (*c*) chambers, x 200. 3, Spore, outer face, x 250. 4, Plant, (*a*) antheridial receptacle, x 3. 5, Ventral view of portion of thallus, (*v*) ventral scale, x 25. 6, Thickenings in wall of sporangium, x 250. 7, Pore of thallus, x 150. (1, 4, 7, after K. Mueller; the others after Massalongo.)



lobed, the lobes inflated. Sporangia one per lobe, brown, splitting open irregularly without an operculum. **Spores** 65–75 µm, tuberculate, 10–12 hemispheric tubercles across longest dimension.

Similar species — *Athalamia hyalina* has grayish-green thalli that are 2–6 mm wide and less than 1.5 cm long. Its thallus margins are upturned with ventral scales conspicuously projecting, the receptacle stalks are colorless and lack furrows, and the carpocephala usually has only four lobes.

Ecology — *Peltolepis quadrata* forms small mats on moist exposed to shaded soil or on ledges and crevices in talus slopes and outcrops. Usually a calciphile it sometimes occurs on igneous rocks (Schuster 1992a). By extension, calciphilous bryophytes sometimes also occur on ultramafic rocks that are also rich in base elements. In western North America, *P. quadrata* is known from alpine to subalpine habitats, with a single known site at an elevation of about 7,000 feet in an area dominated by limestone bedrock (Wagner 1996b). Forest types range from *Abies lasiocarpa* and *Pinus albicaulis* to above timberline. Because *P. quadrata* occurs at high elevations, capsules develop in late summer. This thalloid liverwort is probably a poor competitor with vascular plants, and population sizes may shrink through time with natural succession.

Distribution — *Peltolepis quadrata* is known from Eurasia, Greenland, and North America. In westeren North America, it is known from Alaska south to British Columbia, Oregon, and the southern Rocky Mountains. In Oregon, *Peltolepis quadrata* is reported from Baker County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Schofield (2002, p. 167), Schuster (1992a, p. 115), Arnell (1956, p. 274), Frye and Clark (1937, p. 54 as *Peltolepis grandis*), Evans (1923, p. 37 as *P. grandis*).

References with photos — Wagner (2014).

Pressia quadrata (Scopoli) Nees von Esenbeck

Recent synonyms: none
Common names: blister ribbon; narrow mushroom-headed liverwort

Summary — A ribbon-like thalloid liverwort with several chloroplasts per cell and heretogeneous thallus tissues. Terrestrial.

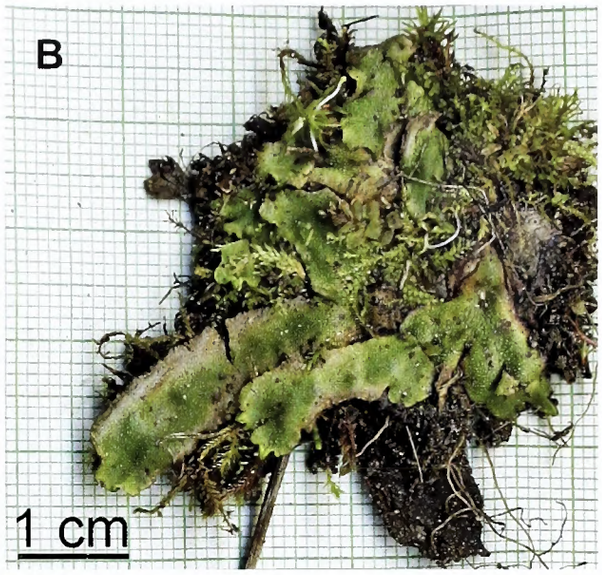
Diagnostic characters: *Preissia quadrata* can be distinguished by the whitish cells surrounding the pores. The cells lack chloroplasts and form small mounds that resemble blisters. Dried herbarium specimens are notably white dotted from the appearance of the cells around the pores. Fresh plants have a peculiar odor that most people find unpleasant and a hot taste that burns the tongue (Paton 1999). This hot taste may be lacking in regional material (M. Hutten, pers. comm.).

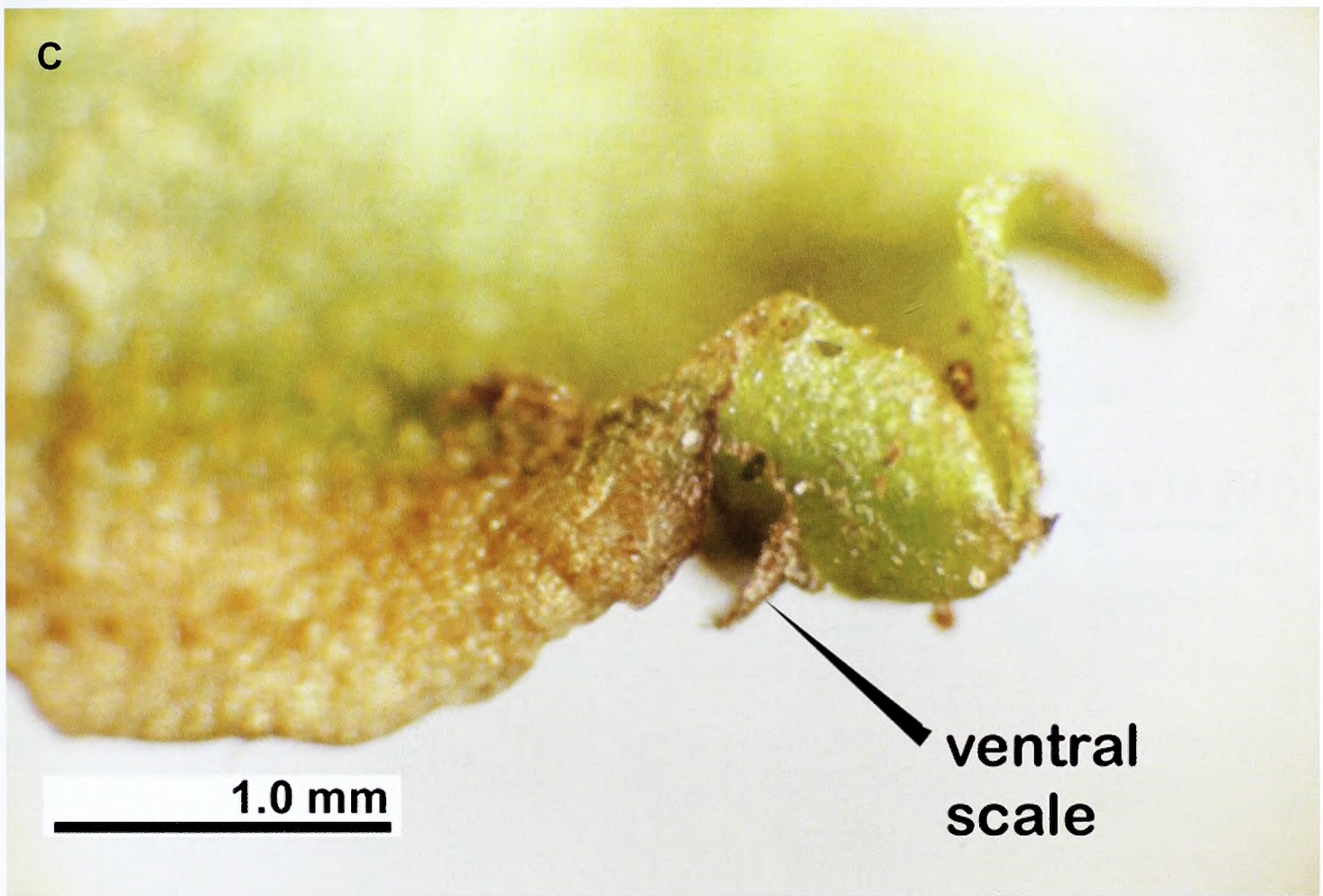
Technical description

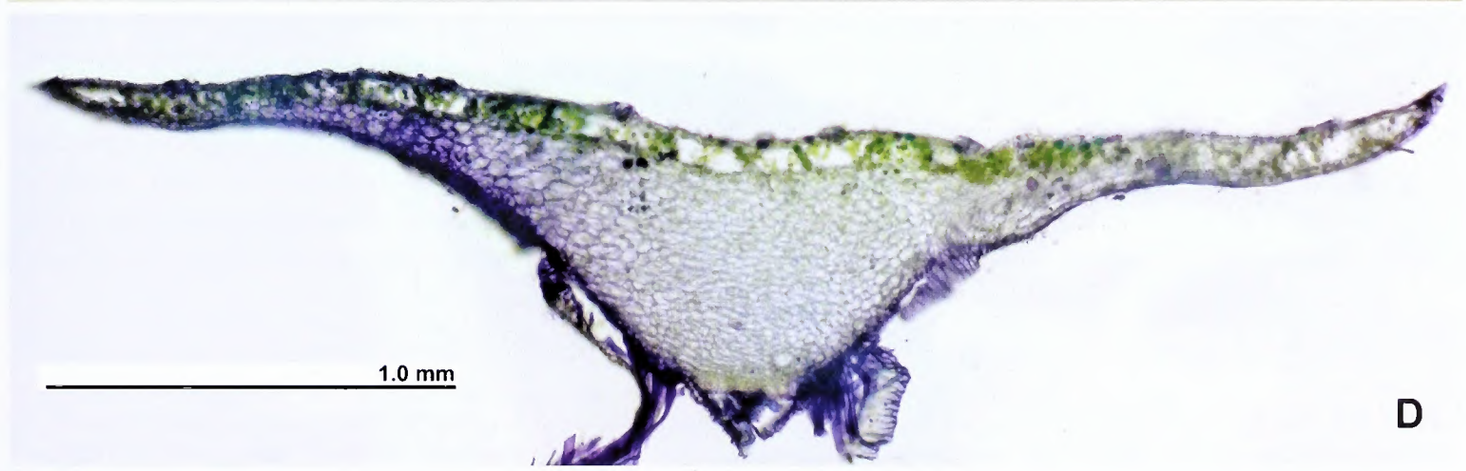
THALLOID LIVERWORT. **Plants** medium to large, 3–6 mm wide; dull grayish-green with pores visible to the naked eye as white dots, giving the surface a rough appearance; lateral margins becoming purplish or bleached out in older plants. Pores in microscopic view with cross shaped openings formed by superimposed rings of cells; barrel-shaped in transverse section. Ventral scales blackish-purple, metallic in appearance. Oil bodies lacking.

Plate 115. Pressia quadrata. *A–B. Fresh thallus. C. Ventral scale. D. Thallus cross-section. (A: Wagner s.n. field photo; B–D: Hutten s.n. NPS)*


A


B
1 cm


C
1.0 mm
ventral
scale


1.0 mm
D

Dioicous. Antheridial receptacle stalked, convex across upper surface. Female carpocephala stalked, with 3–5 lobes or rays; pseudoperianths present, enclosing capsules.

Similar species — Only *Marchantia* shares the compound, barrel shaped pores of *Preissia* and the blister-like appearance. *Marchantia*, the more common genus, usually has gemmae cups on the thallic surface and its sexual structures differ conspicuously. *Conocephalum* and *Marchantia* (common large marchantioid liverworts) both smell sweet compared to *Preissia*. The absence of oil cells in ventral scales separates *Preissia* from all other genera with epidermal pores.

Ecology — *Preissia quadrata* is perennial, visible whenever the substrate is exposed. It grows on soil with little organic material, typically on cliff ledges or in crevices in rocky areas. Elevations in Oregon vary from relatively low (Columbia River Gorge) to high (Elkhorn Mountain). Outside the Pacific Northwest, *Preissia quadrata* is strictly calciphilous (Schuster 1992a). Doyle and Stotler (2006) describe its habitat as, "damp soil and rocks of shaded creek banks and seepages; splash of creeks and cascades; often under willow; places that remain damp for long periods of time following snow-melt."

Distribution — *Preissia quadrata* is circumboreal in temperate to boreal regions. In western North America, it extends south into Washington, Oregon, California, and Idaho. In Oregon, *P. quadrata* is reported from Baker, Clackamas, Jefferson, Multnomah, and Wallowa counties within the Blue Mountain and Willamette Valley ecoregions.

References with descriptions and/or illustrations — Faubert (2012, p. 34), Schofield (2002, p. 177), Schuster (1992a, p. 363), Arnell (1956, p. 264).

References with photos — Wagner (2014), Atherton et al. (2010, p. 157), Lincoln (2008, p. 23).

Riccia californica Austin

Recent synonyms: none
Common name: California riccia

Summary — A bifurcating ribbon-like thalloid liverwort that forms rosettes. Terrestrial.

Diagnostic characters: *Riccia californica* is distinguished by its (1) thalloid habit with differentiated tissue, (2) plants repeatedly bifurcating, forming rosettes, (3) ciliate thalli, and (4) spore size.

Technical description

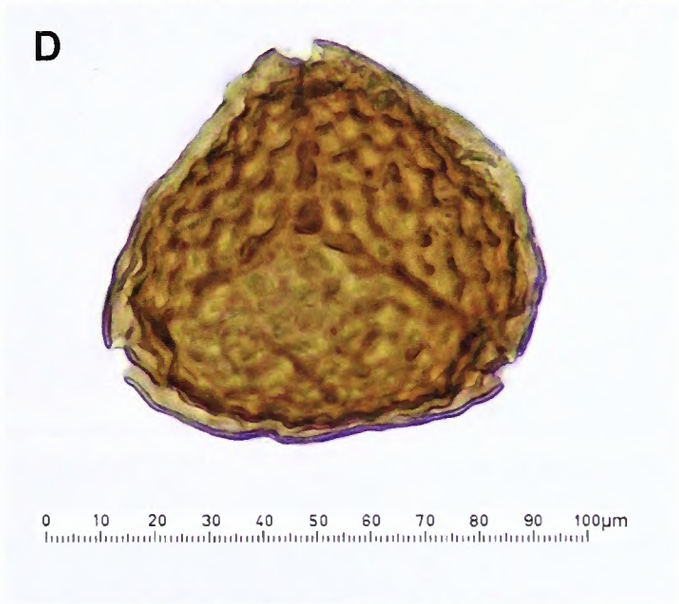
THALLOID LIVERWORT. **Plants** medium-sized, forming rosettes (8) 10–16 (18) mm in diameter, 1–4 times dichotomous, light green to whitish grey-green, glaucescent (rarely faint, almost imperceptible purplish pigmentation of flanks but not on margins), reticulate above, usually concolorous below. Main segments 1–3 times dichotomous, oblong or oblong-cuneate to subquadrate, 1–2 mm wide; terminal segments lingulate or oblong-ovate to narrowly obovate, with rounded or blunt, occasionally subtruncate or retuse (slightly notched) apices, 0.8–1.5 mm wide. Margins obtuse, elevated and tumid (swollen or inflated) when young, toward apices of terminal segments with few to many, variable, slender to rather stout taper-pointed, rather

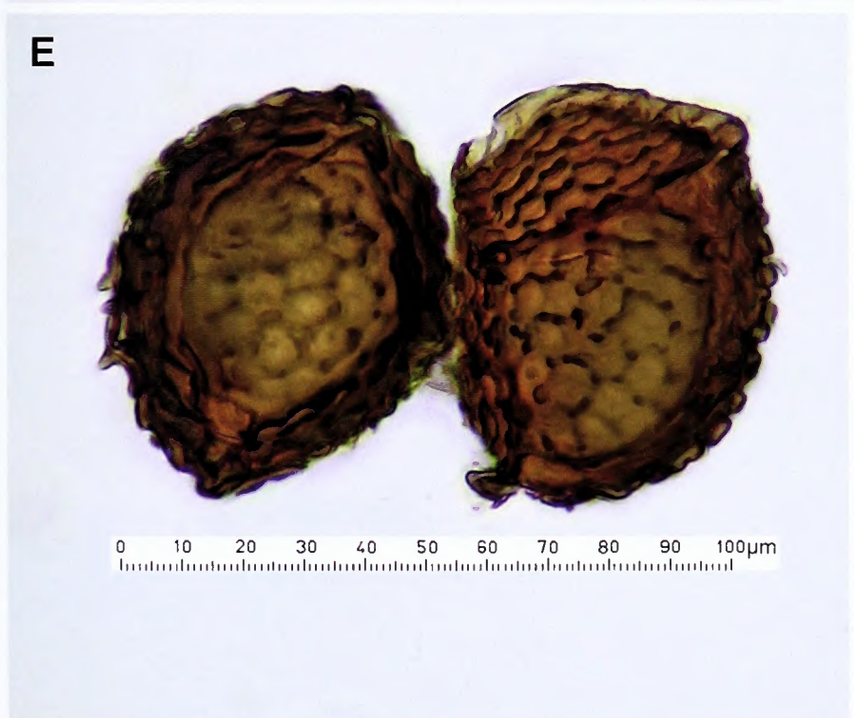
Plate 116. Riccia californica. *A. Thallus with sporangia. B. Thallus showing rhizoids. C. Two spores, distal aspect. D. Spore, proximal aspect. E. Two spores, lateral aspect. F. Eight spores. (A—E: Wagner m2983. DHW; F: Wagner 7679. OSC)*

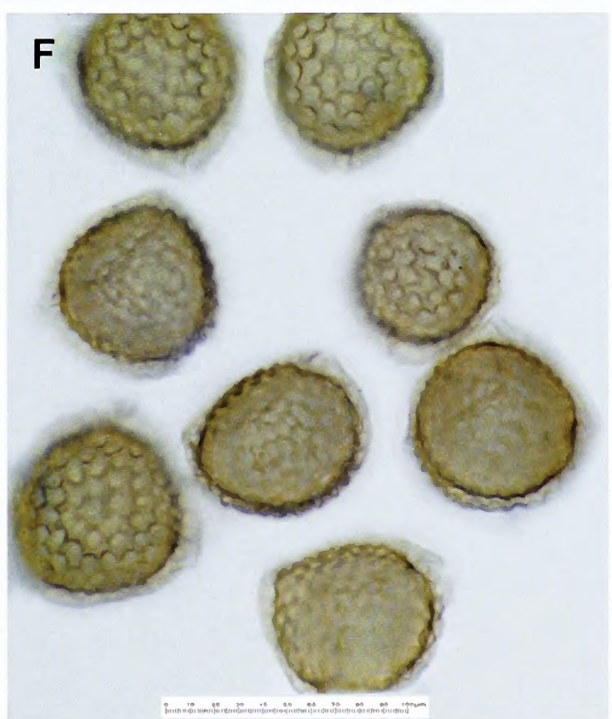

A
0 1 2mm


0 1 2mm
B


C
0 10 20 30 40 50 60 70 80 90 100µm


D
0 10 20 30 40 50 60 70 80 90 100µm


E
0 10 20 30 40 50 60 70 80 90 100µm


F

rigid but thin-walled, finely granulate cilia, averaging (100) 150–300 (400) µm long, occurring on both margins, the tumid lateral faces and, occasionally, a few on dorsal surface even in the broad, flat furrow. Rarely almost or wholly lacking; median sulcus broad and parallel-sided, except at the very tip, where convergent, about 0.35–0.45 thallus width, rather long-persistent; cross sections canaliculated-elliptical, parabolic toward base, 15–25 cells high medially, ventral outline more or less convex to almost rectilinear. Cells of dorsal epidermis hemispherical, ellipsoidal or papilliform, delicate and soon collapsing, leaving irregular vestiges; hypodermal cells thin-walled, about 40–80 µm broad and often wider than high. Ventral scales minute, ephemeral. Tubers lacking.

Monoicous. Antheridial ostioles not or faintly elevated. Capsules long-included. Spores brown, remaining translucent, (65) 70–90 (108) µm in diameter, angular, with a smooth, more or less sinuous-crenulate wing margin 4–9 (12) µm wide; outer faces regularly areolate-tuberculate with 10–13 areolae across spore face, the areolae averaging about 8 µm wide; meshes raised as distinct tubercles or truncate papillae about 2–4 µm high; inner faces similarly but more shallowly areolate, with meshes hardly raised as tubercles.

Similar species — Schuster (1992) includes *Riccia californica* in the subgenus *Riccia*, section *Riccia* were it is distinguished as a large, vigorous taxa with cilia, never having a calcified, chalk-white thalli, smaller spores and presence of areolae across the spore face. Frye and Clark (1937) distinguish *R. californica* by its monoicous condition, presence and length of cilia, and spore size. The common *Riccia sorocarpa* lacks cilia.

Ecology — *Riccia californica* occurs on temporarily moist soil and lightly shaded banks. Associated species might include: *Oxymitra*, *Corsinia*, *Reboulia*, *Anthoceros*, *Riccia curtisii, R. dictyospora*, *R. hirta*, and *R. macallisteri*. Fruiting in November.

Distribution — *Riccia californica* is a North American endemic, known from Oregon, California and Texas. In Oregon, *A. bolanderi* is reported from Curry County within the Klamath Mountain ecoregion.

References with descriptions and/or illustrations — Schuster (1992, p. 669), Frye and Clark (1937, p. 24).

Reference with photos — Wagner (2014).

Sphaerocarpos hians Haynes

Recent synonyms: none
Common name: trumpet bottlewort

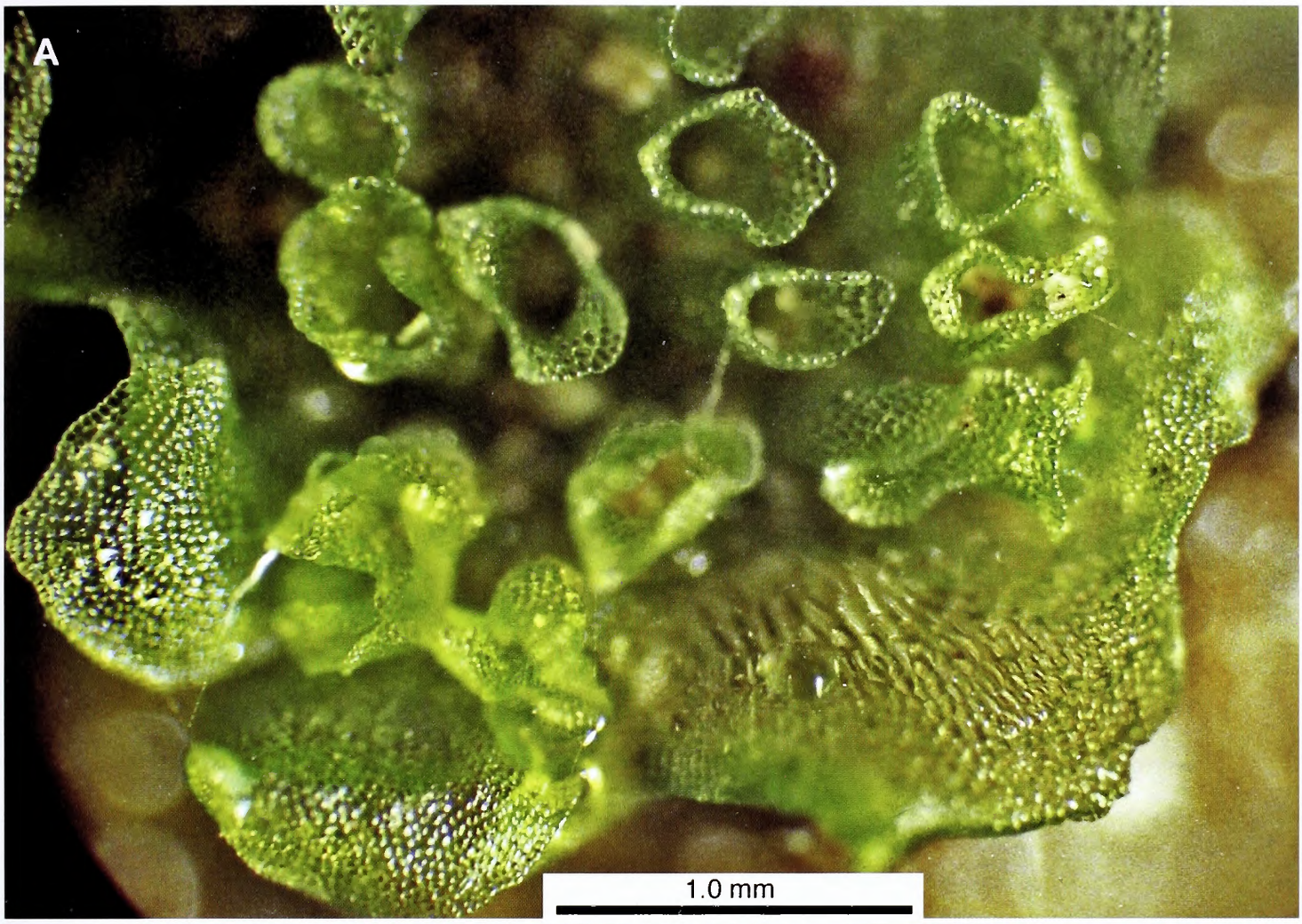
Summary — A small mounded or rosette liverwort with homogeneous thallus tissues. Terrestrial.

Diagnostic characteristics — *Sphaerocarpos hians* is distinguished by its (1) whitish-green ruffled roundish rosettes under 1 cm in diameter, (2) flaring mouth on the archegonial involucres, (3) habit on bare mud flats along creeks and lakes at low water, and (4) fruiting in late summer or fall.

Technical description

THALLOID LIVERWORT. **Plants** forming small, 1–2 cm, whitish-green rosettes, fragile and translucent, 4–8 mm in diameter. **Leaves** are rounded distally, margins crisped and ascending.

Plate 117. Sphaerocarpos hians. *A–B. Fresh thallus. (A, B: Wagner m1210. DHW)*


A
1.0 mm


B
1.0 mm

Dioicous. Female (archegonial) involucres conspicuous,inflated, bottle or flask-shaped, 1–2 mm high, flaring open at the mouth, some partially hidden by the ruffled thallus, appearing in late summer or fall. Antheridial involucres much less conspicuous, 0.2–0.4 mm. Capsules forming inside the archegonial involucres and not visible without dissection.

Similar species — *Sphaerocarpos texanus*, the only other *Sphaerocarpos* in Oregon and Washington has flasks contracted at the mouth with a pore-like opening much smaller than the diameter of the involucre. It occurs on open, disturbed ground such as old fields, vacant lots, construction sites and fruits in late winter and early spring.

Ecology — *Sphaerocarpos hians* forms whitish-green, ruffled, roundish rosettes on mud flats along creeks. It may also occur in low-elevation mudflats such as those along seasonal lakes and reservoirs in late summmer. Elevations at the northern Idaho and eastern Washington sites are about 2,500 feet, while the western Oregon location occurs at approximately 250 feet. Its widely disjunctive range is puzzling, and it seems possible *S. hians* could turn up anywhere in the Columbia basin or western Oregon and Washington. Plant associations in Oregon include *Fraxinus latifolia* and *Salix* spp. *Sphaerocarpos* is a poor competitor and becomes displaced as succession proceeds.

Distribution — *Sphaerocarpos hians* is endemic to western North America and known from Washington, Oregon, western Montana, and Idaho. In Oregon, *S. hians* is reported from Benton County within the Willamette Valley ecoregion.

References with descriptions and/or illustrations — Timme (2003), Christy and Wagner (1996, part V, p. 55), Frye and Clark (1937, p. 106), Haynes and Howe (1923, p. 4).

References with photos — Wagner (2014).

DIVISION Marchantiophyta: Leafy liverworts

Anastrophyllum minutum (Schreber) R.M. Schuster

Recent synonyms: none
Common name: tiny notchwort

Summary — A leafy liverwort with transversely inserted leaves that are divided less than one-half. Underleaves are lacking. Terrestrial.

Diagnostic characteristics — *Anastrophyllum minutum* can be distinguished by its (1) small size, (2) dark green to brown color, (3) shoots less than 1 mm wide, (4) transversely inserted bilobed leaves, (5) typically erect and crowded stems, and (6) cells below the lobe tips arrayed in concentric rings (Paton 1999).

Technical description

Leafy Liverwort. **Plants** up to 5 cm long, yellowish-brown, seldom pure green, with sparse rhizoids at the base of the stem. **Leaves** spreading, of equal size on sterile shoots, almost transverse, almost quadrate, channeled, bilobed to 1/3, sinus wide and rounded-right angled, lobes rounded or shortly pointed, incurved towards each other. Ventral lobe somewhat larger, mostly rounded, dorsal lobe mostly pointed. Marginal cells 10–20 µm, in the center of the leaf 13–20 µm, rounded rectangular or quadrate; cell walls of leaves conspicuously and evenly thickened (not thickened just at the corners, i.e., lacking trigones). **Underleaves** lacking. Oil bodies botryoidal, consisting of distinct, small spherules. Gemmae bright red when present (but not seen in Oregon material).

Dioicous. Male bracts in 4–10 pairs; antheridia solitary, stalk uniseriate. Female bracts sub-dentate, to irregularly dentate. Perianths subcylindrical and somewhat dorsiventrally compressed; cilia at mouth 2–4 (–6) cells long and apical cell 10–20 × 22–42 µm. Sporophytes rare.

Similar species —*Cephalozia*, *Cephaloziella*, *Lophozia*, and *Marsupella* all have species of small plants with bilobed leaves and cell walls uniformly thin or thickened at the corners of the cells only. Oil bodies in these look-alikes (*Cephaloziella, Lophozia*, *Marsupella*) are either granulose or entirely absent (*Cephalozia*). *Lophozia sudetica,* the closest look-alike, is remarkably similar and was mistaken for *Anastrophyllum minutum* by Jessup (2000) due to its same size, bilobed leaves, lack of underleaves, and reddish angular gemmae. However, *Lophozia sudetica* has more secund leaves (especially on more prostrate shoots) and while its leaf cells lack large trigones, its walls are not consistently evenly thickened as in *Anastrophyllum minutum*. The best character for separating *Lophozia sudetica* from *Anastrophyllum minutum* is the arrangement of cells in the leaf lobes, which lie in distinct concentric rows radiating from the lobe tips in *A. minutum*, a feature first noted by Paton (1999). There is an apparently undescribed species of *Anastrophyllum* found in middle elevation streams in Oregon's western Cascades that differs from *A. minutum* in having collenchymatous leaf cells and granulose oil bodies.

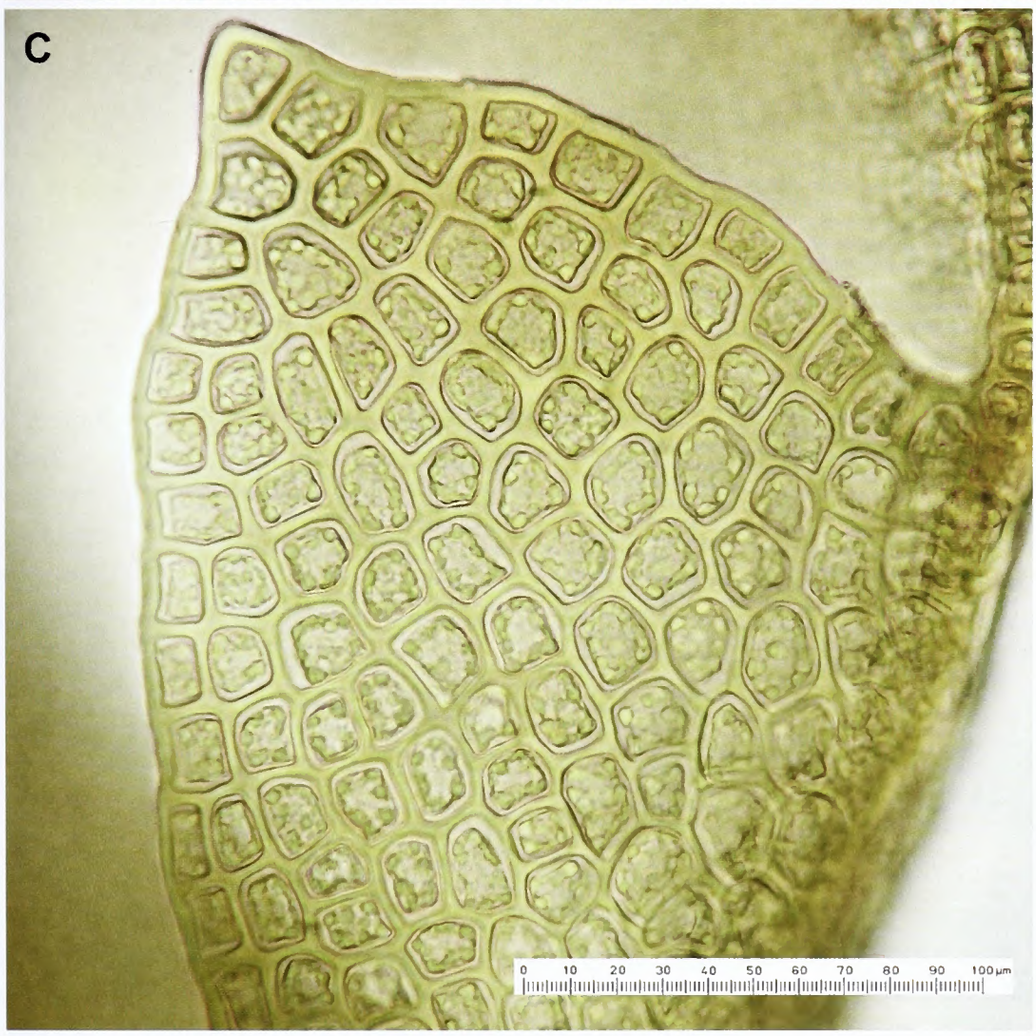
Ecology — *Anastrophyllum minutum* is known from peaty soil at elevations higher than 5,500 feet. In the *Tsuga mertensiana* zone, *A. minutum* colonies typically associate with other bryophytes in tight mats on ledges or at the base of cliffs. The presence of gemmae and lack of sporophytes in the Oregon collections suggests the species is dispersed primarily by vegetative means. Damsholt (2002) mentions the gemma-free forms are found in plants with more widely spaced leaves, which match the plants from Hood River County.

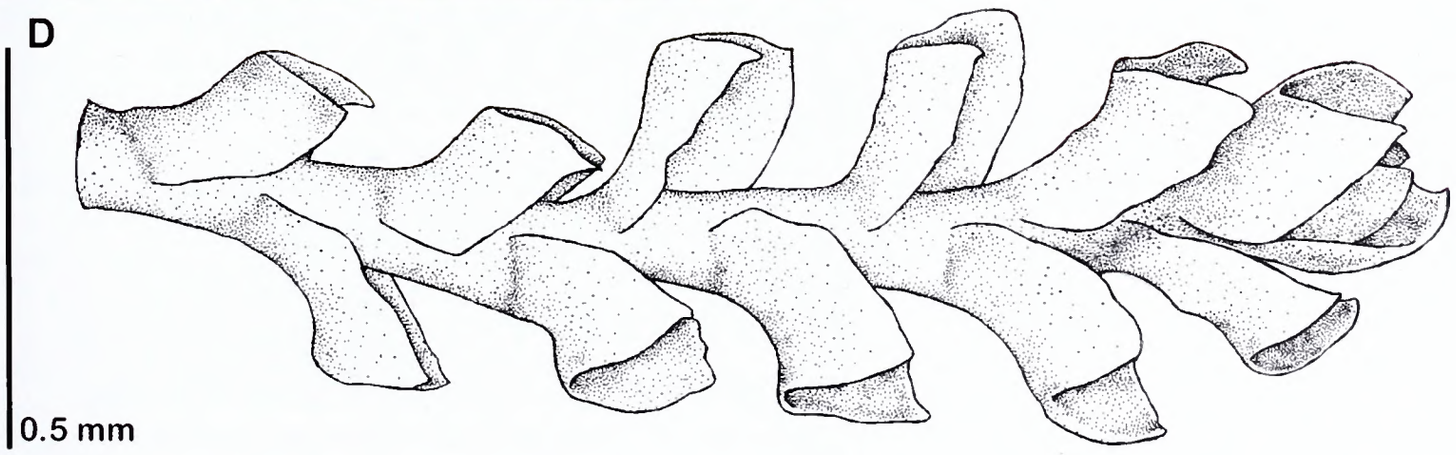
Distribution — *Anastrophyllum minutum* is circumboreal and known from western North America in Alaska south through British Columbia, Alberta, Washington, Oregon, California, Idaho, and Mexico. In Oregon, *A. minutum* is reported with certainty only from Hood River County within the West Cascades ecoregion. Records outside of Hood River County need confirmation or additional study.

Plate 118. Anastrophyllum minutum. *A. Habitat. B. Shoot tip. C. Leaf lobe. D. Line drawing of shoot. (A: from BBS; Des Callaghan: http://rbg-web2.rbge.org.uk/bbs/meetings/mtgs06/scotland/mtgs063.htm. B, C: Berg B091. DHW; D: Wagner s.n. OSC)*


A


B
500 µm


C
0 10 20 30 40 50 60 70 80 90 100 µm


D
0.5 mm

References with descriptions and/or illustrations — Faubert (2012, p. 176), Paton (1999, p. 240), Hong (1996), Hicks (1992, p. 52), Smith (1990, p. 124), Frey and Clark (1945, p. 376).

References with photos — Wagner (2014), Atherton et al. (2010, p. 132), Lincoln (2008, p. 99).

Anthelia julacea (Linnaeus) Dumortier

Recent synonyms: none
Common name: alpine silverwort

Summary — A very small leafy liverwort with transverse, isophyllous, julaceous leaves that are divided less than one-half. The underleaves are of the same morphology as the lateral leaves. Oil bodies are lacking. Terrestrial.

Diagnostic characteristics — *Anthelia julacea* can be distinguished by its (1) small (< 1 mm diam.) size, (2) julaceous plants with three rows of tightly appressed and deeply bilobed leaves, (3) sharp lobe tips, (4) soft fragile nature (leaves are hard to detach intact with forceps), (5) lack of oil bodies, and (6) white filamentous coating giving the plant a silvery appearance in the field.

Technical description

Leafy Liverwort. **Plants** usually in pure and wide patches. **Stems** 3–4 mm long or occasionally longer, with narrow, ascending or erect branches parallel to the main stem. **Leaves** alternate, nearly transverse, with a tendency toward incubous, not decurrent, loosely to densely imbricate, suberect to erect, appressed or the tips incurved, simple bilobed, ovate, somewhat convex dorsally, somewhat channeled; lobes equal, lanceolate to somewhat ovate-lanceolate, acute to acuminate, the apical cell often hyaline; sinus 2/3 of leaf length or less, narrow, acute. **Underleaves** equaling stem leaves in size or slightly smaller. Oil bodies absent in most cells or in some 1–2 small (1–2 µm) transparent oil bodies present.

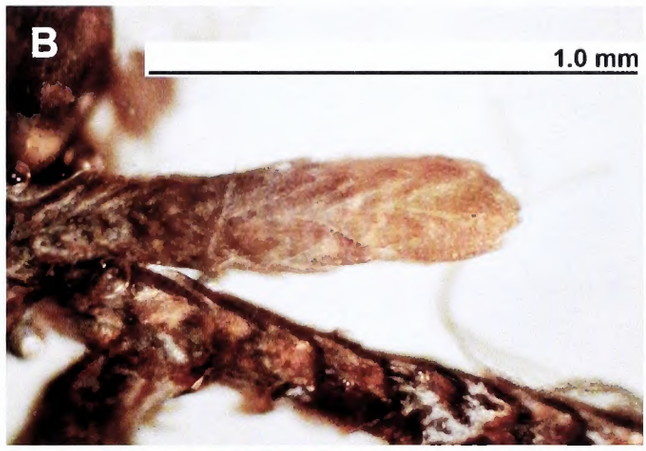
Dioicous. Antheridial bracts on male shoots are separate from shoots bearing perianths. Perianths rare, oblong, about twice as long as wide, half their length exserted beyond the bracts. Elaters 8–9 µm wide with two (very rarely three) strap-like, red brown spirals.

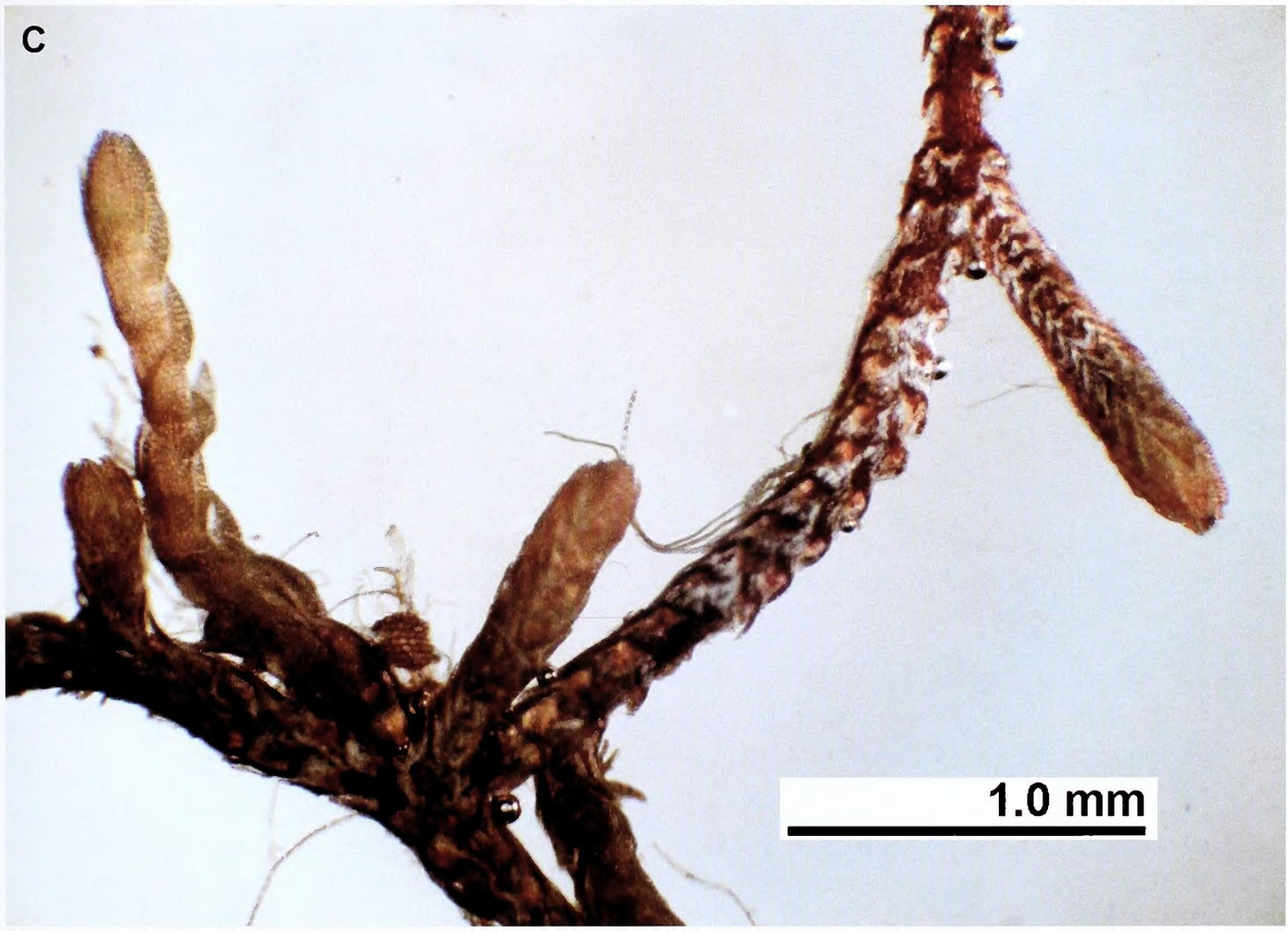
Similar species —Its wide, strap-like spirals (only 2) of the elaters and dioicous condition separate *Anthelia julacea* from the similar *A. juratzkana*. In general, *A. julacea* has somewhat more dentate leaves and longer perianths than *A. juratzkana*. Although the genus is easily recognized, fertile material with capsules are needed for positive species identification. Crenulation of leaf margins may provide a clue but needs study with regional material to determine reliability. Smith (1990) states, "There is a considerable body of opinion that *A. julacea* and *A. juratzkana* are not distinct species, but they differ markedly in reproductive structures and there seem no grounds for reducing *A. juratzkana* to a variety of *A. julacea*. The former is readily recognized in the field by the clavate fertile shoots and the non- or scarcely exserted perianth."

Ecology — *Anthelia julacea* occurs on peaty soil associated with low ericaceous shrubs in subalpine and alpine habitats.

Plate 119. Anthelia julacea. *A–C. Shoot tips and branches. D. Spores and elater. (A–C: sterile shoots possibly A. julacea. Anonymous s.n. USFS; D: Wagner 2366a. OSC)*


A
1.0 mm


B
1.0 mm


C
1.0 mm


D
0 10 20 30 40 50 60 70 80 90 100 µm

Distribution — *Anthelia julacea* is widespread in the northern hemisphere's boreal and montane regions, reaching its southern limit in western North America in Oregon. In Oregon, *A. julacea* is reported from Clackamas, Hood River, and Wallowa counties within the Blue Mountain and West Cascades ecoregions.

References with descriptions and/or illustrations — Faubert (2012, p. 258), Schofield (2002), Paton (1999, p. 161), Smith (1990, p. 88), Arnell (1956, p. 41), Frey and Clark (1943, p. 181).

References with photos — Wagner (2014), Atherton et al. (2010, p. 109).

Barbilophozia barbata (Schreber) Loeske

Recent synonym: *Lophozia barbata* (Schreber) Dumortier

Common name: bearded pawwort

Summary — A leafy liverwort with succubous leaves divided less than one-half. The underleaves are lacking or when present small, entire to bilobed. Terrestrial.

Diagnostic characteristics — *Barbilophozia barbata* can be distinguished by its (1) presence of three to four equally lobed leaves (a character of *Barbilophozia*), (2) rounded obtuse lobe tips, (3) cilia lacking at the leaf bases, and (4) lack of prominent underleaves.

Technical description

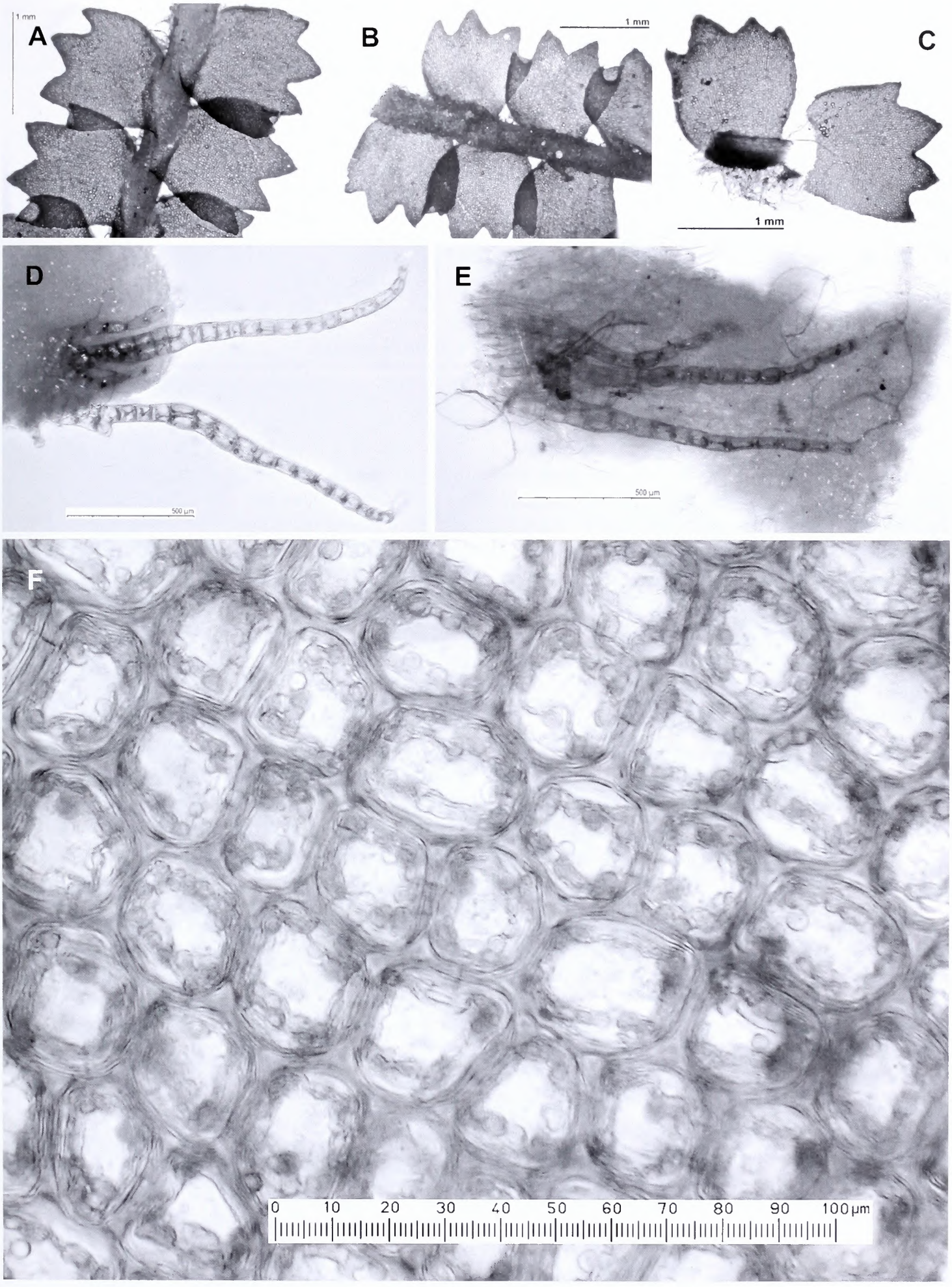
Leafy Liverwort. **Plants** dark green to brown, 2–6 cm long and 2.5–3.5 mm wide with numerous rhizoids. **Leaves** rather distant, obliquely inserted, uniform in size, horizontally spreading from the stem, sometimes directed somewhat forward, almost quadrate-triangular, divided to 0.2 mm in 4 lobes, with wide, usually obtuse and gibbous incisions, lobes usually obtuse or obtusely pointed, almost equally large or the two middle lobes somewhat larger. Cells at mid-lobe averaging about 25 µm long, with thin walls but rather large trigones; marginal cells 18–21 µm. Oil bodies about 10 per cell, spherical, homogeneous, 2–4 µm. **Underleaves** small or absent; when present ciliate or bilobed.

Dioicous. Female bracts somewhat longer than the leaves, somewhat more deeply incised, incisions gibbous and lobes frequently pointed. Perianths long exserted, ovoid-cylindrical, constricted at the mouth, multiplicate at the margin with numerous, mostly 2-celled teeth. Gemmae rare, 3–6 angled, reddish-yellow.

Similar species — *Barbilophozia barbata* lacks the cilia at the base of the leaves and prominent underleaves that are present on the other two local *Barbilophozia* species (*B. hatcheri* and *B. lycopodioides*). Also, *B. barbata* lobes are simply triangular rather than rounded-mucronate, and they are plane rather than cupped or channeled. The lobe tips are obtuse and lack points. *Barbilophozia hatcheri* usually has numerous gemmae, and *B. lycopodioides* is much bigger.

Ecology — *Barbilophozia barbata* is terrestrial on peaty substrates over rock, usually growing with mosses or other liverworts at high elevations.

Plate 120. Barbilophozia barbata. *A. Shoot, dorsal view. B. Shoot, ventral view. C. Leaves. D–E. Underleaves. F. Leaf median cells. (A–E: Lawton s.n. WTU)*


A
1 mm
B
1 mm
C
1 mm
D
500 µm
E
500 µm
F
0 10 20 30 40 50 60 70 80 90 100 µm

Distribution — *Barbilophozia barbata* is widespread around the northern hemisphere in boreal and montane regions and known from Eurasia and North America. In western North America, it is known from Alaska south to British Columbia, Alberta, Washington, Oregon, Montana, Idaho, Wyoming, Colorado, and Arizona. In Oregon, *B.barbata* is reported from Clatsop County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Faubert (2012, p. 187), Hong and Matthews (2001), Paton (1999, p. 180), Smith (1990, p. 98), Arnell (1956, p. 90), Frye and Clark (1945, p. 426).

References with photos — Wagner (2014), Atherton et al. (2010, p. 114).

Barbilophozia lycopodioides (Wallroth) Loeske

Recent synonym: *Lophozia lycopodioides* (Wallroth) Cogniaux
Common names: giant fourpoint, maple liverwort, greater pawwort

Summary — A leafy liverwort with succubous leaves divided less than one-half. The underleaves are well developed, up to one third the length of the lateral leaves, bifid nearly to the base, lobe tips ciliate, and lobes often fringed with uniseriate cilia. Terrestrial.

Diagnostic characteristics — *Barbilophozia lycopodioides* can be distinguished by its (1) large size, pale yellowish-green color, and ruffled shallowly 4-lobed leaves, (2) obtuse lobe tips, each with a conspicuous mucronate tip, (3) lack of gemmae, and (4) elongated cilia cells at the leaf base, with the longest usually more than seven times longer than wide.

Technical description

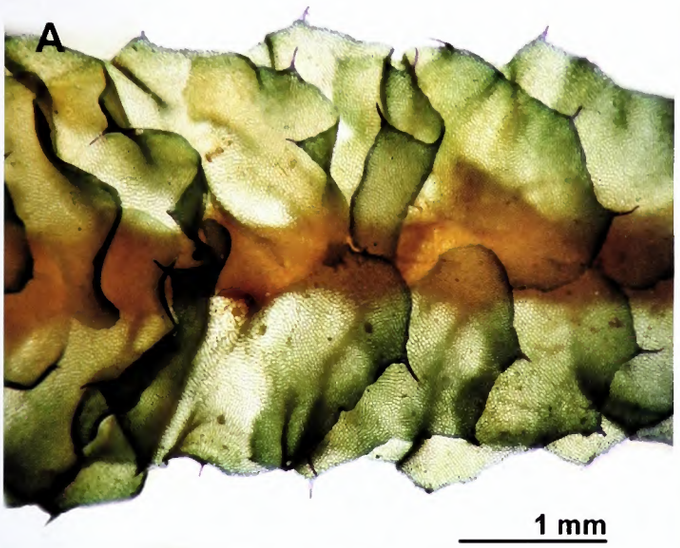
Leafy Liverwort. **Plants** pale green to yellowish-green, sprawling, shoots upturned at the apex, (2.5–) 3–5 mm wide and 5–9 cm long. **Leaves** overlapping closely, wider than long, obliquely inserted and spreading widely, usually 4-lobed (occasionally 3- or 5-lobed), the lobes separated by shallow sinuses, each lobe obtuse with a short, abrupt point (mucro) at the tip that is several cells long; 5–8 sinuous cilia present near the postical leaf base, cilia 0.5–1 mm long. Oil bodies 2–10 per cell. **Underleaves** deeply forked into two slender lobes, with ciliate margins. Gemmae 1–2 celled, quadrate to triangular, reddish-brown, rare.

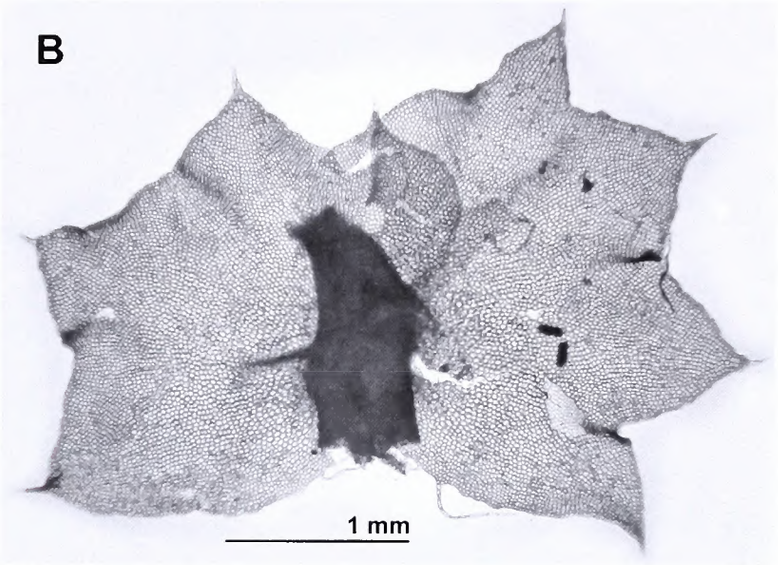
Dioicous. Androecia soon intercalary, male bracts similar to leaves but strongly concave at base; perianths ovoid-cylindrical, 5–6 mm long, exerted well beyond ciliate lobed bracts; contracted to the ciliate-dentate mouth, with teeth 1–3 cells long. (Plants are usually sterile.)

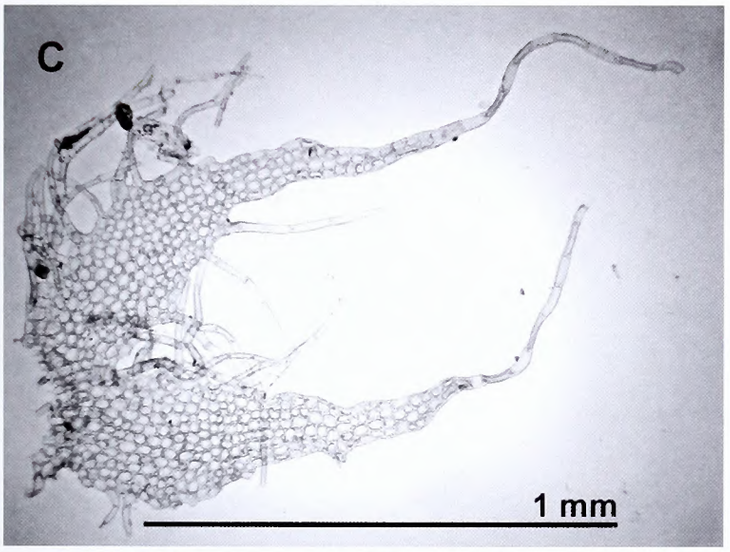
Similar species — The very similar *B. hatcheri* can be distinguished by its 1–2.5 mm wide and 2–5 cm long shoots, more deeply lobed leaves with acute lobe tips instead of mucros, 2–4, 0.18–0.3 mm long basal leaf cilia and shoot tips with abundant masses of reddish-brown angular gemmae.

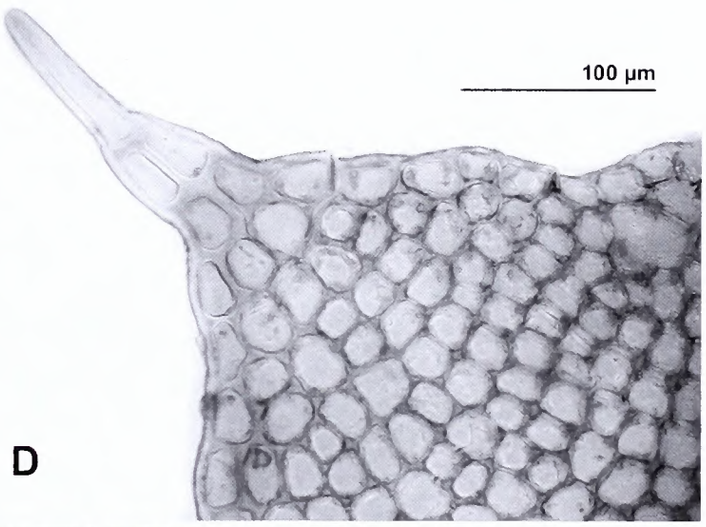
Ecology — *Barbilophozia lycopodioides* forms mats on peaty soil on damp ledges of rock outcrops and cliffs at elevations ranging from 3,400 to 7,500 feet. Sites are restricted to alpine peaks with considerable snowpack. Forest associations include *Abies amabilis, Abies lasiocarpa, Abies procera, Picea engelmannii, Pinus contorta* var. *latifolia*, and *Tsuga mertensiana.*

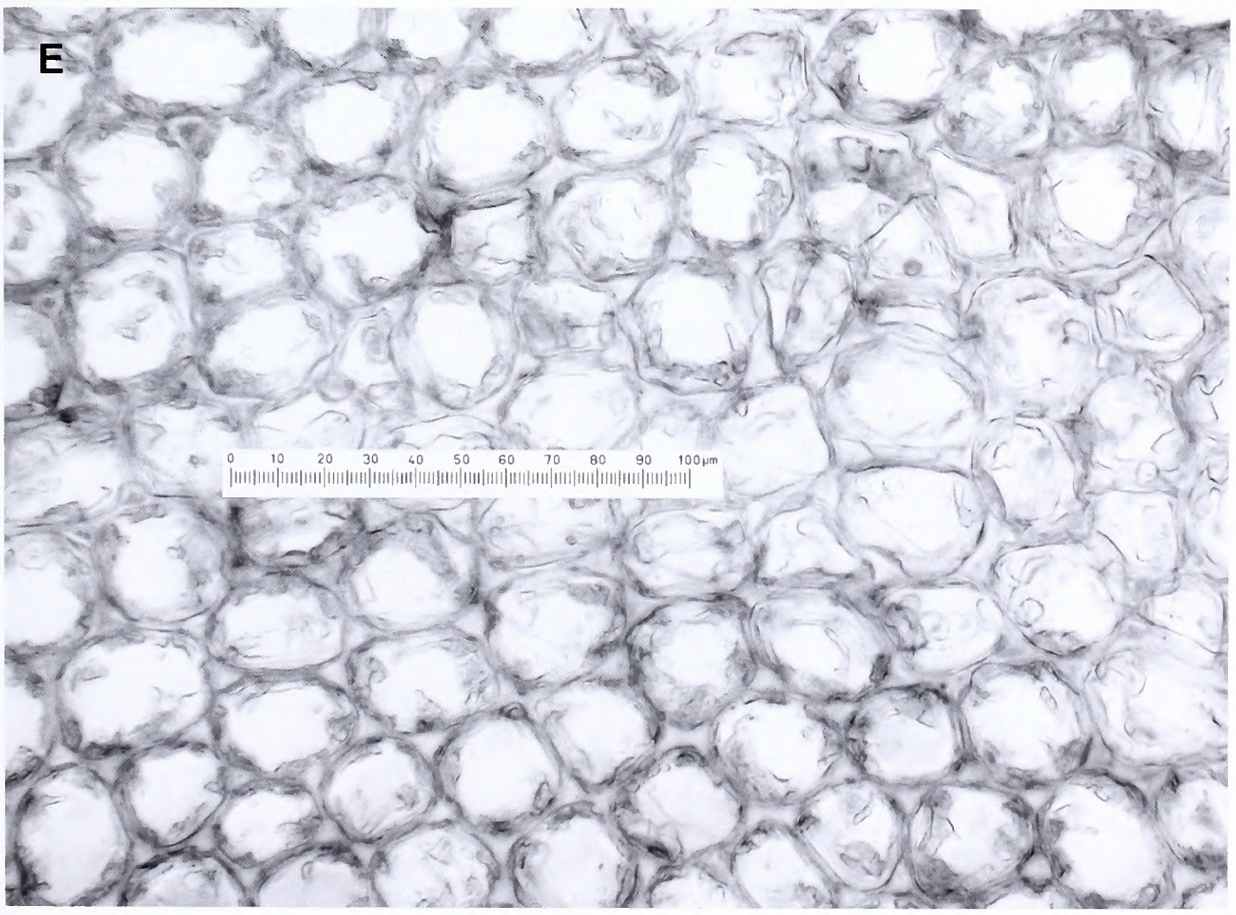
Plate 121. Barbilophozia lycopodioides. *A. Shoot. B. Leaves. C. Underleaf. D. Leaf apiculus. E. Leaf medial cells. (A–E: Lawton WTU)*


A
1 mm


B
1 mm


C
1 mm


100 µm
D


E
0 10 20 30 40 50 60 70 80 90 100µm

Distribution — *Barbilophozia lycopodioides* is circumboreal. In western North America, it is known from Alaska south to British Columbia, Alberta, Washington, Oregon, Montana, Idaho, Utah, Wyoming, and Colorado. In Oregon, *B. lycopodioides* is reported from Baker County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Faubert (2012, p. 192), Hong and Matthews (2001), Paton (1999, p. 178), Pojar and MacKinnon (1994, p. 439), Smith (1990, p. 98), Vitt et al. (1988, p. 147), Schuster (1969, p. 337), Arnell (1956, p. 92), Frye and Clark (1945, p. 428).

References with photos — Wagner (2014), Lincoln (2008, p. 105).

Blepharostoma arachnoideum M. Howe

Recent synonyms: none
Common name: spidery threadwort

Summary — A leafy liverwort with transversely inserted leaves that are completely divided into uniseriate segments and underleaves that are only slightly smaller than the lateral leaves. Terrestrial.

Diagnostic characteristics — *Blepharostoma arachnoideum* can be distinguished by its leaf lobes composed of uniseriate filaments. In the field, under a hand lens *Blepharostoma* spp. look as much like a tangle of filamentous algae as a liverwort. Close observation will reveal the divided leaves.

Technical description

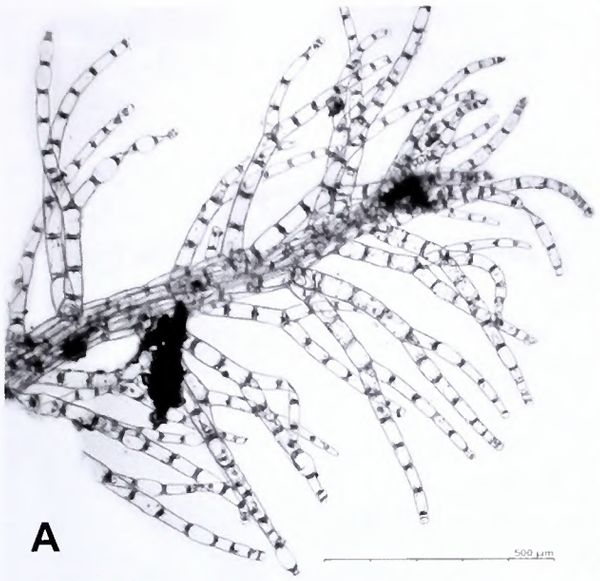
Leafy Liverwort. **Plants** tiny, with frequent, thread-like, lateral branches. **Leaves** transversely inserted, remote, divided to the base into 2–3 (rarely 4) capillary uniseriate segments that are occasionally forked a few cells above the base; leaf segment cells rectangular with the cross walls not protruding when viewed in profile. **Underleaves** similar to the lateral leaves but with fewer lobes, sometimes one lobe reduced and not as long as the other lobes of the underleaf. Gemmae frequent toward the stem apex, unicellular when dispersed, ellipsoidal, formed by budding of leaf segment tips, often forming moniliform (like a string of beads) chains of 12–18 cells.

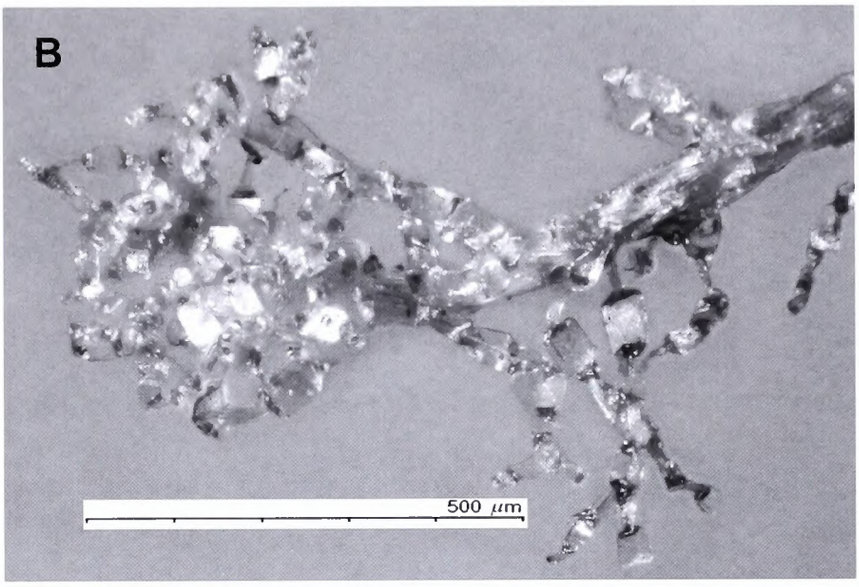
Dioicous probably. Androecia not yet described. Perianths cylindrical, similar in form to *Blepharostoma trichophyllum* but with considerably larger cells.

Similar species — Species of *Kurzia* resemble *Blepharostoma* in being very tiny plants with leaves divided into slender lobes. In *Kurzia* the leaf lobes are two cells wide at the base and not uniseriate throughout. *Blepharostoma arachnoideum* is separated from *B. trichophyllum* by its evenly thickened cell walls (with not even the cell wall junctions thickened) and frequently forked leaf segments. Its leaf segments are fewer on average, with only 2–3 per leaf in relatively robust plants (instead of the 3–4 found in a typical *B. trichophyllum*) and the forking is seen on every shoot in robust plants, so that as many as half the leaves have a forked segment in well-developed material. Forked segments, which are uncommon in *B. trichophyllum*, are seen occasionally but never on every shoot. Finally, *B. arachnoideum* frequently produces chains of unicellular gemmae while *B. trichophyllum* does not.

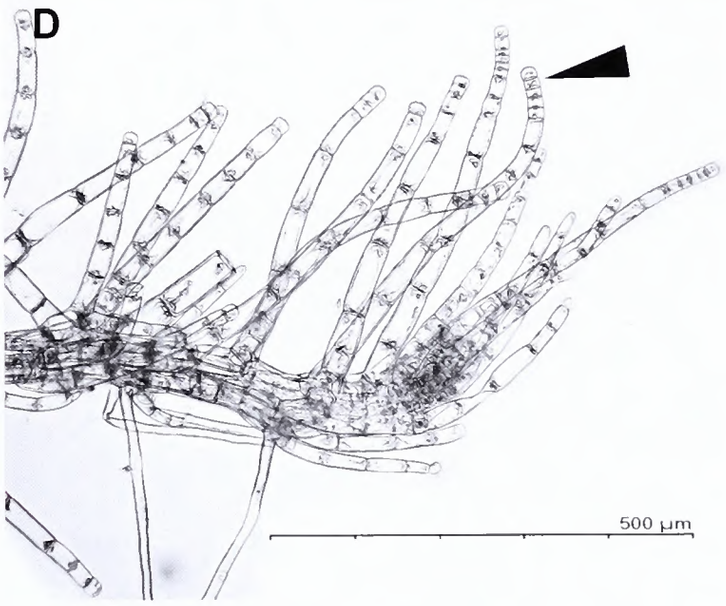
Ecology — *Blepharostoma arachnoideum* grows on rotting wood, rock or damp soil in mesic habitats at middle to higher elevations in older coniferous forests.

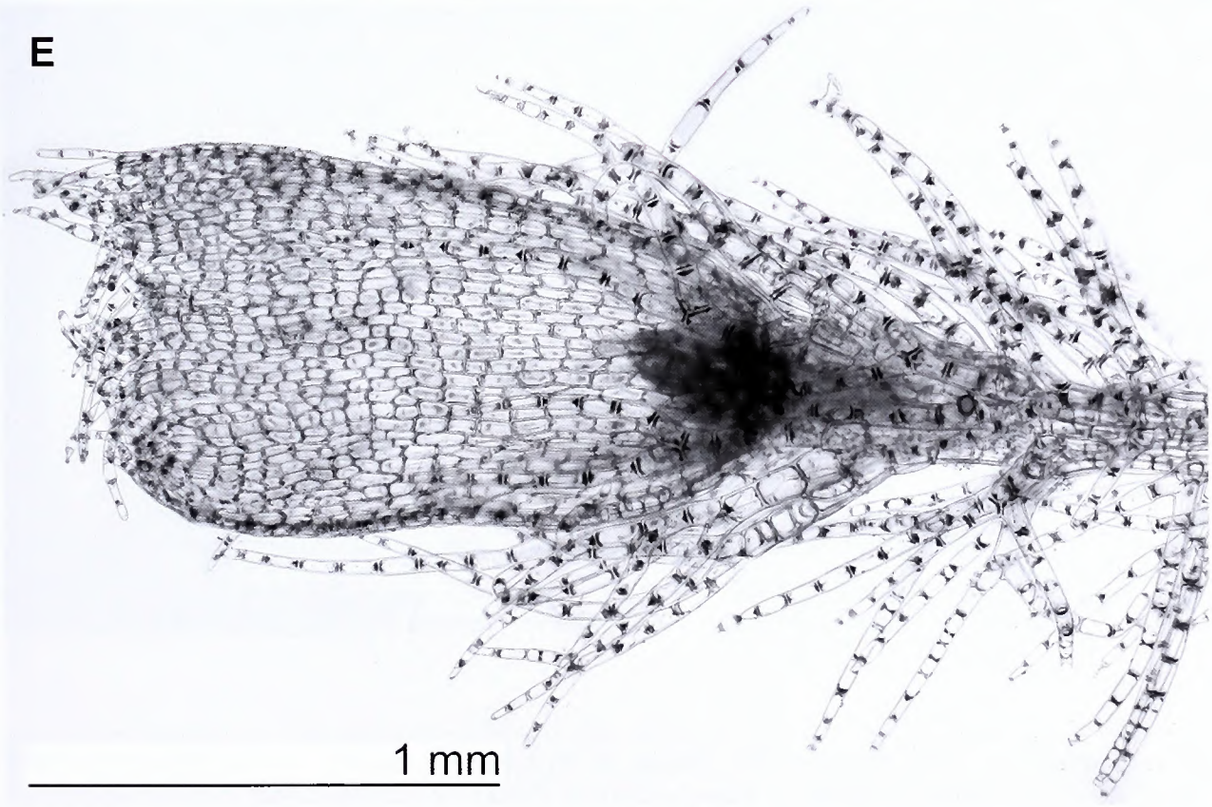
Plate 122. Blepharostoma arachnoideum. *A. Shoot, wet mount. B. Dry shoot. C. Segment bases (40x). D. Gemmiferous shoots. E. Perianth. (A: Walton 1335. UBC; B: Helliwell 9682. DHW; C: Frantz 1919. NY; D: Kofranek 4134. OSC)*


A
500 µm


B
500 µm


C
100 µm


D
500 µm


E
1 mm

Distribution — *Blepharostoma arachnoideum* is known from western North America in British Columbia, Washington, Oregon, and California. In Oregon, *B. arachnoideum* is reported from Benton, Douglas, Lane, Linn, and Multnomah counties within the Coast Range and West Cascades ecoregions.

References with descriptions and/or illustrations — Frye and Clark (1943, p. 192), Wagner (2011).

References with photos — Wagner (2014), Atherton et al. (2010, p. 77–78 for color photos of similar species: *B. trichophyllum* and *Kurzia*).

Calypogeia sphagnicola (Arnell & J. Persson) Warnstorf & Loeske

Recent synonyms: none
Common name: bog pouchwort

Nomenclatural note: *Calypogeja* is a variant spelling that has been frequently used for the genus. The conservation of *Calypogeia* was approved by the International Code of Botanical Nomenclature: Grueter et al. 1988. (Berlin Code), p. 153.

Summary — A leafy liverwort with incubous leaves that are entire or rarely shallow bilobed. The underleaves are prominent, much smaller than lateral stem leaves, and bifid to the middle. Terrestrial in sphagnum bogs.

Diagnostic characteristics — *Calypogeia sphagnicola* can be distinguished by its (1) habitat restricted to *Sphagnum*, and (2) widely spaced leaves on pale shoots.

Technical description

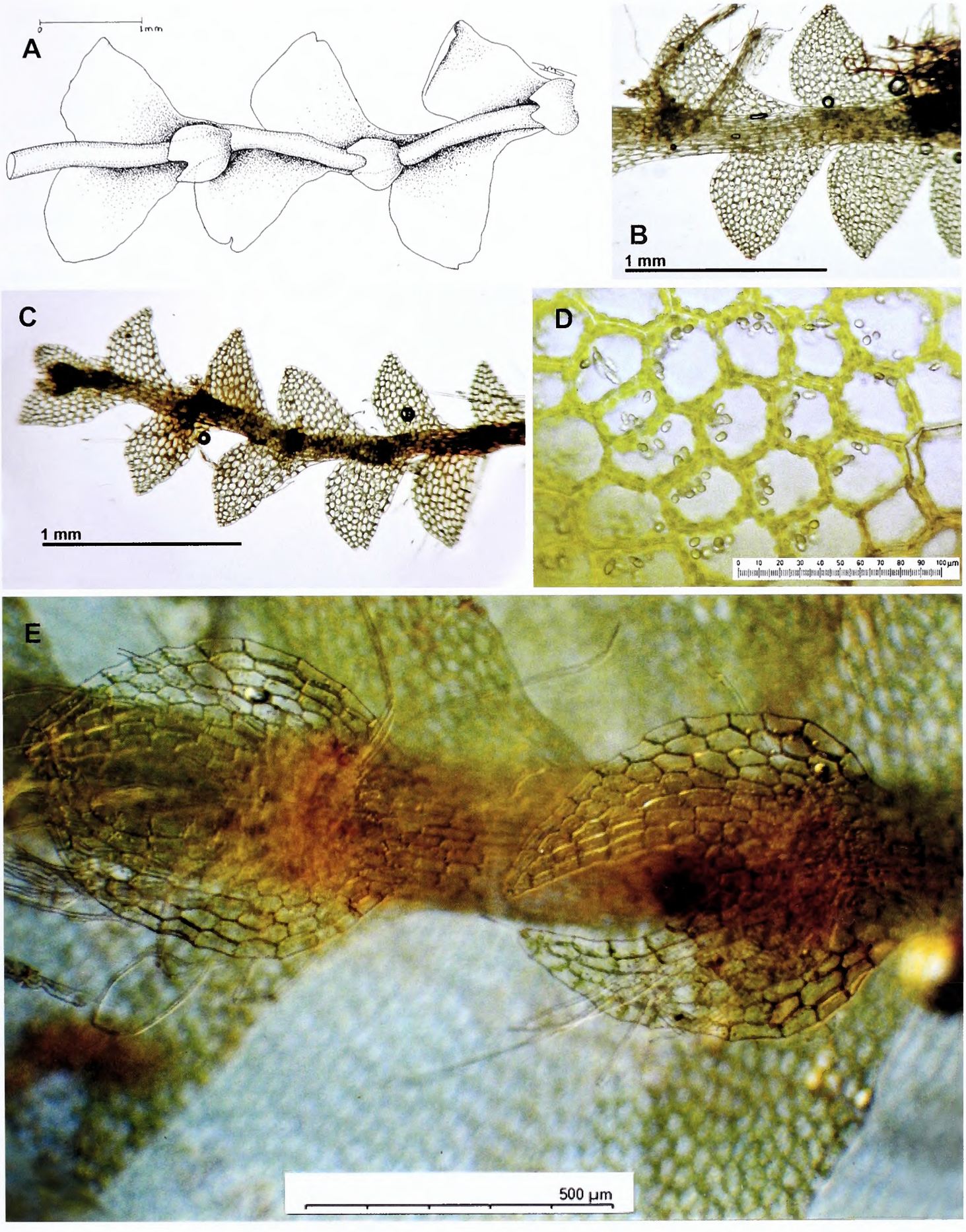
Leafy Liverwort. **Plants** pale with whitish-green shoots, occurring singly or sparsely grouped twining among *Sphagnum*. **Leaves** incubous, barely overlapping to more typically widely spaced. The margins of the leaf closest to the shoot base (proximal) spreading at a ~45° angle. Leaf apex usually pointed, rarely two-lobed. **Underleaves** bilobed (bifid), the sinus between the lobes extending one-third to halfway down the leaf, the outer margins rounded. Oil bodies usually few, composed of 1–3 segments.

Autoicous. Plants usually sterile. Androecia spicate, of 4–5 (–11) pairs of bilobed bracts; gynoecium on short lateral branch, sporophyte developing in a subterranean marsupium.

Similar species — *Calypogeia muelleriana* has rounded leaf tips, heterogeneous oil bodies composed of small globules of various sizes that look like well-chewed pieces of chewing gum, and its underleaves are only shallowly bilobed. *Calypogeia fissa,* while still pale, is darker green than *C. sphagnicola,* has more closely overlapping leaves with two small lobes or teeth at the tips, and its underleaves are deeply bifid, often with a shoulder or bump on the outer margin. *Calypogeia azurea* is pale bluish-green and live plants have striking blue oil bodies. In the Pacific Northwest, these similar *Calypogeia* species occur on soil or decaying wood in both forests and wetlands, but only rarely on *Sphagnum*.

Ecology — *Calypogeia sphagnicola* is usually restricted to poor fens containing *Sphagnum*. In Pacific Northwest North America, it usually occurs in associations of *Kalmia microphylla, Ledum glandulosum* or *L. groenlandicum*,

Plate 123. Calypogeia sphagnicola. *A. Shoot drawing. B–C. Shoots. D. Oil bodies. E. Underleaves. (A: Wagner s.n. ORE?; B, C: Norris 98859. CAS; D: Wagner m1682a. DHW; E: Wagner m0792a. DHW)*


A
0
1 mm
B
1 mm
C
1 mm
D
0 10 20 30 40 50 60 70 80 90 100 µm
E
500 µm

Myrica gale, and *Vaccinium uliginosum* in the Sitka spruce, western hemlock, and silver fir zones. Additional associated vascular plant species include *Darlingtonia californica*, *Drosera rotundifolia*, *Triantha glutinosa*, and *Trientalis europaea* subsp. *arctica*. Associated bryophytes include *Cephalozia connivens*, *C. lunulifolia*, *Mylia anomala*, *Sphagnum capillifolium*, *Sphagnum fuscum*, *S. palustre*, and *S. rubellum*. Despite being best known from acidic fen habitats, in Oregon *Calypogeia sphagnicola* also has been collected in a fen on ultramafic soils where calciphiles are sometimes found on base-rich substrates. Schuster (1953) also reported *C. sphagnicola* from calcareous microhabitats within acidic poor fens and bogs.

Distribution — *Calypogeia sphagnicola* is circumboreal and bipolar. In western North America, it is known from British Columbia, Washington, Oregon, and Montana. In Oregon, *C. sphagnicola* is reported from Clackamas, Coos, Curry, Douglas, Jackson, Lane, Lincoln, Linn and Tillamook counties within the Coast Range and West Cascades ecoregions.

References with descriptions and/or illustrations — Faubert (2012, p. 230), Lincoln (2008, p. 58), Paton (1999, p. 87), Crum (1991, p. 65), Smith (1990, p. 41), Hong (1990) p. 317), Schuster (1969, p. 133), Mueller (1957, p. 1171), Arnell (1956, p. 60), Schuster (1953, p. 541), Frye and Clark (1946, p. 680).

References with photos — Wagner (2014), Atherton et al. (2010, p. 89).

Cephaloziella hampeana (Nees) Schiffner

Recent synonyms: none
Common name: Hampe's threadwort

Summary — A tiny leafy liverwort with transversely inserted and deeply bilobed leaves. Underleaves are usually lacking on vegetative stems, but present on reproductive shoots. Terrestrial, but often occurring in wet habitats.

Diagnostic characteristics — *Cephaloziella hampeana* can be distinguished by its (1) green to brown coloration usually lacking any red color, (2) lack of underleaves on vegetative stems, (3) ovoid gemmae, and (4) growth on *Sphagnum*.

Technical description

Leafy Liverwort. **Plants** up to 12 mm long with leafy shoots to 600 um wide, pale or yellow-green to dark brown, less often reddish. **Leaves** distant or seldom contiguous, erecto-patent to patent or squarrose, or suberect, 280 µm long, bifid to 1/2 to 3/4; leaves 2–4 times as wide as the stems and with broad, pointed lobes. **Underleaves** absent on vegetative shoots and occasional on reproductive shoots. Gemmae frequent on the margins of younger leaves, ovoid 8–14 × 16–25 µm, green, purple, reddish to brown.

Autoicous. Androecia terminal on leading shoot, of 4–8 pairs of imbricate bracts, bracts larger than leaves; perianths exserted 1/3 to 2/3 of their length, oblong to cylindrical, decolorate and plicate distally, mouth crenulate-dentate with elongate cells.

Similar species — *Cephaloziella* are so small in size, that any other tiny green to brown colored species would be considered similar. Its growth on *Sphagnum* is diagnostic, although not unique. The lack of underleaves on vegetative shoots is a critical trait. Paton (1999) remarked that *C. hampeana* is "distinguished by the autoicous inflorescences associated with distant, often more or less patent to squarrose, rather broad-lobed leaves,

Plate 124. Cephaloziella hampeana. *A–B. Shoots. C. Perianth. (A–C: Wagner m2414e. OSC)*


A
0 0.1 0.2 0.3 0.4 0.5mm
B
0 0.1 0.2 0.3 0.4 0.5mm
C
0 0.1 0.2 0.3 0.4 0.5 mm

underleaves normally absent on non-fertile, non-gemmiferous shoots, the female bracts generally not or scarcely dentate, and the base of the bracts around mature perianths at least partially exposed."

Ecology — *Cephaloziella hampeana* grows on soil or rotting logs, sometimes on shaded, basic rocks on pond shores or swamps or bogs (Lincoln 2008). Less often found in rather dry places or on decaying wood, "Hampe's threadwort" normally occurs on living rather than moribund *Sphagnum*. It more often occurs on tracts, waste ground and rocky slopes and is also more tolerant of shade and wet conditions and heavy metal mine spoil and mildly basic substrates (Paton 1999).

Distribution — *Cephaloziella hampeana* is known from Eurasia, Iceland, and Central and North America. In western North America, it is known from British Columbia, Washington, Oregon, California, Idaho, and Montana. In Oregon, *C. hampeana* is reported from Harney, Jackson, Klamath and Lane counties within the Blue Mountain, Coast Range, East Cascades, and Klamath Mountain ecoregions.

References with descriptions and/or illustrations — Faubert (2012, p. 137), Paton (1999, p. 143), Hicks (1992, p. 120), Smith (1990, p. 78), Arnell (1956, p. 73), Frye and Clark (1944, p. 543).

References with photos — Wagner (2014), Atherton et al. (2010, p. 89).

Cephaloziella spinigera (Lindberg) Jørgensen

Recent synonyms: none
Common name: spiny threadwort

Summary — A leafy liverwort with succubous to transversely inserted leaves that are divided less than one-half. Underleaves are lacking or sparse. Terrestrial.

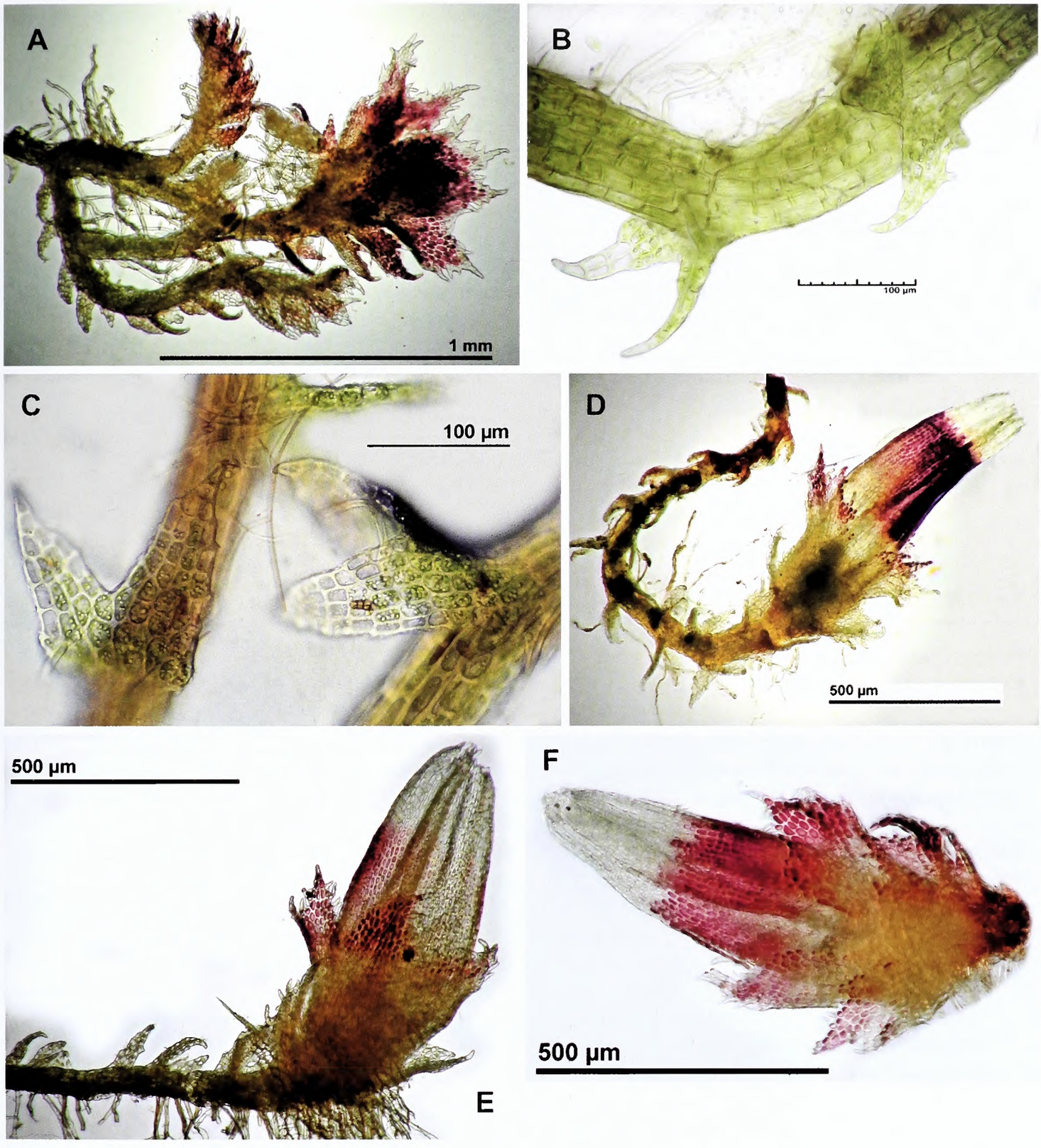
Diagnostic characteristics — *Cephaloziella spinigera* can be distinguished by its (1) very small size and bog-like habitat, (2) deeply bilobed leaves that often have small, sharp teeth near the leaf base, and (3) dentate bracts subtending the perianth.

Technical description

Leafy Liverwort. **Plants** very slender, pale green to purplish-red, creeping over other bryophytes. Shoots procumbent. **Stems** branching sparsely and irregularly, cortex on dorsal side somewhat translucent, cortical cells 26–40 (–52) µm long, 12–20 (–32) µm wide. **Leaves** on sterile stems distant, erecto-patent, transversely inserted, concave, 100–190 µm long, 64–140 µm wide; margins entire or sinuose-dentate, some with a spinose tooth near base, bilobed to 0.6–0.9; sinus acute; lobes lanceolate or narrowly lanceolate, acuminate, often incurved; base 2–4 (6) cells wide, these cells 8–13 (–16) µm wide, often thick-walled; cuticle papillose. Leaves on fertile stems dentate to spinose-dentate. **Underleaves** usually present on all shoots or sparse, subulate or bilobed, 34–80 µm long. Gemmae fairly frequent.

Autoicous. Male inflorescence terminal on short ventral branches near female or becoming intercalary successionally on long branch, spicate, often purplish red, bracts larger than leaves, imbricate, concave, often subsecund, margins toothed but not spinosely so. Female inflorescence terminal on long shoots, bracts bilobed, margins dentate but not spinosely so and teeth not recurved; cell walls strongly thickened; bracteoles

Plate 125. Cephaloziella spinigera. *A. Autoicous shoots. B. Shoot. C. Leaves with oil bodies. D–F. Gynoecium. (A, D–E: Sundberg 735. ORE; B: Stone 9070. OSC; C: Wagner 9031a. DHW)*


A
1 mm
B
100 µm
C
100 µm
D
500 µm
500 µm
E
F
500 µm

similar. Perianth ellipsoid, plicate above; mouth irregularly crenulate, cells heavily thickened, 25–125 µm long, 5–10 µm wide, 3.5–7.7 times as long as wide.

Similar species — *Cephalozia* species lack oil bodies and have stems with a hyaloderm. Other *Cephaloziella* species lack the dentate bracts below the perianth. Sterile specimens are virtually impossible to identify (Paton 1999).

Ecology — *Cephaloziella spinigera* is a bog or fen species. In Oregon it is associated with moss genera *Warnstorfia*, *Drepanocladus*, *Tomentlypnum*, and *Meesia*.

Distribution — *Cephaloziella spinigera* is widespread around the northern hemisphere in boreal and montane regions. In the western North America, it is known from Washington, Oregon, and California. In Oregon, *C. spinigera* is reported from Jackson, Klamath, and Lane counties within the Coast Range, East Cascades, and West Cascades ecoregions.

References with descriptions and/or illustrations — Faubert (2012, p. 139), Paton (1999, p. 137), Crum (1991, p. 83 & p. 204), Smith (1990, p. 74), Arnell (1956, p. 65).

References with photos — Wagner (2014), Atherton et. al. (2010, p. 104).

Gymnomitrion concinnatum (Lightfoot) Corda

Recent synonyms: none
Common names: braided frostwort, pointy whiteworm

Summary — A small leafy liverwort with julaceous and transversely inserted leaves that are shallowly bilobed. Underleaves are minute or lacking and when present anisophyllous (two different shapes or size of leaves on the same stem) compared to stem leaves and entire to shallow bilobed. Terrestrial.

Diagnostic characteristics — *Gymnomitrion concinnatum* can be distinguished by its (1) minute size, (2) densely-packed unbranched shoots with leaves in two ranks, (3) pale yellowish-brown color except for a whitish fringe on some of the lobe tips, and (4) verrucose cuticle.

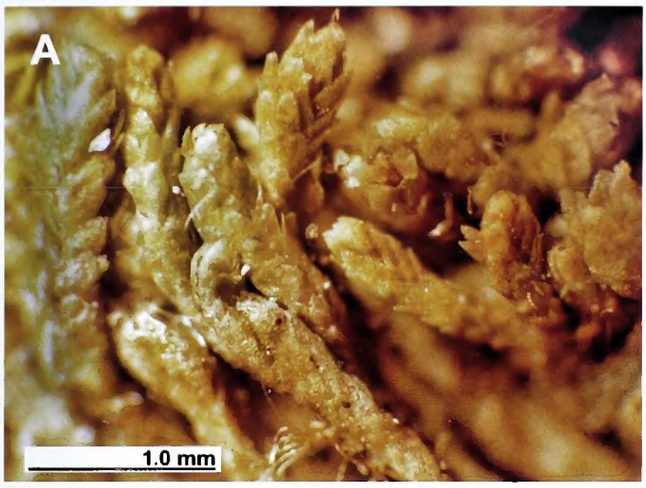
Technical description

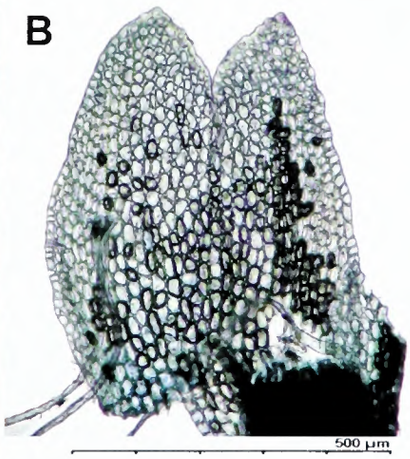
Leafy Liverwort. **Plants** erect, unbranched, 0.3–0.5 mm wide and 12–20 mm long, widening slightly near the tips like a club, yellowish-brown to dull greenish-white, forming densely packed mats. **Leaves** erect, tightly imbricate, arranged along stem in two opposite braid-like ranks, shallowly bilobed, the lobe tips acute, often sharply pointed, the margins whitish-transparent (hyaline); cuticle minutely papillose when viewed under high magnification. **Underleaves** lacking. Oil bodies from apical and marginal cells vanishing soon after collection.

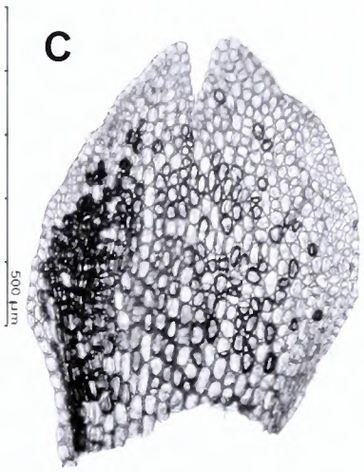
Dioicous. Sexual shoots clavate. Androecia terminal, becoming intercalary, of several pairs of imbricate, saccate bracts; perianths vestigial, perigynium lacking.

Similar species — Smaller *Marsupella* species, which resemble *Gymnomitrion,* are usually dark brown to blackish and very rarely have bleached margins on the leaves. *Gymnomitrion obtusum,* which has rounded leaf tips and is pure pale green color, has a better developed hyaline margin around the leaf tips and a smooth cuticle.

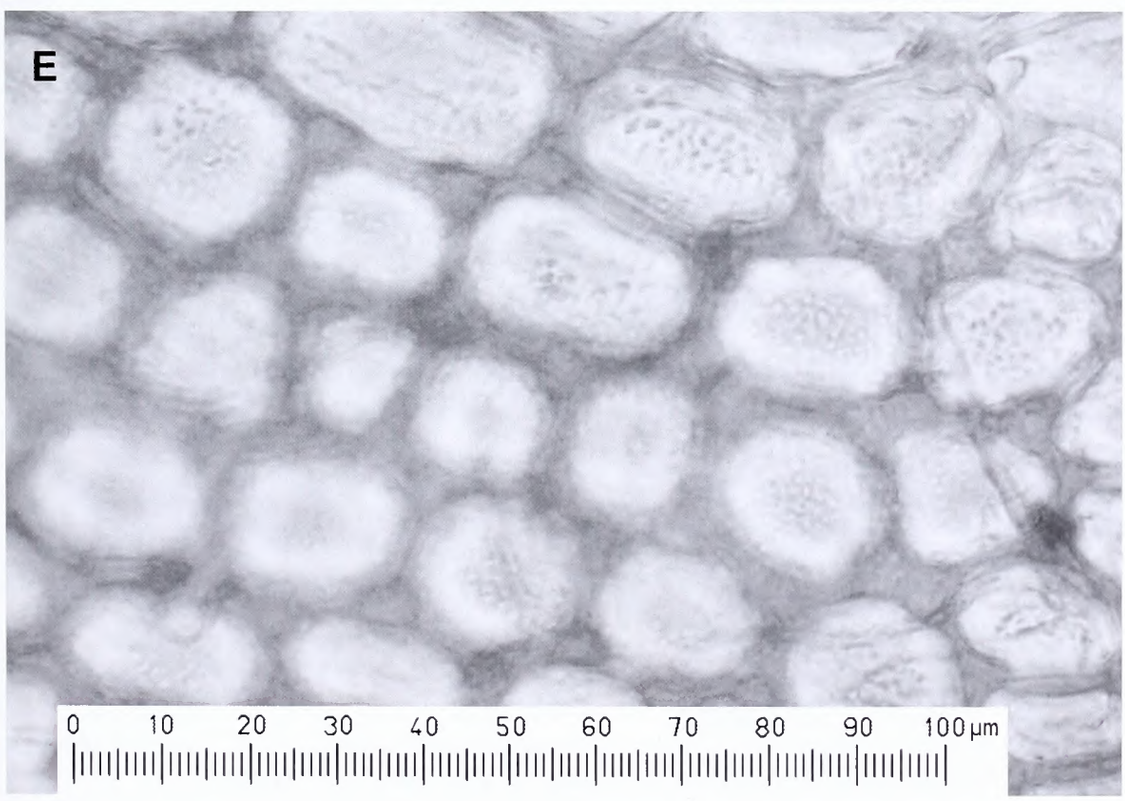
Plate 126. Gymnomitrion concinnatum. *A. Dry Habit. B–C. Leaves. D–E. Verrucose cuticle. (A: Frye 87. WTU; B–E: McCune 4568. OSC)*


A
1.0 mm


B
500 µm


C
500 µm


D
0 10 20 30 40 50 60 70 80 90 100µm


E
0 10 20 30 40 50 60 70 80 90 100µm

Ecology — *Gymnomitrion concinnatum* occurs on peaty soil on cliffs and rock outcrops in full sun or shade. Little information is available on associated bryophyte or vascular plant species. In California it has been found at 375–6,000 foot elevations (Doyle and Stotler 2006), but in Oregon and Washington it has been found only in subalpine parkland areas in *Abies lasiocarpa* and *Tsuga mertensiana* associations.

Distribution — *Gymnomitrion concinnatum* is circumboreal and bipolar and occurs in both eastern and western North America. In western North America, it is known from British Columbia, Washington, Oregon, California, and Montana. In Oregon, *G. concinnatum* is reported from Hood River, Marion, and Multnomah counties within the West Cascades ecoregion.

References with descriptions and/or illustrations — Faubert (2012, p. 264), Doyle and Stotler (2006, p. 156), Paton (1999, p. 329), Smith (1990, p. 164), Schuster (1974, p. 135), Mueller (1957, p. 796), Arnell (1956, p. 227), Frye and Clark (1943, p. 214).

References with photos — Wagner (2014), Atherton et al. (2010, p. 162), Lincoln (2008, p. 101).

Haplomitrium hookeri (J.E. Smith) Nees

Recent synonyms: none
Common name: hooker's flapwort

Summary — A leafy liverwort with isophyllous transversely inserted leaves that are irregularly ovate to rhombic. Terrestrial.

Diagnostic characteristics — *Haplomitrium hookeri* looks like a flaccid fleshy loose-leaved *Bryum*. The leaf shape is variable on a single shoot, increasing in size from base towards apex. The three rows of leaves with round leaf apices distinguishes *H. hookeri* from any other liverwort.

Technical description

> Leafy Liverwort. **Plants** occurring mostly as scattered individuals amongst other bryophytes, pale green, mostly unbranched above the soil. **Leaves:** Lower leaves distant, obliquely inserted. Upper leaves gradually increasing in size, close together and crowded at the stem apex, usually transversely inserted, concave, of varying shape, oval-lingulate-circular, towards the apex obtusely pointed, margin slightly undulate. Cells in mid-leaf, 24–40 × 36–60 µm with very thin walls, larger towards the leaf base smaller towards apex. Oil bodies 20 per cell, small, about 2 µm. **Underleaves** transversely inserted, not distinguishable from the leaves. Calyptra cylindrical, ~5 mm long. Spores spherical, green-brown, ~25 µm, densely and finely papillose.
>
> **Dioicous**. Male plants usually in separate tufts, shorter than the female plants.

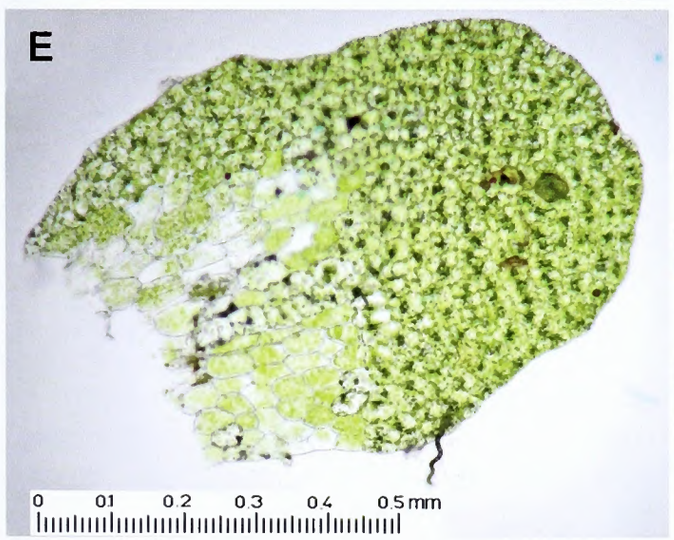
Similar species — No other liverwort species resemble *Haplomitrium hookeri*, and its similarity to the moss *Bryum* is superficial. Schofield (2002) suggests living plants look something like miniature brussel sprouts. Bartholomew-Began (2001) described how to identify *H. hookeri*, "easily distinguished from other hepatics within the flora by its (1) branched rhizomatous habit with erect leafy shoots, (2) descending, leafless stolons, and (3) the absence of rhizoids. In addition, *H. hookeri* is further distinguished by the production of a true calyptra in

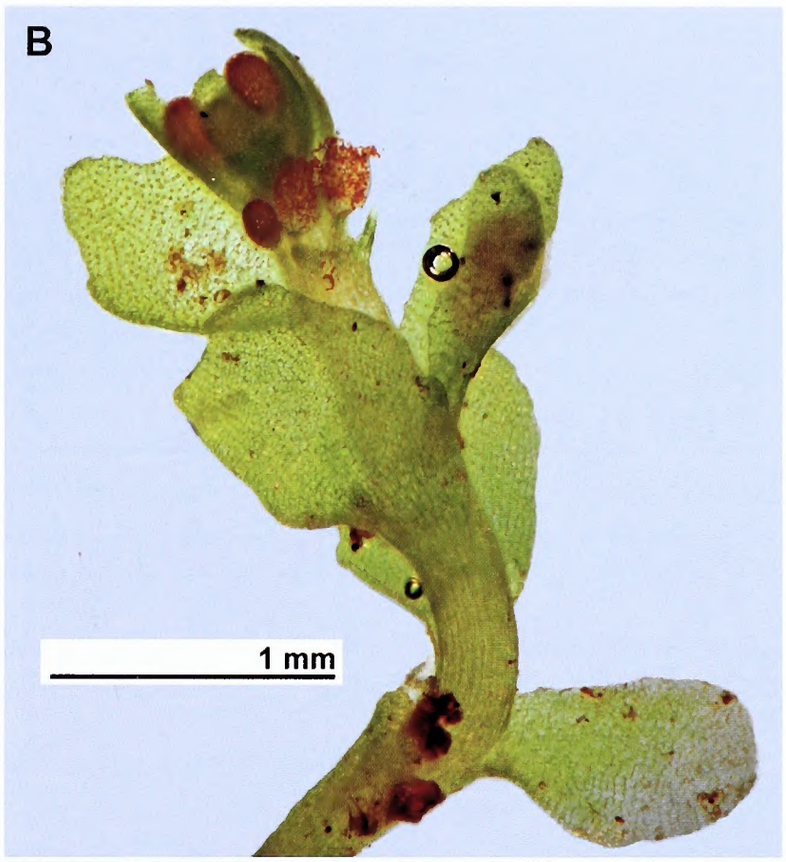
Plate 127. Haplomitrium hookeri. *A. Shoot. B. Male shoot. C. Shoot with calyptra and capsule. D–E. Leaves. F. Antheridia dehiscing. G. Spores and elaters. (A: Wagner m2174b. DHW; B–G: Wagner m2414d. OSC, UC, DHW)*


A
1 mm


C


D
0 01 0.2 0.3 0.4 0.5mm


E
0 01 0.2 0.3 0.4 0.5mm


B
1 mm


F
0.2 0.3 0.4 0.5mm


G

lieu of a perianth, and massive sporophyte in which the capsule wall is unistratose with each cell traversed by a single annular longitudinal band." This leafy liverwort is difficult to notice in the field because it usually grows entangled as scattered shoots among other liverworts.

Ecology — *Haplomitrium hookeri* grows on soil in full sun intermixed with other bryophytes (especially liverworts and hornworts). At one montane site in Oregon it was growing in a cushion of *Lophozia opacifolia.* At the Oregon coast it formed individual strands in a dense mat of *Anthoceros punctatus*, *Phaeoceros carolinianus*, and *Blasia pusilla* and was most closely associated with the hornworts. That low elevation coastal site is unusual, as *H. hookeri* is otherwise known from "late-snow areas near or above tree line in mountains" (Schofield 2002; Bartholomew-Began 2001), although Atherton et al. (2010) report it from dune slacks. Populations are usually sparse, except for an extensive population in the Mt. Baker region of Washington state where it occurs at the edge of boulders on Mt. Baker.

Distribution — *Haplomitrium hookeri* is widespread but irregularly distributed over temperate and boreal regions in both northern and southern hemispheres. In western North America, it reaches its southern limit in Oregon. In Oregon, *Haplomitrium hookeri* is reported from Lane County within the Coast Range and West Cascades ecoregions.

References with descriptions and/or illustrations — Paton (1999, p. 36), Smith (1990, p. 10), Worley (1969), Arnell (1956, p. 35), Frye and Clark (1943, p. 171).

References with photos — Wagner (2014), Atherton et al. (2010, p. 72).

Harpanthus flotovianus (Nees) Nees

Recent synonyms: none
Common name: great mountain flapwort

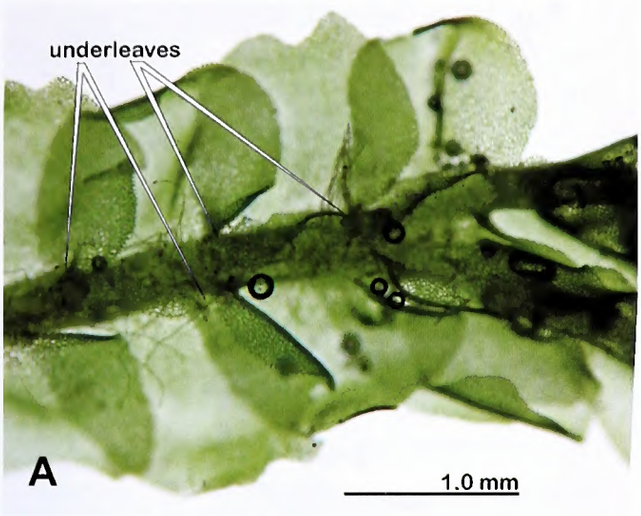
Summary — A leafy liverwort with succubous leaves lobed less than one-half. Underleaves are anisophyllous compared to stem leaves and are entire to bilobed. Terrestrial.

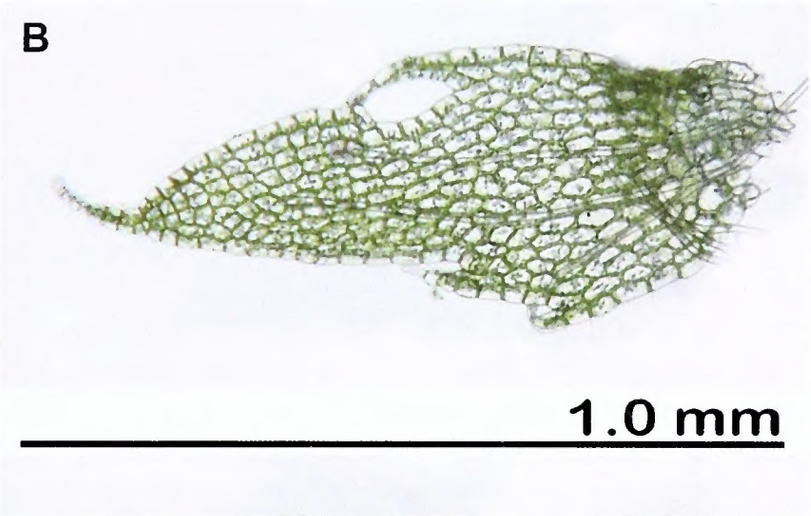
Diagnostic characteristics — *Harpanthus flotovianus* can be recognized by its (1) regularly bilobed leaves, which have a peculiar asymmetry that is difficult to describe but easily recognized once observed and learned, (2) shallow sinus on rounded-obtuse lobe tips, (3) prominent lanceolate underleaves, and (4) teeth or cilia on the underleaf margins.

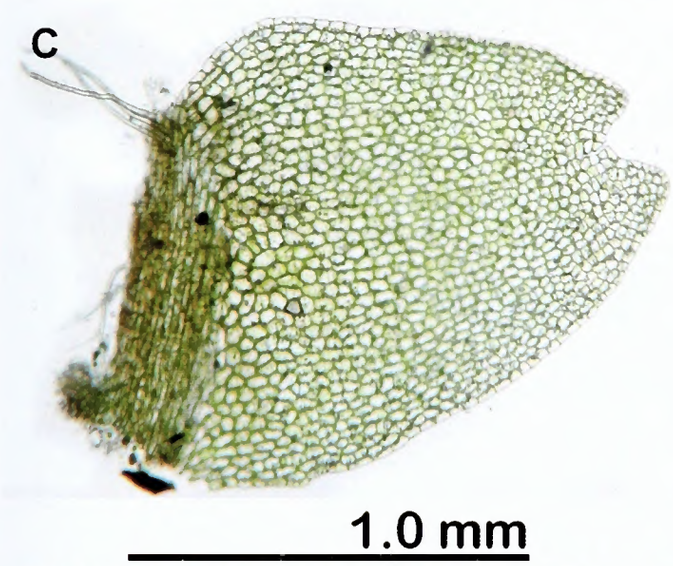
Technical description

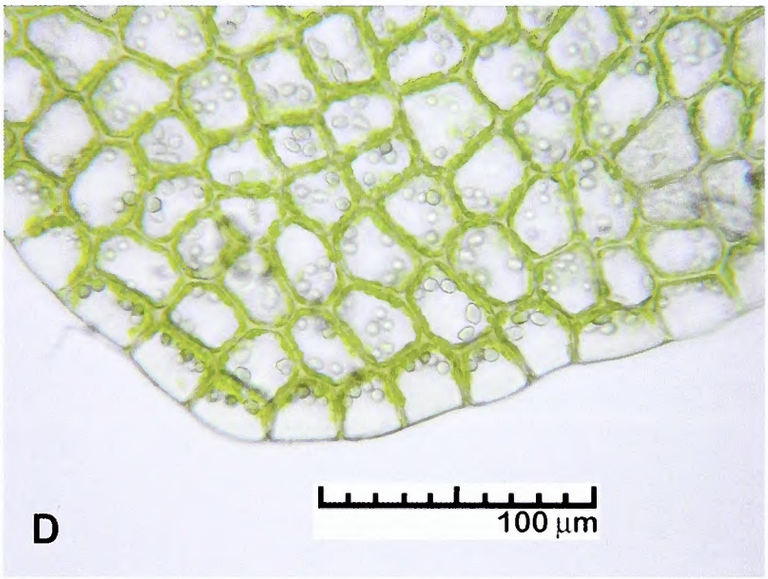
Leafy Liverwort. **Plants** with flaccid shoots, 2–10 cm long and ~1.5 mm wide; pale green (seldome pure green) to (more often) brownish olive-green, somewhat shiny. **Stems** procumbent to ascending, sparsely branched. Rhizoids numerous, long. **Leaves** rather distant, very obliquely (almost longitudinally) inserted, horizontally spreading, reflexed, long decurrent, asymmetrically ovoid, sinus shallowly lunate, lobes obtuse and not sharply pointed. Marginal cells ~20 µm (in leaf center ~30 µm), walls colorless, somewhat thickened, trigones more or less large. Oil bodies 3–4 per cell, spherical oval, about 4 µm, brownish, granular. **Underleaves** of the same width or somewhat narrower than the stem, to 0.5 mm long, variably shaped but mostly long and narrowly pointed from an ovoid base, somewhat spreading from the stem, apex incurved, margin entire or somewhat dentate-ciliate.

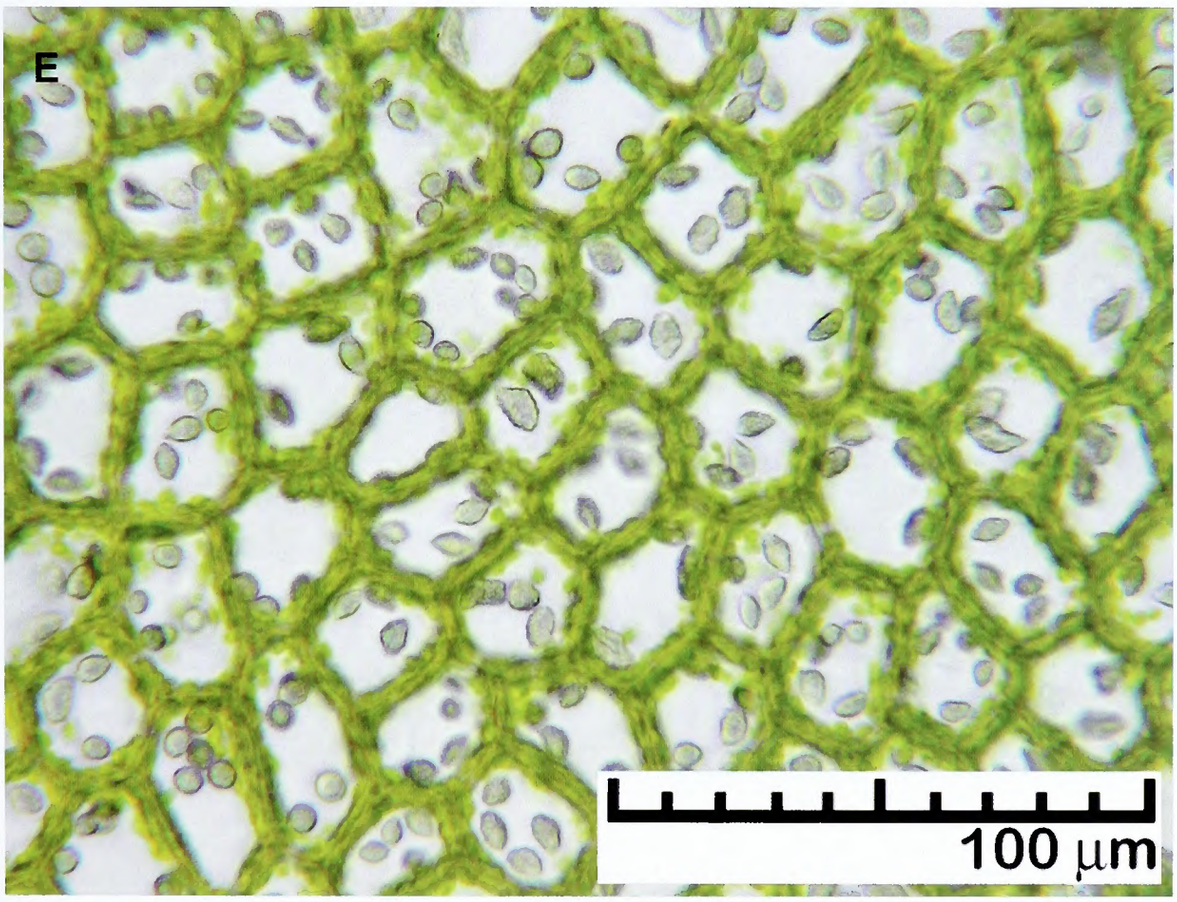
Plate 128. Harpanthus flotovianus. *A. Shoot, ventral view with underleaves. B. Under leaf. C. Leaf. D. Leaf apex. E. Cells with oil bodies. (A–E: Wagner m1774. DHW)*


underleaves
A
1.0 mm


B
1.0 mm


C
1.0 mm


D
100 µm


E
100 µm

Dioicous. Female bracts small, in 2–3 pairs, with mostly 2–3 acute lobes. Perianth large, up to 3 mm long, cylindrical, slightly curved, apex deeply lobed, wall of the base several cells thick. Androecia stout, ovoid, ventrally situated in axils of underleaves, bracts bilobed, small and concave. Spores 12–14 µm, elaters 12 µm wide. Gemmae unknown (or in British Isles occasional).

Similar species — Smith (1990) noted that *Harpanthus flotovianus* is "only likely to be mistaken for a *Chiloscyphus polyanthus, Lophocolea*, or a large *Leiocolea*, (a section of *Lophozia*) from all of which it differs in underleaf shape." *Harpanthus flotovianus* also resembles *Geocalyx*, which has bifid underleaves and is a soft, fleshy green contrasting with the more brownish-green coloration of *H. flotovianus*. Additionally, in Oregon, *Geocalyx* species are usually found only at lower elevations below 3,000 feet, while *H. flotovianus* is a montane species.

Ecology — *Harpanthus flotovianus* is a typical bog and fen species found usually above 3,000 feet. In Oregon, *H. flotovianus* is associated with such moss genera as *Drepanocladus*, *Meesia, Tomenthypnum*, and *Warnstorfia*. According to Hong (1993), *H. flotovianus* "occurs on moist humus, soil covered rocks and decaying wood in forests and is frequently associated with *Cephalozia bicuspidata* and *Scapania undulata*."

Distribution — *Harpanthus flotovianus* is widespread in boreal and montane regions of the northern hemisphere. In western North America, it reaches the southern limit of its range in Washington and Oregon. In Oregon, *H. flotovianus* is reported from Deschutes, Douglas, Grant, Klamath, and Lane counties within the Blue Mountain and West Cascades ecoregions.

References with descriptions and/or illustrations — Faubert (2012, p. 255), Schofield (2002, p. 118), Paton (1999, p. 405), Smith (1990, p. 215), Arnell (1956, p. 159 as *H. flotowianus*).

References with photos — Wagner (2014).

Herbertus aduncus (Dickson) Gray subsp. *aduncus*

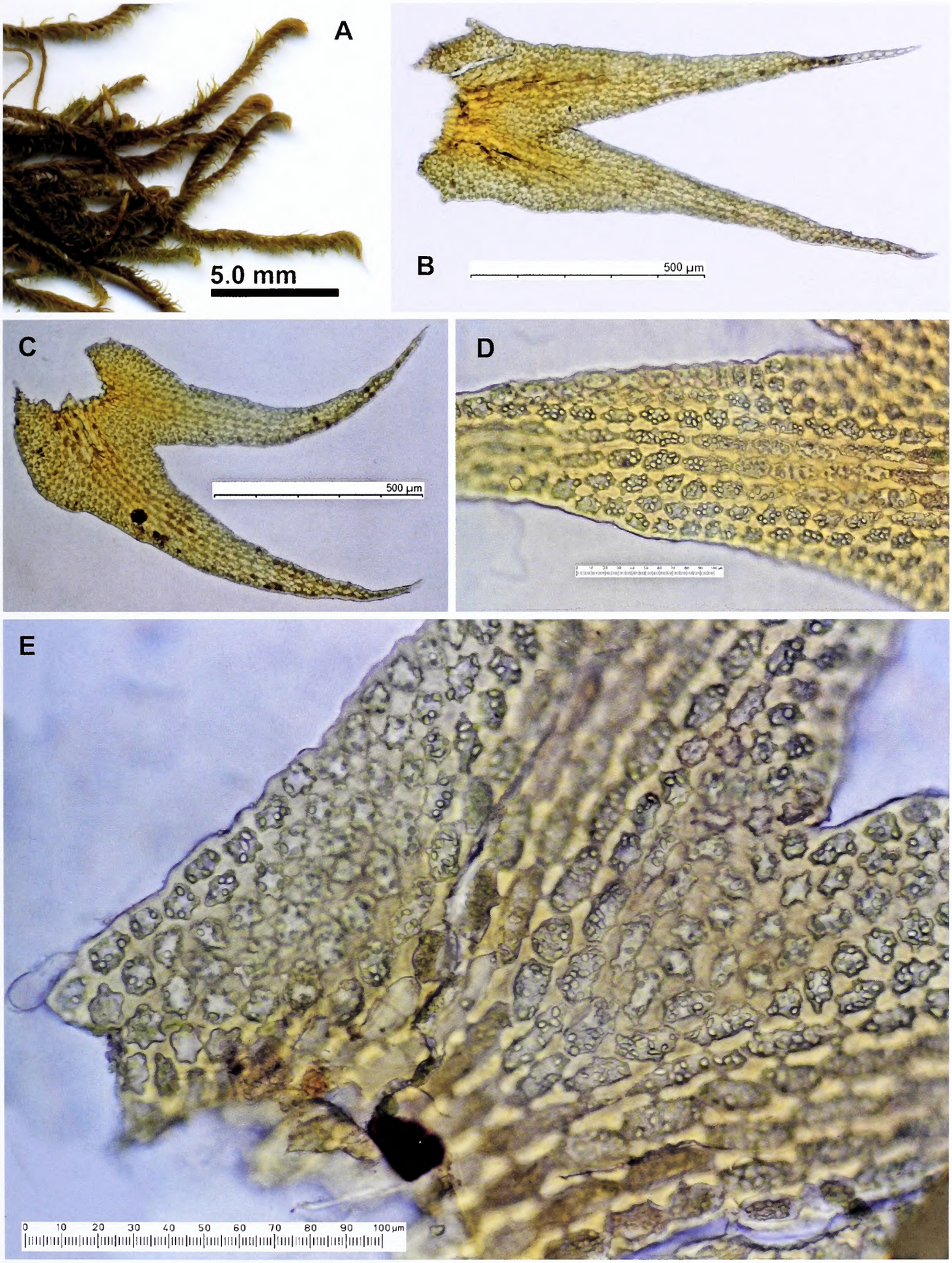
Recent synonyms: none
Common names: common scissorleaf, red prongwort

Taxonomic note: *Herbertus aduncus* has been treated under a number of different names, some synonyms and some misapplied. According to Schofield (2007a), the taxon present in our area is subspecies *aduncus*. Smith (1990) noted Schuster (1966) recognized three subspecies—*H. aduncus* subsp. *aduncus* from Japan and western North America, subsp. *hutchinsiae* from oceanic Europe, and subsp. *tenuis* (Evans) Miller and Scott from the Appalachians—but adds (somewhat uncertainly) that they are distinct.

Summary — A leafy liverwort with transversely inserted leaves that are deeply divided into two lobes (bifid) to below the middle. The underleaves scarcely differing from the lateral leaves, but bifid to the middle. Terrestrial on moist rock walls in Oregon, epiphytic to the north.

Diagnostic characteristics — *Herbertus aduncus* is distinguished by the three rows of bifid leaves, which make the genus unmistakable among liverworts. The slender lobes cause *H. aduncus* more likely to be mistaken for a moss.

Plate 129. Herbertus aduncus ssp. aduncus. *A. Dry habitat. B. Underleaf. C. Leaf. D. Oil bodies in vitta. E. Oil bodies in leaf base. (A–E: Wagner m1108. OSC)*


A
5.0 mm
B
500 µm
C
500 µm
D
E
0 10 20 30 40 50 60 70 80 90 100 µm

Technical description

LEAFY LIVERWORT. **Plants** brownish to red-brown (sometimes dark green or wine-red), in turfs. **Stems** erect to reclining, sometimes unbranched or irregularly sparsely branched and sometimes with numerous flagelliferous branches; main stems 1–10 cm. **Leaves** asymmetrically or symmetrically bilobed with lobes narrow, 4–7 times as long as wide, vitta of elongate cells strong, extending to midleaf or beyond, leaves imbricate, secund, occasionally somewhat squarrose. Oil bodies averaging 7–13 per cell. **Underleaves** are similar to stem leaves.

Dioicous. Androecia apical, of 4–8 pairs of deeply bilobed bracts, concave at the base and not as deeply lobed as leaves; perianths ovoid, divided into slender lobes.

Similar species — *Herbertus dicranus* is the only other *Herbertus* species occurring in western North America,. *Herbertus aduncus* is slightly smaller than *H. dicranus* and has more deeply divided leaves (greater than 0.7) that are parallel to the base and with underleaves that differ only slightly from the lateral leaves.

Ecology — *Herbertus aduncus* is epiphytic in the northern part of its range, where it is found in cool moist sites in a variety of forest types. In British Columbia and Washington it often occurs as an epiphyte on shrubs and trees in wetlands. It is found only on cliffs in Oregon where it associates primarily with mosses and other liverworts. The plants are quite brittle and dispersal is probably due to fragmentation. Sporophytes, which have been found only on epiphytic plants, appear in late spring to summer.

Distribution — *Herbertus aduncus* is known from Asia and western North America. It is fairly abundant from Alaska south through British Columbia, Washington, and reaching the southern extent of its range in Oregon. In Oregon, *H. aduncus* is reported from Clatsop and Multnomah counties within the Coast Range and West Cascades ecoregions.

References with descriptions and/or illustrations — Schofield (2007a), Juslen (2004), Schofield (2002, p. 121), Smith (1990, p. 16), Arnell (1956, p. 46 as *Herberta adunca*), Macvicar (1926, p. 348).

References with photos — Wagner (2014).

Herbertus dicranus (Taylor) Trevisan

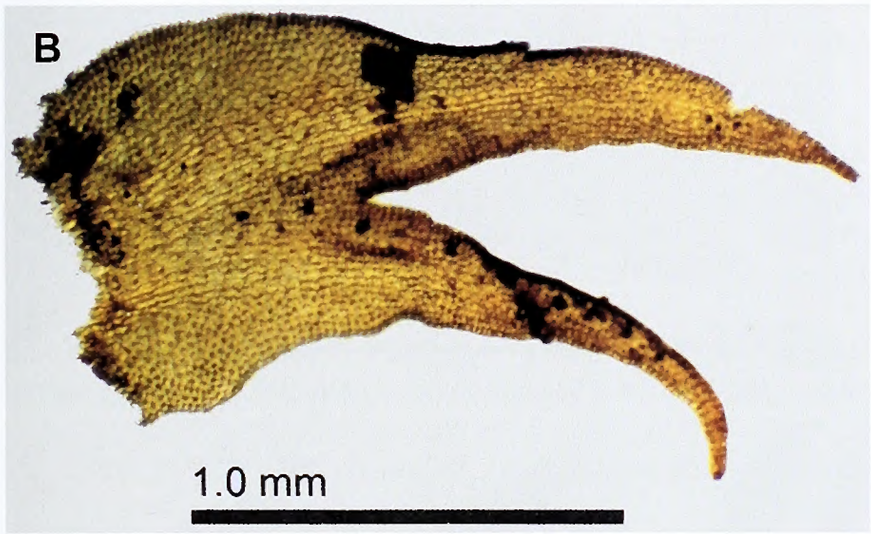
Recent synonyms:
Herbertus sakuraii (Warnstorf) S. Hattori
Herbertus lonchobasis H.A. Miller
Herbertus wichurae Stephani
Common names: pacific scissorleaf, pacific prongwort

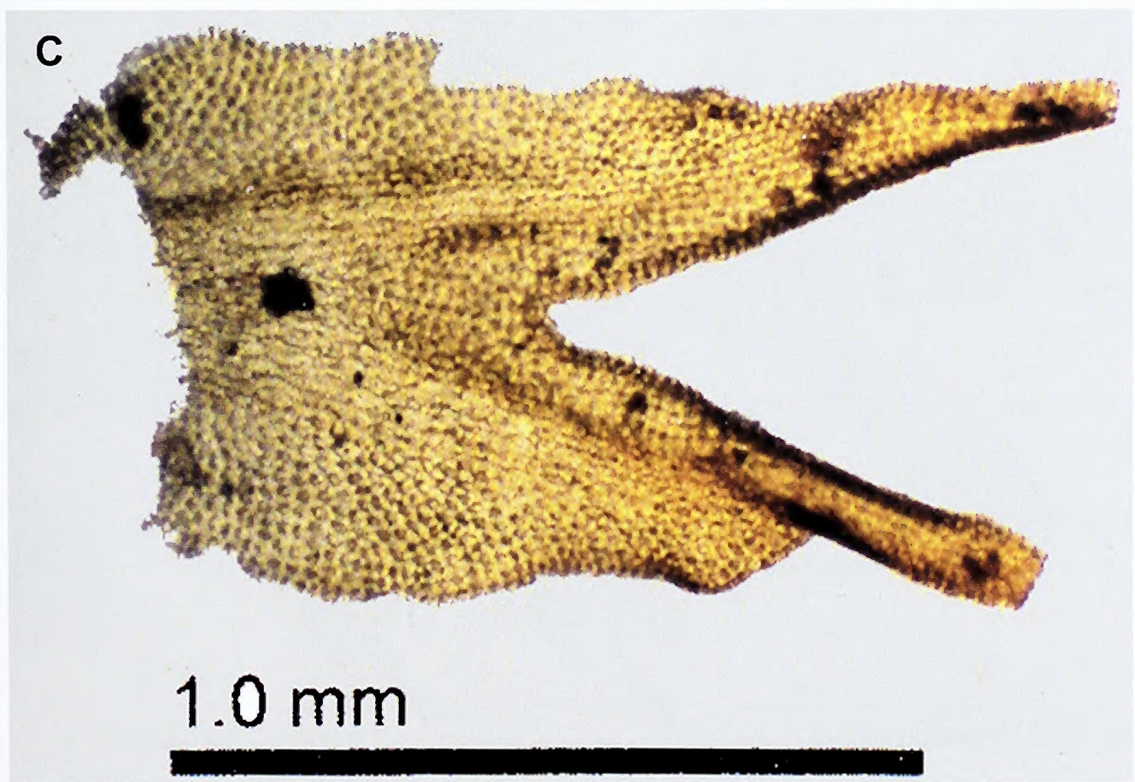
Taxonomic note: This species was known in our area as *Herbertus sakuraii* until it was synomized under *H. dicranus* by Hodgetts (2003).

Summary — A leafy liverwort with transverse inserted leaves that are deeply bifid nearly to the middle. The underleaves are similar to the lateral leaves but slightly broader and also bifid to the middle. It is terrestrial in Oregon and known as an epiphyte northward.

Plate 130. Herbertus dicranus. *A. Dry habitat. B. Leaf. C. Underleaf. (A,B: Schofield 68047. UBC; C: Schofield 72298. UBC)*


A
1 mm


B
1.0 mm


C
1.0 mm

Diagnostic characteristics — *Herbertus* species are easily identified by the isophyllous shoots with deeply bilobed leaves. See *H. adnexus* for additional information.

Technical description

LEAFY LIVERWORT. **Plants** in tall or short loose or tight turfs of erect to suberect shoots, 1–20 cm long, rusty-brown to occasionally vinaceous (wine-red) or nearly black. **Stems** unbranched, occasionally irregularly or densely branched and sometimes with flagelliferous branches on the underside of the plant (postical). **Leaves** asymmetrically lobed, usually closely imbricate, falcate-secund, especially on main shoots, almost transversely inserted, 2–3 times as long as wide, with lobes 1/2 or less of leaf length, broadly lanceolate; leaf base margin on the upper side of the plant (antical) usually bulging to nearly auriculate, often with marginal downward pointing teeth and slime papillae; vitta extending 2/3 length of lobes; cuticle smooth. Specialized asexual reproduction by way of brittle shoots. **Underleaves** similar, but broader than the stem leaves.

Dioicous. Androecia apical, of 4–8 deeply bilobed bracts; perianths ovoid, divided into slender lobes.

Similar species — Only *Herbertus adnexus* could be confused with *Herbertus dicranus*. In *H. dicranus* the leaves are bilobed for one-half or less of the leaf length while in *H. adnexus* the leaves are lobed to 2/3 of the leaf length. In *H. dicranus* the leaf margins strongly bulge at the base but do not bulge at the base in *H. adnexus*. The underleaves of *H. dicranus* tend to be relatively broader than the lateral leaves, while the underleaves of *H. adnexus* are similar to the lateral leaves.

Ecology — *Herbertus dicranus* grows with mosses and other liverworts and is often associated with *Plagiochila* or *Bazzania* at elevations between 3,000–6,000 feet. *Herbertus dicranus* is mostly terrestrial but is also found as an epiphyte. Substrates identified by Juslen (2004) include dry to moist and open to shaded cliffs, outcrops, boulders, tree trunks, tree bases, dead trees, bushes, rotten stumps, decorticated trees, and twigs.

Distribution — *Herbertus dicranus* is known from Asia, Hawaii, and western North America in British Columbia, Washington and Oregon. In Oregon, *H. dicranus* is reported from Clatsop County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Schofield (2007a), Schofield (2002, p. 121), Juslen (2004).

References with photos — Wagner (2014).

Hygrobiella laxifolia (Hooker) Spruce

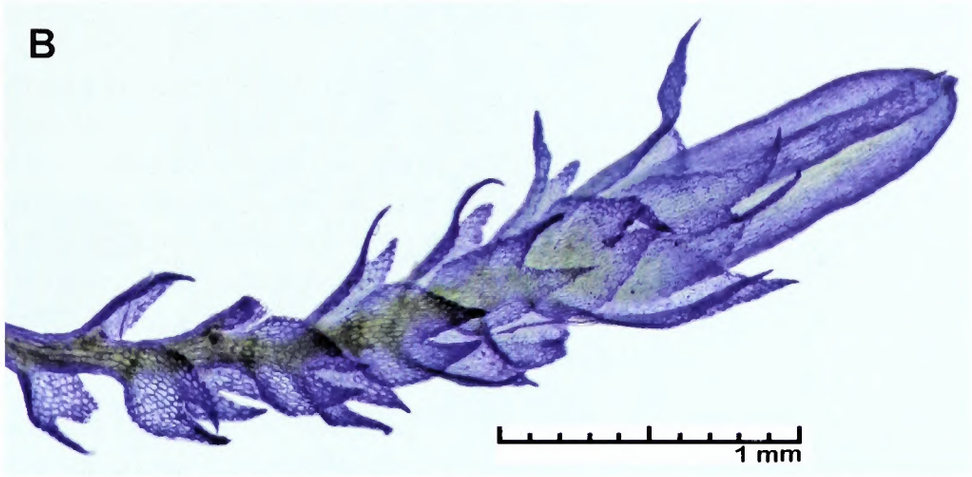
Recent synonyms: none
Common name: lax notchwort

Summary — An isophyllous leafy liverwort with transversely inserted leaves that are less than one-half bifid. Oil bodies are lacking. Terrestrial.

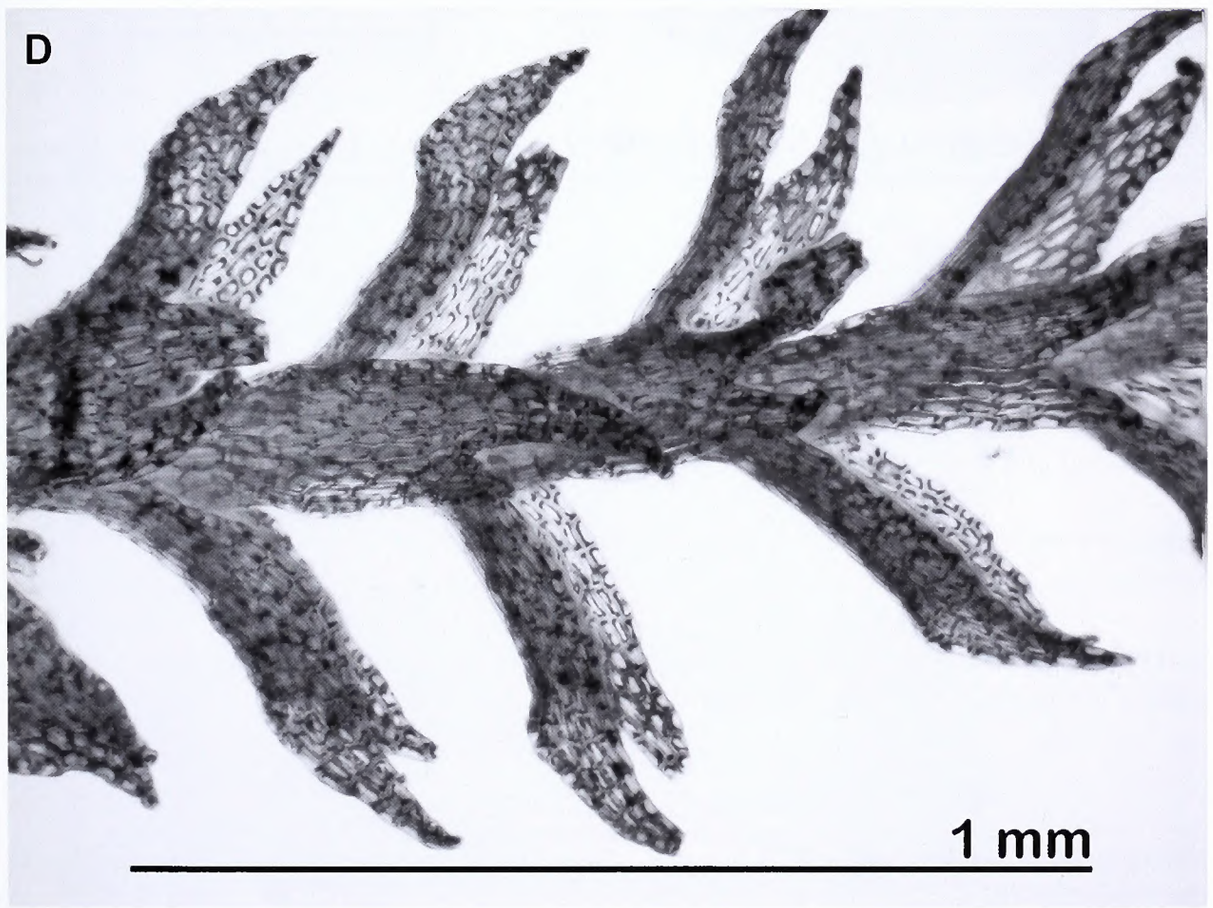
Diagnostic characteristics — *Hygrobiella laxifolia* can be distinguished by its (1) lack of oil bodies, (2) isophyllous shoots, and (3) conspicuous underleaves that are bilobed to one-fourth the leaf length.

Plate 131. Hygrobiella laxifolia. *A. Vegetative shoot. B. Perianth. C. Lateral male shoot. D. Ventral view of shoot. (A–D: Thomas s.n. DHW)*


A


B
1 mm


C
1 mm


D
1 mm

Technical description

Leafy Liverwort. **Plants** prostrate or procumbent to erect in patches, olive-green to olive-brown or reddish-brown to blackish. **Stems** 5–20 mm usually unequal, the ventral the larger, narrow, acute to obtuse; sinus descending 1/4 to 1/2 the leaf length, narrow, acute 1 mm long, suberect, filiform; normal branches lateral, ascending; flagella from near base, with small or no leaves; rhizoids scarce, short, on the stem base and flagella. **Leaves** alternate, transversely inserted, not decurrent, distant except imbricate near tip of fertile stem, erect-spreading to spreading, simply bilobed, lanceolate to elliptic, up to 1 mm long, larger toward the tip of the stem, minute toward the base, roundedly concave ventrally, flaccid. **Underleaves** common, large, resembling the lateral leaves but somewhat smaller and more irregular in form, up to 1 mm long, a few sometimes not lobed.

Dioicious. Male inflorescences terminal, near the middle of the shoot, or terminal on short shoots. Female inflorescences terminal on stem or normal branches; female bracts similar to the leaves.

Similar species — *Hygrobiella laxifolia* is distinguished from all other Cephaloziaceae with bilobed leaves by its lateral intercalary branches, frequent postical microphyllous flagella, and underleaves nearly the same as lateral leaves.

Ecology — *Hygrobiella laxifolia* is known from rock crevices or depressions near streams, often irrigated by seepage, in the splash zone, or within the spray zone of waterfalls in alpine and subalpine habitats.

Distribution — *Hygrobiella laxifolia* is known from Eurasia, Greenland, and North America. In western North America, it is known from British Columbia, Alberta, Washington, Oregon, Idaho, and Montana. In Oregon, *H. laxifolia* is reported from Marion County within the West Cascades ecoregion.

References with descriptions and/or illustrations — Faubert (2012, p. 127), Schofield (2002, p. 123), Paton (1999, p. 126), Smith (1990, p. 65), Arnell (1956, p. 222), Frye and Clark (1943, p. 185).

References with photos — Wagner (2014), Atherton et al. (2010, p. 101).

Jamesoniella autumnalis var. *heterostipa* (A. Evans) Frye & L. Clark

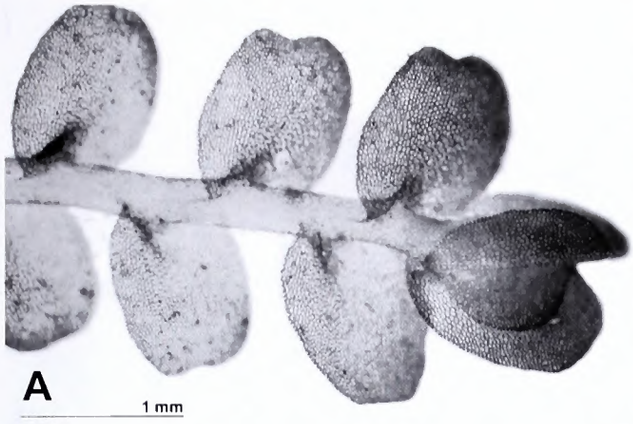
Recent synonyms: none
Common name: Waldo Lake liverwort

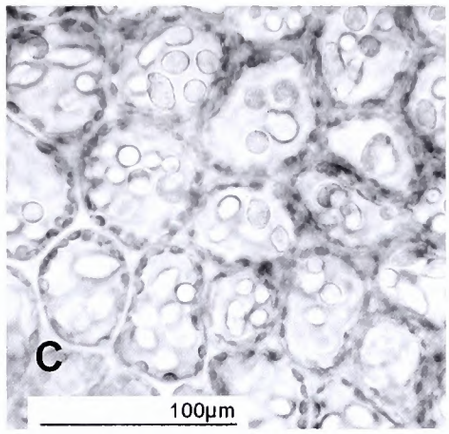
Taxonomic note: There are unresolved taxonomic issues regarding the use of the name *Jamesoniella autumnalis* var. *heterostipa* and whether this variety represents a distinct taxon. Schuster (1969) and Hicks (2003) interpreted it as merely a deep-water ecotype of the widespread *J. autumnalis*. It is quite likely *J. autumnalis* var. *heterostipa* does not apply to the Waldo Lake plant at all and may represent an undescribed taxon.

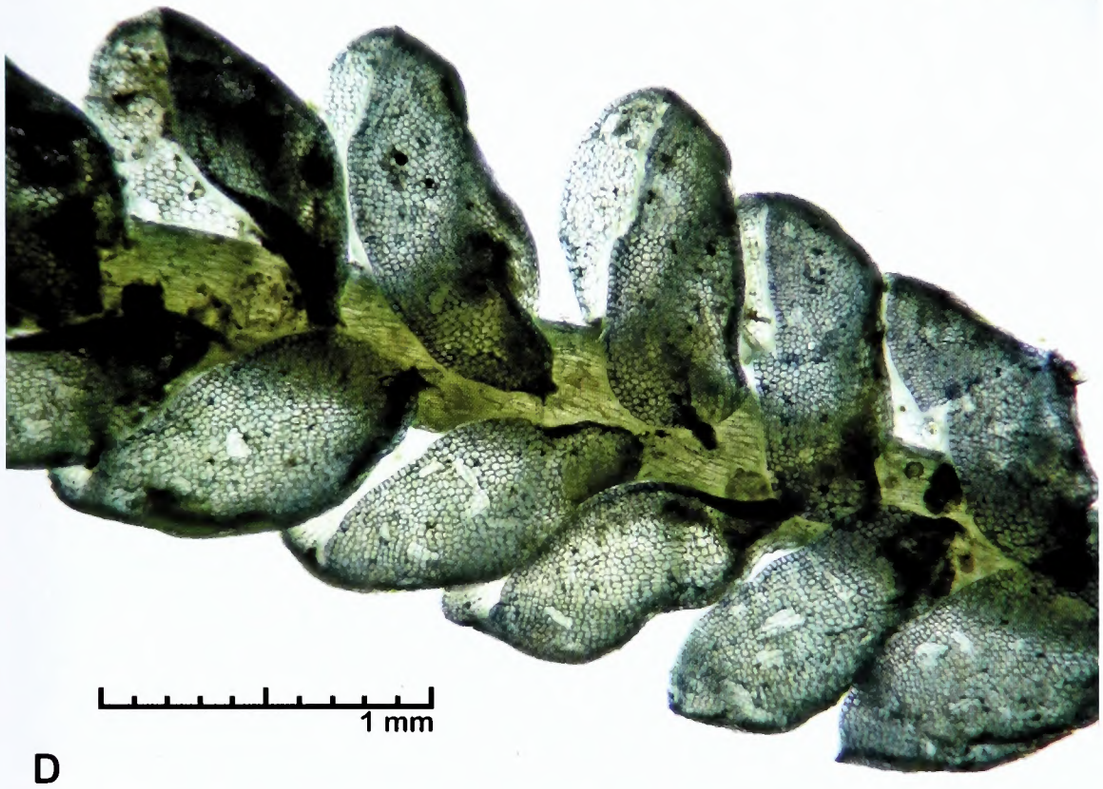
Summary — A leafy liverwort with succubous entire round to ovate leaves and underleaves that are smaller than the stem leaves. Aquatic.

Diagnostic characteristics — *Jamesoniella autumnalis* var. *heterostipa* can be distinguished by its (1) submerged aquatic habit, (2) regular but sporadically occurring large underleaves, (3) 5% of the leaves with a truncated or

Plate 132. Jamesoniella autumnalis var. heterostipa. *A–B. Shoots. C. Oil bodies. D. Male shoot, dorsal view. E. Male shoot, ventral view. (A: Wagner m0736. DHW; B, E: Wagner m0765d. DHW; C: Larson #3 6-9-90. DHW; D: Larson #2 6-9-90. DHW)*







D

slightly indented leaf tip, (4) leaf base broader than half the greatest leaf width, and (5) oil bodies (2–) 3–6 (–7) per cell, the largest fusiform-reniform.

Technical description

LEAFY LIVERWORT. **Plants** dark green, lacking reddish pigmentation, 2 mm wide and 5 cm or more long. **Leaves** suborbicular to oval, 1.5–2 mm long and 1.4–1.9 mm wide, more or less horizontal to succubous, plane or undulate. **Underleaves** variable, 0.75–1.3 mm long, filiform, lanceolate or ovate. Rhizoids reddish.

Dioicous. Androecia of 6–8 strongly concave, imbricate bracts. Female plants unknown.

Similar species — *Riccardiella gemmipara* is similar but has gemmae, poorly differentiated (isophyllous) leaves, and underleaves on erect fertile shoots and grows on rocks in flowing montane streams. Aquatic *Jungermannia* species have uniformly round-tipped leaves, lack underleaves altogether and some have reddish pigmentation.

Ecology — *Jamesoniella autumnalis* var. *heterostipa* is reportedly an obligate aquatic taxon growing over rocks in moving water or sometimes forming extensive loose mats in lakes. In ultra oligotrophic lakes, healthy plants have been recovered from depths of up to 328 feet (Wagner et al. 2000). Plants from deep water have very small, remote leaves and are morphologically identifiable only on the basis of comparison of a graduated series of specimens from deep to shallow water. In Oregon, *J. autumnalis* var. *heterostipa* is known from 5,400 feet in elevation, where forest associations are mostly *Abies lasiocarpa* and *Tsuga mertensiana*.

Distribution — *Jamesoniella autumnalis* var. *heterostipa* is known from only four sites in North America. In western North America, it is known from British Columbia and Oregon. In Oregon, *J. autumnalis* var. *heterostipa* is reported from Lane County within the West Cascades ecoregion.

References with descriptions and/or illustrations — Wagner et al. (2000, p. 95), A. Evans (1915).

References with photos — Wagner (2014).

Jungermannia polaris Lindberg

Recent synonym: *Solenostema pumilum* subsp. *polaris* (Lindberg) R.M. Schuster
Common name: arctic flapwort

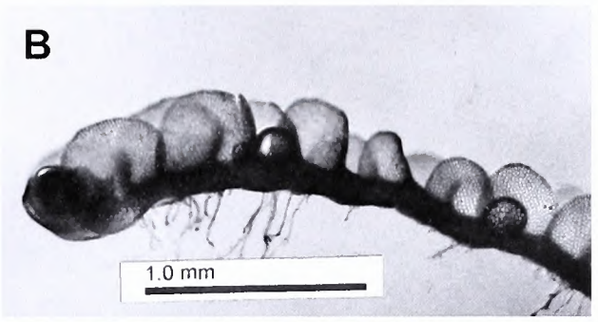
Taxonomic note: Frye and Clark (1943) incorrectly treated *Jungermannia polaris* as a synonym of *Jungermannia atrovirens*.

Summary — A leafy liverwort with nearly transversely inserted ovate to rounded leaves. Underleaves are lacking. Terrestrial to aquatic.

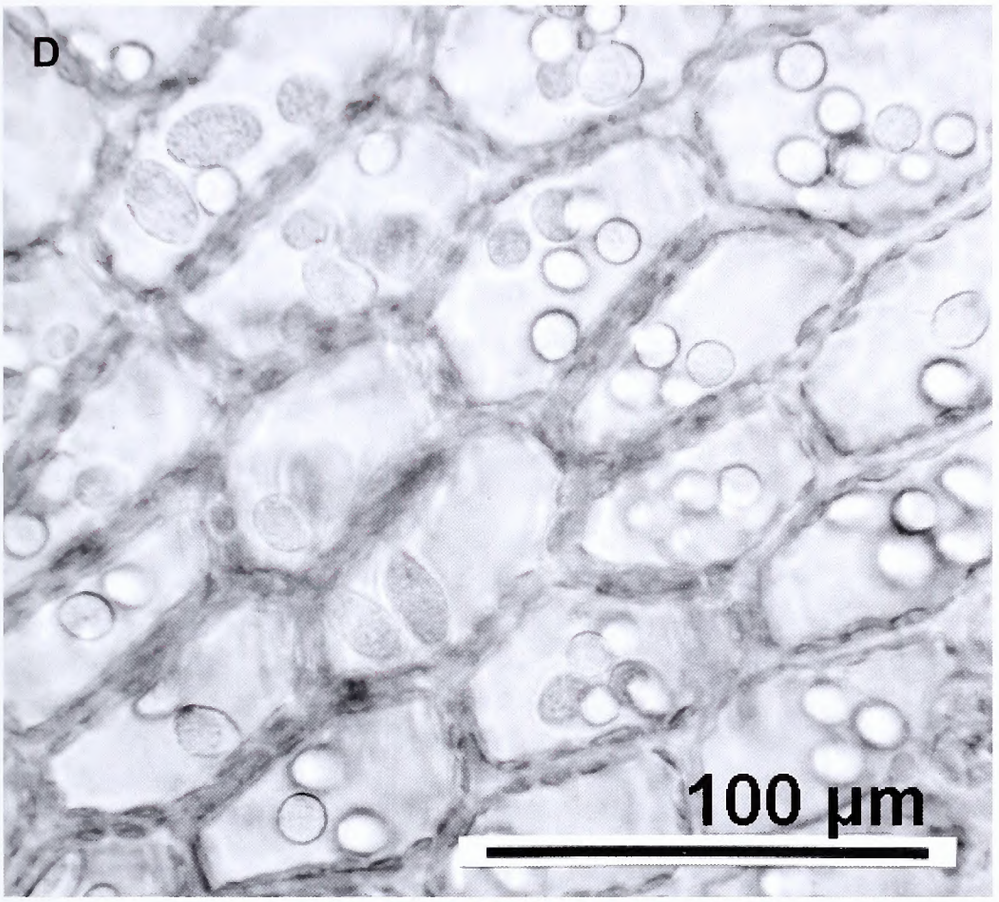
Diagnostic characteristics — *Jungermannia polaris* can be distinguished by its (1) small size, (2) habitat on damp rocks, (3) rounded-cordate and concave leaves, and (3) obovate perianths.

Plate 133. Jungermannia polaris. *A–C. Shoots. D–E. Oil bodies (A: Anonymous 1590. USFS; B: Wagner m0765ac. DHW; C: Wagner 8217. DHW; D: Wagner m0757b. DHW; E: Veverka CSV090512-2. USFS)*


A
1.0 mm


B
1.0 mm


C
1 mm


D
100 µm


E
100 µm

Technical description

Leafy Liverwort. **Plants** yellowish-green to blackish-green, prostrate with ascending tips, sometimes with a few branches, shoots 0.75–0.95 mm wide and 4–10 mm long. **Leaves** scarcely overlapping below, becoming more crowded toward shoot tips, erect, broadly ovate to round or obovate (wider than long), widest at the middle, 0.45–0.52 mm long × 0.4–0.6 mm wide, concave, nearly transverse; median cells 15–20 × 15–25 µm; margins entire; oil bodies larger than chloroplasts, mostly 2–4 per cell, subspherical to ellipsoidal, faintly granular, 3.4–4.5 × 5–9 µm. **Underleaves** lacking.

Paroicous. Perianth obovoid, widest above the middle, with a prominent furrow for most of its length.

Similar species — *Jungermannia pumila* has shoots 1–3.5 mm wide and leaves spreading horizontally, broadly elliptical, widest at the middle, 1.2–1.6 times long as wide, not distinctly concave. Its median cells are 20–25 × 25–30 µm. The elongate perianths gradually narrow to the apex, and in the Pacific Northwest it generally occurs at lower elevations (0- 5,000 feet) than *J. polaris*. *Jungermannia atrovirens* is dioicous, while *J. polaris* is paroicous.

Ecology — *Jungermannia polaris* forms small to sometimes extensive mats, or is hidden among other bryophytes over peaty soil on damp ledges and rock crevices, sometimes along streams and rivulets or aquatic in partial shade to full sunlight. Wagner et al. (2000) reported it from depths of 130–330 feet in an ultra oligotrophic lake in Oregon. Schuster (1969) and Paton (1999) reported *J. Polaris* as a calciphile and rare on igneous rocks. Elevations for known locations in the Pacific Northwest range from 5,000–7,500 feet. Forest types include *Tsuga mertensiana* and *Abies lasiocarpa* associations.

Distribution — *Jungermannia polaris* is circumboreal and mostly arctic-alpine in distribution. In western North America, it occurs south to British Columbia, Washington, Oregon, California, and Montana. In Oregon, *Jungermannia polaris* is reported from Baker, Klamath, and Lane counties within the Blue Mountain and West Cascades ecoregions.

References with descriptions and/or illustrations — Faubert (2012, p. 243), Wagner et al. (2000, p. 96), Váňa and Hong (1999, p. 137), Paton (1999, p. 269), Smith (1990, p. 140), Schuster (1969, p. 918 as *Solenostoma pumilum* subsp. *polaris*), Arnell (1956, p. 105), Frye and Clark (1943, p. 290 as *J. atrovirens*).

References with photos — Wagner (2014).

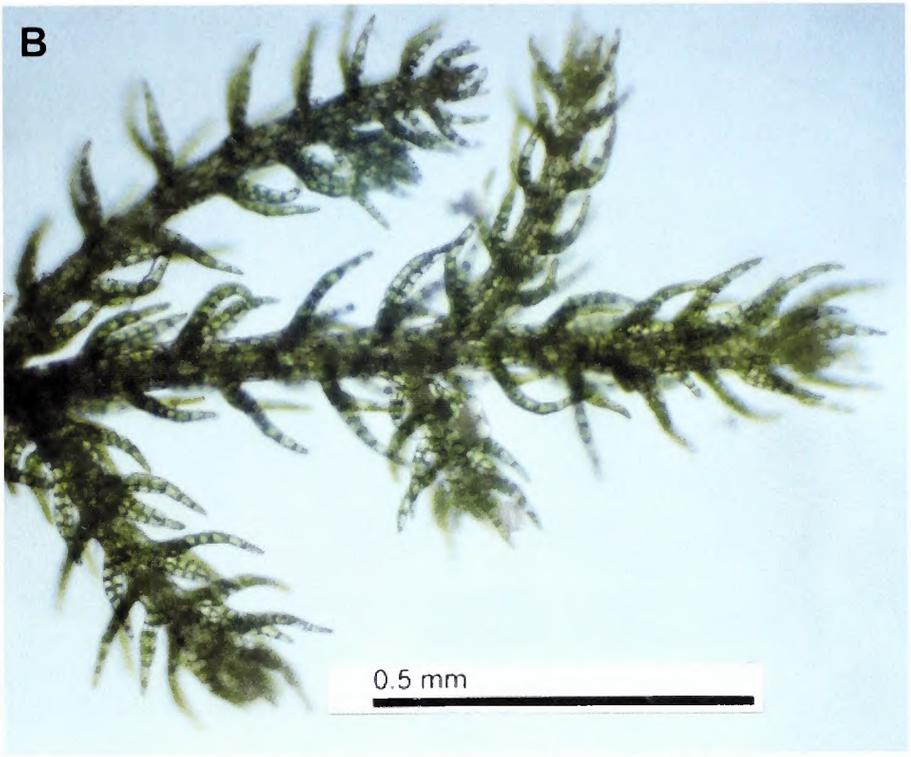
Kurzia sylvatica (A. Evans) Grolle

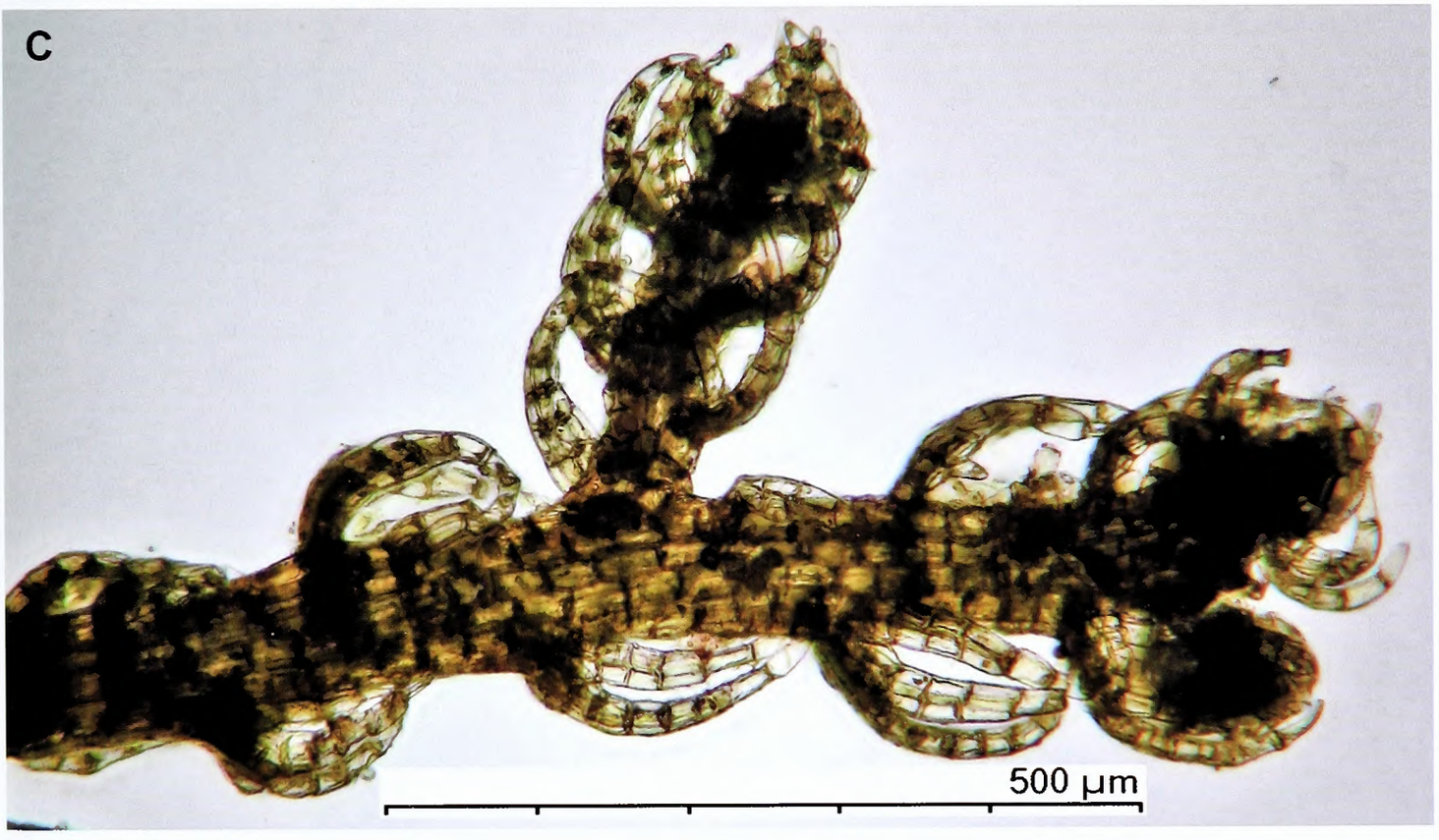
Recent synonyms:
Lepidozia sylvatica A. Evans
Microlepidozia sylvatica Jørgensen
Common names: pacific fingerwort, wood fingerwort

Taxonomic note: There is no consensus among experts as to whether *Kurzia makinoana* (Steph.) Grolle and *K. sylvatica* are independent species or whether one or both taxa are present in western North America. As Lockhart et al. (2012) and the ITIS database (www.itis.gov) treat *K. makinoana* as a synonym of *K. sylvatica,* we refer plants from Oregon identified as *K. makinoana* here to *K. sylvatica*. Additional study is needed on the *Kurzia* representatives in western North America.

Plate 134a. Kurzia sylvatica. *A.– B. Shoots. C. Shoot tip dorsal. (A,B: Wagner m0788. DHW, OSC, BLM Coos Bay; C: Norris 101215. CAS)*


A
1 mm


B
0.5 mm


C
500 µm

Summary — An isophyllous leafy liverwort with leaves and underleaves divided to the base into three or four finger-like lobes. Terrestrial.

Diagnostic characteristics — *Kurzia sylvatica* can be distinguished by its (1) very small (barely 0.35 mm wide) regularly pinnately branched shoots, (2) dense felt-like mats growing tightly over rotting wood or deeayed organic matter, (3) leaves and underleaves divided into three or four slender finger-like lobes that are biseriate at the base, and (4) oil bodies usually lacking.

Technical description

Leafy Liverwort. **Plants** in very thin loose mats to dense turfs, seldom above 1 cm deep and up to 1.5 cm long; leafy shoots up to 0.35 mm wide. **Leaves** transversely inserted, not decurrent, distant to loosely imbricate, erect- to widely spreading, with incurved apices, simple 3- to 4-lobed, averaging about 0.21 mm long and 0.18 mm wide; branch leaves usually 2–3 parted, smaller; segments entire except for turgid cells, usually 2 (sometimes 3–4) cells wide at base, tipped by a row of 2–4 linear-oblong cells; sinuses descending 3/4–5/6 the length of the leaf to within 2–3 cells of the base. **Underleaves** on branches (and many on main axes) strongly asymmetrical.

Dioicous. Frequently fertile; inflorescences on short postical branches on main axes. Female bracts pointed, dentate, with short ciliate lobes; perianth mouth with 2–4 30 μm long cilia.

Similar species — *Lepidozia reptans* has a similar pinnate branching pattern and may occur in patches of diminutive plants nearly as small as *Kurzia*. Its leaves are divided into four lobes for only one-half the leaf length. *Blepharostoma* plants, which are also sometimes as small as *Kurzia*, also have leaves divided to the base in 3–4 slender, finger-like lobes but the lobes are straight and composed of a single row of cells.

Kurzia species can be distinguished with certainty only by examining the perianths and female bracts (Arnell 1981, Smith 1990). Schumacker and Váňa (2005), Paton (1999), Smith (1990), and Macvicar (1926) all provide keys separating *K. pauciflora*, *K. sylvatica,* and *K. trichoclados*. Doyle and Stotler (2006) separate *K. sylvatica* from *K. makinoana* by stem leaves that are usually overlapping and symmetrical, with the dorsal and ventral leaf lobes equally as large (vs. the somewhat remote asymmetrical leaves with smaller and often spinose dorsal lobes in *K. makinoana*). However, *Kurzia sylvatica* produces asymmetrical underleaves with 1–2 markedly reduced or aborted lobes while *K. markinoana* has underleaves that are usually symmetrical or with only one lobe slightly smaller.

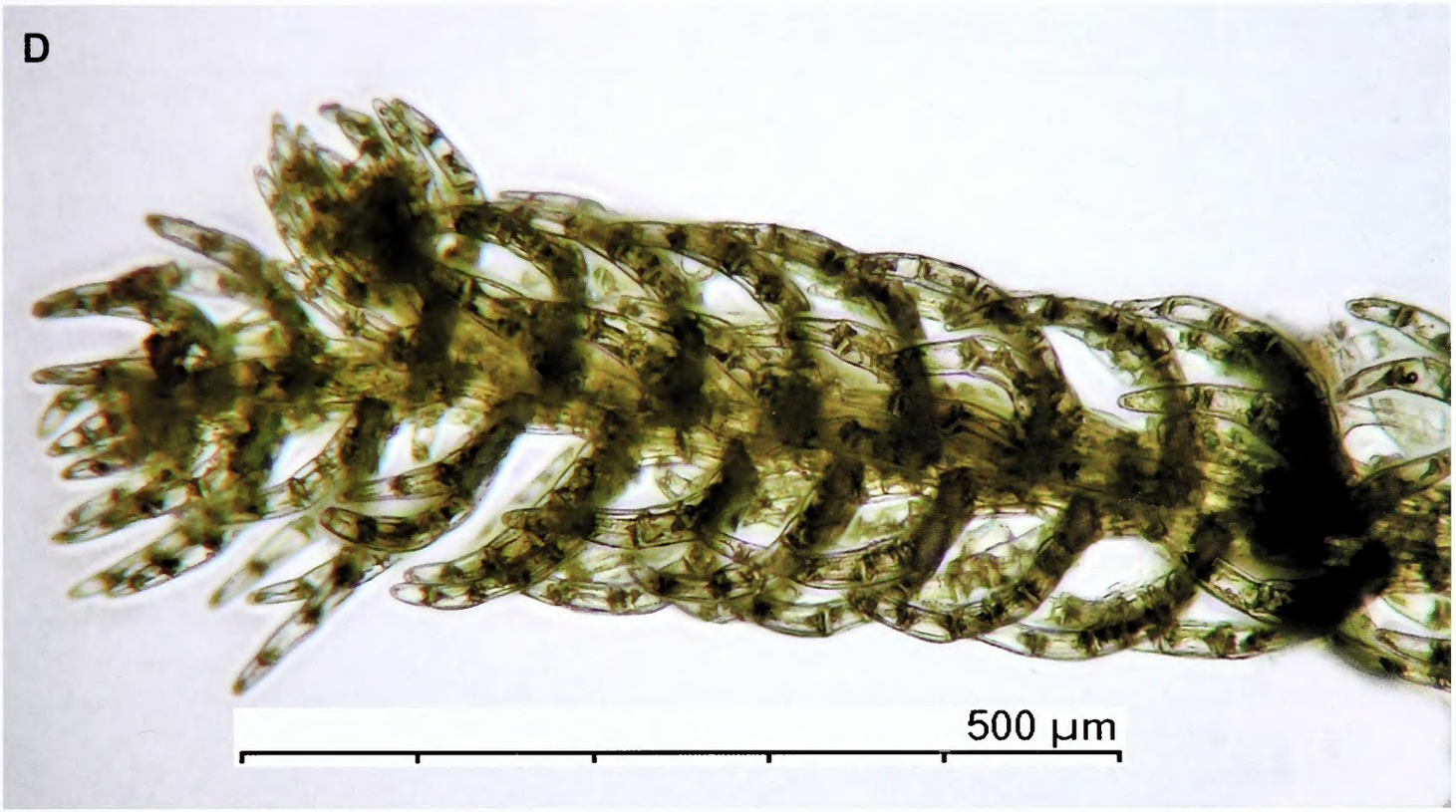
Ecology — In Oregon, *Kurzia sylvatica* is known from coastal wetland sites on decaying wood. It is associated with other decaying wood bryophytes such as *Cephalozia* spp., and *Chiloscyphus* spp. Arehegonial shoots have been identified in Oregon material, but no sporophytes. In eastern North America, Hicks (1992) noted that *K. sylvatica* is common on peaty banks along streams, on woody debris, and as individual strands mixed in with other bryophytes. Lincoln (2008) adds habitat on acid rocks or soil in shaded places.

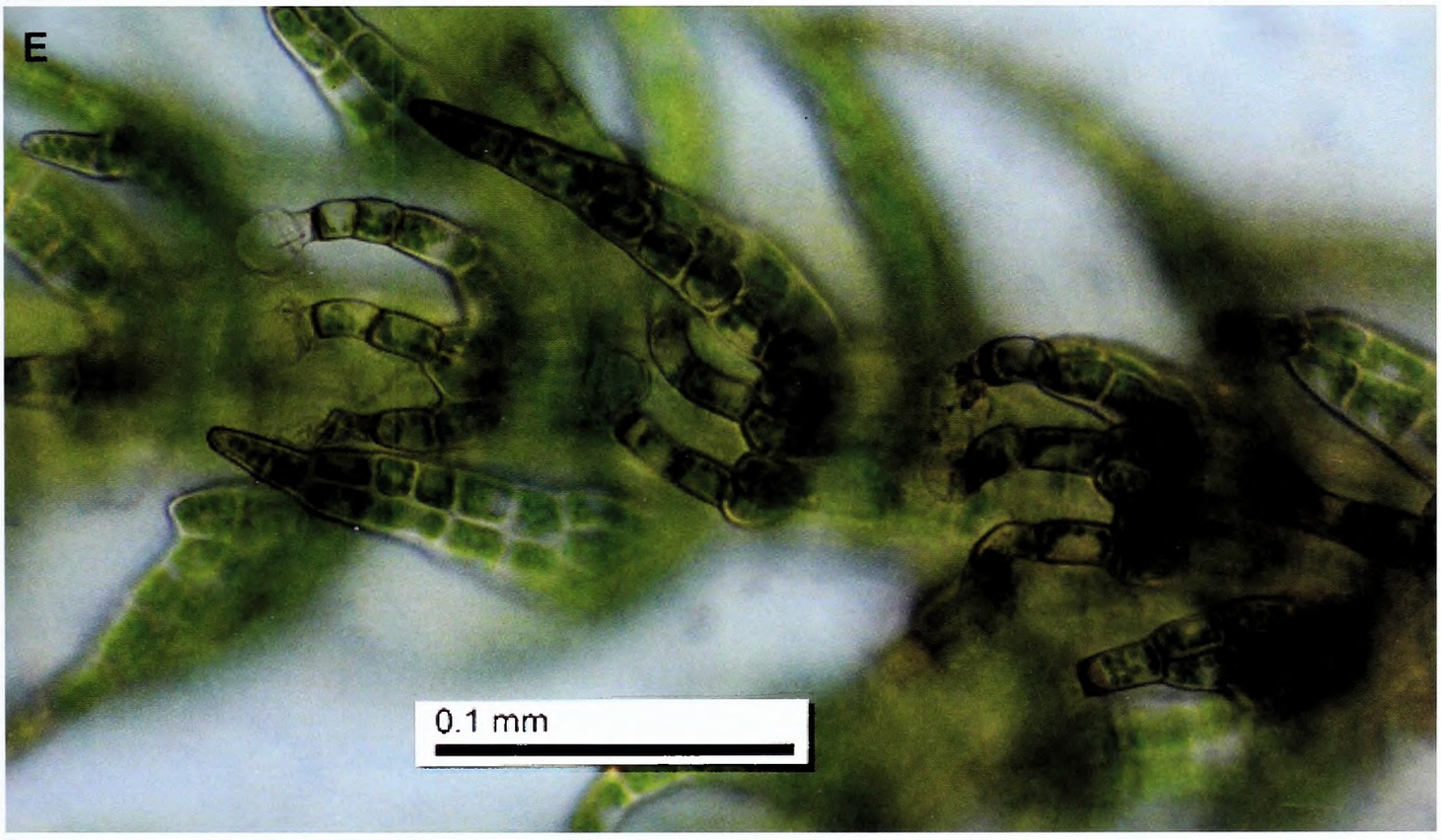
Distribution — *Kurzia sylvatica* is known from Eurasia and North America. In western North America, it is known from British Columbia, Washington, Oregon, and California. In Oregon, *K. sylvatica* is reported from Coos County in the Coast Range ecoregion.

References with descriptions and/or illustrations — Lockhart et al. (2013, p. 207), Lincoln (2008, p. 55), Damsholt (2002, p. 442), Paton (1999, p. 63), Hicks (1992, p. 28), Smith (1990, p. 24), Schuster (1969, p. 49 as *Microlepidozia sylvatica*), Arnell (1956, p. 53 as *Lepidozia silvatica*), Frye and Clark (1946, p. 658 as *Lepidozia sylvatica*).

References with photos — Wagner (2014).

Plate 134b. Kurzia sylvatica. *D.– E. Shoot tip ventral. (E: Wagner m0788. DHW, OSC, BLM Coos Bay; D: Norris 101215. CAS)*


D
500 µm


E
0.1 mm

Marsupella condensata (Ångström) Lindberg

Recent synonyms: none
Common name: compact rustwort

Summary — A leafy liverwort with almost transversely inserted, bilobed leaves that are divided less than one-half. Underleaves are lacking. Terrestrial.

Diagnostic characteristics — *Marsupella condensata* is distinguished by its (1) small size, (2) tightly overlapping leaves, (3) dark color, and (4) oil bodies in all cells. In addition, Godfrey and Schofield (1979) remark, "Especially distinctive are the julaceous shoots with red-gold to chestnut-brown secondary pigmentation and leaves with lunate sinus and with oil bodies in all cells including the marginal cells."

Technical description

Leafy Liverwort. **Plants** growing in dense low carpets or (more often) mixed with other bryophytes. Shoots 0.5–2 cm long, 0.1–0.2 mm wide, julaceous, stiff, dark brown to black, when dry mostly somewhat shiny, especially at the shoot apices. **Stems** brittle, rather richly branched, some shoots leafless or small-leaved and others longer and with larger leaves, filiform or slightly clavate. **Leaves** small, below more distant and smaller, above more crowded and larger, almost transverse, imbricate, broadly ovate, concave, bilobed, sinus 0.2–0.25 of leaf, shallow and rounded, lunate, lobes acute and incurved. Marginal cells about 18 µm (in the leaf center up to 15–20 µm, in the base up to 35 µm), wall yellow, somewhat incrassate, trigones distinct. Cuticle smooth. Oil bodies obscurely granular, 2–3 per cell, spherical-oval. **Underleaves** lacking.

Dioicious. Female plants clavate, bracts up to 3 times larger than the leaves, broader than long, connate at the base. Male plants clavate, with thick, apical androecium, bracts larger, more imbricate and more concave at the base than the leaves. Perianth apparently connate, with bracts in the lower 1/4, conical, reaching up to 2/3–3/4 of bract length, mouth crenulate and incurved.

Similar species —*Gymnomitrion* species are similar but have white leaf margins that lack chloroplasts and oil bodies in marginal cells. Other small *Marsupella* species can be distinguished by their smaller cells and leaves that have an acute (never lunate) sinus.

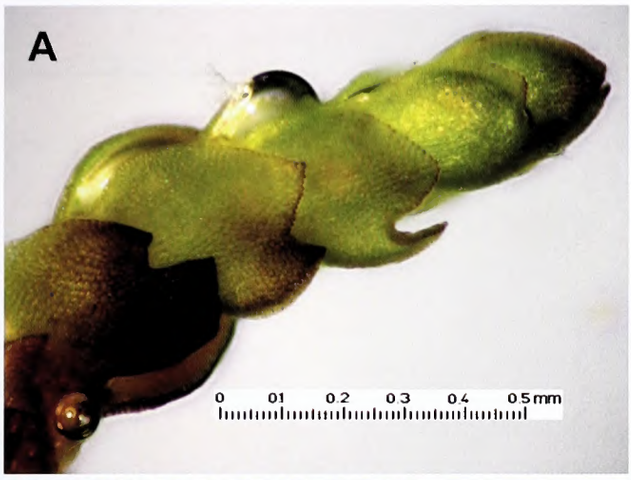
Ecology — *Marsupella condensata* is arctic-alpine, occurring on peaty soil in relatively exposed sites that may be moist throughout the year from snowmelt as well as within liverwort mats from mountain summits and alpine ridges. One Oregon site is on a heather slope. However, the "compact rustwort" is probably more closely associated with microsite conditions (e.g., bare soil around a pond) than with a particular vascular plant community.

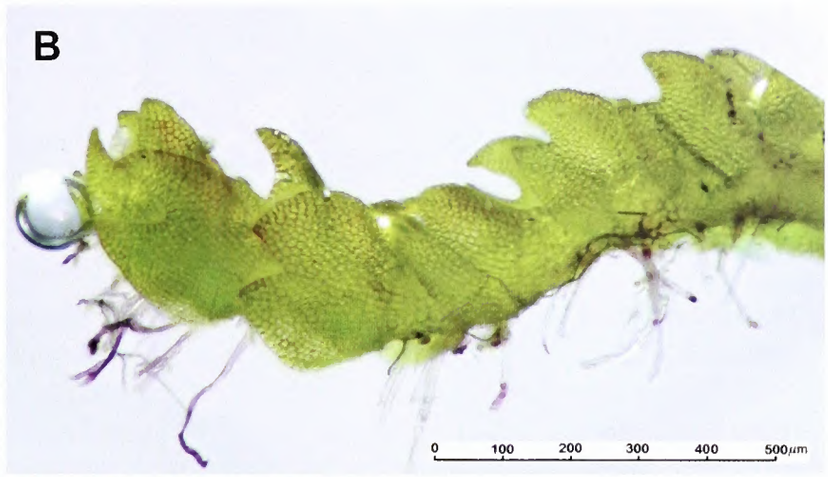
Distribution — *Marsupella condensata,* widespread in boreal and montane regions of the northern hemisphere, is known from Eurasia and North America. In western North America, it has been recorded from Alaska south to British Columbia, Washington, and Oregon. In Oregon, *M. condensata* is reported from Hood River and Linn counties within the West Cascades ecoregion.

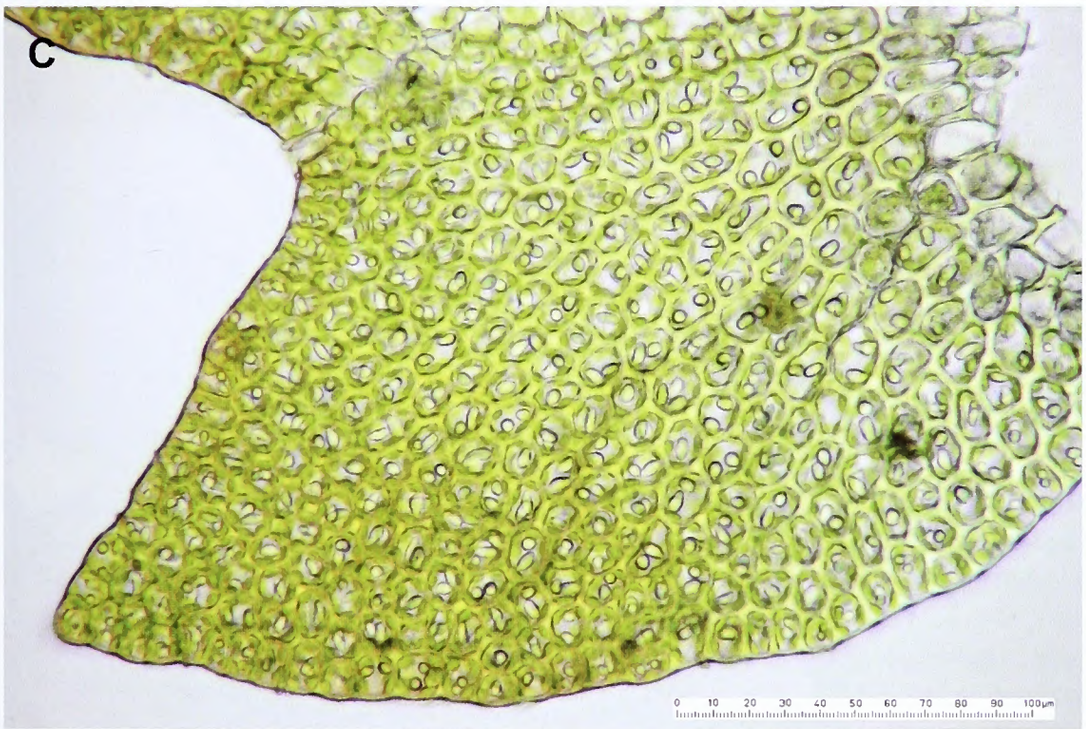
References with descriptions and/or illustrations — Faubert (2012, p. 269), Damsholt (2002, p. 269), Paton (1999, p. 321), Smith (1990, p. 160), Hong (1982), Schuster (1974, p. 110, 112), Arnell (1956, p. 230), Frye and Clark (1943, p. 220), Macvicar (1926, p. 108).

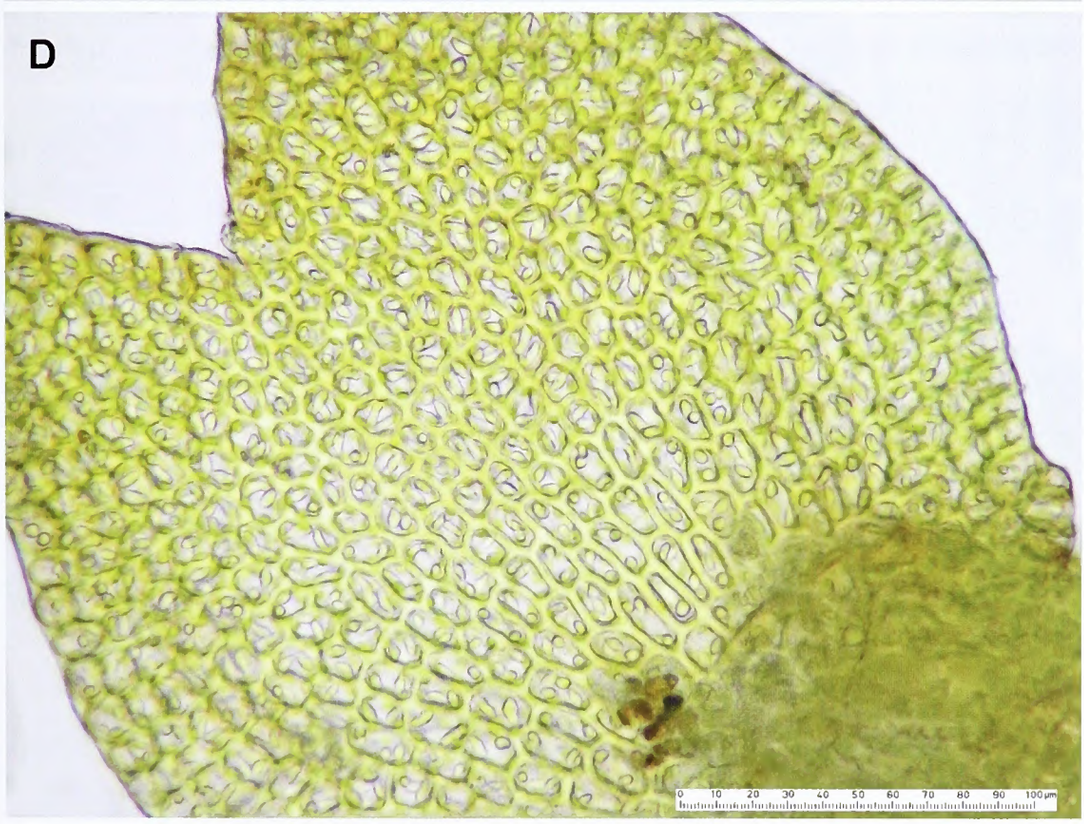
References with photos — Wagner (2014).

Plate 135. Marsupella condensata. *A. Shoot tip. B. Shoot, lateral aspect. C. Leaf cells with oil bodies. D. Leaf middle to base. (A: Berg s.n. FWS; B–D: Wagner m2894. DHW.)*


A
0 01 0.2 0.3 0.4 0.5mm


B
0 100 200 300 400 500µm


C
0 10 20 30 40 50 60 70 80 90 100µm


D
0 10 20 30 40 50 60 70 80 90 100µm

Marsupella emarginata var. *aquatica* (Lindenberg) Dumortier

Recent synonyms:
Marsupella aquatica (Lindenberg) Schiffner
Marsupella robusta (De Notaris) A. Evans
Common names: stream ladderwort, robust rustwort

Taxonomic note: *Marsupella emarginata* var. *emarginata* is quite variable. However, the aquatic populations treated as a variety are confined to a single habitat (stenotypic) and differ little among themselves. Wagner (2014) feels that var. *aquatica* is better treated as a species (*M. aquatica;* see synonym above) instead of a variety; Arnell (1981), Schofield (2002), and several earlier twentieth century authors (see Schuster 1974) accepted this liverwort at the specific level. Even when not always formally recognized, its treatment as a separate morphological species is considered at least plausible by contemporary authors (e.g., Smith 1990, Frey et al. 2006).

Summary — A leafy liverwort with transversely inserted julaceous leaves that are divided less than one-half. Underleaves are lacking. Aquatic.

Diagnostic characteristics — *Marsupella emarginata* var. *aquatica* can be distinguished by its (1) strictly aquatic habitat, (2) stiffly pectinate (comb-like) shoots, (3) large green to blackish leaves that are wider than long and have a very shallow sinus (to only 1/5 the leaf length), and (4) leaf lobes that are rounded but sometimes with a short sharp apiculus.

Technical description

Leafy Liverwort. **Plants** procumbent to erect in mats or turfs, dark or greyish-green or brown, sometimes partly yellow-green or reddish-brown to purple, more often dull than glossy; leafy shoots 1–8 cm long , 1.3–3.5 mm wide; stem hyalodermis cell walls sometimes brownish. **Leaves** patent to suberect (then shoots more or less terete), (0.8–) 1.0–2.0 (–2.5) mm wide, 0.8–1.6 mm long, frequently obcordate or semi-cordate, not antically decurrent or only slightly so; margins narrowly to rather broadly recurved to plane; sinus obsolete to 1/5 leaf length, often more or less lunate, a 90°–160°angle between the lobes; lobes short and broad to scarcely differentiated, rounded or (less often) subacute, apex sometimes apiculate; leaf cells averaging (16–) 18–26 (–28) µm wide; median cells near leaf base up to 75 µm long. Oil bodies sometimes soon vanishing (fugacious) from a few to many marginal cells. **Underleaves** lacking.

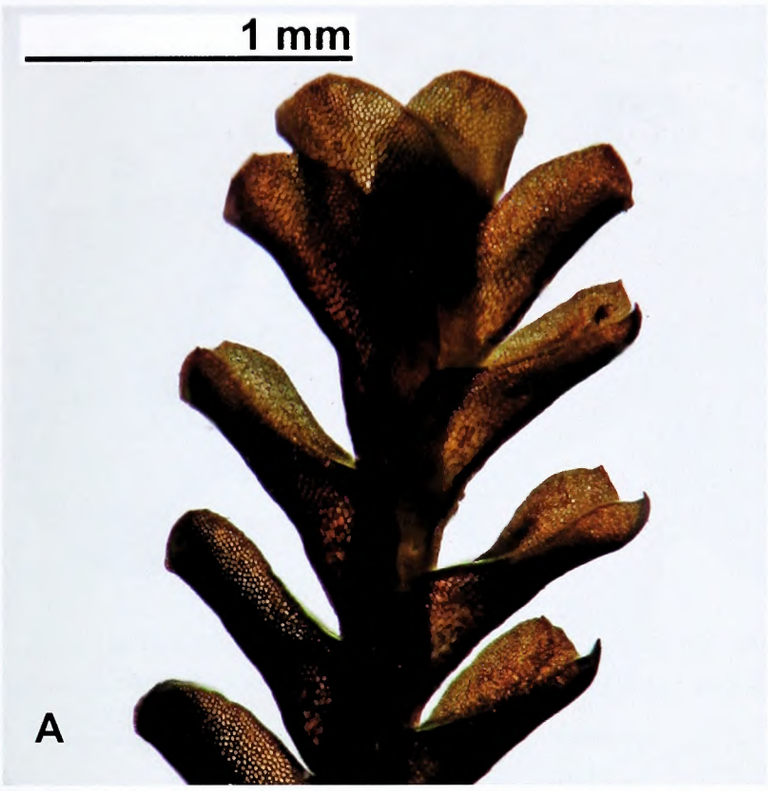
Dioicous. Androecia apical, bracts 3–5 bilobed; fleshy perigynium present; perianths subentire, shorter than bracts. Reproduction structures are rare.

Similar species — *Marsupella sphacelata,* also found in streambeds and submerged at least part of the year, differs from the red-brown *M. emarginata* var. *aquatica* in its blackish pigmentation and smaller leaves with a deep sinus.

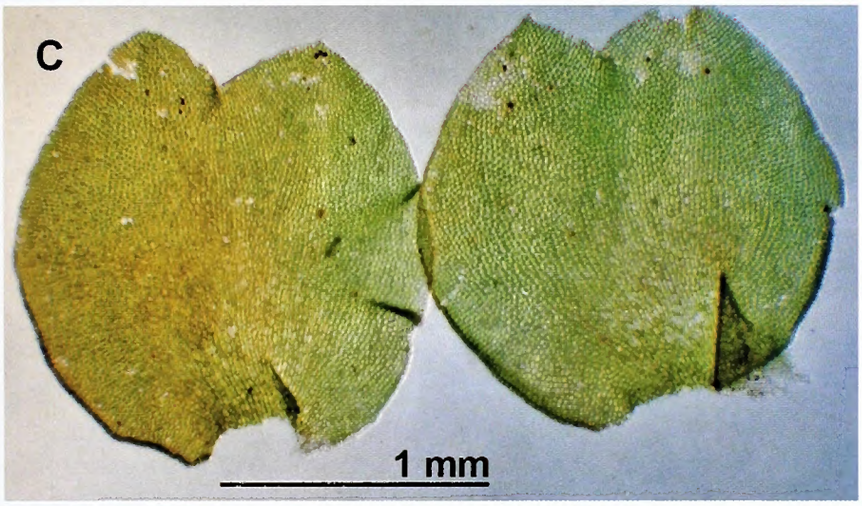
Ecology — *Marsupella emarginata* var. *aquatica* is always found in running water and is restricted to subalpine and montane streams with relatively fast moving water with rocky substrates. The sole Oregon site occurs within the *Tsuga mertensiana* forest zone.

Distribution — *Marsupella emarginata* var. *aquatica* is known from Europe, Greenland, and North America. In western North America, this acquatic leafy liverwort is known from Alaska, British Columbia, Washington, and Oregon. In Oregon, *M. emarginata* var. *aquatica* is reported from Lane County within the West Cascades ecoregion.

Plate 136. Marsupella emarginata var. aquatica. *A. Shoot tip. B. Leaves attached to stem. C. Leaves. D. Leaf median cells. (A, B: Wagner m0605. DHW; C: Wagner m0614. DHW; D: Wagner m0611. DHW.)*


1 mm
A


B


C
1 mm


D
0 10 20 30 40 50 60 70 80 90 100 µm

References with descriptions and/or illustrations — Faubert (2012, p. 270), Damsholt (2002, p. 255), Paton (1999, p. 303), Smith (1990, p. 156), Hong (1982), Schuster (1974, p. 82), Arnell (1956, p. 239), Frye and Clark (1943, p. 231).

References with photos — Wagner (2014), Atherton et al. (2010, p. 155), Lincoln (2008, p. 108).

Marsupella sparsifolia (Lindberg) Dumortier

Recent synonyms: none
Common names: sharp ladderwort, rounded rustwort

Summary — A leafy liverwort with transversely inserted julaceous leaves that are less than half divided. Underleaves are lacking. Terrestrial.

Diagnostic characteristics — *Marsupella sparsifolia* can be distinguished by its (1) small size and blackish appearance, (2) two rows of transversely inserted bilobed leaves with a relatively deep sinus, (3) paroicous fertile shoots, and (4) upper montane habitat.

Technical description

Leafy Liverwort. **Plants** with long shoots, erect, frequently bearing numerous subinvolucral innovations, greenish, mostly with purplish-brown or blackish secondary pigmentation. **Leaves** on sterile shoots of uniform size, distant, spreading, transverse, concave to slightly channeled, broad, round ovate-obovate, bilobed to 1/4 leaf-length; sinus mostly rectangular to acutely angled, lobes ovate-triangular, somewhat concave, mostly acute. Marginal cells 12–14 µm (~20 µm at leaf center, ~13 µm in the lobes), walls thin, trigones small. Oil bodies small, several in each cell, rapidly disappearing. **Underleaves** lacking.

Paroicous. Fertile shoots clavate, leaves increasing in size towards the top, female bracts connate in the lower half. Perianths exceed the bracts for about 3/4 of its length.

Similar species — *Marsupella sphacelata,* the most common species likely to be confused with *M. sparsifolia,* is also small and blackish and has a similarly deep sinus. However, the dioicous *M. sphacelata* has leaf lobes that are almost always apically rounded (unlike the obtuse to acute leaf lobes in the paroicous *M. sparsifolia*).

Ecology — *Marsupella sparsifolia* is found in shiny pure patches or singly among other bryophytes on occasionally flooded sand, sandy soil along streams, or acidic soil in late snow areas. It is also found on siliceous cliffs, rocks, and stones that are occasionally flooded (Damsholt 2002). *Marsupella sparsifolia* is strictly montane (subalpine to alpine in the Pacific Northwest) on moist, open ground. Since this species is bisexual (paroicous), healthy populations can be expected to produce sporophytes.

Distribution — *Marsupella sparsifolia* is widespread in polar and alpine regions and known from Europe, South Africa, New Zealand, and North America. In western North America, *M sparsifolia* is known from British Columbia, Alberta, Washington, Oregon, California, and Montana. In Oregon, *M. sparsifolia* is reported from Hood River County within the West Cascades ecoregion.

Plate 137. Marsupella sparsifolia. *A. Shoot tip. (A: Hong 84-515. CAS)*


A
1 mm

References with descriptions and/or illustrations — Faubert (2012, p. 270), Damsholt (2002, p. 264), Paton (1999, p. 315), Hong (1982), Schuster (1974, p. 38), Arnell (1956, p. 236), Frye and Clark (1943, p. 226).

References with photos — Wagner (2014).

Marsupella sprucei (Limpricht) Bernet

Recent synonyms:
Marsupella ustulata (Huebener) Spruce
Marsupella ustulata var. *sprucei* (Limpricht) R.M. Schuster
Common names: Spruce's rustwort

Summary — A leafy liverwort with almost transversely inserted, bilobed leaves that are divided less than one-half. Underleaves are lacking. Terrestrial.

Diagnostic characteristics — *Marsupella sprucei* can be distinguished by its (1) small size, (2) dark green to brownish-black plant color, (3) paroicous fertile shoots, and (4) montane habit.

Technical description

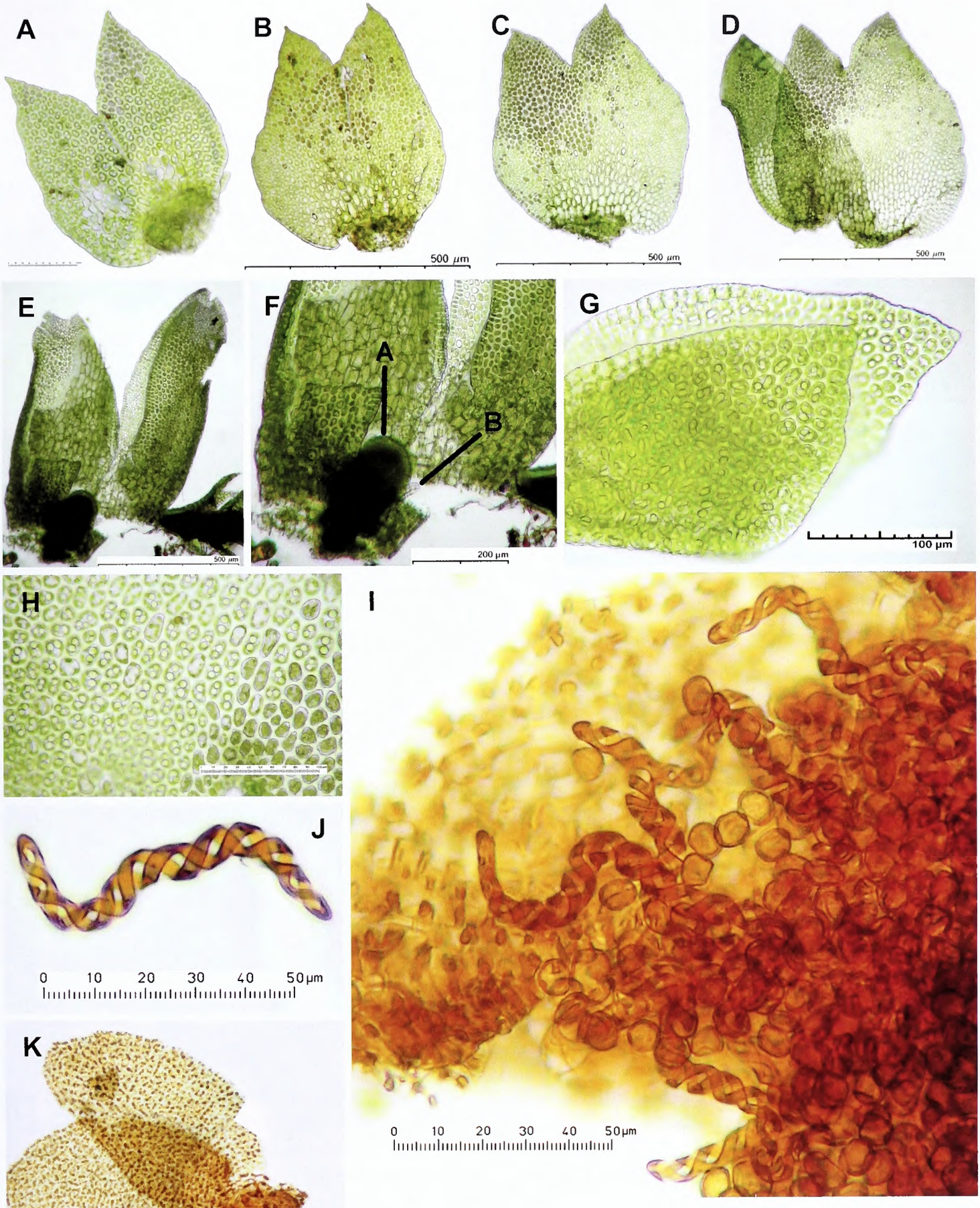
Leafy Liverwort. **Plants** 1–5 mm long with leafy shoots 0.3–0.6 mm wide, ascending to erect or with some shoots procumbent or prostrate in dense to rather open turfs. Plants are pale yellowish or brownish-green to dark brown, red or red-brown, seldom black. Rhizoids are hyaline, yellow or brown, with branched ends sometimes red. **Leaves** patent to suberect, ovate to semi-ovate, or suborbicular to rectangular. The leaf sinus is 1/4–1/3 leaf-length, acute to narrowly rounded, or seldom ovate and more broadly rounded. Leaf lobes are triangular and acute, to narrowly rounded or seldom ovate and more broadly rounded, and weakly concave, or not at all. Leaf cells average 12–20 µm wide. The walls thin or sometimes slightly thickened. Trigones are minute to well developed. The cuticle is smooth to papillose-striate. Oil bodies are sometimes lost from marginal cells. **Underleaves** are lacking.

Paroicous or rarely synoicous. Plants are usually fertile and sporophytes are common. Inflorescences are more or less clavate or sometimes fusiform. Lobes of all bracts are acute or apiculate rounded and rather weakly concave. The sinus is mostly 1/5 to 1/3 the bract length, with the antical margin occasionally narrowly recurved. Male bracts are in 1–2 pairs. Female bracts are up to 0.9 mm long, with an acute sinus. The perigynia is well developed. Perianths are 0.2–0.5 mm high. Spores are minutely papillose, 8–13 µm. Elaters are 3 µm wide, bispiral and ribbon-like.

Similar species — *Marsupella sparsifolia* and *M. brevissima* share the paroicous habit of *M. sprucei*. Other *Marsupella* species known from Oregon are dioecious. *Marsupella sparsifolia* is a larger plant, up to 3 cm tall, and has sheathing leaf bases and reddish-brown, pink to reddish-purple rhizoids. *Marsupella brevissima* is also a slightly larger plant, up to 1 cm tall, reddish-brown and has less ovate leaves and lacks a perianth.

Ecology — *Marsupella sprucei* is found in on shaded or sunny sites ranging from deciduous woodland and hillsides slopes to mountain screes and summits, in and beside streams and on moist areas downhill from late snow melt. It occurs on moist acid or neutral stones, small boulders and outcrops, especially sandstone, schist and crumbling rock, or on thin layer of soil on ledges and on earthen banks.

Plate 138. Marsupella sprucei. *A. Vegetative leaf. B. Male bract. C. Small male bract. D. Two male bracts. E. Dissected bracts and perianth fragment. F. Dissected bracts and perianth fragment; A = antheridium, B = archegonium. G. Oil bodies in dorsal leaf lobe. H. Oil bodies in bract. I. Elaters and spores. J. Single elater with two spirals. I. Three capsule valves. (A–I:. Kofranek 6715. DHW)*


A
B
C
D
500 μm
500 μm
500 μm
E
F
A
B
G
500 μm
200 μm
100 μm
H
I
J
0 10 20 30 40 50μm
K
0 10 20 30 40 50μm
100 μm

Distribution — *Marsupella sprucei* is known from Eurasia, Iceland, Greenland, North America, South America (Argentina) and New Zealand. In western North America, *M. sprucei* is known from British Columbia, Washington and Oregon. In Oregon, *M. sprucei* is reported from Douglas County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Paton (1999, p. 313), Smith (1990, p. 158), Schuster (1974, p. 23 and 30), Arnell (1956, p. 234), Fry and Clark (1943, p. 228, as *Marsupella ustulata*).

References with photos — Lockhart et al. (2013, p. 275), Faubert (2012, p. 272), Atherton et al. (2010, p. 158).

Mesoptychia gillmanii (Austin) L. Söderström & Váňa

Recent synonyms:
Lophozia gillmanii (Austin) R.M. Schuster
Leiocolea gillmannii (Austin) A. Evans
Common name: Gillman's pawwort

Summary — A leafy liverwort with succubous bilobed leaves. The underleaves, which are very small compared to the lateral, are entire to bilobed. Terrestrial.

Diagnostic characteristics — *Mesoptychia gillmanii* can be distinguished by its (1) bilobed leaves and consistent presence of small underleaves, (2) lack of gemmae, (3) paroicous fertile shoots, (4) perianths with a relatively long beak, and (5) the strongly striate-papillose leaf cells, which stand out distinctively on sterile plants (but sterile plant identification must be done with caution).

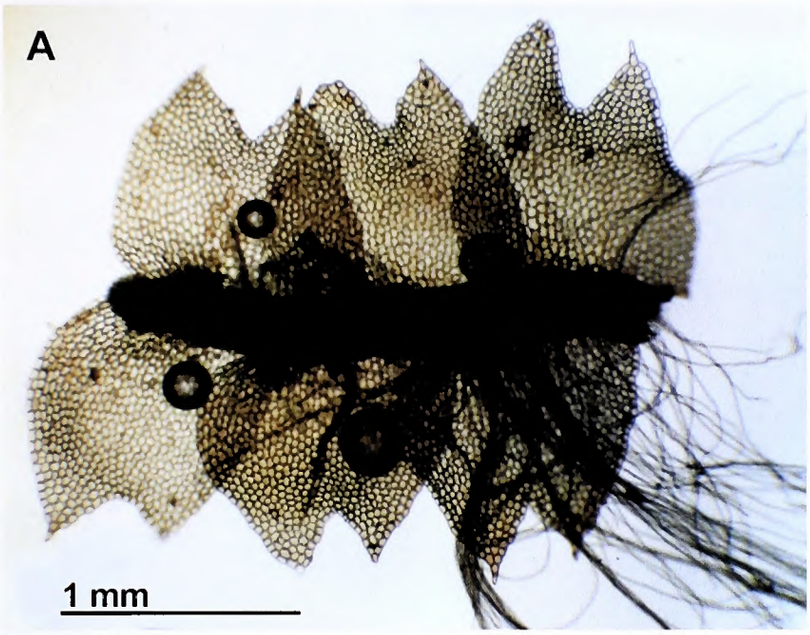
Technical description

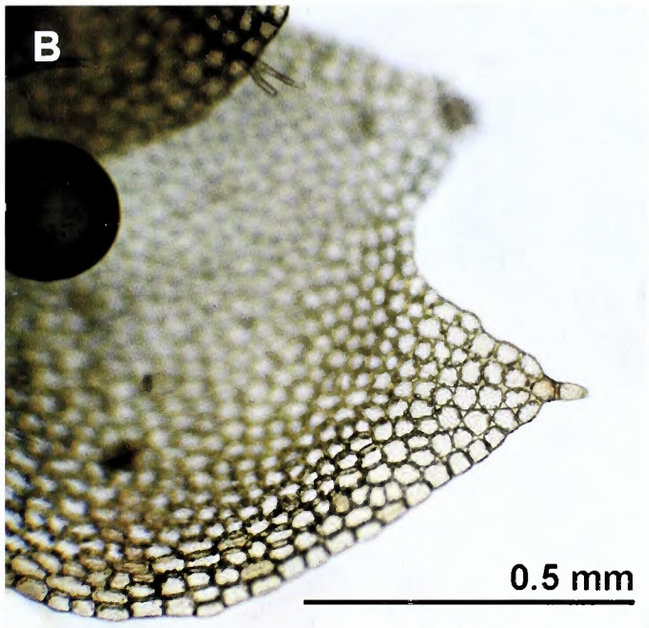
Leafy Liverwort. **Plants** usually procumbent, 2–3 cm long, 2–3 mm wide, lower parts red-brown to almost black, upper parts greenish-yellow to yellowish-brown; rhizoids numerous, colorless or brownish. **Leaves** closely overlapping, oblique to almost longitudinally inserted, erect to horizontally spreading, generally only slightly asymmetrical, not very decurrent, more or less broadly ovate, sometimes rectangular on young shoots, bilobed to 0.25 the leaf length, sinus narrow and obtuse, lobes acute, sometimes pointed or obtuse and rounded, generally of equal size; marginal cells 25–36 µm, larger (35–40 × 35–50 µm) towards the base, mostly with large trigones; cuticle striate-papillose, surface ornamentation most conspicuous towards leaf base. **Underleaves** small, always present, 2–4 cells wide at the base and gradually narrowing upwards, seldom with basal teeth. **Gemmae** absent.

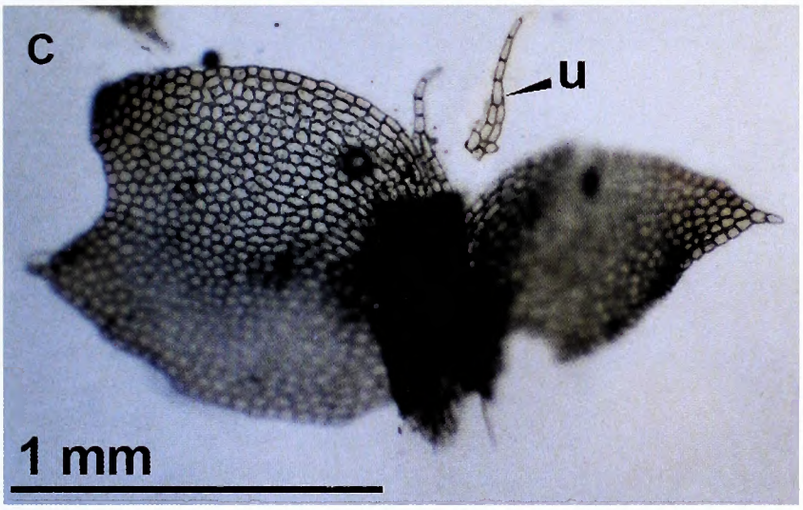
Paroicous. Female bracts transversely inserted, frequently with narrow, gibbous (bulging or swollen on one side) sinus and long, pointed lobes. Perianths short, wide, cylindrical or clavate, not plicate, abruptly constricted to a rather long ciliate beak.

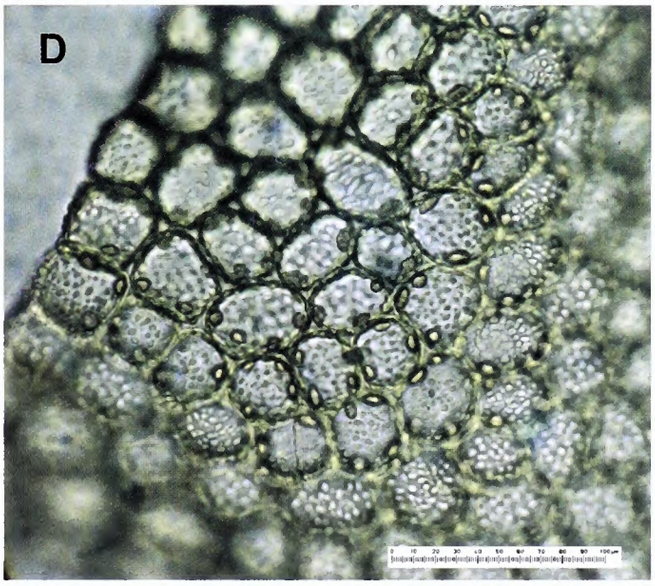
Similar species — *Lophozia* species with bilobed leaves are dioicous, lack underleaves on all shoots, and have gemmae or have a beakless perianth. Paton (1999) explains, "attempts to determine non-fertile material as *Lophozia gillmanii* [*Mesoptychia gillmanii*] are to be discouraged because this species is so variable in size, leaf shape, and cell size. Generally it is usual for inflorescences to develop more frequently on monoicous than on dioicous species so that non-fertile populations are more likely to be referable to dioicous species."

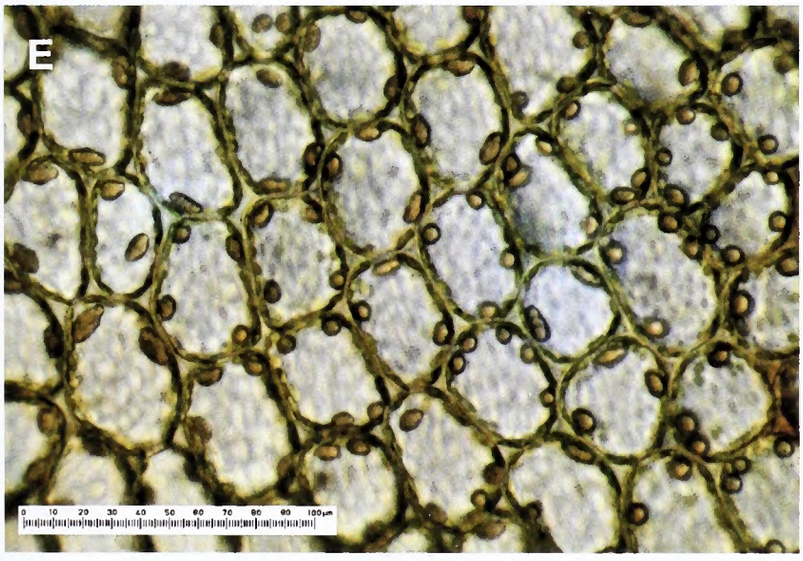
Plate 139. Mesoptychia gillmanii. *A. Shoot. B. Leaf. C. Leaf and underleaf. D. Cells with verrucae. E. Cells with oil bodies. (A–E: Wagner 8242. DHW)*


A
1 mm


B
0.5 mm


C
u
1 mm


D


E

Ecology — *Mesoptychia gillmanii* is known from peaty soil usually associated with cliffs or ledges, often in boreal-alpine habits. Lincoln (2008) reported the liverwort [as *Lophozia gillmanii*] as a pioneer on bare rock that is constantly moist, as in the spray zone of waterfalls while Schuster (1969) referred to the species [also as *L. gillmanii*] as an obligate calciphile. *Mesoptychia gillmanii* is known from limestone in Baker County, Oregon. Its lack of gemmae suggests dispersal by *M. gillmanii* is primarily by spores.

Distribution — *Mesoptychia gillmanii* is widespread in boreal and montane regions of the northern hemisphere. In western North America, "Gillman's pawwort" occurs in Washington, Oregon, and California. In Oregon, *M. gillmanii* is reported from Baker and Grant counties within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Damsholt (2002, p. 123 as *Lophozia gillmanii*), Paton (1999, p. 218 as *Leiocolea gillmanii*), Lincoln (2008, p. 74 as *Lophozia gillmanii*), Smith (1990, p. 114 as *Leiocolea gillmanii*), Schuster (1969, p. 374, 380 as *Lophozia gillmanii*), Arnell (1956, p. 110 as *Leiocolea gillmanii*), Frye and Clark (1944, p. 309 as *Leiocolea gillmanii*).

References with photos — Wagner (2014).

Nardia japonica Stephani

Recent synonyms: none
Common names: pacific spikewort, Japanese flapwort

Summary — A leafy liverwort with succubous round leaves and anisophyllous and entire underleaves. Terrestrial.

Diagnostic characteristics — *Nardia japonica* can be distinguished by its (1) small size (shoots less than 1 mm wide), (2) shallowly bilobed leaves, (3) distinct underleaves, and (4) clear colorless oil bodies.

Technical description

Leafy Liverwort. **Plants** small, shoots olive green, clear green, golden green, or (sometimes) reddish; growing in a tangled mass. **Leaves** transversely to slightly obliquely inserted, bilobed to about 1/4 leaf length, lobe tips and sinus acute; median cells 8–30 (–32) × 22–40 µm; marginal cells 12–24 µm × 16–26 µm. Oil bodies homogenous, two (occasionally more) per cell, about 1.8 times larger than the chloroplasts, so clear they appear to glisten. **Underleaves** prominent, irregularly lanceolate to triangular-ovate, ~0.25 as long as the leaves.

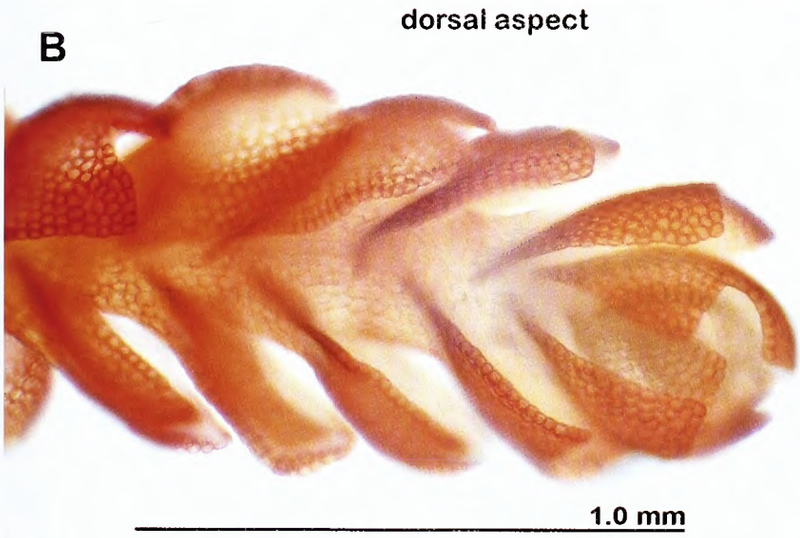
Dioicous. Sporophytes infrequent (not seen in Washington or Oregon material).

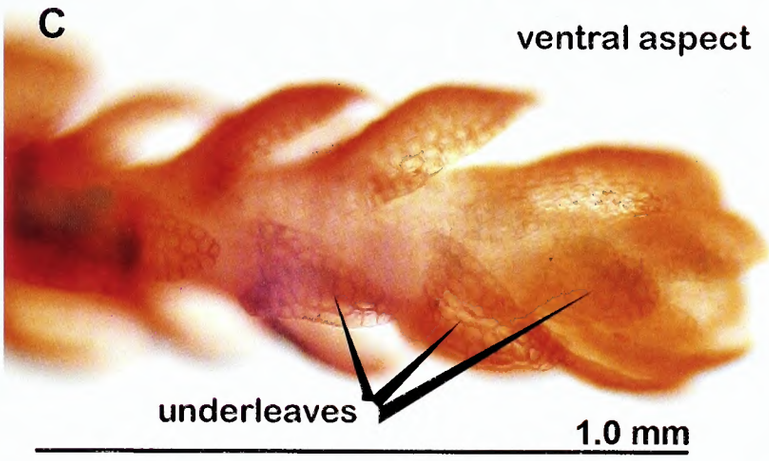
Similar species — *Nardia breidleri* is smaller, often is blackish and lacks underleaves, and has solitary oil bodies. *Marsupella condensata,* which may be quite similar in general appearance, lacks underleaves and has granulose oil bodies.

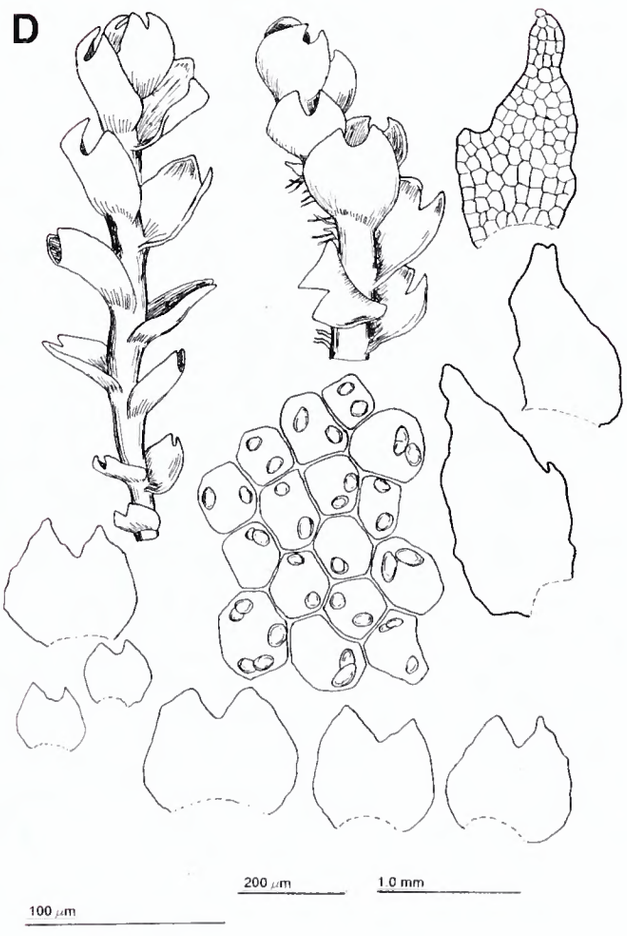
Ecology — *Nardia japonica* grows on peaty soil on rocky ledges or in rocky meadows in forest openings in alpine to subalpine (*Tsuga mertensiana*) vegetation zones. Godfrey (1977) noted that *N. japonica* is always found in open subalpine meadows. The perennial *Nardia japonica* is perennial is most easily identifiable when fertile at the end of the growing season.

Plate 140. Nardia japonica. *A–C. Shoot tips. D. Line drawings. (A–C: Lesher 1419a. USFS; D: Wagner s.n.5-9-79. OSC)*


A
1 mm


dorsal aspect
B
1.0 mm


C
ventral aspect
underleaves
1.0 mm


D
200 µm
1.0 mm
100 µm

Distribution — *Nardia japonica* is known from Asia and North America. In western North America, this leafy liverwort is known from Alaska, British Columbia, Washington, and Oregon. In Oregon, *N. japonica* is reported from Deschutes and Hood River counties within the West Cascades ecoregion.

References with descriptions and/or illustrations — Hicks (2003), Bakalin (2012), Christy and Wagner (1996, part V. p. 38), Godfrey and Godfrey (1980), Amakawa (1959, p. 283).

References with photos — Wagner (2014).

Plagiochila semidecurrens (Lehmann & Lindenberg) Lehmann & Lindenberg

Recent synonym: *Plagiochila semidecurrens* var. *alaskana* (A. Evans) Inoue
Common names: Alaska cedar-shake, pacific featherwort

Summary — A leafy liverwort with succubous round to ovate spinous leaves. Underleaves lacking to minute. Terrestrial.

Diagnostic characteristics — *Plagiochila semidecurrens* can be distinguished by its (1) erect shoots, (2) asymmetrical leaves with a distinctive trough or groove running up midleaf (a generic character), and (3) smooth shiny glossy cuticle.

Technical description

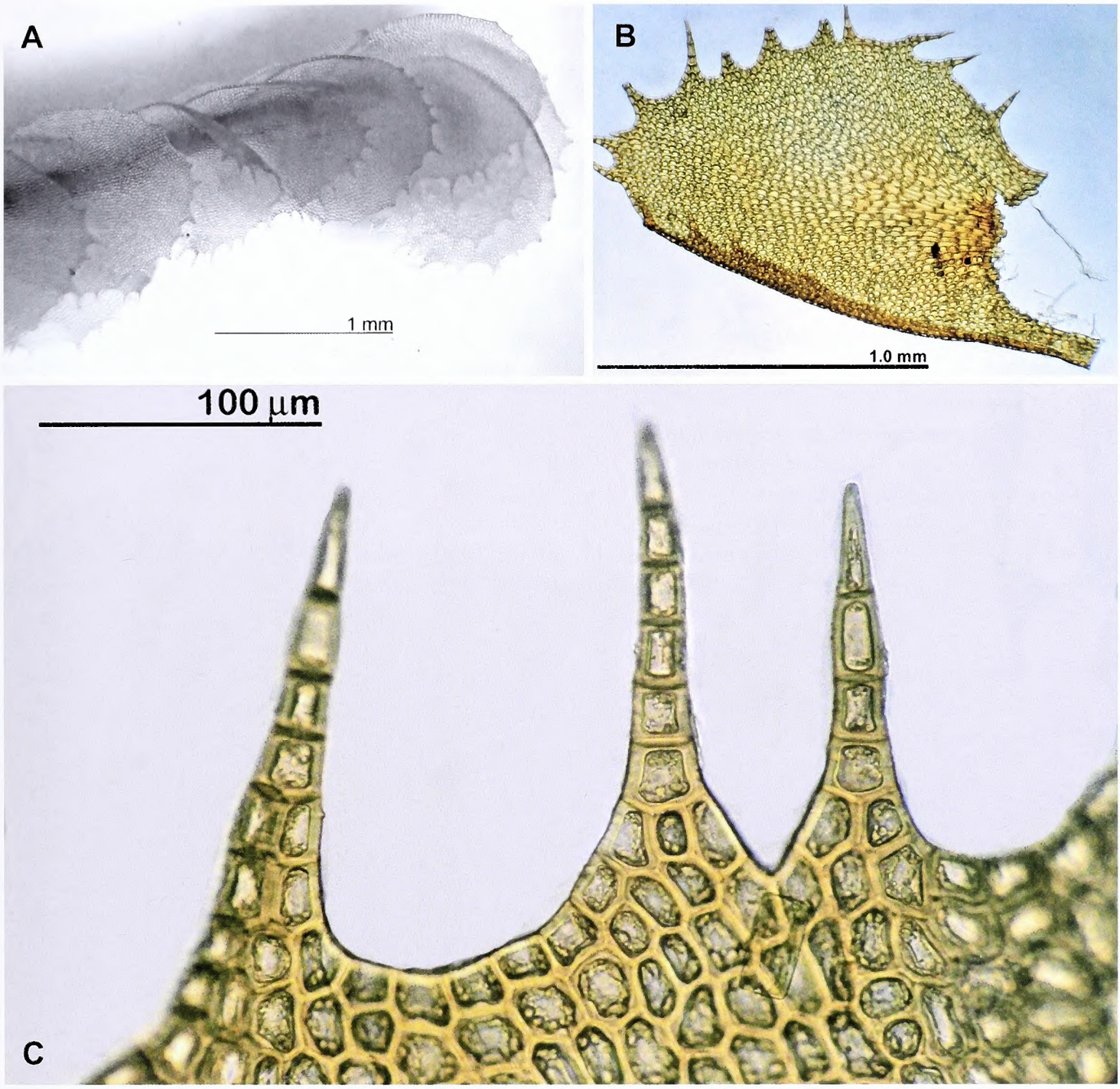
Leafy Liverwort. **Plants** medium-sized, ~2.5 mm wide, strikingly shiny, (especially when dry) dark golden-green to golden-brown; shoots more or less erect-ascending, arising from a creeping rhizomatous stem; rhizoids few, scattered. **Leaves** succubously inserted, decurrent both on the upperside (antically) and lower side (postically), unlobed. Antical leaf margin strongly reflexed while leaf insertion dips downward at mid-base, forming a convex antical fold and longitudinal groove up the leaf center; leaves with a distinct vitta region at mid-base, i.e., elongated cells very numerous, up to 14–20 µm wide × 48–90 µm long and averaging 4.2 times as long as wide. Leaf margins strongly dentate with acicular, cilia-like teeth, usually 17–23 (x = 19) per leaf, frequently 3–5 (–7) cells high, apical cell elongate, tip sharply acute with the base (1–) 2–4 cells wide; leaf cell widths 14–24 µm at the median and 12–18 µm at the margin. **Underleaves** vestigial. **Gemmae** absent.

Dioicous. Sporophytes not observed in this region.

Similar species — At more than arm's length away, *Scapania* species sometimes look like *Plagiochila* because of the similar growth habit. However, when examined under a hand lens the bilobed and folded leaves immediately identify *Scapania* immediately exclude *Plagiochila*. The only other *Plagiochila* species in the area, *P. porelloides*, has a dull leaf surface and lacks the prominent group of elongated cells at leaf base (vitta) of *P. semidecurrens*. Also the trigones in *P. semidecurrens* are very large and bulging compared to the moderately enlarged trigones in *P. porelloides*.

Ecology — *Plagiochila semidecurrens* exhibits a diverse ecology. It is known from cliffs and banks in humid canyons (particularly near waterfalls and maritime influenced exposed cliffs) and tundra cliffs and as an epiphyte (particularly on *Chamaecyparis* and *Pinus*) where it forms thick sheaths up the bases of trees. The Oregon site on Saddle Mountain is a north facing basalt outcrop at the 2,470 foot level.

Plate 141. Plagiochila semidecurrens. *A. Shoot tip. B. Leaf. C. Leaf margin. (A: Schofield 68034. UBC; B, C: Schofield 15835. UBC)*


A
1 mm
B
1.0 mm
100 µm
C

Distribution — *Plagiochila semidecurrens* is known from Asia and North America close to the Pacific Ocean. In western North America, this leafy liverwort is known from Alaska south through British Columbia and Washington to northwest Oregon. In Oregon, *P. semidecurrens* is reported from Clatsop County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Hong (1992), Christy and Wagner (1996, part V. p. 42).

References with photos — Wagner (2014).

Porella arboris-vitae (Withering) Grolle

Recent synonyms:
Madotheca laevigata (Schrader) Dumortier
Porella laevigata (Schrader) Pfeiffer
Common name: bitter scalewort

Summary — A leafy liverwort with incubous deeply bilobed lateral leaves. Lobes divided almost to the base with the dorsal lobe larger and the ventral lobe smaller (forming a distinct lobule). Underleaves are large, prominent, and spinose-ciliate. Terrestrial.

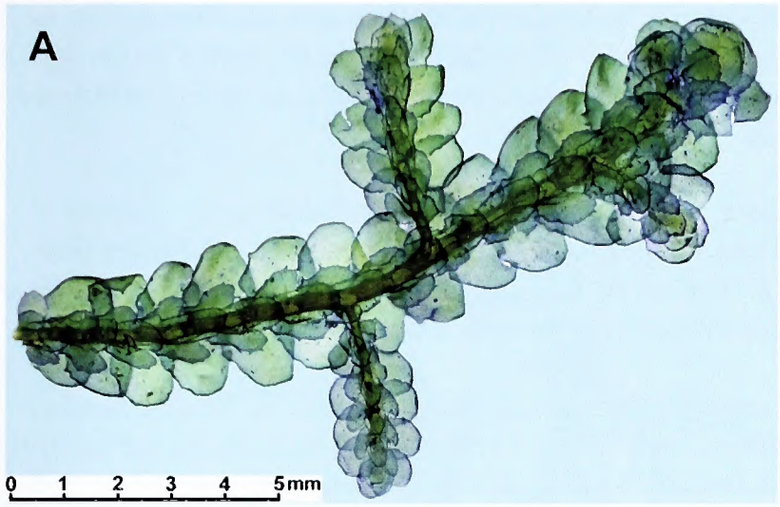
Diagnostic characteristics — *Porella arboris-vitae* can distinguished by its (1) ventral lobe and underleaf margins that are coarsely toothed or spinose (visible with a hand lens), (2) short-decurrent ventral lobe and underleaves, and (3) acrid taste.

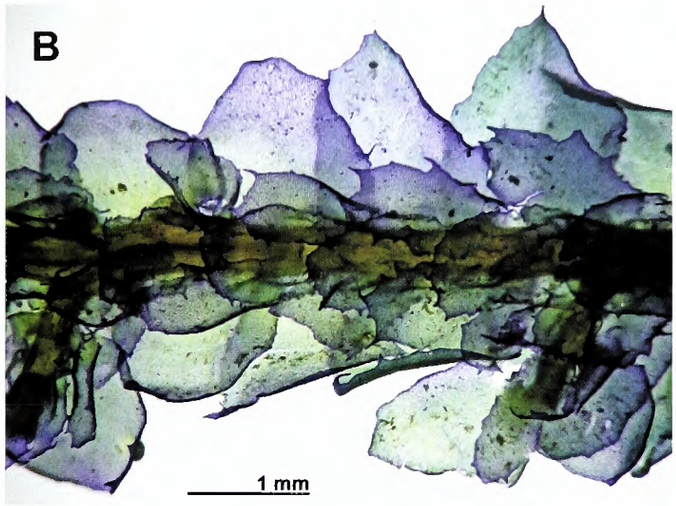
Technical description

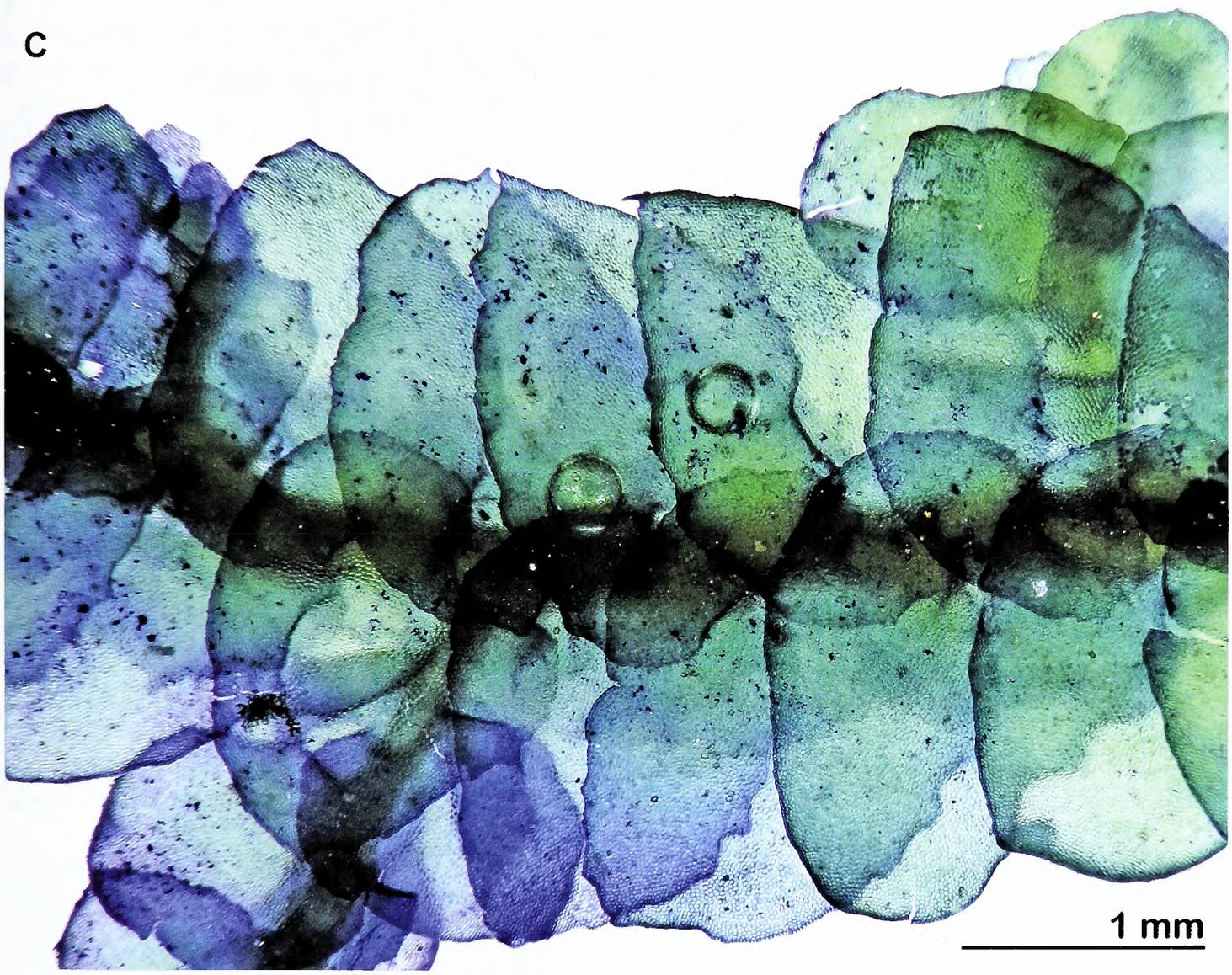
Leafy Liverwort. **Plants** pale yellowish, brownish or greyish green, dark green, brown, to almost black; glossy throughout or dull towards apex, slightly to strongly aromatic and with an acrid taste; up to 8 cm long with leafy shoots 1.5–4.0 mm wide; rhizoids yellowish to pale brown. **Leaves** inserted at a 25°–45° angle with the stem (patent), up to 1.7 (–2.0) mm, longer than wide; lobes semi-ovate or occasionally suborbicular, antical margin appressed; margins often with one to several small teeth (spinose), especially near the apex, antical base sometimes lobed, postical margin usually more or less undulate, sometimes with one to several teeth, base usually lobed or ciliate or both; apex broadly rounded to acute and often apiculate or acuminate, or sometimes nearly all lobes narrowly to broadly rounded. Lobules erecto-patent to erect and almost as wide as the underleaves; lobules oblong or sometimes oval or ovate-triangular, plane to strongly concave or seldom more or less convex; apex broadly rounded to truncate or acute or seldom acuminate, apical margin plane; lateral margins sinuate-undulate to dentate or spinose-ciliate, sometimes lobed or with a tooth or cilium at the base, inner margin not or scarcely decurrent. **Underleaves** distant to approximately 1.5–3 times wider than the stem; margins more often plane than recurved and wings sinuate or lobed or toothed near the base, to dentate or spinose-ciliate, decurrent; wing lengths 1/4 to nearly equal that of the lamina.

Dioicous. Male plants unknown in the British Isles; female inflorescences are reported as fairly common. The only North American collection is sterile.

Plate 142. Porella arboris-vitae. *A–B. Shoot, ventral view C. Shoot, dorsal view (4x). (A–C: Potter s.n. DUKE)*


A
0 1 2 3 4 5mm


B
1 mm


C
1 mm

Similar species — *Porella bolanderi,* which has ventral lobe and underleaf margins that are often dentate or ciliate (although not as coarsely as in *P. arboris-vitae*), differs in its long-decurrent ventral leaves and underleaves. Other Pacific Northwest *Porella* species have entire leaves. *Porella cordaeana* has long decurrent leaf lobes and stains blue-black with Lugol's iodine-potassium iodide (IKI).

Regarding *P. arboris-vitae,* Smith (1990) noted, "I have found [its characteristically] acrid taste ... persists strongly in herbarium specimens up to 40 years old and still persists in 80 year old gatherings." Paton (1999) noted that "most populations are easily recognized in the field by the neatly appressed, usually glossy leaves and especially when the lobes are sharply pointed or the leaves and underleaves are spinose-ciliate."

Ecology — Habitat information provided for the Oregon *P. arboris-vitae* site is incomplete. Its elevation is estimated at 600 feet and the habitat probably resembles that of other *Porella* species in the area—on trees or rock in shaded microclimates. Forest associations include *Pseudotsuga menziesii* and *Tsuga heterophylla.*

Most ecological notes for this speces are based on collections from the British Isles; the species is usually found well above the flood-zone near rivers and streams on damp to rather dry base-rich rocks and boulders. The species is also known from exposed roots, trunks and lower branches of trees (especially *Fagus*, *Fraxinus* and *Corylus*) at lowland and (less often) subalpine elevations. Habitat notes by Smith (1990) read, "On usually dry, at least partly sheltered, basic rock, in stony turf and on nearby tree boles, rarely in deeply shaded humid ravines or woodlands ascending to about 700 m."

Distribution — *Porella arboris-vitae* is known as an amphi-Alantic species from Eurasia, northern Africa, and Iceland. In Oregon, *P. arboris-vitae* is reported from Multnomah County within the West Cascade ecoregion.

References with descriptions and/or illustrations — Damsholt (2002, p. 596 and 597), Paton (1999, p. 459), Smith (1990, p. 247).

References with photos — Wagner (2014).

Porella bolanderi (Austin) Pearson

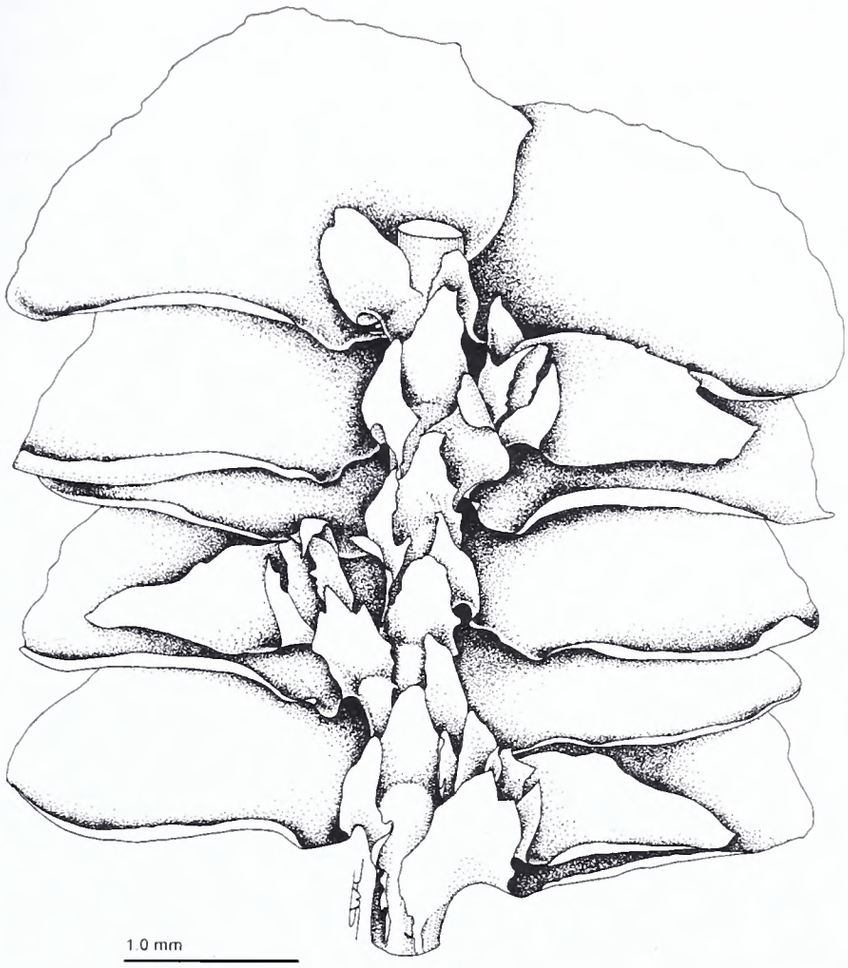
Recent synonyms: none
Common name: Bolander's scalemoss

Summary — A leafy liverwort with incubous deeply bilobed lateral leaves. Lobes divided almost to the base with the dorsal lobe larger and the ventral lobe smaller (forming a distinct lobule). Underleaves are large, prominent, and entire. Terrestrial.

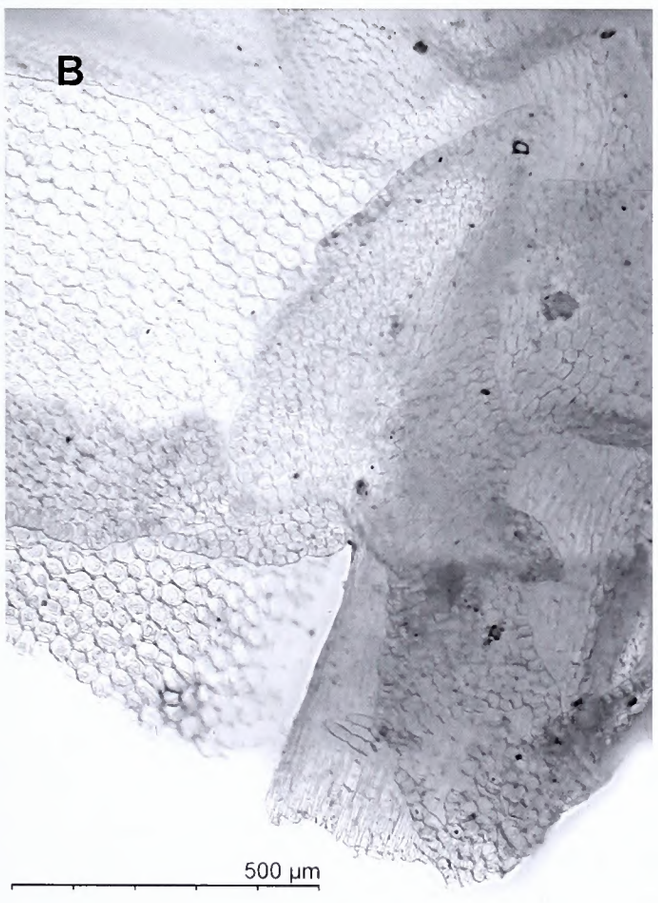
Diagnostic characteristics — *Porella bolanderi* can be distinguished by its (1) long-decurrent ventral leaf lobes, (2) usually overlapping long-decurrent underleaves that narrow to a truncate apex, (3) flattened plicate perianth with a ciliate mouth, (4) leaf cells with a negative (no change) iodine (e.g., IKI) color reaction, and (5) lack of peppery taste when fresh.

Plate 143a. Porella bolanderi. *A. Line drawing, ventral shoot. B. Lobule. (A: Wagner 3040. ORE; B: Knurowski 107. DHW)*

A



B



Technical description

LEAFY LIVERWORT. **Plants** leafy, dark green, grayish-green to olive-brown below, dull, and prostrate with tips often ascending, 2–4 mm wide and 1.5–6 (–10) cm long, simple or sparsely pinnately branched. **Leaves** densely imbricate, bilobed, the dorsal lobes larger and folded over the ventral lobes; lateral leaf dorsal lobe incubous, 1.5–2.5 mm long, 0.6–1.8 mm wide, broadly ovate, rounded or pointed at apex, spreading laterally, the margins toothed or ciliate at base and recurved or sometimes undulate; ventral lobes narrow, ovate-lanceolate to linear-lanceolate, acute, long-decurrent, angled somewhat away from the stem, the margins recurved, undulate and with one or more teeth at the base. Median leaf cells with trigones little enlarged. **Underleaves** ovate, usually overlapping, typically dentate at least at base, long-decurrent, apices acute or narrowly truncate, slightly wider than the stem and about twice as wide as ventral leaf lobes, margins not recurved. Fresh plants are aromatic but lack a peppery taste.

Dioicous. Male branches lateral, oblong to linear. Female branches lateral, commonly on main shoot. Perianths broadly ovoid, longitudinally furrowed (plicate), with a cilate mouth.

Similar species — *Porella cordaeana* has long decurrent ventral leaf lobes and underleaves that usually do not overlap, are rounded and long-decurrent. Its perianth is flat and smooth with a narrow mouth that lacks cilia. It and *P. bolanderi* both lack a peppery taste, but *P. cordaeana* differs in its positive (bluish, purplish, or brownish) color reaction to iodine.

Porella roellii ventral leaf lobes are not or short-decurrent and usually narrower than the underleaves. Its underleaves usually overlap and are blunt. The perianth is flat with a wide, dentate but not ciliate mouth. It and *P. bolanderi* both have a negative reaction to iodine, but *P. roellii* has a burning, peppery taste when fresh.

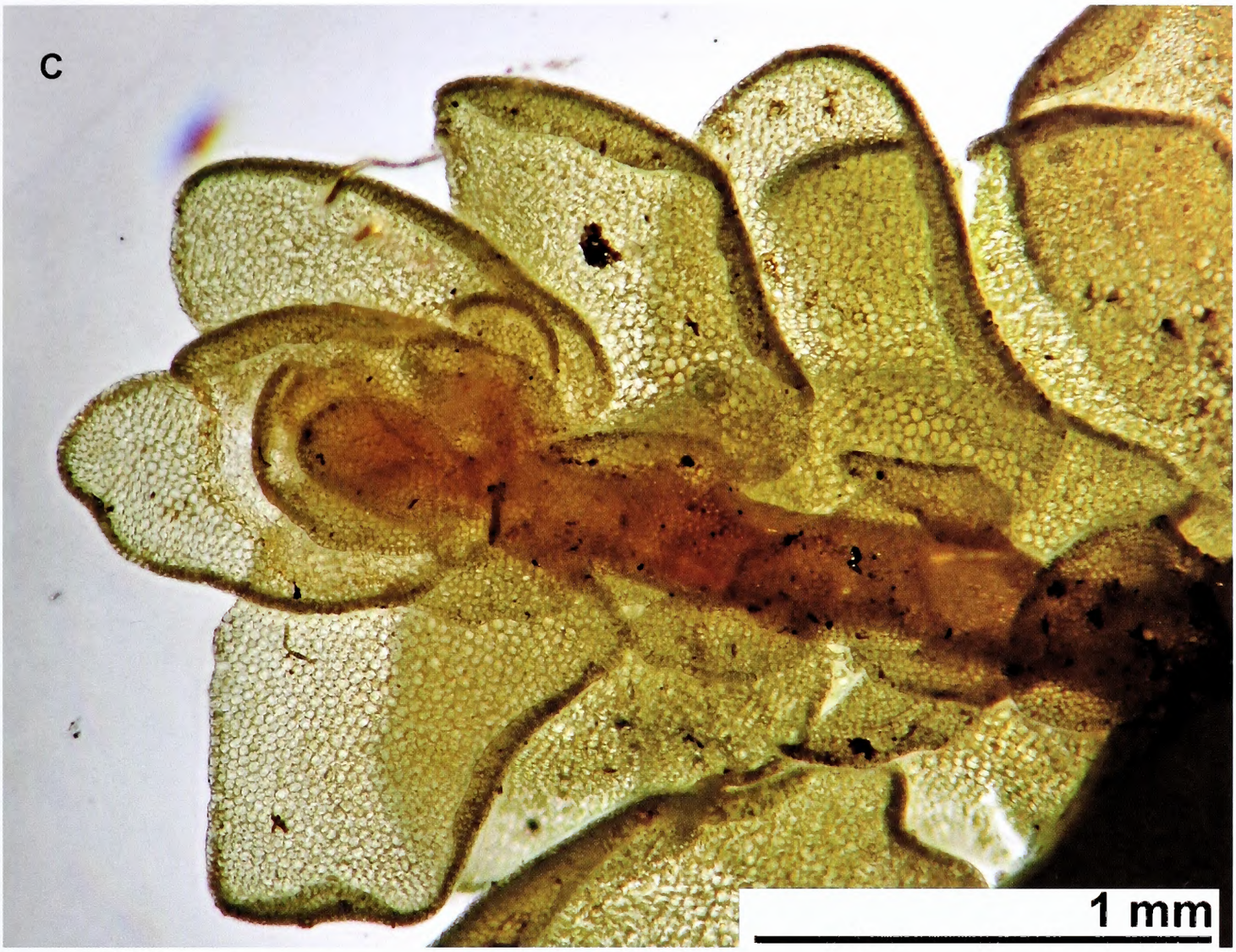
Ecology — *Porella bolanderi* is known from shaded to partly exposed mats on a variety of rock types (siliceous, calcareous, and metamorphic) and from trunks of *Acer macrophyllum*, *Quercus* and *Umbellularia* (Piippo and Norris 1996). Pacific Northwest site elevations range from 500–3,000 feet and primary forest associations include *Pinus ponderosa*, *Pseudotsuga menziesii* and *Quercus garryana*. California and Oregon habitats suggest that *Porella bolanderi* occurs in the typical wet winter/dry summer Mediterranean climate. The disjunct populations in lower-elevation canyons of Utah's Wasatch Mountains are subject to a more continental climate, but *Pinus ponderosa* and *Pseudotsuga menziesii* associations are probably the primary forest types.

Distribution — *Porella bolanderi* is endemic to western North America and known only from Oregon, California, and Utah. Hong (1983) reported it from Washington but these records need verification. In Oregon, *Porella bolanderi* is reported from Douglas, Jackson, Josephine, and Linn counties within the Klamath Mountain and West Cascades ecoregions.

References with descriptions and/or illustrations — Wagner (2014), Piippo and Norris (1996, p. 138), Hong (1983, p. 145), Flowers (1961, p. 82), Frye and Clark (1946, p. 729), Howe (1899 p. 162 plates 111 and 112).

References with photos — Wagner (2014).

Plate 143b. Porella bolanderi. *C. Ventral shoot. (C: Knurowski 107. DHW)*


C
1 mm

Ptilidium pulcherrimum (G. Weber) Hampe

Recent synonyms: none
Common names: lovely fuzzwort, naugahyde liverwort

Summary — A leafy liverwort with leaves divided one-half or more into lobes bordered with uniseriate, multicellular cilia. Usually on trees, rarely on rock.

Diagnostic characteristics — *Ptilidium pulcherrimum* can be distinguished by its (1) highly divided leaves with dense cilia on the margins, (2) leaf sinuses up to 3/4 (or greater) as long as the leaf, and (3) underleaf sinuses up to ~ 1/2 as long as the underleaf.

Technical description

Leafy Liverwort. **Plants** green, yellowish-green, or brownish-green, often tinged with red; prostrate; apices ascending, irregularly pinnately branched. **Leaves** densely packed along the stem, 0.9–1 mm long, 1–1.2 mm wide, bilobed, the sinus up to 0.75–0.8 as long as the leaf; dorsal lobe 6–10 (–12) cells wide at the base; margins ornamented with 6–13 cilia 0.4–0.5 mm long (usually longer than the width of the dorsal lobe base); laminal cells with bulging thickenings at corners (trigones). Oil bodies 15–25, spherical or rodlike, colorless. **Underleaves** prominent, about half as large as the leaves, bilobed to 0.3–0.5 their length, with densely ciliate margins.

Dioicous. Male plants smaller than female plants. Androecia on lateral branches, of 3–6 pairs of imbricate bracts that are concave, otherwise similar to leaves; perianths obovoid, weakly plicate, mouth unlobed, with long, uniseriate cilia.

Similar species — *Ptilidium californicum,* the most common *Ptilidium* species in western North America, has leaf margins with only 1–3 cilia per leaf lobe. The underleaves are bilobed to 0.5–0.9 their length. It usually occurs only on tree trunks and logs.

Ptilidium ciliare, another circumboreal species known from western North America as far south as Washington's northern Cascade Range (Hong 1980a) and Montana, has dorsal leaf lobes that are 15–25 cells wide at the base. The interlobe sinus is equal to ~ 0.45–0.55 the length of the leaf. Marginal cilia are only about as long as the base of the dorsal leaf lobe is wide.

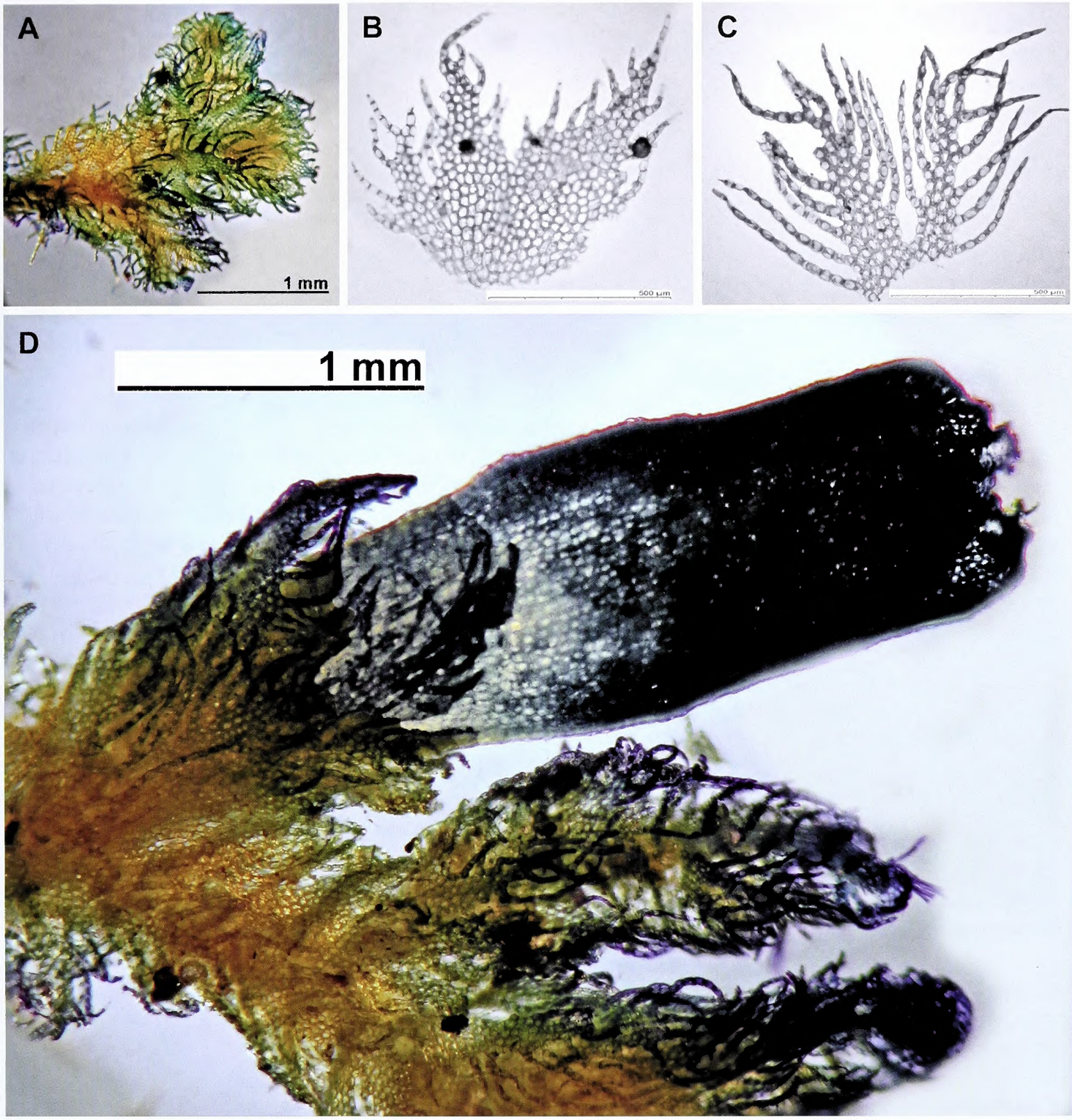
Ecology — *Ptilidium pulcherrimum* is a boreal species that forms mats at tree bases, on decaying wood, among boulders in talus slopes, on cliff ledges, and rarely on soil in cool moist habitats. Details about the single Oregon locality (Antone Creek) reported by Hong (1978) are unknown other than its location is between 3,800 and 8,000 feet in elevation. Associated conifer associations include *Abies grandis*, *Abies lasiocarpa*, *Picea engelmannii* and *Pseudotsuga menziesii*.

Distribution — *Ptilidium pulcherrimum* is circumboreal and bipolar. In western North America, this leafy liverwort occurs at its southern end of its range in Washington, Oregon, Idaho, and Montana. In Oregon, *P. pulcherrimum* is reported from Baker County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Faubert (2012, p. 94), Damsholt (2002, p. 584), Leonardi (2002), Hutten et al. (2001, p. 42), Paton (1999, p. 451), Parish et al. (1996, p. 409), Crum (1991, p. 59 and 175), Smith (1990, p. 245), Vitt et al. (1988, p. 145), Schuster (1966, p. 763), Frye and Clark (1943, p. 199), Macvicar (1926), p. 354.

References with photos — Wagner (2014), Atherton (2010, p. 205), Lincoln (2008, p. 48), Arnell (1956, p. 43).

Plate 144. Ptilidium pulcherrimum. *A. Shoot tip on female plant. B. Leaf on male shoot. C. Leaf on female shoot. D. Perianth. (A–D: Glime 1829. DHW)*


A
1 mm
B
500 µm
C
500 µm
D
1 mm

Radula brunnea Stephani

Recent synonyms: none
Common name: brown flatwort

Summary — A leafy liverwort with incubous bilobed leaves with a basal lobule that is folded under on the ventral side. Underleaves are lacking, and oil bodies are solitary per laminal cell. Terrestrial.

Diagnostic characteristics — *Radula brunnea* can be distinguished by its (1) profusion of tiny branchlets (with reduced leaves attached below almost every leaf along the stem) that are shorter than the leaves and not noticeable from a dorsal view and (2) dark brown color that is distinctive in western North America.

Technical description

Leafy Liverwort. **Plants** rich dark brown, varying to olive-green and appearing blackish-brown when dry; shoots 2.0–6.5 cm long, 1.7–2.8 mm wide, closely pinnately branched; the main stems 170–210 µm in diameter. Branches of two types; macrophyllous branches bearing ordinary vegetative leaves and microphyllous branches arising below virtually every leaf of the main stem except those from which macrophyllous branches arise. **Leaves** of the main stem closely imbricate, the keel convex to straight, somewhat inflated and slightly mammillose; the apex obtuse and recurved, the antical base extended well beyond the axis, auriculate, the auricle usually two-lobed or two-toothed, the line of leaf attachment strongly curved; lobule 700–740 µm wide × 830–970 µm long, the lateral margin short, the apex low, bluntly angled, the base broadly rounded, free to or below the keel, extended across and beyond the stem, auriculate and with 1–2 lobes or teeth, the insertion oblique to nearly transverse. Rhizoids not apparent. Leaf cells somewhat mammillose on outer surface of dorsal lobes, the trigones bulging; cells of lobe margin 7.5–12.5 × 10.0–18.5 µm; cells of median portion 15–25 × 17.5–32.5 µm wide. Oil bodies granular, bumpy in outline, occurring as one per cell, and nearly filling the cell lumen. **Underleaves** lacking.

Dioicous. Reproductive material unknown from North America.

Similar species — From a dorsal view this species looks more like a *Porella* than a *Radula*, as our regionally common *Radula* species are smaller and a soft green. Only *R. obtusiloba* also produces microphyllous branchlets, but it differs in its light green color, its lobule bulging to form a pronounced pouch, and having several clear oil bodies per cell.

Ecology — *Radula brunnea,* which forms dark brown to nearly black patches on cliff faces or on thin moist soil over rock, grows in somewhat sheltered and in open sites. Associated liverworts include *Apometzgeria pubescens, Herbertus dicranus, Marsupella emarginata, Metzgeria conjugata, Radula obtusiloba,* and *Tritomaria quinquedentata.*

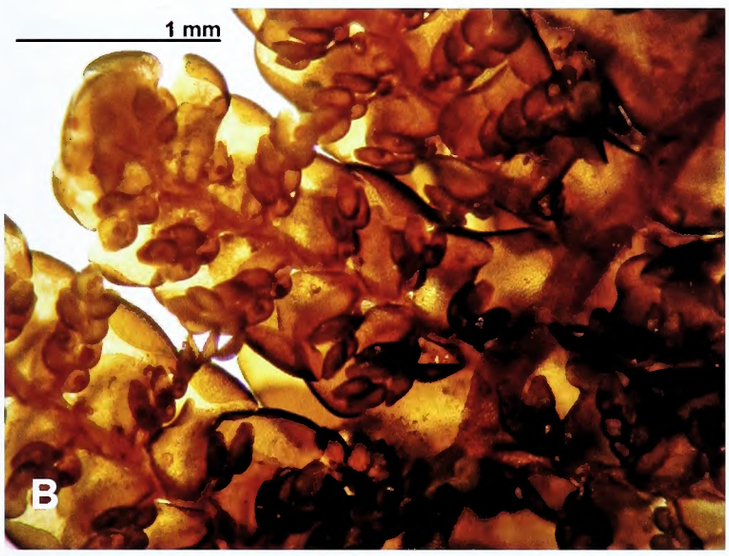
Distribution — *Radula brunnea* is known from Asia and North America. In North America, it is known from a single occurrence in Oregon. *Radula brunnea* is reported from Clatsop County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Christy and Wagner (1996, part V. p. 49).

References with photos — Wagner (2014).

Plate 145. Radula brunnea. *A. Lateral branch. B. Shoot with lateral branches. C. Lateral branches, dorsal view. D. Shoot tip, dorsal. (A–D: Schofield 68047. UBC)*


A
1 mm


1 mm
B


C
1 mm


D
1 mm

Radula obtusiloba subsp. *polyclada* (A. Evans) S. Hattori

Recent synonyms: none
Common name: blunt scalewort

Summary — A leafy liverwort with incubous bilobed leaves with a basal lobule present and folded under on the ventral side. Underleaves are lacking, and there are several oil bodies per laminal cell. Terrestrial.

Diagnostic characteristics — *Radula obtusiloba* subsp. *polyclada* is distinguished by its (1) prominent microphyllous branches, (2) bulging leaf keel, and (3) multiple clear oil bodies.

Technical description

Leafy Liverwort. **Plants** yellow-green to golden-brown, medium sized and fern-like or feather-like from small microphyllous branches regularly found opposite most leaves on the main stem. **Stems** blackish in dry plants. **Leaves** distant to overlapping up to 0.2 the doral lobe width, narrowly ovate, longer than wide. Leaf cells with 2–4, clear, oil bodies containing 1–5 globules. Lobules barely extending past the near edge of the stem.

Dioicous. Fertile plants are unknown from the Pacific Northwest.

Similar species — *Radula brunnea,* the only other *Radula* species with microphyllous branches, differs from *R. obtusiloba* subsp. *polyclada* in its dark brown (not brown) color and straight (not bulging) leaf keel. Like all other *Radula* taxa (except *R. obtusiloba* subsp. *polyclada*), *R. brunnea* has a solitary, brown oil body in each laminal cell.

Ecology — *Radula obtusiloba* subsp. *polyclada* is known from moist rock outcrops, boulders and (less frequently) decaying logs.

Distribution — *Radula obtusiloba* subsp. *polyclada* is known from Asia and North America. In western North America, it is known from Alaska south through British Columbia, Washington, and Oregon. In Oregon, *R. obtusiloba* subsp. *polyclada* is reported from Clatsop County within the Coast Range ecoregion.

References with descriptions and/or illustrations — Godfrey (1977).

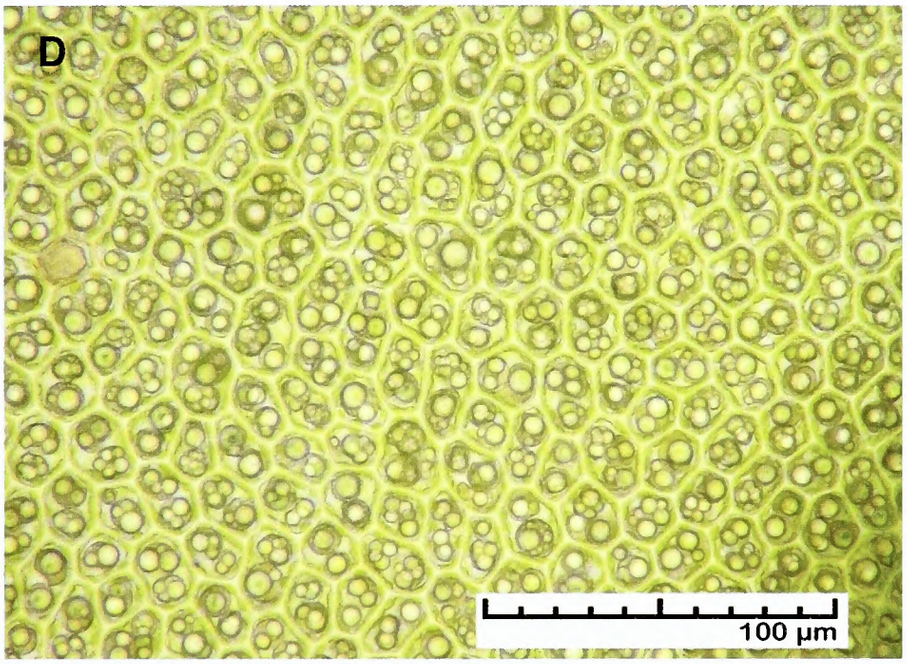
References with photos — Wagner (2014).

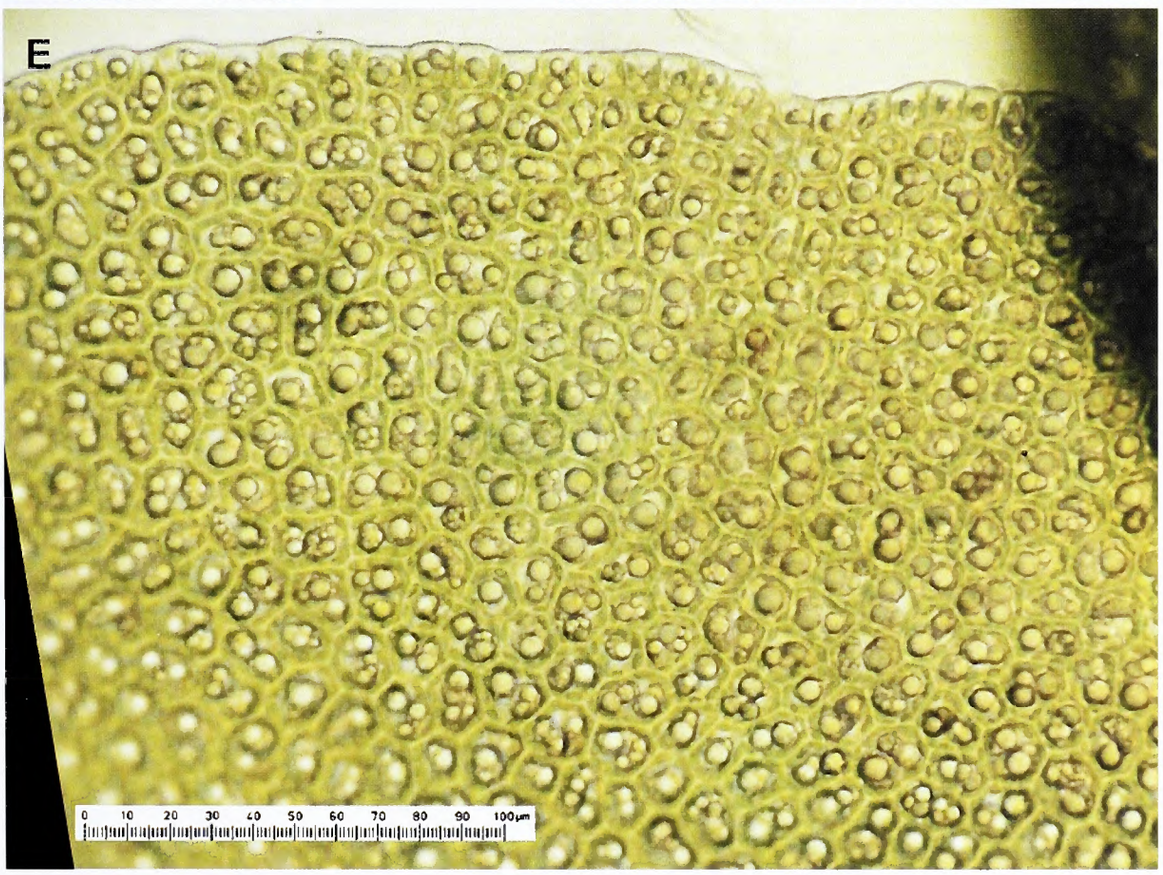
Plate 146. Radula obtusiloba ssp. polyclada. *A. Shoot. B. Shoot segment. C. Shoot tip. D. Median cells with oil bodies. E. Leaf margin cells with oil bodies. (A & D: Wagner m2771. DHW; B, C, E: Wagner 7971. DHW)*


A
1 mm


B
1 mm


C
1 mm


D
100 µm


E
0 10 20 30 40 50 60 70 80 90 100µm

Rivulariella gemmipara (A. Evans) D.H. Wagner

Recent synonym: *Chiloscyphus gemmiparus* A. Evans
Common name: alpine waterwort

Summary — A leafy liverwort with transverse to obliquely inserted leaves that are entire and retuse to shallowly bilobed. Underleaves are variable, often lacking but sometimes large and entire to bilobed. Aquatic.

Diagnostic characteristics — *Rivulariella gemmipara* can be distinguished by its (1) aquatic habitat on rocks in cold fast-moving water, (2) flattened stems on shoots that are appressed to the substrate, and (3) frequent abundant gemmae that are visible at the shoot apices with a hand lens.

Technical description

Leafy Liverwort. **Plants** yellow-brown to dark greasy-green, drying blackish, 5–6 mm wide to 1.5 cm long. **Leaves** obovate, widest above the middle, emarginate to shallowly bilobed at the apex. **Underleaves** tiny, absent or present. In maturity, gemmae of 2–5 cells produced in masses along the leaf edges near the shoot tips. Shoots of two morphologically distinct types: prostrate and erect. Prostrate shoots usually closely appressed to substrate, attached by numerous rhizoids on the underside of flattened stems; leaves attached obliquely, slightly overlappping; underleaves tiny or absent; sex organs lacking. Erect shoots not closely appressed to substrate and generally lacking rhizoids; leaves attached nearly transversely; underleaves usually present, large (especially near the fertile shoot tips; often poorly differentiated from lateral leaves (shoots then essentially isophyllous) and sex organs present.

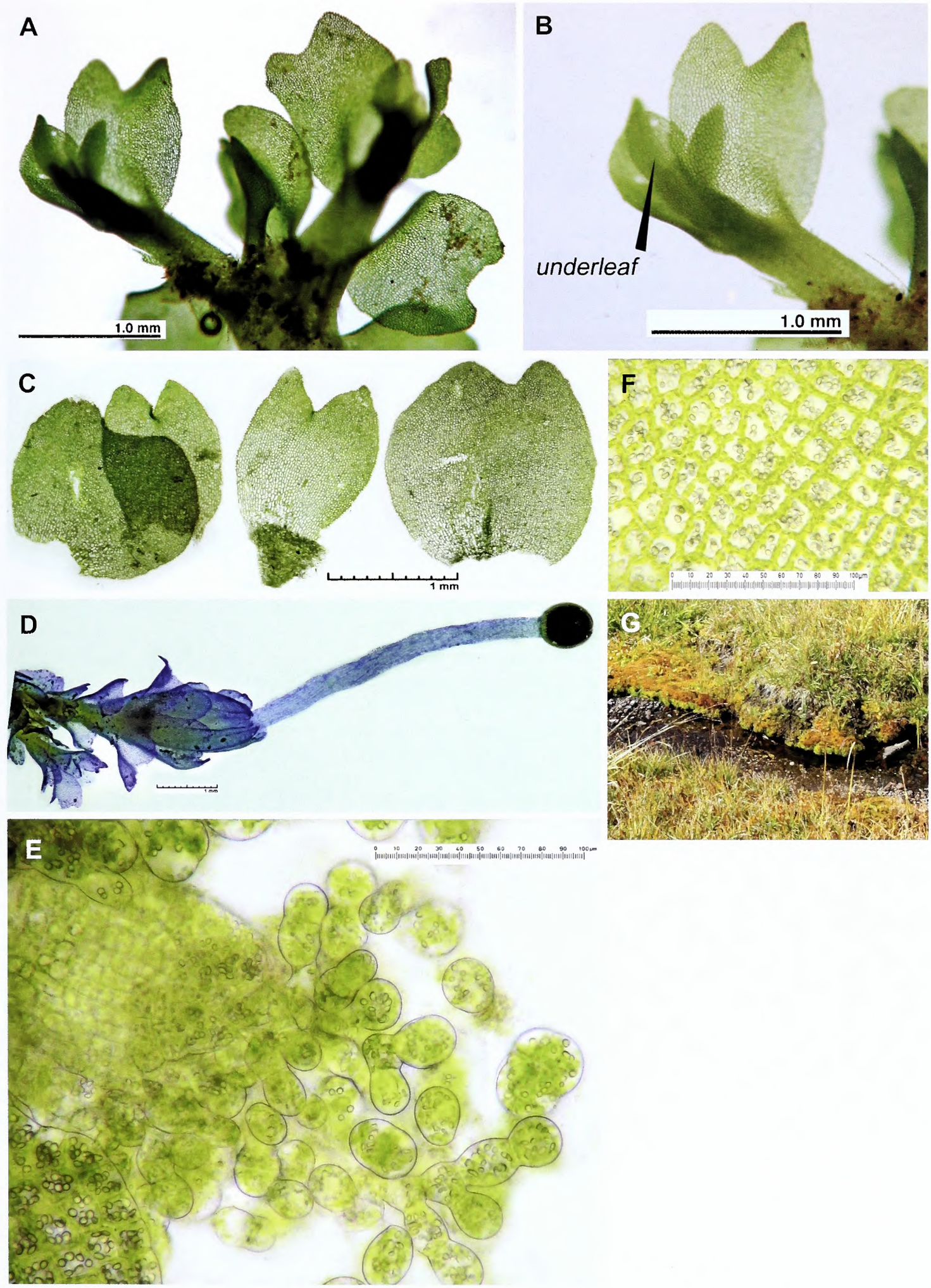
Paroicous or **Polyoicous**. Fertile shoots (erect shoots) typically bisexual, the antheridia in bracts immediately below the archegonial tip (paroicous). Unfertilized shoots often producing small, adventitious male shoots immediately below the undeveloped gynoecia. Perianths oblong, closed at the mouth, with five longitudinal furrows or pleats, forming after fertilization only out of water in the splash zone.

Similar species — *Jungermannia exsertifolia,* which is similar and common in upper elevation streams, differs in its uniformly ovate leaves with rounded tips and the absence of underleaves and gemmae.

Ecology — *Rivulariella gemmipara* forms small turfs or clumps on rocks in beds of cold montane streams, submerged or emergent in the splash zone, in full shade to partial sun. Most populations occur at elevations above 5,100 feet. The "alpine waterwort" grows attached to rocks in moderately fast moving water and is restricted to places where water flows over gravel or rocks. This species does not occur where a stream has a still surface or where organic debris and muck covers the stream bed or in rapidly moving water without rocks. Whenever the stream grade breaks so that the water surface ruffles over a rocky stream bed, the liverwort may be found attached to rocks. *Rivulariella gemmipara* is found only where permanent springs keep the streambed submerged at all times, and it favors sites exposed to sunlight. Western North American plant associations include *Abies amabilis*, *Abies lasiocarpa*, and *Tsuga mertensiana.* Associated liverworts include *Chiloscyphus polyanthos*, *Jungermannia exsertifolia* ssp. *cordifolia* and *Scapania undulata.* Associated aquatic lichens include *Leptogium rivale* and *Peltigera hydrothyria.*

Distribution — *Rivulariella gemmipara* is only known from western North America from one locality in Alaska and then south in Washington, Oregon, California, and Utah. In Oregon, *R. gemmipara* is reported from Deschutes, Jackson, Josephine, and Lane counties within the Klamath Mountain and West Cascades ecoregions.

Plate 147. Rivulariella gemmipara. *A. Shoot. B. Shoot with underleaf. C. Four leaves. D. Perianth, seta, capsule. E. Fasciculate gemmae. F. Median cells with oil bodies. G. Riparian habitat. (A–C: Wagner m1769. DHW; D: Wagner 3453. DHW; E, F: Wagner m2842. DHW; F: Wagner s.n. field photo)*


A
1.0 mm
B
underleaf
1.0 mm
C
1 mm
D
E
F
G

References with descriptions and/or illustrations — Wagner (2013, p. 1), Evans (1938, p. 50 as *Chiloscyphus gemmiparus*), Flowers (1961, p. 63 as *Chiloscyphus gemmiparus*), Frye and Clark (1943, p. 249 as *Chiloscyphus gemmiparus*).

References with photos — Wagner (2014).

Scapania gymnostomophila Kaalaas

Recent synonym: *Diplophyllum gymnostomophilum* (Kaalaas) Kaalaas
Common name: puckered spadewort, narrow-lobed earwort

Summary — A leafy liverwort with transversely inserted and deeply bilobed leaves, no underleaves, and solitary oil bodies in midleaf cells. Terrestrial.

Diagnostic characteristics — *Scapania gymnostomophila* is a small, dark green to blackish scapania with leaf cells each containing a single large brown oil body (persisting for a long time after drying) that fills most of the cell lumen.

Technical description

Leafy Liverwort. **Plants** dark green to blackish, prostrate, 1–2.4 mm wide and up to 1.5 (–2) cm long. **Leaves** in two rows, imbricate, bilobed, the dorsal lobe smaller and folded over the ventral lobe to form a distinctive arched keel at the fold where the leaves attach to the stem; dorsal lobes obovoid to sickle-shaped, narrow, 1/2–3/4 as long and 1/2 (3/4) as wide as the ventral lobes, margins entire, apex acute to obtuse, not decurrent; ventral lobes concave, oval-oblong, only slightly sickle-shaped, 0.44–0.72 mm long and 0.2–0.5 mm wide, apex acute or rounded, margins entire or occasionally with a tooth near apex, not decurrent. Median cells of leaves with a single (rarely 2) large (8–15 × 8–18 µm) brown oil-body filling most of the cell. In most specimens these oil bodies persisting in dried material for 20 years or more, an unusual feature. Gemmae 2–celled, reddish-brown, fusiform, pointed at each end. **Underleaves** lacking.

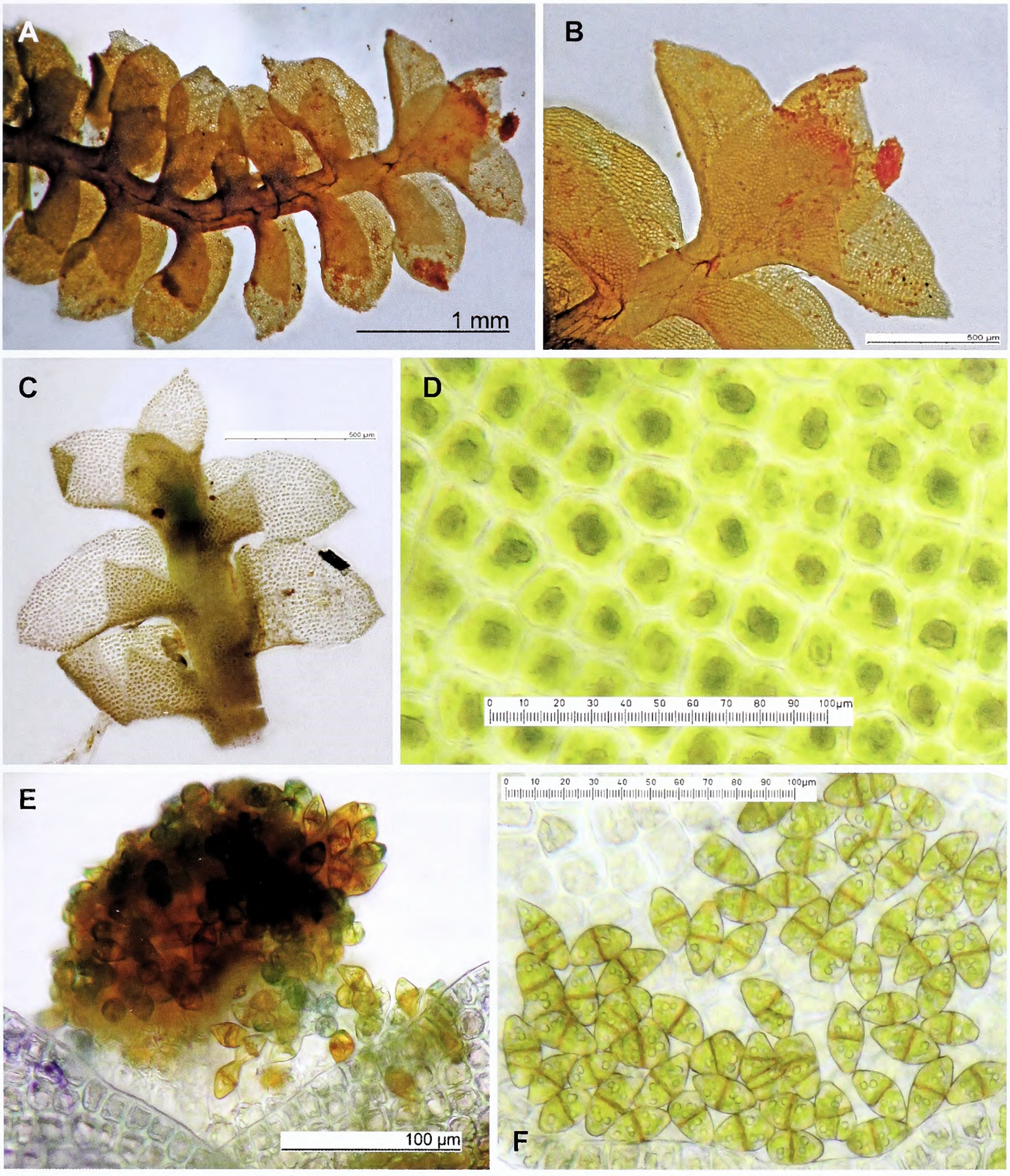
Dioicous. Perianths obovoid, somewhat flattened, plicate distally where narrowing to a ciliate mouth (but not occurring in much of the species' range).

Similar species — In the Pacific Northwest, most rock-dwelling *Scapania* species have toothed leaves and leaf cells containing several, often colorless, oil bodies. *Scapania cuspiduligera* is similar but differs in its larger dorsal leaf lobes (nearly as large as the ventral lobe) and lack of the single large brown oil body.

Diplophyllum, is distinguished by its narrowly ligulate leaf lobes, bright green color and leaf cells containing several clear oil bodies.

Ecology — *Scapania gymnostomophila* forms small patches on ledges and faces and in crevices of mossy shaded cliffs with perennially high humidity and cool temperatures. Reportedly a calciphile, it also occurs on basalt and schist. In Oregon, *S. gymnostomophila* is known from *Pseudotsuga menziesii* and *Tsuga heterophylla* plant associations at 1,200 foot elevations. Associated bryophytes include *Amphidium*, *Anacolia menziesii*, and *Porella*.

Plate 148. Scapania gymnostomophila. *A. Shoot. B–C. Shoot tips. D. Oil bodies. E. Gemmae. F. Gemmae close up. (A, B, E: Wagner 2249. DHW. C, D, F: Hutten s.n. Repository unknown)*


A
1 mm
B
500 µm
C
500 µm
D
0 10 20 30 40 50 60 70 80 90 100µm
E
100 µm
F
0 10 20 30 40 50 60 70 80 90 100µm

Male and female plants have never been collected together, perianths are relatively rare, and dispersal probably occurs by means of gemmae (Schuster 1974) or vegetative fragmentation.

Distribution — *Scapania gymnostomophila* is known from Eurasia, Greenland, and North America. In western North America, it is known from Alaska south to British Columbia, Washington, Oregon, California, Idaho, and Montana. In Oregon, *S. gymnostomophila* is reported from Multnomah County within the West Cascades ecoregion.

References with descriptions and/or illustrations — Faubert (2012, p. 155), Damsholt (2002, p. 311), Paton (1999, p. 349), Smith (1990, p. 176), Hong (1980, p. 42), Schuster (1974, p. 298), Arnell (1956, p. 173), Frye and Clark (1946, p. 578), Macvicar (1926, p. 362).

References with photos — Wagner (2014), Lockhart et al. (2012, p. 244).

Scapania obscura (Arnell & C.E.O. Jensen) Schiffner

Recent synonym: *Scapania subalpina* var. *haynesiae* Frye & Clark
Common names: scorched spadewort, dark earwort

Summary — A leafy liverwort with transversely inserted and deeply bilobed leaves, no underleaves, and 2–5 oil bodies per median leaf cell. Terrestrial.

Diagnostic characteristics — *Scapania obscura* can be distinguished by its (1) small dark brown to black shoots with somewhat loosely folded bilobed leaves, (2) dorsal lobe nearly as large as the ventral lobe, (3) non-decurrent dorsal lobe, (4) long decurrent ventral lobe, and (5) rounded lobe tips that spread back from the stem.

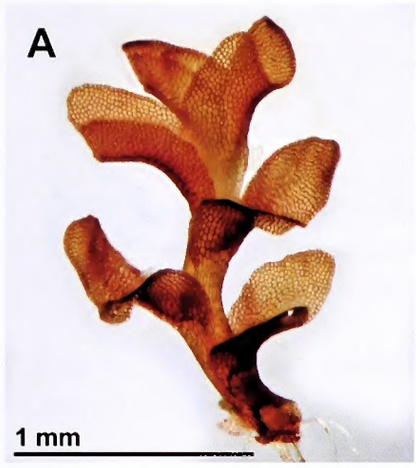
Technical description

Leafy Liverwort. **Plants** medium-sized, 2.0–2.5 mm wide, light golden-green or brownish-green to deep, rich reddish-brown, with both brown and red pigments. **Stems** concolorous, cortical cells in transverse section golden-brown, smaller in diameter than the hyaline medulla cells, which are more or less abruptly larger. **Leaves** lax, ruffly; margins entire, not bordered, the marginal cells collenchymatous. Dorsal lobes transversely inserted, rounded-quadrate to rounded-oblong, extending across and slightly beyond the stem, 0.65–0.80 times as long as the ventral lobes, apex blunt to round. Ventral lobes slightly larger than the dorsal, more or less ovate, the apex blunt to round, the width 0.6–1.0 times the length. Keel rounded, more or less straight to weakly arched, about 0.50–0.65 times as long as the ventral lobe. Median leaf cells about 20 × 30–35 µm. Trigones small. Cuticle weakly papillose. Gemmae (when present) 2–celled, ovoid. Oil bodies 2–5 per cell, only slightly larger (about 1.5 ×) than the chloroplasts. **Underleaves** lacking.

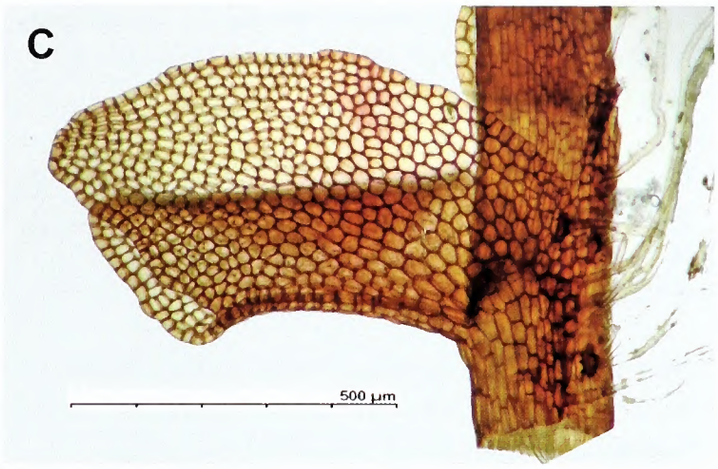
Dioicous. Androecia apical or intercalary, of 2–4 bracts; perianths compressed, mouth truncate, entire, with thick-walled apical cells.

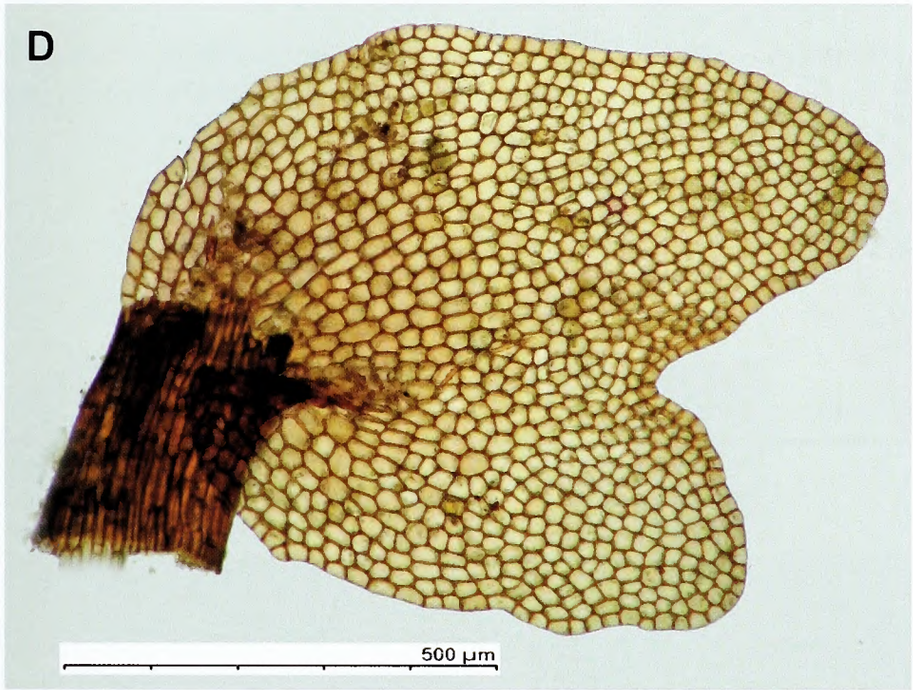
Similar species — Loosely folded lobes and dark coloration characterize both *Scapania obscura* and *Gymnocolea inflata*. *Gymnocolea* differs in its minute underleaves (inconspicuous but detectable by careful examination) and more equal and less folded leaves.

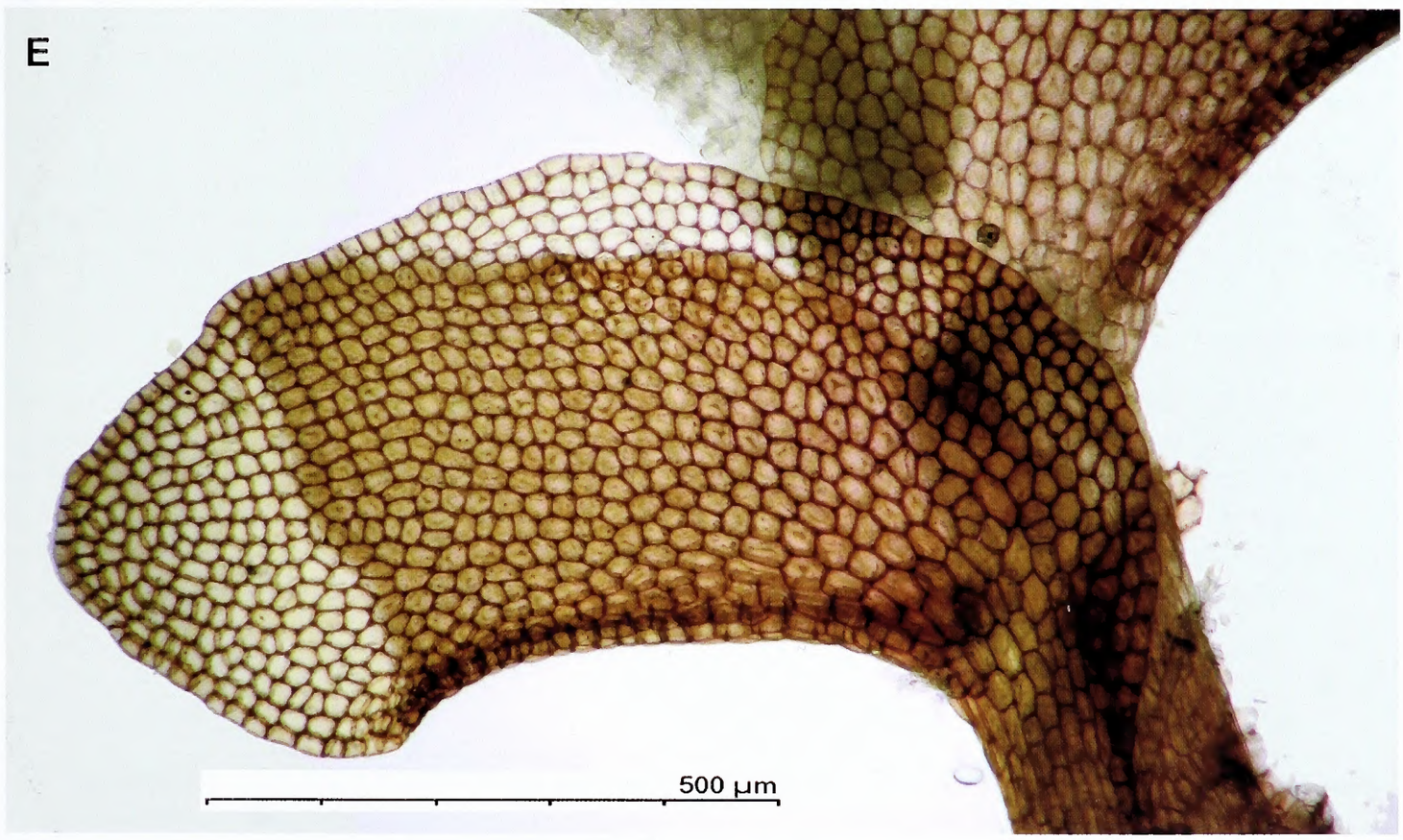
Plate 149. Scapania obscura. *A. Shoot. B. Shoot with ventral leaves stripped. C–E. Leaves. (A–E: Wagner 3507. ORE)*


A
1 mm


B
1 mm


C
500 µm


D
500 µm


E
500 µm

The most similar *Scapania* is the larger *S. subalpina*, which also has subequal lobes, but has a border of thick walled cells, lacks the dark pigmentation of *S. obscura*, and sometimes has dentate leaf margins while *S. obscura* always has entire margins.

Ecology — *Scapania obscura* is known from peaty soil close to streams, below cold water springs, and in snow melt seepage channels generally above 5,000 feet in elevation. The liverwort may be submerged much of the year. In the Pacific Northwest, it grows in full sunlight. Sporophytes are unknown (Schuster 1974, Damsholt 2002) and gemmae, although reported from British Columbia, have not been seen in Oregon material.

Distribution — *Scapania obscura* is known from Eurasia, Greenland, and North America. In western North America, it is known from British Columbia, Alberta, and Oregon. In Oregon, *S. obscura* is reported from Lane County within the West Cascades ecoregion.

References with descriptions and/or illustrations — Damsholt (2013), Damsholt (2002, p. 357), Paton (1999 p. 373 as *Scapania subalpina*), Smith (1990, p. 189 as *Scapania subalpina*), Schuster (1974, p. 543), Arnell (1958, p. 197), Frye and Clark (1946, p. 637, as *Scapania subalpina* var. *haynesiae*).

References with photos — Wagner (2014).

Schistochilopsis laxa (Lindberg) Konstantinova

Recent synonyms:

Lophozia laxa (Lindberg) Grolle
Heterogemma laxa (Lindberg) Konstantinova & Vilnet
Lophozia marchica (Nees) Stephani
Lophozia capitata subsp. *laxa* (Lindberg) Bisang

Common name: bog palewort

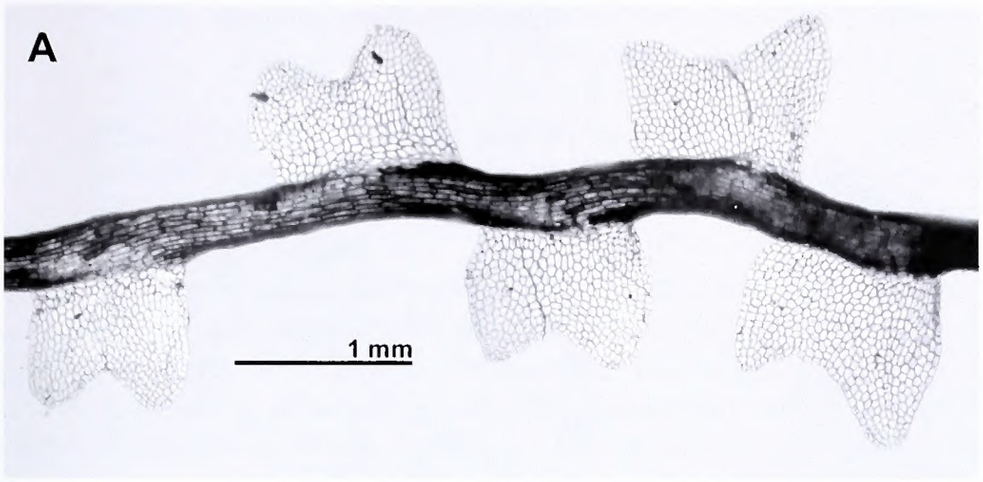
Summary — A leafy liverwort with succubous bilobed leaves. Underleaves are lacking. Terrestrial, but most often in fens and bogs.

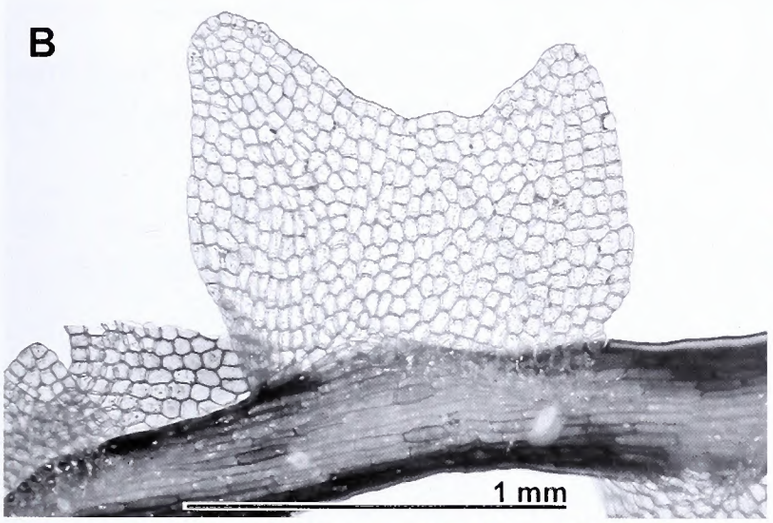
Diagnostic characteristics — *Schistochilopsis laxa* can be distinguished by its (1) small and sometimes solitary translucent green shoots growing among *Sphagnum* heads in bogs and fens, (2) purple-red stem undersides and (often) leaf bases and rhizoids, (3) bilobed to trilobed leaves with wavy margins and round lobe tips, and (4) production of gemmae.

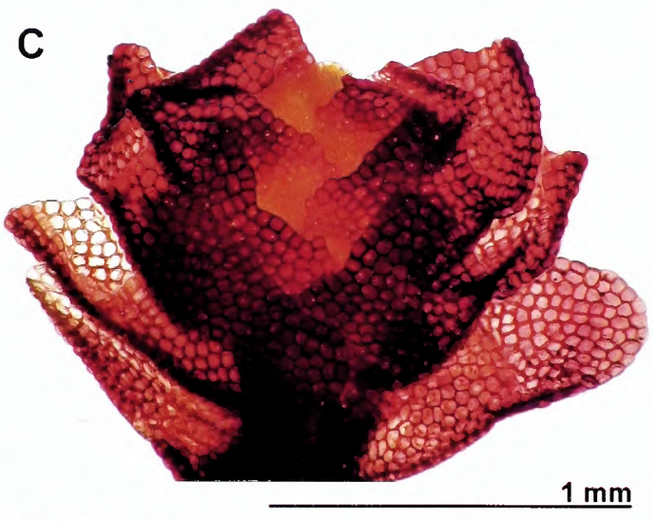
Technical description

Leafy Liverwort. **Plants** yellowish-green to green except for the purple-red underside of the stem and often purple-red leaf bases and rhizoids, 1.8–2 mm wide and up to 2.5 cm long, somewhat flexuose or contorted, delicate, translucent, creeping or entwined among heads of *Sphagnum*. **Leaves** variable, succubous and usually rather widely spaced along the stem, bilobed to trilobed, rectangular in outline, spreading horizontally, margins wavy, lobe tips rounded. **Underleaves** absent. Gemmae green or violet, unicellular, spherical or ovoid, abundant at apices on upper leaves. Oil bodies numerous, composed of 1–5 small, clear, globules.

Plate 150. Schistochilopsis laxa. *A. Shoot. B. Dorsal leaf. C. Male shoot tip. D. Leaf lobe apex cells with oil bodies. (A–C: Wagner 2427. ORE; D. Stone 9070a. OSC)*


A
1 mm


B
1 mm


C
1 mm


D
0 10 20 30 40 50 60 70 80 90 100µm

Dioicous. Androecia of 4–6 pairs of bilobed bracts, often becoming intercalary; perianths exserted half their length, obovoid, plicate above, mouth with 1–2 celled teeth.

Similar species — *Fossombronia foveolata,* which has bright red rhizoids and wavy leaf margins, differs in its very short stem that is never red-pigmented and it does not occur on *Sphagnum*. Other similar "*Lophozia*" species have underleaves and usually do not grow in fens.

Ecology — *Schistochilopsis laxa* is restricted to well-developed *Sphagnum* hummocks in fens and bogs along the coast and in the Cascade Range at elevations from sea level to 5,000 feet. It forms solitary shoots or small mats among *Sphagnum* on the tops and sides of hummocks, often in the company of *Cephalozia* spp. and *Cephaloziella* spp. The "bog palewort" grows in full sun to partial shade but disappears when shaded by encroaching shrubs and trees. Surrounding forest associations include *Abies amabilis, A. lasiocarpa, Picea engelmannii, P. sitchensis, Pinus contorta* var. *contorta* and *P. contorta* var. *latifolia*.

Distribution — *Schistochilopsis laxa* is interruptedly circumboreal in North America. In western North America, it is known from Alaska, British Columbia, and Oregon. In Oregon, *S. laxa* is reported from Baker, Lane, Linn, and Tillamook counties within the Coast Range and West Cascades ecoregions.

References with descriptions and/or illustrations — Damsholt (2002, p. 132), Hong (2012), Paton (1999, p. 203 as *Lophozia capitata*), Schuster (1969, p. 464), Arnell (1956, p. 122 as *Jungermannia laxa*), Frye and Clark (1945, p. 355).

References with photos — Wagner (2014).

Schofieldia monticola J.D. Godfrey

Recent synonyms: none
Common name: alpine masterwort

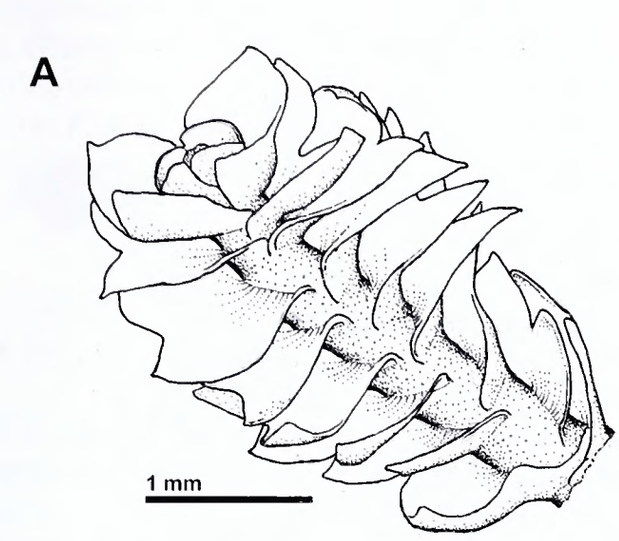
Summary — A fleshy brittle leafy liverwort with succubous to transversely inserted leaves that are bilobed less than one-half their length and occasionally with small underleaves that are rarely up to 1/3 the size of the lateral leaves. Oil bodies are lacking in all cells. Terrestrial.

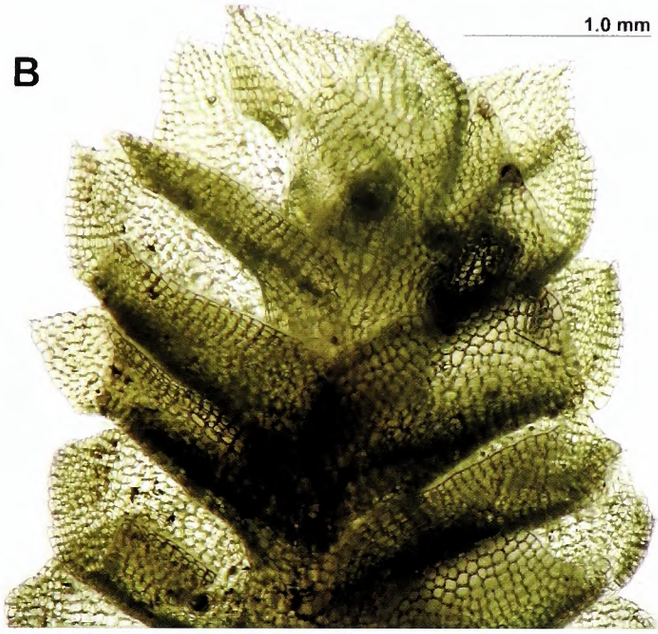
Diagnostic characteristics — *Schofieldia monticola* can be distinguished by its (1) medium size, (2) bilobed leaves, (3) thin, flaccid leaves that are not longer than the stem diameter, and (4) lack of oil bodies in all cells.

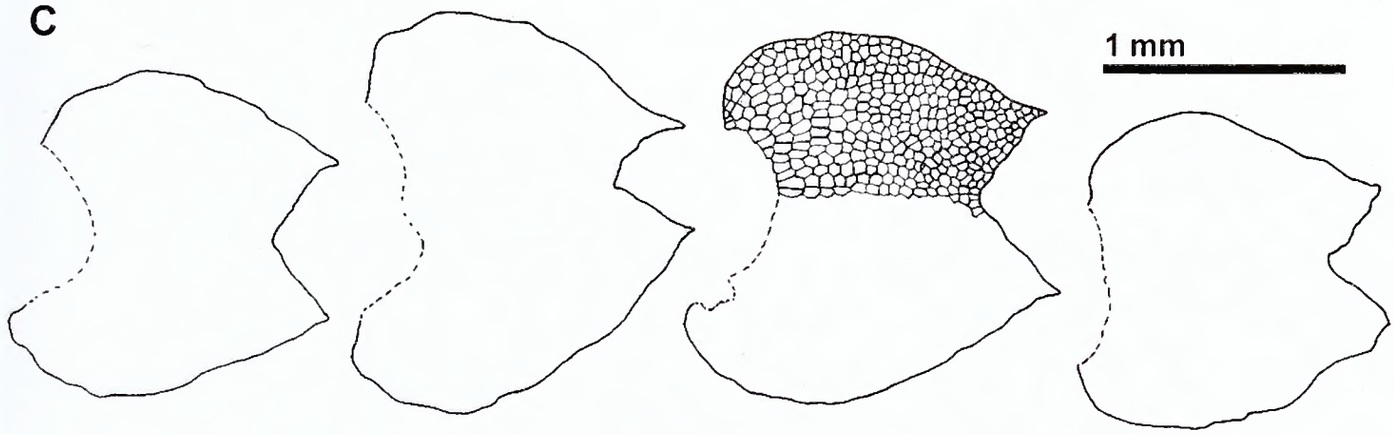
Technical description

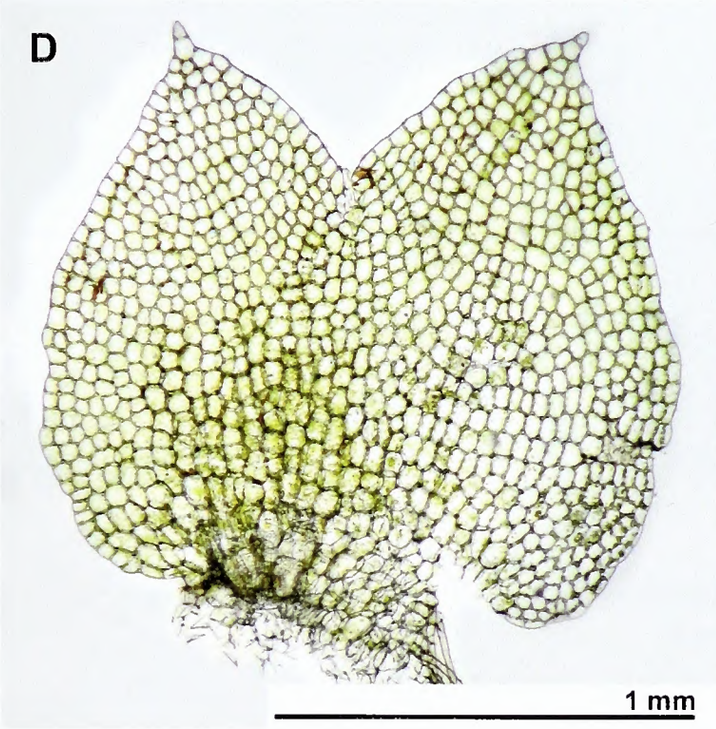
Leafy Liverwort. **Plants** robust, succulent, brittle, 1.5–3 mm wide, 8–15 mm high, growing in crowded, dense turfs, horizontal to slightly ascending at stem apices; clear, bright green, lacking secondary pigmentation, dead shoots becoming whitish or brownish-tinged. **Stems** somewhat elliptical in transverse section, stout, fleshy, brittle, whitish-green; cortical cells thin-walled, green. Rhizoids scattered over ventral stem surface. Leaf insertion oblique (succubous), becoming transverse dorsally. **Leaves** large, broader than long, the width 1.00–1.35 times the length, imbricate, somewhat spreading, concave, firm, rigid, bistratose to multistratose in the basal part and unistratose distally; symmetrically bilobed, occasionally trilobed; sinus obtuse to narrowly rounded, descending about 1/3 the length of the leaf; lobes broadly triangular,

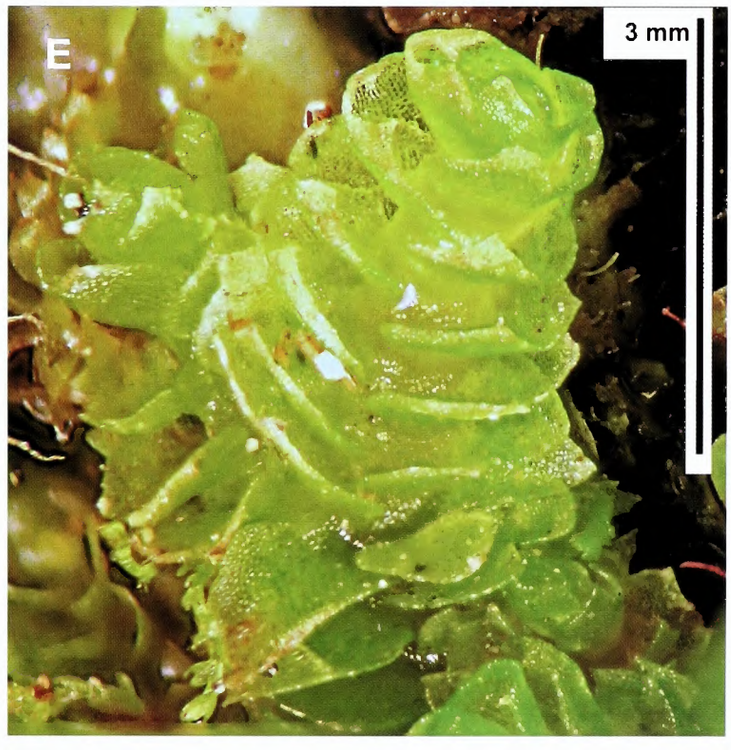
Plate 151. Schofieldia monticola. *A. Branch, line drawing. B. Branch tip. C. Leaves, line drawings. D. Leaf. E. Shoot in situ. (A–D: Wagner m2285. DHW)*


A
1 mm


B
1.0 mm


C
1 mm


D
1 mm


E
3 mm

apices obtuse to usually acute and terminated by one cell or by two single cells in a row; leaf bases more or less auriculate. **Underleaves** frequently present, although often obscured by rhizoids, highly variable in form, ranging from small flaps (3–5 cells broad at the base by 3 or more cells high) to larger structures (not exceeding one-third the size of the leaves), with variably rounded lobes or occasionally lanceolate. Leaf cells thin-walled, lacking trigones except in lobe apices where minute to slightly bulging and small trigones may occur; oil bodies lacking. Asexual reproduction by means of (1) 2–celled (spherical or) elliptical to ovoid gemmae, 14–20 × 20–34 µm, produced among youngest leaves at stem apex.

Dioicous. Androecia terminal at first, becoming intercalary. Gynoecia terminal on leading shoots or borne on short lateral branches. Perianth green, elongate, plicate; mouth lobulate, lobes denticulate, with 1–2-celled teeth.

Similar species — The most similar look-alikes are *Lophozia* species with bilobed leaves. *Lophozia* is more firm and brownish green than the flaccid pale olive-green *Schofieldia*. In addition, all species of *Lophozia* have prominent oil bodies in each cell.

Ecology — *Schofieldia monticola* is terrestrial and found on peaty soil under heather or adjacent to small streams. It is strictly subalpine-alpine, often associated with *Cassiope* and *Phyllodoce*. Commonly associated hepatic species include *Calypogeia azurea, Lophozia opacifolia, L. wenzelii, Moerckia blyttii, Nardia geoscyphus, N. japonica,* and *Plenrocladula albescens*. The Oregon plants were recorded as growing isolated among mosses or in patches of reduced-sized plants on soil rather than in the characteristically tight luxuriant pure mats found in the heart of its range to the north. Leaf cell sizes of the Oregon plants match the typical range, but the plants themselves were much smaller (Godfrey and Godfrey 2008). Reproductive organs have not yet been found in Oregon material.

Distribution — *Schofieldia monticola* is known from Asia and North America. In western North America, it is known from Alaska south through Washington and Oregon. In Oregon, *S. monticola* is reported from Lane County within the West Cascades ecoregion.

References with descriptions and/or illustrations — Godfrey and Godfrey (2008), Schofield (2002, p. 198), Christy and Wagner (1996, part V. p. 54), Godfrey (1976).

References with photos — Wagner (2014).

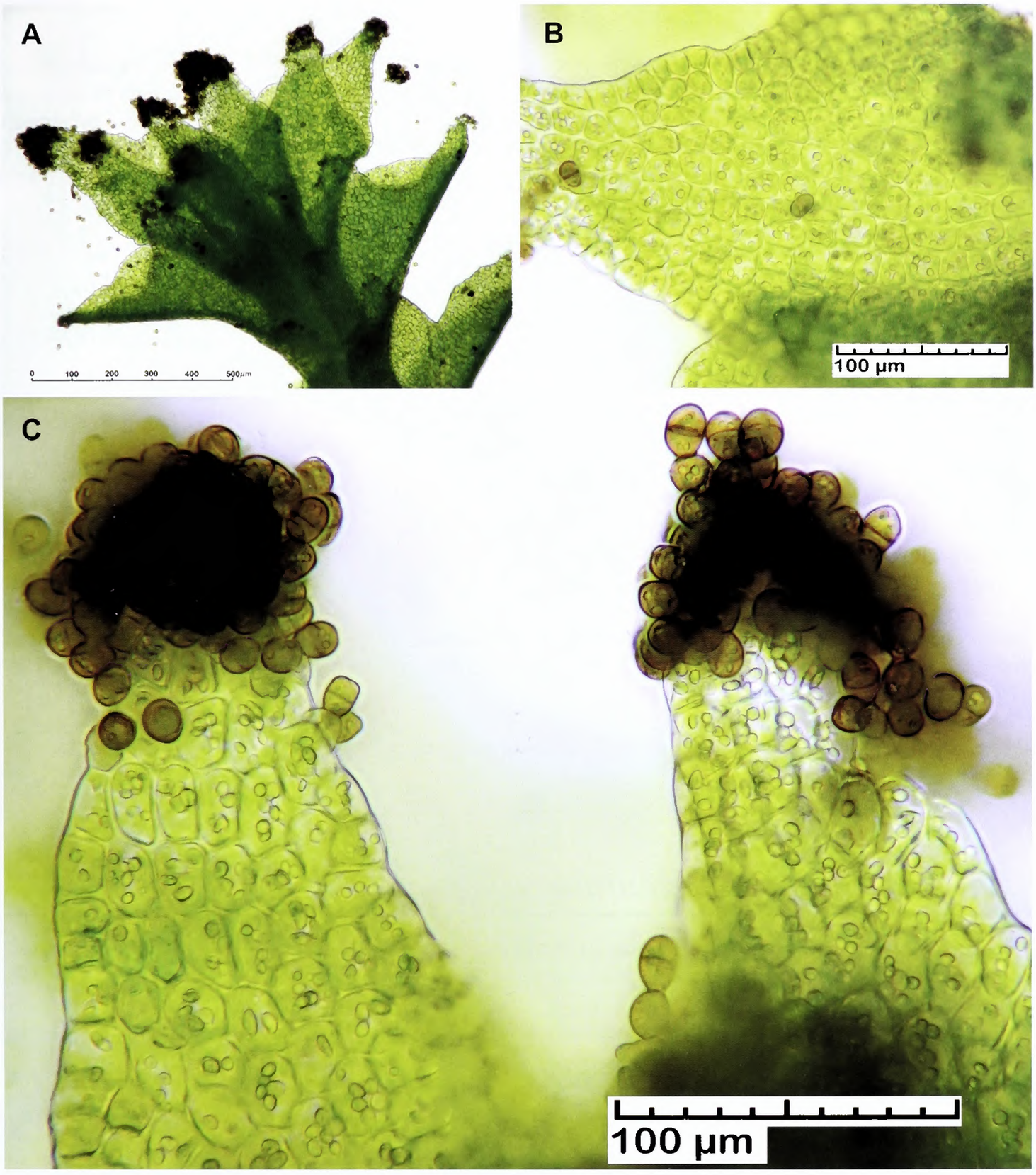
Tritomaria exsecta (Schmidel) Schiffner

Recent synonyms:
Jungermannia exsecta Schmidel ex Schrad.
Lophozia exsecta (Schmidel) Dumort.
Common name: cut notchwort

Summary — A leafy liverwort with transversely inserted leaves that are tri-lobed less than one-half as long as the leaf and with no underleaves. Terrestrial.

Diagnostic characteristics — *Tritomaria exsecta* can be distinguished by its (1) relative large size, (2) asymmetrical tri-lobed leaf, and (3) smooth ovoid gemmae.

Plate 152. Tritomaria exsecta. *A. Shoot tips (10x). B. Oil bodies (40x). C. Gemmae (40x). (A–C: Hardman 6000. OSC, DHW)*


A
0 100 200 300 400 500µm
B
100 µm
C
100 µm

Technical description

LEAFY LIVERWORT. **Plants** green, golden-green or brownish in small patches of prostrate or ascending shoots, 1.2–1.8 mm wide. **Leaves** succubous, transversely inserted, imbricate, broadly ovate, unequally lobed into three or two sharp lobes in weak plants. Ventral lobe larger, margin broadly rounded margin. Leaf sinuses less 1/4 as long as the leaf. Leaf cells small (10–15 μm), thick-walled, and with concave-sided trigones. Oil bodies granular, 4–8 per cell. **Underleaves** lacking. Rhizoids scattered along ventral stem surfaces. Gemmae usually present, ovoid, smooth, two celled, upright on terete shoot tips forming an orange mass.

Dioicous. Antheridia in axils of a series of leaves with saccate bases. Perianths cylindrical, plicate in the upper 1/3, contracted to a dentate-ciliate mouth.

Similar species — *Tritomaria exsectiformis* is similar but differs in its angular or stellate gemmae and larger (19–22 μm) leaf cells.

Ecology — *Tritomaria exsecta* grows on damp, mossy rocks and rotting logs with other bryophytes in spruce-fir forests.

Distribution — *Tritomaria exsecta* is known from Europe, Asia, Africa, and North America. In North America, *T. exsecta* occurs across Canada and is widespread in eastern North America. In western North America, *T. exsecta* is known from Alaska south through British Columbia, Alberta, Washington, Oregon and in the Rocky Mountains to Colorado; disjunct in Mexico. Although ORBIC delisted *T. exsecta* in 1995 because it was not known from Oregon, it has recently been confirmed in the state from Grant County within the Blue Mountain ecoregion.

References with descriptions and/or illustrations — Faubert (2012, p. 220), Damsholt (2002, p. 178), Hong (2002a), Paton (1999, p. 252), Hicks (1992, p. 49), Smith (1990, p. 128), Schuster (1969, p. 646), Arnell (1956, p. 150), Frye and Clark (1945, p. 417).

References with photos — Wagner (2014), Lockhart et al. (2012, p. 239), Atherton et al. (2010, p. 138).

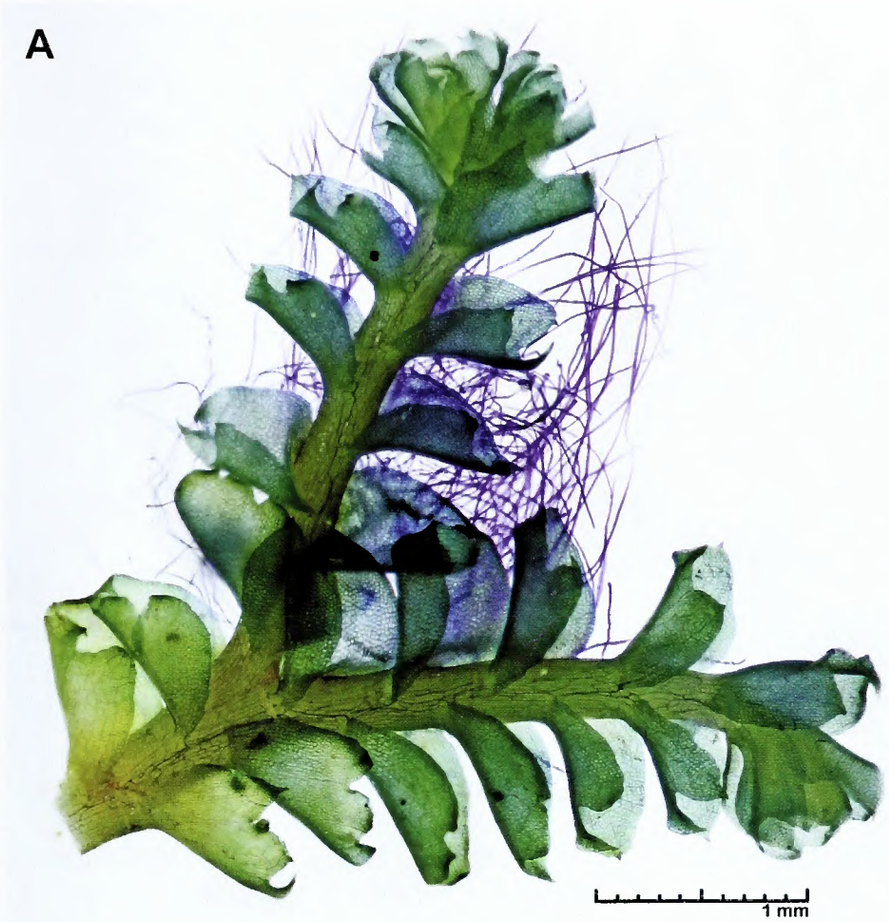
Tritomaria quinquedentata (Hudson) H. Buch

Recent synonym: *Lophozia quinquedentata* (Hudson) Cogniaux
Common names: giant brownwort, arch notchwort

Summary — A leafy liverwort with transversely inserted leaves that are tri-lobed less than one-half the length of the leaf. Underleaves are lacking. Terrestrial.

Diagnostic characteristics — *Tritomaria quinquedentata* can be distinguished by its (1) relatively large size, (2) asymmetrical tri-lobed leaf, and (3) angular gemmae.

Plate 153a. Tritomaria quinquedentata. *A–B. Shoot, dorsal view. (A: Hutten 15622. DHW; Miller 1529. DHW)*


A
1 mm


B
1 mm

Technical description

LEAFY LIVERWORT. **Plants** relatively large, up to 3 mm wide, green-yellowish brown. **Leaves** imbricate, of almost equal size, obliquely inserted, spreading but always somewhat secund towards the dorsal face, crisped when dry, asymmetrical, tri-lobed, rarely 4-lobed, lobes ovoid triangular, pointed (point variably long); ventral lobe larger than the dorsal lobes, mostly concave and frequently obtuse; the two dorsal lobes long pointed, incisions wide and rounded, sometimes narrow and acute angled. Cells 15–20 µm at the margin and 20–25 µm at leaf center, walls thin, trigones frequently large. Oil bodies (2–) 3–12 (–14) per cell, spherical-oval, 2–8 × 2–12 µm, granular. **Underleaves** absent.

Dioicous. Androecia of 2–18 pairs of bracts, bract margins occasionally dentate; perianths obovoid to cylindrical, up to 6 mm long, ciliate at mouth.

Similar species — *Tritomaria quinquedentata* could be mistaken for a *Barbilophozia* species but it lacks the cilia on the ventral base of the leaves and the underleaves that characterize *Barbilophozia*.

Tritomaria is characterized by asymmetrical leaves having unequal lobes, with the dorsal lobe usually distinctly smaller than the other lobe(s). *Tritomaria quinquedentata* is distinguished from other species in the genus by its robust size, angular gemmae, and leaves that are wider than long.

Ecology — *Tritomaria quinquedentata* is restricted to perpetually shady cool and moist organic substrates. According to Hong (1994), "The species occurs on wet humus over boulders, shaded cliffs, soil over exposed rock surfaces, decaying branches at the fringes of spray zones, and among heather on slopes." Paton (1999) also noted growth "besides streams, rivers and lakes and sometimes accumulating silt; on earthy cliff ledges, in crevices, block scree, on hummocks in flushes and in mixed liverwort mats in dwarf shrub communities; occasionally in grassy turf and *Sphagnum* in bogs, on rotting wood and tree bases," and "generally in shaded humid sites but also in wet or insolated habitats and most frequently in mildly base-rich mountainous regions. Sometimes a pioneer on the surface of non-basic rocks."

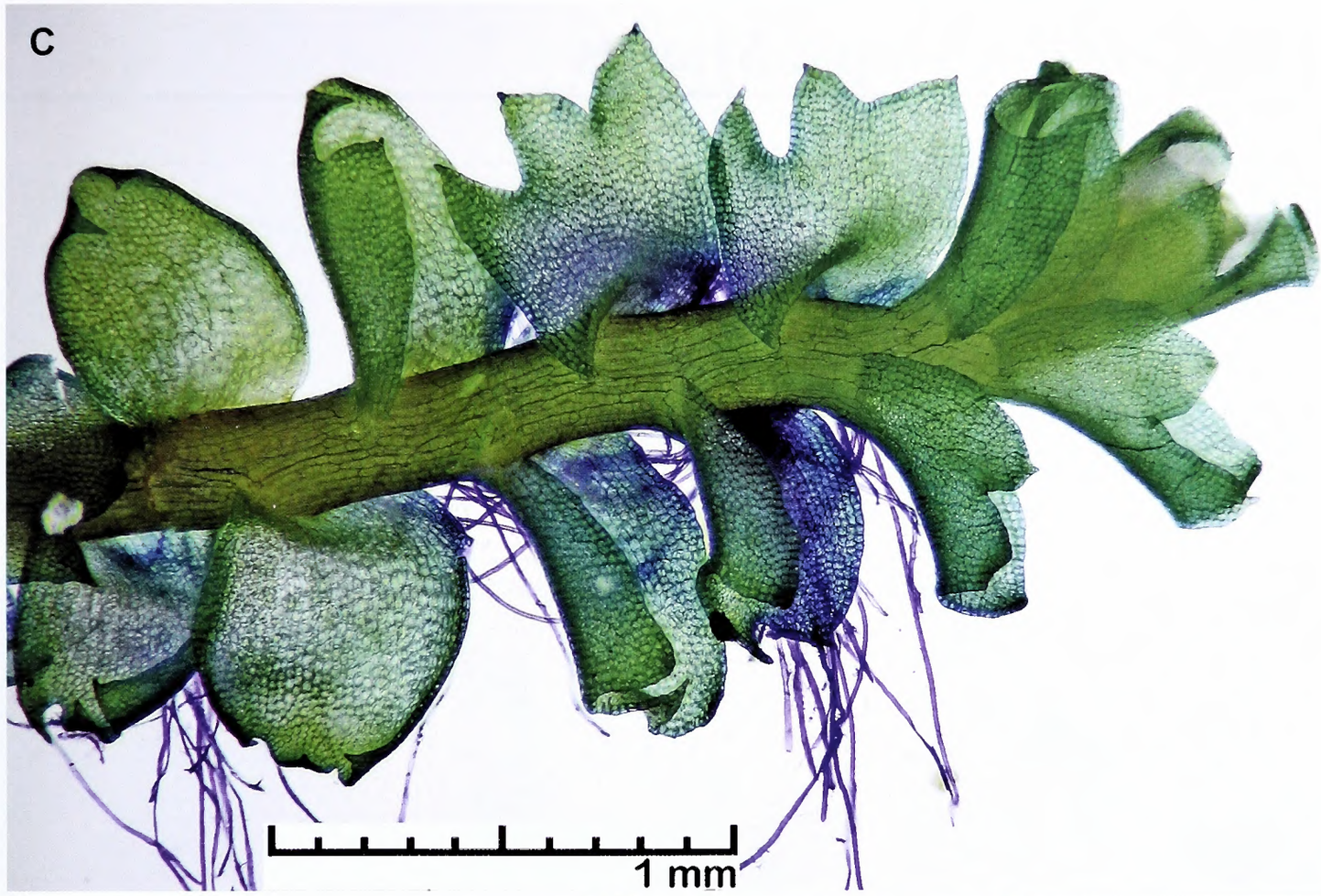
Distribution — *Tritomaria quinquedentata* is circumboreal at high latitudes and is known from Eurasia, Iceland, Greenland, and North America. In western North America, it is more common from Washington's Olympic and Cascade Mountains northward, but it is also known from Oregon. In Oregon, *T. quinquedentata* is reported from Clatsop County within the Coast Range ecoregion.

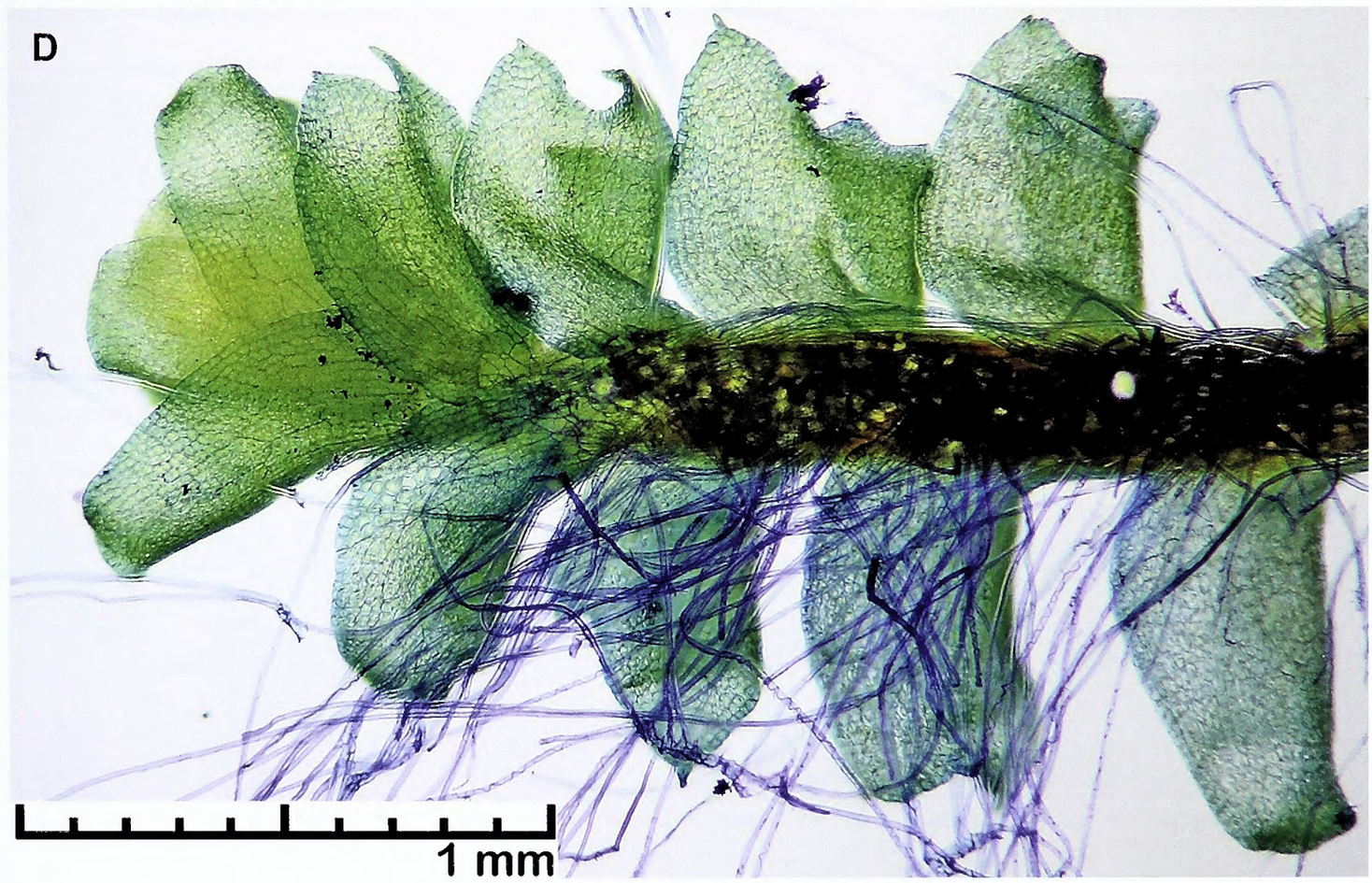
References with descriptions and/or illustrations — Faubert (2012, p. 223), Damsholt (2002, p. 184), Hong (2002a), Schofield (2002, p. 210), Paton (1999, p. 251), Smith (1990, p. 128), Schuster (1969, p. 680), Arnell (1956, p. 148), Frye and Clark (1944, p. 421), Macvicar (1926, p. 193 as *Lophozia quinquedentata*),

References with descriptions and/or illustrations — Lincoln (2008), p. 101.

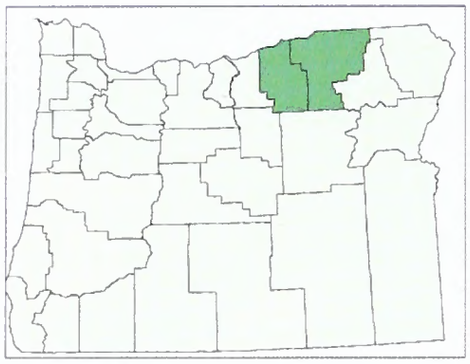
References with photos — Wagner (2014), Atherton et al. (2010, p. 136).

Plate 153b. Tritomaria quinquedentata. *C. Shoot, dorsal view. D. Shoot, ventral view. (C, D: Hutten 15622. DHW)*

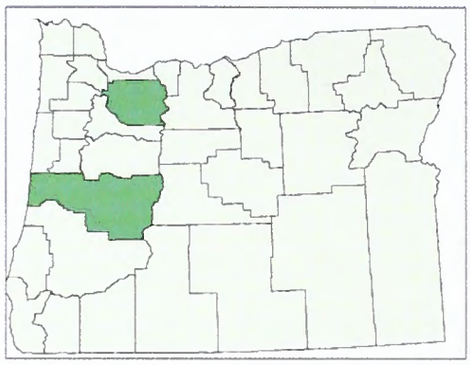

C
1 mm


D
1 mm

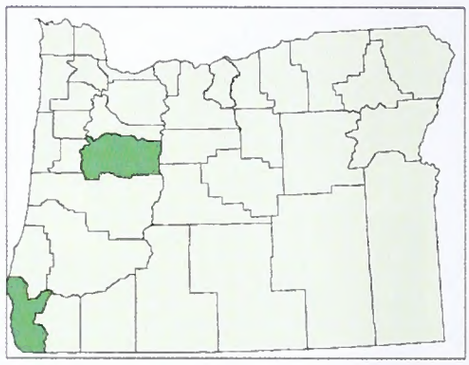
Distribution Maps: Mosses



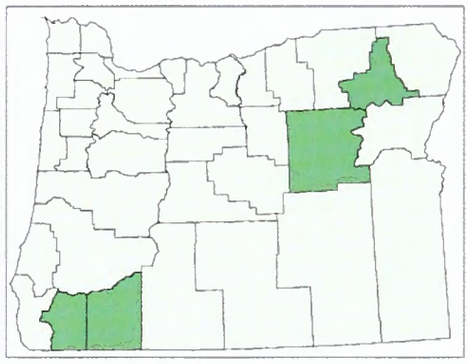
Aloina bifrons



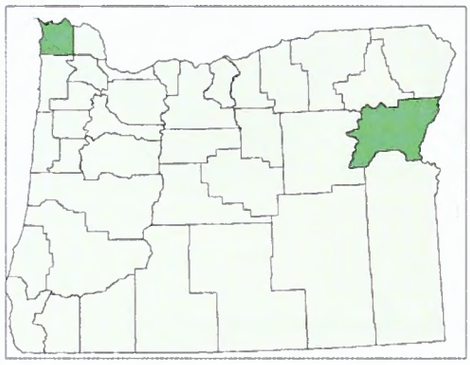
Andreaea nivalis



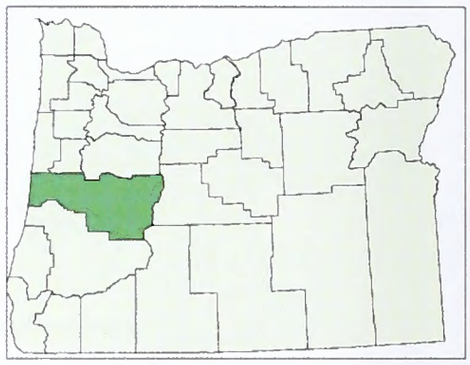
Andreaea schofieldiana



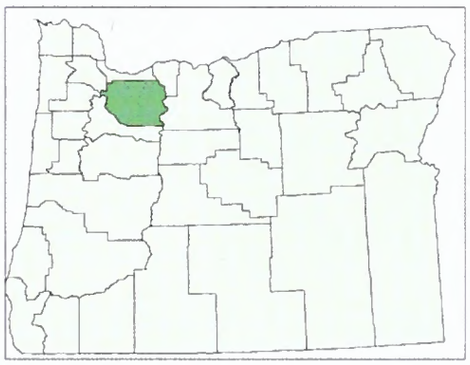
Anoectangium aestivum



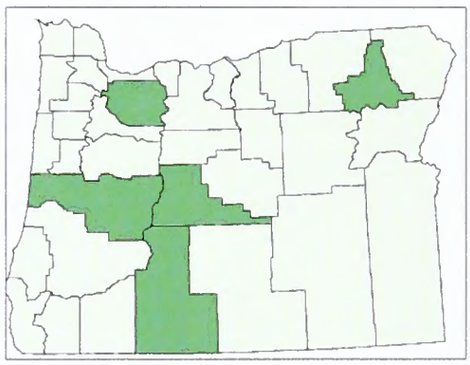
Anomobryum julaceum



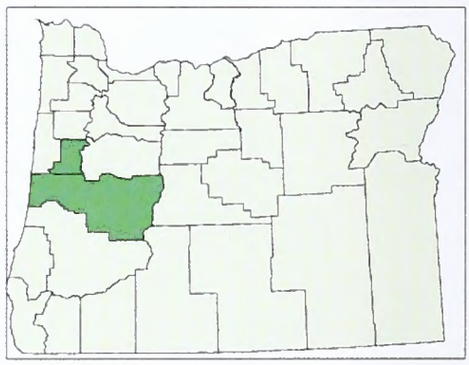
Barbula unguiculata



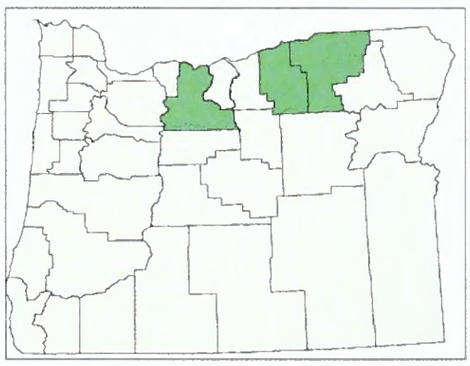
Brachydontium olympicum



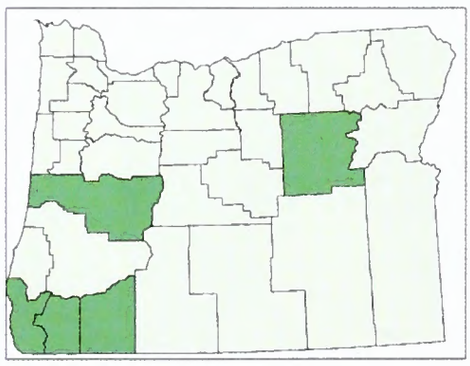
Bruchia bolanderi



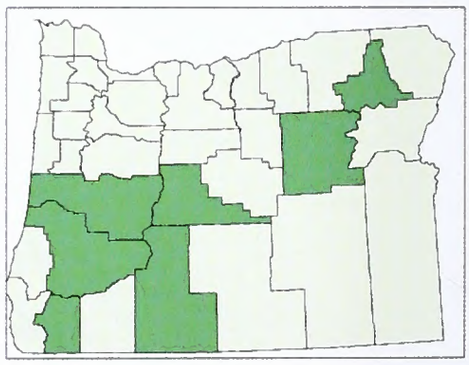
Bruchia flexuosa



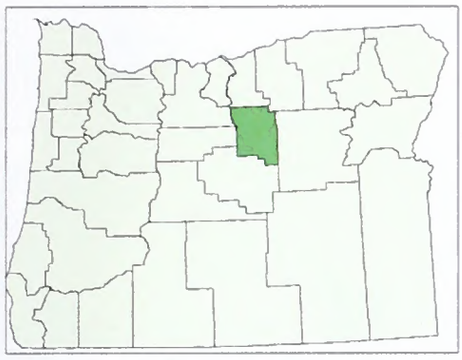
Bryoerythrophyllum columbianum



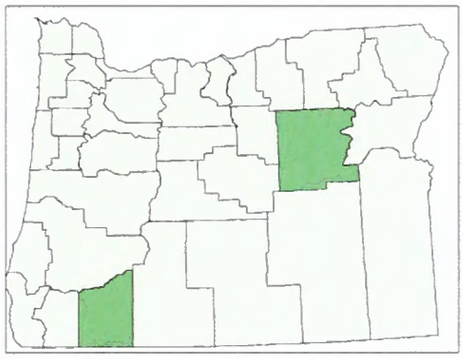
Bryum calobryoides



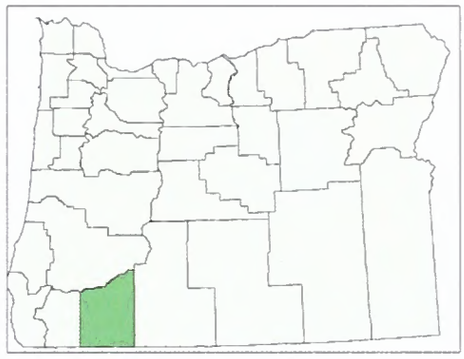
Buxbaumia aphylla



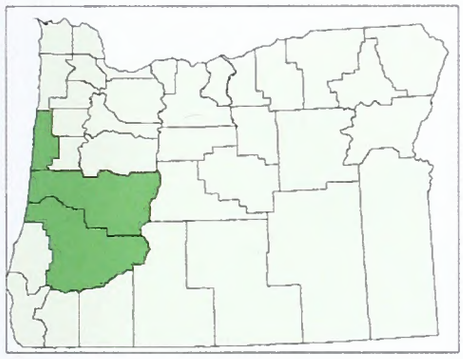
Calliergon richardsonii



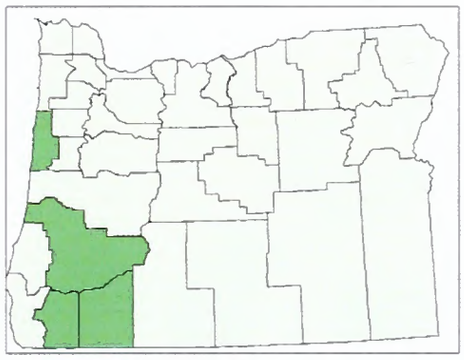
Campylium stellatum



Campylopodiella flagellaceae

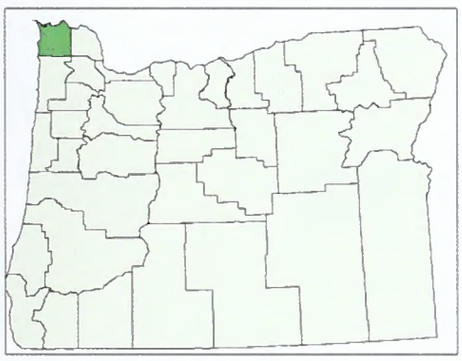


Campylopus schmidii

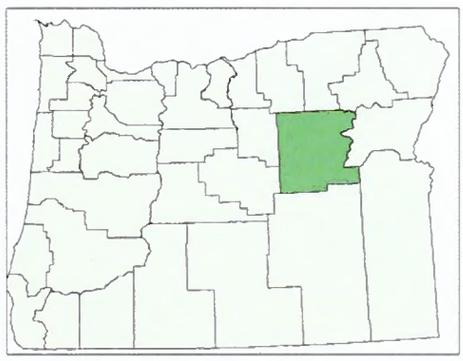


Campylopus subulatus

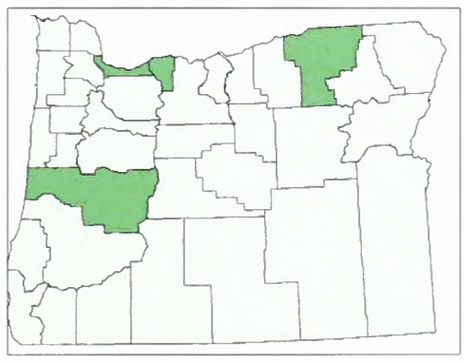
Conostomum tetragonum



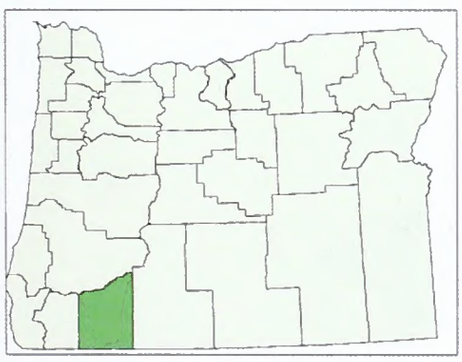
Cynodontium jenneri



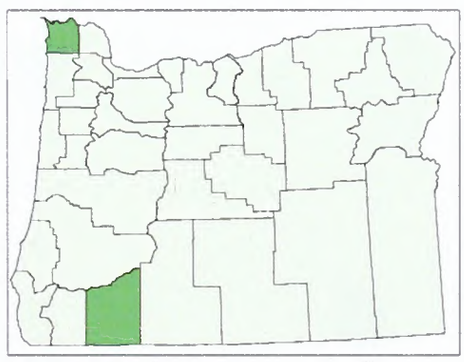
Dichodontium olympicum



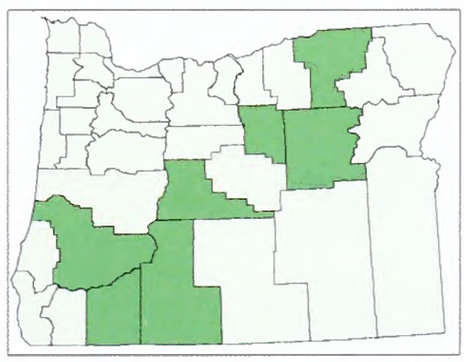
Didymodon eckeliae



Didymodon norrisii

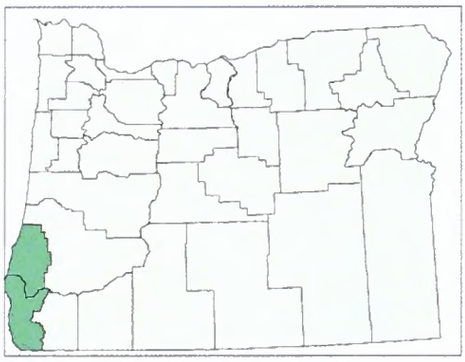


Ditrichum flexicaule

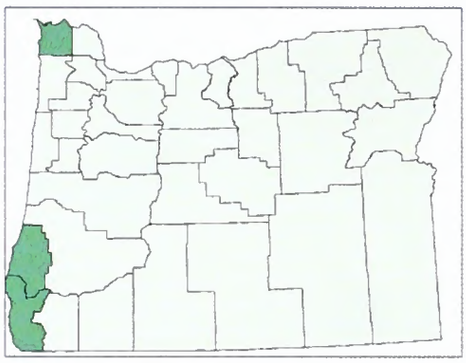


Elodium blandowii

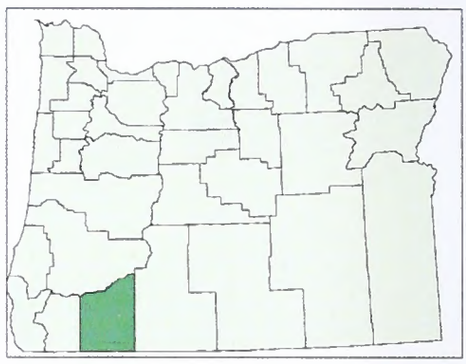
Distribution Maps: Mosses



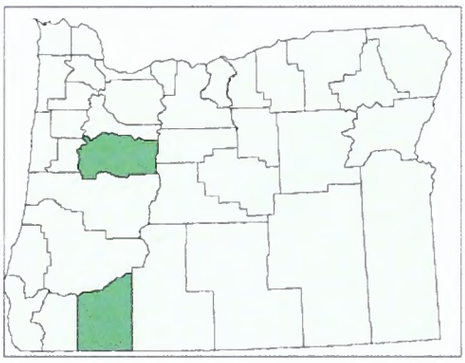
Encalypta brevicollis



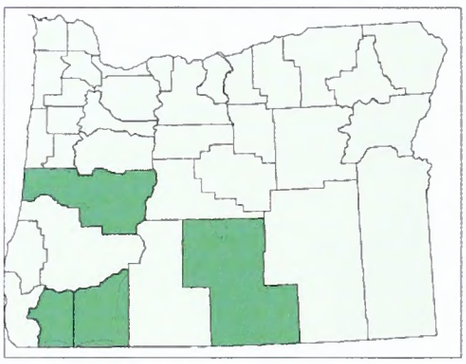
Encalypta brevipes



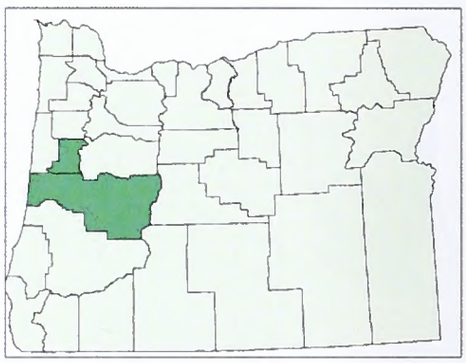
Entosthodon californicus



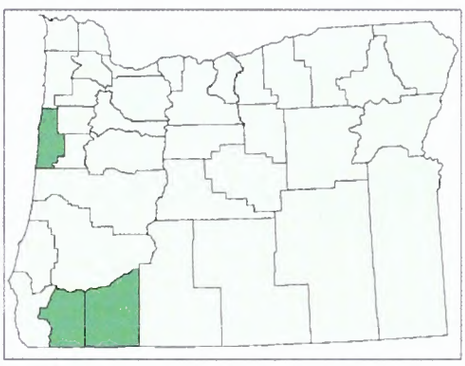
Entostodon fascicularis



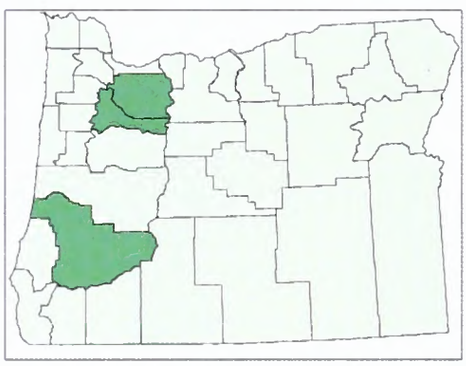
Ephemerum crassinervium



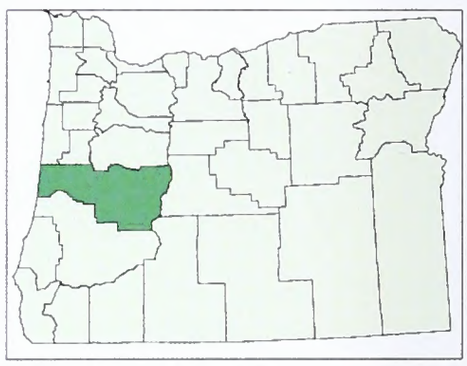
Ephemerum serratum



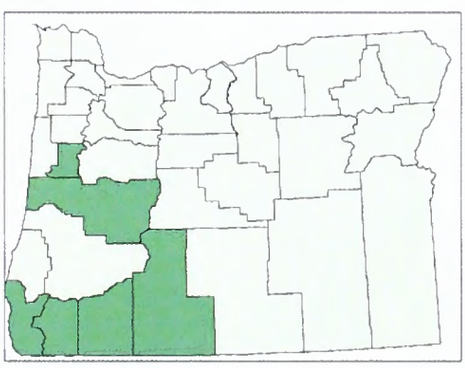
Eucladium verticillatum



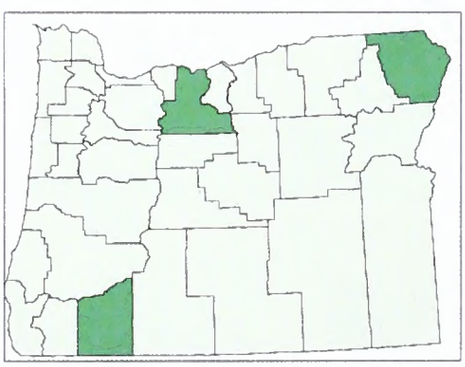
Fissidens fontanus



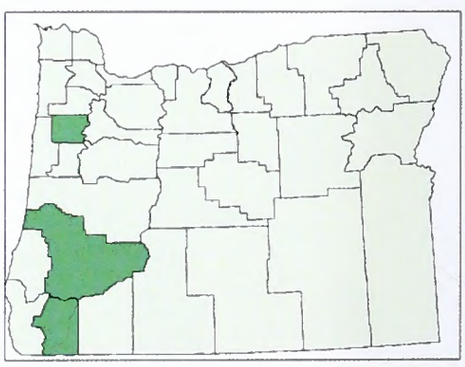
Gemmabryum barnesii



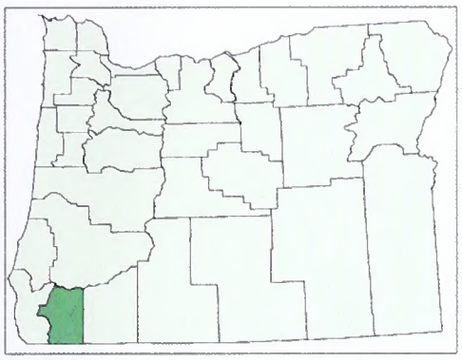
Grimmia anomala



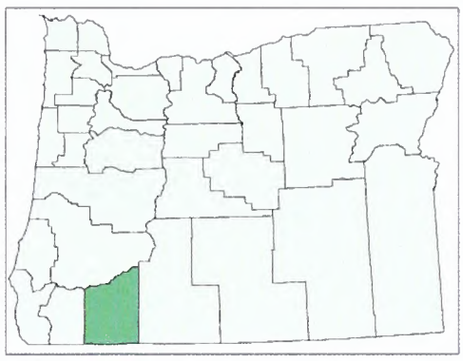
Grimmia donniana



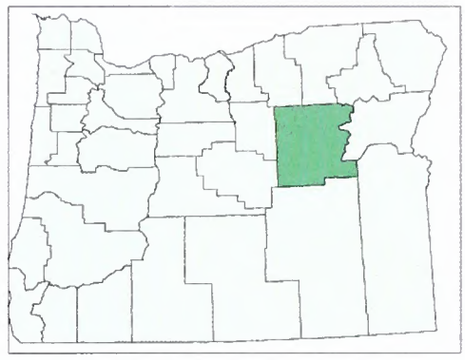
Grimmia lisae



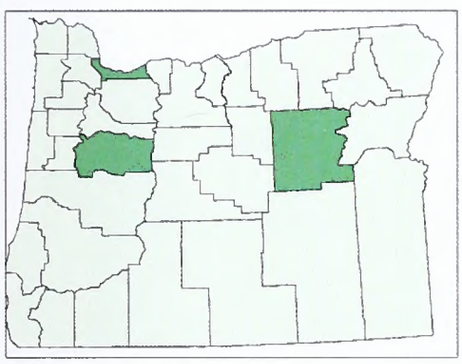
Gymnostomum viridulum



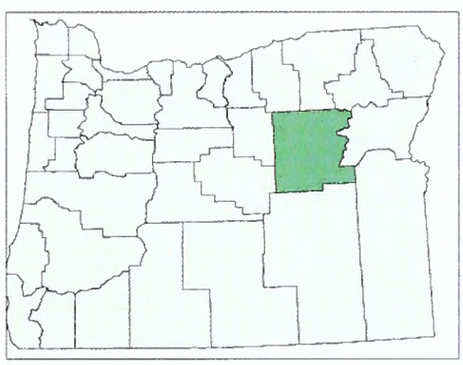
Hygrohypnum alpinum



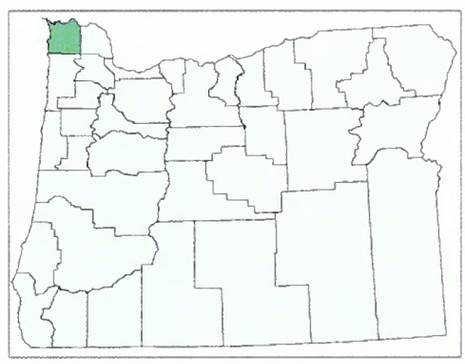
Hygrohypnum cochleariifolium



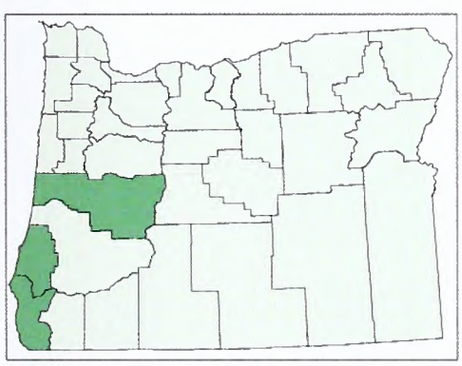
Hypnum lindbergii



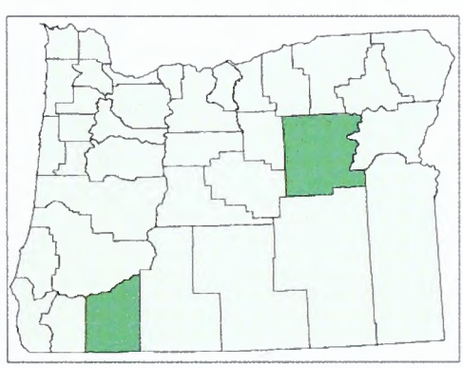
Hypnum pratense



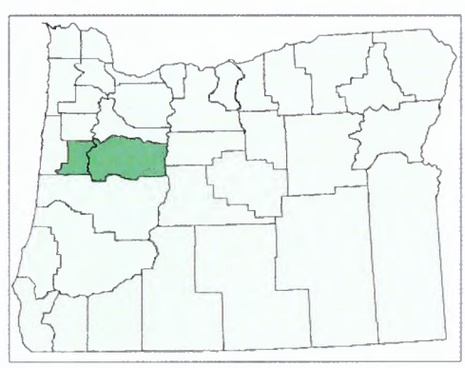
Iwatsukiella leucotricha



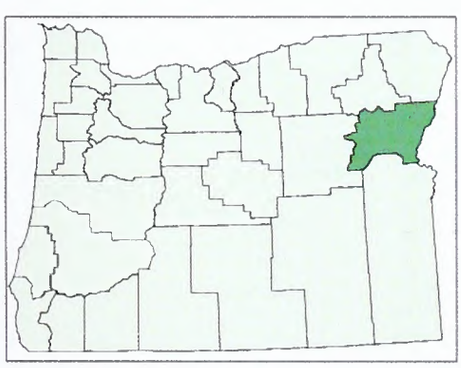
Limbella fryei



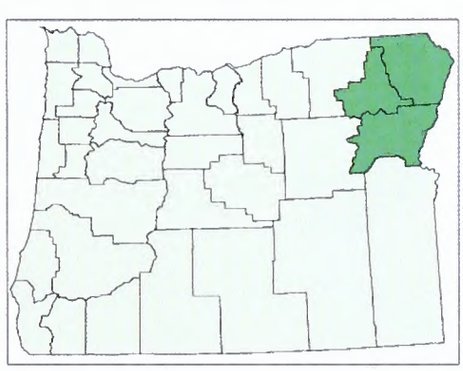
Meesia uliginosa



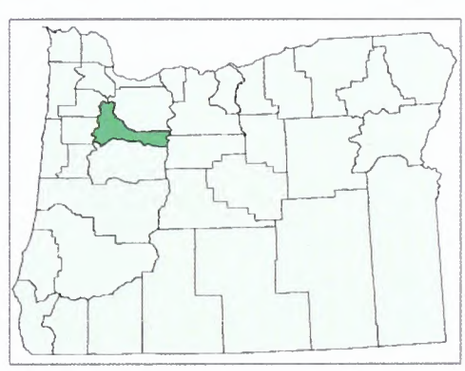
Micromitrium synoicum



Mielichhoferia elongata

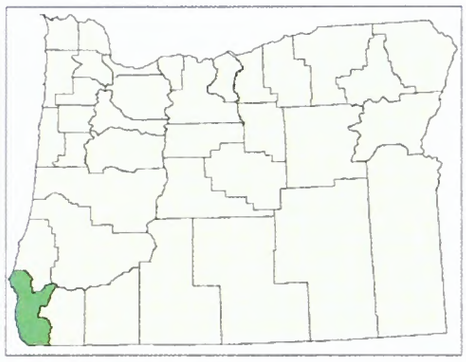


Mnium blytii



Myurella julacea

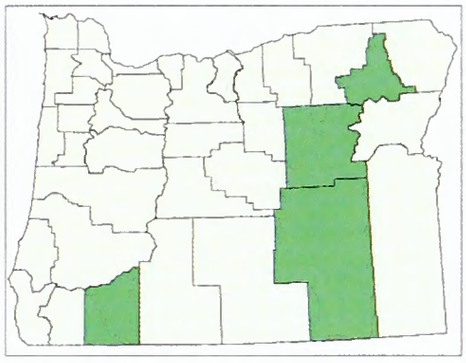
Distribution Maps: Mosses



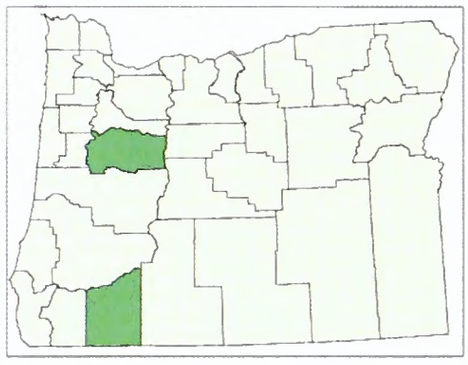
Orthodontium gracile

Orthodontium pellucens

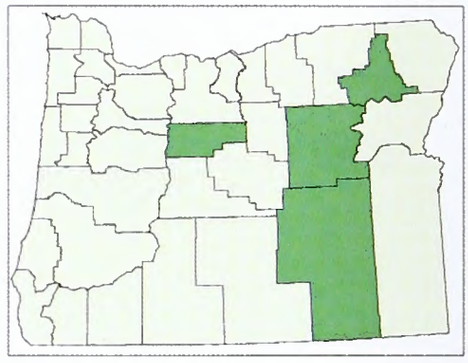
Orthotrichum bolanderi



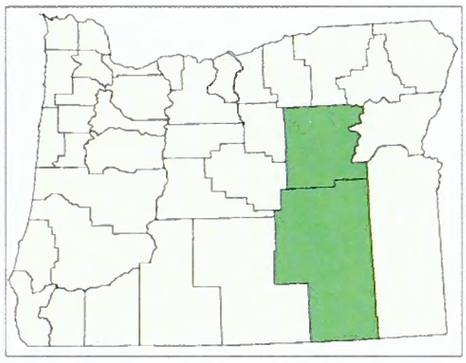
Orthotrichum euryphyllum



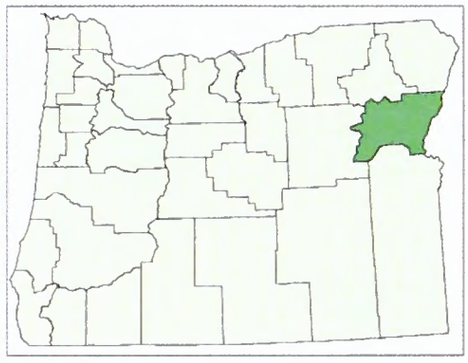
Orthotrichum hallii



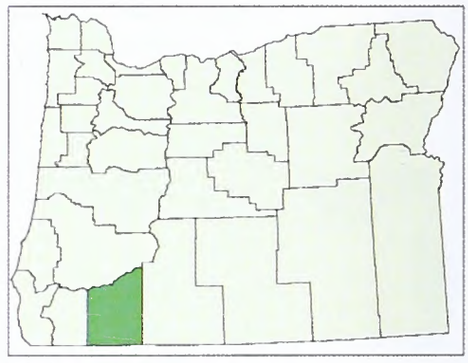
Orthotrichum holzingeri



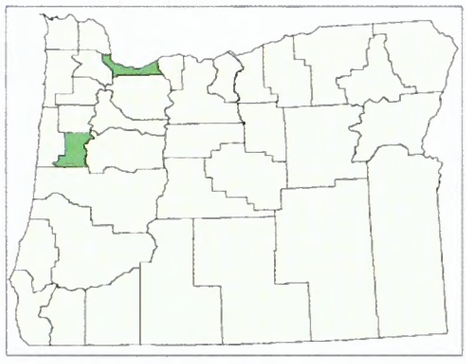
Orthotrichum pallens



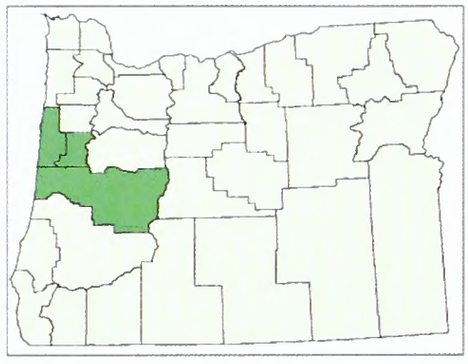
Orthotrichum pellucidum



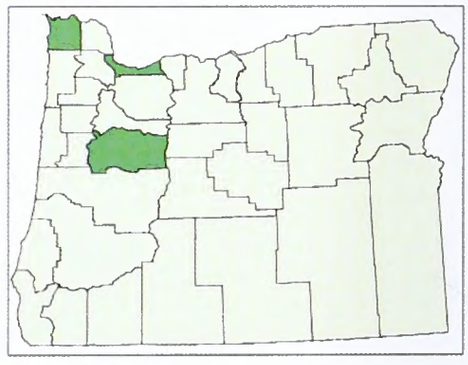
Philonotis yezoana



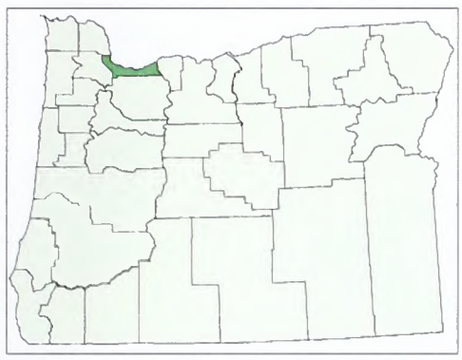
Physcomitrella patens



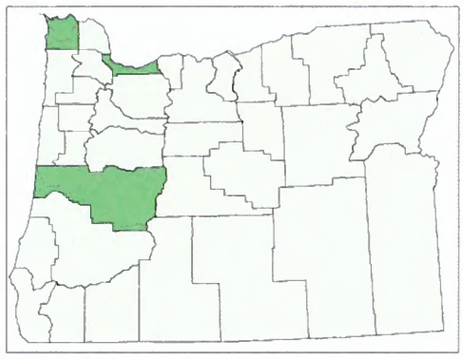
Physcomitrium immersum



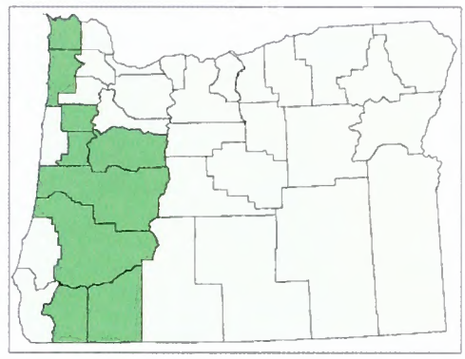
Plagiobryum zierii



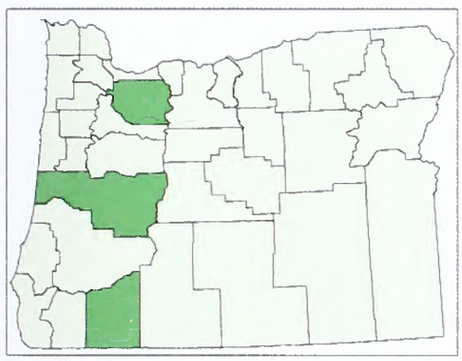
Plagiopus oederianus



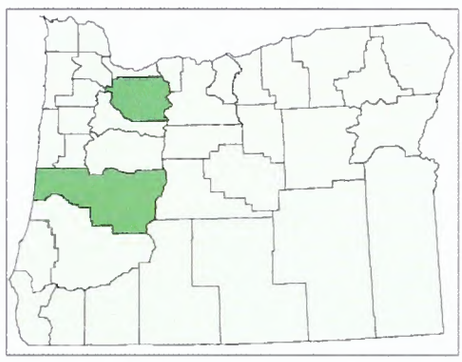
Plagiothecium cavifolium



Plagiothecium piliferum

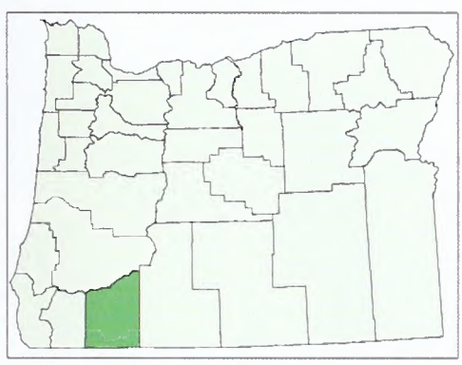


Pohlia bolanderi

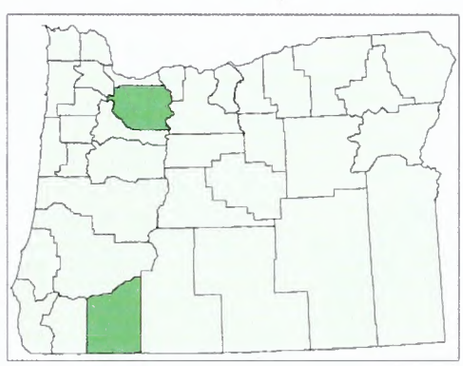


Pohlia cardotii

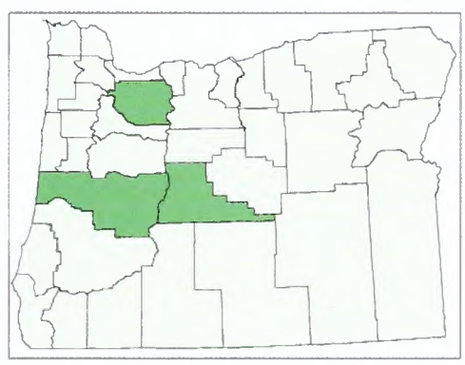
Pohlia ludwigii



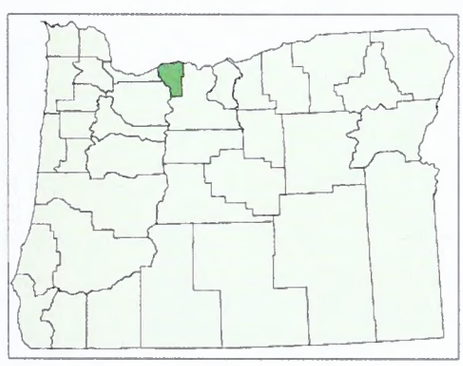
Pohlia obtusifolia



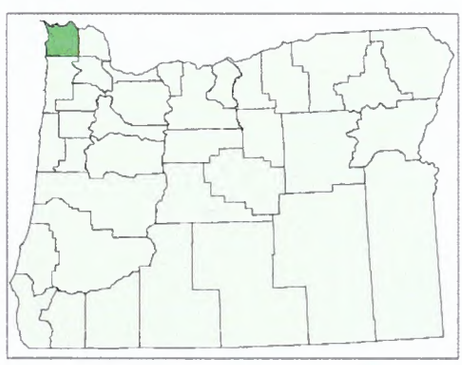
Pohlia tundra



Polytrichastrum sexangulare var. *sexangulare*



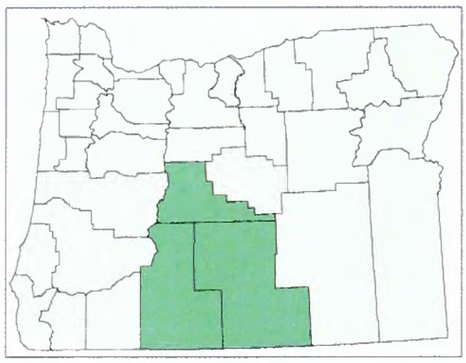
Polytrichastrum sexangulare var. *vulcanium*



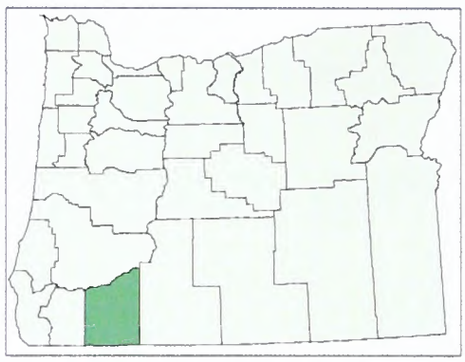
Polytrichum strictum

Pseudephemerum nitidum

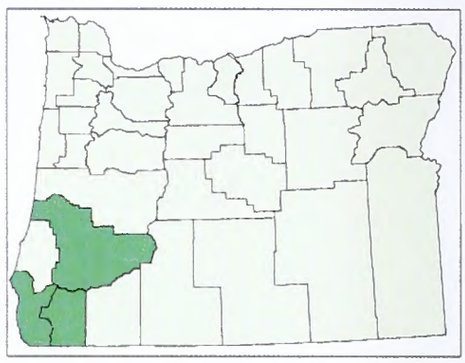
Distribution Maps: Mosses



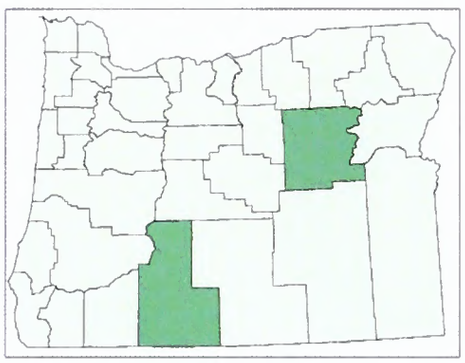
Pseudocalliergon trifarium



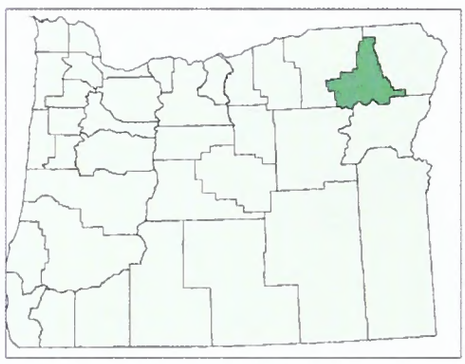
Pseudocrossidium hornschuchianum



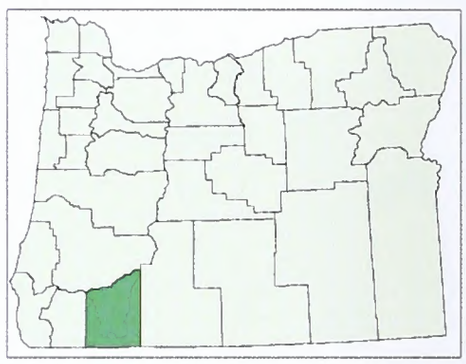
Pseudoleskeella serpentinensis



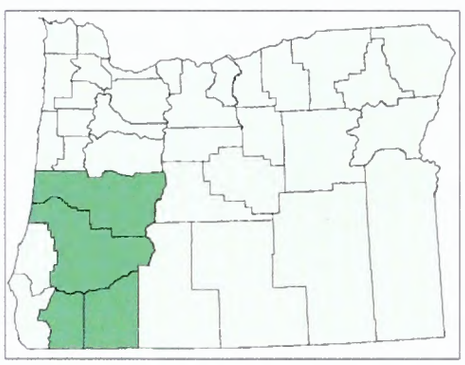
Pseudoleskeella tectorum



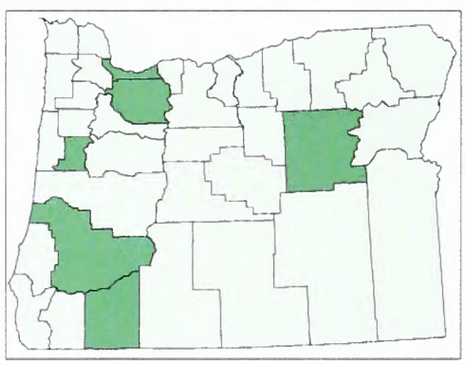
Ptilium crista-castrensis



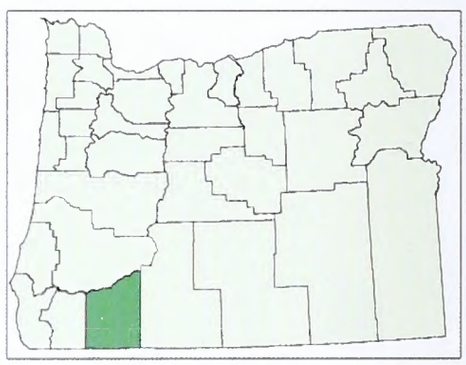
Ptychostomum cyclophyllum



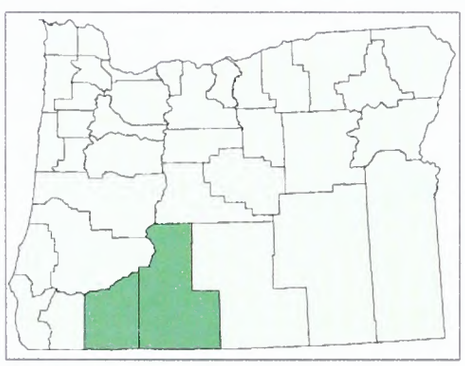
Ptychostomum pacificum



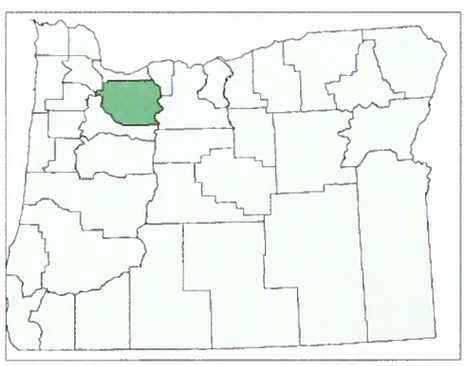
Racomitrium brevipes



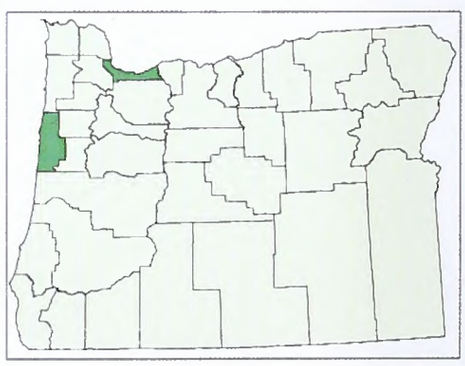
Racomitrium depressum



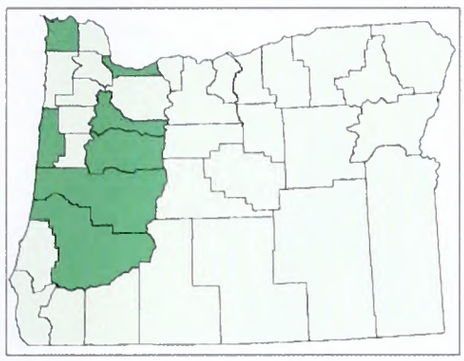
Racomitrium molle



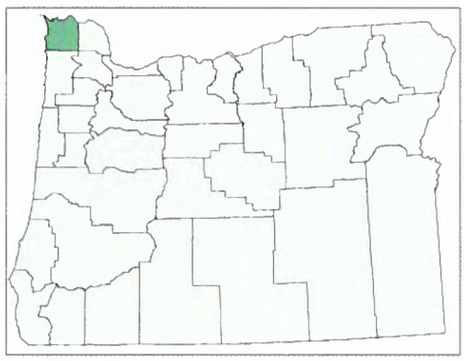
Racomitrium pygmaeum



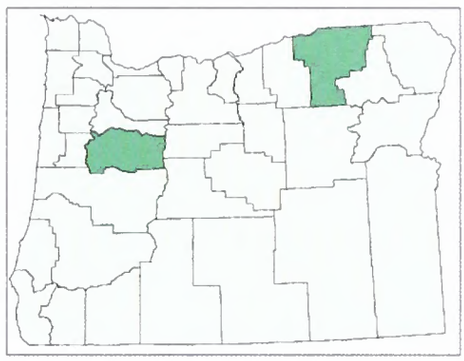
Racomitrium ryszardii



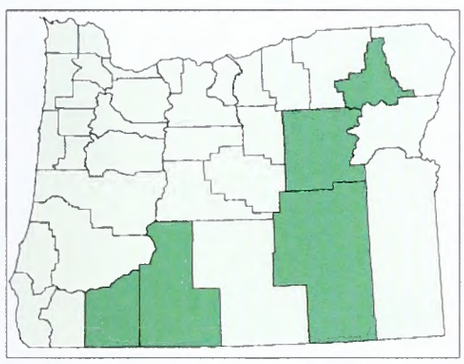
Rhytidiadelphus subpinnatus



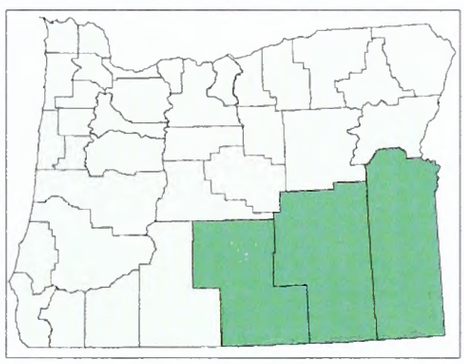
Rhytidum rugosum



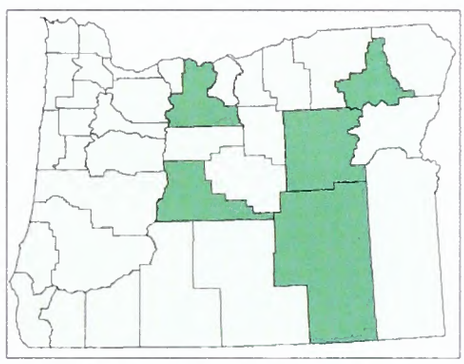
Rosulabryum gemmascens



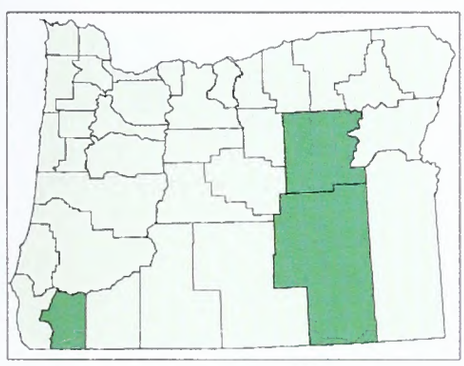
Schistidium cinclidodonteum



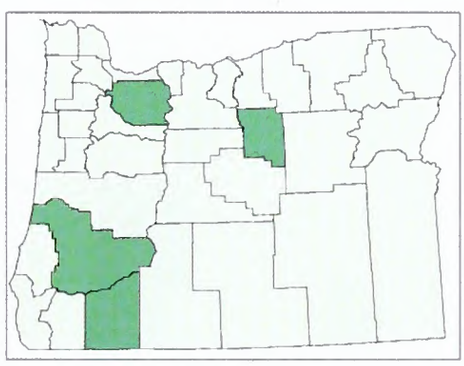
Schistidium flaccidum



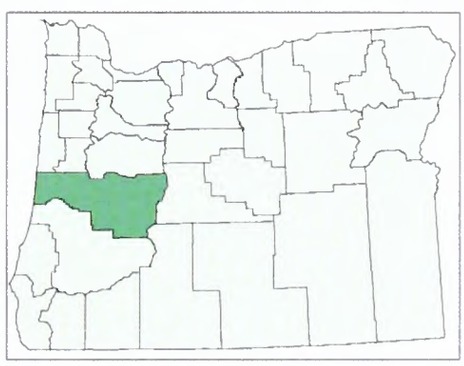
Schistidium heterophyllum



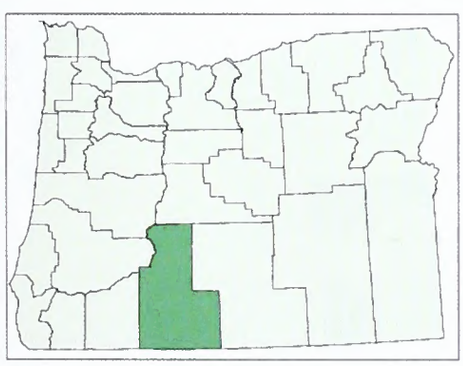
Schistidium tenerum



Scouleria marginata

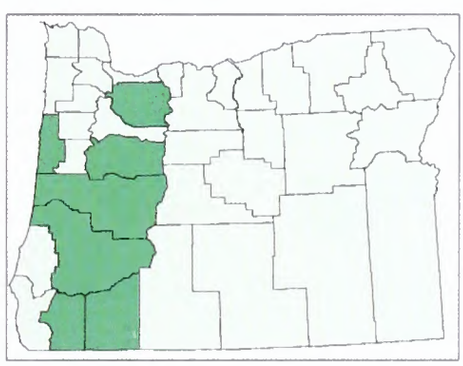


Sphagnum oregonense



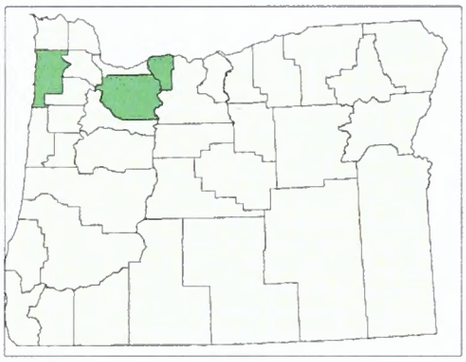
Splachnum ampullaceum

Splachnum sphaericum

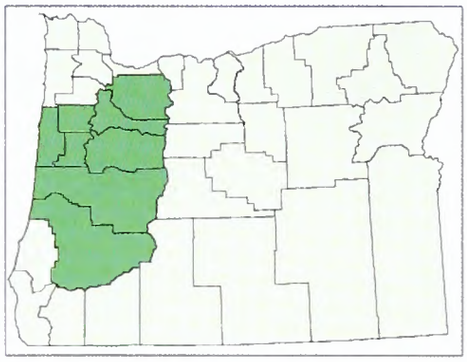


Tayloria serrata

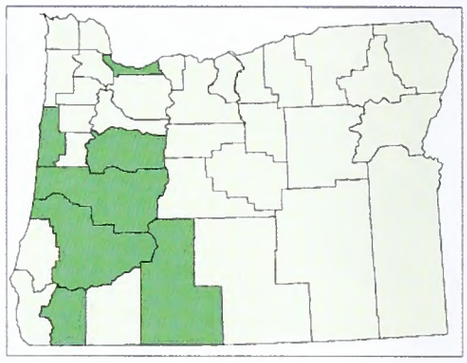
Distribution Maps: Mosses



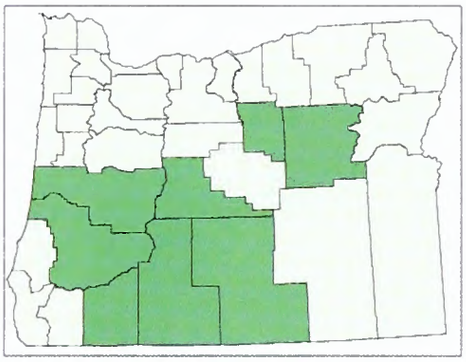
Tetraphis geniculata



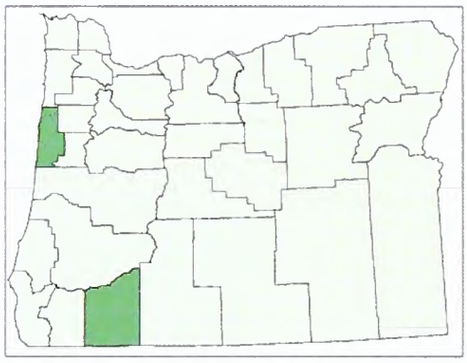
Tetraplodon mnioides



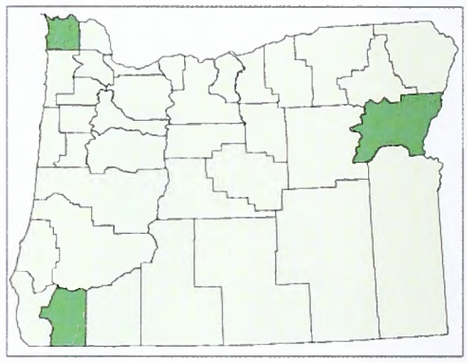
Thamnobryum neckeroides



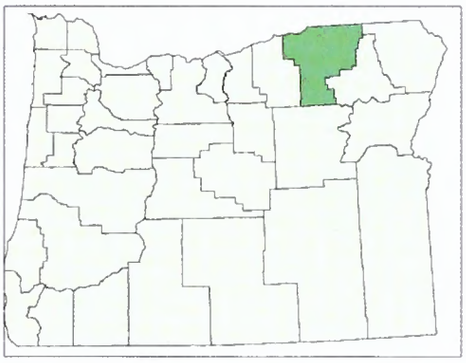
Tomentypnum nitens



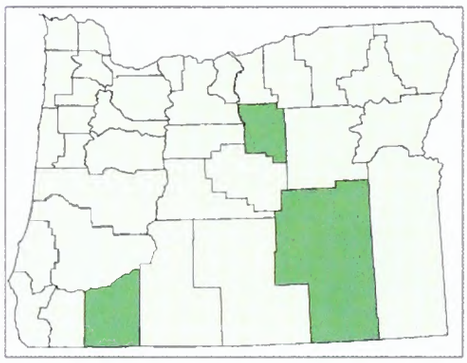
Tortella fragilis



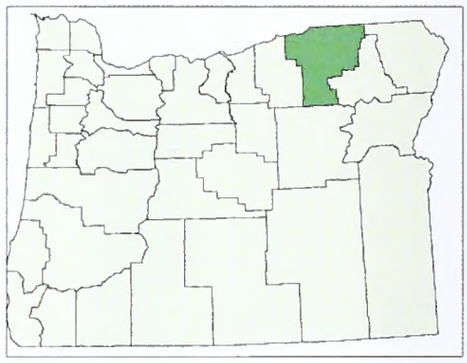
Tortella tortuosa



Tortula inermis

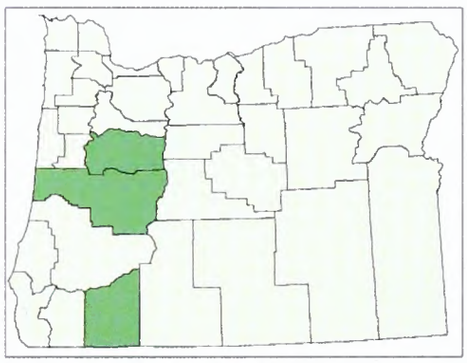


Tortula mucronifolia

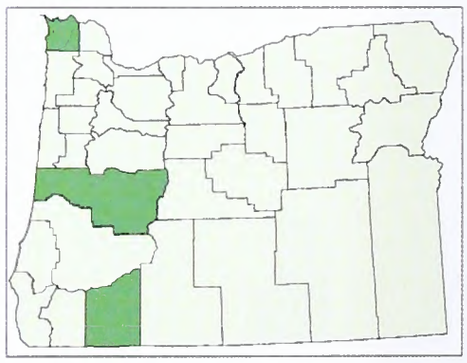


Tortula protobryoides

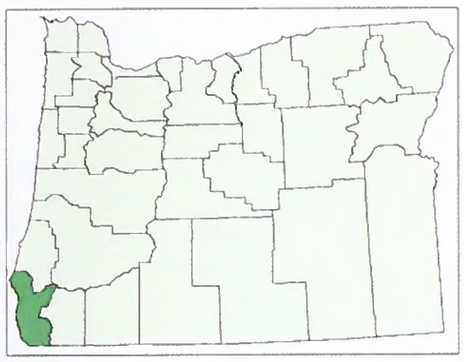
Trematodon asanoi



Trichostomum crispulum

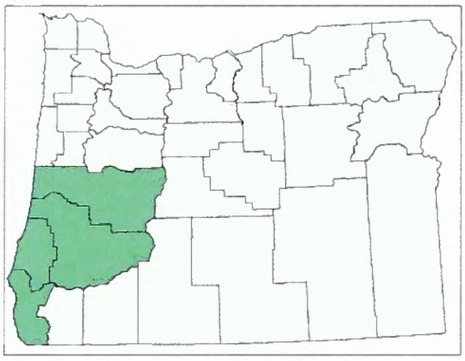


Trichostomum tenuirostre var. *tenuirostre*



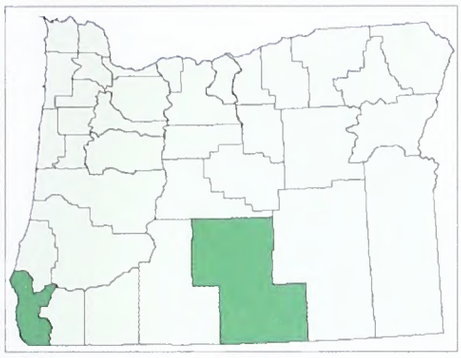
Triquetrella californica

Distribution Maps: Hornworts

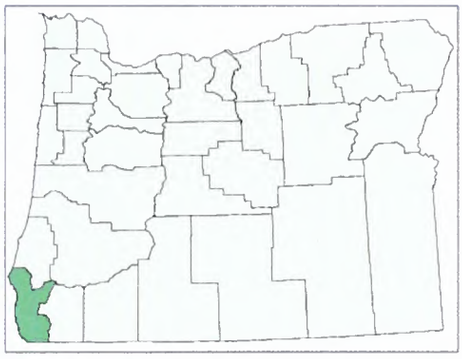


Phymatoceros phymatodes

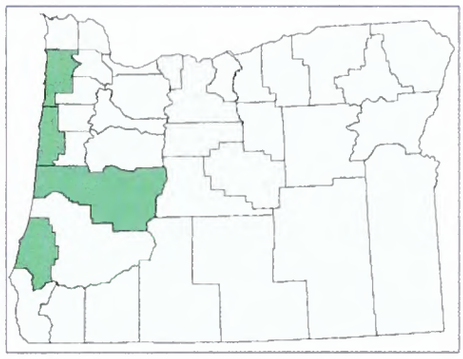
Distribution Maps: Thalloid Liverworts



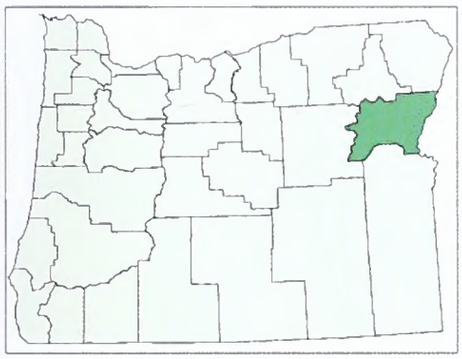
Asterella bolanderi



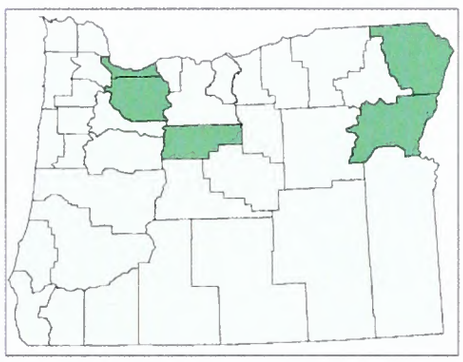
Cryptomitrium tenerum



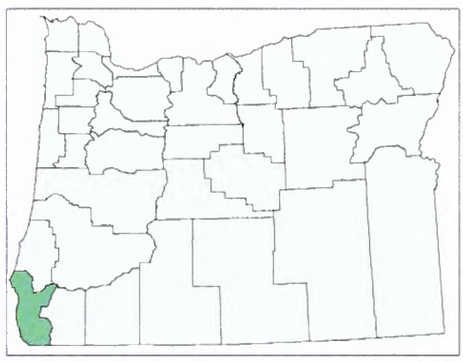
Metzgeria violacea



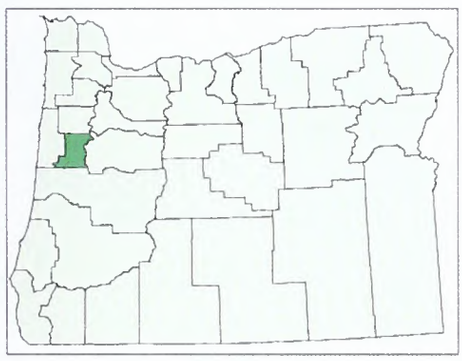
Peltolepis quadrata



Pressia quadrata

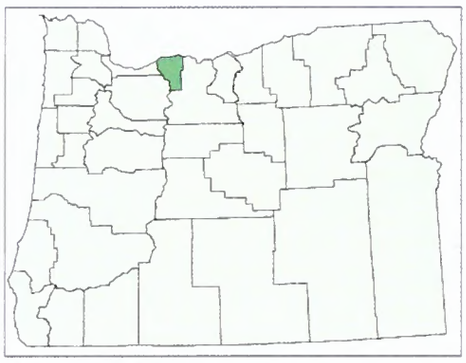


Riccia californica

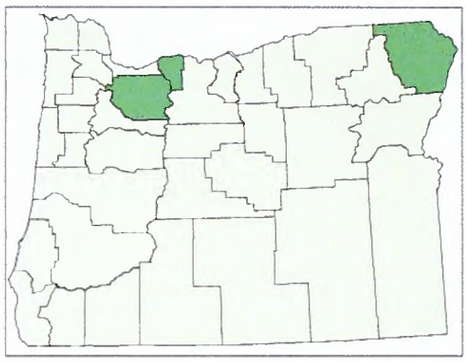


Sphaerocarpos hians

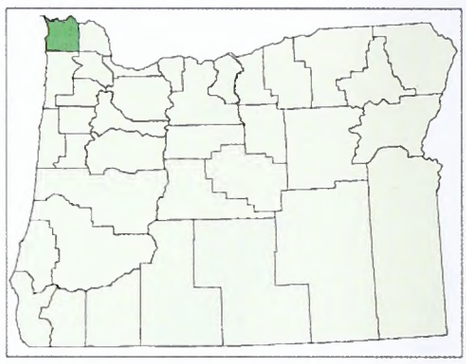
Distribution Maps: Leafy Liverworts



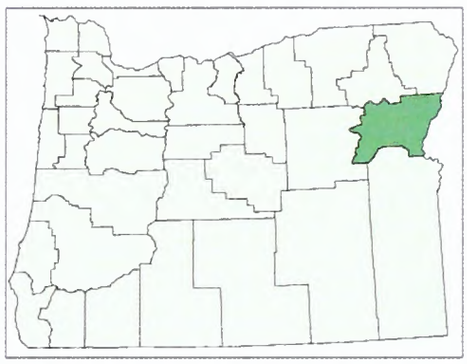
Anastrophyllum minutum



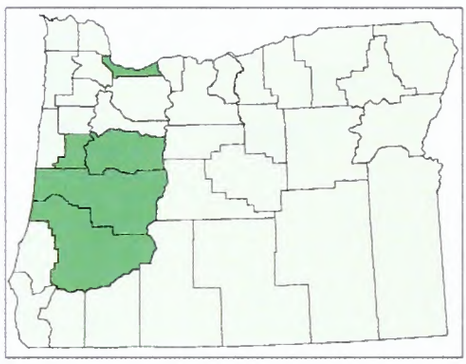
Anthelia julacea



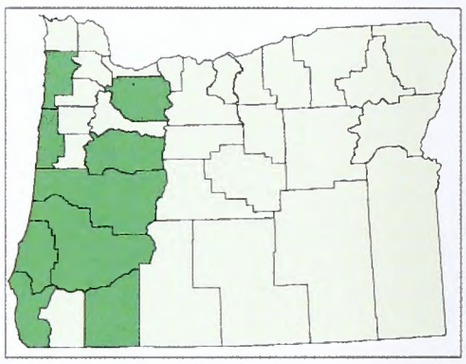
Barbilophozia barbata



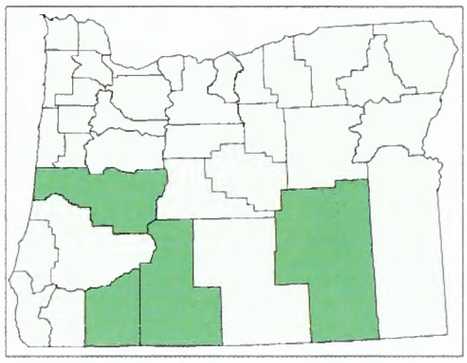
Barbilophozia lycopodioides



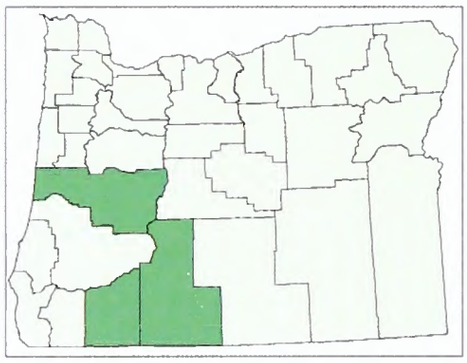
Blepharostoma arachnoideum



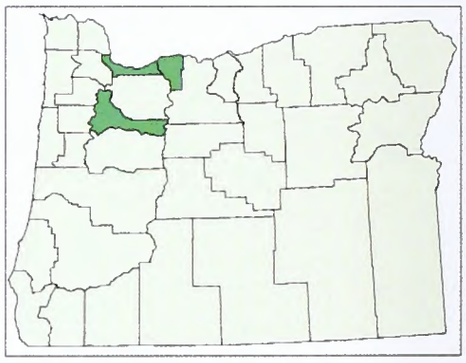
Calypogeia sphagnicola



Cephaloziella hampeana

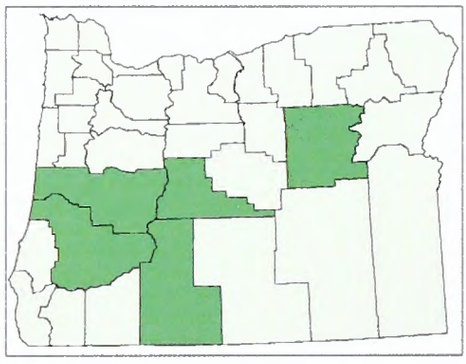


Cephaloziella spinigera

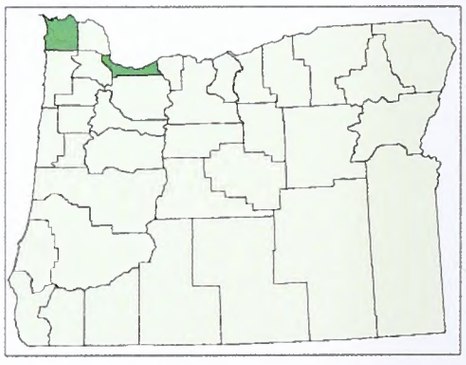


Gymnomitrion concinnatum

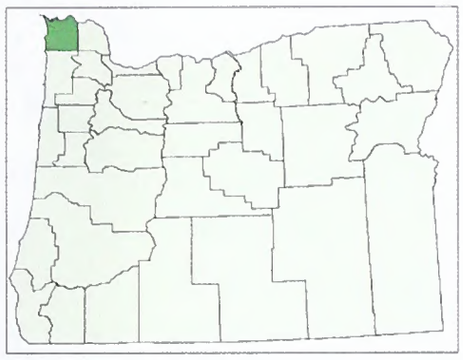
Haplomitrium hookeri



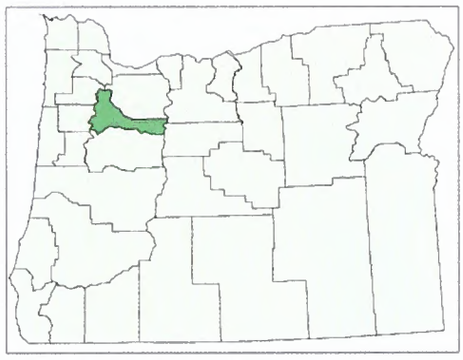
Harpanthus flotovianus



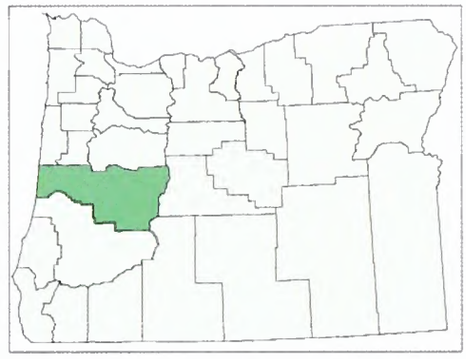
Herbertus aduncus ssp. *aduncus*



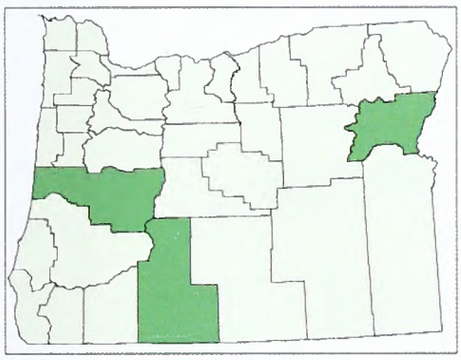
Herbertus dicranus



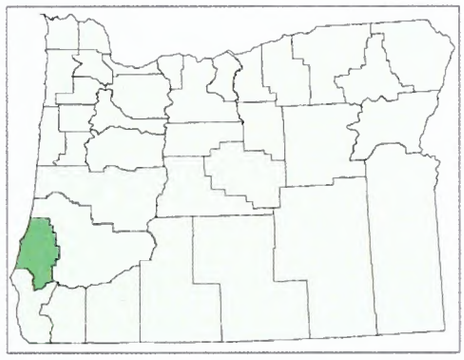
Hygrobiella laxifolia



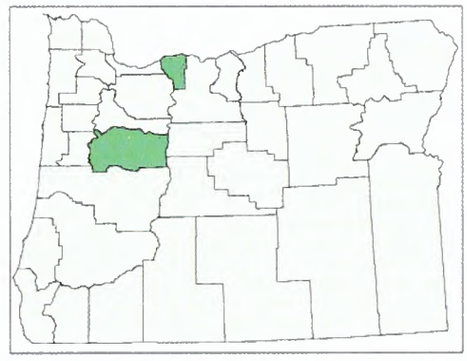
Jamesoniella autumnalis var. *heterostipa*



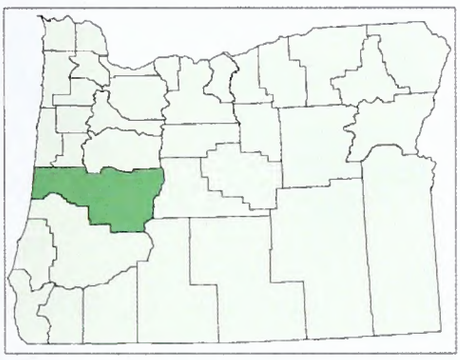
Jungermannia polaris



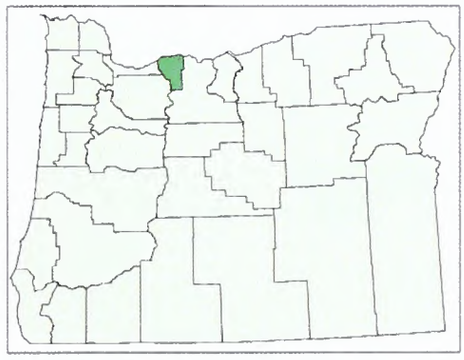
Kurzia sylvatica



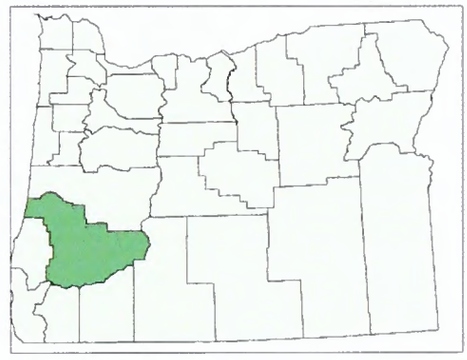
Marsupella condensata



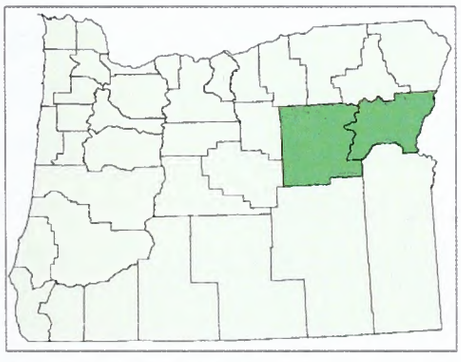
Marsupella emarginata var. *aquatica*



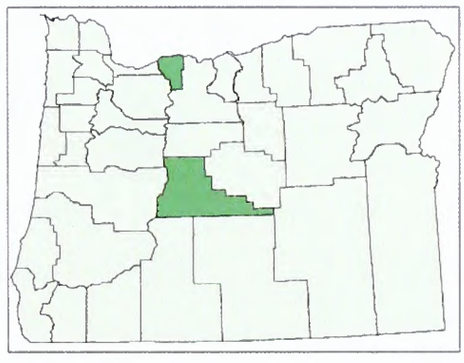
Marsupella sparsifolia



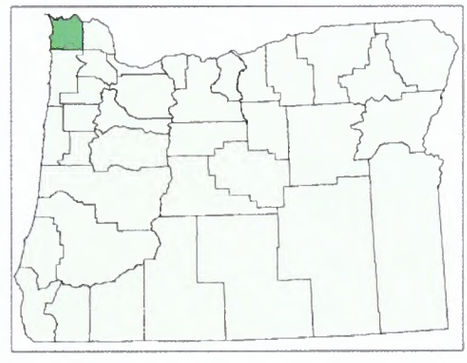
Marsupella sprucei



Mesoptychia gillmanii

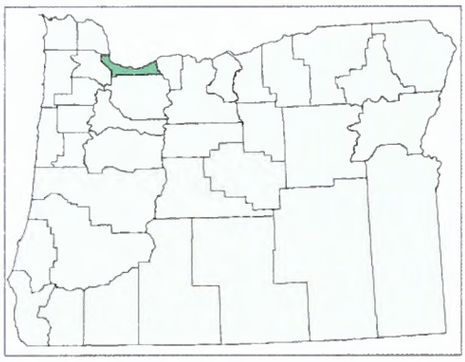


Nardia japonica

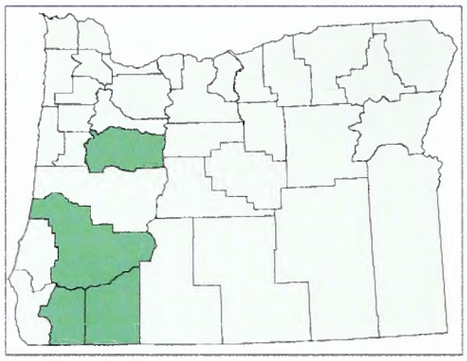


Plagiochila semidecurrens

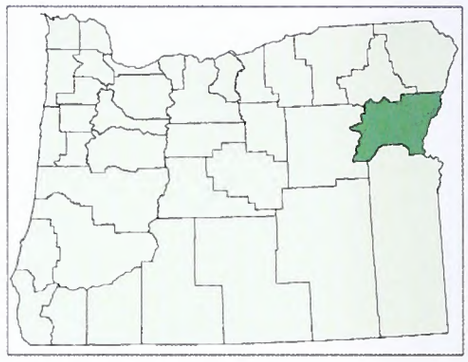
Distribution Maps: Leafy Liverworts



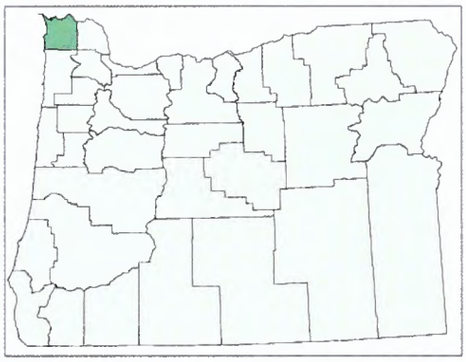
Porella arboris-vitae



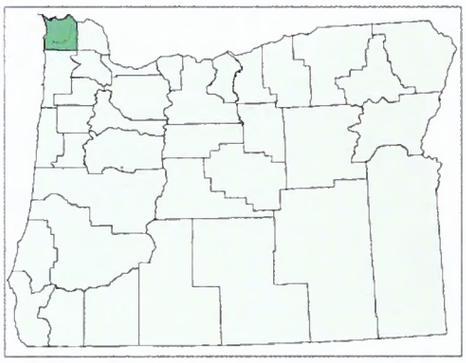
Porella bolanderi



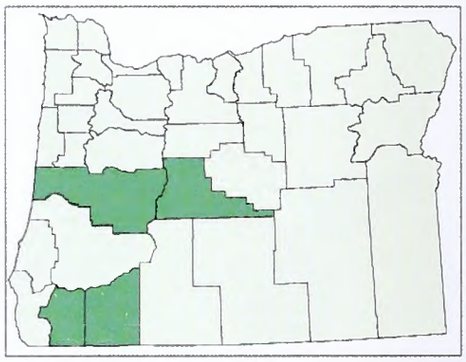
Ptilidium pulcherrimum



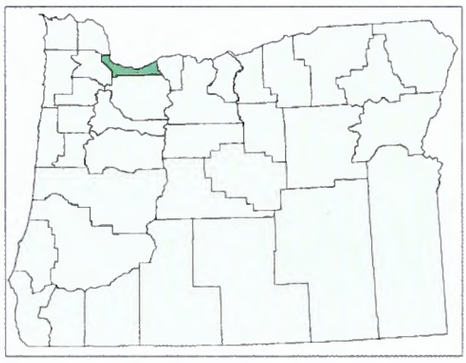
Radula brunnea



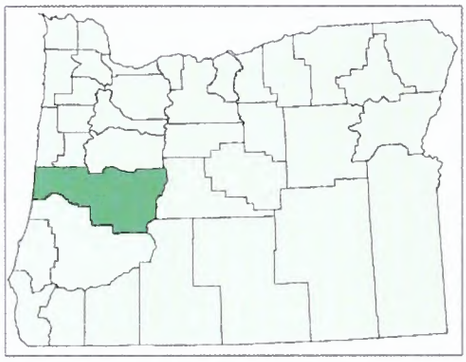
Radula obtusiloba ssp. *polyclada*



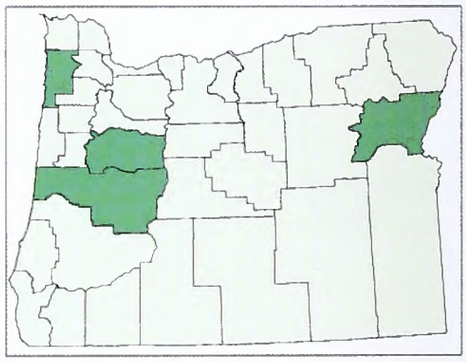
Rivulariella gemmipara



Scapania gymnostomophila



Scapania obscura



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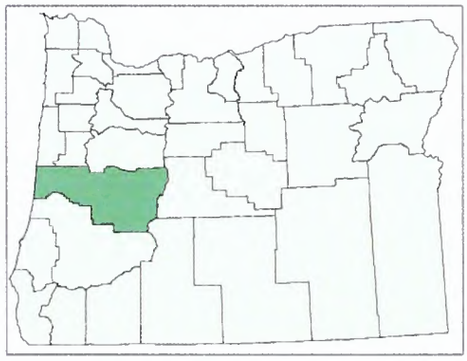
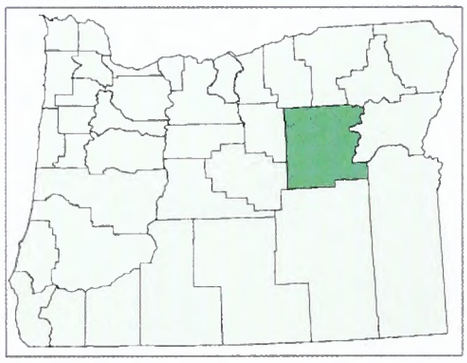
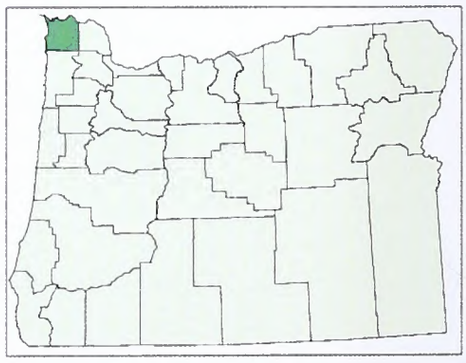


Schofieldia monticola



Tritomaria exsecta



Tritomaria quinquedentata

Abbreviations and acronyms

BBS	British Bryological Society
BLM	Bureau of Land Management
CAS	California Academy of Sciences Herbarium
DHW	Private collection of David Wagner
cm	centimeter
FNA	Flora of North America
Ft	feet
GeoBOB	Geographic Biotic Observation
KOH	potassium hydroxide
m	meter
mm	millimeter
NY	New York Botanical Garden Herbarium
ONHP	Oregon Natural Heritage Program
OLYM	Olympic National Park Herbarium
ORBIC	Oregon Biodiversity Information Center
ORNHIC	Oregon Natural Heritage Information Center
OSC	Oregon State University Herbarium
PMAE	Provincial Museum of Alberta Herbarium
Pvt	private [collection]
SP	species
SPP	species (plural)
SUBSP	subspecies
UBC	University of British Columbia Herbarium
UC	University of California (Berkeley) Herbarium
µm	Micrometer
USDA	United States Department of Agriculture Herbarium [Beltsville]
USDI	United States Department of the Interior
USFS	United States Forest Service
WTU	University of Washington Herbarium

Vascular plant references

Scientific name	Common name
Abies amabilis	Pacific silver fir
Abies concolor	white fir
Abies lasiocarpa	subalpine fir
Abies procera	noble fir
Abies magnifica × *shastensis*	Shasta red fir
Acer macrophyllum	big-leaf maple
Adenostoma fasciculatum	greasewood
Alnus rubra	red alder
Alnus sinuata	Sitka alder
Argentina egedii	Eged's silverweed
Artemisia tridentata	big sagebrush
Artemisia tridentata subsp. *wyomingensis*	bog sagebrush
Betula glandulosa	bog birch
Calamogrostis spp.	reedgrass
Calocedrus decurrens	incense cedar
Carex spp.	sedge
Carex aquatilis var. *dives*	Sitka sedge
Carex obnupta	slough sedge
Carex limosa	mud sedge
Cassiope mertensiana	Merten's mountain heather
Chamaecyparis sp.	cedar
Cheilanthes gracillima	lace lip fern
Corylus spp.	hazlenut
Crassula aquatica	water pygmyweed
Cupressus goveniana subsp. *pigmaea*	pigmy cypress
Darlingtonia californica	California pitcher plant
Drosera rotundifolia	sundew
Eleocharis spp.	spike-rush
Eleocharis ovata	ovate spike-rush
Eleocharis quinqueflora	few-flowered spike-rush
Eragrostis hypnoides	creeping eragrostis
Fagus spp.	beech
Fraxinus latifolia	Oregon ash
Gnaphalium palustre	lowland cudweed
Horkelia spp.	horkelia
Juniperus communis	mountain juniper
Juniperus occidentalis	western juniper
Kalmia microphylla	alpine laruel
Ledum glandulosum	smooth Labrador-tea
Ledum groenlandicum	bog Labrador-tea
Limosella aquatic	Mudwort
Lomatium spp.	desert-parsley
Lomatium utriculatum	fine leaved desert parsley
Lotus corniculatus	birdsfoot trefoil
Ludwigia palustris	marsh seedbox
Lysichiton americanus	Skunk cabbage

Scientific name	Common name
Mimulus guttatus	Monkey flower
Myrica gale	sweet gale
Orobanche uniflora	one flowered broomrape
Phyllodoce empetriformis	red mountain-heather
Picea breweriana	Brewer's weeping spruce
Picea engelmannii	Engelmann spruce
Picea sitchensis	Sitka spruce
Pinus spp.	pine
Pinus albicaulis	white bark pine
Pinus contorta var. *contorta*	shore pine
Pinus contorta var. *latifolia*	lodgepole pine
Pinus jeffreyi	Jeffery pine
Pinus ponderosa	ponderosa pine
Poa secunda	Sandberg's bluegrass
Polygonum hydropiperoides	waterpepper
Polystichum munitum	sword fern
Populus trichocarpa	black cottonwood
Populus tremuloides	quaking aspen
Potentilla spp.	cinquefoil
Potentilla anserina	common silverweed
Potentilla palustris	marsh cinquefoil
Pseudoroegneria spicata	bluebunch wheatgrass
Pseudotsuga menziesii	Douglas fir
Pyrus fusca	western crabapple
Quercus spp.	oak
Quercus douglasii	blue oak
Quercus garryana	Oregon white oak
Salix spp.	willow
Salix geyeriana	Geyer willow
Salix hookeriana	Hooker willow
Salix lucida subsp. *lasiandra*	shining willow
Salix sitchensis	Sitka willow
Saxifraga spp.	saxifrage
Saxifraga oregana	bog or Oregon saxifrage
Scheuchzeria palustris	rannoch-rush
Sedum spp.	stonecrop
Selaginella spp.	selaginella
Sequoia sempervirens	coast redwood
Triantha glutinosa	sticky false asphodel
Trientalis europaea subsp. *arctica*	northern starwort
Triglochin maritimum	arrow-grass
Tsuga heterophylla	western hemlock
Tsuga mertensiana	mountain hemlock
Vaccinium spp.	huckleberry
Vaccinium oxycoccos	swamp cranberry
Vaccinium uliginosum	bog blueberry
Veronica spp.	speedwell

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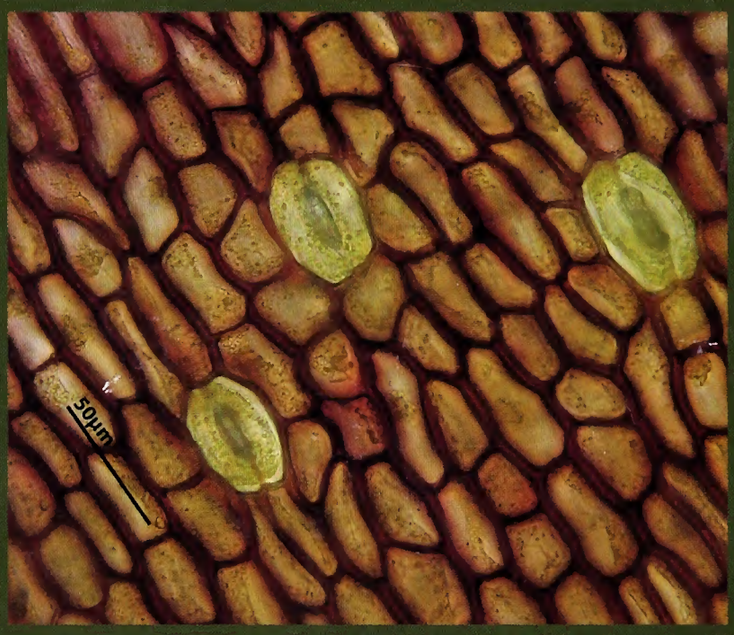
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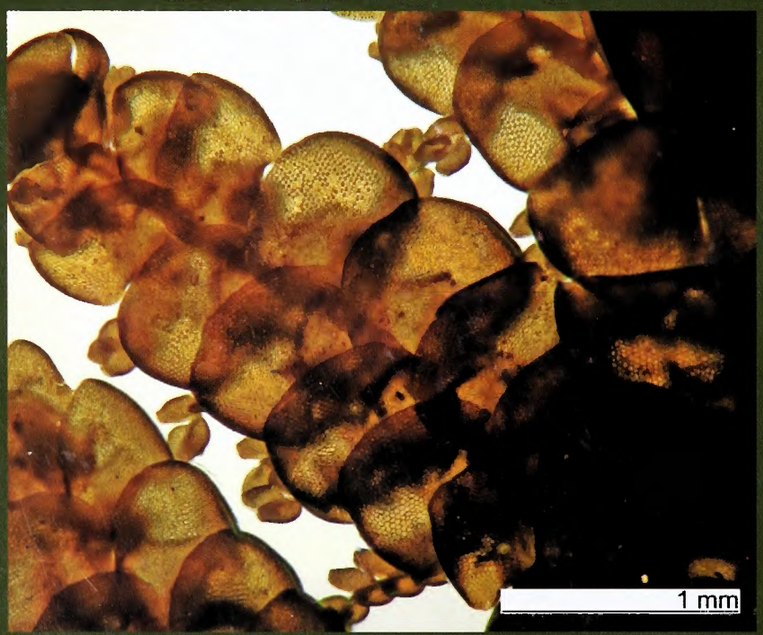
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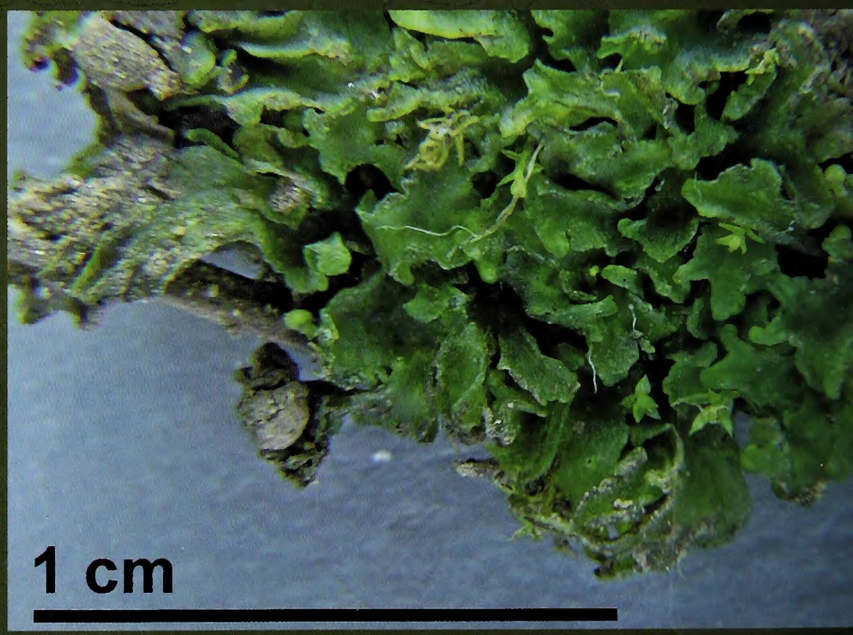
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