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Macroscopic key to the Sphagnaceae of North America

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Several regional identification keys have been published over the past few decades with an emphasis on the field recognition of *Sphagnum* species in the Northern Hemisphere. Ontario was covered by Haavisto (1974), northeastern North America and a portion of boreal North America was covered by McQueen (1985, 1990), and Norway covered by Flatberg (1994). These publications include the majority of common *Sphagnum* species that occur in the Northern Hemisphere.

In July 1996, I had the opportunity to spend three weeks in the field collecting *Sphagnum* species with Dick Andrus and Kjell Flatberg. We traveled from Quebec to the Pine Barrens of New Jersey and to Newfoundland. During that time we observed over 60 species in the field. The present key is based upon the field notes I took during that time and my previous field experiences. The purpose of this key is to enable the field determination of *Sphagnum* species using a combination of macroscopic features and those features that are observable with a 15X to 20X hand lens.

Field determinations should be verified with microscopic examination utilizing a compound microscope. Many *Sphagnum* species are easily modified by their environment as are many other wetland species and one species may take on the macroscopic appearance of another species, but they usually can be distinguished on the basis of microscopic features. Of the 84 species that McQueen and Andrus (1998) recognize for the flora of North America, 25-30 can only be determined for certainty with microscopic examination. The species that require microscopic examination are not specifically keyed out, but they are discussed in the couplets of the key with the species with which they are most likely to be confused. The technical treatments of Andrus (1980) and Crum (1984) should be consulted for verifying field determinations. The nomenclature follows McQueen and Andrus (1998). All of the published sources cited contain descriptions of the unique morphology of the genus *Sphagnum*.

Additional information such as range and habitat are contained in parentheses after each species. For some species additional notes are given to aid in distinguishing them from other closely related species.

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Abbreviations

CB = circum/boreal/polar
O = oceanic
SO = suboceanic
AA = amphiatlantic
AP = amphipacific
NE = northeastern N. America
NW = northwestern N. America
SE = southeastern N. America
CP = Coastal Plain
C = Continental

OM = ombrotrophic mire
PF = poor fen
MF = medium fen
RF = rich fen
WM = weakly minerotrophic
MW = minerotrophic wetlands
FP = forested peatland
OP = open peatland
SW = swamps
P = pocosins

Sphagnum species mentioned in key

S. affine Ren. & Card.
S. alaskense Andrus
S. andersonianum Andrus
S. angermanicum Melin
S. angustifolium (Russ.) C. Jens.
S. annulatum Warnst.
S. aongstroemii C. Hart.
S. arcticum Flatb. & Frisv.
S. atlanticum Andrus
S. austinii Sull.
S. balticum (Russ.) C. Jens.
S. bartlettianum Warnst.
S. brevifolium (Braithw.) Roll
S. capillifolium (Ehrh.) Hedw.
S. carolinianum Andrus
S. centrale C. Jens.
S. compactum de Candolle
S. contortum Schultz
S. cuspidatum Hoffm.
S. cyclophyllum Sull. & Lesq.
S. fallax (Klinggr.) Klinggr.
S. fimbriatum Wils.
S. fitzgeraldii Ren.
S. flavicomans (Card.) Warnst
S. flexuosum Dozy & Molk.
S. fuscum (Schimp.) Klinggr.
S. girgensohnii Russ.
S. henryense Warnst.
S. inundatum Russ.
S. isoviitae Flatb.
S. jensenii Lindb.
S. junghuhnianum Dozy & Molk.
S. koyukukense Andrus
S. lenense Lindb.
S. lescurii Sull.
S. lindbergii Lindb.
S. macrophyllum Brid.
S. magellanicum Brid.
S. majus (Russ.) C. Jens.
S. mcqueenii Andrus
S. mendocinum Sull. & Lesq.
S. microcarpum Warnst.
S. mississippiensis Andrus
S. molle Sull.
S. norvegicum Flatb.
S. obtusum Warnst.
S. oregonense Andrus
S. orientale Sav.-Lub.
S. pacificum Flatb.
S. palustre L.
S. papillosum Lindb.
S. pericheatiale Hampe
S. platyphyllum (Braithw.) Warnst.
S. portoricense Hampe
S. pulchrum (Braithw.) Warnst.
S. pylaesii Brid.
S. quinquefarium (Braithw.) Warnst.
S. recurvum P. Beauv.
S. riparium Angstr.
S. rubellum Wils.

S. rubiginosum Flatb.
S. rubroflexuosum Andrus
S. russowii Warnst.
S. sjörsianum Andrus
S. splendens Maass
S. squarrosum Crome
S. steerei Andrus
S. strictum Sull.
S. subfulvum Sjörs
S. subnitens Russ. & Warnst.
S. subobesum Warnst.
S. subsecundum Nees
S. subtile (Russ.) Warnst.
S. talbotianum Andrus
S. tenellum (Brid.) Bory
S. tenerum Sull. & Lesq.
S. teres (Schimp.) Angstr.
S. tongassense Andrus
S. torreyanum Sull.
S. trinitense C. Mull.
S. viridum Flatb.
S. warnstorfii Russ.
S. wilfii Crum
S. wulfianum Girg.

Key to Sections of *Sphagnum*

1. Branch leaves cucullate or nearly cucullate 2
1. Branch leaf margins inrolled or flat 3
   2. Stem leaves small and triangular, < 1 mm long; branch leaves somewhat squarrose ..... *Rigida*
   2. Stem leaves large, > 1 mm long, lingulate or fan-shaped; branch leaves tightly or loosely imbricate ..... *Sphagnum*
3. Six or more branches per fascicle ..... *Polyclada* (monotypic: *S. wulfianum*)
3. Five or fewer branches per fascicle 4
   4. Branch leaves squarrose or nearly squarrose 5
   4. Branch leaves imbricate or at most only recurved near apex, especially when dry 6
5. Stem leaves small and triangular, < 1 mm long ..... *Rigida*
5. Stem leaves large and lingulate, 1-1.5 mm long ..... *Squarrosa*
   6. Branch leaves ≥ 4 mm long; plants dark brown, greenish or silvery; primarily coastal plants ..... *Isocladus* (monotypic: *S. macrophyllum*)
   6. Branch leaves < 4 mm long; plants various colors; coastal or continental plants 7
7. Hanging and spreading branches very similar, about the same length, or plants with few or no branches ..... *Subsecunda*
7. Hanging branches usually longer and more slender than spreading branches, the distinction between hanging and spreading branches is pronounced 8
   8. Branch leaves with broadly truncate toothed apex ..... *Insulosa* (monotypic: *S. aongstroemii*)
   8. Branch leaves involute near apex 9
9. Stem leaves much smaller than branch leaves and are usually hanging downwards on the stem; plants various shades of green, yellow or brown, never red, but sometimes branches and stems pinkish; on plants with stellate capitula, paired branches of fascicles present between rays of branches (aquatic plants usually lack this feature); plants of wet mineral rich depressions, submerged or near the water level ..... *Cuspidata*

9. Stem leaves nearly the same size as branch leaves or larger and are usually upright on the stem; plants various shades of green, brown or red; on plants with stellate capitula, branches of fascicles single or absent between rays of branches; plants of drier mineral poor acid habitats, not normally submerged, usually growing above water level ..... *Acutifolia*

SECTION *ACUTIFOLIA*

1. Many fascicles with 3 spreading and 2 hanging branches 2
1. Two spreading branches and 1 or 2 hanging branches per fascicle 3
   2. Stem leaves triangular to triangular-lingulate, apex acute..... *S. quinquefarium* (SO, AA, AP; FP)
   2. Stem leaves lingulate, apex truncate or rounded ..... *S. rubiginosum* (O, AA, NW; FP)
3. Stem leaves fan-shaped or lingulate and fringed at least at apex 4
3. Stem leaves variously shaped, margins entire, never fimbriate, with rounded or pointed apex 6
   4. Stem leaves fan-shaped and fringed from apex down sides nearly to base; terminal bud large; sporophytes common, often with 2 or more per plant (summer) ..... *S. fimbriatum* (CB, NE, NW; PF, MF, SW)
   4. Stem leaves lingulate and fringed only at apex or with distinct notch; terminal bud lacking or poorly developed; sporophytes few or none (summer) 5
5. Stem leaves fringed across apex; plants stiff and wiry with long slender spreading branches perpendicular to stem; plants green, never red ..... *S. girgensohnii* (CB; FP) (This species has 2 spreading branches per fascicle and is rarely observed with sporophytes. *S. rubiginosum* has 3 spreading branches per fascicle, frequently is found with sporophytes, and may be variegated red like *S. russowii*. However, the stem leaf is similar to *S. girgensohnii*). *S. arcticum* is an arctic species that has a similar stem leaf to *S. girgensohnii*, but the stem leaf is distinctly longer than broad (*S. girgensohnii* has stem leaves that are nearly as long as broad) and the capitulum is brownish or at least with some brown without any red color.
5. Stem leaves with distinct notch at apex; plants weak-stemmed, not especially wiry or stiff; plants green, but usually splotched with red. ..... *S. russowii* (CB; PF, MF, RF, SW, FP) (*S.junghuhnianum*, a species of the Pacific northwest and Aleutian Islands may be sought here. Both species may be pale in color, but *S. junghuhnianum* is usually a pale yellow to brown color and pale forms of *S. russowii* usually have some hint of pink or red in the stems and leaves. Microscopic examination is needed to distinguish these pale forms from one another. Another species likely to be confused with *S. russowii* in the field is *S. wilfii*. This species from the Queen Charlotte Islands of British Columbia has smaller stem leaves and a relatively undifferentiated capitula. Microscopic examination is necessary to separate these species from *S. russowii*.)
   6. Capitulum flat, stellate; branch leaves in five rows 7
   6. Capitulum flat, rounded or hemispherical, five rays of branches not well-developed; branch leaves imbricate 9
7. Plants of *Thuja*, *Abies*, and/or *Picea* swamps and rich minerotrophic fens; branch leaves mostly straight; stem leaves short, 1.5:1 (l:w) or less, lingulate or triangular with apex

usually rounded, sometimes pointed; plants green, but usually purplish-red tinged, rarely red throughout ..... *S. warnstorfii* (CB; RF, SW)

7. Plants of open bogs, common hummock formers; leaves usually curved to one side; stem leaves long lingulate, 1.5:1 or longer, with rounded or pointed apex; plants green, but usually red throughout or splotched red-green 8
   8. Plants of open, poor fens and bogs; apex of stem leaves rounded to acute. ..... *S. rubellum* (SO, AA, AP; OM, PF)
   8. Plants of weakly minerotrophic mires such as the Pine Barrens of NJ and pocosins of Coastal Plain; apex of stem leaves acute to apiculate and strongly involute ..... *S. bartlettianum* (SO, E, W; WM, P)
9. Plants greenish-brown, yellow-brown, brown or deep red-brown 10
9. Plants green, pale green, pinkish to red 12
   10. Stem leaves lingulate with broad rounded apex; hummock former in dry open acid bogs ..... *S. fuscum* (CB; OM)
   10. Stem leaves lingulate-triangular, apex narrowed, rounded to acute; forms mats or small hummocks in wet, weakly minerotrophic to ombrotrophic habitats 11
11. Plants large and stiff to touch, usually deep brown with a faint metallic purplish sheen when dry; stem leaves ≥ 1.5 mm long, stem leaf apex apiculate or right-angled; branches mostly 1 mm wide or greater; usually in coastal habitats ....*S. flavicomans* (O, NE; OM, WM)
11. Plants moderate sized and soft to touch, green to golden brown, unshaded plants often reddish-purple, with metallic sheen when dry; stem leaves < 1.5 mm long, stem leaves with obtusely angled apex; hummock former shrubby or wooded fens..... ..... *S. subfulvum* (CB, AA, AP; MF, RF)
(*S. subnitens* may be sought here. Strictly a northwest coastal species, *S. subnitens* is yellow-brown tinged with pinkish to purplish brown, but microscopic examination is necessary to distinguish it from *S. subfulvum*). (*S. junghuhnianum* may also be sought here. This species of the Pacific northwest and the Aleutian Islands grows in loose, soft tufts that are a pale yellow to brown color. Microscopic examination is needed to confirm this species from ..... *S. subfulvum* and pale forms of *S. russowii*.)
   12. Stem leaves short, less than 1.5:1 (l:w) 13
   12. Stem leaves long, greater than 1.5:1 (l:w), lingulate, ovate, lanceolate; plants of open bog habitats 14
13. Plants green or variegated red-green in capitulum; stem leaves triangular; branch fascicles usually with 2 spreading and 2 pendent branches; forms hummocks and carpets in damp coniferous forests and hardwood swamps ..... *S. subtile* (CB, NE, AA; FP, SW)
13. Plants usually pinkish to nearly red throughout; stem leaves lingulate; branch fascicles usually with 2 spreading and 1 pendent branch; forms carpets or low hummocks at or near water level in open peatlands ..... *S. andersonianum* (NE, NW, O; WM)
(*S. koyukukense* a species from Alaska may be sought here, but microscopic examination is necessary).
   14. Stem leaves broadest at base 15
   14. Stem leaves broadest above middle 16
15. Stem leaf margins near apex strongly inrolled, apex toothed, stem leaves >1.5 mm long; branches with swollen appearance; plants of coastal areas on damp sand or on pond margins ..... *S. tenerum* (E, O)

15. Stem leaf margins not strongly inrolled, apex not strongly toothed, stem leaves <1.5 mm; branches not appearing swollen; hummock former in open and treed acid bogs ..... *S. capillifolium* (CB; OM)
(*S. tongassense*, an Alaskan species, may be sought here, but microscopic examination is necessary).
    16. Stem leaf with truncate, dentate apex; branch leaves not strongly inrolled at apex, 6-10 teeth at apex; plants soft and lax; capitulum with large blunt, flat branches; plants usually pale green or purple-red ..... *S. angermanicum* (O, AA; PF)
    16. Stem leaf with broad, toothed apex; branch leaves with inrolled margins, apex with up to 8 large teeth; plants stiff when dry; capitulum large and compact with round, pointed branches; plants pale white, yellow or purple, rarely deep colored ..... *S. molle* (O, AA; WM, SW)

SECTION *CUSPIDATA*

1. Stem leaves large, ≥ 1-1.5 mm long, apex irregularly cut or torn 2
1. Stem leaves large or small, apex rounded, truncate, or acute 3
    2. Stem leaves fan-shaped or squarish, broad apex cut or torn with coarse teeth; branch leaves five-ranked; stem dark brown ..... *S. lindbergii* (A, CB; WM, OM)
    2. Stem leaves < 1.5 mm long, broad triangular; stem leaves torn down the middle; branch leaves usually not in five rows; plants pale green or yellow, rarely dark brown ..... *S. riparium* (CB; MF) (*S. lenense* may be sought here. *S. lenense*, an arctic species, is brown in color with a compact appearance and has lingulate stem leaves, strongly five-ranked branch leaves that are recurved when dry).
3. Stem and branch leaves almost the same size and shape 4
3. Stem and branch leaves distinctly different in size and shape 5
    4. Stem leaves lingulate, < 1.5 mm long; branch leaves strongly concave ..... *S. tenellum* (AA, AP, O; OM, WM)
    4. Stem leaves and branch leaves nearly rectangular, ≥ 2 mm long, branch leaves serrate across rounded to truncate apex and less pronounced in stem leaves ..... *S. fitzgeraldii* (SE, CP; P)
5. Stem leaf apex truncate or broadly rounded, 0.8 mm or longer 6
5. Stem leaf apex acute, apiculate, or rounded, but not truncate, 0.5 mm or longer 7
    6. Branch leaves five-ranked; hanging and spreading branches and leaves similar, hanging branches loosely covering the stem, branch leaves long and narrow, recurved at tips when dry; capitulum stellate ..... *S. recurvum* (SO, E; PF, P)
    6. Branch leaves imbricate, but may be five-ranked in wet grown forms; hanging and spreading branches different with hanging branches tightly covering the stem, branch leaves ovate to broadly ovate-lanceolate; the capitulum resembles a small, loose ball of yarn ..... *S. flexuosum* (SO, AA; PF, MF)
(*S. obtusum* has coarse capitulum branches that are distinctly laterally curved when viewed from above. The stem leaf apex is obtuse-truncate and more or less fringed. *S. rubroflexuosum* and *S. talbotianum* may be sought here, but microscopic examination is necessary to distinguish them from *S. flexuosum* and *S. obtusum*).
7. Apex of stem leaf apiculate 8

7. Stem leaves with acute or rounded apex 9
   8. Branches short and thick with broad apiculate leaves, branch leaves in five rows; spreading and hanging branch leaves different; plants green, yellow, and brown ..... *S. pulchrum* (SO, AA; PF, OM) (*S. balticum* may be sought here. The stem leaf apex is obtuse-rounded, but it can look acute due to the inrolled margins. The terminal bud of the capitulum is inconspicuous compared to the distinct terminal bud of *S. pulchrum*. The spreading branch leaves of *S. balticum* are indistinctly five-ranked. *S. mendocinum* may be sought here, but microscopic examination is necessary).
   8. Spreading and hanging branches slender, branch leaves imbricate; spreading and hanging branch leaves similar; plants green, yellow, seldom brown .... *S. fallax* (SO, E; PF, OM). (*S. isoviitae* and *S. brevifolium* have narrower stem leaves, nearly straight branch leaves when dry, and have a darker color, yellow-brown to brown, whereas, *S. fallax* stem leaves are nearly as broad as long, slightly recurved branch leaves when dry, and is a lighter green to yellow brown color. Microscopic examination is necessary to to distinguish these species from *S. fallax*. *S. splendens*, an aporose species of eastern North America and *S. pacificum*, a northwest coastal species may be sought here, but microscopic examination is necessary.)
9. Stem leaves small, < 0.8 mm long, equilateral triangular; plants usually above water level in acid bogs and poor fens ..... *S. angustifolium* (CB; OM, PF, MF, RF)
9. Stem leaves longer than 0.8 mm, isosceles triangular to triangular-lingulate; plants primarily aquatic or found in very wet, mineral-rich habitats 10
   10. Stem leaves with rounded apex 11
   10. Stem leaves with acute apex 12
11. Plants brownish-green, almost black; branch leaves are strongly curved. and turned to one side at branch tips; weakly minerotrophic, aquatic or near water level in wet depressions ..... *S. majus* (AA, AP; OM, PF)
11. Plants orange-brown, yellow-brown; branch leaves imbricate, leaves curved at branch tips, but not all turned in the same direction; minerotrophic and aquatic ..... *S. jensenii* (CB; PF) (*S. annulatum* may be sought here. This species has more strongly curved leaves and branches in the capitulum. The capitulum is glossy with a distinct apical bud. *S. jensenii* has an inconspicuous apical bud and is dull in color.)
   12. Branch leaves long, slender and inrolled only near apex; branch leaves imbricate, teeth on branch leaf margin near apex; plants are plumose; growing primarily in coastal regions in acid ponds ..... *S. trinitense* (O,E) (*S. mississippiensis* may be sought here. The branch leaves of this species are broadly ovate with few teeth at the apex. Microscopic examination is necessary to separate these species).
   12. Branch leaves long, slender and inrolled at least half the length of the leaf; branch leaves imbricate to five-ranked; branch leaf margins without teeth; near coast and/or inland 13
13. Branch leaves inrolled from middle to apex, narrow, often < 0.8 mm wide; sides of triangular stem leaves longer than base; plants slender, weak and floppy; capitulum not noticeable; plants green or yellow, bases of branches in capitulum may be red-tinged ..... *S. cuspidatum* (SO, AA; OM, WM, P)

(At least three other species may be sought here. *S. viridum* has bright green to yellowish capitulum branches, *S. norvegicum* has capitulum branches that are dirty yellowish grey-green, and *S. mcqueenii* has a conspicuous terminal bud. None of these species have any red coloration as in *S. cuspidatum*. Microscopic examination is necessary to separate these species especially in boreal regions.)

13. Branch leaves inrolled from near base to apex, usually more than 0.8 mm wide; base and sides of triangular stem leaves are almost equal in length; plants large; capitulum noticeable; plants green, yellow or brown ..... *S. torreyanum* (O, E; acid ponds) (*S. atlanticum* an east coast species and *S. sjörsianum* a northwest coast species may be sought here, but microscopic examination is necessary.)

SECTION *ISOCLADUS*

Extremely long, nonundulate, tufted branch leaves; plants dark brown, greenish, or silvery; primarily coastal plants ..... *S. macrophyllum* (E, CP;WM) (could be confused with dark aquatic forms of *S. torreyanum*, but its branch leaves not as tufted)

SECTION *INSULOSA*

Plants are pale brownish-yellow, yellowish-green, and loosely tufted; stems are yellowish-green; primarily a western arctic species that also occurs along the northwestern coast of N. America in relatively minerotrophic sites ..... *S. aongstoemii*. It may be confused with *S. tenellum*, but the latter species is pale yellow to golden-brown with a pale green to brown stem, grows in a variety of ombrotophic to weakly minerotrophic habitats in coastal areas of boreal northeastern and northwestern North America.

SECTION *POLYCLADA*

Six or more branches per fascicle; branch leaves in five rows; hemispherical capitulum; thick stems sometimes dark brown to black; large plants forming loose carpets on damp humus in mineral poor, coniferous swamps and fens ..... *S. wulfianum* (CB, absent in W. Canada).

SECTION *RIGIDA*

1. Stem leaves of two types, either triangular with short slit down middle at apex or oval shaped with rounded apex; branch leaves with rounded apex, margins inrolled; stem brown, plants pale brownish-green, sometimes tinged with violet ..... *S. compactum* (CB; E, W; OM, WM, P)

1. Stem leaves triangular with broadly rounded apex, almost truncate; branch leaves elongated, leaves abruptly inrolled above middle to form long, tubular apex; stem pale green, plants whitish-green ..... *S. strictum* (AA, OO)

SECTION *SPHAGNUM*

1. Stem leaves long rectangular; plants pink and/or purple-red in open areas and green in shaded areas ..... *S. magellanicum* (CB; C; OM, PF, MF, RF; OP, FA)

(*S. alaskense* may be sought here. This species is very similar to *S. magellanicum* in macroscopic characters, but papillae are found on the chlorophyllous cells as observed in cross section. This species has only been found in Alaska).

1. Stem leaves variously shaped, usually ovate to obovate; plants green, yellow, brown, or without any red coloration 2
   2. Stem leaves fan-shaped, greatly expanded below apex; 2-3 spreading branches and 3 hanging branches; plants green, gold-brown, purple-brown; forming dense carpets in wet forests ..... *S. centrale* (C; CB; MF, RF, FP)
   2. Stem leaves oval-shaped, widest at middle 3
3. Branches, especially in the capitulum, slenderly club-shaped; growing submerged or near water level in shallow, sandy-bottomed ponds; plants green, brown, or gold-brown; coastal habitats ..... *S. portoricense* (O; SE; P, SW, P)
3. Branches cylindrical and tapered; plants usually not growing submerged; not strictly coastal 4
   4. Capitulum small and distinctly flattened with small pointed branches; plants green, reddish-brown seen in capitulum; newest branches of capitulum noticeably shorter than branches below ..... *S. henryense* (SO; E, W; PF, MF, FP, P)
   4. Capitulum large and rounded; plants green, brown, purple-brown; newest branches approximately same size as older branches 5
5. Stem leaves > 1.5 mm long and length is almost twice the width; plants green to gold-brown with darkest coloration in young branches of capitulum and paler color in longer branches at base of capitulum; growing on margins of mineral rich habitats, rarely dominant ..... *S. palustre* (SO; AA, AP; PF, MF, RF; FP)
5. Stem leaves < 1.5 mm long, only slightly longer than broad; plants green to dark brown, uniformly colored throughout or at most capitulum variegated in color 6
   6. Plants yellowish-green, tan to yellow brown in color; stem leaves lingulate 7
   6. Plants brownish-green, light brown to rich dark, chocolate brown; stem leaf almost fan-shaped 8
7. Stem leaves about 1.0 mm long and half size of branch leaves, finely fringed around margins; a ruderal coastal species of wet depressions ranging from NJ to Texas ..... *S. pericheatiale* (O; SE; SW, P)
7. Stem leaves > 1.0 mm long and about same length of branch leaves, finely fringed above middle of leaf; common species of poor fens in northeastern and northwestern North America ..... *S. papillosum* (SO; AA, AP; PF; OP)
   8. Branch fascicles with one pendent branch, spreading branches horn-like curved; plants red brown, dark brown to rich chocolate brown color ..... *S. austinii* (O, AA, NW; OM)
   8. Branch fascicles usually with more than one (2-3) pendent branch per fascicle; branch leaves frequently squarrose; plants slender overall; plants green, tinged brown or purple-brown; when growing intermixed with other species of this section, these species are pale ..... *S. affine* (SO; AA; FM, MW, P) and *S. steerei* (These two species can only reliably be separated with microscopic features. *S. affine* is amphiatlantic with oceanic tendencies and more common in temperate and subtropical regions. This species is also paler in color, generally green

to yellowish-brown. *S. steerei* is more common further north in the arctic and is a darker brown color.

SECTION *SQUARROSA*

1. Branch leaves strongly squarrose throughout plant; stem leaves long triangular with truncate apex; pale green, rarely dark brown. ..... *S. squarrosum* (CB, A, C; MF, FP)
1. Branch leaves imbricate in upper portion of plant and slightly squarrose in lower portion; stem leaves tongue-shaped with rounded or flat apex, apex may have 3-4 low, broad teeth; plants brown in open areas, pale green in shaded areas ..... *S. teres* (A; NW, AP; PF, MF)

SECTION *SUBSECUNDA*

1. Plants slender or large and tumid, unbranched or with 1-2 branches per fascicle, capitulum absent 2
1. Plants large, usually branched, capitulum present; plants greenish, variegated yellow, orange, ochre in color 4
   2. Plants deep red (to red brown) or red to pinkish in color 3
   2. Plants green to light green ..... *S. microcarpum* (SE) (Microscopic examination is necessary to confirm this species to distinguish it from monopodal forms of other species such as .. *S. lescurii* and *S. inundatum*.)
3. Stem leaves longer (1.5-2.5 mm) than branch leaves (0.9-1.2 mm), fascicles with 1-2 branches common ..... *S. pylaesii* (AA, O; WM)
3. Stem and branch leaves similar and very large (3.5-4.0 mm long), fascicles uncommon, stems and branches (when present) swollen and terete ..... *S. cyclophyllum* (SE; CP, P)
   4. Stem leaves ≤ 1.2 mm long; branch leaves slightly curved to one side 5
   4. Stem leaves > 1.2 mm long; branch leaves rarely curved to one side 7
5. Stem leaves only slightly longer than broad, very small (0.5-0.7 mm), with broad apex, margin flat; branch leaves slightly longer or same size as stem leaves, margins inrolled nearly entire length, leaves slightly curved to one side; small, slender, wiry plants; capitulum usually without terminal bud; stem dark brown .. .. *S. subsecundum* (CB, AA, AP; PF, MF) (*S. orientale* and *S. subobesum* both arctic species, may be sought here. *S. oregonense* a species of the northwestern coast of the continental U.S. may also be sought here. The stem leaves of these species are at least 1.0 mm long. Otherwise, microscopic examination is necessary to separate these three species from *S. subsecundum*.).
5. Stem leaves nearly twice as long as broad (0.7-1.2 mm), slightly rounded at apex, nearly acute, margins flat or inrolled 6
   6. Branch leaves nearly twice the length of the stem leaves, inrolled only near the apex, slightly curved to one side; capitulum large, flat, terminal bud present, branches have appearances of being twisted in different directions when viewed from above; stem pale green to light brown, plants variegated with yellow or brown to ochre ..... *S. contortum* (CB, NE, C, NW; RF) (*S. carolinianum* may sought here. Microscopic examination is required to separate these species.

6. Branch leaves 1.25-1.5 times longer than stem leaves, inrolled for nearly half the length of the leaf, nearly straight; capitulum small or large, branches of capitulum are only slightly curved when viewed from from above; stems greenish to brownish, variegated with yellow and orange (never deep red) ..... *S. inundatum* (CB, AA, AP, O; WM)

7. Terminal bud large; 1-3 branches per fascicle, 2 spreading and 1 hanging, little or no difference between hanging and spreading branches, branches do not conceal stem; stem and branch leaves of similar size, shape, and structure ... *S. platyphyllum* (CB, W; MF, RF)

7. Terminal bud indistinct; 4-5 branches per fascicle, 2-3 spreading and 2 hanging, branches noticeably different, hanging branches conceal stem; stem and branch leaves noticeably different in size, shape, and structure ..... *S. lescurii* (AA; WM) (*S. carolinianum* may be sought here. It can look similar to *S. pulchum*, but *S carolinanum* has obtuse stem leaves. Microscopic examination is required for identification.)

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The Macrolichens in West Virginia

A new publication, *The Macrolichens in West Virginia* by Don G. Flenniken, is scheduled for distribution after 10 April, 1999. This 231 page, soft-bound, 8.5X11" manual covers 284 species found or reported from West Virginia and includes 320 color photographs on 26 plates, keys to genera and species, brief descriptions of each species, and distribution maps.

Copies are US $28.00 plus postage ($3.20 Priority Mail in U.S., $7.00 Canada, Mexico, Central America, western Europe, and the Middle East; $9.00 elsewhere). Send check drawn on U.S. bank or Money Order payable to: Don Flenniken, 2273 Blachleyville Rd. Wooster, Ohio 44691. USA. Don't forget return address. For more info e-mail - FlennikenD@aol.com

Additional State and County Mosses for the Great Plains

Steven P. Churchill[1] & Robert F. Steinauer[2]

Additional state and county records are provided for Nebraska, Oklahoma, South and North Dakota based on previous and recent collections from the Great Plains.

Campylium stellatum (Hedw.) C. E. O. Jensen Amblystegiaceae. Nebraska: Cherry County, ca. 36 miles south of Valentine, 42°22'N, 100°32'W, at base of *Carex prairea* tussocks, in sandhills fen, *Steinauer 365* (MO). New to Nebraska. The costa is variable in the specimen examined - very faint to double with one costa often longer, or appearing single.

Drepanocladus longifolius (Mitt.) Broth. ex Paris Amblystegiaceae. Fig. 1. South Dakota: Lawrence County, along South Fork Rapid Creek, S-SE of Lead, 44°08'N, 103°50'W, shallow pool along stream, 25 May 1977, *Churchill 9105* (MO; verif. L. Hedenäs). New to the Great Plains. Considered a form of *D. aduncus* (Hedw.) Warnst. by Crum and Anderson (1981), this species has been recognized by both Janssens (1983) and Hedenäs (1997). Synonyms of *Drepanocladus longifolius* include *D. capillifolius* (Warnst.) Warnst. and *D. crassicostatus* Jenssens (Hedenäs, 1997). *Drepanocladus aduncus* is the only member of the genus that is common throughout the Great Plains north of Kansas (Fig. 1).

Pseudocrossidium crinitum (Schultz) R. H. Zander [*Tortula aurea* E. B. Bartram] Pottiaceae. Oklahoma: Greer County, Quartz Mountains, 34°54'N, 99°18'W, on soil, 5.v.1956, *Ikenberry s.n.* (MO). This appears to be the second record for Oklahoma, first reported by Crum and Anderson (1981) from Canadian County, Oklahoma as *Tortula aurea* based on *Redfearn 27095* (MICH n.v.).

Saelania glaucescens (Hedw.) Broth. *in* Bomanss. & Broth. Ditrichaceae. Fig. 2. South Dakota: Fall Rivers County, at Stone Quarry Canyon, ca. 4 miles northeast of Edgemont on Highway 18. 43°20'N, 103°46'W (Sec. 16, T8S, R3E), sandstone canyon with open *Pinus ponderosa* woods, on shaded sandy slope, *Churchill & Churchill 19590* (MO). Previously reported for Nebraska by Churchill (1979,

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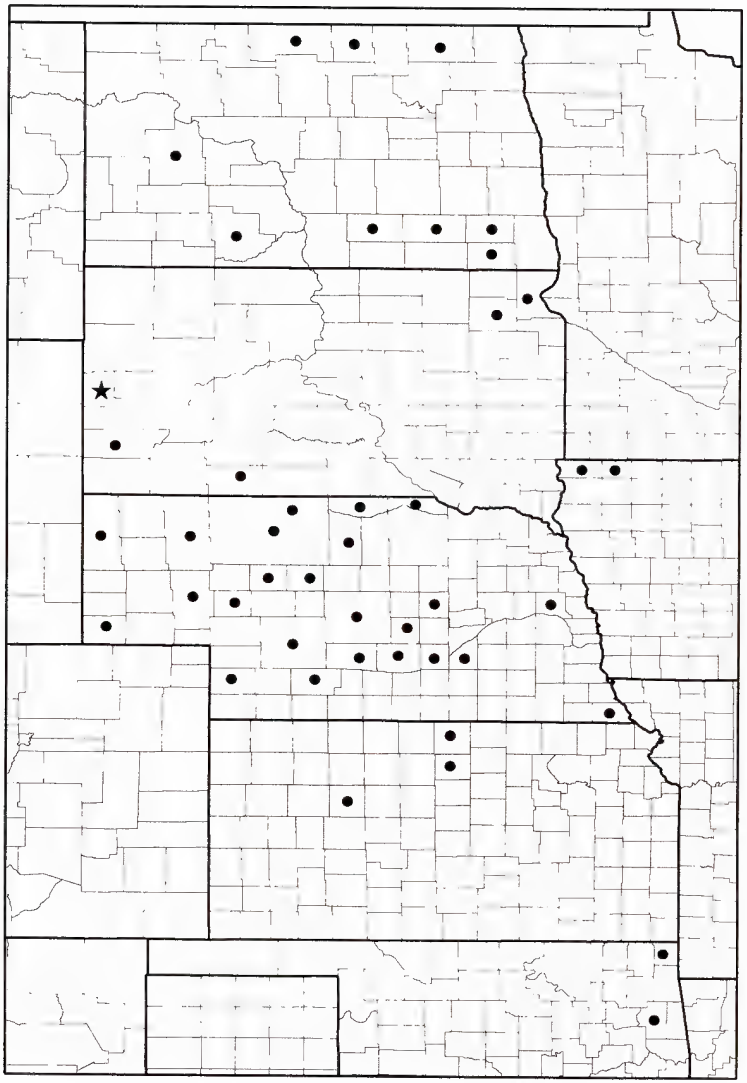

Figure 1. Distribution of *Drepanocladus aduncus* (dots) and *D. longifolius* (star) in the Great Plains.

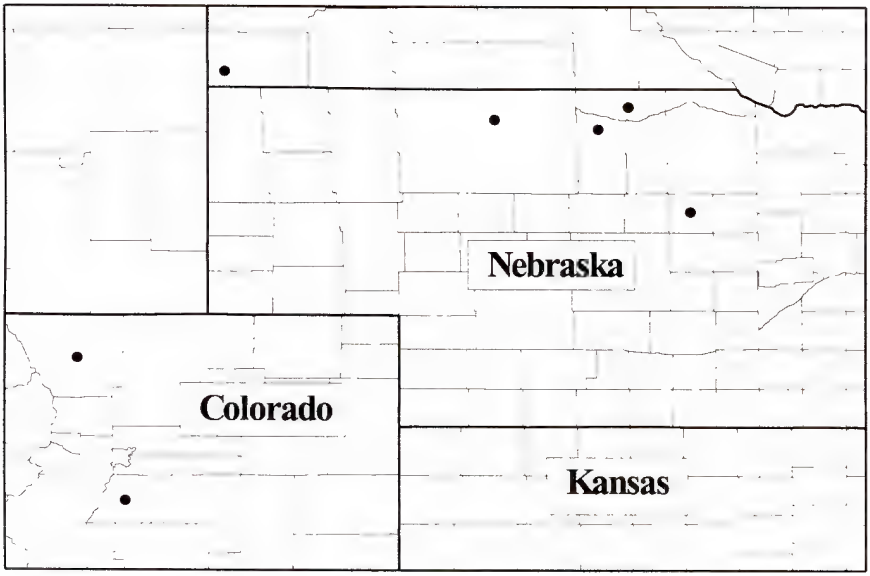

Figure 2. Distribution of *Saelania glaucescens* in the Great Plains and Rocky Mountains (based on collections in MO).

1985) from Brown: *Churchill & Kizirian 12301* (MO); Cherry: *Churchill 7203* (MO); Garfield: *Churchill 8082* (MO); Keya Paha: *Churchill 12001* (MO). In the Great Plains this species is typically found in mixed conifer-deciduous or conifer woods, most often found on shaded sandy slopes. Associated with *Encalypta*, *Mnium* and *Pohlia*.

Weissia muehlenbergianum (Sw.) W. D. Reese & B. A. E. Lemmon [*Astomum*] Pottiaceae. North Dakota: Stutsman County, Arrow Wood National Wildlife Refuge, 47°19'N, 98°47'W, *Churchill & Kantak 12493-A* (MO). This east central collection is the second report for the state, previously reported from Billings County in western North Dakota (Blaney & Norris, 1987).

Acknowledgements. The first author is grateful to Jesús Muñoz for the preparation of the maps, and to Ernest Churchill for assisting with recent field work in South Dakota.

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Great Plains mosses now available through W3 TROPICOS

The majority of Great Plains mosses have now been databased at MO. Information can be accessed from http://mobot.mobot.org/Pick/search/most.html or by www.mobot.org. then from the right side choose Bryophyte under TROPICOS options.

At present the following information is provided: state, country, coordinates, date, collector and collection number – further information can be found by clicking on collector. An initial synopsis is planned providing keys to all taxa, ecological and geographical information which will augment the database.

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New State and County Records for the genus *Sphagnum* from Delhaas Woods, Bucks County, Pennsylvania

Walter F. Bien[1] and Richard R. Andrus[2]

The Coastal Plain physiographic province situated in southeastern Pennsylvania makes up less than 5% of the state land mass and occurs as a narrow strip of and that parallels the Delaware River floodplain through portions of adjoining Bucks, Philadelphia, and Delaware Counties. The low-lying topography of the Pennsylvania Coastal Plain and immediate access along the Delaware River has attracted land use since the time of William Penn (circa 1682) for whom the state of Pennsylvania is named. During the 1950's and 60's as a result of its proximity to the Philadelphia metropolitan area, much of the Coastal Plain woodlands in Bucks County were impacted by suburban encroachment and industrialization.

Amidst this development, the Delhaas Woods section (175 acres) of the Silver Lake Nature Center, located in Bristol Township, Bucks County, Pennsylvania (74°52' W and 40°07' N), is recognized by the Eastern Chapter of the Nature Conservancy as the best remaining portion of Coastal Plain woodlands remaining in the state of Pennsylvania. In recent history, the area has not escaped the adverse consequence of development. During World War II, sections of Delhaas Woods were cleared of trees to build a munitions storage facility. Following the abandonment of this facility, a corridor of trees was cut through the middle of the Delhaas Woods for the construction of high tension wires. During the "energy crisis" of the 1970's many of the remaining oak trees were felled for firewood, and the final insult to the area was the unscrupulous dumping of contractor waste under the power lines. Fortunately however, the Eastern Chapter of the Nature Conservancy purchased several parcels of this land since 1985 in an initiative to rescue the Delhaas Woods. The purchased land was presented to the Bucks County Department of Parks and Recreation and is managed locally by the Silver Lake Nature Center (SLNC). Today, as a result of this conservation effort, much of the Delhaas Woods has slowly regenerated and presently supports several Pennsylvania Species of Special Concern.

Recently, this anomalous refugium has been found (1998) to support a disjunct *Sphagnum* flora more typical of the minerotrophic fens in the New Jersey Pine Barrens. The Delhaas Woods are underlain with unconsolidated sandy and acidic soils that are geochemically suitable to support a limited *Sphagnum* growth within a few specialized wetland habitats. However, local climatic conditions, warm summer temperatures and periodic droughts, prevent any significant peat formation. The wetlands supporting *Sphagna* at SLNC are

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classified as either topogenous (surface runoff) or soligenous (groundwater) and commonly have standing water during the cooler parts of the year and are driest during the summer growing season when the evaporation rate often exceeds the precipitation rate (high P/E ratio).

Forty-one *Sphagnum* taxa are reported to occur throughout Pennsylvania's sixty-seven counties and only *S. recurvum* P. Beauv. is previously reported to occur in Bucks County (List and Andrus, 1989). However, recent collections (spring and summer 1998) from wetland habitats at the SLNC complex: Coastal Plain forest, vernal ponds, wet meadows, and an unglaciated bog (considered a Pennsylvania Community of Special Concern) revealed 14 *Sphagnum* species (2 new state records ++ and 13 new county records +):

+	*S. affine* Ren. & Card.	+*	*S. isoviitae* Flatb.
++	*S. angermanicum* Melin	+	*S. lescurii* Sull.
+	*S. cuspidatum* Hoffm.	+	*S. molle* Sull.
+	*S. compactum* DC.	++	*S. pylaesii* Brid.
+	*S. fimbriatum* Wils.		*S. recurvum* P. Beauv.
+	*S. henryense* Warnst.	+	*S. squarrosum* Crome
+*	*S. inundatum* Russ.	+	*S. trinitense* C. Müll.

*See special notes

1) Coastal Plain Forest. The Coastal Plain Forest is the largest vegetation habitat in the Delhaas Woods section of SLNC and is made up of a discontinuous stand of hydric and mesic woodlands. Several populations of *S. squarrosum* were observed growing in scattered lawns on moist, but nonflooded sections, of the forest floor. Both *S. affine* (Bien 1016 PA) and *S. recurvum* (Bien 1012 PA) were collected from the base of trees and shrubs along the forest periphery (partial shade).

2) Unglaciated Bog. The unglaciated bog is bordered by a dense shrub-thicket that is encroaching into the remaining open bog where a number of open pools support *S. cuspidatum* (Bien 1019 PA) and small patches of *S. isoviitae* (Bien 1006 PA). Several species were collected on low hummocks surrounding the base of Carex tussocks and low shrubs: *S. henryense* (Bien 1003 PA), *S. angermanicum* (Bien 1004 PA), *S. squarrosum* (Bien 1014 PA) and *S. affine* (Bien 1013 PA). Both *S. recurvum* (Bien 1017 PA) and *S. fimbriatum* (Bien 1010 PA) were collected from the base of larger shrubs in the drier transition zone between forest and bog.

3) Wet and Dry Meadow. The service road along the power lines traps water creating a pattern of wet and dry open meadows where the water table is seasonally variable. Within this drainage catena only the lowest lying areas retain enough available water to sustain *Sphagnum* growth. Samples of *S. inundatum* (Bien 1005 PA), *S. lescurii* (Bien 1015 PA), and *S. trinitense* (Bien 1007 PA) were collected from shallow depressions with standing

water during the spring (1998). In a partial shaded area, *Sphagnum fimbriatum* (Bien 1018 PA) was collected on shrub roots just above the water table. *Sphagnum compactum* (Bien 1008 PA) and *S. molle* (Bien 1009 PA) were sampled from a single location at the highest point along the wet-to-dry gradient near the end of the service road. The "damming" effect of the service road and occasional cutting of trees and shrubs below the power lines appears to be a beneficial disturbance that maintains an exposed habitat for *Sphagnum* species with greater light and temperature requirements.

4) Vernal Ponds. Several desiccation tolerant species were collected from a vernal pond that runs as a drainage swale for approximately 30 meters adjacent to the power line service road. This shallow depression supports a large carpet of *S. pylaesii* (Bien 1000 PA) and casual amounts of *S. cuspidatum* and *S. trinitense*. Water trapped in this drainage swale slowly drains to the wet meadow on the lower side of the service road. By mid-summer (1998) most of the swale had dried back exposing a large desiccated mat of *S. pylaesii*. Although the surrounding area was surveyed for additional sites, surprisingly none were found, and this single location is the only known occurrence of *S. pylaesii* in Pennsylvania.

The *Sphagnum* flora at SLNC represents 34% of Pennsylvania's known *Sphagnum* taxa, and apart from *S. squarrosum*, all are Coastal Plain species. Ten of the 14 species recently discovered at the SLNC complex have a limited distribution in Pennsylvania. *Sphagnum angermanicum* and *S. pylaesii* are new state records. As a result of *S. inundatum* and *S. isoviitae* being recently segregated into new species, their distribution in Pennsylvania is reported here for the first time (see special notes). *Sphagnum compactum* and *S. trinitense* are previously reported to occur at several sites all within Clinton County (List and Andrus, 1989) and *Sphagnum molle* is known from single sites in Westmoreland and Clinton counties (R. Andrus pers. com.). *Sphagnum cuspidatum*, *S. lescurii*, *S. recurvum* and *S. squarrosum* are reported to occur in five or less Pennsylvania counties, and only *S. affine*, *S. fimbriatum* and *S. henryense* are reported to occur in more than five counties in Pennsylvania (List and Andrus, 1989). A total of four *Sphagnum* species are reported to occur in the two adjoining counties (Philadelphia and Delaware Counties) that also border the Atlantic Coastal Plain in Pennsylvania, making the Delhaas Woods in Bucks County, the last significant stronghold of Atlantic Coastal Plain *Sphagna* in Pennsylvania.

Special Notes: At the time of the List and Andrus (1989) publication, *S. inundatum* Russ. was formerly lumped with *S. lescurii* Sull., but is now recognized by Andrus as a separate species in the sense of Daniels and Eddy (1985). Similarly, *S. isoviitae* Flatb. has recently been segregated from *S. fallax* (Klinggr.) Klinggr. as a new species (Flatberg 1992) and is probably more widespread in Pennsylvania than its reported occurrence at SLNC. Although this paper officially reports both species at SLNC, Andrus has previously collected *S. inundatum* (five counties) and *S. isoviitae* (four counties) in Pennsylvania. Additional sites may become known with further examination of *S. lescurii* and *S. fallax* in herbarium collections. The substantial precipitation in the spring of 1998 created prime

wetland conditions for *Sphagna* at the SLNC. However, a period of extended drought followed, and by mid-summer many wetland areas were completely dried back and much of the *Sphagna* was either completely desiccated or showing signs of extreme water stress. It remains unclear what effect this drought event, which extended through December 1998, will have on the *Sphagnum* flora and especially those species that are less desiccation tolerant. Voucher specimens have been deposited at Binghamton.

Acknowledgements. I would like to thank Bob Murcer, Director of Silver Lake Nature Center, for granting permission to conduct this study and for his assistance in providing background material about the Delhaas Woods.

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Annual Meeting American Bryological and Lichenological Society
July 30 - August 1, 1999
Southern Illinois University, Carbondale

The American Bryological and Lichenological Society (ABLS) will hold its annual meeting and foray in southern Illinois, July 30-August 1, just prior to the XVI International Botanical Congress in St. Louis. The International Association for Lichenology (IAL), the International Association of Bryologists (IAB), and Moss 99 Conference are co-sponsors. The meeting and field trips are being organized by Barbara Crandall-Stotler (crandall@plant.siu.edu), Andrew Wood (wood@plant.siu.edu) and Bob Egan (egan@unomaha.edu). Field trips are planned for the Shawnee National Forest, Giant City State Park, and Crab Orchard National Wildlife Refuge. Student members are encouraged to attend and participate in oral paper presentations for the annual ABLS A. J. Sharp Award. Limited student travel grants will be available. Time has been set aside for general business meetings as needed. Participants may stay in SUI dormitory housing or at local motels. Campgrounds are available within 15 miles of Carbondale. Participants will have ample time on Sunday afternoon, August 1, to travel to St. Louis for the opening of the XVI International Botanical Congress.

Registration fee will be US$30.00 and will include meetings, programs, snacks, and Saturday evening dinner. Housing in the SIU dormitories will cost US$17.15/night (double) or US$21.70/night (single). Local motels range from US$35.00/night to US$109.00/night. The Saturday field trip to Shawnee National Forest will cost US$20.00/person. Registration forms have been sent to ABLS members in January and posted on the ABLS web site http://ucjeps.herb.berkeley.edu/bryolab/ABLS.html

The Moss Family Cryphaeaceae in North America North of Mexico

William D. Reese

Two genera with five species of Cryphaeaceae occur in North America north of Mexico: *Cryphaea* with four species and *Schoenobryum* with one species. This article summarizes the occurrence of these mosses North America north of Mexico based on my review of the family for the Flora of North America project. Included are keys, brief descriptions, statements of ranges, and distribution maps.

The Cryphaeaceae as treated here for North America north of Mexico comprise only *Cryphaea* and *Schoenobryum*. Several closely related genera of the family occur outside of the area (Akiyama 1990; Manuel 1981). Other North American genera, *Alsia*, *Dendroalsia*, and *Forsstroemia*, have been included in the concept of the Cryphaeaceae by various authors, (e.g., Crosby & Magill 1981), but may be assigned to other families: *Alsia* and *Dendroalsia* in the Leucodontaceae and *Forsstroemia* in the Leptodontaceae. Concepts of the family as defined by genera assigned to it have varied. See Crosby and Magill (1981) and Manuel (1974) for some proposed generic alignments. World-wide the family comprises 8--10 genera and ca. 60--70 species, primarily in tropical and subtropical regions.

The Cryphaeaceae are defined by the combination of creeping primary stems with firm spreading-erect branches, immersed capsule, corticolous habitat, dull aspect, and pale peristome. The vegetative leaves of many of the species of this family are very similar.

Cryphaeaceae

Plants small to medium in size, mostly dull, with creeping primary stems bearing spreading to pendent branches, mostly brownish-green. Stems irregularly branched; paraphyllia lacking; pseudoparaphyllia lacking; axillary hairs 2-4 per axil, of 1--2 short proximal cells with brownish walls and 1--3 elongate distal cells. Branches short to elongate, simple to much-branched, terete. Leaves spirally inserted, imbricate, rapidly spreading when moistened, mostly ovate-acuminate, margins entire, or serrate distally, apex mostly acute; costa single; medial cells rhomboidal to fusiform, smooth to prorulose; alar cells rounded to quadrate. Sexuality: autoicous. Perigonia gemmiform, small, axillary. Perichaetia gemmiform, axillary or terminal on branches. Seta single, very short. Capsule immersed, erect, symmetric, stomates scanty, proximal; annulus usually revoluble; operculum conic-rostrate; peristome mostly double, pale; exostome of 16 teeth; endostome of 16 small linear segments or lacking, cilia lacking. Calyptra mitrate or subcucullate, smooth to papillose. Spores spherical, mostly granular or papillose, sometimes smooth.

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KEY TO GENERA OF CRYPHAEACEAE IN NORTH AMERICA NORTH OF MEXICO

1. Perichaetia lateral along branches; peristome double (single in *C. ravenelii*) ..... 1. *Cryphaea*
1. Perichaetia terminal on branches; peristome single ..... 2. *Schoenobryum*

Cryphaea

Plants small, dull, green to glaucous- or brownish-green. Branches mostly short, slender, wiry, simple or irregularly branched; axillary hairs 3--4 per axil, with 1(--2) short proximal cells and 2--3 elongate distal cells. Leaves tightly imbricate when dry, mostly wide-spreading when moist, concave, margins plane or somewhat recurved proximally; medial cells smooth or prorulose abaxially, especially distally, mostly smooth adaxially. Perichaetia lateral on branches; inner leaves mostly more or less awned, the awns usually denticulate-roughened. Peristome mostly double, exostome teeth narrowly triangular, papillose; endostome segments narrow, papillose, sometimes indistinct or lacking. Calyptra mostly conic, sometimes almost cucullate, smooth or papillose.

Plants of *Cryphaea* grow in thin or dense colonies, with the slender, often inconspicuous branches standing out from the substrate. The dull wiry aspect of the spreading, mostly simple branches is very characteristic. The genus was reviewed for North America north of Mexico by Manuel (1973).

The name *Cryphaea* is derived from the Greek--*cryph*, hidden--referring to the immersed sporophytes.

1. Leaf apex rounded to bluntly acute; peristome single, exostome teeth joined in pairs ..... 4. *Cryphaea ravenelii*
1. Leaf apex acute to acuminate; peristome double, exostome teeth single.
    2. Costa ending in leaf acumen, percurrent or nearly so; leaf apices acuminate ..... 3. *Cryphaea nervosa*
    2. Costa ending at midleaf or above, but not percurrent; leaf apices acute
3. Inner perichaetial leaves mostly 1.6--1.9 mm long, their awns about 1/5--1/4 length of expanded portion of leaf; costa stout, often bifid at tip; plants common, widespread in eastern and southeastern U.S ..... 2. *Cryphaea glomerata*
3. Inner perichaetial leaves mostly 2.5--2.8 mm long, their awns about 1/2 length of expanded portion of leaf; costa slender, not bifid at tip; plants rare, in the U.S. known only from southern Florida ..... 1. *Cryphaea filiformis*

1. *Cryphaea filiformis* (J. Hedwig) S. E. Bridel, Musc. Recent. Suppl.4: 139. 1819. *Neckera filiformis* J. Hedwig, Sp. Musc. 202. 1801; *Cryphaea floridensis* H. A. Crum; *Cryphaea glomerata* var. *scabra* A. J. Grout.

Branches mostly elongate, often branched. Leaves narrowly acute to short-acuminate, wide spreading when wet, mostly 1.3--1.6 mm long; costa ending in base of acumen, often laterally spurred, not bifid at tip. Inner perichaetial leaves mostly 2.5--2.8 mm long; awns distinct, strongly denticulate, about 1/2 length of expanded portion of leaf. Peristome double; exostome teeth single; endostome segments slenderly triangular. Calyptra conic. Spores papillose.

Mature spores present March--April. On twigs and branches of trees and shrubs, in humid forests; sea level.

Range in North America north of Mexico (Fig. 3): Fla. Also in Mexico, West Indies, and Central America.

Vegetatively, *C. filiformis* is rather similar to *C. glomerata*, but the branches of the former are generally longer and the inner perichaetial leaves are much longer and have proportionally longer awns. Although Grout (1934) wrote that the capsules of *C. filiformis* are often at the tips of stems and branches, this is not correct; he was misled by a mixed collection that included *Schoenobryum concavifolium* in addition to *C. filiformis* (Reese 1995). In *S. concavifolium* the perichaetia are terminal.

Cryphaea filiformis was attributed to Georgia by Sharp et al. (1994), but this was an error based on misinterpretation of the specimen label on Grout's *North American Musci Perfecti 218*, a mixed collection partly from southern Georgia and partly from southern Florida (Reese 1995).

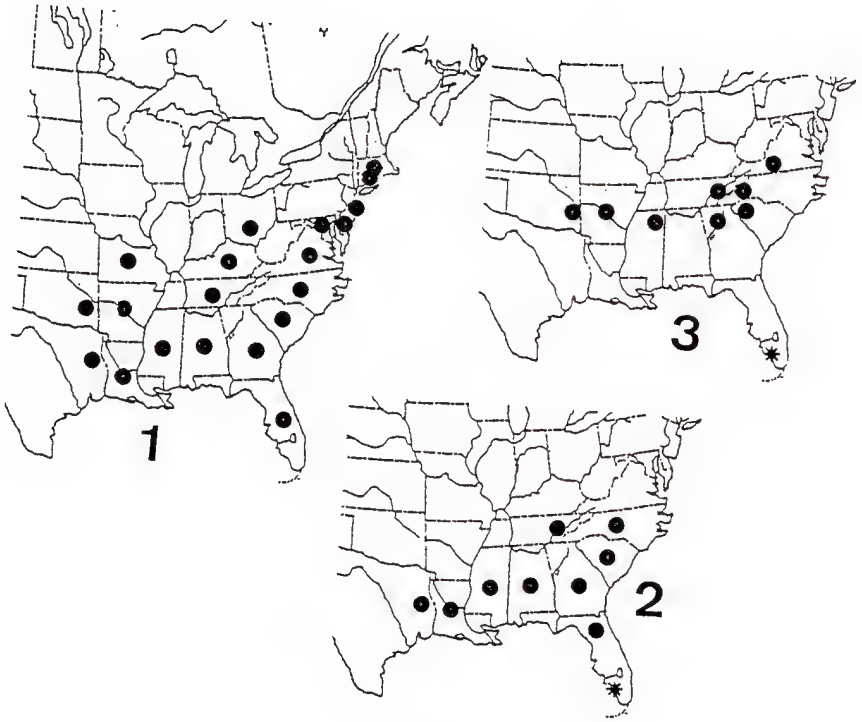
2. *Cryphaea glomerata* W. S. Sullivant in A. Gray, Man. N. U.S. Bot. ed. 2, 656. 1856.

Branches short or elongate, mostly simple. Leaves broadly acute, wide-spreading when wet, mostly 0.8--1.2 mm long; costa ending at midleaf or in base of acumen, often laterally spurred and often more or less bifid at tip. Inner perichaetial leaves mostly 1.6--1.9 mm long; awn usually distinct, denticulate, about 1/5--1/4 length of expanded portion of leaf. Peristome double; exostome teeth single; endostome segments linear, slender. Calyptra broadly conic. Spores smooth or papillose.

Mature spores present September--June. On twigs, branches, and trunks of shrubs and trees, on logs, rarely on rock, in humid forests; 0--1000 m.

Range (Fig. 1): Ala., Ark., Conn., Del., Fla., Ga., Ky., La., Md., Mass., Miss., Mo., N.J., N.C., Ohio, Okla., S.C., Tenn., Tex., Va.

Cryphaea glomerata often grows mixed with *C. nervosa*, but the two can be easily distinguished under low magnification by the more narrowly pointed and plicate-appearing leaves of *C. nervosa*. The ranges of *C. glomerata* and the subtropical *C. filiformis* overlap in southern Florida. See comments under *C. filiformis* for differentiation from that species. *Cryphaea glomerata* is similar to and often occurs with *C. ravenelii*; see comments under the latter for differentiation.



1. Range of *Cryphaea glomerata*. 2. Range of *Cryphaea nervosa* (dots) and distribution of *Schoenobryum concavifolium* in North America north of Mexico (asterisk in southern Florida). 3. Range of *Cryphaea ravenelii* (dots) and distribution of *C. filiformis* in North America north of Mexico (asterisk in southern Florida).

3. *Cryphaea nervosa* (W. J. Hooker & W. M. Wilson) J. K. A. Müller, Linnaea 19: 211. 1846. *Daltonia nervosa* W. J. Hooker & W. M. Wilson in T. Drummond, Musci Amer. So. States 100. 1841.

Branches short to elongate, mostly simple. Leaves acuminate, wide-spreading when wet, mostly 1.0--1.2 mm long; costa percurrent or nearly so, not spurred, not bifid at tip. Inner perichaetial leaves mostly 1.6--1.9 mm long; awn usually distinct, denticulate, about 1/5--1/4 length of expanded portion of leaf. Peristome double; exostome teeth single; endostome segments irregularly linear. Calyptra subcucullate to cucullate. Spores papillose.

Mature spores present December--April. On twigs, branches, and trunks of trees in humid forests, sometimes in swamp forests; 0--1060 m.

Range (Fig. 2): Ala., Fla., Ga., La., Miss., N.C., S.C., Tenn., Tex.

Plants of *C. nervosa* generally grow in more humid habitats than those of *C. glomerata*, with which its plants are often intermingled. The narrowly pointed leaves of *C. nervosa* make it easy to recognize in the field. The costa is often so prominent that the leaves of dry plants appear to be plicate.

4. *Cryphaea ravenelii* C. F. Austin, Bot. Gaz. 2: 89. 1877.

Branches short to elongate, mostly simple. Leaves rounded to bluntly acute, ascending when wet, mostly 1 mm long; costa ending in base of acumen, often laterally spurred and often bifid at tip. Inner perichaetial leaves mostly 1.6--1.8 mm long, apiculate or with short rough awn to about 1/6--1/4 length of expanded portion of leaf. Peristome single; exostome teeth mostly joined in pairs; endostome lacking. Calyptra narrowly conic-subcucullate. Spores papillose.

Mature spores present April and May. On trunks and branches of saplings and living and dead trees, and on exposed roots, in forests; to 330 m.

Range (Fig. 3): Ark., Ga., Miss., N.C., Okla., S.C., Tenn., Va.

Cryphaea ravenelii is rare. Although similar at first glance to *C. glomerata*, it can be easily distinguished by its blunt leaf apices and paired exostome teeth. Further, the inner perichaetial leaves of *C. glomerata* have a greater tendency to be awned than those of *C. ravenelii*. *Cryphaea ravenelii* occupies the same habitats as *C. glomerata* and the two species have often been collected growing together.

Schoenobryum

Schoenobryum concavifolium (W. Griffith) H. C. Gangulee, Mosses E. India 5: 1209. 1976. *Orthotrichum concavifolium* W. Griffith, Calcutta J. Nat. Hist. 2: 484. 1842.

Plants small, dull, brownish-green, irregularly branched; branches short to elongate, usually branched; leaves tightly imbricate when dry, wide-spreading when wet, concave, broadly acute to short-acuminate, mostly 1.0 mm long, margins plane; costa sometimes laterally spurred, rarely bifid at tip. Perichaetia terminal on branch tips. Peristome single, exostome teeth papillose. Inner perichaetial leaves mostly 2.0--2.3 mm long, awn distinct, nearly smooth to denticulate, about 1/5 length of expanded portion of leaf; Peristome single, teeth narrowly triangular. Calyptra conic, somewhat papillose distally. Spores granular.

Mature spores present in April. On twigs, branches, and tree trunks in humid forests; sea level.

Range in North America north of Mexico (Fig. 2): Fla. Also in Mexico, West Indies, Central America, South America, and Asia.

The name *Schoenobryum* is derived from the Greek--*schoeno*, a rope, and *bryo*, moss-- referring to the perceived ropelike appearance of the stems, especially when dry.

Schoenobryum concavifolium is very rare in the United States, where it is known only from a few specimens from Collier County, in southern Florida. Its presence in the United States was undetected until Buck reported it in 1994. The plants are firm when dry and often have a shrub-like aspect due to the clustered erect branches. The terminal perichaetia give the branch tips a club-like appearance. In general the plants are quite similar to those of *Cryphaea filiformis* but differ in their terminal perichaetia, single peristome, and the awns of the perichaetial leaves only about 1/5 the length of the expanded portion of the leaf. The two species have been collected growing together (Reese 1995). In *Cryphaea filiformis*, also a rare moss of southern Florida, the perichaetia are lateral, the peristome is double, and the awns of the perichaetial leaves are about 1/2 the length of the expanded portion of the leaf.

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A. J. Grout's North American Musci Perfecti number 218, and an observation on O. E. Jenning's illustration for *Ptychomitrium incurvum*. Evansia 12: 157--160.
Sharp, A. J., H. Crum & P. M. Eckel. 1994. The Moss Flora of Mexico. 2 vols. New York.

Acknowledgments. I am grateful to the curators of BRIT(SMU), CANM, DUKE, FH, FLAS, LAF, MICH, MO, NY, and TENN for the loan of specimens for this study.

Specimens Examined

All specimens examined of the rare species *Cryphaea filiformis*, *C. ravenelii*, and *Schoenobryum concavifolium* are cited in full. Representative specimens are cited in abbreviated format for the other species.

Cryphaea filiformis Florida. Collier Co.: On twig, Big Cypress, 6 mi. W of Deep Lake, *Grout s.n.*, 15 April 1934, DUKE. High hammock, Deep Lake, *McFarlin 496*, 31 March 1931, MICH, MO. Deep Lake, apparently on bark, *Grout & McFarlin* X^{O}, 3-31-31 NY; annotated by M. Manuel as holotype of *C. glomerata* var. *scabra* Grout. Deep Lake, *A. J. Grout, N. Am. Musci Perf. 218, p.p.*, DUKE, FH, MO, NY, TENN. [The label for *N. Am. Musci Perf. 218* states that it is a mixed collection partly from Florida and partly from Georgia, but the *C. filiformis* must have come from Florida. The NY specimen includes *C. glomerata*, *Leucodon julaceus*, and *Schoenobryum concavifolium*.] Near Copeland, Bryophytes of Florida, Fakahatchee Strand, 13, *D. Griffin, III*, March 1979, CANM, FLAS. North of Jerome, Bark of red maple, *Sharp s.n.*, 20 Dec 1948, p.p., CANM, TENN (both with *Schoenobryum concavifolium*). Fakahatchee Strand State Preserve, Royal Palm Hammock, *Buck 22771 p.p.* (mostly *Schoenobryum concavifolium* in the FLAS specimen), *22752, 22863*, 6-7 Dec 1992, FLAS, NY.

Cryphaea glomerata Alabama. Houston Co.: *Reese & Pursell 2750*, LAF. Arkansas. Stone Co.: *Anderson 11,582*, DUKE. Connecticut. *Young s.n.*, NY. Delaware. *Commons 36*, NY. Florida. Suwannee Co.: *Whitehouse 23984*, BRIT(SMU). Georgia. Charlton Co.: *Anderson 5508*, DUKE, FH. Kentucky. Logan Co.: *Ireland, 3127*, DUKE. Louisiana. St. Martin Parish: *Reese 2134*, LAF. Maryland. Great Falls, *Chamberlain 2092*, MICH. Massachusetts. Cambridge, *James s.n.*, 1860, NY. Mississippi. Harrison Co.: *Reese & Pursell 3082*, LAF. Missouri. Barry Co.: *Redfearn 8945*, LAF. New Jersey. Palisades, MICH. North Carolina. Swain Co.: *Anderson 12,650*; *H. A. Crum & L. E. Anderson, Mosses of North America 675*, LAF. Ohio. com. Hampe 1870, NY. Oklahoma. McCurtain Co.: *Redfearn, Jr., et al. 18,707*, DUKE. South Carolina. Pickens Co.: *Anderson 24,494*, DUKE. Tennessee. Monroe Co.: *Sharp 5514*, DUKE. Texas. Newton Co.: *Reese & Pursell 2285*, LAF. Virginia. Hanover Co.: *Ireland 4261*, 9 June 1960, LAF.

Cryphaea nervosa Alabama. Geneva Co.: *Reese & Pursell 2813*, LAF. Florida. Alachua Co.: *Griffin, III, 83*, LAF. Georgia. Coffee Co.: *Buck 25089*, NY. Louisiana. Lafayette Parish: *Reese 11,233*, LAF. Mississippi. Wilkinson Co.: *Reese 11,188*, LAF. North Carolina. Macon Co.: *Anderson 21,453*, DUKE. South Carolina. Aiken Co.: *Anderson 5562*, DUKE. Tennessee. Anderson Co.: *Verdoorn, Musci Selecti et Critici, Ser. III, 119, Aaron J. Sharp s.n.*, March 1934, DUKE. Texas. Hardin Co.: *Whitehouse 23098*, BRIT(SMU) (with *C. glomerata*).

Cryphaea ravenelii Arkansas. Pike Co.: Ouachita National Forest, along Blocker Creek, ca. 2.5 mi. N of Langely, *Redfearn 20214*, 27 July 1966, MO. Georgia. Rome, *Ravenel s.n.*, 1874, DUKE (microscope slide). Elbert Co.: Ca. 1.25 mi. N of Georgia Highway 72 bridge over the Savannah River, *Douglass 665-2*, 5 December 1979, DUKE, (previously determined as *C. glomerata*). Mississippi. Tishomingo Co.:

Tishomingo State Park, *Buck 21936*, 27 Sept. 1992, NY. North Carolina. Alamance Co.: H'way 70 crossing of Back Creek, 3 mi. W of Mebane Cut-off, bark of dogwood, *Clebsch 14550*, 27 Dec 1958, TENN. Halifax Co.: Roanoke River, near Weldon, *Anderson 5673*, 8 May 1937, DUKE. Harnett Co.: *Anderson 3711*, 8/2/35, (previously determined as *C. glomerata*), FH. Oklahoma. McCurtain Co.: State Game Refuge, N of Hochatown, 600 ft., on *Carpinus*, *Sharp s.n.*, 26 August 1960, TENN. South Carolina. Kershaw Co.: Wateree River, W of Camden, *Anderson 5573*, 7 April 1937, DUKE, (in mixture with *C. glomerata*). Tennessee. Rhea Co.: Dayton, margin of Lake Chickamauga, *Sierk 225*, 19 February 1958, CANM, DUKE, MICH, TENN. Anderson Co.: *F. Verdoorn, Musci Selecti et Critici, ser. III, 119*, *A. J. Sharp s.n.*, March 1934, FH, MICH, MO, TENN. Virginia. Dinwiddie Co.: *Carroll 78*, 15 April 1932, NY.

Schoenobryum concavifolium Florida. Collier Co.: Deep Lake, *A. J. Grout, N. Am. Musci Perf. 218 p.p.*, in mixture with *Cryphaea filiformis*, *C. glomerata*, *Leucodon julaceus*, and *Papillaria nigrescens*; although the label states that the material was collected in part in Florida and in part in Georgia, the *C. filiformis* and *S. concavifolium* must have been taken in Florida; FH, NY, TENN. North of Jerome, Bark of red maple, *Sharp s.n.*, 20 Dec 1948, p.p., CANM, TENN (both with *Cryphaea filiformis*). Fakahatchee Strand State Preserve, *Buck 22750, 22752A, 22771 p.p.*, (with *C. filiformis*), 6 Dec, 1992; *23023*, 11 Dec. 1992. FLAS, NY.

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Bryophyte Ecology - June 6-12
Lichens and Lichen Ecology - June 16-19
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WEB http://maine.maine.edu/~eaglhill

Checklist of Maine Mosses

Bruce Allen

This is a county checklist of the mosses reported from Maine. Counties appear abbreviated within the list in both small and upper case. Those in capital letters represent county records that have been verified and documented by me, or in the case of *Sphagnum* by Lewis Anderson. Counties in small letters represent other literature reports, the identities of these collections have not been verified by me. The numbers in parentheses after the county abbreviations correspond to numbers in the *Key to distributional information* section. Counties that appear without a number in parentheses have been documented in Maine Mosses (1998, B. Allen, Missouri Botanical Garden, St. Louis, MO). I thank Jerry Snider for providing the County map of Maine.

Androscoggin, **AN**; Aroostook,**AR**; Cumberland, **CU**; Franklin, **FR**; Hancock, **HA**; Kennebec, **KE**; Knox, **KN**; Lincoln, **LI**; Oxford, **OX**; Penobscot, **PE**; Piscataquis, **PI**; Sagadahoc, **SA**; Somerset, **SO**; Waldo, **WA**; Washington, **WAS**; York, **YO**.

SPHAGNACEAE

Sphagnum

affine Ren. & Card.: CU(7)
angermanicum Melin: ha(31); WAS(7)
angustifolium (Russ.) C. Jens.: FR(7)
austinii Sull: ha(15)
capillifolium (Ehrh.) Hedw.: AR(7); CU(2); HA(1); LI(1); OX(9); pi(50); SA(7); WAS(3); YO(6)
centrale C. Jens.: KE73)
compactum DC: HA(1); LI(2); pi(50); was(20)
cuspidatum Hoffm.: CU(7); HA(7); LI(1); ox(37); SA(7); was(20); YO(9)
fallax (Klinggr.) Klinggr.: CU(9); HA(1); SA(7); was(20); YO(9)
fimbriatum Wils.: AN(7); ke(46); LI(1); ox(37); SA(7); was(20);
flavicomans (Card.) Warnst.: HA(7); LI(1); SA(8); WAS(7)
flexuosum Dozy & Molk.: WAS(3)
fuscum (Schimp.) Klinggr.: HA(7); ox(37); SA(6); WAS(7)
girgensohnii Russ.: CU(7); FR(7); HA(1); KE(6); LI(1); OX(9); PI(4); WAS(4)
imbricatum Russ.: HA(4); LI(1); ox(37); was(20,19)
inundatum Russ.: HA(1); LI(1)
lescurii Sull.: CU(9); KE(7); KN(7); LI(1)
magellanicum Brid.: an(37); CU(7); HA(4); ke(39); LI(1); ox(37); SA(7); WAS(4);YO(4)
majus (Russ.) C. Jens.: WAS(7)
palustre L.: AN(7); CU(7); HA(1); LI(1); OX(9); SA(7); WAS(7); YO(8)
papillosum Lindb.: HA(7); ox(37); pi(50); WAS(7)
platyphyllum (Braithw.) Sull. ex Warnst.: ox(37)

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AROOSTOOK
PISCATAQUIS
SOMERSET
PENOBSCOT
WASHINGTON
FRANKLIN
HANCOCK
WALDO
OXFORD
KENNEBEC
ANDRO
KNOX
LINCOLN
SAGADAHOC
YORK
CUMBERLAND

MAINE

pulchrum (Braithw.) Warnst.: HA(7); WAS(7)
pylaesii Brid.: HA(1); WAS(7)
quinquefarium (Braithw.) Warnst.: FR(7); HA(7); OX(9); was(49)
recurvum P. Beauv.: an(37); ke(39); LI(1); ox(37); WAS(3)
rubellum Wils.: CU(9); FR(4); HA(3); KN(2); ox(37); PI(4); WAS(3)
russowii Warnst.: AR(7); AN(7); CU(7); FR(7); PI(4); WAS(7)
squarrosum Crome: AR(7); FR(7); HA(9); LI(9); OX(9); pi(50); WAS(7); YO(4)
strictum Sull.: WAS(7)
subnitens Russ. & Warnst.: ox(37)
subsecundum Nees: CU(7); HA(4); ox(37); pi(23); was(20)
subtile (Rus,) Warnst.: LI(7); OX(9)
tenellum (Brid.) Bory: HA(7); LI(1); was(20,19)
tenerum Sull. & Lesq.: HA(1)
teres (Schimp.) Aönstr.: ar(17); ha(21); PI(4)
torreyanum Sull.: HA(7); ox(37); WAS(7)
warnstorfii Russ.: ox(37); WAS(7)
wulfianum Girg.: ox(37); was(20)

ANDREAEACEAE

Andreaea
rupestris Hedw.: AN; AR; CU; FR; HA; KN; LI ; OX; PE; PI; SA; SO; WA; was (40);YO
rothii Web. & Mohr: FR; HA; KN; OX; SA; WAS
crassinervia Bruch: fr(37); OX

SELIGERIACEAE

Blindia
acuta (Hedw.) B.S.G.: AN; HA; KN; OX; SO

DITRICHACEAE

Ceratodon
purpureus (Hedw.) Brid.: AN; AR; CU; FR; HA; KE; KN; LI; OX; PE; pi(28); SA; SO; WA; WAS; YO

Distichium
capillaceum (Hedw.) B.S.G.: PI; SO .

Ditrichum
lineare (Sw.) Lindb.: AN; AR; CU; FR; HA; KE; LI; OX; PI; WAS; YO .
pallidum (Hedw.) Hampe: CU; ha(21,38); KE; LI; OX; PE; SO; YO
pusillum (Hedw.) Hampe: AN; AR; CU; FR; HA; ke(39,40); LI; OX; PE; PI; wa(37); was(49)

Pleuridium
subulatum (Hedw.) Rabenh.: an(37); CU; ha(21); KE; YO

Saelania
glaucescens (Hedw.) Broth.: an(37); FR; KE; OX; SO

FISSIDENTACEAE

Fissidens
adianthoides Hedw.: AR; CU; FR; HA; KE; OX; PE; PI; SA; SO
bryoides Hedw.: AR; CU; HA; KE; KN; OX; PE; SO
bushii (Card. & Thér.) Card. & Thér.: AN; CU; FR; KE; KN; OX; PE; PI
dubius P. Beauv.: AN; AR; CU; FR; HA; ke(39,40); KN; OX; PE; PI; SO; WA
fontanus (B.-Pyl.) Steud.: KE
grandifrons Brid.: Not yet known from Maine.
osmundioides Hedw.: AN; AR; CU; HA; KE; LI; OX; PE; pi(28); SO
subbasilaris Hedw.: an(37)
taxifolius Hedw.: AR; ke(39,40); ox (37); wa (37)

BRUCHIACEAE

Trematodon

ambiguus (Hedw.) Hornsch.: AN; AR; CU; HA; KE; OX; PI; SA; SO; WAS; YO

longicollis Michx.: ox (37)

DICRANACEAE

Arctoa

blytii (Schimp.) Loesk.: ha(38); PE; PI

fulvella (Dicks.) Bruch & Schimp.: PI

Cynodontium

alpestre (Wahlenb.) Milde: CU(2); FR(7); PI(5); SO(5); WAS(6)

strumiferum (Hedw.) Lindb.: ha(38); PI(6)

Dichodontium

pellucidum (Hedw.) Schimp.: AN; AR; KN; OX; SO .

Dicranella

cerviculata (Hedw.) Schimp.: AN; OX; PI; WAS

heteromalla (Hedw.) Schimp.: AN; AR; CU; FR; HA; KE; KN; LI; OX; PE; PI; SA; SO; WAS; WA; YO

palustris (Dicks.) Warb.: HA; OX

rufescens (With.) Schimp.: fr(37); PI

schreberiana (Hedw.) Crum & Anders. var. robusta (Braithw.) Crum & Anders.: AR

subulata (Hedw.) Schimp.: OX

varia (Hedw.) Schimp.: AR; CU; ha(21); fr(37)

Dicranodontium

denundatum (Brid.) Britt. PI(6); WAS(7)

Dicranoweisia

crispula (Hedw.) Milde: PI(5)

Dicranum

acutifolium (Lindb. & Arnell) Weinm.: PI

bonjeanii De Not : KN; HA; LI; SO; WA; WAS

condensatum Hedw.: HA; LI .

elongatum Schwaegr.: AR; PI

fuscescens Turn.: AR; CU; FR; HA; LI; OX; PI; SO; WAS

leioneuron Kindb.: Not yet known in Maine

majus Turn.: an(37); HA; KN; LI; OX; SA; WAS

muehlenbeckii Bruch & Schimp.: Not yet known in Maine.

ontariense Peters.: AR; CU; HA; KE; KN; LI; OX; PE; PI; SA; SO; wa(35); WAS; YO .

polysetum Sw.: AN; AR; CU; FR; HA; KE; KN; LI; OX; PE; PI; SA; SO; WA; WAS; YO

scoparium Hedw.: AN; AR; CU; FR; HA; KE; KN; LI; OX; PE; PI; SA; SO; WA; WAS; YO

spurium Hedw.: CU; fr(37); HA; KN; OX; SA; WAS

undulatum Brid.: AN (1); AR; CU; FR; HA; KE; KN; OX; SA; SO; WA; WAS

Oncophorus

wahlenbergii Brid.: AR(6); CU(6); HA(4); KE(6); KN(2); LI(2); OX(6); PE(6); pi(23); SA(6); SO(5); WAS(6)

Orthodicranum

flagellare (Hedw.) Loeske: AN; AR; CU; FR; HA; KE; LI; OX; PE; PI; SA; SO; wa(37); WAS; YO

fulvum (Hook.) Roth.: AN; CU; FR; HA; KE; KN; LI; OX; PE; PI; SA; SO; WA; WAS; YO

montanum (Hedw.) Loeske: AN; AR; CU; FR; HA; KE; KN; LI; OX; PE; PI; SA; SO; WA; WAS; YO

viride (Sull. & Lesq.) Roth: AN; AR; CU; FR; HA; KE; LI; OX; PI; SO; WAS

Paraleucobryum

longifolium (Hedw.) Loeske: AR(7); CU(9); FR(6); HA(4); KE(7); KN(2); OX(6); PE(7); PI(3); SO(5); WA(6); WAS(7)

Rhabdoweisia
crispata (With.) Lindb.: FR; HA(9); OX; SA; SO; wa(37)
LEUCOBRYACEAE
Leucobryum
albidum (P. Beauv.) Lindb.: ha(38); WAS(7); YO(7)
glaucum (Hedw.) Ångstr.: AN(7); AR(7); CU(6); FR(6); HA(6); KE(6); KN(7); LI(1); OX(4); PE(3); PI(5); SA(3); SO(5); WAS(3); WA(5); YO(6)
ENCALYPTACEAE
Encalypta
ciliata Hedw.: AN; AR; OX; SO; YO
procera Bruch: KN; LI; OX
POTTIACEAE
Barbula
convoluta Hedw.: an(37); ox(37); was(49)
unguiculata Hedw.: AN(7); AR(7); ha(47); LI(7)
Bryoerythrophyllum
recurvirostre (Hedw.) Chen: AN(7); AR(7); LI(9); OX(9); PE(8); PI(4); SO(5)
Didymodon
fallax (Hedw.) Zand.: wa(35;37)
vinealis (Brid.) Zand.: ha(21); ox(37)
Gymnostomum
aeruginosum Sm.: OX(6); SO(5)
Hymenostylium
recurvirostrum (Hedw.) Dix.: OX(6); PI(8); SO(5)
Phascum
cuspidatum Hedw.: ha(21)
Pottia
randii Kenn.: ha(27); kn(33)
truncata (Hedw.) B.S.G.: an(37); CU(6); wa(34)
Tortella
humilis (Hedw.) Jenn.: LI (9); YO (9)
fragilis (Hook. & Wils.) Limpr.: ha(38); PI(4); SO(6)
tortuosa (Hedw.) Limpr.: AN(7); AR(6); FR(6); HA(8); KE(6); KN(2); OX(6); SO(5); wa(37)
Tortula
papillosa Wils.: LI(7)
Trichostomum
tenuirostis (Hook. & Tayl.) Lindb.: HA(1); OX(6); pi(24); SO(5); YO(6)
Weissia
controversa Hedw.: ha(38); KE(3); PE(6); wa(36)
GRIMMIACEAE
Coscinodon
cribrosus (Hedw.) Spruce: KN; OX
Grimmia
affinis Hornsch.: HA
donniana Sm.: PI; SO
hartmanii Schimp.: OX
hermannii Crum: CU; FR; KE; OX; PE; WA
olneyi Sull.: AN; HA; OX; SA
pilifera P.-Beauv.: an(37); CU; ke(37); ox(37)
unicolor Hook.: OX(9)

Schistidium
agassizii Sull. & Lesq.: AN; CU; HA; OX; PE; PI; SO; YO
apocarpum (Hedw.) Bruch & Schimp.: AN; AR; CU; FR; HA; KE; KN; LI; OX; PE; PI; SA; SO; wa(35); was(49);YO
maritimum (Turn.) Bruch & Schimp.: CU; HA; LI; SA; WAS; yo(16)
rivulare (Brid.) Podp.: AN; AR; CU; FR; KE; LI; OX; PE; PI; SA; WAS
Racomitrium
aciculare (Hedw.) Brid.: AN; CU; FR; HA; KN; LI; OX; PI; SO; WA; WAS
canescens (Hedw.) Brid.: FR; HA; OX; PE; PI; WAS(49)
fasciculare (Hedw.) Brid.: FR; OX; PI
lanuginosum (Hedw.) Brid.: HA; PI
microcarpon (Hedw.) Brid.: AR; FR; OX; PI; SO
sudeticum (Funck) Bruch & Schimp.: PI
venustum Frisvoll: AN; CU; FR; HA; KN; LI; OX; PI; PE; SA; WA; WAS; YO
EPHEMERACEAE
Ephemerum
serratum (Hedw.) Hampe: ox(37);YO
spinulosum Schimp.: PE; YO
Micromitrium
austinii Aust.: without collector or locality (MCTC)
megalosporum Aust.: YO
FUNARIACEAE
Aphanorrhegma
serratum (Drumm.) Sull.: ox(37)
Funaria
hygrometrica Hedw.: AN(7); CU(7); HA(7); KE(3); KN(7); LI(1); OX(7); PI(7); SA(7); WAS(3)
Physcomitrium
pyriforme (Hedw.) Hampe: AR(7); CU(7); KE(3); OX(7)
SPLACHNACEAE
Splachnum
ampullaceum Hedw.: AR(5); CU(7); FR(5); HA(5); KE(7); OX(5); PE(7)
rubrum Hedw.: AR(7)
Tayloria
serrata (Hedw.) Bruch & Schimp.: FR(5); pi(28)
Tetraplodon
angustuatus (Hedw.) Bruch & Schimp.: FR(5); OX(7); PI(7); WAS(7)
mnioides (Hedw.) Bruch & Schimp.: HA(5); OX(7); PI(7)
SCHISTOSTEGACEAE
Schistostega
pennata (Hedw.) Web. & Mohr: AN(7); CU(7); HA(8); KE(7); KN(2); OX(7)
BRYACEAE
Anomobryum
julaceum (Gaertn.; Meyer & Schreb.) Schimp.: OX
Bryum
amblyodon C. Müll.: HA; KN; LI; SA; WAS
argenteum Hedw.: AN; CU; HA; ke(37); KN; LI; ox(37); PE; PI; SA; wa(35); WAS; YO
caespiticium Hedw.: AN; CU; LI; HA; ke(37); OX; PI SA; SO; wa (34); was (34)
capillare Hedw.: CU; HA; KE; OX; PE; WAS; YO; ha (38); wa (36)
dichotomum Hedw.: PI; WAS; YO

lisae De Not. var. *cuspidatum* (Bruch & Schimp.) Marg.: AN; AR; CU; HA; KN; OX; PI; SA; WAS; wa(35); YO
muehlenbeckii Bruch & Schimp.: HA
pallens Sw.: AN; AR; HA; KN; OX; pi(24); SO
pallescens Schwaegr.: OX; pi(28); WAS
pseudotriquetrum (Hedw.) Gaertn. et al.: AN; AR; CU; HA; KE; OX; pi(28) PE; WA; WAS
uliginosum (Brid.) B.S.G.: SO
weigelii Spreng.: Mant. AR; CU; FR; OX; PI
Leptobryum
pyriforme (Hedw.) Wils.: AN; CU; FR; HA; KE; KN; OX; PI
Mielichhoferia
elongata (Hoppe & Hornsch.) Hornsch.: OX
Pohlia
annotina (Hedw.) Lindb.: AN(7); AR(7); CU(7); LI(7); OX(6); PI(7); WAS(7)
bulbifera (Warnst.) Warnst.: FR(7); PI(48); WAS (7)
cruda (Hedw.) Lindb.: FR(7); HA(8); KE(6); OX(7); PE(7); SO(5); wa(36)
elongata Hedw.: FR(7); ox(37); pi(28); SO(5)
lescuriana (Sull.) Grout: an(37); KE(7); LI(7); ox(37); PI(7)
nutans (Hedw.) Lindb.: AN(7); AR(7); CU(7); FR(2); HA(4); KE(6); KN(6); LI(1); OX(6); PE(7); PI(4); SA(6); SO(5); WA(6); WAS(7); YO(6)
obtusifolia (Brid.) L. Koch: OX(8)
proligera (Breidl.) Arnell: LI(7); OX(7)
wahlenbergii (Web. & Mohr) Andrews: AR(7); fr(37); ha(38); LI(9); OX(7); pi(23); WAS(7)
Rhodobryum
ontariense (Kindb.) Kindb.: AN; CU; HA; KE; PE; OX; SO
MNIACEAE
Cyrtomnium
hymenophylloides (Hüb.) T. Kop.: HA(5); OX(9)
Mnium
ambiguum H. Müll.: KE(9); OX(9)
hornum Hedw.: AN(7); CU(7); HA(3); KE(6); KN(7); LI(1); OX(6); SA(6); SO(5); WA(7); WAS(6); YO(2)
marginatum (With.) P. Beauv.: ox(37)
spinulosum (Voit.) Schwaegr.: AN(3); cu(37); HA(7); OX(4); pi(28); SO(5); wa(37)
stellare Hedw.: AR(7); LI(5); OX(2); SO(5)
thomsonii Schimp.: ox(37); SO(5); was(49)
Plagiomnium
ciliare (C. Müll.) T. Kop.: AR(7); CU(7); FR(6); HA(8); KE(7); OX(7); PE(7); PI(7); SO(7); WA(5); was(49)
cuspidatum (Hedw.) T. Kop.: AN(7); AR(7); CU(7); FR(7); HA(4); KE(4); LI(6); OX(3); SA(7); SO(5); WA(6); was(34)
drummondii (Bruch. & Schimp.) T. Kop.: AR(7); KE(7); OX(3); PE(7); PI(7); WA(6)
ellipticum (Brid.) T. Kop.: an(37); AR(6); FR(7); LI(5); PE(3); SO(5); yo(29)
medium (Bruch & Schimp.) T. Kop.: fr(37); OX(8); PE(8); PI(7); SO(5); YO(7)
rostratum (Schrad.) T. Kop.: an(37); ha(38); ox(37)
Pseudobryum
cinclidioides (Hüb) T. Kop.: AR(7); CU(7); FR(7); HA(8); ke(37); LI(5); OX(4); PE(7); SO(5); wa(37)
Rhizomnium
appalachianum T. Kop.: CU(8); HA(8); ke(32;39); OX(4); SO(5); WA(8); was(35)
magnifolium (Horik.) T. Kop: FR(6); ha(30); pi(30)

pseudopunctatum (Bruch & Schimp.) T. Kop.: AR(8); kn(30); pi(24)
punctatum (Hedw.) T. Kop.: AR(2); FR(6); HA(8); KE(6); KN(7); LI(5); OX(7); pi(30); SA(8); WA(5); WAS(9); YO(8)

AULACOMNIACEAE

Aulacomnium
androgynum (Hedw.) Schwaegr.: HA(6); ke(36); LI(1); SA(7); WAS(8)
heterostichum (Hedw.) Bruch & Schimp.: ke(39); LI(8); ox(37)
palustre (Hedw.) Schwaegr.: an(37); AR(2); CU(2); FR(7); HA(7); KE(7); KN(7); LI(1); OX(7); PE(6); PI(8); SA(6); SO(5); WA(5); WAS(6); YO(2)
turgidum (Wahlenb.) Schwaegr.: PI(5)

MEESIACEAE

Meesia Hedw.
triquetra (Richt.) Ångstr.: ar(32); PE(9)

BARTRAMIACEAE

Bartramia
Bartramia pomiformis Hedw.: AN(6); AR(7); FR(2); HA(4); ke(39); LI(1); OX(7); SA(7); SO(5); wa(37)
Conostomum
tetragonum (Hedw.) Lindb.: PI(4)
Philonotis
fontana (Hedw.) Brid.: AN(7); FR(6); HA(4); KE(3); KN(2); LI(1); OX(7); PE(7); pi(53); sa(53); SO(5); yo(53)
marchica (Hedw.) Brid.: cu(53)
Plagiopus
oederiana (Sw.) Crum & Anders.: ha(38); OX(9)

TIMMIACEAE

Timmia
megapolitana Hedw.: SO

ORTHOTRICHACEAE

Amphidium
lapponicum (Hedw.) Schimp.: FR(8); OX(9)
mougeotii (Bruch & Schimp.) Schimp.: AN(4); HA(4); OX(5); SO(5)
Drummondia
prorepens (Hedw.) Britt.: CU(8); HA(8); ke(37); OX(8); WA(6); YO(7)
Orthotrichum
anomalum Hedw.: KE(7); ha(21); LI(1); ox(37); SO(8)
elegans Hook. & Grev.: AN(8); AR(7); was(50)
obtusifolium Brid.: AN(8); AR(7); KE(6); KN(8); LI(1); ox(37); PI(7)
ohioense Sull. & Lesq.: FR(6); KE(7); OX(9); PE(7); SO(5); YO(5)
pumilum Sw.: ox(37); wa(37)
pusillum Mitt.: KE(6); SA(7)
sordidum Sull. & Lesq.: AR(7); CU(3); FR(6); HA(4); KE(3); KN(2); LI(1); OX(5); PI(5); SA(3) WA(6); was(49)
speciosum Nees: an(37)
stellatum Brid.: AR(5); HA(1); KE(7); PE(7); PI(7); YO(6)
strangulatum P. Beauv.: fr(37); ha(50); OX(8)
Ulota
coarctata (P. Beauv.) Hammar: AR(7); HA(4); KE(6); KN(2); LI(5); OX(8); PE(7); PI(4); SA(3); SO(5); WA(6); WAS(4); YO(8)
crispa (Hedw.) Brid.: AR(7); CU(7); FR(6); HA(4); KE(6); KN(2); LI(1); OX(6); PE(3); PI(7); SA(3); SO(2); WA(2); WAS(4); YO(6)

hutchinsiae (Sm.) Hammar: AN(3); CU(8); FR(7); HA(7); KE(7); KN(2); LI(1); OX(7); PE(8); SO(5); WA(6); WAS(8); YO(6)
phyllantha Brid.: KN(3); HA(1); SA(1); WAS(4)
Zygodon
conoideus (Dicks.) Hook. & Tayl.: WAS
FONTINALACEAE
Dichelyma
capillaceum (With.) Myr.: AN; CU; HA; KE; KN; LI; OX; pe(51); WA; WAS.
falcatum (Hedw.) Myr.: AN; FR; HA; OX; PI; was(51)
pallescens Bruch & Schimp.: AN; CU; ha(38); KN; OX; PE; WA
Fontinalis
antipyretica Hedw.: AN(3); ha(38); KE(7); KN(2); OX(8); PI(6); WA(7); yo(51)
duriaei Schimp.: AR(7)
gigantea Sull.: AN(8); cu(51); FR(6); HA(8); ke(39); KN(8); LI(7); OX(4); PE(7); PI(8); wa(35); was(51); YO(8)
howellii Ren. & Card.: cu(51); YO(5)
dalecarlica Schimp.: FR(7); HA(4); KN(8); LI(7); OX(6); PE(8); PI(8); SA(6); SO(5); WAS(7); WA(8)
flaccida Ren. & Card.: CU(8); OX(8); SA(7); YO(3)
hypnoides Hartm.: AR(7); KE(6)
novae-angliae Sull.: AN(8); AR(8); CU(8); FR(7); HA(4); KE(1); KN(7); LI(1); OX(6); PE(7); PI(2); SA(8); SO(5); WA(8); WAS(7);YO(8)
novae-angliae var. *cymbifolia* (Aust.) Welch: HA(8); OX(8); PI(8); YO(8)
novae-angliae var. *latifolia* Card.: yo(51)
sphagnifolia (C. Müll.) Wijk & Marg.: AN(8); CU(8); FR(8); KN(8); HA(1); LI(5); PI(8)
sullivantii Lindb.: AN (78); HA(8); LI(5); OX(6); PE(78)
CLIMACIACEAE
Climacium
americanum Brid.: CU(8); KE(6); LI(1); OX(8); SO(5); WA(8)
dendroides (Hedw.) Web. & Mohr: AR(4); CU(8); FR(6); HA(4); KE(7); LI(7); OX(8); PE(6); PI(7); SA(3); SO(2); WA(5); WAS(9)
ANODONTACEAE
Anomodon
attenuatus (Hedw.) Hüb.: AN(7); AR(7); CU(7); FR(2); HA(7); KE(6); KN(2); LI(5); OX(6); PE(7); SO(5); WA(6)
minor (Hedw.) Fürnr.: ke(39); OX(6); PE(7)
rostratus (Hedw.) Schimp.: AN(7); CU(9); ha(38); ke(32;39); KN(9); LI(9); OX(8); PE(7); SO(5)
rugelii (C. Müll.) Keissl.: AR(7); FR(7); OX(2); PI(4); SO(5)
viticulosus (Hedw.) Hook. & Tayl.: ox(37)
Haplohymenium
triste (Ces.) Kindb.: HA(4); OX(2)
HEDWIGIACEAE
Hedwigia
ciliata (Hedw.) P. Beauv.: AN(7); AR(7); CU(9); FR(7); HA(4); KE(6); KN(7); LI(1); OX(6); PI(7); PE(6); SA(6); SO(5); WA(6); was(49)
LEUCODONTACEAE
Leucodon
brachypus Brid.: HA(8); OX(8)
andersonianus (Crum & Anders.) Reese & Anders.: AR(7); CU(8); FR(6); HA(4); KE(7); KN(9); OX(8); PI(7); SA(7); SO(5); WA(6); YO(6)

NECKERACEAE
Homalia
trichomanoides (Hedw.) Schimp.: AN(7); FR(6); HA(8); OX(8); SO(2)
Neckera
pennata Hedw.: AN(3); AR(4); CU(2); FR(3); HA(4); ke(32;39); LI(1); OX(4); PE(8); PI(4); SA(3); SO(2); WA(8); WAS(7)
complanata (Hedw.) Hüb.: HA(9)
Thamnobryum
alleghaniense (C. Müll.) Nieuwl.: AN(7); ke(18); OX(8); WA(6)
FABRONIACEAE
Anacamptodon
splachnoides (Brid.) Brid.: CU(7); HA(1); KN(2); OX(4); SO(4); WAS(7)
THELIACEAE
Thelia
asprella Sull.: ox(37); YO(4)
hirtella (Hedw.) Sull.: LI(5); YO(6)
LESKEACEAE
Haplocladium
microphyllum (Hedw.) Broth.: HA(9); PI(7)
Leskea
gracilescens Hedw.: AR(4); CU(8); KE(2); LI(6); OX(8); PE(7); SO(4)
obscura Hedw.: ox(37;54); yo(37)
polycarpa Hedw.: CU(7); fr(37); KE(3); OX(6); PE(3)
Leskeella
nervosa (Brid.) Loeske: AR(7); CU(7); FR(6); HA(1); KN(2); OX(8); PI(3)
Lindbergia
brachyptera (Mitt.) Kindb.: AN(5); KE(6); OX(5)
PTERIGYNANDRACEAE
Heterocladium
dimorphum (Brid.) Schimp.: an(37); FR(6); OX(5)
Myurella
julacea (Schwaegr.) Schimp.: AR(4); HA(5); ox(37); pe(37)
sibirica (C. Müll.) Reim.: AN(7); HA(8); OX(9); SO(5)
Pterigynandrum
filiforme Hedw.: AR(7); CU(7); FR(6); HA(4); KN(2); OX(7); PE(7); PI(7); SO(5)
THUIDIACEAE
Abietinella
abietinum (Hedw.) Fleisch.: HA(8); OX(8)
Cyrto-hypnum
minutulum (Hedw.) Buck & Crum: SO(5)
Rauiella
scita (P. Beauv.) Reim.: AN(5); AR(7); CU(9); KE(4); KN(2); OX(5); PE(5); PI(5)
Thuidium
delicatulum (Hedw.) Schimp.: AR(6); CU(2); FR(7); HA(4); KE(7); KN(7); LI(5); OX(4); PE(7); PI(2); SA(3); SO(5); WA(5); WAS(3); YO(2)
philibertii Limpr.: an(37); AR(8); OX(8)
recognitum (Hedw.) Lindb.: AR(7); ha(38); KN(8); LI(9); OX(8); PE(3); PI(8); was(49)
AMBLYSTEGIACEAE
Amblystegium
serpens (Hedw.) Schimp.: AN(8); AR(7); ke(32;39); HA(8); LI(7); wa(37;54)

var. *juratzkanum* (Schimp.) Rau & Herv.: CU(8); ha(38; 71); ox(37); wa(37)
varium (Hedw.) Lindb.: AN(8); AR(8); CU(7); fr(37); HA(9); KE(6); OX(9); pi(28); SO(3); WA(5)
Calliergon
cordifolium (Hedw.) Kindb.: AR(7); CU(1); FR(2); HA(5); KE(6); LI(1); OX(4); PE(2); SO(5)
giganteum (Schimp.) Kindb.: an(37); CU(8); KN(2); ox(37)
richardsonii (Mitt.) Kindb.: AR(6)
stramineum (Brid.) Kindb.: cu(45); FR(7); HA(5); OX(7); pi(24); SO(5); WAS(7)
trifarium (Web. & Mohr) Kindb.: ar(17)
Calliergonella
cuspidata (Hedw.) Loeske: OX(8); pe(37)
Campylium
chrysophyllum (Brid.) J. Lange: AN(7); AR(7); CU(9); HA(8); FR(6); KN(2); LI(8); OX(4); PE(6); SO(5); WA(6); WAS(7)
hispidulum (Brid.) Mitt.: AR(8); CU(8); fr(37); HA(8); KE(7); OX(8); PE(9); YO(6)
polygamum (Schimp.) C. Jens.: fr(37); HA(8); ox(37); PE(8); SO(5)
radicale (P. Beauv.) Grout: ha(55;71); KE(7); ox(37); YO(2)
stellatum (Hedw.) C. Jens.: AN(8); ar(17); OX(8); pe(37); SO(5); WA(6)
Conardia
compacta (C. Müll.) Robins.: WAS
Cratoneuron
filicinum (Hedw.) Spruce: AR(4); ha(22)
Drepanocladus
aduncus (Hedw.) Warnst.: AR(7); CU(6); ha(38); pe(37); OX(5); sa(52); SO(5); was(49)
var. *kneiffii* (Schimp.) Mönk.: an(37); kn(37); ox(37); pe(52)
revolvens (Sw.) Warnst.: ha(52); ox(37)
uncinatus (Hedw.) Warnst.: AR(3); CU(9); FR(8); HA(4); KE(6); LI(1); OX(4); PE(6); PI(4); SO(4); WA(6); WAS(4)
vernicosa (Mitt.) Warnst.: OX(8)
Helodium
blandowii (Web. & Mohr) Warnst.: AR(2); OX(2)
paludosum (Sull.) Aust.: an(37); CU(5); KE(3); ox(37); YO(5)
Hygroamblystegium
fluviatile (Hedw.) Loeske: an(37); AR(7); CU(8); KE(6); OX(8); PE(7)
tenax (Hedw.) Jenn.: AN(7); AR(7); CU(2); ha(38); KE(1); KN(7); OX(6); SO(5); WA(6)
Hygrohypnum
closteri (Aust.) Grout: CU(5)
duriusculum (DeNot.) Jamieson: FR(6); HA(8); PI(4)
eugyrium (Schimp.) Loeske: FR(6); HA(4); ke(37); KN(7); LI(1); OX(7); PE(7); p(i28); SO(5)
luridum (Hedw.) Jenn.: HA(8); ox(37); SO(5)
montanum (Lindb.) Broth.: PI(4); OX(2)
ochraceum (Wils.) Loeske: cu(26); FR(6); HA(4); KE(9); KN(7); LI(5); OX(4); pe(37); PI(6); WAS(7)
subeugyrium (Ren. & Card.) Broth.: FR(6)
Leptodictyum
humile (P. Beauv.) Ochyra: HA(8); OX(8); PI(7)
riparium (Hedw.) Loeske: AN(8); AR(7);HA(8); KE(1); LI(1); OX(7); PE(7); SO(5); wa(37)
Platylomella
lescurii (Sull.) Andrews: CU(8); HA(4); KE(9); KN(8); LI(1); OX(8); PE(6)
Scorpidium
scorpioides (Hedw.) Limpr.: AR(7)

Warnstorfia
exannulata (Schimp.) Loeske: cu(52); OX(4); PE(8); PI(8)
fluitans (Hedw.) Loeske: AN(7); AR(7); CU(7); FR(7); HA(5); KE(7); KN(8); LI(1); OX(8); PE(7); PI(7); SA(6); SO(5); WAS(9); YO(9)
pseudostraminea (C. Müll.) Tuom. & T. Kop.: OX

BRACHYTHECIACEAE

Brachythecium
acuminatum (Hedw.) Aust.: CU(7); FR(4); KE(7); ox(37); wa(37); was(49)
calcareum Kindb.: fr(37); KE(6); LI(5); ox(37); SO(5)
campestre (C. Müll.) Schimp.: AR(7); CU(9); ha(38); KE(6); LI(7); OX(8); PE(8); SA(3); WA(8); YO(6)
digastrum C. Müll. & Kindb.: OX(5)
oedipodium (Mitt.) Jaeg.: AN(8); AR(7); HA(8); KE(7); OX(7); pe(37); pi(24)
laetum (Brid.) B.S.G.: AN(6); AR(7); HA(8); ke(32;39); OX(8); SO(5)
plumosum (Hedw.) Schimp.: AN(7); AR(73(; CU(1); HA(4); KE(6); KN(7); LI(5); OX(5); PI(7);SA(6); SO(5); WA(6)
populeum (Hedw.) Schimp.: AN(8); AR(7); HA(1); ke(32;39); LI(1); OX(8); PE(8); WA(6)
reflexum (Starke) Schimp.: an(37); AR(7); CU(9); FR(6); HA(8); KE(6); KN(7); LI(5); OX(6); PE(7); PI(4); SA(7); WA(6); WAS(5)
rivulare Schimp.: AR(7); CU(9); FR(6); HA(1); KE(7); KN(7); LI(7); OX(6); PI(7); WA(5); WAS(7); YO(8)
rutabulum (Hedw.) Schimp.: AR(7); FR(6); HA(7); KE(6); KN(8); LI(1); OX73); PE(8); PI(5); WA(5)
salebrosum (Web. & Mohr) Schimp.: AN(8); AR(7); CU(8); FR(6); HA(9); KE(9); LI(1); OX(6); SA(7); SO(5); WA(5); YO(8)
velutinum (Hedw.) Schimp.: AR(7); CU(6); HA(8); KE(7); LI(1); OX(7); PE(7); SA(7); SO(5); WA(6)

Bryhnia
graminicolor (Brid.) Grout: ha(38); OX(5)
novae-angliae (Sull. & Lesq.) Grout: AN(7); AR(7); CU(9); FR(6); HA(8); KE(6); KN(7); LI(6); OX(5); PE(7); PI(8); SA(7); SO(5); WA(5); YO(6)

Bryoandersonia
illecebra (Hedw.) Robins.: ke(39); ox(37); pe(37)

Cirriphyllum
piliferum (Hedw.) Grout: OX(2)

Eurhynchium
hians (Hedw.) Sande Lac.: an(37)
pulchellum (Hedw.) Jenn.: AN(8); AR(7); CU(8); ha(38); KE(9); KN(7); LI(5); OX(8); PI(8); SO(5); WA(6); WAS(3)

Homalotheciella
subcapillata (Hedw.) Broth.: OX(5)

Isothecium
myosuroides Brid.: CU(1); HA(1); LI(1); SA(1); WAS(1)

Platyhypnidium
riparioides (Hedw.) Card.: AR(7); FR(6); HA(4); KE(9); KN(2); OX(4); PI(2); SO(5); wa(37)

Steerecleus
serrulatus (Hedw.) Robins.: HA(6); KE(6); KN(7); OX(8); WAS(3); YO(6)

Tomentypnum
nitens (Hedw.) Loeske: ar(17)

ENTODONTACEAE

Entodon
cladorrhizans (Hedw.) C. Müll.: OX(5)
seductrix (Hedw.) C. Müll.: an(37); WAS(6)

PLAGIOTHECIACEAE

Plagiothecium

cavifolium (Brid.) Iwats.: AN(3); cu(44); FR(7); HA(8); KE(7); KN(2); LI(5); OX(7); PE(7); SO(5); WA(5); was(49)

denticulatum (Hedw.) Schimp.: CU(2); FR(6); HA(7); KE(7); LI(5); OX(2); PE(7); PI(6); WA(5)

laetum Schimp.: AR(7); CU(6); FR(6); HA(1); KE(6); LI(1); OX(8); pi(23); WA(6); WAS(2); YO(6)

latebricola Schimp.: ox(37)

SEMATOPHYLLACEAE

Sematophyllum

demissum (Wils.) Mitt.: HA(5)

marylandicum (C. Müll.) Britt.: CU(9); HA(4); KN(2)

HYPNACEAE

Callicladium

haldanianum (Grev.) Crum: AN(7); AR(7); CU(2); FR(6); HA(4); KE(6); KN(7); LI(1); OX(4); PE(6); pi(24); SA(3); SO(5); WA(5); WAS(6); YO(2)

Herzogiella

striatella (Brid.) Iwats.: AN(7); AR(7); CU(2); FR(7); HA(7); KE(6); KN(2); LI(1); OX(7); pi(25); SA(7); SO(5); WA(6); WAS(2)

turfacea (Lindb.) Iwats.: AR(7); CU(2); HA(7); KE(3); LI(1); OX(8); pi(25); SA(7); SO(5); WA(5); WAS(6); YO(8)

Homomallium

adnatum (Hedw.) Broth.: AN(8); fr(37); ha(21); KE(6); OX(8); YO(6)

Hypnum

cupressiforme Hedw.: CU; HA; KN; LI; SA; WA; WAS; YO. ox (1939) var. *filiforme* Brid.: CU; HA; LI; SA; WA

curvifolium Hedw.: HA; KN; OX; WA

fertile Sendtn.: ox (37); was (49)

hamulosum Schimp.: OX

imponens Hedw.: AN; AR; CU; fr(37); HA; ke(39,40); KN; LI; OX; PE; PI; SA; SO; WA; WAS; YO

lindbergii Mitt.: AN; AR; CU; FR; HA; KE; LI; OX; PE; SA; SO; WA; WAS

mammillatum (Brid.) Loeske: CU; HA; WAS

pallescens (Hedw.) P.-Beauv.: AN; AR; CU; FR; HA; KE; KN; LI; OX; PE; PI; SA; SO; WA; was(49); YO

plicatulum (Lindb.) Jaeg.: AR; FR; HA; LI; OX; SA; WAS

pratense Spruce: AR; HA; OX; pe(37); SO

Isopterygiopsis

muelleriana (Schimp.) Iwats.: AN(7); FR(8); KN(9); OX(8); pi(25); SO(5)

pulchella (Hedw.) Iwats.: SO(8); ox(37)

Isopterygium

tenerum (Sw.) Mitt.: ha(38)

Platydictya

jungermannioides (Brid.) Crum: OX(9)

minutissima (Sull. & Lesq.) Crum: ox(37)

subtilis (Hedw.) Crum: AR(7); FR(6); OX(8); PI(4)

Platygyrium

repens (Brid.) Schimp.: AN(8); AR(7); CU(7); FR(6); HA(4); KE(6); KN(2); LI(5); OX(2); PE(7); PI(7); SA(7); SO(5); WA(2); WAS(6); YO(6)

Pseudotaxiphyllum

distichaceum (Mitt.) Iwats.: pi(17;29); SA(7)

elegans (Brid.) Iwats.: AN(7); AR(7); CU(1); HA(8); KN(2); LI(2); OX(6); SA(3); WA(6); WAS(7); YO(6)

Ptilium

crista-castrensis (Hedw.) De Not.: AR(2); cu(45); FR(8); HA(9); KE(6); KN(8); LI(9); OX(4); PE(6); PI(8); SA(7); WA(6); WAS(1)

Pylaisiadelpha

recurvans (Michx.) Buck: AN(6); AR(7); CU(7); FR(6); HA(8); ke(37); LI(5); OX(6); PE(6); PI(7); SA(7); SO(3); WA(6); WAS(7); YO(8)

tenuirostris (Bruch. & Schimp) Buck: ha(38); SO(5)

Pylaisiella

intricata (Hedw.) Grout: AN(8); AR(7); CU(8); FR(6); HA(8); LI(7); OX(8); SO(5); was(37;54); YO(8)

polyantha (Hedw.) Grout: AN(8); AR(7); CU(8); OX(6); PI(4)

selwynii (Hedw.) Crum et al: AN(8); AR(7); CU(2); FR(6); HA(5); KE(6); OX(8); PI(7); YO(8)

Taxiphyllum

deplanatum (Mitt.) Fleisch.: ha(38); ke(41); ox(37); SA(7); wa(37;54)

HYLOCOMIACEAE

Hylocomium

brevirostre (Brid.) Schimp.: HA(4); ox(37)

pyrenaicum (Spruce) Lindb.: FR(3); OX(5); PI(5)

splendens (Hedw.) Schimp.: AR(3); cu(45); FR(3); HA(6); KE(6); KN(2); LI(1); OX(7); PE(3); SO(5); SA(7); WA(6); WAS(7)

umbratum (Hedw.) Schimp.: AR(7); FR(2); OX(5); PI(4); was(49)

Pleurozium

schreberi (Brid.) Mitt.: AN(7); AR(7); CU(9); FR(6); HA(4); KE(6); LI(1); OX(4); PE(3); pi(28); SA(3); SO(5); WA(5); WAS(5); YO(2)

Rhytidiadelphus

squarrosus (Hedw.) Warnst.: FR(8); HA(4); KE(6); OX(4); PI(7); SO(5); WA(5); was(37;54)

triquetrus (Hedw.) Warnst.: AR(3); FR(2); HA(7); ke(32;39); KN(8); LI(7); OX(8); PI(7); SA(7); SO(5); WA(1); WAS(7)

Rhytidium

rugosum (Hedw.) Kindb.: HA(8)

BUXBAUMIACEAE

Buxbaumia

aphylla Hedw.: AR(7); cu(42); HA(8); KE(6); PE(8)

Diphyscium

foliosum (Hedw.) Mohr: AN(7); CU(7); FR(6); HA(4); KE(6); KN(7); LI(1); OX(7); PE(7); PI(8); SA(7); SO(5); WA(6); WAS(9); YO(8)

TETRAPHIDACEAE

Tetraphis

geniculata Hedw.: HA(8); OX(9); WAS(7)

pellucida Milde: AN(7); AR(2); CU(8); FR(6); HA(4); KE(2); KN(2); LI(1); OX(6); PE(8); PI(8); SA(3); SO(5); WA(5); WAS(6); YO(2)

Tetrodontium

ovatum (Funck) Schwaegr.: PI(7)

POLYTRICHACEAE

Atrichum

altecristatum (Ren. & Card.) Smyth & Smyth: AR(7); CU(8); LI(7); OX(7); PE(8); YO(2)

angustatum (Brid.) Bruch & Schimp.: HA(7); ke(32;39;53); KN(2); OX(6); PE(8); pi(28); SA(7); WA(7); was(49)

crispum (James) Sull.: CU(7); KN(8); LI(2); OX(6); WAS(9)

oerstedianum (C. Müll.) Mitt.: AN(7); AR(7); CU(8); HA(8); FR(6); KE(6); KN(7); LI(6); OX(6); PE(7); SA(6); SO(5); WA(2); WAS(7); YO(6)
tenellum (Röhl.) Bruch & Schimp: OX(9); WAS
undulatum (Hedw.) P. Beauv.: ha(38;55); ke(32;39); LI(9); PI(7); SA(7); wa(34)
Pogonatum
dentatum (Brid.) Brid.: FR(6); PI(5); WAS(7)
pensilvanicum (Hedw.) P. Beauv.: AN(8); AR(8); cu(42); HA(8); KN(7); LI(1); OX(7); PE(8); PI(3); wa(37;54); WAS(7)
urnigerum (Hedw.) P. Beauv.: cu(37); OX(7); pi(28); PE(8); WAS(7)
Polytrichastrum
alpinum (Hedw.) G. L. Sm.: AN(7); AR(7); cu(45); FR(6); HA(4); kn(37); LI(7); OX(7); PI(8); SO(5); WA(6); was(49)
Polytrichum
commune Hedw. : AN(7); AR(8); CU(7); FR(7); HA(6); KE(6); KN(2); LI(1); OX(4); PE(7); pi(28); SA(3); WA(6); WAS(6); YO(6)
var. *perigoniale* (Michx.) Hampe: ha(21); ke(39)
formosum Hedw.: KN(2); OX(8)
hyperboreum R. Br.: FR(14)
juniperinum Hedw.: AN(7); AR(5); CU(9); FR(6); HA(6); KE(7); LI(1); OX(2); pi(28); SA(7); SO(5); WA(5); WAS(3); YO(6)
longisetum Brid.: FR(9); OX(9)
ohioense Ren. & Card.: CU(9); ha(38); ke(41); ox(37); pi(28); was(49)
pallidisetum Funck: AN(7); AR(7); CU(9); FR(6); KE(6); LI(1); OX(4); PE(8); PI(5); SA(3); SO(3); WA(5); WAS(2); YO(6)
piliferum Hedw.: AN(7); AR(5); CU(7); FR(6); HA(4); KE(7); KN(2); LI(3); OX(4); PE(7); PI(6); SA(3); SO(5); WA(6); WAS(7); YO(2)
strictum Brid.: CU(6); FR(7); HA(7); ke(43;40); LI(7); ox(37); PI(6); SA(7); SO(5); WAS(7); wa(37)

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Platygyrium in North America North of Mexico

William D. Reese

Two species of *Platygyrium* (Hypnaceae) occur in North America north of Mexico. The purpose of this article is to summarize their occurrence in North America based on my review of the genus for the Flora of North America project.

Platygyrium is generally similar to *Homomallium* and *Pylaisiella*. Fruiting specimens of the three genera are easily distinguished: in *Homomallium* the capsules are curved and asymmetric, often strongly so, in contrast to the erect symmetric capsules of *Platygyrium* and *Pylaisiella*, and the long slender rather obliquely rostrate operculum of *Platygyrium* (especially conspicuous when dry) easily distinguishes it from *Pylaisiella*, in which the operculum is only conic or with a short blunt rostrum. *Platygyrium* and *Pylaisiella* commonly grow on xylic substrates but *Homomallium* typically occurs on rock. Dehiscent branchlets clustered at branch tips are very common in *Platygyrium*, particularly in *P. repens*, but such branchlets also occur in *Homomallium*, although infrequently. Also, the leaf margins of *Platygyrium* are usually recurved, sometimes strongly so, while those of *Homomallium* and *Pylaisiella* are erect. Recurvature of the leaf margins is not always well defined in *P. repens* but is usually conspicuous in *P. fuscoluteum*.

Platygyrium

Plants glossy, small to medium sized, creeping, yellowish- to brownish-green or darker. Stems subpinnately branched; branches short to elongate, erect to prostrate, loosely foliated to julaceus, straight to curved at tips; pseudoparaphyllia filamentous or broader; axillary hairs 1--3 per axil, 3--7 cells long, the 1--2 proximal cells short and with firm brown walls, the distal cells elongate and colorless. Leaves on stems and branches similar, ascending-imbricate to homomallous, smooth to somewhat plicate, ovate-acuminate, concave, often yellowish across base; margins entire to rarely slightly serrulate distally, somewhat to strongly recurved; apex acute to slenderly acuminate; costa short and double, commonly indistinct; medial cells elongate, smooth; alar cells conspicuously quadrate in vertical rows, conspicuously thick-walled. Asexual reproduction by dehiscent branchlets at branch tips. Dioicous. Perigonia gemmiform, axillary. Perichaetia small, inconspicuous, axillary. Seta straight, elongate, smooth, twisted when dry. Capsule erect, long exserted, cylindric to subcylindric, symmetric to slightly asymmetric, exothecial cells oblong-rectangular, annulus sharply differentiated in 2--3 rows of cells, stomates phaneropore, scanty, on base of capsule; operculum obliquely rostrate; peristome double, exostome pale yellow-orange, teeth incurved-connivent when dry, erect or incurved when wet, finely papillose to papillose-striolate on outer surface, transversely ridged on inner surface, conspicuously bordered, smooth at tips; endostome segments nearly as long as teeth, brown, narrowly linear, jointed, perforated or intact, sometimes adherent to columella or teeth; cilia lacking. Spores green. Calyptra cucullate, naked.

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Key to Platygyrium of North America north of Mexico

1. Leaves mostly 1.3--1.6 mm long, usually homomallous, often somewhat plicate; branches elongate, prostrate, straight; brood branchlets rare and inconspicuous on branch tips; uncommon plants of medium to high elevations in mountains of southern Arizona, southwestern New Mexico, and southwestern Texas ..... 1. *Platygyrium fuscoluteum*
1. Leaves mostly 0.8--1.1 mm long, ascending to imbricate, not plicate; branches often short, erect, straight or curved; brood branchlets usually common and conspicuous on branch tips; weedy plants from sea level to moderate elevations throughout southeastern and temperate eastern North America and in portions of northwestern North America ..... 2. *Platygyrium repens*

1. *Platygyrium fuscoluteum* J. Cardot, Rev. Bryol. 37: 49. 1910. *Regmatodon fusco-luteus* W. P. Schimper ex É. Bescherelle, Mem. Soc. Sci. Nat. Cherbourg 16: 232. 1872; *Platygyrium fuscoluteum* (W. P. Schimper) J. Cardot, Rev. Bryol. 38: 40. 1911, hom. illeg., non Cardot 1910.

Plants yellowish-brown, relatively robust. Branches mostly elongate, prostrate, straight, loosely foliated, never julaceus; brood branchlets usually inconspicuous, on branch tips. Leaves usually homomallous, often somewhat plicate, mostly 1.3--1.6 mm; margins in proximal half usually conspicuously recurved; apex rather abruptly slenderly acuminate; medial cells slenderly elongate, mostly 50--65 X 5-6 µm. Seta reddish, 10--13 mm. Capsule brown, cylindric, nearly symmetric to distinctly asymmetric, somewhat strumose when dry, with operculum 2--2.5 mm long; operculum slenderly and mostly obliquely long-rostrate. Spores 18 µm, finely granular. Calyptra 2--2.5 mm.

Mature spores present in February. Montane forests on old logs, stumps, tree trunks, damp boulders, rock faces, and shaded banks, 1300--2744 m; Ariz., N.Mex., Tex.; Mexico.

The glossy yellowish-brown creeping plants bearing usually homomallous leaves with long slender tips on elongate branches are distinctive. Under the microscope the often somewhat plicate leaves with recurved margins and quadrate alar cells make the species easy to recognize. It is not sympatric with *P. repens*. Brood branchlets are much less conspicuous and much less common than in *P. repens*, but can often be found by careful search; they are rather effectively concealed in leaf axils at the branch tips. *Homomallium mexicanum* J. Cardot often co-occurs with *P. fuscoluteum* and could be mistaken for it. The capsule of the *Homomallium* is curved, and constricted below the mouth, however, and the leaves are imbricate (not homomallous) have erect margins, and are not plicate, and brood branchlets are lacking.

The nomenclature for this species is exceptional. The Schimper ex Bescherelle (1872) and the Cardot (1910) specific epithets, although the same, were arrived at independently and are based on different types from different places in Mexico! Cardot published the combination "*Platygyrium fuscoluteum* (W. Schimper) J. Cardot" in 1911, but by the International Code of Botanical Nomenclature his 1910 *Platygyrium fuscoluteum* precludes use of his 1911 combination! So valid nomenclature for this species actually begins with Cardot's 1910 name,

Range in North America north of Mexico of *Platygyrium fuscolutens* (stars, in southwestern states) and P. repens (dots and shaded area).

not with the much earlier Schimper/Bescherelle name of the same spelling but on a different type!

2. *Platygyrium repens* (S. E. Bridel) W. P. Schimper, in P. Bruch, W. P. Schimper & W. T. Gümbel, Bryol. Eur. 5(46--47): 95. 1851. *Pterigynandrum repens* S. E. Bridel, Musc. Recent. Suppl. 1: 131. 1806; *Platygyrium orthoclados* N. C. Kindberg; *Platygyrium repens* var. *ascendens* (C. F. Schwägrichen) A. J. Grout; *Platygyrium repens* var. *orthoclados* N. C. Kindberg

foliated or sometimes julaceus; brood branchlets usually abundant and conspicuous on branch tips. Leaves ascending to imbricate, non-plicate, mostly 0.8--1.1 mm; margins in proximal half inconspicuously to strongly recurved; apex acute to acuminate; medial cells slenderly elongate, mostly 44--57 X 5-6 µm. Seta reddish brown, 12--20 mm. Capsule brown, subcylindric, broadest toward base, symmetric or slightly asymmetric, somewhat strumose when dry, with operculum 1--2.5 mm long; operculum slenderly and mostly obliquely long-rostrate. Spores 13--18 µm, finely granular. Calyptra 1.5--2 mm.

Mature spores present August to April and June, perhaps all year. Shady, often moist forests on logs, stumps, tree trunks and bases, old wood structures, less commonly on shaded rock and soil, sea level to 1980 m. CANADA: Alta., B.C., Man., N.B., Nfld., N.W.T., N.S., Ont., P.E.I., Que., Sask. UNITED STATES: Ala., Ark., Conn., Del., D.C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., La., Maine,, Md., Mass., Mich., Minn., Miss., Mo., Nebr., N.H., N.J., N.Y., N.C., N.Dak., Ohio, Okla., Pa., R.I., S.C., S.Dak., Tenn., Tex., Utah, Vt., Va., W.Va., Wisc., Wyo. Also in Europe; Asia; attributed to Africa.

Platygyrium repens is frequent and common throughout most of its remarkably wide range in North America. It is one of the most ubiquitous pleurocarpous mosses in eastern North America, occurring from the Gulf of Mexico to Quebec; in the north it ranges westward to British Columbia and Northwest Territories. It fruits rather infrequently in the northern reaches of its range, and not at all in the southern portions. Brood branches are usually present and are rarely much elongate and in such abundance that the plants dissolve into seemingly amorphous masses of slender branchlets. Young colonies comprise straggly loosely foliated plants, sometimes *Fabronia*-like in appearance and quite different from the more compact mature forms with more appressed leaves.

A common colony form is compact mats with numerous very short erect branches bearing abundant brood branches at their tips. The characteristically bronzy dark-green or blackish-green color makes the colonies recognizable from a distance. Plants with elongate turgid, julaceus branches occur sporadically throughout the range of *P. repens*, but most populations have loosely foliated branches. The julaceus morphology is most frequent on rock substrates. See comments above for differentiation of *P. repens* from the rather similar *Homomallium* and *Pylaisiella*. Although most specimens of *P. repens* can be identified easily and with confidence, occasional sterile specimens lacking brood branchlets may defy certain identification. *Homomallium adnatum* sometimes has brood branchlets at its branch tips, and some sterile specimens may not be confidently distinguished from sterile specimens of *P. repens*. However, in *H. adnatum* the medial leaf cells of are generally much shorter (rhombic or to 3--5:1) than those of *P. repens*, and foliose paraphyllia are sometimes present in the former but lacking in *P. repens*. Erect branches bearing brood branchlets at their tips are also common in *Leskeella nervosa* (S. E. Bridel) L. Loeske, a slender dull, brownish plant with narrow costate leaves, which co-occurs with *P. repens* in the northern reaches of its range and which has sometimes been mistaken for it.

Selected Specimens Examined

Platygyrium fuscoluteum

ARIZONA. Cochise Co., *Weber et al. B-11,631*, COLO, LAF, TENN. NEW MEXICO. Grant Co., on rocks, Black Mts., East Canyon, 5 Aug 1911, *J.M. Holzinger*, issued as "*Platygyrium repens* ... var." in Grout's *N.Am. Musci Pleurocarpi 414*: [Printed as part of the label: "A very unusual form from an unusual habitat and Mr. Holzinger doubts the determination, but some of the plants have the characteristic branch-like gemmae."] Later, in MFNA, Grout referred this to *P. fuscoluteum*! I agree. COLO, DUKE, FH, NY, TENN; *Crowell* 11, FH. TEXAS. Brewster Co., *Reese* LAF.

Platygyrium repens

Canada. ALBERTA. Lesser Slave Lake Distr., *Brinkman 4641*, CANM, FH, TENN; W of Edmonton, *Schofield 44405*, UBC. BRITISH COLUMBIA. Liard Hot Springs, *Worley 5231*, UBC, *Porsild & Porsild 22160*, CANM. 59 22N, 126 03'W, *Correll 12222*, DUKE, FH, MICH, *11727*, MICH. MANITOBA. Sandilands Forest Reserve Area, *Ritchie 3036A*, CANM, NY. Turtle Mtns., *Bird 5758*, CANM, MICH, UBC. NEW BRUNSWICK. Madawaska Co., *Ireland 14614* , ALTA, CANM, NY, UBC. NEWFOUNDLAND. ca. 48 30N, 58 19W, *Tuomikoski 2575*, CANM. NORTHWEST TERRITORIES. Mckay Lake, 64*N, 110*20'W, *sin. coll.*, 19 Aug 1976, UBC. NOVA SCOTIA. Annapolis/Queens Co., *Comeau & Stanley M-9* , CANM, NY. ONTARIO. Skead's Farm, near Ottawa, *Macoun*, 15 May 1885, NY, (ISOTYPE OF P. REPEN S VAR. ORTHOCLADOS Kindb.). Parry Sound Dist, *Ireland 23927*; NY. PRINCE EDWARD ISLAND. Queens Co., *Ireland 13644* , CANM, UBC. QUEBEC. Rimouski, Nottaway, *Lepage 8977*; NY. Gatineau Hills, 45*31N, 75*50W, *Crum 2813*, BRIT, NY. SASKATCHEWAN. South shore of Lake Athabasca, 59*01N, 109*W, *Argus 371-62*, CANM; 108*28'W, 55*52'N, *Welsh 555*, COLO.

United States.ALABAMA. Elmore co., *Bowers & Haynes 12845* , CANM, DUKE, MO, NY. ARKANSAS. Boone Co., *Gier 569*, NY. CONNECTICUT. East Haven, *JA Allen s.n.*, Oct. 31 1880, NY. DELAWARE. New Castle Co., *Buck 17773*; NY. DISTRICT OF COLUMBIA. Along Potomac River near Dead Run, *Leonard & Killip 630*, CANM. FLORIDA. Jackson Co., *Anderson & Crum 13671*, DUKE. GEORGIA. Walker Co., *Buck 21737*, NY. ILLINOIS. Peoria Co., *Chase 1110*, CANM, NY. INDIANA. White Co., *Welch 12861*, NY. IOWA. Allamakee Co., *Welch 17226*, NY. KANSAS. Riley Co., *Churchill 7448*, NY. KENTUCKY. Estill Co., *Wharton 434*, CANM, MICH, NY. LOUISIANA. St. Tammany Parish, *Reese 14049*, LAF, NY. MAINE. Oxford Co., *Williams 9363*, NY. MARYLAND. Prince Georges Co., *Hermann 15093*, NY. MASSACHUSETTS. Essex Co., *Huntington s.n.*, , 2 Mar 1902, NY. MICHIGAN. Cheboygan Co., *Pinkley 58*, NY. MINNESOTA. Beltrami Co., *Churchill 6353*, MO, NY. MISSISSIPPI. Grenada Co., *Reese 17256, 17260*, LAF, MICH, NY. MISSOURI. Lawrence Co., *Redfearn 4597*, NY. NEBRASKA. Brown Co., *Churchill 11875* , MO, NY. NEW HAMPSHIRE. Grafton Co., *Cleavitt 480*, NY. NEW JERSEY: Alpine Boro, *Weigmann 155*, NY. NEW YORK. Niagara Co., *Buck 16369*, NY. NORTH CAROLINA. Hyde Co., *Anderson 4669*, NY. NORTH DAKOTA. Billings Co., *Churchill 11606-a*, NY. OHIO. Greene Co., *Welch 17139*, NY. OKLAHOMA. McCurtain Co., *Ikenberry s.n.*, 25.iv.1952, COLO, MO, NY. PENNSYLVANIA. Berks Co., *Wilkens B-141*, NY. RHODE ISLAND. Washington Co., *Tucker 988*, DUKE. SOUTH CAROLINA. Pickens Co., *Buck 17728*, NY. SOUTH DAKOTA. Hardin Co., *Churchill 11341*, NY. TENNESSEE. Carter Co., *Buck 1075*, NY. TEXAS. Harrison Co., *Whitehouse 27841*, NY. UTAH. Rich Co., *Flowers 1255*, COLO. VERMONT. Newfane, *Welch 2057*, NY. VIRGINIA. Warwick Co., *Patterson SE-44*, NY. WEST VIRGINIA. Tucker Co., *Allard 10229* , CANM, NY, UBC. WISCONSIN. Richland Co., *Nee 13014*, NY. WYOMING. Crook Co., *Churchill 8827*, DUKE, NY.

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Notes on New and Rare Mosses to Kentucky

Allen C. Risk[1]

Collecting efforts in Kentucky, mainly the eastern part of the state, over the past several years have resulted in twenty-one new mosses for the state and the discovery of additional localities for many taxa uncommon in the region. All collections listed below are those of the author, unless otherwise indicated, and are housed in MDKY (Herbarium of Morehead State University). Species marked with an asterisk are new reports for Kentucky.

Abietinella abietina (Hedw.) Fleisch. **Estill Co.**: knob 0.5 mile north of Ravenna, very narrow ridge with little tree cover, on limestone, *4704*; Preacher Estes Mt., narrow north-facing limestone point, on small ledges, *6077*. **Rowan Co.**: Cave Run Lake area, between Long Br. and Ham Br., on limestone in semi-open forest, *5516*. The three new localities are xeric and calcareous, which accords well with the habitat assessment provided for *A. abietina* by Crum and Anderson (1981). Smith (1927) provided the first report of this species from Kentucky. Catling et al. (1993), in a description of a new sedge species, *Carex juniperorum*, also indicated *A. abietina* was present at the sites in Kentucky and Ohio with the sedge, but did not provide specific locality data for the moss.

Amphidium mougeotii (Bruch & Schimp. *in* B.S.G.) Schimp. **Menifee Co.:** Red River Gorge area, Klaber Br., sandstone gorge, wet crumbly sandstone behind waterfall, *4940*. **Morgan Co.**: Yocum Cr., sandstone gorge, on ceiling of overhang behind waterfall, *5949*; Wolfpen Br. of Devils Fk., sandstone gorge, wet backwall of overhang in sandstone cliff, *6024*; Licking R., Kay Br., sandstone gorge, on moist cobble in cliff overhang, *10947*. *Amphidium mougeotii* occurs in southeastern Canada and southward to Georgia, Tennessee, and Alabama (Crum and Anderson 1981). The species was previously reported for Kentucky from the Red River Gorge region by Studlar and Snider (1989).

Anacamptodon splachnoides (Froel. *ex* Brid.) Brid. **Bath Co.**: Pioneer Weapons Hunting Area, around margin of water in hollowed-out stump, *5941*. **Harlan Co.**: Black Mt., bark of *Acer rubrum* L., *646*. **Montgomery Co.**: 2.8 miles south-southeast of Jeffersonville, knothole of *Acer rubrum*, *5844*. *Anacamptodon splachnoides* occurs throughout the eastern United States (Crum and Anderson 1981), but seems to be rather infrequent to rare in Kentucky (fld. obs.). The species was previously reported from the Red River Gorge region by Studlar and Snider (1989).

Anomodon rugelii (C.Müll.) Keissl. **Harlan Co.**: Black Mt., headwaters of Clover Fk., deep forested valley, on yellow buckeye (*Aesculus flava* Soland.) trunk, *6612*. **McCreary Co.**: Yahoo Cr. below Yahoo Falls, sandstone gorge, on tree base, *3334*. The only previous reports of this species from Kentucky were by Cranfill and Meijer (1981) from Black Mountain in Harlan County and by Risk (1998) from Letcher County. *Anomodon rugelii* occurs in the northeastern United States and southeastern Canada and extends southward in the mountains to Georgia and Tennessee (Crum and Anderson 1981).

Atrichum crispum (James) Sull. **Bell Co.**: Shillalah Cr., sandstone gorge, sand by stream, *7536*. **Leslie Co.**: Hoskin Br., abandoned coal mine, margin of pool, *6299*; Left Fk. Elisha Cr., swampy streamhead, *6216*, *6218*. **McCreary Co.**: Big South Fk. Cumberland R., near Devil's Jump, sandstone gorge, on sand by stream, *3223*, *3236*. **Montgomery Co.**: 1 mile northeast of

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Jeffersonville, Slate Cr. valley, on wet soil, *5878*, *6188*. **Morgan Co**.: Open Fk., sandstone gorge, on sandstone boulder, *10857*. **Powell Co**.: 1.3 miles south-southeast of Rogers Chapel, streamhead swamp, *5865*. **Wolfe Co**.: Sarges Br., sandstone gorge, wet strata along stream, *10347*. According to Crum and Anderson (1981), the species is fairly widespread in the eastern United States, but is uncommon. *Atrichum crispum* was previously reported from Kentucky by Smith (1927), no county given; Crum (1956), from Montgomery County; and Risk (1991), from Rowan County.

Atrichum cylindricum (Willd. *in* Web.) G.L.Sm. **Bath Co**.: below Cave Run Lake dam, Licking R., bottomland forest, on wet clay, *7092*. **Fleming Co**.: 2 miles northeast of Plummer's Landing, bottomland swamp forest, on clay soil, *4248, 4250*. **Laurel Co**.: near Laurel River Lake, Holly Bay Recreation Area, Sam Br., on moist clay in forested streamhead, *7796*. **Montgomery Co**.: 2.8 miles south-southeast of Jeffersonville, bottomland forest, on wet clay, *5845*; 1 mile northeast of Jeffersonville, bottomland swamp forest, at tree base, *5883, 5889*. The only previous Kentucky report of this species, from the Red River Gorge region, is based on a collection by E. L. Braun (Studlar and Snider 1989). *Atrichum cylindricum*, however, appears to be a consistent inhabitant of wet bottomland forests in the eastern Knobs region of Kentucky.

Brachelyma subulatum (P.Beauv.) Schimp. *ex* Card. **McCreary Co**.: Big South Fork of the Cumberland R., Big Shoals, on sandstone boulder next to river, *3734*. *Brachelyma subulatum* occurs primarily in the Coastal Plain of the southeastern United States, with scattered, more inland localities (Crum and Anderson 1981). The only previous Kentucky report was by Norris (1967), also from the Cumberland River system.

Bryum miniatum* Lesq. **McCreary Co.: west side of the Cumberland R. at Pitch Rapids, large sandstone outcrop, in seep, *3051b*, *3051c*. This species is also known from Missouri, Newfoundland, and along the west coast from British Columbia to California inland to Montana (Crum and Anderson 1981). The specimens reported here have the beautiful metallic red sheen typical of the species.

Callicladium haldanianum (Grev.) Crum. **Leslie Co**.: Sugar Cr., moist soil by dirt road in mixed mesophytic forest, *6321*. This species is widespread in eastern North America (Crum and Anderson 1981), but field observations suggest it is rather rare in Kentucky. *Callicladium haldanianum* was documented previously for the Red River Gorge region (Studlar and Snider 1989) and Letcher County (Risk 1998).

Campylostelium saxicola (Web. & Mohr) B.S.G. **Elliott Co**.: Laurel Cr., on wet ceiling of sandstone overhang behind small waterfall, *6031*. **Laurel Co**.: Rock Cr., on wet ceiling of sandstone overhang that overarches stream, *6579*. **Morgan Co**.: Yocum Cr., on wet ceiling of sandstone overhang by stream, *5953*, *5958*; Devils Fk., on wet ceiling of small recess in sandstone cliff, *6016*, wet ceiling and backwall of sandstone overhang by stream, *6017*. **Wolfe Co**.: Red River, Sarges Br., sandstone gorge, moist ceiling and backwall of sandstone overhang by stream, *10324*. The only previous report from Kentucky was from Harlan County by Cranfill and Meijer (1981). Reese (1998) indicated that *C. saxicola* inhabits rock shelters in the southern portion of its range. This observation is consistent with the collections reported here, with the qualifications that these rock shelters are comprised of sandstone and typically are overhanging, or immediately adjacent to, a stream.

Cirriphyllum piliferum (Hedw.) Grout. **Elliott Co**.: Laurel Cr., sandstone gorge, on sandstone boulder, *6043*, on rotten log, *6060*. **Letcher Co**.: Poor Fk., across from junction with Bad Br., moist soil, *1691b*. **McCreary Co**.: Yahoo Cr., below Yahoo Falls, sandstone gorge, on sandstone boulder near falls, *3325*. This is a northern species that extends down the Appalachian Mountains in the east (Crum and Anderson 1981). The only previous Kentucky

report was by Risk (1998) from Letcher County. These additional Kentucky collections are all from deep, narrow sandstone gorges or from higher elevation areas in the southeastern corner of the state.

Conardia compacta (C.Müll.) Robins. **McCreary Co.**: Big South Fork National River and Recreation Area, near Devil's Jump, sandstone gorge, on moist soil in sandstone rockhouse, *3721, 3722, 3973.* **Menifee Co.**: Lion Cave Br., sandstone gorge, on moist sandstone (calcareous) cliff, *10846.* **Rowan Co.**: Minor Cr., sandstone gorge, top of small limestone outcrop at base of sandstone cliff, *8793.* According to Crum and Anderson (1981), *C. compacta* occurs across Canada and extends south to Pennsylvania, Indiana, and Missouri. Snider and Andreas (1996) indicate the species occurs in eight Ohio counties as well. In Kentucky, the species appears to be restricted to either limestone or calcareous sandstone outcrops in deep sandstone gorges. The only previous Kentucky report was from Boone County by Baur (1934).

Dichelyma capillaceum (With.) Myr. **Bath Co.**: Licking River valley below Cave Run Lake, between Bayou Cr. and Licking R., oxbow lake, on trunk of *Cephalanthus occidentalis* L., *5547.* This species is scattered throughout eastern North America (Crum and Anderson 1981) and occurs in sites where it is normally submerged, but may be exposed by frequent lowering of water (Welch 1957). The only previous Kentucky report of *D. capillaceum*, with no locality data given, was that by Short (1837).

Dichodontium pellucidum (Hedw.) Schimp. **Wolfe Co.**: Holly Cr., sandstone gorge, on sandstone strata along stream, *11015.* This species is widespread in the northeastern United States (Crum and Anderson 1981). Field observations, however, suggest it is rather rare in eastern Kentucky.

Entodon brevisetus (Hook. & Wils. *in* Wils.) Lindb. **Letcher Co.**: Poor Fk., across from mouth of Bad Br., bark of recently fallen *Fagus grandifolia* Ehrh., *1703. Entodon brevisetus* is an uncommon species that ranges from New Brunswick to Minnesota and southward in the Appalachian Mountains to South Carolina and North Carolina (Crum and Anderson 1981). The species was previously documented for Kentucky only from the Red River Gorge region (Studlar and Snider 1989).

Ephemerum cohaerens (Hedw.) Hampe. **Estill Co.**: 1.1 mile west-northwest of Cottage Furnace, ridge, on moist clay by pool in dirt road, *8249a* [mixed with *E. crassinervium* (Schwaegr.) Hampe]. **Menifee Co.**: Cave Run Lake, junction of Meyers Fk. and Beaver Cr., on mud flat by lake, *8824. Ephemerum* species are generally widespread and very undercollected. Crum and Anderson (1981) indicate that *E. cohaerens* occurs throughout much of the eastern United States. Risk (1991) provided the only previous Kentucky report of this species.

Ephemerum crassinervium (Schwaegr.) Hampe. **Bath Co.**: unnamed tributary of Licking River across from Minor Clark Fish Hatchery, powerline right-of-way, on bare, moist soil, *10093.* **Estill Co.**: 1.1 miles west-northwest of Cottage Furnace, on moist clay by pool in dirt road, *8249b.* **Letcher Co.**: Pine Mt., Big Hollow, bare moist clay of abandoned dirt road, *7681, 7682, 7683.* **Menifee Co.**: Cave Run Lake, junction of Meyers Fk. and Beaver Cr., on mud flat by lake, *8826.* **Rowan Co.**: slightly east of Morehead City Park, Triplett Cr., on bare moist soil in abandoned stream channel of creek, s.n. *Ephemerum crassinervium* was previously reported from Bad Branch in Letcher County by Risk (1998).

Ephemerum serratum* (Hedw.) Hampe. **Bath Co.: Pioneer Weapons Hunting Area, Cave Run Botanical Area, on thin soil over limestone by prairie, *3779.*

Fabronia ciliaris (Brid.) Brid. var. *ciliaris*. **Carroll Co.**: along golf course at General Butler State Park, on trunk of deciduous tree, *4128.* **Estill Co.**: vicinity of Grassy Knob, dry southwest-facing slope, on limestone, *5931, 5935.* **McCreary Co.**: 1.2 miles southeast of Flat Rock,

grassy woods, trunk of *Juniperus virginiana* L., 3014. **Mercer Co**.: Fort Harrod State Park, trunk of *Ulmus*, *2303*. *Fabronia ciliaris* var. *ciliaris* is widespread in the eastern United States and occurs on tree trunks, particularly in towns, and rocks (Crum and Anderson 1981).

Herpetineuron toccoae* (Sull. & Lesq. *in* Sull.) Card. **Breathitt Co.: North Fk. Kentucky River near junction with Cedar Cr., sandstone outcrop, *11256*. **Knott Co**.: Yellow Mt., headwaters of Patten Br., on sandstone boulder, *2372*. **Leslie Co**.: Bobs Fk., moist sandstone boulder by stream, *6318*. **McCreary Co**.: Big South Fork National River and Recreation Area, near Devil's Jump, sandstone gorge, on sandstone boulder, *3098*. According to Crum and Anderson (1981), *H. toccoae* is relatively widespread in the southeastern United States. The species appears to be rather rare in Kentucky, however. In Kentucky, it appears to be restricted to deep sandstone gorges or deep valleys in heavily forested areas.

Heterocladium macounii Best. **Bell Co**.: Cumberland Mt., Shillalah Cr., sandstone gorge, shaded underside of outcrop by stream, *7491*. **Laurel Co**.: Cane Creek, near junction with Pounder Br., sandstone gorge, on ceiling of wet sandstone overhang by stream, *8980*. **Letcher Co**.: Pine Mt., Cold Iron Br., sandstone gorge, recess of sandstone rockhouse, *4856*; Pine Mt., upper end of Poor Fk., wet ceiling of sandstone rockhouse, *4918*. **Morgan Co**.: Devils Fk., sandstone gorge, moist ceiling of recess in sandstone cliff, *6008*. The only previous Kentucky collections are from McCreary County (Allen 1985), Rowan County (Risk 1991), and Letcher County (Risk 1998).

Heterophyllium affine (Hook. *in* Kunth.) Fleisch. **Laurel Co**.: Rock Cr., sandstone gorge, trunk of *Rhododendron maximum* L., *6584*; Cane Cr. near junction with Pounder Br., sandstone gorge, on base of *Tsuga canadensis* (L.) Carr., *9000*. **Letcher Co**.: Pine Mt., Cold Iron Br., on sandstone boulder, *4609*. **Menifee Co**.: Cave Br., on sandstone cobble, *7778*. **Wolfe Co**.: Red River, Sarges Br., sandstone gorge, on limb of *Rhododendron maximum* L., *10311*. *Heterophyllium affine* occurs in the mountains of the southeast in Georgia, North Carolina, South Carolina, Tennessee, and Virginia (Crum and Anderson 1981). The only previous reports from Kentucky are those from Cumberland Falls State Park (Norris 1967) and Bad Branch (Risk 1998).

Hygrohypnum micans (Mitt.) Broth. **Letcher Co**.: Pine Mt., Cold Iron Br., wet sandstone by long stream cascade, *4596*. **McCreary Co**.: Big South Fk. Cumberland R., Difficulty Cr., on limestone by stream, *4009*. **Morgan Co**.: Devils Fk., Black Cave Hollow, sandstone gorge, wet sandstone by waterfall, *10961*. Crum and Anderson (1981) indicate the species occurs in Vermont, New York, and New Jersey and extends southward in the mountains to the Carolinas and Tennessee. Previous Kentucky reports are for the Red River Gorge (Studlar and Snider 1989) and Letcher County (Risk 1998).

Leucodon brachypus Brid. **Harlan Co**.: Black Mt., headwater of Clover Fk., deep valley, trunk of *Liriodendron tulipifera* L., *6614*; Pine Mt., Hi Lewis Br., in barrens-like area, on tree base, *11408*. **Letcher Co**.: Pine Mt., Line Fork Caverns area, trunk of *Liriodendron tulipifera* L. by waterfall, *5809*. This species seems to be truly rare in eastern Kentucky (fld. obs.). The three new reports are all from extreme southeastern Kentucky, at elevations above 2000 feet.

Lindbergia brachyptera (Mitt.) Kindb. **Bath Co.:** Pioneer Weapons Hunting Area, Cave Run Botanical Area, small prairie area, on trunk of ***Juniperus virginiana*** L., *3778*. According to Crum and Anderson (1981), this species is widespread and fairly common in eastern North America.

**Micromitrium austinii* Sull. *in* Aust. Bath Co.: unnamed tributary of Licking R. across from Minor E. Clark Fish Hatchery, on bare soil in powerline right-of-way, *9996*. Though not previously reported from Kentucky, it seems likely that this tiny moss is frequently overlooked.

Neckera besseri(Lob.) Jur. [includes *Homalia trichomanoides* (Hedw.) Schimp. *in* B.S.G. fo. *gracilis* James *in* Peck, fide He (1992)]. **Estill Co.**: Red Lick Cr., ridgetop limestone outcrop, on underside of limestone ledge, *4450*; knob 0.5 mile north of Ravenna, limestone outcrop, *4709*; White Oak Cr., dry limestone outcrop, on underside of limestone ledge, *4716*; Little Hardwick Cr., limestone cliff, on shelf below projecting ledge of cliff, *8255*. The habitat of this species, clinging to the undersides of limestone ledges, is distinctive. The taxon also occurs in Arkansas, Missouri, New York, Vermont, and Virginia (Crum and Anderson 1981). Previous Kentucky collections were from Letcher and Mercer counties (He 1992).

Neckera pennata Hedw. **Harlan Co.**: Black Mt., about one-fourth mile west of Hwy. *160*, *Acer saccharum* Marsh. trunk, *661*. **Laurel Co.**: Cane Creek near junction with Pounder Br., sandstone gorge, trunk of *Acer rubrum* L., *9006*. **Letcher Co.**: Poor Fk., across from mouth of Bad Br., trunk of *Aesculus flava* Soland., *1697a*; Pine Mt., Cold Iron Br., trunk of *Quercus prinus* L., *4855*. **Menifee Co.**: Red River Gorge area, Klaber Br., sandstone gorge, trunk of *Fagus grandifolia* Ehrh., *4938*; Spaws Cr., sandstone gorge, trunk of *Nyssa sylvatica* Marsh., *10363*. *Neckera pennata* is widely distributed in northern North America and extends southward in the Appalachian Mountains (Crum and Anderson 1981). The new Kentucky localities are either in deep sandstone gorges along the western escarpment of the Cumberland Plateau or in high elevation areas of the Cumberland Mountains. The only previous Kentucky report, from Harlan County, is that by Fulford and Shacklette (1942).

Oncophorus raui (Aust.) Grout. **Menifee Co.**: upper end of Spaws Cr., sandstone gorge, on moist sandstone cliff, *10358*. According to Crum and Anderson (1981), *O. raui* occurs in Pennsylvania and the Southern Appalachians. The habitat at the Spaws Creek site is similar to that described in Risk (1998) for the species in Letcher County, Kentucky.

Orthotrichum diaphanum* Brid. **McCreary Co.: Wolf Ridge, trunk of *Juniperus virginiana* L. at margin of field, *2665*. *Orthotrichum diaphanum* is scattered in the western and central United States and is rare in the eastern United States (Crum and Anderson (1981). In the east the species has been reported from two counties in Ohio (Snider and Andreas 1996) and from the Western Highland Rim in Tennessee (Smith 1989).

Phascum cuspidatum* Hedw. **Estill Co.: three miles south of Spout Springs, Grassy Knob area, open, high limestone clifftop, on soil, *5921*. This small moss is easily overlooked. A survey of the literature (Jennings 1951, Welch 1957, Crum and Anderson 1981, Crum 1983, Reese 1984, Smith 1989, Snider and Andreas 1996) suggests the species is relatively widespread in eastern North America.

Philonotis glaucescens* (Hornsch.) Broth. **Harlan Co.: Black Mt., wet siltstone outcrop, *663*. **Jackson Co.**: War Fk., moist sandstone outcrop, *4665*. **Knott Co.**: Mallie, wet thin soil over sandstone outcrop, *431*. **Letcher Co.**: Pine Mt., Line Fork Cavern area, wet limestone behind waterfall, *4749a, 4767*. According to Crum and Anderson (1981), the species occurs along the Gulf Coast and northward to Kansas.

Philonotis gracillima* Ångstr. **Knott Co.: Carr Fork Wildlife Management Area, unnamed tributary of Carr Fork, wet clay-rich soil along stream in forested cove, *11416*. The habitat where the above specimen was discovered accords well with that described by Crum and Anderson (1981). The species occurs in scattered localities in the southeastern United States (Crum and Anderson 1981).

Physcomitrium collenchymatum* Gier. **Morgan Co.: 2.5 miles east of Dan, Sage Br., sandstone gorge, bare clay of streambank, *10870*. This weedy ephemeral is rare and scattered throughout much of eastern North America (Crum and Anderson 1981). The plants grew in mixture with the much larger *P. pyriforme*. After a few months of storage in a herbarium

cabinet, the capsules of *P. collenchymatum* have become open and flared, as is characteristic of the species (Crum and Anderson 1981).

Pleurochaete squarrosa (Brid.) Lindb. **Bath Co.**: Pioneer Weapons Hunting Area, prairie-like area, on limestone, *3764*. **Estill Co.**: 2.2 miles north of Red Lick Cr.-Locust Br. jct., ridgetop, open limestone outcrop, *4453*; South Fk. Station Camp Cr., forested ridge, limestone outcrop, *4506*; 0.5 mile north of Ravenna, narrow ridge, on limestone, *4706*; Grassy Knob area, ridge, open limestone clifftop, *5906*; ridge area between Brooks Mt. And Reeves Mt., on limestone, *6068*; Little Hardwick Cr., ridge, open limestone ledge, *8260*. **Rowan Co.**: 1 mile north of Claylick Boat Ramp (Cave Run Lake), on limestone at top of west-facing cliff, *5280*. **Wayne Co.**: 0.4 mile west of McCreary County line on Rt. 92, limestone glade, on limestone, *3407*, *3409*. *Pleurochaete squarrosa* seems to be rather predictably present on open, ridgetop and upper slope, limestone outcrops in the Knobs region of eastern Kentucky. Estill County, particularly, seems to have an abundance of this underreported species. The species was previously reported for Rowan County (Risk 1991).

Polytrichum pallidisetum Funck. **Bell Co.**: Cumberland Mt., Shillalah Creek Wildlife Management Area, sandstone gorge, moist sandstone boulder by stream, *7558*. **Elliott Co.**, Laurel Cr., near Carter School Road crossing, sandstone gorge, on thin soil over sandstone boulder, *6038*, on rotten log, *6048*. **Laurel Co.**: Rock Cr., narrow sandstone gorge, on wet base of sandstone cliff, *6581*, on soil around *Rhododendron maximum* L., *6583*. **Morgan Co.**: Baldwin Cr., forested ravine, on face of sandstone boulder near stream, *10935*. **Rowan Co.**: tributary of Minor Cr., sandstone gorge, on sandstone boulder by stream, *10983*. **Wolfe Co.**: Red River, Sarges Br., sandstone gorge, soil over sandstone boulder, *10356*. *Polytrichum pallidisetum* occurs in eastern Canada and New England and extends southward in the Appalachians to Tennessee and South Carolina (Crum and Anderson 1981, Smith 1989). Additionally, Snider and Andreas (1996) report *P. pallidisetum* from two counties in Ohio. In Kentucky, the species appears to be restricted to the narrowest of sandstone gorges along the western escarpment of the Cumberland Plateau and to gorges in the Cumberland Mountains, typically on sandstone boulders near a stream. It was previously known from Wolfe County, based on a collection by E. L. Braun (Studlar and Snider 1989) and from Letcher County (Risk 1998).

Polytrichum strictum Brid. **Harlan Co.**: Cumberland Gap National Historical Park, Martins Fk., semi-open boggy area, in *Sphagnum* hummocks, *6642*. This species ranges from Greenland to Alaska and south to Georgia, Ohio, Illinois, and Minnesota in the east (Crum and Anderson 1981). Smith (1989) reported it from the Cumberland Plateau of Tennessee. The localities for this and the previous report of *P. strictum* in Kentucky (Risk 1998) are both in boggy streamheads in higher elevation areas of the Cumberland Mountains.

Pseudotaxiphyllum distichaceum (Mitt.) Iwats. **Elliott Co.**: Laurel Cr., sandstone gorge, on soil, *6040*. **Laurel Co.**: Rock Cr., sandstone gorge, wet base of sandstone cliff by stream, *6582*. **McCreary Co.**: Big South Fork National River and Recreation Area, near Devil's Jump, sandstone gorge, ceiling of sandstone rockhouse, *3974*. **Morgan Co.**: Devil Cr., sandstone gorge, sandstone outcrop by stream, *11473*. The species is widespread in the eastern United States (Crum and Anderson 1981), but the only previous Kentucky reports are those by Studlar and Snider (1989) from the Red River Gorge and Risk (1991) from Rowan County.

Racomitrium aciculare (Hedw.) Brid. **Bell Co.**: Cumberland Mt., Shillalah Creek Wildlife Management Area, moist rock by stream, *7494*. **Letcher Co.**: Pine Mt., upper end of Poor Fk., forested valley, wet sandstone at margin of stream, *4910*. **Morgan Co.**: Licking R., Kay Br., sandstone gorge, moist sandstone strata by stream, *10949*. *Racomitrium aciculare* occurs on rocks and ledges along streams from the Newfoundland region to the Great Lakes and south in

the Appalachians to North Carolina, Tennessee, and Georgia (Crum and Anderson 1981). It was previously reported for Kentucky from the Cumberland Falls area (Norris 1967), Rowan County (Risk 1991), and Letcher County (Risk 1998).

Rhizomnium appalachianum T.Kop. **Bell Co.**: Cumberland Mt., Shillalah Creek Wildlife Management Area, sandstone gorge, wet soil over sandstone, *7555*. **Laurel Co.**: Cane Creek near junction with Pounder Br., sandstone gorge, moist sand by stream, *8992*. **McCreary Co.**: Cogur Fk., sandstone gorge, on sand around pool in cliff overhang, *2932*. **Wolfe Co.**: Red River Gorge, Tight Hollow, sandstone gorge, *Campbell* s.n. In the southeast this species is restricted to mountainous and upland regions, usually occurring in seepage or waterfall spray areas (Crum and Anderson 1981).

Sphagnum bartlettianum* Warnst. **Bath Co.: unnamed tributary of Licking R. across from Minor Clark Fish Hatchery, streamhead seep, *7927*, *7957*, *7958*. **Laurel Co.**: Cane Br., wet open streamhead swamp in powerline right-of-way, *7472, 7476, 7479*; Sam Br. (near Laurel River Lake), streamhead forest, on moist soil, *7793*, *7794*. **Rowan Co.**: slightly south of Rowan County Airport, Carey Br., large hillside seep, *7080, 7085*. According to Crum (1984), the species occurs in coastal regions from New Jersey and Pennsylvania to Florida. Andrus (1979) and Andrus et al. (1992), in contrast, indicate that *S. bartlettianum* occurs in numerous areas well inland from the Coastal Plain. Snider and Andreas (1996) indicate *S. bartlettianum* is present in one Ohio county. All of the Kentucky sites are characterized by very wet, open to thinly forested streamheads.

Sphagnum cuspidatum Ehrh. *ex* Hoffm. **Leslie Co.**: 1.2 miles southwest of Helton, Hoskin Br., floating in pond on unreclaimed strip mine, *6292, 6295*; 3.2 miles west-northwest of Thousandsticks, Hell for Certain Cr., unreclaimed strip mine, floating in pond, *6720, 6722, 6725*; 2.1 miles southwest of Thousandsticks, unreclaimed strip mine, wet soil around margin of pools, *6710, 6713, 6789, 6788, 6791*. **Letcher Co.**: 2.3 miles west of Whitesburg on Hwy. 15, Dry Fk., seepy siltstone roadcut, *4150*. **McCreary Co.**: narrow ridge between Marsh Cr. and Cumberland R., floating in natural seasonal pond, *2650*. **Rowan Co.**: Farmers, 0.2 mile south of U.S. 60 on Rt. 801, base of slope in roadcut, wet area over shale, *9338*. *Sphagnum cuspidatum* occurs in coastal regions of eastern North America and extends inland in the Great Lakes region (Crum 1984). In Kentucky, the species is successfully invading abandoned, unreclaimed coal strip mines. Of the localities listed above, three are on abandoned coal mines and two are on rock cuts associated with roadside right-of-ways. The species seems to be extremely rare in eastern Kentucky in natural wetlands. *Sphagnum cuspidatum* was previously reported from Letcher County by Risk (1998).

Sphagnum fallax* (H.Klinggr.) H.Klinggr. **Leslie Co.: Redbird Wildlife Management Area, Henry Fk., unreclaimed strip mine, margin of pool, *6589*; 2.1 miles southwest of Thousandsticks, Bull Cr., unreclaimed strip mine, margin of pool, *6709, 6792*; 3.2 miles west-northwest of Thousandsticks, Hell for Certain Cr., unreclaimed strip mine, wet soil along pond margin, *6721, 6723*. **Rowan Co.**: Open Fk., 1 mile southeast of Brinegar, wet area near unreclaimed clay mine, *5820*. The species is widespread in northern North America and the northeast United States and extends southward in the Appalachian Mountains (Crum 1984). All of the sites reported here are unnatural wetlands associated with unreclaimed mines.

Sphagnum fuscum* (Schimp.) Klinggr. **Leslie Co.: 1.2 miles southwest of Helton, Hoskin Br., unreclaimed strip mine, small hummock on wet soil, *6298*; Redbird Wildlife Management Area, Henry Fk., unreclaimed strip mine, open marshy area by shallow pools, *6590, 6591*; 2.1 miles southwest of Thousandsticks, Bull Cr., unreclaimed strip mine, hummock by pool, *6712, 6790*. *Sphagnum fuscum* is widespread in northern North America and also occurs in

Wisconsin, Michigan, Ohio, West Virginia, and Maryland (Crum 1984). As with *S. fallax*, all localities listed for *S. fuscum* are wetlands on unreclaimed mines.

Sphagnum girgensohnii* Russ. **Leslie Co.: 0.7 mile north of Daniel Boone Parkway, Couch Br., unreclaimed strip mine, wet soil at margin of pool, *6717*. **Rowan Co.**: Clack Mt., abandoned clay pit, margin of pool, *8489*. This is yet another mainly boreal peat moss species on unreclaimed mines in Kentucky.

Sphagnum macrophyllum* Brid. **Bath Co.: Hog Hollow area, *Panicum-Juncus* meadow, at margin of pool, *5961*. **Leslie Co.**: 3.2 miles west-northwest of Thousandsticks, Hell for Certain Cr., unreclaimed strip mine, floating in pool, *Kiser 328*. A Coastal Plain species with inland localities in the Cumberland Plateau of Tennessee and northeastern Alabama (Crum 1984). The Bath County locality is in an area well-known by Kentucky botanists for having Coastal Plain species. The site, unfortunately, is threatened by off-road vehicle use.

Sphagnum magellanicum Brid. **Bath Co.**: Hog Hollow area, streamhead seep, *7931, 7961*. **Harlan Co.**: Cumberland Gap National Historical Park, Martin Fk., open *Sphagnum* bog, *6884*. **Laurel Co.**: Cane Br., powerline right-of-way, swampy open streamhead, *7478*. *Sphagnum magellanicum* is widespread across Canada and the northeastern United States and extends southward along the coast to Florida (Crum (1984). The three Kentucky localities listed above are all extremely wet, open to semi-open streamheads. Interestingly, *Eriophorum virginicum* L., a rare sedge in Kentucky, occurs in the state only in the three sites listed above. *Sphagnum bartlettianum* is also present in two of the sites as well.

Sphagnum portoricense* Hampe. **Leslie Co.: 2.1 miles southwest of Thousandsticks, Bull Cr., unreclaimed strip mine, on wet soil, *6716*. This species is widespread in coastal regions of the eastern United States (Crum 1984). Only a small patch of the moss was present at the above site.

Sphagnum rubellum* Wils. **Bell Co.: Cumberland Gap National Historical Park, Martins Fk., bog dominated by *Osmunda*, *6876, 6878*. **Harlan Co.**: Cumberland Gap National Historical Park, Martins Fk., open *Sphagnum* bog, *6644, 6881, 6882, 6883*. This boreal-montane species is rare at the Bell County site, but is common in the Harlan County site.

Sphagnum squarrosum* Crome. **Leslie Co.: Redbird Wildlife Management Area, Henry Fk., unreclaimed strip mine, on moist soil, *6592*. **Letcher Co.**: 2.3 miles west of Whitesburg on Hwy. 15, Dry Fk., seepy siltstone roadcut, *4149*. **Rowan Co.**: Open Fk., 1 mile southeast of Brinegar, wet area by dirt road near abandoned clay mine, *5814, 5815*. *Sphagnum squarrosum* is widespread in northern North America and extends southward in the Appalachians (Crum 1984). The species is also known from six counties in Ohio (Snider and Andreas 1996). All three of the sites listed above are in unnatural wetlands.

Sphagnum subtile* (Russ.) Warnst. **Bell Co.: Cumberland Gap National Historical Park, Martins Fk., on sand hummocks along streambank, *6872, 6874, 6875*. **Harlan Co.**: Cumberland Gap National Historical Park, Martins Fk., on sand hummocks along streambank, *6646, 6648*, top of hummock in *Rhododendron maximum* L. thicket, *6886*. This boreal member of the Section *Acutifolia* is not recognized by Crum (1984), but as pointed out by Andrus (1980) and McQueen (1989), it can be distinguished from closely related taxa by stem leaf and spore characters. Its occurrence in shaded habitats adjacent to open bogs at the above sites is consistent with habitats described by Crum (1984), Andrus (1980), and McQueen (1989).

Sphagnum trinitense* Müll.Hal. **McCreary Co.: 4 miles north of Whitley City, powerline right-of-way, natural seasonal ridgetop pond, *3361, 8106*. *Sphagnum trinitense* occurs near the coast from Massachusetts to Florida to Louisiana and extends inland up the Mississippi River to Kansas and Illinois (Andrus 1980). The mostly appressed capitular branch leaves, serrulate

median branch leaves, and strongly denticulate proximal branch leaves place these collections within *S. trinitense*.

Tetrodontium brownianum (Dicks.) Schwaegr. **Bell Co.**: Shillalah Cr., sandstone gorge, ceiling of sandstone overhang, *7556*. **Elliott Co.**: Laurel Cr., sandstone gorge, slanting underside of overhanging sandstone boulder, *6041*, backwall of sandstone overhang, *6050*. **Laurel Co.**: Cane Cr. near junction with Pounder Br., sandstone gorge, ceiling of sandstone overhang, *8985*. **Leslie Co.**: Sugar Cr., wet backwall of sandstone rockhouse, *6320*. **McCreary Co.**: Big South Fk. Cumberland R., Devil's Jump area, backwall of sandstone overhang, *3979*; Railroad Fk., sandstone gorge, ceiling of sandstone overhang, *3985*. **Morgan Co.**: Yocum Cr., sandstone gorge, underside of overhanging sandstone boulder, *5945*; Devils Fk., sandstone gorge, ceiling of sandstone overhang, *6013*. **Rowan Co.**: Slabcamp Cr., sandstone gorge, ceiling of sandstone rockhouse, *4945*; tributary of Minor Cr., sandstone gorge, ceiling of sandstone overhang, *8784*. **Wolfe Co.**: Sarges Br., sandstone gorge, ceiling of sandstone overhangs, *10309*, *10310*, *10325*, *10338*. Although *T. brownianum* is stated to be very rare by Crum and Anderson (1981), as Snider and He (1992) indicate, the species is actually much more common than previously believed. In the Cliff Section of the Cumberland Plateau in eastern Kentucky *T. brownianum* is frequent on the moist ceilings of sandstone overhangs. Snider and He (1992) reported the species from McCreary, Menifee, Powell, and Wolfe counties and Risk (1998) reported the species from Letcher County.

Timmia megapolitana Hedw. **Mercer Co.**: Shawnee Run, limestone gorge, on wet limestone by waterfall, *2561*. In eastern North America the species occurs from eastern Canada south to Virginia, Ohio, Arkansas, and Nebraska (Crum and Anderson 1981). Previous Kentucky reports are from Boone County (Fulford and Shacklette 1942) and by Short (1837) (no locality given).

Tortella tortuosa* (Hedw.) Limpr. **Breathitt Co.: North Fork Kentucky River near junction with Cedar Creek, on calcareous sandstone outcrop, *11257*. **Menifee Co.**: Murder Br., sandstone gorge, on limestone near cave entrance, *8774*. **Morgan Co.**: Cave Run Lake area, Mine Br., on limestone around cave entrance, *7095*. **Rowan Co.**: Passenger Br., sandstone gorge, on limestone outcrop, *4927*. *Tortella tortuosa* is present in much of Canada, the Great Lakes region, and the mountains of Tennessee and North Carolina (Crum and Anderson 1981). Its occurrence in Kentucky on a south-facing, calcareous sandstone outcrop and various limestone outcrops is consistent with its habitat in other regions. All reported collections have the V-shaped region of hyaline cells at the leaf base typical of *Tortella*, sharply apiculate apices, and the spirally contorted leaf tips characteristic of *T. tortuosa*.

Tortula norvegica* (Web.) Wahl. *ex* Lindb. **Estill Co.: Redlick Cr., narrow ridge, on top of open limestone outcrop, *4451*. In Crum and Anderson (1981), this specimen keys to *T. ruralis* (Hedw.) Gaertn. et al. However, the species delimitations followed here for *Tortula* are those presented by Misher in Sharp et al. (1994). Features such as upper lamina cell size (12 – 18 µm) and leaf margin (plane in the upper one-fourth) align the specimen with *T. norvegica*.

Tuerckheimia angustifolia Saito. **McCreary Co.**: Big South Fk. Cumberland R., between Blue Heron and Devil's Jump, sandstone gorge, wet backwall (shale) of a predominantly sandstone overhang, *3708*. This species is rare in eastern North America and has been reported from Arkansas, Florida, North Carolina, and Tennessee (Crum and Anderson 1981). Allen (1985) and Risk (1991) provided the only previous Kentucky reports of the species.

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Racopilum tomentosum: First Report of Its Sporophytes in Florida, and Observations on Its Sexuality

William D. Reese[1]

Racopilum tomentosum (Hedwig) Bridel is known in the United States only from Florida, where it occurs sporadically in a few counties in the southern part of the state and along the western side of the peninsula as far north as Citrus and Sumter counties. Although this moss is often fertile in the extra-U.S. portions of its range (American tropics, Bermuda, Africa), sporophytes were not known from the U.S. populations (Breen 1963; Crum & Anderson 1981) until they were discovered during my review of *Racopilum* for the Flora of North America project.

Sporophytes are present in various stages of development in a collection of *R. tomentosum* from Florida, Collier County: Collier--Seminole State Park, Royal Palm Hammock, *H. A. Crum and L. E. Anderson, Mosses of North America 595*, (*L. E. Anderson & H. Crum 13440)*. Of the four duplicates of this collection I have seen, those at DUKE, FLAS, and LAF have sporophytes while the one at MICH has gametoecia but lacks sporophytes. The sporophytes of the Collier County specimen are described below.

Seta brown, 14--27 mm long. Capsule curved, brown, sulcate when dry, 3--4 mm long. Operculum obliquely rostrate, 2.5 mm long. Calyptra tardily cucullate, 2.5--3 mm, usually with sparse delicate hairs, sometimes naked with age. Spores smooth, 13--15 µm.

The sexuality of *R. tomentosum* has been described as autoicous (e.g., Brotherus 1925; Crum & Anderson 1981). Breen (1963), however, stated that in several instances she found the "sex organ buds" to contain both antheridia and archegonia, i.e., the synoicous condition. Presumably her observations are based on Florida specimens. The gametoecia of *R. tomentosum* are tiny and may be difficult to find. They sit approximately erect along the flanks of the stem, axillary to the lateral leaves but seemingly displaced dorsally. Their long-awned leaves make the gametoecia visible at high magnification under the dissecting microscope.

In the case of the MNA specimen cited above, dissection of three gametoecia from a single stem without a sporophyte revealed that both antheridia and archegonia are present, confirming Breen's observations. One gametoecium contained six old archegonia and eight large empty antheridia; the second contained ten old archegonia and about six empty antheridia; the third contained nine old archegonia and ca. four old antheridia. In another specimen from Florida, *Philips 97* (LAF), the gametoecia examined contained only archegonia.

Sexuality of *R. tomentosum* in extra-Florida Specimens

The 18 extra-United States specimens of *R. tomentosum* at LAF constitute a sample for the examination of sexuality. Eight of these specimens include plants bearing gametoecia and sporophytes, four have plants with gametoecia but lacking sporophytes, and six evidently lack sexual expression. The results of my dissection of sexual structures from the 12 collections bearing gametoecia are given below.

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BRAZIL. *Lowey SP101.* Sporophytes present. One gametoecium from a stem with a sporophyte: All antheridia. Five gametoecia, all from a single stem lacking a sporophyte: 1. All archegonia; 2. All antheridia; 3. Three mature antheridia (two unopened, one empty) + 13 archegonia, mostly mature and dehisced. In this gametoecium the antherida clearly matured after most of the archegonia had already dehisced. 4. Sixteen dehisced and two immature archegonia + two immature antheridia; 5. Seventeen nearly mature but unopened antheridia. AUTOICOUS and SYNOICOUS.

COLOMBIA. *Churchill et al. 13405-a.* Sporophytes lacking. Four gametoecia from three different stems: All archegonia. DIOICOUS?

COLOMBIA. *Linares et al. 1543.* Sporophytes present. Four gametoecia from a stem with sporophytes: All archegonia. Five gametoecia from a stem without sporophytes: All archegonia. Eleven gametoecia from a stem with sporophytes: All archegonia. Three gametoecia from a stem without a sporophyte: All archegonia. DIOICOUS?

COSTA RICA. *Griffin & Morales B 118.* Sporophytes present. Four gametoecia from a stem with a sporophyte: Three contained all antheridia, the other had all archegonia. Two gametoecia from another stem with a sporophyte: Both had all antheridia. AUTOICOUS.

ECUADOR, GALÁPAGOS. *Weber M-131.* Sporophytes lacking. Two gametoecia from a single stem: Both contained all antheridia. DIOICOUS?

ECUADOR, GALÁPAGOS. *Weber M-364.* Sporophytes lacking. Two gametoecia from one stem: Both had all archegonia. Three gametoecia from a single stem: Two had all archegonia but the third gametoecium contained two open archegonia, two unopened archegonia, and six unopened antheridia. SYNOICOUS p.p.

HISPANIOLA, DOMINICAN REPUBLIC. *Reese 14994.* Sporophytes present. One gametoecium at the base of a mature sporophyte contained all archegonia. Six gametoecia from a single stem bearing mature sporophytes: Four included only archegonia; one had only antheridia; one contained two archegonia and several antherida. AUTOICOUS and SYNOICOUS.

HISPANIOLA, DOMINICAN REPUBLIC. *Reese 15424.* Sporophytes present (old setae): Two old seta bases from one stem: A few old archegonia on the flanks of the vaginula. One old seta base and two gametoecia from a single stem: Only old archegonia in all three. DIOICOUS?

JAMAICA. *Orcutt 4778.* Sporophytes present. Inner perichaetial leaves and flanks of the vaginula of a mature sporophyte: Only archegonia. Six gametoecia from stems with mature sporophytes: 1. All archegonia; 2. All antheridia; 3. Two archegonia + several antheridia; 4--6. All archegonia. SYNOICOUS p.p.

SURINAM. *P. & J. Florschütz 4715.* Sporophytes present. Two gametoecia from stems with sporophytes: All antheridia. AUTOICOUS.

VENEZUELA. *Gaincer (Bravo) 0026.* Sporophytes present. Inner perichaetial leaves and flanks of the vaginula of a mature sporophyte, and a single gametoecium: All archegonia. DIOICOUS?

VENEZUELA. *Griffin et al. 017450.* Sporophytes lacking. Six gametoecia from one stem: All with only archegonia. Five gametoecia from another stem: All archegonia. DIOICOUS?

Based on the specimens studied some populations of *R. tomentosum* in Florida, Brazil, Hispaniola, Jamaica, and the Galápagos include synoicous plants and others have autoicous plants. The possibility of the dioicous condition cannot be ruled out for some populations. No doubt synoicous populations occur elsewhere in the broad range of this moss. Synoicy is not clear-cut in *R. tomentosum* because in all specimens in which synoicous gametoecia were discovered there were also perichaetia or perigonia, or both.

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Bryophyte records from Arkansas, Missouri, and Oklahoma

Carl Darigo[1]

This paper reports on mosses and liverworts from Arkansas, Missouri and Oklahoma, including ***Didymodon vinealis*** (Brid.) Zand. var. ***vinealis*** and ***Weissia condensa*** (Voit) Lindb. new to Oklahoma, ***Riccia stenophylla*** Spruce new to Missouri, and 131 new county records.

Personal collections were made either during Botany Group outings of the Webster Groves Nature Study Society, or on private trips. Several previously unpublished collections by Bruce Allen, Chris Casado and Bill Summers are included. Oklahoma data resulted from determinations of Gilford J. Ikenberry specimens collected from the 1930's to 1950's, as discussed in Darigo (1998).

All specimens were verified by Bruce Allen, Steve Churchill or Alan Whittemore, and are deposited at MO. Moss distribution comments were taken from Redfearn (1983).

MOSSES

AMBLYSTEGIACEAE

Campylium chrysophyllum (Brid.) J. Lange - OKLAHOMA--**Okfuskee**: Ikenberry.

Hygroamblystegium noterophilum (Sull. & Lesq. *in* Sull.) Warnst.- MISSOURI--**Crawford**: Onondaga Cave State Park, Darigo 3244. Uncommon.

H. tenax (Hedw.) Jenn. var. *tenax* - MISSOURI--**Dent**: Montauk State Park, Darigo & Darigo 3301; **Mercer**: Chloe Marsh Conservation Area, Summers & Yatskievych 8777; **Pemiscot**: Smith-Ellis Cemetery, Darigo 3201.

Leptodictyum humile (P. Beauv.) Ochyra - MISSOURI--**Adair**: Hwy AA, N of Kirksville, Summers & Yatskievych 8712A; **Clark**: Hwy CC, S of Iowa state line, Summers & Yatskievych 8730; **Howard**: 1½ mi. W of Fayette, Darigo & Tinker 3129; **Iron**: Bismarck Lake Conservation Area, Summers 8817; **Mercer**: Chloe Lowry Marsh Conservation Area, Summers & Yatskievych 8776; **Ozark**: Mark Twain National Forest, Summers 7583; **Pemiscot**: cemetery, 2 mi. NW of Steele, Darigo 3184; **Perry**: Ball Mill Resurgence Natural Area, Darigo & Darigo 3110; **Scott**: Hwy 61 roadside park N of Benton, Darigo 3170; **Washington**: Washington State Park, Darigo 3105.

L. riparium (Hedw.) Warnst.- MISSOURI--**Dunklin**: Hornersville Swamp Conservation Area, Darigo & Sullivan 3225.

AULACOMNIACEAE

Aulacomnium palustre (Hedw.) Schwaegr.- MISSOURI--**Howell**: Sims Valley Community Lake, Summers 8924. Uncommon.

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BRACHYTHECIACEAE

Brachythecium acuminatum (Hedw.) Aust. var. *acuminatum* - MISSOURI--**Dent**: Montauk State Park, Darigo & Darigo 3296; **Perry**: Ball Mill Resurgence Natural Area, Darigo & Darigo 3112.

B. acuminatum (Hedw.) Aust. var. *cyrtophyllum* (Kindb.) Redf. & Crum - MISSOURI--**Washington**: Pea Ridge Conservation Area, Darigo 3071. Common in Missouri, but infrequently collected. Differs from var. *acuminatum* in having broader, more concave, acute leaves and shorter leaf cells.

B. laetum (Brid.) B.S.G..- ARKANSAS--**Mississippi**: Big Lake National Wildlife Refuge, Darigo 3212. MISSOURI--**Adair**: Hwy AA, N of Kirksville, Summers & Yatskievych 8711; **Madison**: Amidon Conservation Area, Darigo & Darigo 3088; **Scott**: Hwy 61 roadside park N of Benton, Darigo 3169; Tywappity Community Lake, Summers & Yatskievych 8593. OKLAHOMA--**Murrray**: Botany Creek, Arbuckle Mtns., Ikenberry.

Bryhnia graminicolor (Brid.) Grout - MISSOURI--**Franklin**: Shaw Arboretum, Allen 20495; **Scott**: Tywappity Lake Conservation Area, Darigo 3233.

Bryoandersonia illecebra (Hedw.) Robins.- MISSOURI--**Scott**: Tywappity Community Lake, Summers & Yatskievych 8597.

Eurhynchium hians (Hedw.) Sande-Lac.- MISSOURI--**Adair**: Hwy AA, N of Kirksville, Summers & Yatskievych 8712B; **Pemiscot**: Dry Bayou Missionary Baptist Church, Darigo 3199; **Perry**: Ball Mill Resurgence Natural Area, Darigo & Darigo 3109. OKLAHOMA--**Murray**: Botany Creek, Arbuckle Mtns., Ikenberry.

Homalotheciella subcapillata (Hedw.) Broth.- MISSOURI--**Perry**: Ball Mill Resurgence Natural Area, Darigo & Darigo 3113.

Steerecleus serrulatus (Hedw.) Robins.- MISSOURI--**Harrison**: Old Catholic Church Prairie, Summers & Yatskievych 8758; **Scott**: Tywappity Lake Conservation Area, Darigo 3234.

BRYACEAE

B. caespiticium Hedw.- MISSOURI--**St. Charles**: Busch Conservation Area, Darigo 3083.

B. capillare Hedw. var. *capillare* - MISSOURI--**Pemiscot**: Oak Grove Cemetery, Darigo 3206; **St. Francois**: St. Joe State Park, Darigo 3135.

B. dichotomum Hedw.- MISSOURI--**Marion**: levee near Hannibal, Darigo & Darigo 3294; **Pemiscot**: Dry Bayou Missionary Baptist Cemetery, Darigo 3200. Uncommon.

B. pseudotriquetrum (Hedw.) Gaertn. et al.- MISSOURI--**Clark**: Hwy CC, S of Iowa state line, Summers & Yatskievych 8731. OKLAHOMA--**Cleveland**: Hwy 77, Shepherd.

Pohlia nutans (Hedw.) Lindb.- MISSOURI--**Bollinger**: Amidon Conservation Area, Darigo & Darigo 3094.

DICRANACEAE

Campylopus tallulensis Sull. & Lesq.- MISSOURI--**Carter**: Casado 366. Has only been reported in two other Missouri counties and listed as S1-Critically Imperiled (Anonymous, 1998).

Dicranella heteromalla (Hedw.) Schimp.- MISSOURI--**Scott**: Tywappity Community Lake, Summers & Yatskievych 8595.

Dicranum flagellare Hedw.- ARKANSAS--**Mississippi**: Big Lake National Wildlife Refuge, Darigo & Summers 3213.

DITRICHACEAE

Pleuridium subulatum (Hedw.) Rabenh.- MISSOURI--**Perry**: Timber Ridge Cemetery, Darigo & Darigo 3097.

ENTODONTACEAE

Entodon seductrix (Hedw.) C. Müll.- ARKANSAS--**Mississippi**: Big Lake National Wildlife Refuge, Darigo & Summers 3216. MISSOURI--**Harrison**: Pawnee Prairie Conservation Area, Summers & Yatskievych 8754A.

EMPHEMERACEAE

Ephemerum spinulosum Bruch & Schimp. *in* B.S.G.- MISSOURI--**Franklin**: Shaw Arboretum, Allen 4794;. **Iron**: Mark Twain National Forest, Summers 7562. Rare; listed as S?-Unranked (Anonymous, 1998).

FABRONIACEAE

Clasmatodon parvulus (Hampe) Hook. & Wils. *ex* Sull. *in* Gray - ARKANSAS--**Mississippi**: Big Lake National Wildlife Refuge, Darigo 3208. MISSOURI--**Dunklin**: Warbler Woods Conservation Area, Darigo 3185. OKLAHOMA--**Murray**: Botany Creek, Arbuckle Mtns., Ikenberry.

FISSIDENTACEAE

Fissidens taxifolius Hedw.- MISSOURI--**Dunklin**: Hornersville Swamp Conservation Area, Darigo & Sullivan 3223.

FONTINALACEAE

Fontinalis novae-angliae Sull. var. *latifolia* Card.- OKLAHOMA--**Okmulgee**: 3 mi. W of Henryetta, Ikenberry; **Pushmataha**: 29½ mi. N of Antlers, Ikenberry. Previous Oklahoma listings (1991) as "*F. novae-angliae* Sull." are possibly *F. novae-angliae* Sull. var. *latifolia* Card.

F. welchiana Allen - OKLAHOMA--**Latimer**: 9 mi. S of Wilburton, Bird 3182.

FUNARIACEAE

Funaria hygrometrica Hedw.- MISSOURI--**Warren**: Katy Trail State Park near Dutzow, Darigo 3101.

Physcomitrium pyriforme (Hedw.) Hampe - MISSOURI--**Dunklin**: Hornersville Swamp Conservation Area, Darigo & Sullivan 3226; **Mercer**: Chloe Lowry Marsh Conservation Area, Summers & Yatskievych 8779; **Mississippi**: Delaney Lake, Darigo 3173; **Washington**: Washington State Park, Darigo 3106.

GRIMMIACEAE

Grimmia laevigata (Brid.) Brid.- OKLAHOMA--**Cleveland**: Hwy 77, Shepherd; **Pittsburg**: 1 mi. N of Haileyville, Ikenberry; **Seminole**: 6 mi. S of Seminole, Ikenberry.

G. teretinervis Limpr.- OKLAHOMA--**Cimarron**: 1 mi. W of Kenton, Ikenberry.

Jaffueliobryum raui (Aust.) Thér.- OKLAHOMA--**Woodward**: Boiling Springs Park, Ikenberry 856.

J. wrightii (Sull. *in* Gray) Thér.- OKLAHOMA--**Cimarron**: 1 mi. W of Kenton, Ikenberry.

Schistidium apocarpum (Hedw.) Bruch & Schimp. in B.S.G.- OKLAHOMA--**Adair**: Hwy 59, 7 mi. S of Hwy 62, Ikenberry; **Lincoln**: 5 mi. N of Chandler, Ikenberry; **Logan**: Hwy 51 W of Hwy 77, Ikenberry; **Ottawa**: E of Miami, Ikenberry; **Pawnee**: Lake Pawnee, Davy 121.

Rogers: 1 mi. N of Foyil, Ikenberry.

HELODIACEAE

Helodium paludosum (Sull.) Aust.- MISSOURI--**Wayne**: Mark Twain National Forest, Summers & Brant 8701. Rare and previously reported only twice in Missouri; listed as S1-Critically Imperiled (Anonymous, 1998).

HYPNACEAE

Isopterygium tenerum (Sw.) Mitt.- MISSOURI--**Wayne**: Mark Twain National Forest, Summers & Brant 8702.

Platygyrium repens (Brid.) Schimp. *in* B.S.G.- ARKANSAS--**Mississippi**: Big Lake National Wildlife Refuge, Darigo 3210.

Taxiphyllum taxiraeum (Mitt.) Fleisch.- OKLAHOMA--**Carter**: Hwy 77, 10 mi. S of Davis, Ikenberry.

LESKEACEAE

Haplocladium microphyllum (Hedw.) Broth.- MISSOURI--**Dunklin**: Ben Cash Conservation Area, Darigo & Sullivan 3228; **Perry**: Ball Mill Resurgence Natural Area, Darigo & Darigo 3111; **St. Francois**: St. Joe State Park, Darigo & Darigo 3084. Uncommon.

H. virginianum (Brid.) Wat. & Iwats.- MISSOURI--**Dunklin**: Hornersville Swamp Conservation Area, Darigo & Sullivan 3224.

Leskea gracilescens Hedw.- MISSOURI--**Adair**: Hwy AA, N of Kirksville, Summers & Yatskievych 8716; **Dunklin**: Warbler Woods Conservation Area, Darigo 3186; **Harrison**: Pawnee Prairie Conservation Area, Summers & Yatskievych 8756A; **Howell**: 3½ mi. N of Brandsville, Summers 8688.

L. obscura Hedw.- ARKANSAS--**Mississippi**: Big Lake National Wildlife Refuge, Darigo & Summers 3215.

Lindbergia brachyptera (Mitt.) Kindb.- MISSOURI--**Harrison**: Pawnee Prairie Conservation Area, Summers & Yatskievych 8756B.

LEUCODONTACEAE

Leucodon julaceus (Hedw.) Sull.- MISSOURI--**Dunklin**: Hornersville Swamp Conservation Area, Darigo 3222. OKLAHOMA--**Okfuskee**: Ikenberry.

MNIACEAE

Plagiomnium cuspidatum (Hedd.) T. Kop.- ARKANSAS--**Mississippi**: Big Lake National Wildlife Refuge, Darigo 3211. MISSOURI--**Adair**: Hwy AA, N of Kirksville, Summers & Yatskievych 8712; **Mercer**: Chloe Lowry Marsh Conservation Area, Summers & Yastskievych 8778.

ORTHOTRICHACEAE

Drummondia prorepens (Hedw.) Britt.- MISSOURI--**Dunklin**: Ben Cash Conservation Area, Darigo & Sullivan 3229.

Orthotrichum ohioense Sull. & Lesq. *in* Aust.- ARKANSAS--**Mississippi**: Big Lake National Wildlife Refuge, Darigo & Summers 3214. MISSOURI--**Clark**: N of Goose Pond near Wayland, Summers & Yatskievych 8742; **Dunklin**: Warbler Woods Conservation Area, Darigo 3187; **Pemiscot**: Smith-Ellis Cemetery, Darigo 3202.

O. pumilum Sw.- MISSOURI--**St. Charles**: Busch Conservation Area, Darigo 3306. Uncommon.

O. stellatum Brid.- MISSOURI--**St. Charles**: Weldon Springs Conservation Area, Darigo 3099.

O. strangulatum P. Beauv.- OKLAHOMA--**Muskogee**: Greenleaf Lake, Ikenberry; **Ottawa**: E of Miami, Ikenberry.

POLYTRICHACEAE

Atrichum angustatum (Brid.) Bruch & Schimp. *in* B.S.G.- MISSOURI--**Adair**: Hwy AA, N of Kirksville, Summers & Yatskievych 8710.

A. undulatum (Hedw.) P. Beauv.- MISSOURI--**Scott**: Tywappity Community Lake, Summers & Yatskievych 8596.

POTTIACEAE

Barbula unguiculata Hedw.- MISSOURI--**Dunklin**: Hornersville Swamp Conservation Area, Darigo 3220; **Howard**: 1½ mi. W of Fayette, D.Darigo & Tinker 3130; **Mississippi**: Delaney Lake, Darigo 3174; **Wayne**: Lake Wappapello State Park, Darigo 3268.

Didymodon vinealis (Brid.) Zand. var. *vinealis* - OKLAHOMA--**Cimarron**: 1 mi. W of Kenton, Ikenberry. This specimen, collected 7 October 1950 from hillside rock ledges, is an Oklahoma state record. The plants were mixed with *Grimmia teretinervis* Limpr. and *Jaffueliobryum wrightii* (Sull. *in* Gray) Thér.

Syntrichia pagorum (Milde) Amann - MISSOURI--**Pemiscot**: Mt. Zion Cemetery, Darigo 3182. OKLAHOMA--**Okfuskee**: Ikenberry.

Tortella humilis (Hedw.) Jenn.- MISSOURI--**Pemiscot**: Dry Bayou Missionary Baptist Church, Darigo 3198.

Tortula atherodes Zand.- MISSOURI--**Bollinger**: Pine Hill United Methodist Church Cemetery, Darigo & Darigo 3093. Uncommon.

Weissia condensa (Voit) Lindb.- OKLAHOMA--**Ottawa**: E of Miami, Ikenberry. Collected 25 April 1959 along a spring run and is an Oklahoma state record.

W. controversa Hedw.- OKLAHOMA--**Carter**: Hwy 77, 10 mi. S of Davis, Ikenberry; **Okfuskee**: Ikenberry.

W. jamaicensis (Mitt.) Grout - MISSOURI--**Dent**: Montauk State Park, Darigo & Darigo 3297. Uncommon.

W. sharpii Anderson & Lemmon - MISSOURI--**Montgomery**: Danville Conservation Area, Darigo & Darigo 3119. This collection is the northernmost station for the species in Missouri.

PTYCHOMITRIACEAE

Ptychomitrium drummondii (Wils.) Sull.- ARKANSAS--**Mississippi**: Big Lake National Wildlife Refuge, Darigo & Summers 3217. MISSOURI--**Dunklin**: Warbler Woods Conservation Area, Darigo 3189. Uncommon.

SEMATOPHYLLACEAE

Sematophyllum adnatum (Michx.) Britt.- MISSOURI--**Pemiscot**: Mt. Zion Cemetery, Darigo 3183. Uncommon.

LIVERWORTS

JUBULACEAE

Frullania eboracensis Gott.- MISSOURI--**Madison**: Amidon Conservation Area, Darigo & Darigo 3089.

F. inflata Gott. var. *communis* Schust.- MISSOURI--**St. Charles**: Busch Conservation Area, Darigo & Darigo 3082.

LOPHOCOLEACEAE

Lophocolea heterophylla (Schrad.) Dum.- MISSOURI--**Bollinger**: Amidon Conservation Area, Darigo & Darigo 3095.

POREL LACEAE

Porella platyphylloidea (Schwein.) Lindb.- MISSOURI--**Washington**: Washington State Park, Darigo 3103.

PTILIDIACEAE

Ptilidium pulcherrimum (G. Web.) Hampe - MISSOURI--**Lincoln**: Cuivre River State Park, Allen 7835. Has been reported from only one other Missouri county and listed as S1-Critically Imperiled (Anonymous, 1998).

RICCIACEAE

Riccia fluitans L.- MISSOURI--**Dunkin**: Frisbee Cutoff, St. Francis River, Darigo & Sullivan 3231

R. stenophylla Spruce - MISSOURI--**Mercer**: Chloe Lowry Marsh Conservation Area, Summers & Yatskievych 8774. This specimen, collected 25 June 1998, from wet soil at edge of a fresh water marsh, is a Missouri state record. According to Schuster (1992), previous United States reports are from Texas, Florida, and possibly California and North Carolina.

Ricciocarpos natans (L.) Corda - MISSOURI--**Mercer**: Chloe Lowry Marsh Conservation Area, Summers & Yatskievych 8775

SPHAEROCARPACEAE

Sphaerocarpos texanus Aust.- MISSOURI--**Warren**: Katy Trail State Park near Dutzow, Darigo & Sullivan 3100.

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Interesting Bryophytes in Michigan's Upper Peninsula

William Manierre[1]

Although the summer of 1998 was one of the driest on record in Michigan's Upper Peninsula, it produced several unusual bryophytes within the approximately 20,000 acres of the Huron Mountain Club whose holdings, 40 miles northwest of Marquette, are bordered to the north by Lake Superior and fall entirely within the range of the Huron Mountains.

(1) In April I found *Grimmia anodon*, a "very rare [moss] in the East" according to Crum & Anderson (1991) and predominantly a western species, a decided disjunct in Michigan. It did not, however, turn out to be a first for the state. A 1992 collection in the Lower Peninsula by Michael Penskar of the Michigan Natural Features Inventory takes precedence. It was found in Kent County along the east shore of the Thornapple River approximately 12 miles east of Grand Rapids. Though it has been in the University of Michigan Herbarium for seven years, it was not reported in the literature. The present note, with Penskar's permission, reports his find as the first known collection in Michigan and the 1998 Huron Mountain find as the second for the state and the first for the Upper Peninsula.

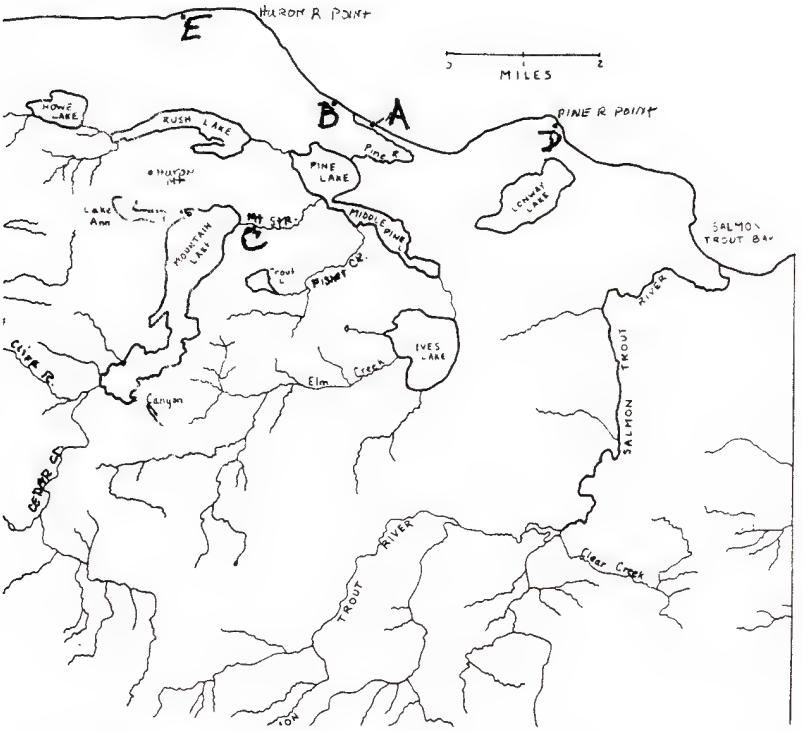
Two striking features first attracted my attention: the long, silvery hair points and a decidedly bluish cast overall. Other more definitive features did not become apparent until later in the year following further development. These were the very short, double-curved setae attached off-center to small, immersed, semi-globular capsules slightly bulging on one side and completely lacking peristomes.

A pronounced xerophyte and calciphile, *Grimmia anodon* in the western states prefers as substrate "dry, exposed calcareous rocks," according to Ireland and Miller (1982), whereas the "eastern North American plants [tend to occur] primarily on man-made concrete structures." The Michigan specimens exhibit a similar dichotomy. Those found in Kent County grew on a limestone or dolomite boulder within a natural setting. Those from Marquette County had as an alkaline substrate the roof of an all-cement building that once served as part of a fish hatchery. It is now densely covered with such mosses as *Grimmia rivularis* and *Orthotrichum anomalum* along with the lichens *Physcia adscendens, Xanthoria elegans*, and *Physconia perisidiosa.*

Ireland and Miller add, regarding mosses inhabiting such "man-made concrete structures," that "this is evidence of recent spread and establishment, although it is not possible to determine how or from where the populations originated." But two thing we do know: the date and origin of the substrate. It was constructed in 1914 by "Cement" Gus.

Neither cement structures nor disturbed areas characterize Huron Mountain holdings, but the Club gravel pit is of some ecological interest. What is "quarried" is the 570 million year old Jacobsville sandstone that is substrate at this location forming a bluff some forty feet above Lake Superior. The bluff itself is part of the shoreline of former post-glacial Lake Nippissing. Perennial seepage from underground springs creates a small wetland here — a fen with a dense flora of sedges, fern allies, and mosses, of which by far the most abundant species is *Philonotis fontana.* A number of species of greater interest were also found in this wetland:

[1] Huron Mountain Wildlife Foundation, Big Bay, MI 49808-9998.



Map showing the Huron Mountain area at the shore of Lake Superior. A, cement house. B, gravel pit. C, Mountain Stream Falls. D, Pine River Point. E, Huron River Point. Map reprinted by permission of the Huron Mountain Wildlife Foundation.

(2) In late September I found *Physcomitrium immersum* in the mud along the edges of a tire track in the center of this disturbed area growing in proximity to three other bryophytes of more than passing interest. *Physcomitrium immersum* is considered "rare and scattered in distribution" by Crum and Anderson and is correctly reported here for the first time from the state of Michigan.

It may be distinguished from *Aphanorrhegma serratum*, which it very much resembles, by differences in the cells of the capsule wall. The exothecial cells of *Aphanorrhegma* are "collenchymatous on both sides of the annulus," while in *Physcomitrium immersum* they are not; and in *P. immersum* dehiscence is "along a persistent annulus of one or two rows of small, orange or brownish cells" (ibid.), clearly visible under high power, while analogous cells in *Aphanorrhegma* are much less evident. Furthermore, *P. immersum* may be easily distinguished from other species of *Physcomitrium* in that its capsules are immersed and its spores mature in the fall rather than the spring. In my specimen capsules were available and dehiscence occurring. Otherwise I would have found positive identification impossible.

(3) Next to the *Physcomitrium* but almost infinitely more numerous was a large population of *Ephemerum spinulosum* with what must have been thousands of microscopic capsules. The appropriately named and tightly packed "pygmy ephemerals" were growing on top of their dense, persistent protonema which served as a cushion over the substrate in contrast to the no more than 20 or 25 plants of *Physcomitrium* that sat directly on bare mud. Though "widely distributed in eastern North America" (ibid.), *Ephemerum spinulosum* is a distinct rarity in Michigan's Upper Peninsula where, prior to our 1998 discovery, it had been collected but once, by Henry S. Conard in Ontonagon County in 1937. William Campbell Steere's notice (1942) of Conard's find underscores the relevant point (ibid.). "Although Dr. Conard's specimen is not fully mature, its identity is reasonably certain and extends to a surprising extent the known range of the genus in Michigan, since no members have previously been found in the Upper Peninsula ... ." Nor do I find any reference to subsequent appearances in the Upper Peninsula. Interestingly enough, however, a reference to Conard's sixty-two year old specimen was made by Dr. Virginia S. Bryan of Duke University in a recent E-mail letter to Dr. Crum in which she authenticates the 1998 collection by stating that "It is good *spinulosum*, and I was delighted to see it." She continues, "I may have told you earlier that I have seen good, typical *E. spinulosum* from Ontonagon Co. (an ISC loan). It was collected by Conard in 1937."

(4) Following along the edge of the tire track, in close association with the *Ephemerum*, was a large colony of the hornwort *Phaeoceros laevis*, which also is a rarity in Michigan's Upper Peninsula, as are hornworts in Michigan in general. A reference in Nichols & Steere (1936) to *Phaeoceros laevis* at "Agate Falls ... along the Ontonagon River" is the only mention of the species in the Upper Peninsula that I have found.

Revealing their presence largely by the very visible, elongate and grasslike capsules (3-4 cm.), these hornworts were in the midst of sporulation when first observed (23 Sept.). When viewed closeup or, better through peepers, details of the microhabitat were seen to be covered with the bright yellow spores that help to distinguish this species from its relative *Anthoceros punctatus*. So densely covered were its own rather dark thalli as to be rendered distinctly yellowish by the layer of spores, but this partial discoloration was not owing to spores alone. The *Ephemerum* too played a part in casting a yellowish tint over the surface of the hornwort. Those surfaces provided numerous perforations and lobe edges through and alongside of which the mosses and their protonemata climbed and emerged so as to overtop the upper layers of the hornworts which then seemed to take on a color different from their own.

(5) *Philonotis capillaris* is the last bryophyte of special interest found in the tire track of our small wetland. I find no record of it from Michigan's Lower Peninsula, but it has been found on Sugar Island (Chippewa County) in the Upper Peninsula. On the Huron Mountain Club site it grew in some abundance, intermingled with *Phaeoceros laevis* and *Ephemerum spinulosum*, all three at some distance from the scanty population of *Physcomitrium immersum*, which, avoiding competition of any kind, grew quite separately from the others.

(6) A poorly defined channel carrying moisture to the point at which the bluff drops suddenly to lake level marks the southern border of the wetland. At the edge of this channel some fifty yards from the tire track is a very small population of *Bryum muehlenbeckii*, considered "rare and scattered" by Crum & Anderson (1981) and not yet found in Lower Michigan. This site is one of the few recorded from northern Michigan. Another, reported sixty years ago in a Bryologist

article by George E. Nichols (1938) continues to thrive on the base of Huron Mountain immediately above the north shore of Mountain Lake. And, in 1988, I found the plant on the ridge along the top of Huron Mountain at 1510 ft. above sea level. It was growing next to the path in a seep midway between the dolmen and the two geodetic survey markers. Thus, three separate locations for *Bryum muehlenbeckii* exist within the comparatively small area of the Huron Mountain Club. I find mention of but two others in the entire state. Although the species is usually described as dull, perhaps worth mentioning is that all Huron Mountain specimens examined have been bright red and extremely shiny.

Two additional mosses, both new to the Upper Peninsula and extremely rare anywhere in the state, were found last May four miles due east of the gravel pit on Jacobsville sandstone at the shore of Lake Superior at Pine River Point:

(7) The first of these, *Seligeria campylopoda* was growing abundantly on the sandstone and on scattered, large boulders of unknown origin and composition whose edges were well rounded by wave action. Topped with their innumerable setae and capsules, these tiny mosses stood all of 3 mm high and, without magnification, resembled nothing more than a low, undefined fuzz on the substrate. Omitting the sporophytes, the measurements ranged from 0.5 to 1 mm, and the mosses were virtually invisible.

This is the same location at which Nichols discovered the rare *Seligeria recurvata* in the 1930's, and F. J. Hermann found there the "even more rare" *Gyroweisia tenuis* in 1981. By 1998 *Seligeria recurvata* was still there and in an abundance seemingly equal to that of S. *campylopoda*. But no less than the gravel pit, this location has been greatly disturbed since the 30's and increasingly so since the 80's, not by man but by major erosion by weather, ice, and violent wave action. The rocks and surfaces on which Nichols and Hermann made their discoveries are no longer there; sizeable portions of sandstone berm and cliff have disappeared. Under these circumstances, the striking persistence of the bryophyte populations is noteworthy.

(8) Separate from the *Seligeria*, on a single unattached, 3-inch fragment of sandstone were a few sterile stems of *Fabronia ciliaris,* another moss new to the Upper Peninsula. Though larger than *Seligeria, F. ciliaris* is, according to Crum & Anderson, "very small and not often seen except by the informed" and "a member of a family found as rarities in the southern part of the state" (Crum 1973) where, so far as I can tell, the *Fabronia* has been found only twice, in Ionia and Van Buren Counties (Mazzer & Sharp, 1963).

Surprisingly, given the scarcity of *Fabronia* reports from the state, a second location for it was found at Huron Mountain in late August of last summer. This location is, once again, four miles from Pine River Point, this time to the southwest at Mountain Stream Falls, which had proved to be a favorite and prolific hunting ground for Nichols sixty five years before. He did not find *Fabronia ciliaris*, however. And in fact, I almost didn't either — just two stems, adequate for identification, found intertwined with other collected bryophytes (*Mnium thomsonii, Anomodon rostratus, Myurella julacea*, and *Geocalyx graveolens*). These were growing on the nearly vertical rock slope immediately next to the falls and well within their spray, but whether directly on metamorphosed acidic Precambrian bedrock over 2.5 billion years old, "600 million year old" Jacobsville sandstone, or mere wet, vegetable duff on top of the rock, I cannot say. On Mountain Stream "water flows on a streambed of bare sandstone above the falls and plunges to the crystalline bedrock surface below. Water turbulence at the base of the falls causes relatively rapid

erosion of the sandstone at its contact with crystalline bedrock [which maintains] the almost vertical slope of the waterfall" (Simpson *et al.*, 1990). It is precisely at this poiint that these minimal specimens of *Fabronia ciliaris* chose to grow.

(9) In late August of 1998, about 1/4 mile downstream from the falls, I collected the very slender, richly branched *Leskea polycarpa*, unfortunately in a sterile condition. This collection is another first for the Upper Peninsula. The species has been collected in two counties in southern Michigan, in Macomb Co. by D. Cooley (in 1847), and in Eaton County by F. H. Erbisch (in 1959). Neither specimen, preserved in the herbarium of Michigan State University, has been recorded in the literature. The species occurred at the Huron Mountain Club in the form of two small, dense mats loosely adhering to the base of a much larger clump of *Platyhypnidium riparioides* in a characteristically wet habitat at the rocky edge of the stream in a tangle of sodden, half-rotten logs — the whole semi-submerged and in a like condition all year round except in the spring when completely flooded.

(10) In 1935, Nichols found the "first authentic Michigan record" for the liverwort *Porella pinnata* "attached to submerged rocks" in Cliff River and, in 1938, a second population of this "unusual species" in a similar habitat in Cedar Creek. Fifty years later I found it growing on submerged rocks and sticks in a backwater of Fisher Creek, and, last year, I found still another location, on submerged sandstone along the edge of Mountain Stream approximately 150 yards above the falls.

Although *Porella pinnata* is not uncommon in the southern United States, where it grows on tree trunks and often luxuriantly in swamps on the "knees" of bald cypress, it becomes, according to Schuster (1980), "a rare and sporadically appearing plant" as it extends "northward into the Coniferous Forest Biome." In Michigan's Upper Peninsula it is definitely rare; I find but two sites reported in the literature. It seems deserving of mention that twice as many sites on four separate streams are presently known within the much more restricted confines of the Huron Mountain Club.

(11) In mid-July, three miles north-northwest of Mountain Stream, I found the disjunct leafy liverwort *Lophozia obtusa* tightly clustered with *Fissidens osmundioides* and *Blindia acuta* in a baylet along the battered shoreline of Lake Superior at Huron River Point. The immediate site was the perpendicular, fifteen foot wall of layered sandstone directly facing a free-standing "stack" of the same height. The orientation is straight north with nothing but waves and ice for protection against the wild winter winds from Canada one hundred and forty miles across the lake.

Rudolph M. Schuster (1969) provides a succinct description of this "nordic or nordic-alpine species." "The most obvious differential features of *L. obtusa* are the almost horizontally oriented, uniformly bilobed, rather lax leaves, with rounded or obtuse lobes [and] the generally narrow sinus conspicuously if narrowly reflexed at base."

This 1998 find is evidently only the second for the state, the first being that of Steere (1937), along the Lake Superior shoreline near Copper Harbor. Schuster states that "in North America *Lophozia obtusa* is very rare ... except in the west." Its distributional pattern and general rarity thus almost exactly parallel those of the earlier discussed *Grimmia anodon*.

Each of these bryophytes clearly exemplifies the long-recognized pattern of disjunction of west coast or Rocky Mountain plants, both vascular and non-vascular, appearing sporadically, as with *Lophozia obtusa* or regularly and frequently, as with *Frullania bolanderi*, in Michigan's Upper Peninsula.

Specimens of numbered bryophytes are deposited at the University of Michigan except for *Fabronia ciliaris* and *Lophozia obtusa*, the collections of which were too small for division. All are in my personal collection, all verified by Howard Crum, to whom many thanks are given for encouragement, instruction, and patience expended during the past eleven years.

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The genus *Leucobryum* (Musci: Leucobryaceae) in Maine

Paul L. Redfearn, Jr. [1]& Bruce Allen[2]

The species of *Leucobryum* have thick, glaucous to whitish leaves that consist mostly of an expanded costa. The costa is differentiated into outer layers of enlarged, hyaline leucocysts and a central layer of smaller, green chlorocysts. Since a similar costal modification is found in the Dicranaceae (i.e., *Campylopus*, *Brothera*, *Paraleucobryum*) and the peristomes of *Leucobryum* and *Dicranum* are identical the two families are sometimes merged. However, many recent treatments (Crum & Anderson 1981, Ireland 1982, Walther 1983, Vitt 1984, Robinson 1985, Anderson, *et al.* 1990, Eddy 1990, Allen 1994, Peterson 1994, Churchill & Linares 1995) recognize both families. Robinson (1985, 1990) attributed basic structural and functional differences to the leucobryaceous leaf and on this basis redelimited the family. The important functional aspect of the leucobryaceaeous leaf involves its ability to generate and hold air within the leucocysts. Robinson suggests that "such bubbles are necessary for the photosynthesis in the chlorocysts which are remote from the surface of the leaf, and which could not properly exchange gases if the leucocysts were all filled with water." Although many authors include the genus *Octoblepharum* (not found in Maine) in the Leucobryaceae, Reese (1998) places this genus in the Leucophanaceae because of its peculiar peristome.

Leaf size, shape and stature are important taxonomic characters in *Leucobryum*, as also are characters found in the reduced leaf lamina and the number of leucocyst layers at the base of the leaves. In determining the leucocyst-layer number it is necessary to make leaf cross-sections at the extreme leaf base (first six sections). The glaucous-green to whitish color of the plants makes the use of a contrast enhancing stain (e.g., crystal-violet) helpful. The pores of the leucocysts can be demonstrated by staining with safranin.

Leucobryum Hampe, Flora 20: 282. 1837.

Plants in compact to loose cushions or mats, white to pale green, glaucous, grayish or pale brown. Stems simple or forked to irregularly branched, from 0.5–15 cm high; central strand of small, thin-walled, frequently fugacious cells present or absent; rhizoids red-brown, on stems and from apex of leaves. Leaves crowded, consisting mostly of a broad costa, limb lanceolate or subulate-lanceolate and concave to subtubulose, erect, spreading, reflexed to flexuose or falcate-secund, little changed when dry, spreading from an oblong-obovate to elliptic sheath, apex acute or obtuse and cucullate; margins incurved above, entire, or weakly denticulate at the apex; costa as seen in transverse section near the base consisting of 1–4 layers of abaxial and 1–4 layers of adaxial leucocysts, with single pores in their internal walls that enclose a central layer of quadrate chlorocysts; external pores often present on the abaxial surfaces of the cell walls of leucocysts in apical and basal regions of leaves; leaf lamina present from leaf base to mid-leaf, consisting of a narrow (2-12 rows of cells) marginal band of hyaline, linear, long-rectangular, short-rectangular or quadrate, variably porose, firm to lax walled, cells. Asexual reproduction by small caducous leaf-like gemmae and by leaves with rhizoids borne adaxially on exposed chlorocysts at the leaf apex. Pseudautoicous; male plants dwarfed, growing on tufts of tomentum or leaves of female

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plants. Setae elongate, 1 or occasionally 2 per perichaetia. Capsules inclined, asymmetric, rarely erect and symmetric, often plicate when dry, often strumose, stomata absent; opercula long-rostrate; annulus mostly nonrevoluble; peristome teeth 16, divided ½ their length, vertically pitted-striolate below, papillose above. Calyptrae cucullate, often split incompletely to the base which clasps the tip of seta until capsule matures. Spores yellowish or brownish, nearly smooth to minutely papillose. n = 6–11 (Fritsch 1991).

The name *Leucobryum* combines the Greek *leuco*, white and *bryum*, a moss. The characteristic pale color of *Leucobryum* is caused by air bubbles in the leucocysts (Robinson 1985). In Maine *Leucobryum* is a common woodland moss that often occurs in extensive mats. The genus can be recognized by its cushion-like growth form, and thick, whitish leaves. *Leucobryum* is sometimes called the "pin cushion moss" because of its habit, and indeed large mats of it make a comfortable woodland-seat. But beware, *Leucobryum* absorbs and holds large amounts of water for some time after a rain storm; Ireland (1982) relates that in Quebec it is sometimes called "Mother-in-law Cushion" because "... if you are out for a walk in the woods with your mother-in-law you should invite her to sit down to rest on a cushion of *Leucobryum* which has a dry appearance but frequently contains great quantities of water."

There are about 122 species of *Leucobryum* in the temperate and tropical regions of the world. Recently, Burch (1997) suggested the genus may be polyphyletic, but that possibility remains to be evaluated. Only two species are recognized in North America (Redfearn 1999), and these are not always easy to separate. Characters such as cushion height, leaf limb to sheath ratio, leaf length, and the number of leucocyst layers above and below the chlorocysts in transverse leaf sections near the base have been used to separate the species. The latter character is given great consideration in many floras. However, the number of leucocysts above and below the chlorocysts is too variable, e.g, on plants from the same colony and even on different sides of the same leaf, to be consistently used in separating the species. The best ways to separate the North American species of *Leucobryum* are by cushion height, leaf length, and the ratio of leaf limb to sheath length. Although both species have the same sexual system (dioicous with dwarf males) they differ in their frequency of sexual reproduction. In North America 16 % of the collections of *L. glaucum* examined had sporophytes, while 61% of the collections of *L. albidum* contained sporophytes. (Redfearn 1999).

Although the two North American species of *Leucobryum* are concentrated in different regions (*L. albidum* in the southeast; *L. glaucum* in the northeast) their ranges overlap extensively. Morphological intergradation between them is so great that one could recognize them as varieties rather than species. Patterson, Boles, & Shaw (1998), however, using nuclear ribosomal DNA analysis, demonstrated the presence of two distinct, genetically discontinuous haplotypes, one corresponding to *L. glaucum* the other to *L. albidum*.

1. Plants in low cushions or mats; stems less than 1 cm tall (rarely to 4.5 cm); leaves 2–4(–6) mm long, limb subtubulose, erect to wide-spreading, shorter than (rarely equal to) the length of sheath ..... *L. albidum*
1. Plants in tall cushions or mats; stems 1–12.5 cm tall (rarely shorter); leaves usually 3–9 mm long, limb concave to subtubulose, erect-spreading, sometimes falcate-secund, 1–2 (–3) times the length of sheath ..... *L. glaucum*

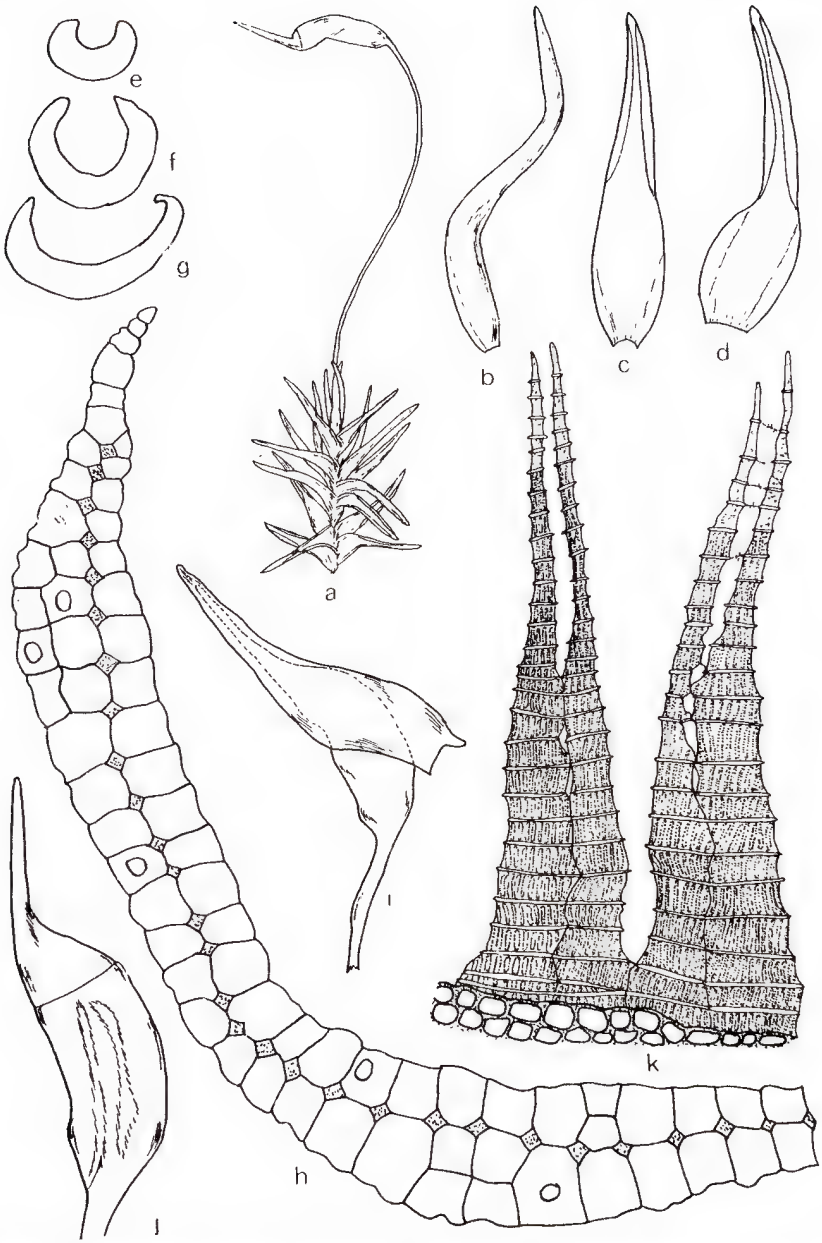

Figure 1. *Leucobryum albidum*. a. Habit. b–d. Leaves. e–g. Transverse sections of leaf, upper tubulose portion to upper sheath. h. Transverse section of lower sheath of leaf . i. Capsule with calyptra. j. Capsule with operculum. k. Peristome.

Leucobryum albidum (Brid. *ex* P. Beauv.) Lindb., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 20: 403. 1863.
Dicranum albidum Brid. *ex* P. Beauv., Prodr. Aethéogam. 52. 1805.

Plants in low, compact cushions or mats. Stems less than 1 cm tall (rarely to 4.5 cm), Leaves 2–4(–6) mm long, limb subtubulose, erect to wide-spreading, straight, apex apiculate, broadly acute to obtuse, entire, spreading from an oblong-obovate sheath, shorter than (rarely equal to) the length of the sheath; costa in transverse section near base showing lateral, thicker regions composed mostly of 2(–3) layers of enlarged leucocysts above and below the central layer of chlorocysts, and a central, thinner region composed of 1 layer of smaller leucocysts above and below chlorocysts; lamina narrow, 8–11 cells wide, cells quadrate to rectangular. Asexual reproduction by small leaf-like gemmae on minute, forked branches at stem tip or on pseudopodium-like branches and by leaves bearing rhizoids at leaf apex. Setae 8–12 mm long, brown to reddish. Capsules strongly inclined and curved when dry and empty, sometimes slightly strumose, 1.2–1.8 mm long, red to reddish-brown; opercula 1–1.3 mm long; peristome teeth dark red. Calyptrae 2 mm long. Spores minutely papillose, 11–16 µm. $n = 6$ (Anderson and Bryan 1958).

On moist shaded soil. In Maine known from Cumberland (*Wilson* NY), Hancock (*Bold 208* SMS, UT), Oxford (*J. A. Allen* NY), Sagadahoc (*Eckel* MICH), and Washington (*Holmes 111* MO) Counties.

Leucobryum albidum, a common southeastern North America species, is known in Maine from only a few, mostly coastal, localities. It is a small moss with plants that grow as compact, short cushions that are no more than 10 cm in diameter. The leaves of *L. albidum* often have rounded to obtuse leaves. Its smaller size is usually enough to separate it from *L. glaucum*. However, *L. glaucum* is extremely variable in size and at the smaller end of its range, *L. glaucum* and *L. albidum* intergrade. The best way to recognize *L. albidum* is by its leaves that have a reflexed limb that is usually shorter than the leaf sheath. Of the 5 collections examined from Maine, 2 (40%) had plants with sporophytes.

Leucobryum glaucum (Hedw.) Ångstrom, Summ. Veg. Scand. 1: 94. 1846.
Dicranum glaucum Hedw., Sp. Musc. Frond. 135. 1801.

Plants in tall, compact cushions or mats. Stems 1–12.5 cm tall (rarely shorter). Leaves 3–9 mm long, limb concave to subtubulose, erect or erect-spreading, sometimes falcate-secund, apex acute or apiculate, usually ± serrulate at the tip, spreading from an oblong-obovate sheath, 1–2(–3) times the length of sheath; costa in transverse section near base showing lateral, thicker regions composed mostly of 2–3(–4) layers of enlarged leucocysts above and below the central layer of chlorocysts and a central, thinner region composed of 1 layer of smaller leucocysts above and 2 layers below chlorocysts (or vice versa), occasionally with only 1 layer of leucocysts above and below chlorocysts; lamina narrow 5–11 cells wide, cells quadrate to rectangular. Asexual reproduction by clusters of small caducous leaf-like gemmae at stem tip and by leaves bearing rhizoids at apex. Setae 8–18 mm long, reddish. Capsules strongly inclined and curved when dry and empty, usually strumose, 1.5–2 mm long, red to reddish brown; opercula 1.5–2 mm long, red to reddish-brown; peristome teeth dark red. Calyptrae ca. 2 mm long. Spores nearly smooth to minutely papillose, 13–18 µm.

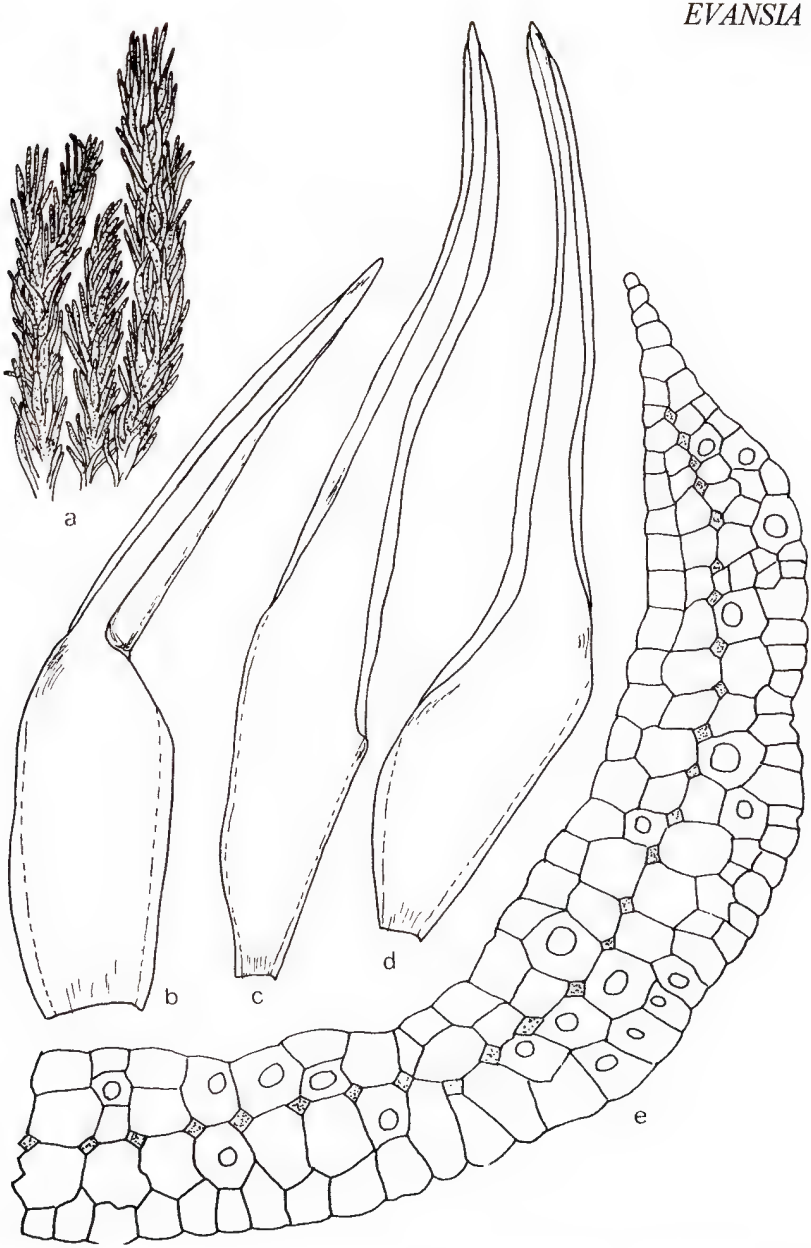

Figure 2. *Leucobryum glaucum.* a. Habit. b–d. Leaves. e. Transverse section of lower sheath of leaf.

On shaded to open humus, soil, rotting logs and stumps, tree bases, and rock ledges in forests and bogs. In Maine known from Androscoggin (*Allen 14664* MO), Aroostook (*Allen 16445* MO), Cumberland (*Allen 6027* MO), Franklin (*Allen 10300* MO), Hancock *(Redfearn 37739 MO)*, Kennebec (*Allen 10121* MO), Knox *(Allen 15802* MO), Lincoln (*Allen 15892* MO), Oxford (*J. A. Allen* MO), Penobscot (*Merrill 23* MO, NY), Piscataquis (*Merello 27* MO), Sagadahoc (*Allen 16774* MO), Somerset (*Allen 9370* MO), Waldo (*Allen 10367* MO), Washington (*Pedano 339* MO), and York (*Allen 13059* DUKE, MO, NY) Counties.

Leucobryum glaucum is the common species of *Leucobryum* in Maine. It often grows in extensive, tall cushions that under favorable circumstances may exceed 1 meter in diameter. Normally, the separation of *L. glaucum* from *L. albidum* is not difficult because *L. glaucum* is much larger in size. But, newly established cushions or plants growing in stressed habitats are smaller, shorter and closely approach those of *L. albidum*. Many past treatments of *Leucobryum* relied on the different number of layers of leucocysts above and below the chlorocysts to separate them. This feature is, however, highly variable and will not reliably distinguish the two species. The length ratio of leaf sheath to leaf limb provides the most consistent way to separate *L. glaucum* from *L. albidum*. Of the 58 collections examined from Maine only 4 (6%) had plants with sporophytes. This is a lower percentage than for *L. glaucum* in North America where 16% of collections examined had sporophytes (Redfearn 1999).

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A pocket calculator program to compute CMA in the genus *Usnea* (Lichenized Ascomycetes)

Darrell Wright[1]

Relative thickness of cortex, medulla and axis is now important for species determinations in the difficult genus *Usnea* (e.g., Halonen et al. 1998; Herrera-Campos et al. 1998; Tavares 1997). Although the calculations are not complicated, they are tedious and error prone, and, in this connection, users will find the convenience and accuracy of the little program listed below quite satisfying. It computes and displays thickness of cortex, medulla and axis as percentages of the thickness of the total branch according to the method of Clerc (1984, 1987), and runs on any of the Texas Instruments TI-80 series pocket programmable graphing calculators, now used for mathematics instruction in high schools and colleges and widely available in a variety of stores, including discount houses. As an option, it will also display the CMA percentages in a table with the actual thicknesses of the tissues in microns and a list of the data entered.

The program is listed exactly as it will appear when entered in the TI-82 Program Edit screen, except that there the longest lines will wrap, there are no line numbers, and no comments can be entered. The program is entered according to instructions in the calculator manual (Texas Instruments Instructional Communications 1993, p. 13ff.) A space is produced by pressing the "ALPHA" key followed by 0, something I was not able to find in the manual.

PROGRAM:CMA

```
1:  Input "C1 ",C                 Input left cortex measurement to variable C
2:  Input "M1 ",M                 Input left medulla measurement to M
3:  Input "A ",A                  Input axis measurement to A
4:  Input "M2 ",N                 Input right medulla measurement to N
5:  Input "C2 ",D                 Input right cortex measurement to D
6:  C+M+A+N+D  B                  Sum C, M, A, N, and D; store result to branch thickness B
7:  100((C+D)/2)/B  P             Compute mean cortex thickness as % of B, store to P
8:  100((M+N)/2)/B  Q             Compute mean medulla thickness as % of B, store to Q
9:  100(A/B  R                    Compute axis thickness as % of B, store to R
10: round({P,Q,R,},0  L1          Round C, M, and A, store to list L1
11: round(6.2*{(C+D)/2,           Round mean tissue thicknesses, multiply by microscope
      (M+N)/2, A, B},0  L2        scale factor, store to list L2
12: {C,M,A,N,D}  L3               Store original data (eyepiece micrometer units) to list L3
13: Disp "C",round(P,0)           Display % thickness of cortex rounded to 0 decimal places
14: Disp "M",round(Q,0)           Display % thickness of medulla
15: Disp "A",round(R,0)           Display % thickness of axis
16: Disp "ENTER CONTINUES"        Message following display of results
17: Pause                         Wait while message is displayed
18: Disp "STAT+ENTER:TBL"         Instructions for displaying table of data and results
```

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Under the dissecting 'scope at about 15x, remove a longitudinal sliver of cortex from the "largest part of the largest branch" (Clerc 1987, but see note below), exposing a cross section of the branch. The deepest part of the cut should be at the center of the branch so that the true relative thicknesses of cortex, medulla and axis are visible. Run the program by pressing the PRGM key, selecting the program by name and pressing ENTER when the highlight is on EXEC. At higher magnification (35x), orient the branch vertically in the field of view, select a full, typical diameter and, moving from left to right, record the following thicknesses from the eyepiece micrometer in micrometer units: left cortex, C1; left medulla, M1; axis, A; right medulla, M2; right cortex, C2 (Clerc 1987, fig.1). There is no need to use actual measurements, since the calculations involve only ratios; if the micrometer scale is recorded along with the measurements, thicknesses in microns can be calculated when needed. Sometimes papillae and tubercles are small or confluent such that it is tempting to measure thickness of cortex from their apices; I measure from the base of the papillae or tubercles rather than from their apices.

To display the table, press STAT followed by ENTER. The first column shows the %C, %M, and %A values; the second column gives the corresponding tissue thicknesses in microns (means for C and M, one side); and the third column is a list of the data you entered. Note that the list of variables stored to a TI-82 list is enclosed in curly braces. Enter the scale factor for your eyepiece micrometer in place of the value 6.2 in line 11. If you do not want the table option, omit lines 10 through 12 and 16 through 18.

Note: In my experience, the CMA varies dramatically with the size of the branch, and the largest part of the largest branch (Clerc 1987) will not necessarily have the characteristic CMA. It might be better to specify the branch to be sectioned as having a certain diameter at its widest point relative to the diameter of the trunk at its widest point, e.g., the diameter of a 50% branch would be half the diameter of the trunk.

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The genus *Dicranella* (Musci: Dicranaceae) in Maine

Bruce Allen[1]

Dicranella is a genus of small mosses often found on bare soil in disturbed places. It has a simple gametophyte marked by a dioicous sexual condition and leaves with both a long, single costa and no alar cell differentiation. Within individual plants of *Dicranella* leaf size, cell form, margin stance, and costal length often vary considerably depending on the position of the leaves. Leaves near the base of the stem tend to be reduced when compared to those on the upper parts of the stem nearer the perichaetial leaves. The gametophytes of *Ditrichum* and *Trematodon* are similar to those of *Dicranella*. These genera differ from *Dicranella* in sporophytic features: *Ditrichum* has longer, more cylindrical capsules and peristome teeth finely divided to the base; *Trematodon* has capsules with a very long, narrow neck.

Dicranella belongs to a generic complex whose internal boundaries are based solely on sporophytic features. Generic relationships within the complex are blurred by the reticulate distribution of sporophytic character states. Allen (1994) outlined some of the taxonomic problems in this complex and sorted out *Dicranella* and *Anisothecium* on the basis of three sporophytic features: stomata presence, annulus form, and peristome attachment. Allen's (1994) treatment also synonymized *Microdus*, sometimes considered distinct by reason of its reduced peristome teeth, with *Dicranella*. This treatment of *Dicranella/Anisothecium* was based mostly on the examination of neotropical material. The present study, however, of north temperate material indicates that these three genera are more intricately related. Indeed, it now appears that none of them deserves generic recognition because of a reticulation in the distribution of the above three characters (see Table 1), and the unique distribution of character states in *D. subulata* (Hedw.) Schimp. *Dicranella subulata* has stomata in its capsules, but the peristome is attached at the mouth and it possess a two-layered annulus that is intermediate between the two groups: simple and adherent at the surface, but complex interior to this.

The name *Dicranella* combines the generic name *Dicranum* with the diminutive Latin suffix -*ella*, i.e., Little *Dicranum*.

Table 1. Distinguishing features of three members of the *Dicranella* generic complex and *D. subulata*. Characters states: *stomata*, – absent, + present; *annulus*, + complex, usually revoluble, – simple, usually adherent; *peristome attachment*, i at mouth, b on basal membrane.

	Stomata	Annulus	Peristome attachment
Dicranella	–	–	b
Anisothecium	+	–	b
Microdus	–	+	i
D. subulata	+	– & +	i

The nomenclature surrounding this three-taxa generic complex is confusing. Grout (1936) lectotypified *Dicranella* with a species of *Anisothecium*, but this choice was recently overturned by the designation of a conserved type for *Dicranella* (Zijlstra 1998) which makes possible the recognition of both genera. Although *Microdus* is a later synonym of *Leptotrichella* (Ochyra

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1997) at the generic level, at the subgeneric level *Microdus* has priority, while *Leptotrichella* again has priority at the sectional level.

Dicranella (C. Müll.) Schimp., Coroll. Bryol. Eur. 13. 1855.
Anisothecium Mitt., J. Linn. Soc., Bot. 12: 39. 1869.
Leptotrichella (C. Müll.) Lindb., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad.21: 185. 1864.
Microdus Schimp. *in* Besch., Mem. Soc. Sci. Nat. Cherbourg 16: 161. 1872.

Plants small or medium, terrestrial, gregarious or in tufts and mats; stems erect, simple or forked, radiculose at base. Leaves distant and reduced below, upper leaves crowded, erect-appressed to erect-spreading, recurved, squarrose or curved-secund, lanceolate from an erect-spreading or clasping base, gradually or abruptly narrowed above to a linear or subulate limb; margins plane or recurved, entire throughout or entire below and serrulate to denticulate at apex, or serrulate throughout; costa single, stout, subpercurrent, percurrent, or excurrent; cells linear to subquadrate, smooth, firm- or thin-walled, not pitted, alar cells not differentiated. Dioicous. Setae elongate, erect, straight or flexuous; capsules ovoid, globose or oblong occasionally cylindric, erect or curved, smooth or ribbed when dry, struma present or absent; stomata present or absent; annuli variable: large, compound, revoluble; of several rows of small, quadrate, loosely coherent cells variously persistent at the capsule mouth after dehiscence; complex, at surface with several rows of small thick-walled cells adhering to the capsule mouth after dehiscence, interior to this a compound, structure. Opercula conic-rostrate. Peristome teeth 16, well-developed or reduced, reddish, undivided or divided to below the middle into 2 papillose forks, dorsal lamellae vertically striate-papillose or irregularly papillose, inserted at mouth or on a short, smooth basal membrane. Calyptrae cucullate, smooth, entire at base. Spores smooth, lightly roughened to densely papillose or warty.

1. Vegetative leaves clasping at base ..... 2.
1. Vegetative leaves erect-spreading at base ..... 3.
2. Leaves long-decurrent, obtuse or rounded to cucullate at apex ..... *D. palustris*
2. Leaves not decurrent, acute to obtuse at apex ..... *D. schreberiana var. robusta*
3. Leaves lanceolate to narrowly ovate-lanceolate; costa usually long-excurrent, filling most of the upper leaf blade 4
3. Leaves triangular-lanceolate to broadly lanceolate; costa subpercurrent to percurrent, lamina extending to the apex 6
4. Perichaetial leaves clasping at base, spreading or squarrose above; setae red; capsules with stomata ..... *D. subulata*
4. Perichaetial leaves not clasping at base, widely spreading or secund above; setae yellow; capsules without stomata 5

5. Median leaf cells short-rectangular, firm-walled, 11–27 μm x 5 μm; shoulder margins lightly doubly serrulate; capsules evenly thickened at neck ..... *D. heteromalla*
5. Median leaf cells elongate-rectangular, lax, 22–62 μm x 5–7 μm; shoulder margins entire to slightly serrulate; capsules strumose ..... *D. cerviculata*
6. Leaf margins plane, sinuate-dentate at and above the shoulders, median leaf cells thin-walled, bulging at the margins ..... *D. rufescens*
6. Leaf margins recurved, entire except at tip, median leaf cells firm-wall throughout ..... *D. varia*

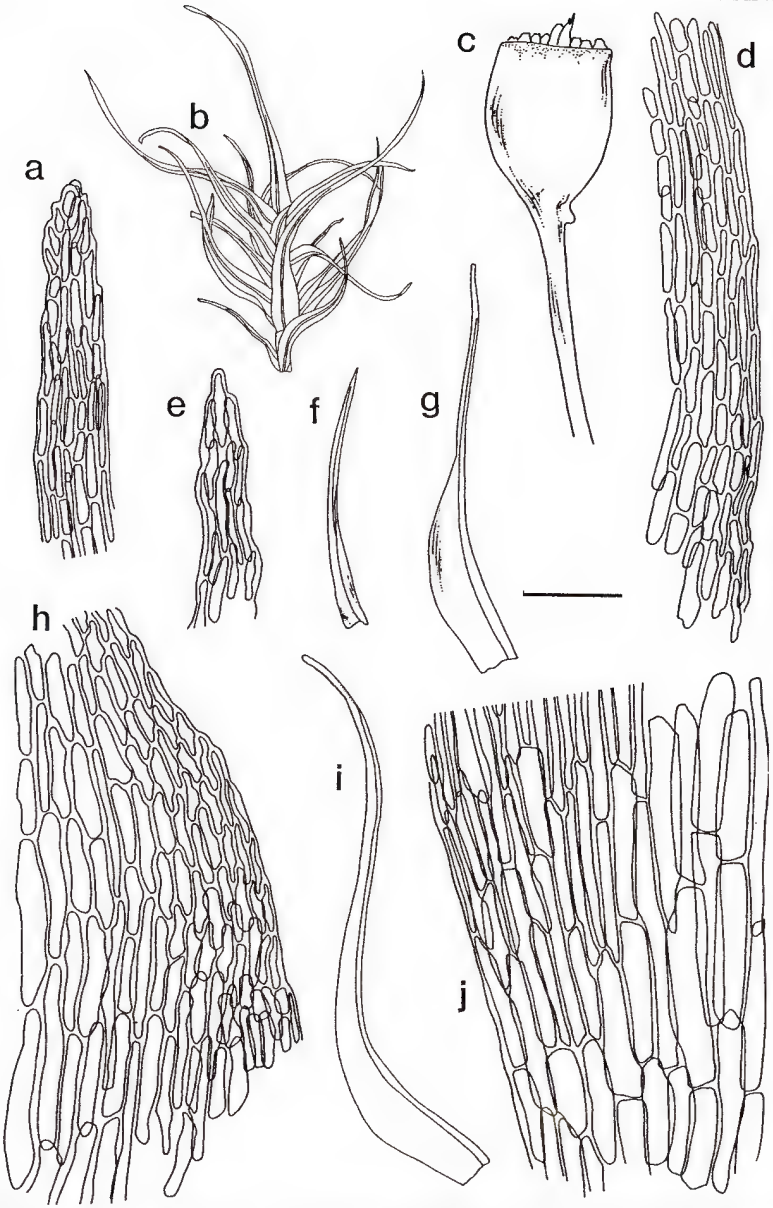

Figure 1. *Dicranella cerviculata*. a. Leaf apex. b. Habit. c. Capsule. d. Median leaf margin just above leaf base. e. Leaf Apex. f.,g.,i. Leaves. h. Leaf margin at upper part of leaf base. j. Basal leaf margin. Scale in mm: bar = 0.05 (a,d,e,h,j); bar = 0.46 (f,g,i); bar = 0.64 (c); bar = 1.06 (b). Figures a,d,e,h,j from *Merrill 135* (MO); figures b,c,f,g,i from *Allen 14718* (MO).

1. *Dicranella cerviculata* (Hedw.) Schimp., Coroll. Bryol. Eur. 13. 1855.
Dicranum cerviculatum Hedw., Sp. Musc. Frond. 149. 1801.

Plants small, shiny, yellow-green to yellow-brown in tufts, lightly radiculose at base, rhizoids smooth or lightly roughened. Stems 4–6 mm high. Leaves lanceolate to ovate-lanceolate, 1.5–3 mm long, erect-spreading at base, erect-flexuous to curved-secund, gradually narrowed to the apex; margins erect to weakly recurved at midleaf, entire to slightly serrulate at the shoulders and apex; costa long-excurrent, filling most of the upper leaf blade; median and upper leaf cells elongate-rectangular, lax, bulging and thin-walled, 22–62 µm x 5–7 µm, basal leaf cells elongate, thin-walled, bulging. Setae single, yellow, at times becoming red with age, 6–7 mm long; capsules suberect and curved, 0.75–1.0 mm long, ovoid, when dry smooth, sometimes furrowed when old, strumose, stomata absent; opercula 1.0 mm long, conic at base, long-rostrate above; annulus imperfect, of a single row of small, thick-walled cells often adhering to the capsule mouth after dehiscence; peristome teeth 300–350 µm long, divided halfway to the base into two hyaline, papillose forks, red and strongly striate-papillose in lower half, teeth on a very low, smooth basal membrane. Spores 17–25 µm, smooth to lightly roughened. Calyptra 2 mm long.

On humus or soil on ground in woods, at base of cliffs, in bogs, or on upturned stumps. In Maine known from Androscoggin (*Allen 14718* MO), Oxford (*Adams s.n.* MO, NY), Piscataquis (*Merrill 135* MO), and Washington (*Holmes 136* MO) Counties.

Dicranella cerviculata can be confused with *D. heteromalla* since both have a similar field aspect, yellow setae, and sometimes grow mixed. The presence of a capsule struma in *D. cerviculata* is often used to separate the two species. However, struma development in *D. cerviculata* is variable and because the capsules of *D. heteromalla* are sometimes distinctly thickened at the neck this feature is not fully reliable in distinguishing the two. When compared side by side, *D. heteromalla* has a firmer, more sleek and slender aspect than *D. cerviculata* which often has a flaccid aspect due to its more spreading leaves and thicker subula. In addition, the capsules of *D. heteromalla* are narrower than those of *D. cerviculata*. The best distinguishing features of the two species are found in their median leaf cells, leaf margins, and upper leaf lamina. In *D. cerviculata* the median leaf cells are elongate-rectangular and have thin, bulging walls, while those of *D. heteromalla* are short-rectangular and firm-walled. The leaf margins in *D. cerviculata* are entire to faintly serrulate while those of *D. heteromalla* are lightly doubly serrulate. The costa in *D. cerviculata* fills the entire upper leaf lamina while in *D. heteromalla* a narrow band of laminal cells reaches 2/3 the leaf length.

2. *Dicranella heteromalla* (Hedw.) Schimp., Coroll. Bryol. Eur. 13. 1856.
Dicranum heteromallum Hedw., Sp. Musc. Frond. 128. 1801.

Plants small to medium, shiny, dark-green to green, at times yellow-green to yellow-brown in tufts, lightly radiculose at base, rhizoids smooth or lightly roughened. Stems 5–35 mm high. Leaves lanceolate to narrowly ovate-lanceolate, 3–4 mm long, erect-spreading at base, erect-flexuous to curved-secund, gradually narrowed to the apex; margins erect to plane, lightly doubly serrulate at the shoulders, serrate to spinose at apex; costa excurrent; median and upper leaf cells subquadrate to short-rectangular, firm-walled, not bulging, 11–27 µm x 5 µm, basal leaf cells elongate, firm-walled. Setae single, yellow, at times becoming red when old, 7–15 mm long capsules ovoid to oblong, suberect or curved, 0.8–2.0 mm long, when dry smooth when

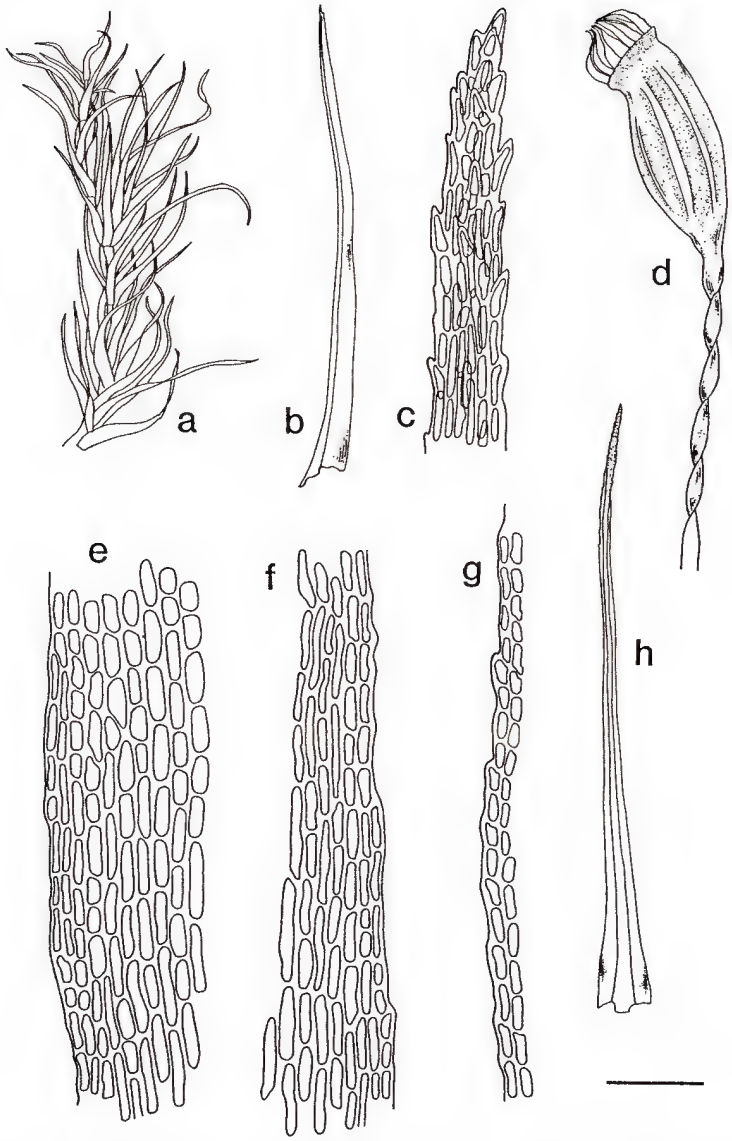

Figure 2. *Dicranella heteromalla*. a. Habit. b. & h. Leaves. c. Leaf apex. d. Capsule. e. Basal leaf margin. f. Median leaf margin. g. Upper leaf margin. Scale in mm: bar = 0.05 (c,e,f,g); bar = 0.49 (b,h); bar = 0.5 (d); bar = 1.14 (a). Figures a,d from *Allen 16478* (MO); figures b,c,e-h from *Allen 14592* (MO).

young, strongly furrowed when old, not strumose, occasionally thickened at neck, stomata absent; opercula 0.8–1.0 mm long, conic at base, long-rostrate above; annulus imperfect, of a single row of small, thick-walled cells adhering to the capsule mouth after dehiscence; peristome teeth 350–450 µm long, divided halfway to the base into two hyaline, papillose forks, red and strongly striate-papillose in lower half, teeth on a very low, smooth basal membrane. Spores 9–15 µm, smooth to lightly roughened. Calyptra 1.5–2 mm long.

On bare soil of trails and stream banks or humus on roots, tree bases, overturned stumps, rotting logs, over rocks and boulders, and crevices of seeping cliffs. In Maine known from Androscoggin (*Allen 14702* MO), Aroostook (*Allen 16478* MO), Cumberland (*Allen 5992* MO), Franklin (*Allen 10238* MO), Hancock (*Allen 3742* MO), Kennebec (*Allen 10125* MO), Knox (*Allen 6038* MO), Lincoln (*Allen 21109* MO), Oxford (*Allen 16685* MO), Penobscot (*Merrill 10* MO), Piscataquis (*Merrill 11a* MO), Sagadahoc (*Allen 14592* MO), Somerset (*Allen 9428* (MO), Waldo (*Allen 10355* MO), Washington (*Pedano 326* MO), and York (*Redfearn 31132* MO) Counties.

Dicranella heteromalla is a remarkably widespread species, found throughout the Northern Hemisphere, Central and western South America, India, and in northern to middle Africa. It is a very common species on bare soil or humus in Maine and is extremely variable in size. When found in ephemeral habitats (overturned stumps and fire pits) or in weedy places (along roads, sidewalks, or trails) the plants are usually small, while in more stable places (crevices of cliff faces and boulders) the plants can be medium-sized. *Dicranella heteromalla* has yellow setae, lanceolate, falcate-secund leaves that gradually narrow to the apex, and distinctly curved capsules. When mature and dry the capsules are erect at base but pinched and sharply inclined, nearly vertically, just below the mouth and strongly furrowed. Its gametophyte is similar to that of *D. cerviculata*, and both species have yellow setae. *Dicranella cerviculata* differs from *D. heteromalla* in its distinctly strumose capsules and more flaccid appearance due to its more spreading leaves and thicker leaf subula. Furthermore, *D. cerviculata* has thinner-walled, bulging median leaf cells that are longer than those of *D. heteromalla*, and while the leaf margins in *D. cerviculata* are entire to faintly serrulate those of *D. heteromalla* are lightly doubly serrulate. In addition, the costa in *D. cerviculata* fills the entire upper leaf lamina while in *D. heteromalla* a narrow band of laminal cells continues up to 2/3 the leaf length.. Both *D. cerviculata* and *D. heteromalla* have a simple, adherent annulus, and a peristome borne on a very short, smooth basal membrane (see Ireland, 1982). These character states (simple, adherent annulus and peristome basal membrane) are features of the *anisothecium*- group, but unlike the members of that group the capsules of *D. heteromalla* and *D. cerviculata* lack stomata.

3. *Dicranella palustris* (Dicks.) Crundw. *ex* Warb., Trans. Brit. Bryol. Soc. 4: 247. 1962.
Bryum palustre Dicks., Fasc. Pl. Crypt. Brit. 4: 11. 1801.
Anisothecium palustre (Dicks.) Hagen, Kongel. Norske Vidensk. Selsk. Skr. (Trondheim) 1914(1): 35. 1915.
Dicranum squarrosum Starke, J. Bot. (Schrader) 1801(1): 68. 1803.
Dicranella squarrosa (Starke) Schimp., Syn. Musc. Eur. 71. 1860.

Plants medium, shiny, light-green to yellowish-green, in tufts, lightly radiculose below, rhizoids smooth. Stems 5–50 mm high. Leaves oblong to broadly ovate-lanceolate, 2–3 mm long, well-spaced, squarrose to squarrose-recurved from an erect, clasping, oblong to obovate, long-decurrent base, gradually tapered above, rounded to obtuse, at times cucullate,

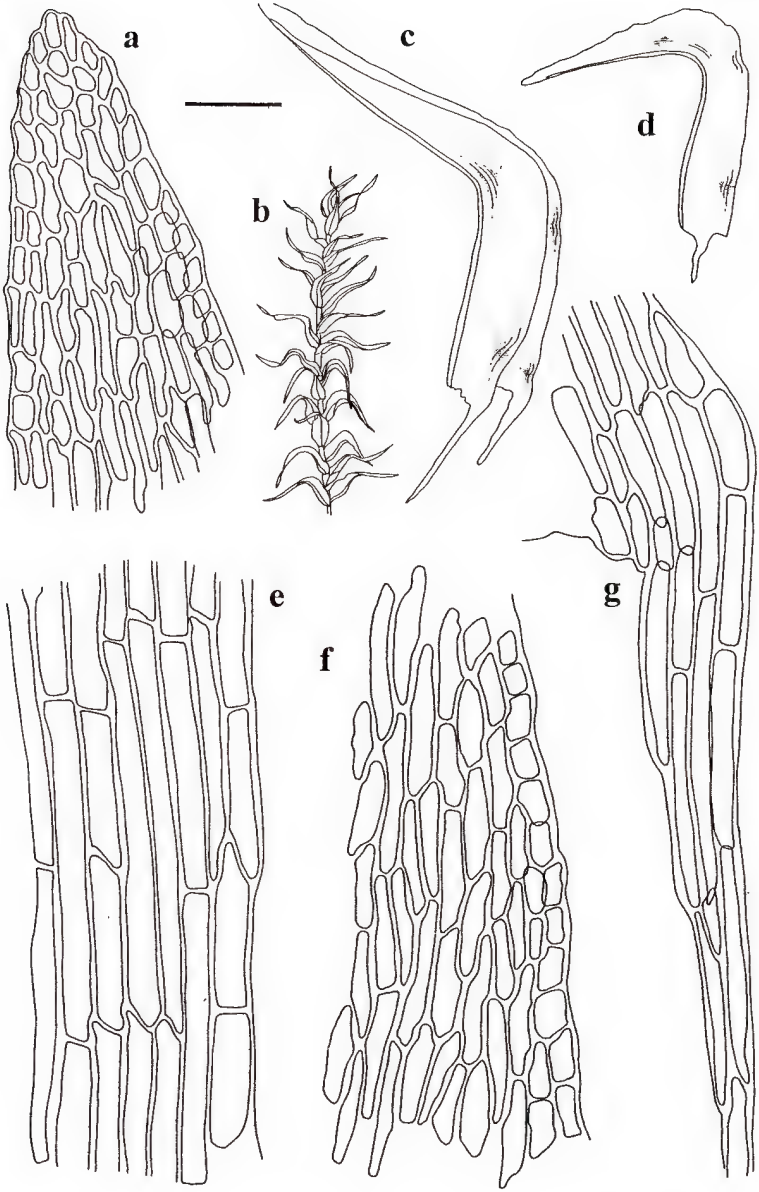

Figure 3. *Dicranella palustris*. a. Leaf apex. b. Habit. c. & d. Leaves. e. Basal leaf cells. f. Median leaf margin. g. Basal leaf margin with leaf decurrency. Scale in mm: bar = 0.05 (a,e,f,g); bar = 0.56 (c,d); bar = 2.8 (b). Figures a,c-g from *Allen 2278* (MO); figure b from *Rand* (MO).

subtubulose, contorted when dry, concave when wet; margins entire or irregularly crenulate above; costa subpercurrent; median and upper leaf cells short-rectangular to quadrate along the margins, otherwise rectangular to long-rectangular, firm-walled, 38–76 µm x 4–16 µm, basal leaf cells elongate to linear, firm-walled, 66–140 µm x 4–16 µm. Sporophytes not known in eastern North America.

On sandy soil at edges of streams or ponds and in seeps, occasionally submerged; at times along roadsides. In Maine known from Hancock (*Allen 3742* MO) and Oxford (*Rand s.n.* NY) Counties.

Dicranella palustris has distinctive squarrose to squarrose-recurved leaves that are clasping at base, entire, broadly rounded to obtuse at the apex and long-decurrent. *Dicranella subulata* and *D. schreberiana* var. *robusta* are similar to *D. palustris* in having clasping leaf bases. In *D. subulata*, however, only the perichaetial leaves are clasping and it further differs from *D. palustris* in its narrower leaves and long-excurrent costae. *Dicranella schreberiana* var. *robusta* and *D. palustris* are similar in aspect, but *D. schreberiana* var. *robusta* has more acute, irregularly serrulate leaf apices, and non-decurrent leaf bases.

The leaves of *D. palustris* are well-spaced on the stem, but with considerable variation in the degree of their separation. Plants from wet habitats often have such well-spaced leaves that they do not overlap at base, while plants from dry habitats have leaves that overlap considerably at base.

4. *Dicranella rufescens* (With.) Schimp., Coroll. Bryol. Eur. 13. 1855.
Bryum rufescens With., Syst. Arr. Brit. Pl., ed. 4, 3: 801. 1801.
Dicranum rufescens (With) Turn., Musc. Hibern. 66. 1804.
Anisothecium rufescens (With.) Lindb., Musci Scand. 26. 1879.

Plants small, green, reddish-brown, in tufts, lightly radiculose below, rhizoids smooth or lightly roughened. Stems 5–10(–15) mm high. Leaves 1–2 mm long, lower leaves distant and spreading, upper leaves erect-spreading to subsecund, triangular-lanceolate to broadly lanceolate, gradually narrowed to a broadly acute apex, somewhat keeled above; margins plane, slightly serrulate to sinuate-dentate at and above the leaf shoulders, serrulate at apex; costa broad, percurrent, occasionally subpercurrent or shortly excurrent; leaf cells long-rectangular, thin-walled, 40–60 µm x 6–10 µm, marginal leaf cells somewhat inflated and bulging. Setae 5–7 mm long, red-brown, smooth; capsules 0.75 mm long, ovoid, reddish-brown, erect, symmetrical, smooth, stomata present, annulus of several rows of small, quadrate, loosely coherent cells variously persistent at the capsule mouth after dehiscence; opercula 0.5–0.6 mm long, conic at base, short-rostrate; peristome teeth 300–350 µm high, red, striate-papillose, divided 1/2 their lengths, basal membrane 50 µm high, smooth, dark red, with thick trabeculae. Spores 16–25 µm, lightly papillose, yellowish. Calyptra not seen.

On soil. In Maine known from Piscataquis (*Dunham* MAINE) County. Reported from Franklin (Parlin, 1939) County.

Dicranella rufescens has triangular-lanceolate to broadly lanceolate leaves gradually narrowed to a broadly acute apex, usually a percurrent costa, and long-rectangular, thin-walled cells that are often inflated and bulging at the margin. Its lowermost leaves are commonly reduced, and the

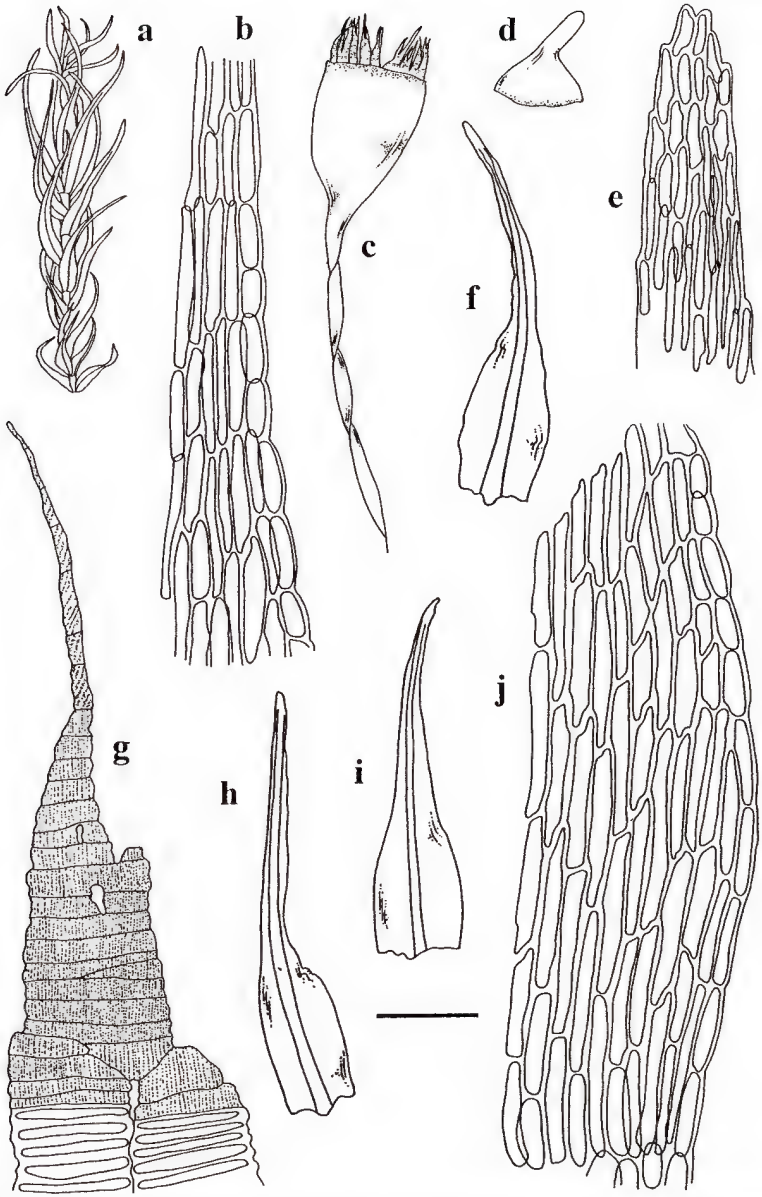

Figure 4. *Dicranella rufescens*. a. Habit. b. Median leaf margin. c. Capsule. d. Operculum. e. Leaf apex. f,h,i. Leaves. g. Peristome tooth, outer (dorsal) surface. j. Basal leaf margin. Scale in mm: bar = 0.05 (b,e,g,j); bar = 0.34 (f,h,i); bar = 0.5 (c,d); bar = 1.22 mm (a). Figure a from *Hutchinson* (MO); figures b,c,d,f,h,i,j from *Moosehead Lake* (NY); figures e,g from *Dunham* (MO).

perichaetial leaves are broadly ovate, at times sheathing the base of the setae. *Dicranella rufescens* belongs to the *anisothecium*-group which is distinguished by a combination of three features: capsules with well-formed stomata, a rudimentary annulus that consists of little more than several rows of weakly differentiated cells, and a peristome borne on a well-developed, smooth basal membrane. *Dicranella varia* and *D. schreberiana* var. *robusta* are the other members of the *anisothecium*-group in Maine. The former has similar shaped leaves, but it differs from *D. rufescens* in having entire, narrowly recurved leaf margins with firm-walled, non-bulging marginal leaf cells and evenly papillose peristome teeth. *Dicranella schreberiana* var. *robusta* differs from *D. rufescens* in having leaves squarrose to squarrose-recurved from an erect, oblong to obovate, clasping base.

5. *Dicranella schreberiana* (Hedw.) Hilf. *ex* Crum & Anders. var. *robusta* (Schimp. *ex* Braithw.) Crum & Anders., Mosses E. N. Amer. 1: 171. 1981.
Dicranella schreberi var. *robusta* Schimp. *ex* Braithw., J. Bot. 9: 289. 1871.

Plants medium, shiny, light-green to yellowish-green, in tufts, lightly radiculose below, rhizoids smooth. Stems 5–50 mm high. Leaves oblong to broadly ovate-lanceolate, 1–1.5 mm long, closely- or well-spaced, squarrose to squarrose-recurved from an erect, clasping, oblong to obovate, non-decurrent base, gradually tapered above, acute to obtuse, subtubulose, firm, not contorted when dry; margins irregularly serrulate to serrate; costa percurrent to subpercurrent; median and upper leaf cells short-rectangular to quadrate along the margins, otherwise rectangular to long-rectangular, firm-walled, 20–40 µm x 5–6 µm, basal leaf cells long-rectangular to elongate, firm-walled, 30–80 x 8–12 µm. Setae single, dark red, 10–13 mm long; capsules ovoid, suberect or curved, 0.75–1.0 mm long, smooth, not strumose, stomata present; opercula 0.8–1.0 mm long, conic-rostrate; annulus of several rows of small, quadrate, loosely coherent cells variously persistent at the capsule mouth after dehiscence; peristome teeth to 450 µm long, divided halfway to the base into two hyaline, papillose forks, red and strongly striate-papillose in lower half, teeth attached above the mouth on a low, smooth, basal membrane. Spores 14–18 µm, smooth to lightly roughened. Calyptra not seen.

On limestone. In Maine known from Aroostook (*Allen 16388* MO) County.

Dicranella schreberiana var. *robusta* is similar to *D. palustris* in overall aspect. Both species have distinctive squarrose to squarrose-recurved leaves that are strongly clasping at base and show considerable variation in how well-spaced the leaves are on the stems. Plants from wetter habitats usually have greater spacing between the leaves than those from drier habitats. The above cited Maine collection of the species came from a dry habitat, the plants are small (5 mm high) and have leaves with overlapping leaf bases. *Dicranella palustris* differs from *D. schreberiana* var. *robusta* in having entire to irregularly crenulate leaves with more broadly rounded apices and long-decurrent leaf bases. Although *D. subulata* has clasping perichaetial leaves, it differs from *D. schreberiana* var. *robusta* in having lanceolate to ovate-lanceolate leaves with long-excurrent costae. *Dicranella schreberiana* var. *robusta* belongs to the *anisothecium*-group as indicated by the presence in its sporophyte of stomata, a rudimentary annulus, and peristome teeth attached above the mouth on a short, smooth basal membrane.

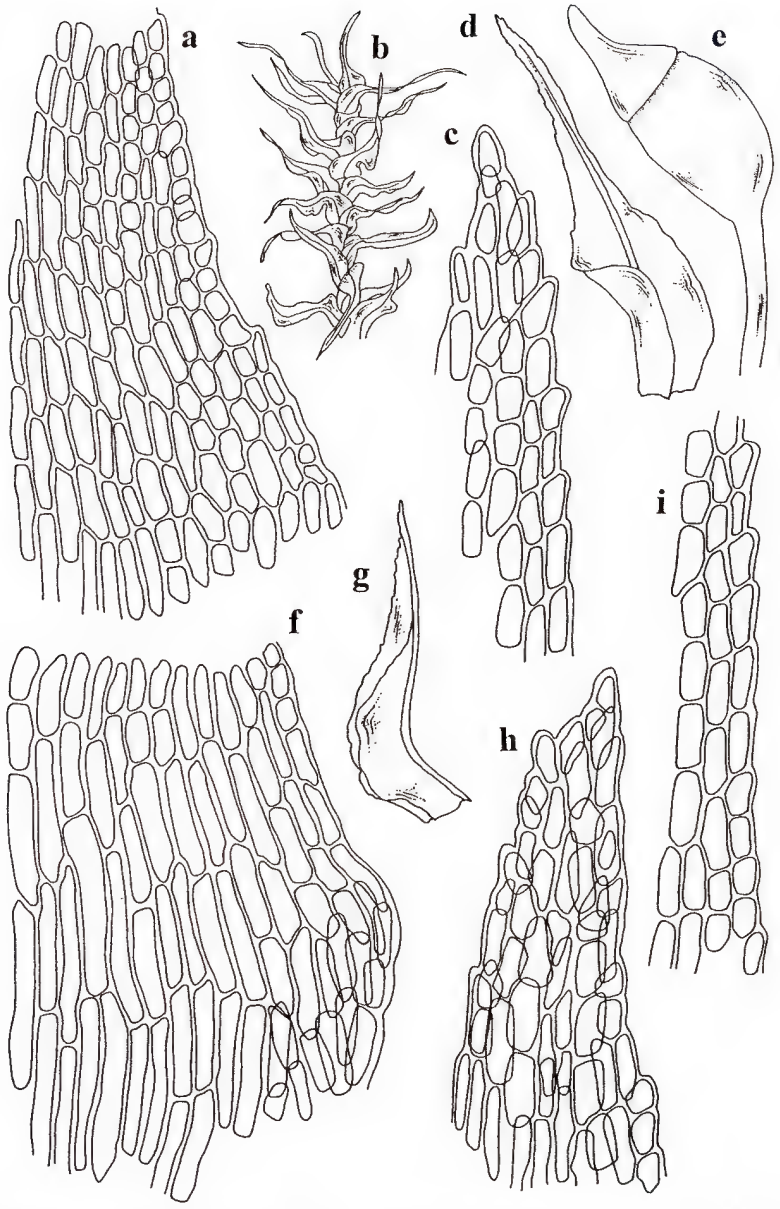

Figure 5. *Dicranella schreberiana* var. *robusta*. a. Median leaf margin. b. Habit. c. & h. Leaf apices. d. & g. Leaves. e. Capsule. f. Basal leaf margin. i. Upper leaf margin. Scale in mm: bar = 0.05 (a,c,f,h,i); bar = 0.34 (d,g); bar = 0.69 (e); bar = 1.14 (b). Figures a-d, f–i from *Allen 16388* (MO); figure e from *Ireland 12834* (MO).

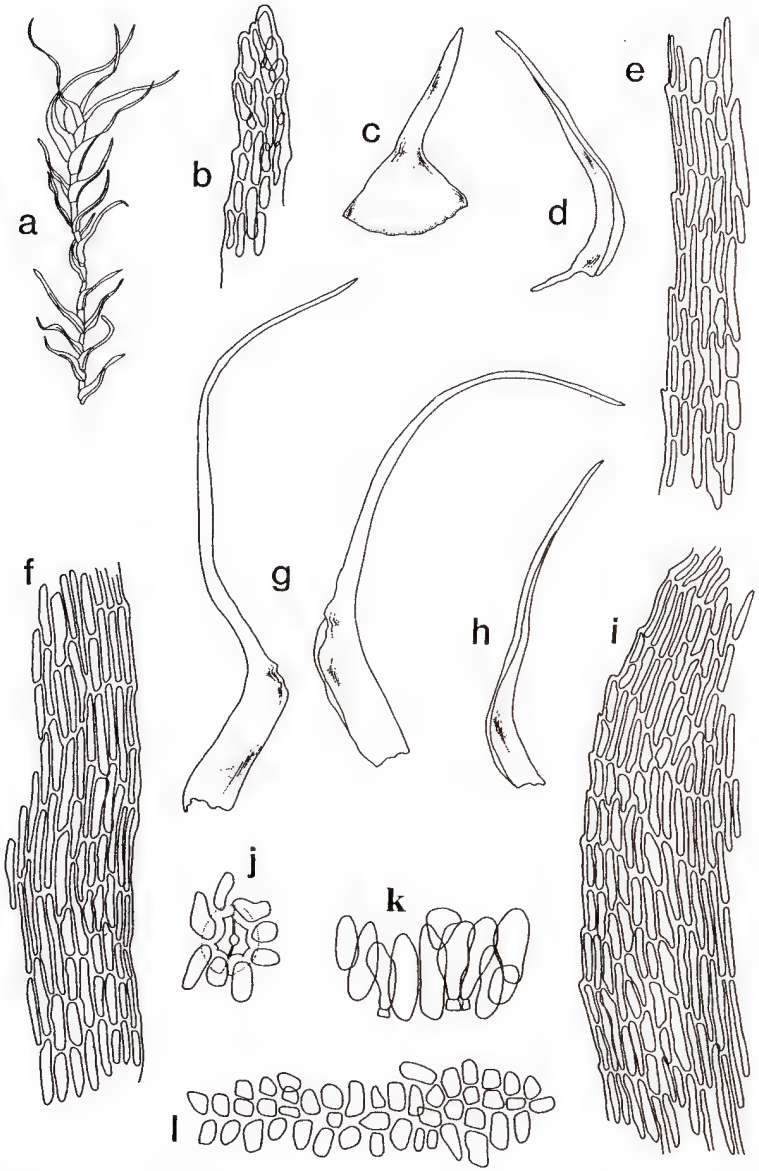

Figure 6. *Dicranella subulata*. a. Habit. b. Leaf apex. c. Operculum. d. & h. Leaves. e. Upper leaf margin. f. Basal leaf margin. g. Pericahetial leaves. i. Median leaf margin. j. Stomata. k. Inner annulus. l. Outer annulus. Scale in mm: bar = 0.05 (b,e,f,i,j,k,l); bar = 0.5 (c,d,g,h); bar = 1.9 (a). All figures from *James s.n.* (MO).

6. *Dicranella subulata* (Hedw.) Schimp., Coroll. Bryol. Eur. 13. 1855.
Dicranum subulatum Hedw. Sp. Musc. Frond. 128. 1801.

Plants small, shiny, yellow-green to green, in tufts, lightly radiculose at base, rhizoids smooth or lightly roughened. Stems to 10 mm high. Leaves lanceolate to narrowly ovate-lanceolate, 1–2 mm long, erect-spreading at base, flexuous above, gradually subulate; margins erect, serrulate to denticulate at the shoulders and at the apex; costa long-excurrent; median and upper leaf cells rectangular, firm-walled, not bulging, 24–30 μm x 4 μm, basal leaf cells long rectangular, firm-walled, 24–48 μm long. Perichaetial leaves flexuous-spreading to squarrose, oblong-clasping at base, abruptly subulate above, to 3 mm long. Setae single, red, 9–13 mm long; capsules ovoid to oblong, suberect or curved, 1–1.3 mm long, furrowed when dry, not strumose, stomata present in neck; opercula 0.5–1.0 mm long, conic at base, long-rostrate above; annulus complex, at surface consisting of several rows of small thick-walled cells adhering to the capsule mouth after dehiscence, interior to this an enlarged, compound structure; peristome teeth 370 μm long, divided halfway to the base into two hyaline, spirally papillose forks, red and strongly vertically striate-papillose in lower 1/2, teeth inserted at the mouth. Spores 16–22 μm, smooth to lightly roughened. Calyptra 1 mm long.

On soil. In Maine known from Oxford (*Parlin s.n.* NY, *Bacon 547* NY) County.

Dicranella subulata is distinguished by its red setae, strongly clasping perichaetial leaves, long-excurrent costae, stomatose capsules, and remarkable two-layered annulus. The common *D. heteromalla* differs from it in having yellow setae, non-clasping perichaetial leaves, and non-stomatose capsules that have an oblique mouth and simple annulus. *Dicranella palustris* and *D. schreberiana* var. *robusta* also have clasping perichaetial leaves, but they differ from *D. subulata* in having clasping, squarrose to squarrose-recurved vegetative leaves that have broad apices and subpercurrent to percurrent costae. *Dicranella palustris* further differs from *D. subulata* in having leaves long-decurrent at base.

Although *D. varia* and *D. rufescens* are similar to *D. subulata* in having stomatose capsules and red setae, they differ in having non-clasping perichaetial leaves, triangular-lanceolate leaves, percurrent to short excurrent costae, and simple annuli. In addition, *D. varia* has smooth capsules and recurved upper leaf margins, while *D. rufescens* has erect capsules and broad, thin-walled, bulging marginal leaf cells.

Dicranella subulata is a critical species for understanding the entire *Dicranella*-complex because it mixes *microdus*-group (no peristome basal membrane) and *anisothecium*-group (stomata in capsule) features with a feature intermediate (complex annulus) to the two groups.

7. *Dicranella varia* (Hedw.) Schimp., Coroll. Bryol. Eur. 13. 1856.
Dicranum varium Hedw., Sp. Musc. Frond. 133. 1801.
Anisothecium varium (Hedw.) Mitt., J. Linn. Soc., Bot. 12: 40. 1869.

Plants small in dull, dirty-green, light-green, or yellow-green tufts, lightly radiculose at base, rhizoids smooth or lightly roughened. Stems 3–10 mm high. Leaves triangular-lanceolate, 1–2 mm long, from a lanceolate base gradually narrowed to a broadly acute apex, lower leaves distant and spreading, upper leaves erect-spreading to subsecund; margins irregularly recurved,

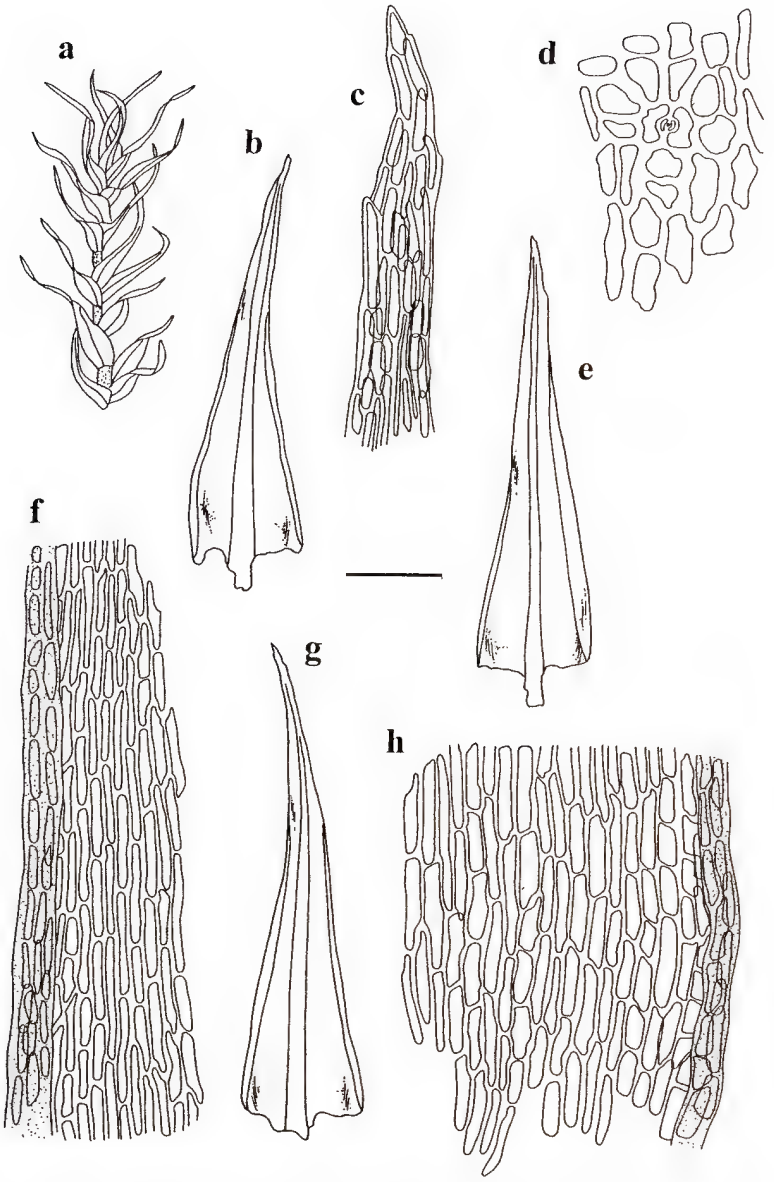

Figure 7. *Dicranella varia*. a. Habit. b,e,g. Leaves. c. Leaf apex. d. Stomata and exothecial cells. f. Median leaf margin. h. Basal leaf margin. Scale in mm: bar = 0.05 (c,d,f,h); bar = 0.34 (b,e,g); bar = 1.14 (a). Figures a–c, e–h from *Allen 16388A* (MO); figure d from *Blake 43* (NY).

entire below, denticulate at tip; costa percurrent to subpercurrent; median cells oblong-linear, firm-walled throughout, 20–45 µm x 2–6 µm. Setae red, 5–7 mm long, erect to weakly flexuous; capsules erect to weakly inclined and curved, 0.8–1.2 mm long, ovoid, smooth, not strumose; stomata present in neck; opercula 0.5–0.7 mm long; peristome teeth 350–400 µm long, red, lightly and evenly papillose, divided 1/2 their lengths, basal membrane 50 µm, smooth, dark red, with thick trabeculae. Spores 17–20 µm, lightly papillose, yellowish. Calyptra not seen.

On limestone. In Maine known from Aroostook (*Allen 16388A* MO) and Cumberland (*Blake 43* NY) Counties. Reported from Hancock (Greenwood 1927) and Franklin (Parlin 1939) Counties.

Dicranella varia has non-clasping, triangular-lanceolate leaves with percurrent to subpercurrent costae. In this respect it resembles *D. rufescens* which differs from *D. varia* in having thin-walled, often bulging leaf cells and plane leaf margins. *Dicranella varia* belongs to the *anisothecium*-group and so has a simple annulus, stomata in its capsules, and peristome teeth borne on a short, thickened, smooth basal membrane. The flexuous seta in this species appears to be a weak expression of a cygneous seta. *Dicranella varia* is a widespread species found throughout the Northern Hemisphere with extensions into Central America (Guatemala) and western South America (Peru).

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Lichen Diversity and Biomass in Relation to Management Practices in Forests of Northern Idaho

Abbey L. Rosso[1] and Roger Rosentreter[2]

This note summarizes the results of a study comparing lichen diversity and biomass across four stand types in forests of Northern Idaho. The study was conducted as part of a week-long course on lichen ecology and identification, held at Priest River Experimental Forest Research Station during the summer of 1998. The course was taught by the authors, and sponsored by the USDA Forest Service. It brought together professional botanists and foresters from Idaho, Montana, Oregon and Washington. Participants included: Mike Arvidson, Teresa Catlin, Bonnie England, LeAnn Eno, Leslie Ferguson, Therese Gibson, Anne E. Hammet, Leonard Lake, Karen Larson, Mike Mancuso, Maria Mantas, Mark Mousseaux, Lee Paladina, Sara Pearl, Dianne Penny, Marlene Reynolds, Linda Swartz, and Arthur Zack.

Priest River Experimental Forest is located 1 degree south of the Canadian border, and is centered in the inland extension of oceanic influence (McCune, 1984; McCune and Rosentreter, 1998). Participants in a previous year's course surveyed lichens in various habitat types within the experimental forest to document species present in the area (McCune and Rosentreter, 1998). Our surveys were designed as a first look at potential effects of various management regimes on lichen communities in the region. We hope our results serve as a starting point and inspiration for larger studies.

Lichen communities are known to differ between old and young stands (Lesica et al., 1991; McCune, 1993; Neitlich, 1993). In forests west of the Cascades, green tree retention may help retain species that would otherwise be missing or sparse in young managed stands (Peck and McCune, 1997). However, less is known about effects of management on lichen communities in the drier forests of Idaho. Maintenance of forage lichens is particularly important in these forests, as they are food for the federally-listed woodland caribou which inhabit the region, as well as for northern flying squirrels (Rosentreter et al., 1997), red-backed voles, and other wildlife (Sharnoff and Rosentreter, 1998).

METHODS. We surveyed for lichens in six sites: a clear cut, a 15 yr old stand, two shelterwood stands, and two mature stands. One full set of stands was located in the checkerboard of state forest lands adjacent to the Priest River Experimental Forest, and an additional shelterwood/mature pair was located within the experimental forest. In the shelterwood stands, scattered mature trees had been left during the initial harvest to moderate climate. Although the intent of a shelterwood system is to remove these remnant trees once the younger cohort is established, the stands are similar initially to a green-tree retention cut.

The potential vegetation of all sites was within the *Tsuga heterophylla* series (Cooper et al., 1991). Additional characteristics of each site are summarized in Table 1.

In each stand we placed one large circular plot (34.7m radius), as per Forest Health Monitoring (FHM) protocols (McCune et al., 1997). For lichen community surveys, we followed FHM

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methods except that we included a search for ground dwelling species (< 0.5 m from the ground) in addition to the search for epiphytes (McCune and Rosentreter, 1998). To estimate relative biomass among stands, we used litter pickup of lichen functional groups (McCune, 1994), with 12, 2-m radius subplots per FHM plot. Three groups each surveyed 2 stands, with those most experienced in lichen identification divided among groups. In each stand, 2 people completed the litter pickups, while 2-3 people surveyed for epiphytes, and one person surveyed for ground species. Data from the epiphyte surveys were pooled within each stand, with the final abundance codes representing the maximum recorded among surveyors (see Table 2).

RESULTS AND DISCUSSION. Species documented for each stand are listed in Table 2. Litter biomass and species richness for each of the stands are shown in Fig 1.

The results from these stands suggest that many lichen species can establish relatively quickly after harvest, as soon as 15 years, though biomass accumulates more slowly. As expected, the recent clearcut (CC-St) had lowest species richness of all stands, and many of the documented species were associated with a single large stump that was within the plot (9 of the 13 species). The 15 yr old stand (15yr-St) had considerably more lichen richness than the clearcut, and much more than we had anticipated. Most of the additional richness was green algal foliose species ("other" lichens), such as *Cetraria platyphylla*, *Hypogymnia physodes*, *Hypogymnia tubulosa*, and *Vulpicida canadensis*. The rapid colonization of young trees in this stand may have been facilitated by propagules from a large remnant larch located approximately100 meters outside of the plot. However, both the recent clearcut and the 15 yr old stand had very low lichen biomass, as indicated by the lack of detectable lichen litter and tiny specimens.

We had expected that shelterwood cuts would retain most of the diversity found in mature stands, and have greater species richness than young stands. However, the shelterwood stand on state forest land (SH-St) had considerably lower richness than the nearby mature stand (MA-St). Lichen richness in this shelterwood was comparable to that of the nearby 15 yr old stand. The lack of structural diversity and hardwoods in this shelterwood stand may have contributed to the relatively low species richness. A near absence of ground lichens in the shelterwood stand also contributed to the low species richness. The lack of ground lichens was likely due to the recent broadcast burn, which took place after harvest. The 15 yr old stand was also broadcast burned, but not as recently; it had both greater richness and greater abundance of ground lichens than the shelterwood stand.

In contrast with the shelterwood stand on state land, the shelterwood in the experimental forest (SH-Ex) had the greatest total richness of all stands, including the nearby mature stand (MA-Ex). This was not expected, as a high proportion of the remnants in the shelterwood had lost their tops due to windfall, and thus lost much of their lichen substrate. However, much of the richness in this stand was found on the shrubs. Shrubs and other hardwoods can be excellent substrates for lichens (Neitlich and McCune, 1997). The development of the shrub layer and associated lichens may have been fostered, in part, by the increased light after harvest, and protected from fire by the use of pile burning rather than broadcast burning after harvest. Lichen richness in the nearby mature stand (MA-Ex) may have been limited by its relatively dense canopy and associated low light levels (Table 1), and by the low structural diversity of the stand (2-layer canopy with depauperate ground cover and few shrubs, Table 1).

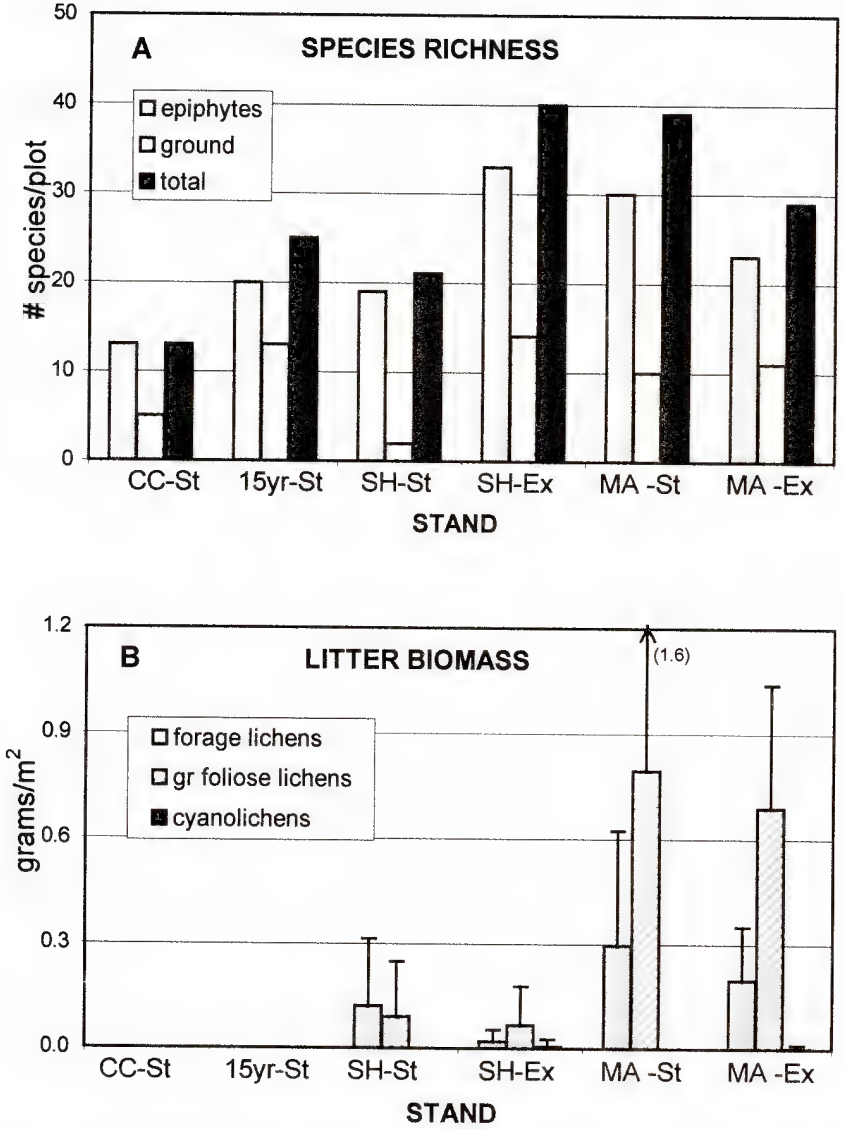

Figure 1. Species richness and lichen litter biomass for each forest stand surveyed: A. Species richness, with epiphytes, ground dwelling species, and total species shown separately. B. Average litter biomass in 12, 2-m radius subplots (biomass as g/m^2); biomass of each functional group shown separately, with error bars representing the standard deviation among subplots (1 SD). Stand abbreviations are defined in Table 1 and in the text.

While shelterwood cuts may maintain many of the species associated with older stands, they appear to be much less effective at maintaining lichen biomass. Both shelterwood cuts had less than 24% of the total biomass of litter found in either of the mature stands. This would be expected given the removal of mature trees by timber harvest. Loss of remnant trees in the experimental forest shelterwood due to windfall may have contributed further to the low biomass in that stand. Biomass in the mature stands and the experimental forest shelterwood was dominated by green algal foliose species, mainly *Platismatia glauca*. In contrast, lichen litter in the state land shelterwood was dominated by forage lichens, predominantly *Bryoria* spp.; retention trees in this stand included a high proportion of larch, which are excellent substrates for *Bryorias*. Thus, the type of trees selected for during management may influence the relative proportion of lichen functional groups in the stand. Effects on biomass, as well as richness and species composition, should be considered during forest management.

MANANGEMENT IMPLICATIONS We make several management recommendations based on our results and the field observations made during this study:

1. Retention trees should be windfirm if left scattered, or should be left in clumps if susceptible to windthrow.
2. For retention of ground lichens and shrub layers, avoid intensive broadcast burning.
3. To foster high lichen species richness, allow for development of shrubs within stands. In general, the retention and recruitment of hardwoods in conifer dominated stands should help increase lichen richness.
4. To enhance forage lichens for caribou, flying squirrels, and other wildlife that depend on lichens for winter food, maintain or enhance larch (*Larix occidentalis*) in managed stands. Larch are self- pruning, and thus maintain high light levels in their canopies which are conducive to development of dense lichen communities. They are also deciduous conifers, so light and moisture can penetrate through their canopies in the winter, yet they provide shade to the stand in the summer. Larch twigs have thick, rough-textured, and numerous spur shoots that are excellent points of attachment and retention for forage lichen.

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Table 1. Description of study sties. Codes for tree species are as follows: LAOC=*Larix occidentalis*; PIEN=*Picea engelmannii*; PIMO =*Pinus monticola*; PIPO =*Pinus ponderosa*; PSME =*Pseudotsuga menziesii*; THPL=*Thuja plicata*; mixed = PIMO, PIPO, PIEN, LAOC. Stand abbreviations are: CC=clearcut; SH=shelterwood; MA=mature; St=state land; and Ex=experimental forest land.

STAND:	CC-St	15yr-St	SH-St	SH-Ex	MA-St	MA-Ex
stand type	clear cut	plantation	shelterwood	shelterwood	mature	mature
management	state	state	state	federal	state	federal
stand age (yrs)	7	15	80+	115+	80+	115+
dominant tree(s)	PIPO	PIPO	PSME (LAOC)	PSME	PSME	THPL
structure	even age	even age	2-layer	2-layer	multilayer	2-layer
yrs since burned[a]	7	15	4	12(pile)	-	-
post harvest plant	PIPO	PIPO	mixed[c]	PSME/PIPO	-	-
Basal Area (ft^2/acre)[b]	0	40	8	8	176	184[c]
Canopy density (%)[b]	0	15	3	3	60	68
Slope (%)	0	0	0	5-20	0	15

a. postharvest burn; broadcast burned except as noted

b. average of 5 measurements

c central portion of the plot was much denser than the average measurement (=280)

Table 2. Species documented in each stand, with epiphytic (epi; > .5 m from ground) and ground dwelling (grd; ground and up to .5 m) occurrences listed separately. Stands and stand abbreviations are described in Table 1 and in the text. Numbers are maximum abundance codes recorded amongsurveyers: 1 = rare (< 4 individuals seen/plot); 2 = uncommon (4-10 individuals seen/plot); 3 = common (>10 individuals seen, with presence on up to half the substrate); 4 = abundant (present on > half of the available substrate).

	CC-St		15yr-St		SH-St		SH-Ex		MA-St		MA-Ex	
Species:	epi	grd	epi	grd	epi	grd	epi	grd	epi	grd	epi	grd
Alectoria imshaugii	-	-	-	-	3	-	2	-	2	-	2	-
Alectoria sarmentosa	-	-	3	-	3	-	3	-	3	-	3	-
Bryoria capillaris	-	-	2	-	-	-	-	-	3	-	-	-
Bryoria fremontii	-	-	3	-	3	-	3	-	3	-	2	-
Bryoria fuscescens	-	-	2	2	-	-	3	-	3	-	2	-
Bryoria glabra	-	-	-	-	-	-	-	-	3	-	-	-
Bryoria pseudofuscescens	-	-	3	3	3	-	3	-	3	-	-	-
Bryoria sp.	1	-	-	-	-	-	-	-	-	-	-	-
Cetraria chlorophylla	-	-	2	2	2	-	3	-	3	-	3	1
Cetraria merrillii	-	-	-	-	-	-	2	-	-	-	-	-
Cetraria orbata	1	-	-	-	-	-	-	-	2	-	2	-
Cetraria pallidula	-	-	-	-	1	-	1	-	2	-	1	-
Cetraria platyphylla	-	-	3	-	3	-	3	1	3	-	3	-
Cladonia cariosa	-	-	-	2	-	-	-	-	-	-	-	-
Cladonia carneola	-	-	-	-	-	-	-	1	-	-	-	-
Cladonia cenotea	-	-	-	1	-	-	-	2	-	3	-	-
Cladonia chlorophaea	-	-	-	-	-	-	-	-	-	-	-	2
Cladonia coniocraea	1	1	-	-	-	-	-	2	-	-	-	-
Cladonia fimbriata	1	1	3	3	-	1	-	2	-	3	-	3

Cladonia multiformis	-	-	-	-	-	-	-	-	-	-	-	1
Cladonia ochrochlora	-	-	3	2	-	-	-	3	2	3	-	3
Cladonia pyxidata	-	-	1	-	-	-	-	1	-	2	-	-
Cladonia squamosa	-	-	-	-	-	-	-	-	-	3	-	-
Cladonia sulphurina	-	-	-	-	-	-	-	-	-	2	-	-
Cladonia transendens	-	-	-	-	-	-	2	-	-	-	-	-
Cladonia umbricola	-	-	-	-	-	-	-	-	-	3	-	-
Esslingeriana idahoensis	-	-	-	-	-	-	-	-	3	-	1	-
Evernia prunastri	-	-	-	-	-	-	1	-	-	-	-	-
Hypocenomyce scalaris	-	-	3	-	-	-	1	-	-	-	-	-
Hypogymnia imshaugii	-	-	-	3	3	-	3	1	3	-	3	-
Hypogymnia inactiva	-	-	-	-	-	-	-	-	-	-	1	-
Hypogymnia metaphysodes	-	-	-	-	-	-	3	1	-	-	2	-
Hypogymnia occidentalis	-	-	-	-	3	-	3	-	3	-	-	-
Hypogymnia physodes	1	-	4	-	3	-	3	-	3	-	3	-
Hypogymnia rugosa	-	-	-	-	-	-	3	-	-	-	3	-
Hypogymnia tubulosa	-	-	4	-	2	-	3	-	3	-	3	-
Letharia columbiana	-	-	-	-	-	-	1	-		-	-	-
Letharia vulpina	1	-	3	2	-	-	3	3	2	-	2	-
Lobaria pulmonaria	-	-	-	-	-	-	-	-	3	-	-	-
Melanelia exasperatula	-	-	2	-	1	-	3	-	-	-	3	-
Melanelia subelegantula	-	-	-	-	1	-	-	-	-	-	-	-
Nephroma parile	-	-	-	-	-	-	-	-	?	-	-	-
Nephroma resupinatum	-	-	-	-	-	-	-	-	2	-	-	-
Nodobryoria abbreviata	-	-	-	-	-	-	3	-	2	-	-	-

Nodobryoria oregana	-	-	-	-	-	-	2	-	2	-	-	-
Parmelia hygrophila	-	-	-	-	-	-	3	-	3	-	3	-
Parmelia saxatilis	-	-	-	-	-	-	-	-	1	-	-	-
Parmelia sulcata	-	-	3	-	2	-	3	-	3	-	3	1
Parmeliopsis ambigua	2	-	2	2	2	-	3	2	3	-	3	2
Parmeliopsis hyperopta	-	-	-	-	2	-	3	2	3	-	3	2
Peltigera canina	-	-	-	2	-	-	-	-	-	-	-	-
Peltigera didactyla	2	2	-	-	-	3	-	-	-	-	-	-
Peltigera lepidophora	2	2	-	-	-	-	-	-	-	-	-	-
Peltigera membranacea	-	-	-	-	-	-	-	1	-	3	-	3
Peltigera praetextata	3	3	-	2	-	-	-	-	-	-	-	-
Peltigera venosa	-	-	-	-	-	-	-	-	-	2	-	1
Peltigera sp.	-	-	-	-	-	-	-	-	-	2	-	-
Platismatia glauca	-	-	3	-	4	-	3	2	4	-	4	2
Platismatia stenophylla	-	-	-	-	-	-	-	-	-	-	1	-
Ramalina farinacea	-	-	-	-	-	-	3	-	-	-	-	-
Usnea filipendula grp.	-	-	-	-	-	-	2	-	-	-	-	-
Usnea substerilis	-	-	-	-	-	-	1	-	-	-	-	-
Usnea sp.	1	-	1	-	-	-	-	-	-	-	-	-
Vulpicida canadensis	-	-	4	2	3	-	2	-	2	-	-	-
Xanthoria candelaria	2	-	-	-	1	-	-	-	2	-	-	-
Xanthoria polycarpa	1	-	-	-	-	-	1	-	-	-	-	-
TOTAL	13	5	20	13	19	2	33	14	30	10	23	11
TOTAL - epis + grd	13		25		21		40		39		29	

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The aim of *Evansia* is to provide a vehicle for the presentation and exchange of useful information on North American bryophytes and lichens. Articles are frequently popular in nature rather than technical and are intended to teach and inform both amateurs and professionals. The articles include, but are not restricted to, announcements of and reports on forays and meetings, presentations of techniques and aids for studying and curating lichens and bryophytes, and reports on local floras. Checklists and papers documenting new regional, state, or county records must include voucher specimens (collector and collection number) and an indication of where the specimens are deposited or a literature reference.

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Composition and Cover of Epiphytic Lichens on *Pseudtosuga menziesii* and *Populus tremuloides* in Southwestern Idaho.

Erin Martin and Stephen J. Novak

Abstract. Species composition and percent cover of epiphytic lichens were determined on trunks of *Pseudotsuga menziesii* and *Populus tremuloides* at two study sites in Southwest Idaho: Marshall Lake Trail and Mores Mountain. In this study, we tested whether bark pH and directional position on the tree trunk influenced the distribution of lichens on these two tree species. Forty trees were examined using a 5X10 cm quadrat to determine lichen cover in the four cardinal directions. Five lichen species were found on *P. menziesii* at the Marshall Lake Trail study site and six at the Mores Mountain study site. Three different lichen species were found on *P. tremuloides* at Marshall Lake Trail site: where as no lichens were detected on *P. tremuloides* at the Mores Mountain site. For both tree species, lichens were most abundant on the south aspect of the tree trunks. This result differs from other studies, and may be due to optimal lichen growth conditions occurring on the south aspect of tree trunks during cooler and moister winter season, at these arid study sites.

Introduction. Typically, the bark of deciduous trees is more basic than the bark of conifers. Lichens can produce secondary chemicals that change the chemistry and texture of their substrate, making bark a more suitable habitat for further colonization by lichens and expansion of lichen thalli (Rogers 1988). Bark pH influences availability of minerals and organic substances, changes in diffusion rates and toxicity of the substrate (Brodo, 1973). Hardwood gaps in forests can greatly boost lichen diversity (Neitlich and McCune 1997). The hardwood species in this study, *Populus tremuloides*, is one of the most geographically wide spread deciduous trees in North America (Jonescu 1970) and stands of this tree species are distributed throughout Idaho. Stands of *P. tremula* in Europe are scattered throughout conifer forests, often support a variety of threatened lichen species and increasing the biodiversity of the lichen flora in these forests (Gustafsson and Eriksson 1995).

This study investigated the composition and cover of lichens on two tree species: *Populus tremuloides* Michx. and *Pseudotsuga menziesii* (Mirbel) Franco. We hypothesized that differences in lichen composition may be related to differences in bark pH of the two trees, and that differences in cover should be related to the aspect of the trunk for both species. Varying lichen occurrences have been found to reflect differences in moisture levels, temperature, light and stability of conditions (Eversman 1982). Many studies show an increase in lichen abundance on the north and east sides of trees due to cooler and moister microclimates (Eversman 1982, Gough 1975, Jonescu 1970, Peard 1988). In some climates, the conditions associated with the north side of a tree trunk allows lichen species more time to photosynthesize and obtaining maximal growth, before daily desiccation during the summer (Eversman 1982). Morphology of the bark may also play a role in the colonization of lichen species. For instance, *P. tremuloides* typically has very smooth bark, where *P. menziesii* possesses rough bark.

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Site Study. Sites in Southwest Idaho were chosen for this study, as both *P. tremuloides* and *P. menziesii* are abundant in this area. The first site (44° 08' N 114 ° 57' W) is located along the Marshall Lake Trail in the Sawtooth National Forest (T10N R13E). The second (43° 47'N 116° 06'W) is along the Mores Mountain loop trail in the Boise National Forest (T5N. R3E). Elevation of the two sites ranges from 7200-7400 ft. At both sites stands, *P. menziesii* stands are slightly upslope from the stands of *P. tremuloides*. *Populus tremuloides* at the Mores Mountain site have a twisted and deformed appearance attributed to sudden changes in humidity and temperature (Jonescu 1970). Both sites have dry, rocky soil supporting *Artemisia tridentata* Nutt. and *Festuca idahoensis* Elmer. adjacent to the stands of *P. tremuloides*.

Methods. Lichens were sampled from the trunks of *P. tremuloides* and *P. menziesii* at a height of 0.5-m. A 100-m transect was established through the center of each stand, and at 10-m intervals the tree nearest to the transect line was sampled until a total of 10 trees were analyzed for each species at each site (Eversman 1982). Dying or dead trees, and snags were not sampled. At 0.5-m from the soil line, a 5X10 cm quadrat was oriented vertically on the trunk in the four cardinal directions. Percent cover of lichens in each plot was determined using the cover classes of Eversman, (1982): 1 (0-5%), 2 (6-25%), 3 (26-50%), 4 (51-75%), 5 (76-94%), and 6 (95-100%) with each lichen species in the plot being assigned a cover class. Specimens were collected and identified to species; taxonomy and nomenclature follow McCune and Goward (1995), Purvis et al. (1992), and Wirth (1995). Lichen species were then placed into three morphological groups for the purpose of analysis: tufted, crustose, and foliose. Diameter at breast height (DBH) was measured for all trees sampled, however age determinations were not performed in these stands, due to inaccurate ring counts usually obtained for *P. tremuloides* (Jonescu 1970).

Three trees were selected randomly along each transect for bark collection. Samples consisted of the first layer of bark and were taken in areas devoid of lichen cover. Bark pH was determined by soaking 1 g of finely chopped bark in 30 ml of distilled water for two hours. A pH meter was used to determine the pH of the solution (Eversman 1982; Hoffman 1974), and average bark pH calculated for each of the stands.

Light conditions in each stand were classified by eye in order to assess light intensities under the canopy. This was done to ensure light intensities were similar for all the sample sites, since large differences in lichen species composition have been observed in light versus shaded areas (Gustafsson and Eriksson 1995). Light intensities were similar for all of the trees sampled. However, light conditions are expected to be more constant on an annual basis for *P. menziesii* because it sheds only a fraction of its needles in the fall. Organisms on *P. tremuloides* are exposed to more extreme environmental conditions in the fall and winter, after its leaves have dropped.

Results. A positive linear relationship exists between the number of lichen species and DBH for both tree species (Figures 1 and 2). *Pseudotsuge menziesii* had a larger average DBH (70.0-cm) than *P. tremuloides* (12.5 cm) and supported a more diverse lichen flora (Table 1). Completely different lichen species were associated with the two tree species. Five lichen species were found on *P. menziesii* at Marshall Lake Trail and six at Mores Mountain. Three lichen species were found on *P. tremuloides* at the Marshall Lake Trail site; these lichens were not found on *P. menziesii* at all. No lichens were observed for the *P. tremuloides* trees at the Mores Mountain

Figure 1: Number of epiphytic lichen species present on the trunks of *P. menziesii* in relation to diameter at breast height for both study sites.

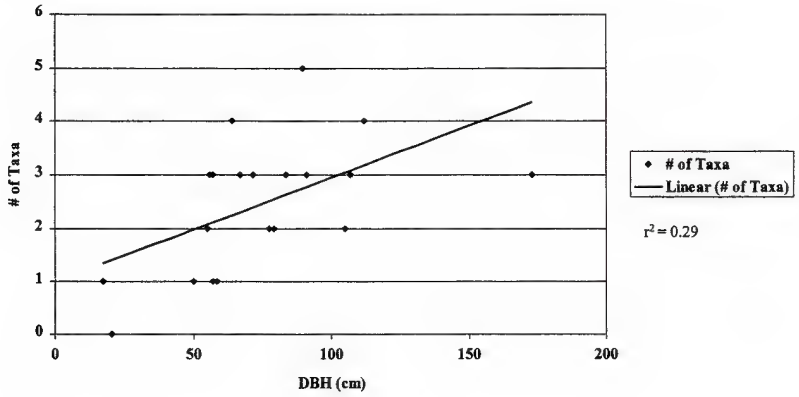
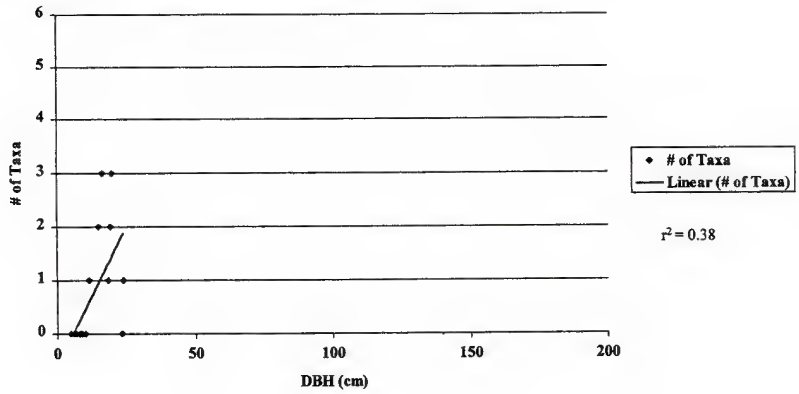


Figure 2: Number of epiphytic lichen species present on the trunks of *P. tremuloides* in relation to diameter at breast height for both study sites.



site, while only two of the *P. tremuloides* sampled at the Marshall Lake Trail site were devoid of lichens.

Table 1: Lichens found on *P. menziesii* and *P. tremuloides* listed by morphological group.

P. menziesii:	***P. tremuloides:***
Tufted Group	**Crustose Group**
Bryoria fusecens	*Caloplaca holocarpa*
Letharia vulpina	*Lecanora populicola*
Nodobryoria abbreviata	**Foliose Group**
Crustose Group	*Xanthoria ulophyllodes*
Candelariella aurella	
Lecanora cadubriae	
Lecanora varia	
Foliose Group	
Hypogymnia imshaugii	
Melanielia exasperatula	

For this analysis, lichen species were placed into three morphological groups: Tufted, crustose, and foliose (Table 1). At both sites, the tufted group had the highest percent cover of lichens on *P. menziesii*, and was not found on *P. tremuloides* at all. This group consisted of three species of lichens (Table 1), with *Letharia vulpina* being the dominant lichen at both sites. Both crustose and foliose groups were found on *P. menziesii* and *P. tremuloides* at the two sites, however, the lichen species which composed these morphological groups on *P. menziesii* was completely different when compared to the groups on *P. tremuloides* (Table 1).

Lichens appeared to have the highest percent cover on the south-facing side of both *P. menziesii* and *P. tremuloides* (Figures 3 and 4). Lichen cover was highest on the *P. menziessi* trees at the Mores Mountain site for all aspects. The cover of the foloiose morphological group was highest on south aspect at Marshall Lake Trail, and absent from this aspect at Mores Mountain. Foliose cover occurred on the western aspect of *P. menziesii* at Mores Mountain. Crustose and Tufted groups occurred on all aspects for *P. menziesii* trees at both sites. Crustose and foliose groups occurred on all aspects on the *P. tremuloides* trees at Marshall Lake Trail, with the highest average percent cover occurring in the south and east aspects.

Average bark pH differed between the two tree species but, all occurred in the acidic range. The average pH of *P. menziesii* ranged from 4.0 to 4.41 at Marshall Lake and Mores Mountain respectively, and was more acidic than *P. tremuloides*. The bark of *P. tremuloides* ranged from 4.94 to 5.51 at Marshall Lake and Mores Mountain respectively.

Discussion. The number of lichen species present on the two trees appeared to increase with an increase in the DBH of these trees. This result was not surprising because larger and assumed to be older trees would have had more time for lichens to become established. Lichen species composition was completely different for the two tree species examined in this study indicating that hard wood gaps in conifer forests of southwest Idaho help to boost the lichen diversity. No lichens were found on *P. tremuloides* at the Mores Mountain site, instead a high percent cover of cyanobacteria was observed on these trees. On average, *P. tremuloides* trees at the Mores Mountain site had smaller DBH values then the trees at the Marshall Lake Trail study site. Therefore, it seems likely that the trees at Mores Mountain are probably younger, and have not

had sufficient time for lichen colonization to occur. The cyanobacteria present may represent one of the earliest colonizing communities on *P. tremuloides* at this site.

Moisture gradients on the trunk vary with the directional position and influence lichen activity (Rogers 1988). In Colorado, Peard (1983) found the south and west sides of a tree trunk to be harsher microclimates due to greater exposure to solar radiation and winds. Several studies show an increase in lichen abundance on the north and east aspects of trees (Eversman 1982, Gough 1975, Jonescu 1970, Peard 1983). However, lichens in this study were found to be most abundant on the south sides of both tree species (Figures 3 and 4). These study sites are in an arid region where moisture is most available in the fall and winter months, rather than the summer months. During this time, the south side of a tree trunk may be able to attain above freezing temperatures, due to greater solar radiation. This may allow lichens present on this aspect, to utilize available moisture and attain higher growth rates. Snowfall accumulates on lichen thalli during winter, and may melt on the southern aspect of these trees, making the water available for use by these lichens. Directional microclimates on tree trunks that promote optimal lichen growth conditions seem to be related to the climatic conditions of the site and therefore would be expected to vary with site location.

Bates and Brown (1981) found that epiphytic plants respond to variation in bark acidity. At both study sites the bark of *P. menziesii* was more acidic than the bark of *P. tremuloides*, and supported different lichen species, but both bark substrates occurred in the acidic range. These results suggest that bark pH may not be the largest contributor to lichen colonization and other factors may play a more significant role.

Bark morphology influences the establishment of corticolous, or bark inhabiting communities (Barkman 1969), and porous bark makes the trunk a suitable habitat for the establishment of lichen communities (Rogers 1990). Greater lichen cover and diversity on *P. menziesii* may be due to the roughness of its bark. The smooth bark of *P. tremuloides* presents a less hospitable environment for lichen establishment. Lichens found on *P. tremuloides* at the Marshall Lake site were situated around the roughened fissures and lenticels on the tree. Lichens were absent from the smoothest portions of the bark.

Because of their dependence on the atmosphere for nutrients and water, epiphytic lichen species are often used to document changes in atmospheric conditions (Barkman 1969). Lichen species found at both sites are reported to be moderately tolerant to air pollutants (McCune and Geiser 1997). *Lecanora populicola* (DC) Duby was found only on *P. tremuloides* at the Marshall Lake Trail site. This lichen species is reported to be very sensitive to air pollution, and evetually became extinct in England about 150 years ago (Purvis et al. 1992). The Marshall Lake Trail site, a far distance from any large urban center, probably possesses low air pollution levels. *Lecanora populicola* was not found at the Mores Mountain site, this may be due to the young age of the *Populus* stands at this location. However, I would not expect to observe this lichen at Mores Mountain, because of its close proximity to Boise, ID, a large city and the resulting higher levels of air pollution.

Lichens are dependent on a number of factors during colonization of bark substrates including: size of the tree (age related), morphology of the bark, bark pH, and air pollution levels. Lichens exhibit specific substrate preferences, which are related to their ecological requirements. The number of lichen species appears to increase with an increase in DBH, indicating that larger

Figure 3: Epiphytic lichen cover by morphological group for the Marshall Lake Trail study site as determined by the midpoints of each cover class.

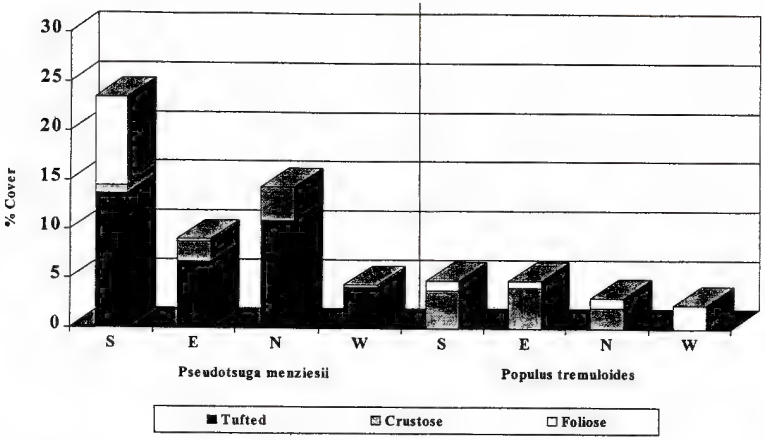
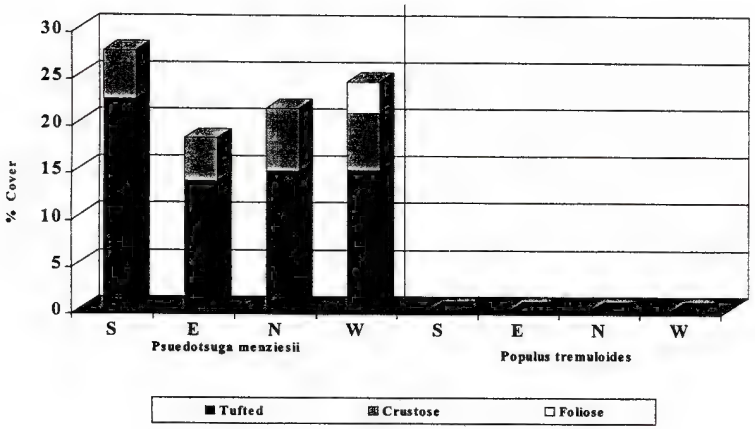


Figure 4: Epiphytic lichen cover by morphological group for the Mores Mountain study site as determined by the midpoints of each cover class.



(older) trees have a more diverse lichen flora. Bark morphology may influence the colonization of lichen species. Rough bark is more hospitable to epiphyte colonization than smooth bark. Relationships between lichen abundance and aspect on the trunk appears to be relative to the location and climate of a site. Lichens in this study were most abundant on the south aspect of the tree trunks. This may be due to optimal lichen growth conditions that may occur on the south aspect of a tree, in this arid climate, during cooler months of the year.

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Two Species of Grimmia New to Louisiana

William Dean Reese[1] & Terry A. Hedderson[2]

The two collections of *Grimmia* documented below are new records for Louisiana. Until now, the only other member of the Grimmiaceae recorded from Louisiana is *Schistidium apocarpum* (Hedwig) Bruch & Schimper, which is known from a few localities in the central and northern portions of the state (Reese 1984).

Grimmia laevigata (Bridel) Bridel. Louisiana. Lafayette Parish: On a landscape boulder in a planter under a pecan tree in front of the Service Chevrolet salesroom on Cameron Street, N side of Lafayette. Growing with Desmatodon plinthobius Sull. & Lesq. And Bryum sp. 2 December 1998, *Reese 18494* (LAF).

No exposed rock exists naturally in southern Louisiana; thus the landscape boulder was imported from elsewhere, perhaps with its mosses already in residence; it was installed in 1979. *Grimmia laevigata* is of wide occurrence in North America but is mostly lacking in the southern portions of the Gulf Coast states, where native rock substrates are rare.

Grimmia pulvinata (Hedwig) Smith. Louisiana. Rapides Parish: On crumbling, shaded concrete wall at Forest Hills, glass houses and grounds of nursery, 31°02'N,92°32'W. Growing with *Ptychomitrium serratum* (Müll. Hal.) Besch. and Tortella humilis (Hedwig) Jenn. 6 March 1993, *Hedderson 10372b*, (LAF & herb. Hedderson).

Grimmia pulvinata is wide-spread but rare in North America (Crum & Anderson 1981). The nearest occurrences to the Louisiana site seem to be in Missouri and Oklahoma (Redfearn 1987).

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A Catalogue of Tennessee Lichens, Revisited

Alex Ciegler

In 1972 Skorepa published a catalogue of the lichens reported for Tennessee; the catalogue was based primarily on a literature survey covering the years 1858 to the time of the report. Skorepa accepted 427 species in 94 genera, one subspecies, 14 varieties, and 21 forms. A perusal of his compiled data and a few studies subsequently published show that most of the species listed for Tennessee were found on the eastern Tennessee border and, in particular, in the Smoky Mountains as a result of two major studies (Degelius, 1943; Dey, 1978). A limited survey that excluded crustose lichens was conducted over a three year period in an area known as The Land Between the Lakes (Philips, 1970). This area included Steward County located in north-central Tennessee on the southern Kentucky border and Trigg and Lyon Counties in Kentucky. Only a few scientific reports have been published on a small number of species from western Tennessee (Wilhelm and Ladd, 1992; Ekman, 1996). Data from the above publications are given in Table 1. All species names have been updated to conform to the sixth lichen checklist (Esslinger and Egan, 1995). No known lichen surveys had been conducted in the central or south-central area of the state.

In 1998, Arnold Engineering Development Center (AEDC) initiated a lichen survey on Arnold Air Force Base (AAFB) as part of efforts to establish a baseline inventory of biological diversity on the bases's lands. AAFB is a Department of Defense installation in Coffee and Franklin Counties, south-central Tennessee, near the city of Tullahoma. The base is located within the Highland Rim physiographic region and encompasses 39,081 acres. Topography ranges from relatively flat land with poor surface drainage in the northern portion of the base to moderate relief with defined stream channels in the southern section. About 88 percent of AEDC is undeveloped with 29,021 forested acres; the rest is comprised of open areas, open water habitat, and a little over 2,000 acres of facilities. The forested area is about 80 percent hardwoods, primarily oak, and 20 percent softwood (pine). There are approximately 1,900 acres of jurisdictional wetlands (Bingham and Winford, 1998).

Seven sites totaling 3,029 acres were selected by AEDC for the lichen survey. These sites were chosen by AEDC conservation biologists to represent the diversity of terrain and natural vegetation communities present on the base including wetland systems and localities with known occurrences of rare, threatened, and endangered (RTE) vascular plant species. An additional four sites totaling about 2,000 acres were chosen by the current investigator for added study. These additional sites included dry, oak-type forest, rolling forested hills, and marshland communities. Several small sites, each under one acre, were also sampled: an old cemetery, concrete structures still remaining on the abandoned site of the former airbase, and miscellaneous small points. The entire survey was conducted over a total of about 5,000 acres.

AEDC has an extensive concentration of karst wetlands, a component within a barrens ecosystem on the southeast region of the Eastern Highland Rim of Tennessee. Although the soils of the barrens are poor for farming, they possess an exceptionally rich and diverse assortment of disjunct plants and animal species. AAFB comprises the largest remaining undeveloped or

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nonagricultural piece of land in the Tennessee barrens (De Selm, 1981, 1989, 1990). At least 68 RTE plants and animals have been identified at AAFB, most of them in or near karst formations. Additionally, several disjunct populations of Coastal Plain vascular plant species, in association with wetland communities, were reported by Clebsch and Pyne in 1995. The Barrens are characterized by highly acidic soils overlaying a cherty limestone residuum (Wolfe, 1996). Very small areas of this limestone base are exposed at various points at AAFB as a result of soil erosion. These alkaline sites were carefully examined for they often support unique lichen communities. A total of 1,342 lichen specimens were collected for identification. All specimens were deposited at the University of Tennessee Herbarium in Knoxville.

Table 1 shows a total of 567 lichen species within 156 genera as occurring in Tennessee of which 216 were found at AAFB. Of the 216 taxa comprising 79 genera, 66 taxa represent new state records; accession numbers (AAFB) are given for the latter in Table 1. Since no lichens were previously reported from Coffee and Franklin Counties, the 216 taxa found at AAFB represent a new data base for the region. The relatively large number of new state records may seem unusual but it is believed that this only reflects the previous lack of surveys in central Tennessee. The two lichens listed by the Federal government as being RTE species (*Cladonia perforata* A. Evans and *Gymnoderme lineare* (A. Evans) Yoshimura and Sharpe) were not found. This is not surprising in that physiographic conditions noted for their growth do not occur at AAFB. Some of the species found at the base may represent a disjunct population, e.g., *Parmotrema margaritatum* (Hue) Hale and *Phaeophyscia hispidula* (Ach.) Essl. occur primarily in the western part of the United States. However, until more lichen distribution studies for North America become available, a disjunct claim may be unwarranted. No strong pattern of physical or environmental selection for lichen occurrence was noted in the survey with two exceptions: ground-dwelling taxa such as *Cladonia* spp. tended not to occur in the wetlands; taxa such as *Bacidia granosa*, *B. sabulatorum, Caloplaca feracissima, Farnoldia jurana, Protoblastenia rupestris*, and *Sarcogyne regularis* were found on alkaline substrates such as discarded concrete blocks, concrete structures, alkaline rocks, and marble tombstones. *Candelaria concolor* and *Physcia dubia* were also found on alkaline substrates since they can tolerate alkaline conditions but normally occur on acidic substrates. No correlation was found between lichen distribution and the distribution of vascular flora particularly with respect to the high incidence of disjunct vascular plants among karst formations.

The eleven sites surveyed were, more or less, evenly distributed over the base. Although the 5,000 acres investigated represent only about 12 to 13 percent of the total acreage at AAFB, based on the pattern of lichen distribution it is believed that a good representation of the lichen population for the area was obtained.

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Key to lichen records:

A = Arnold Air Force Base (Ciegler, 1998)

T = University of Tennessee Herbarium

S = Smoky Mountains (Degelius, 1941)

H = High Appalachians (Dey, 1978)

L = Land between the Lakes (Phillips, 1970)

M = Miscellaneous species: Berry, 1941; Cain, 1935; Calkins, 1890; Ciegler, Unpublished Data; Ekman,1996; Evans, 1947; Fink, 1904, 1906, 1907, 1919; Hedrick, 1933; Howe, 1910; Ihlen and Tonsberg, 1996; Magnusson, 1929, 1935; Motyka, 1964; Mozingo, 1954, 1961; Phillips, 1963; Sharp, 1930; Sheard, 1995, Sierk, 1958; Skorepa, 1972; Tuckerman, 1859; Wilhelm and Ladd, 1992

** = New state record; voucher specimens indicated by AAFB acquisition number.

Table 1.
LICHEN RECORDS FROM TENNESSEE

Acarospora cervina A. Massal. AAFB 1042	A						**
Acarospora fuscata (Schrader) Arnold			S				
Acarospora glaucocarpa (Ach.) Korber AAFB 1061	A						**
Acrocordia gemmata A. Massal.		T					
Ahtiana aurescens (Tuck.) Thell & Randlane		T					
Alectoria sarmentosa (Ach.) Ach.			S			M	
Allocetraria oakesiana (Tuck.) Randlane & Thell	A	T	S	H			
Amandinea punctata (Hoffm.) Coppino & Scheid	A					M	
Anaptychia palmulata (Michaux) Vainio	A	T	S	H	L		
Anisomeridium biforme (Bor.) R.C. Harris AAFB 473	A						**
Anisomeridium subprostans (Nyl.) R.C. Harris						M	
Anzia americana Yoshim. & Sharp						M	
Anzia colpodes (zia Ach.) Stizenb.			S	H			
Arthonia bisepta Degel.						M	
Arthonia caesia (Flotow) Koerber			S			M	
Arthonia cinnabarina (DC.) Wallr.	A		S				
Arthonia polymorpha Ach. AAFB 1280	A						**
Arthonia punctiformis Ach.			S				
Arthonia rubella (Fee) Nyl.	A						**
Arthonia sp.	A			H			
Arthopyrenia cinereopruinosa (Schaerer) A. Massal.			S				
Arthopyrenia plumbaria (Stizenb.) R.C. Harris AAFB 1276	A						**
Arthothelium interveniens (Nyl.) Zahlbr. AAFB 910	A						**
Arthothelium spectabile A. Massal. AAFB 16	A						**
Aspicilia cinerea (L.) Korber AAFB 25	A						**
Aspicilia sp.	A						
Bacidia assulata Vezda						M	
Bacidia diffracta S. Ekman	A					M	
Bacidia granosa (Tuck.) Zahlbr.	A						**
Bacidia helicospora S. Ekman	A						
Bacidia laurocerasi (Delise ex Duby) Ozenda & Clauzade	A	T					
Bacidia polychroa (Th.Fr.) Korber	A	T	S				
Bacidia rubella (Hoffm.) A. Massal.						M	
Bacidia sabuletorum (Schreber) Lettau AAFB 1043	A						**
Bacidia schweinitzii (Fr. ex Michener) Schneider	A	T	S				
Bacidia sp.	A						
Bacidia subincomta (Nyl.) Arnold AAFB 478	A						**
Bacidina californica S. Ekman AAFB 276	A						**
Bacidina egenula (Nyl.) Vezda AAFB 427	A						**

Bacidina inundata (Fr.) Vezda AAFB 1018	A						**
Baeomyces rufus (Hudson) Rebent		T		H			
Biatora helvola (Koerber) Hellborn		T	S				
Biatora vernalis (L.) Fr. AAFB 980	A						**
Biatorella rappii Zahlbr. AAFB 502	A						**
Brigantiaea leucoxantha (Sprengel) Sant. & Hafellner		T					
Bryoria bicolor (Ehrh.) Brodo & D. Hawksw.			S	H			
Bryoria furcellata (Fr.) Brodo & D. Hawksw.		T	S	H			
Bryoria nadvornikiana (Gyelnik) Brodo & D. Hawksw.		T	S	H			
Bryoria tenuis (E. Dahl) Brodo & D. Hawksw.				H			
Bryoria trichodes (Michaux) Brodo & Hawksw.		T					
Bryoria trichodes subsp. *americana* (Michaux) Brodo & D. Hawksw.				H			
Buellia amphidexia Imshaug ex R.C. Harris AAFB 635	A						**
Buellia caloosensis Tuck. AAFB 947	A						**
Buellia curtisii (Tuck.) Imshaug	A					M	
Buellia dialyta (Nyl.) Tuck.			S				
Buellia disciformis (Fr.) Mudd		T	S				
Buellia elizae (Tuck.) Tuck.		T					
Buellia imshaugiana R.C. Harris AAFB 792	A						**
Buellia lepidastra (Tuck.) Tuck.						M	
Buellia mammilana (Tuck.) W.A. Webber						M	
Buellia rappii Imshaug ex R.C. Harris AAFB 361	A						**
Buellia schaereri DeNot		T					
Buellia spuria (Schaerer) Anzi		T					
Buellia stigmaea Tuck.						M	
Buellia stillingiana J. Steiner	A					M	
Buellia vernicoma (Tuck.) Tuck.		T					
Bulbothrix goebelii (Zenker) Hale	A					M	
Bulbothrix laevigatula (Nyl.) Hale			S				
Byssoloma subdiscordans (Nyl.) P. James						M	
Caloplaca camptidia (Tuck.) Zahlbr.		T					
Caloplaca cerina (Hedwig) Th. Fr.		T					
Caloplaca cinnabarina (Ach.) Zahlbr.						M	
Caloplaca discolor (Willey) Fink		T					
Caloplaca feracissima H. Magn. AAFB 1032	A						**
Caloplaca ferruginea (Hudson) Th. Fr. AAFB 77	A						**
Caloplaca flavovirescens (Wulfen) Dalle Torre & Sarnth.	A	T					
Caloplaca holocarpa (Hoffm. ex Ach.) M. Wade		T					
Caloplaca schaereri (Florke) Zahlbr.		T					
Caloplaca sp.	A		S				
Caloplaca wrightii (Willey) Fink AAFB 37	A						**
Candelaria concolor (Dickson) Stein	A	T			L		
Candelaria fibrosa (Fr.) Mull. Arg.	A	T			L		
Candelariella xanthostigma (Ach.) Lettau						M	
Canoparmelia caroliniana (Nyl.) Elix & Hale	A	T			L		
Canoparmelia crozalsiana (de Lesd.) Elix & Hale	A				L		

Canoparmelia texana (Tuck.) Elix & Hale		T				M	
Catapyrenium squamulosum (Ach.) Breuss		T					
Catapyrenium tuckermanii (Rav. ex Mont.) Thomson		T			L		
Cetraria aculeata (Schreber) Fr.						M	
Cetraria islandica (L.) Ach.		T		H			
Cetrelia cetrariodes (Duby) Culb. & C. Culb.			S	H			
Cetrelia chicitae Culb. & C. Culb.		T		H			
Cetrelia olivetorum (Nyl.) W. Culb. & C. Culb		T		H			
Chaenotheca sp. AAFB 674	A						**
Chrysothrix candelaris (L.) J.R. Laundon	A		S				
Chrysothrix chlorina (Ach.) J.R. Laundon			S				
Cladina arbuscula (Wallr.) Hale & Culb.	A	T		H			
Cladina ciliata (Stirton) Trass						M	
Cladina mitis (Sandst.) Hustich						M	
Cladina portentosa (Dufour) Follmann			S			M	
Cladina rangiferina (L.) Nyl.	A	T	S	H	L		
Cladina subtenuis (Abbayes) Hale & Culb.	A	T					
Cladina subtenuis f. *cinerea* (Ahti) Ahti AAFB 444	A						**
Cladonia apodocarpa Robbins		T					
Cladonia botrytes (K. Hagen) Willd.			S				
Cladonia brevis (Sandst.) Sandst.						M	
Cladonia caespiticia (Pers.) Florke		T	S	H			
Cladonia cariosa (Ach.) Spreng						M	
Cladonia caroliniana Tuck.	A	T	S				
Cladonia cenotea (Ach.) Schaerer						M	
Cladonia cervicornis subsp. *cervicornis* (Ach.) Flotow	A						
Cladonia cervicornis subsp. *verticillata* (Hoffm.) Ahti		T		H		M	
Cladonia chlorophaea (Florke ex Sommerf.) Sprengel	A	T		H	L		
Cladonia coccifera (L.) Willd.			S				
Cladonia coniocraea (Florke) Sprengel & Ahti	A	T		H	L		
Cladonia cornuta subsp. *cornuta* (L.) Hoffm.						M	
Cladonia crispata (Ach.) Flotow		T					
Cladonia cristatella Tuck.		T		H			
Cladonia cylindrica (A. Evans) A. Evans	A					M	
Cladonia deformis (L.) Hoffm.						M	
Cladonia didyma (Fee) Vainio	A	T	S	H			
Cladonia digitata (L.) Hoffm.				H			
Cladonia fimbriata (L.) Fr.	A	T	S				
Cladonia floerkeana (Fr.) Somm.						M	
Cladonia floridana Vainio						M	
Cladonia furcata (Hudson) Schrader		T	S	H			
Cladonia gracilis (L.) Willd.		T	S	H			
Cladonia grayi G.Merr. ex Saudst		T		H			
Cladonia incrassata Florke		T	S	H			
Cladonia macilenta Hoffm.		T	S	H			
Cladonia macilenta v. *bacillaris* (Genth) Schaerer	A	T	S	H	L		
Cladonia mateocyatha Robbins		T					

Cladonia merochlorophaea Asah				H			
Cladonia ochrochlora Florke		T	S				
Cladonia parasitica (Hoffm.) Hoffm.		T	S				
Cladonia peziziformis (With.) J.R. Laundon	A	T		H	L		
Cladonia phyllophora (Ehrh.) Hoffm.						M	
Cladonia piedmontensis G. Merr.						M	
Cladonia pleurota Schaerer		T		H			
Cladonia polycarpia G.K. Merr		T					
Cladonia polycarpoides Nyl.	A	T					
Cladonia pyxidata (L.) Hoffm.		T	S				
Cladonia ramulosa (With.) J.R. Laundon	A	T		H			
Cladonia rappii A. Evans						M	
Cladonia rei Schaerer			S				
Cladonia robbinsii A. Evans						M	
Cladonia sobolescens Nyl. ex Vainio		T					
Cladonia squamosa Hoffm.	A	T	S	H	L		
Cladonia strepsilis (Ach.) Grognot	A	T					
Cladonia subulata (L.) F. H. Wigg						M	
Cladonia turgida Hoffm.						M	
Cladonia uncialis (L.) F.H. Wigg		T	S	H			
Cliostomum griffithii (Sm.) Coppins AAFB 489	A						**
Coccocarpia erythroxyli (Sprengel) Swinscow & Krog		T					
Coccocarpia palmicola (Sprengel) Arv. & D.J. Galloway		T		H			
Collema bachmanianum (Fink) Degel.		T					
Collema coccophorum Tuck.						M	
Collema conglomeratum Hoffm. AAFB 1165	A						**
Collema cristatum (L.) F. H. Wigg						M	
Collema flaccidum (Ach.) Ach.		T					
Collema furfuraceum (Arnold) Du Rietz	A	T	S	H			
Collema leptaleum Tuck.						M	
Collema nigrescens (Hudson) DC.		T		H			
Collema pulchellum var. *leucopeplum* (Tuck.) Degel.						M	
Collema subflaccidum Degel.	A			H			
Collema tenax (Sw.) Ach.						M	
Collema texanum Tuck.						M	
Conotrema urceolatum (Ach.) Tuck.			S				
Cresponea premnea (Ach.) Egea & Torrente						M	
Dendriscocaulon umhausense (Auersw.) Degel.						M	
Dermatocarpon luridum (With.) J.R. Laundon		T				M	
Dermatocarpon miniatum (L.) W. Mann		T					
Dibaeis absoluta (Tuck.) Kalb & Gierl						M	
Dibaeis baeomyces (L.F.) Rambold & Hertel	A	T		H			
Dirinaria frostii (Tuck.) Hale & Culb.						M	
Dirinaria picta (Sw.) Clem. & Shear			S				
Endocarpon pusillum Hedwig		T					
Ephebe americana Henss.				H			
Ephebe lanata (L.) Vainio			S	H		M	

Ephebe solida Born.				H		M	
Erioderma mollissimum (Samp.) Du Rietz			S				
Everniastrum catawbiense (Degel.) Hale ex Sipman		T	S	H			
Farnoldia jurana (Schaerer) Hertel AAFB 425	A						**
Fellhanera bouteilei (Desmaz.) Vezda		T					
Flakea papillata O.Eriksson						M	
Flavoparmelia baltimorensis (Gyelnk & Foriss) Hale	A	T					
Flavoparmelia caperata (L.) Hale	A	T	S	H	L		
Flavopunctelia flaventior (Stirton) Hale				H			
Fuscidea cyathoides (Ach.) V. Wirth & Vezda						M	
Fuscidea mollis (Wahlenb.) V. Wirth & Vezda			S				
Fuscidea sp.			S				
Fuscopannaria leucophaea (Vahl) P.M. Jorg			S			M	
Fuscopannaria leucosticta (Tuck.) P.M. Jorg		T	S			M	
Fuscopannaria maritima (P. M. Jorg.) P. M. Jorg.						M	
Glyphis cicatricosa Ach.		T					
Graphis afzelii Ach. AAFB 964	A						**
Graphis anfractuosa Eschw. AAFB 912	A						**
Graphis desquamescens (Fee) Zahlbr. AAFB 667	A						**
Graphis librata C. Knight AAFB 773	A						**
Graphis lineola Ach. AAFB 475	A						**
Graphis scripta (L.) Ach.	A		S				
Graphis sp. Harris 23509 AAFB 493	A						**
Graphis tenella Ach.			S				
Gymnoderma lineare (A. Evans) Yosh. & Sharp		T		H			
Heppia lutosa (Ach.) Nyl.		T					
Heterodermia albicans (Pers.) Swinscow & Krog	A	T					
Heterodermia appalachensis (Kurok.) Culb.		T					
Heterodermia casarettiana (Massal.) Trevisan	A					M	
Heterodermia crocea R.C. Harris			S				
Heterodermia dendritica (Pers.) Poelt		T					
Heterodermia echinata (Taylor) Culb.						M	
Heterodermia galactophylla (Tuck.) Culb.		T					
Heterodermia granulifera (Ach.) Culb.		T					
Heterodermia hypoleuca (Muhl.) Trevisan		T	S				
Heterodermia leucomelos (L.) Poelt		T	S	H			
Heterodermia microphylla (Kurok) Skorepa						M	
Heterodermia obscurata (Nyl.) Trevisan	A	T	S	H	L		
Heterodermia propagulifera (Vainio) Dey				H			
Heterodermia pseudospeciosa (Kurok.) Culb.	A	T					
Heterodermia speciosa (Wulfen) Trevisan	A	T	S	H	L	M	
Heterodermia squamulosa (Degel.) Culb.		T	S	H			
Heterodermia tremulans						M	
Hydrothyria venosa J.L. Russell		T					
Hypogymnea enteromorpha (Ach.) Nyl.		T					
Hypogymnia krogiae Ohlsson				H			
Hypogymnia physodes (L.) Nyl.		T	S	H			

Hypogymnia tubulosa (Schaerer) Hav.		T	S	H			
Hypogymnia vittata (Ach.) Parrique		T	S				
Hypotrachyna croceopustulata (Kurok.) Hale		T		H			
Hypotrachyna densirhizinata (Kurok.) Hale		T		H			
Hypotrachyna dentella (Hale & Kurok.) Hale				H			
Hypotrachyna gondylophora (Hale) Hale		T		H			
Hypotrachyna imbricatula (Zahlbr.) Hale			S	H			
Hypotrachyna laevigata (Sm.) Hale				H			
Hypotrachyna livida (Taylor) Hale	A	T			L		
Hypotrachyna oostingii (J.P. Dey) Hale				H			
Hypotrachyna osseoalba (Vainio) Park & Hale		T					
Hypotrachyna producta Hale				H			
Hypotrachyna prolongata (Kurok.) Hale		T		H			
Hypotrachyna pustulifera (Hale) Skorepa	A					M	
Hypotrachyna revoluta (Florke) Hale		T	S	H			
Hypotrachyna rockii (Zahlbr.) Hale		T		H			
Hypotrachyna sinuosa (Sm.) Hale				H			
Hypotrachyna thysanota (Kurok.) Hale				H			
Hypotrachyna virginica (Hale) Hale				H			
Icmadophila ericetorum (L.) Zahlbr.		T					
Imshaugia aleurites (Ach.) S.F. Meyer		T	S	H			
Imshaugia placorodia (Ach.) S.F. Meyer						M	
Ionaspis lacustris (With.) Lutzoni			S				
Ionaspis odora (Ach.) Th. Fr. ex Stein						M	
Ionaspis sp.		T					
Lasallia papulosa (Ach.) Llano		T	S	H			
Lasallia pensylvanica (Hoffm.) Llano						M	
Lecania erysibe (Ach.) Mudd			S				
Lecanora albella var. *rubescens* (Imshaug & Brodo) Lumbsch AAFB 874	A						**
Lecanora allophana Nyl.		T					
Lecanora argentata (Ach.) Malme	A		S				
Lecanora caesiorubella subsp. *caesiorubella* (Ach.) Brodo AAFB 220		T					
Lecanora caesiorubella subsp. *glaucomodes* (Nyl.) Imshaug & Brodo	A						**
Lecanora caesiorubella subsp. *prolifera* Fink) R.C. Harris AAFB 720	A						**
Lecanora campestris (Schaerer) Hue						M	
Lecanora chlarotera Nyl.		T					
Lecanora cinereofusca var. *cinereofusca* H. Magnusson	T						
Lecanora crenulata Hook AAFB 32	A						**
Lecanora expallens Ach.		T	S				
Lecanora hybocarpa (Tuck.) Brodo	A					M	
Lecanora imshaugii Brodo	A						
Lecanora insignis Degel.			S				
Lecanora minutella Nyl.						M	
Lecanora olivaceopallida H. Magn.			S				

Lecanora oreinoides (Korber) Hertel & Rambold		T				M	
Lecanora polytropa (Hoffm.) Rabenh.						M	
Lecanora pulicaris (Pers.) Ach. AAFB 1174	A						**
Lecanora subrugosa Nyl.						M	
Lecanora symmicta (Ach.) Ach.			S				
Lecanora varia (Hoffm.) Ach.	A	T					
Lecidea chalybeiza Nyl.	A	T					
Lecidea degelii H. Magn.			S				
Lecidea deminutula H. Magn.			S				
Lecidea fuliginosa Taylor						M	
Lecidea hebescens Nyl.						M	
Lecidea lithophila (Ach.) Ach.						M	
Lecidea lurida (Ach.) DC.						M	
Lecidea parasema Ach.	A					M	
Lecidea plana (J. Lahm) Nyl.			S				
Lecidea sp.	A						
Lecidea subtilis Degel			S				
Lecidella elaeochroma (Ach.) Hazsl.			S				
Lecidella sp.						M	
Lepraria lobificans Nyl. AAFB 492	A						**
Lepraria neglecta (Nyl.) Erichsen		T	S			M	
Lepraria sp.	A						
Leproloma membranaceum (Dickson) Vainio	A					M	
Leproloma sp.	A						
Leptogium appalachense Nyl.		T					
Leptogium austroamericanum (C.W. Malme) Dodge	A	T					
Leptogium azureum (Sw.) Mont.						M	
Leptogium burnetiae C.W.Dodge	A			H			
Leptogium chloromelum (Sw. ex Ach.) Nyl.		T					
Leptogium corticola (Taylor) Tuck.		T	S	H			
Leptogium cyanescens (Rabenh.) Korber	A	T	S	H	L		
Leptogium hirsutum Sierk		T					
Leptogium juniperinum Tuck.		T					
Leptogium laceroides (deLesd) P.M. Jorg.		T	S	H			
Leptogium lichenoides (L.) Zahlbr.		T	S				
Leptogium marginellum (Sw.) Gray AAFB 725	A						**
Leptogium milligranum Sierk						M	
Leptogium saturninum (Dickson) Nyl.		T	S				
Leptorhaphis epidermidis (Ach.) Th. Fr.						M	
Lettauia santessonii Ihlen & Tonsberg						M	
Lobaria pulmonaria (L.) Hoffm.		T	S	H			
Lobaria quercizans Michaux		T	S	H			
Lobaria ravenelii (Tuck) Yoshim.						M	
Lobaria scrobiculata (Scop.) DC.		T	S	H			
Loxospora ochrophaea (Tuck.) R.C. Harris	A		S				
Loxospora pustulata (Brodo & Culb.) R.C. Harris	A					M	
Maronea constans (Nyl.) Hepp. AAFB 901	A						**

Megalaria sp.			S				
Melanelia culbersonii (Hale) Thell.						M	
Melanelia fuliginosa (Fr. ex Duby) Essl.	A					M	
Melanelia halei (Ahti) Essl.				H			
Melanelia hepatizon (Ach.) Thell				H	M		
Melanelia olivacea (L.) Essl.			S				
Melanelia stygia (L.) Essl.				H			
Melanelia subaurifera (Nyl.) Essl.		T	S	H			
Melaspilea demissa (Tuck.) Zahlbr.			S				
Menegazzia terebrata (Hoffm.) Massal.		T	S	H			
Micarea endocyanea (Tuck. ex Welley) R.C. Harris			S				
Micarea peliocarpa (Anzi) Coppins & R.Sant.						M	
Mycoblastus sanguinarius (L.) Norman						M	
Mycoporum compositum (Massal.) R.C. Harris AAFB 59	A					**	
Mycoporum pycnocarpoides Mull. Arg. AAFB 578	A						**
Myelochroa aurulenta (Tuck.) Elix & Hale	A	T	S	H	L		
Myelochroa galbina (Ach.) Elix & Hale	A	T	S	H	L		
Myelochroa obsessa (Ach.) Elix & Hale	A						
Nephroma helveticum subsp. helveticum Ach.	A	T	S	H			
Nephroma parile (Ach.) Ach.		T	S	H			
Nephroma resupinatum (L.) Ach.		T	S	H			
Normandina pulchella (Borrer) Nyl.	A		S				
Ocellularia granulosa (Tuck.) Zahlbr. AAFB 501	A						**
Ochrolechia africana Vainio	A					M	
Ochrolechia pseudopallescens Brodo						M	
Ochrolechia tartarea (L.) Massal.						M	
Ochrolechia yasudae Vainio			S				
Opegrapha vulgata Ach.		T	S				
Orphniospora moriopsis (Massal.) D. Hawksw.						M	
Pannaria conoplea (Ach.) Borg			S			M	
Pannaria lurida (Mont.) Nyl.						M	
Pannaria rubiginosa (Ach.) Bory	A	T		H			
Pannaria tavaresii P.M. Jorg.	A					M	
Paraparmelia alabamensis (Hale & McCull) Elix & J. Johnston						M	
Parmelia omphalodes (L.) Ach.		T		H			
Parmelia saxatilis (L.) Ach.	A	T	S	H	L		
Parmelia squarrosa Hale	A	T		H			
Parmelia sulcata Taylor		T					
Parmeliella corallinoides (Hoffm.) Zahlbr.			S				
Parmeliella pannosa (Sw.) Nyl.						M	
Parmelina quercina (Willd.) Hale		T					
Parmelinopsis horrescens (Taylor) Elix & Hale		T		H			
Parmelinopsis minarum (Vainio) Elix & Hale	A	T	S		L		
Parmeliopsis ambigua (Wulfen) Nyl.						M	
Parmotrema arnoldii (Du Rietz) Hale		T	S	H			
Parmotrema austrosinense (Zahlbr.) Hale	A					M	

Parmotrema chinense (Osbeck) Hale & Ahti	A	T	S	H			
Parmotrema crinitum (Ach.) M. Choisy		T	S	H			
Parmotrema cristiferum (Taylor) Hale		T					
Parmotrema dilitatum (Vainio) Hale	A	T			L		
Parmotrema gardneri (C.W. Dodge) Serus	A	T					
Parmotrema hypotropum (Nyl.) Hale	A	T		H	L		
Parmotrema mellissii (C.W. Dodge) Hale						M	
Parmotrema michauxianum (Zahlbr.) Hale	A	T			L		
Parmotrema perforatum (Jacq.) Massal.	A	T			L		
Parmotrema praesorediosum (Nyl.) Hale AAFB 755	A						**
Parmotrema rampoddense (Nyl.) Hale	A				L		
Parmotrema stuppeum (Taylor) Hale	A	T		H			
Parmotrema tinctorum (Delise ex Nyl.) Hale		T					
Parmotrema ultralucens (Krog) Hale	A	T			L		
Parmotrema xanthinum (Mull. Arg.) Hale		T					
Parmotremopsis antillensis (Nyl.) Elix & Hale						M	
Peltigera canina (L.) Willd.	A	T	S	H			
Peltigera degenii Gyelnik						M	
Peltigera didactyla (With.) J.R. Laundon		T					
Peltigera horizontalis (Hudson) Baumg.	A	T		H			
Peltigera hymenina (Ach.) Delise						M	
Peltigera leucophlebia (Nyl.) Gyelnik						M	
Peltigera membranacea (Ach.) Nyl.		T					
Peltigera polydactylon (Necker) Hoffm.	A	T	S	H	L		
Peltigera praetextata (Florke ex Sommerf.) Zopf	A					M	
Peltigera rufescens (Weiss) Humb.		T	S				
Pertusaria albescens (Hudson) M. Choisy & Werner		T					
Pertusaria amara (Ach.) Nyl.	A	T	S			M	
Pertusaria coriacea (Th. Fr.) Th. Fr						M	
Pertusaria leioplaca DC.	A	T					
Pertusaria macounii (Lamb) Dibben			S			M	
Pertusaria multipunctoides Dibben	A					M	
Pertusaria neoscotica Lamb	A					M	
Pertusaria ophthalmiza (Nyl.) Nyl. AAFB 237	A						**
Pertusaria ostiolata Dibben	A					M	
Pertusaria paratuberculifera Dibben	A					M	
Pertusaria propinqua Mull. Arg.						M	
Pertusaria pustulata (Ach.) Duby						M	
Pertusaria rubefacta Erichsen	A					M	
Pertusaria sp.	A						
Pertusaria subpertusa Brodo AAFB 664	A						**
Pertusaria texana Mull. Arg.	A					M	
Pertusaria trachythallina Erichsen	A	T	S			M	
Pertusaria valliculata Dibben AAFB 1224	A						**
Pertusaria velata (Turner) Nyl.	A	T	S			M	
Pertusaria waghornei Hulting	A	T				M	
Phaeographis lobata (Eschw.) Mull. Arg. AAFB 521	A						**

Phaeographis sericea (Eschw.)Mull. Arg. AAFB 630	A						**
Phaeographis sp.	A						
Phaeophyscia cernohorskyi (Nadv) Essl.	A					M	
Phaeophyscia ciliata Moberg	A		S		L		
Phaeophyscia endococcina (Korber) Moberg						M	
Phaeophyscia hirtella (Hoffm.) Essl.	A					M	
Phaeophyscia hispidula (Ach.) Essl. AAFB 531	A						**
Phaeophyscia imbricata (Vainio) Essl.	A				L		
Phaeophyscia orbicularis (Necker) Moberg		T	S	H	L		
Phaeophyscia pusilloides (Zahlbr.) Essl.	A			H			
Phaeophyscia rubropulchra (Degel.) Moberg	A	T					
Phlyctis sp.	A						
Phyllopsora parvifolia (Pers.) Mull. Arg.						M	
Physcia adscendens (Fr.) H. Olivier						M	
Physcia aipolia (Ehrh. ex Humb.) Furnr.	A		S				
Physcia americana G.Merr.	A	T			L		
Physcia dubia (Hoffm.) Lettau AAFB 1235	A						**
Physcia halei J.W. Thomson						M	
Physcia millegrana Degel.	A				L		
Physcia phaea (Tuck.) J.W. Thomson			S				
Physcia pseudospeciosa J.W. Thomson	A					M	
Physcia sorediosa (Vainio) Lynge AAFB 675	A						**
Physcia stellaris (L.) Nyl.		T	S	H			
Physcia subtilis Degel.			S				
Physcia wainioi Rasanen			S				
Physciella cloantha (Ach.) Essl.	A					M	
Pilophorus cereolus (Ach.) Th. Fr.						M	
Placynthiella uliginosa (Shrader) Coppins & P. James		T	S				
Placynthium stenophyllum (Tuck.) Fink						M	
Plastimatia lacunosa (Ach.) Culb. & C. Culb.		T					
Platismatia glauca (L.) Culb. & C. Culb.		T	S	H		M	
Platismatia tuckermanii (Oakes) Culb. & C. Culb.	A	T	S	H			
Polyblastia cupularis A. Massal.			S			M	
Polysporina simplex (Davies) Vezda			S				
Porina cestrensis (Tuck. ex. Michener) Mull. Arg.						M	
Porina heterospora (Fink) R.C. Harris	A					M	
Porina sp.	A						
Porpidia albocaerulescens (Wulfen) Hert. & Knoph	A	T	S				
Porpidia crustulata (Ach.) Hertel & Knoph	A	T	S				
Porpidia grisea Gowan						M	
Porpidia herteliana Gowan AAFB 1051	A						**
Porpidia macrocarpa (DC.) Hertel & A.J. Schwab		T	S				
Porpidia sp.	A						
Porpidia speirea (Ach.) Kremp.		T					
Protoblastenia calva (Dickson) Zahlbr.						M	
Protoblastenia rupestris (Scop.) J. Steiner AAFB 461	A						**
Protoparmelia badia (Hoffm.) Hafellner						M	
Pseudevernia cladonia (Tuck.) Hale & Culb.		T	S	H			

Pseudevernia consocians (Vainio) Hale & Culb.		T	S	H			
Pseudocyphallaria aurata (Ach.) Vainio	A					M	
Pseudocyphellaria crocata (L.) Vainio			S	H			
Psilolechia lucida (Ach.) M. Choisy		T					
Psora russellii (Tuck.) A. Schneider						M	
Psorula rufonigra (Tuck.) Gotth. Schneider						M	
Punctelia appalachensis (Culb.) Krog		T		H		M	
Punctelia bolliana (Mull. Arg.) Krog	A	T	S				
Punctelia borreri (Sm.) Krog		T					
Punctelia hypoleucites (Nyl.) Krog AAFB 1345	A						**
Punctelia missouriensis Wilhelm & Ladd	A					M	
Punctelia reddenda (Stirton) Krog				H			
Punctelia rudecta (Ach.) Krog	A	T		H			
Punctelia subrudecta (Nyl.) Krog	A	T		H			
Pyrenopsis sanguinea Anzi			S				
Pyrenula citriformis R.C. Harris AAFB 1196	A						**
Pyrenula concatervans (Nyl.) R.C. Harris						M	
Pyrenula pseudobufonia (Rehm) R.C. Harris	A					M	
Pyrenula punctella (Nyl.) Trevisan AAFB 490	A						**
Pyrenula sp.		T					
Pyrrhospora russula (Ach.) Hafellner	A	T				M	
Pyrrhospora varians R.C. Harris	A					M	
Pyxine caesiopruinosa (Tuck.) Imshaug	A				L		
Pyxine sorediata (Ach.) Mont.	A		S	H	L		
Ramalina americana Hale	A				L		
Ramalina farinacea (L.) Ach.						M	
Ramalina intermedia (Delise ex Nyl.) Nyl.				H			
Ramalina montagnei De Not.						M	
Ramalina sp.	A		S				
Rhizocarpon distinctum Th.Fr.						M	
Rhizocarpon eupetraeum (Nyl.) Arnold			S				
Rhizocarpon grande (Florke ex Flotow) Arnold			S				
Rhizocarpon hochstetteri (Korber) Vainio						M	
Rhizocarpon obscuratum (Ach.) Massal.						M	
Rimelia cetrata (Ach.) Hale & Fletcher	A					M	
Rimelia reticulata (Taylor) Hale & Fletcher	A	T	S	H	L		
Rimelia simulans (Hale) Hale & Fletcher		T					
Rimelia subisidiosa (Mull. Arg.) Hale & Fletcher	A	T			L		
Rimeliella subtinctoria (Zahlbr.) Kurok	A				L		
Rinodina ascociscana Tuck.			S				
Rinodina chrysomelaena Tuck.			S				
Rinodina confragosa (Ach.) Koerber			S				
Rinodina exigua (Ach.) Gray	A		S				
Rinodina tephraspis (Tuck.) Herre			S				
Rinodina willeyii Sheard & Giralt						M	
Ropalospora chlorantha (Tuck.) S. Ekman			S				
Sarcogyne regularis Korber AAFB 996	A						**

Schismatomma pericleum (Ach.) Branth & Rostrup						M	
Scoliciosporum umbrinum (Ach.) Arnold			S			M	
Staurothele diffractella (Nyl.) Tuck.						M	
Staurothele tenuissima Degel			S				
Stereocaulon dactylophyllum Florke				H			
Stereocaulon pileatum Ach.				H			
Stereocaulon tennesseense H. Magn. ex Degel			S	H			
Sticta fuliginosa (Hoffm.) Ach.			S	H			
Sticta weigelii Vainio			S	H			
Teloschistes exilis (Michaux) Vainio						M	
Thelidium pyrenophorum (Ach.) Mudd	A					M	
Thelocarpon laureri (Flotow) Nyl. AAFB 92	A						**
Thelotrema subtile Tuck.		T	S				
Thermutis velutina (Ach.) Flotow			S				
Thyrea girardii (Durieu & Mont.) Bagl.& Carestia						M	
Toninia aromatica (Sm.) A. Massal.	A						**
Trapelia coarctata (Sm.) Choisy						M	
Trapelia involuta (Taylor) Hertel AAFB 794	A						**
Trapelia placoides Coppins & P.James						M	
Trapeliopsis flexuosa (Fr.) Coppins & P. James AAFB 24	A						**
Trapeliopsis granulosa (Hoffm.) Lumbsch.		T					
Trypethelium virens Tuck. ex Michener	A		S				
Tuckermannopsis americana (Sprengel) Hale						M	
Tuckermannopsis ciliaris (Ach.) Gyelnik		T	S	H			
Tuckermannopsis orbata (Nyl.) M.J. Lai		T		H			
Umbilicaria caroliniana Tuck.				H			
Umbilicaria mammulata (Ach.) Tuck.				H			
Umbilicaria muehlenbergii (Ach.) Tuck.		T		H			
Umbilicaria vellea (L.) Hoffm.						M	
Usnea cavernosa Tuck.			S				
Usnea ceratina Ach. A				H			
Usnea filipendula Stirton						M	
Usnea fragilescens var. *mollis* (Vainio) Clerc				H			
Usnea hesperina Mot.				H			
Usnea mutabilis Stirton	A					M	
Usnea pensylvanica Mot.						M	
Usnea rubicunda Stirton	A					M	
Usnea sp.	A						
Usnea strigosa (Ach.) Eaton	A			H	L		
Usnea subfloridana Stirton				H			
Usnea subfusca Stirton				H			
Usnea trichodea Ach.				H			
Usnea tristis Mot.						M	
Verrucaria aethiobola Wahlenb.						M	
Verrucaria illinoisensis Servit	A						**
Verrucaria marmorea (Scop.) Arnold						M	
Verrucaria ruderella Nyl.						M	

Verrucaria sp.	A					
Verrucaria submuralis Nyl.						M
Vulpicida viridis (Schwein.) J.E. Mattsson & M.J. Lai	A	T				
Xanthoparmelia conspersa (Ehrh. ex Ach.) Hale		T	S	H		
Xanthoparmelia cumberlandia (Gydnik) Hale				H	L	
Xanthoparmelia plittii (Gyelnk) Hale	A	T		H		
Xanthoparmelia somloensis (Gyelnk) Hale				H		
Xanthoparmelia subramigera (Gyelnk) Hale						M
Xanthoparmelia taractica Hale						M
Xanthoria candelaria (L.) Th. Fr.						M
Xanthoria fallax (Hepp.) Arnold						M
Xanthoria polycarpa (Hoffm.) Rieber				H		

Total number species reported from Tennessee: 569

Number species reported from Arnold Air Force Base (Ciegler):	215
Number species in University of Tennessee Herbarium:	207
Number species reported from Smoky Mountains (Degelius):	159
Number species reported from High Appalachians (Dey):	139
Number species reported from Land between the Lakes (Phillips):	42
Number miscellaneous species reported:	136
Number New State Records:	64

Moss Records for South Texas - 2

Cynthia M. Galloway[1]

The area treated here as South Texas is that area north of the Rio Grande River but south of a line drawn along the northern boundary of Kinney county, heading east to along the northern boundary of Bexar County and continuing slightly southeast to where Matagorda county meets to Gulf of Mexico. (Fig. 1). This area comprises 37 counties, 31 of which have 10 or fewer species of mosses reported and seven with none reported. A previous investigation (Galloway & Burandt 1992) showed the area to be worthy of more in-depth study of its bryoflora.

The collections reported here are from Aransas, Cameron, Duval, Hidalgo, Kleberg, Jim Wells, Nueces, San Patricio, and Willacy counties, all of which previously have been only minimally examined for mosses (cf. Bartram 1928; Grout 1945; Pursell & Reese 1963; Whitehouse, 1954). The specimens reported here result from student collections compiled during two semesters of a non-flowering plants course offered at Texas A&M University; several semesters of independent research topics; and mosses brought in by introductory botany students and others connected with Texas A&M University--Kingsville. Thirty county records are reported at this time. The specimens are held in the Texas A&M University herbarium (TAIU). County names are in boldface. The specimen numbers are those supplied by collectors. Nomenclature is according to Anderson et al. (1990).

AMBLYSTEGIACEAE

Amblystegium varium (Hedw.) Lindb. **Nueces:** Corpus Christi. On soil in planter outside of a movie theater along South Padre Island Drive. This moss has not been previously reported from south of Bexar Co. Galloway T-145.

ANOMODONTACEAE

Anomodon attenuatus (Hedw.) Hueb. **San Patricio:** Lake Corpus Christi State Park. On oak tree, Dennis-4. Previously reported from the north-east portion of the state. This collection represents the southernmost collection in the state.

ARCHIDIACEAE

Archidium hallii Aust. **Kleberg:** Kingsville. On soil, in flowerbed in front of Bishop Hall dormitory on the campus of Texas A&M Univ., Kingsville. Morris-3.

Archidium ohioense Schimp. ex. C.M. **Willacy:** Y Turria Ranch. On soil on the west aspect of Sindero. Gonzalez-15. Rare within the state. This represents the first collection in South Texas.

BRUCHIACEAE

Trematodon longicollis Michx. **Kleberg:** Riviera. Brown-1. The collection of this moss represents a major range extension within the state. There are only three collections reported previously, all from an area adjoining the Louisiana--Texas state line.

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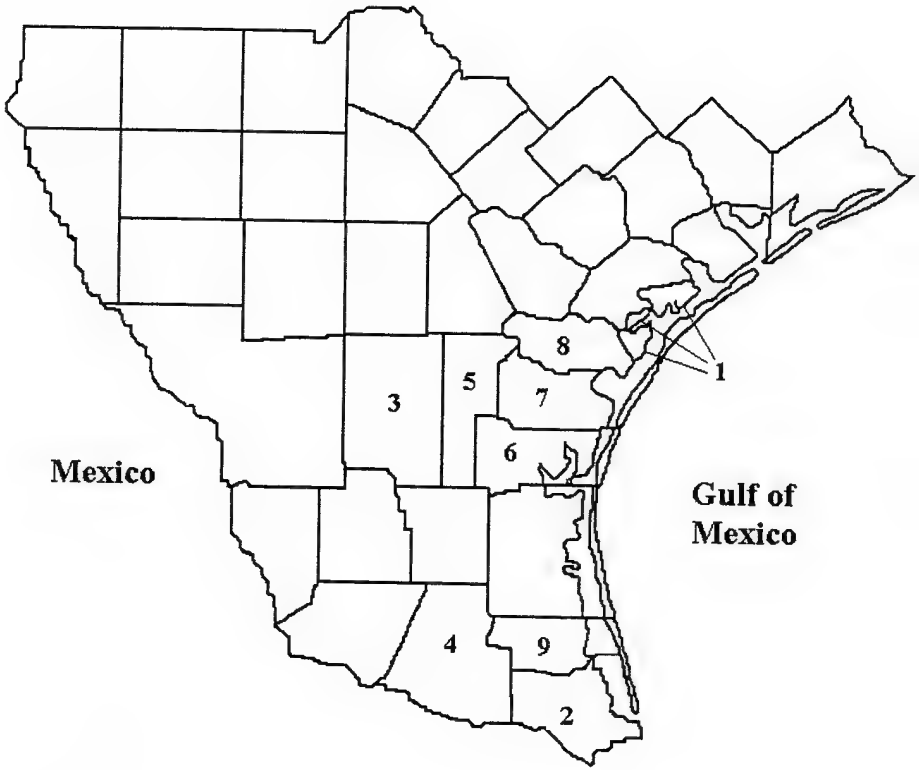

Figure 1. Map of South Texas. Counties collected are listed numerically. 1= Aransas, 2= Cameron, 3= Duval, 4= Hidalgo, 5= Jim Wells, 6= Kleberg, 7= Nueces, 8= San Patricio, 9= Willacy

BRYACEAE

Bryum argenteum Hedw. **Cameron:** Laguna Atascosa National Wildlife Refuge, Lakeside Trail. On soil at bird mist-net station. Dennis-7. Common, scattered throughout the state.

Bryum capillare Hedw. var. *capillare*. **Kleberg:** Kingsville, 3220 North County Rd. 1038, on sandy soil under trailer home. Garza-SS99MG-01. **Aransas:** Goose Island, in a sand pocket on the trunk of an oak tree, Rendon-27. These two collections bridge the gap between Bexar and Cameron counties. Reported once before from south Texas. More commonly found in central and west Texas.

Bryum lisae De Not. var. *cuspidatum* (Bruch. & Schimp. in B.S.G.) Marg. **Jim Wells:** Alice. Hillcrest Elementary School, Morningside St., behind portable building 4, on soil. Salinas-7a; **Nueces:** Corpus Christi, on soil next to athletic club on south Airline, Y. Garza-19; on soil on north side of Corpus Christi Courthouse, Salazar-5. Not common in Texas.

Bryum radiculosum Brid. **Duval:** Benavides, 318 Chaparral St., on soil near porch, Garza S99MG-02. Rarely collected in Texas but probably widespread.

DITRICHACEAE

Ditrichum pallidum (Hedw.) Hampe. **Kleberg:** Kingsville. On soil, in flowerbed in front of Bishop Hall dormitory on the campus of Texas A&M Univ., Kingsville. Morris 4. Commonly found in northeast Texas but not reported south of Victoria Co. in our area.

EPHEMERACEAE

Ephemerum cohaerens (Hedw.) Hampe. **Jim Wells:** Alice, 1105 Miranda St., in backyard flower bed, on soil, Salinas-9. Rarely collected within the state. This represents a seventh county for this moss and five of the seven counties lie within the south Texas area.

FABRONIACEAE

Fabronia ciliaris (Brid.) Brid. var. *wrightii* (Sull.) Buck. **Kleberg:** Kingsville. On metal ice cooler, Beto's market, Garza-2. More commonly found in west Texas. This represents the first collection of this moss in south Texas.

FUNARIACEAE

Funaria flavicans Michx. **Jim Wells:** Alice, 1717 Triangle Dr., on soil in flower bed. Salinas-11; **Nueces:** Bishop, Alamo St., on soil on stairs of mobile home, Morris-7. Found more commonly than *F. hygrometrica.*

Funaria hygrometrica Hedw. **Jim Wells:** Alice. Hillcrest Elementary School. Morningside St., behind portable building 4, on soil in a shaded area. Salinas-7b. Only found once before in south Texas.

Physcomitrium pyriforme (Hedw.) Hampe. **Hidalgo:** Schaleban Ranch. On soil. Hart 02.

LESKEACEAE

Bryohaplocladium microphyllum (Hedw.) Wat. & Iwats. **Kleberg:** Kingsville, Beto's market. On soil at mouth of clay drainage pipe. Garza-3. Scattered throughout the state.

LEUCODONTACEAE

Leucodon julaceus (Hedw.) Sull. **Aransas:** Goose Island. On road leading to the Big Tree. On downed tree branch. Rendon-10. Common moss in the central and north-eastern part of the state. This collection is at the southernmost edge of the known state distribution.

POTTIACEAE

Astomum muhlenbergianum (Sw.) Grout. **Duval:** Duval County Park, 5.5 mi. west of Benivides, on rock underneath tree leaves. Garza-S99MG-15; **Hidalgo:** Schaleban Ranch. On soil. Hart 01; **Nueces:** Corpus Christi, on soil in residential area, Salazar-9. Previously reported from north and south of the Duval and Nueces county collections. These collections bridge what had appeared to be a disjunction in the distribution.

Barbula indica (Hook.) Spring. in Steud. var. *indica.* **Nueces:** Bishop City Park, on soil on north bank of creek, Gonzalez-12; **Duva:** Duval County Park. On rock. Garza-SS99MG-14.

Barbula unguiculata Hedw. **Jim Wells:** Alice. William Adams Jr. High, Third St., under central unit #3, on soil, Salinas-4. Scattered throughout the state.

Desmatodon plinthobius Sull & Lesq., **Duval:** Temple Ranch. On 100 year old water well. Gonzalez-14. Widespread within the state but rare in south Texas.

Didymodon tophaceus (Brid.) Lisa. **Kleberg:** Dick Kleberg Park, on soil, next to office on south side of lake, Garza-13. Previously reported from central and west Texas. This collection extends the range within the state into south Texas.

Weissia controversa Hedw. **Jim Wells:** Alice, Lake Alice, on the right side of the sandbox,eastern exposure, on soil. Salinas 14; **Cameron:** Laguna Atascosa National Wildlife Refuge, Lakeside Trail. On soil at bird mist-net station. Dennis-1. This is one of the more common mosses found within the state.

Weissia jamaicense (Mitt.) Grout. **Jim Wells:** Alice, 1101 Cecilia, old trailer park, on soil. Salinas-15. This is a much more rarely collected moss than *W. controversa* and half of the collections have come from south Texas.

Acknowledgments - I thank William D. Reese for confirming and/or determining the specimens reported here and Dr. Alice Hemple for her technical assistance.

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Grimmia unicolor (Musci: Grimmiaceae) in Maine

Bruce Allen[1] & Patricia Ledlie[2]

Grimmia is a genus of small, erect, dark-green to black mosses predominantly found on bare rock. Most members of the genus are markedly xerophytic, but a few of them are found on rocks or boulders in and along streams or rivers. Overall, the genus is taxonomically difficult and sporophytes are sometimes needed for species determinations. There are, however, a few *Grimmia* species with gametophytes so distinctive they are easy to recognize with or without sporophytes.

Grimmia unicolor Hook. *ex* Grev. is a species that combines both of these unusual features of *Grimmia*. The species is restricted to wet rocks in and along the margins of lakes and streams or in the splash zones of waterfalls. Gametophytically *G. unicolor* can be recognized in the field as small, erect, rheophilous plants having erect-imbricate leaves with obtuse-cucullate apices that are greatly thickened due to a multistratose upper leaf lamina. *Grimmia unicolor* is found across the northern part of eastern North America from Newfoundland, Labrador, and Quebec to southern Manitoba. Toward the south the species is found in Vermont, southern New York, and the Great Lakes regions of Minnesota, Michigan and Ontario. It also occurs in northern and central Europe, Kazakstan, the Altay region of Russia, Mongolia, and China.

Recently *G. unicolor* was collected in western Maine where it was found growing on a thick layer of gravel in the crevices of large boulders set well out into the Rapid River. The boulders and moss were frequently wetted by spray from river waves. The Rapid River flows northwestward out of Lower Richardson Lake into Lake Umbagog in New Hampshire. It is reputed to be one of the fastest flowing rivers in eastern United States. The addition of this species to the Maine moss flora brings the number of *Grimmia* species known in the state to seven.

Grimmia unicolor Hook. & Grev., Scott. Crypt. Fl. 3, pl. 123. 1825.

Plants small, dark-green above, blackish-green below, to 10 mm high. Leaves 1.5-2.0 mm long, erect-imbricate when dry, erect-spreading when wet, oblong-ligulate, muticous, obtuse, cucullate; margins erect to somewhat incurved below, incurved above, entire, 3–4-stratose above; concave; costa subpercurrent, more or less flat at back; upper cells irregularly rounded, thick-walled, 3–8 μm, multistratose; inner basal cells 18–44 μm x 6–8 μm, long or short rectangular, walls mostly straight, those near the costa at base simetimes sinuose, thick-walled, outer basal cells short-rectangular, quadrate to oblate, thick-walled. Sporophytes not known in Maine (description based on plants from Ontario, *Garton 23610*, MO). Dioicous. Setae 3–4 mm long, erect, twisted when dry, erect when moist; capsules erect and symmetric, oblong-cylindric. smooth to somewhat wrinkled when dry, 1–1.2 mm long; annulus of 3 or 4 rows of differentiated cells clinging to the capsule mouth after operculum dehisence; opercula obliquely rostrate, 0.8–1 mm long; stomata present at capsule base; peristome teeth reddish-brown, irregularly divided to perforate above, densely papillose above on dorsal (outer) surface,

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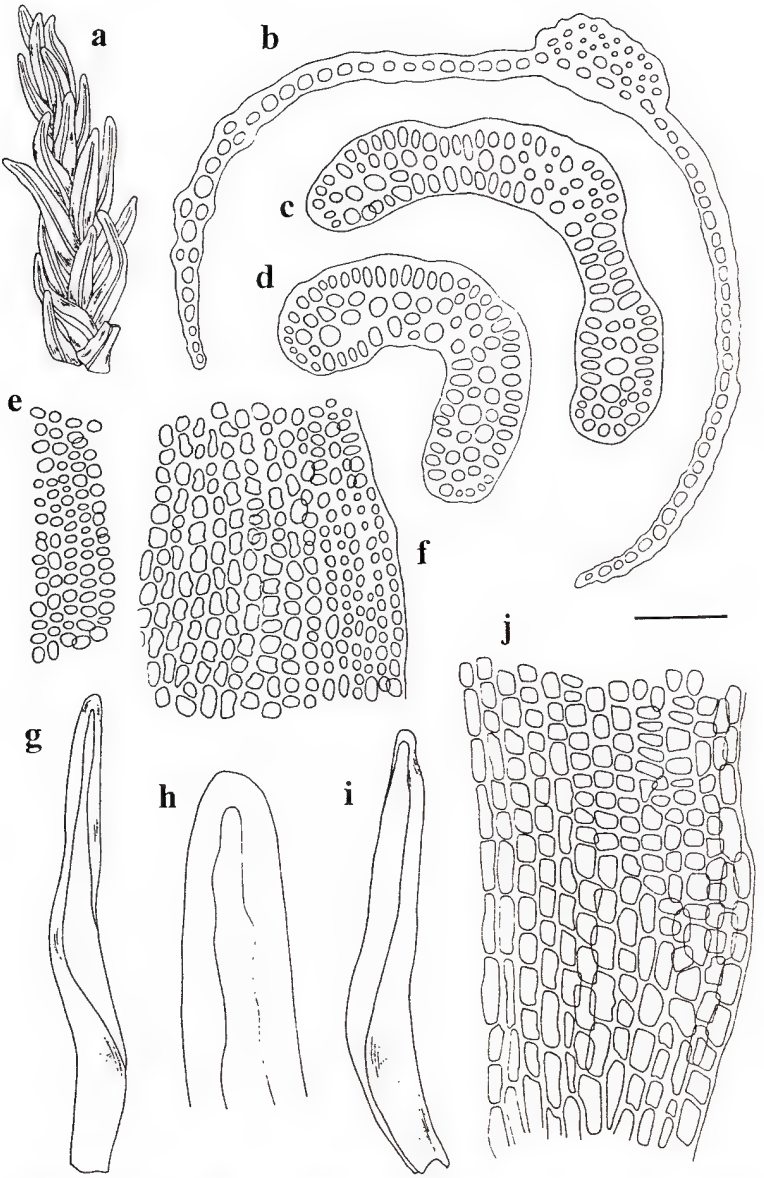

Figure 1. *Grimmia unicolor*. a. Habit. b. Cross-section of lower part of leaf. c. Cross-section of middle part of leaf. d. Cross-section of upper part of leaf. e. Upper leaf cells. f. Median leaf cells at margin just above leaf base. g. & i. Leaves. h. Leaf Apex. j. Leaf cells at leaf base. Scale in mm: bar = 0.05 (b–f,j); bar = 0.1 (h); bar = 0.39 (g,i); bar = 1.05 (a). All figures from *Ledlie 47* (MO).

smooth at base on dorsal (outer) and ventral (inner) surfaces. Calyptrae cucullate, smooth, 1.5 mm long. Spores 8–10 µm, smooth.

Maine specimens. Oxford County. Township C, Rapid River, Cold Spring Pool. (*Ledlie 47, 51, 55* all MO).

Key to the species of *Grimmia* in Maine

1. Leaves concave (in cross-section) 2
1. Leaves keeled (in cross-section) 3
    2. Leaves oblong-ligulate, muticous, apex obtuse, cucullate ..... *Grimmia unicolor*
    2. Leaves lanceolate, hair-pointed, apex acuminate ..... *Grimmia olneyi*
3. Basal leaf cells short-rectangular to quadrate; plants with gemmae 4
3. Basal leaf cells long-rectangular to elongate near costa; plants without gemmae 5
    4. Leaves 1.2-2.2 mm long, margins recurved on one side (rarely both) in lower 1/3; gemmae from basal leaf cells of otherwise normal leaves .....*Grimmia hermannii*
    4. Leaves 2-3 mm long, margins recurved on both sides to 3/4 the leaf length; gemmae from apical leaf cells of short, blunt leaves . *Grimmia hartmanii*
5. Leaf margins plane, basal cells near costa straight-walled, basal marginal cells elongate and hyaline extending upward in a v-shaped pattern ..... *Grimmia donniana*
5. Leaf margins recurved at base on one or both sides, basal cells near costa sinuate, basal marginal cells short-rectangular to quadrate 6
    6. Plants dioicous; setae 1 mm long, capsules immersed; leaf margins mostly recurved on both sides ..... *Grimmia pilifera*
    6. Plants autoicous; setae 2-3.5 mm long, capsules exserted, leaf margins recurved on one side ..... *Grimmia affinis*

Lichens of an Old-Growth Forest in a Little Explored Area of Western Oregon, U.S.A.

Abbey L. Rosso[1], Bruce McCune[1], Tor Tønsberg[2], and Christian Printzen[3].

Our knowledge of old-growth lichen communities in western Oregon comes primarily from surveys conducted in the northwestern quarter of the state, with studies concentrated in and around the Andrews Experimental Forest and Corvallis. Very little information has been available on the lichen flora of the southwestern portion of the state. Here we present a list of species present in an old-growth stand in the Umpqua region of southwestern Oregon (Table 1).

The flora of the Umpqua region is transitional between the Western Cascade forests to the north, and the drier Klamath region vegetation to the south (Franklin and Dryness, 1973). We surveyed an approximately 85 ha old-growth stand centered on "Cobble Knob" in the Rock Creek watershed (43° 27'N 122° 45'W). Rock Creek is a main tributary of the North Umpqua River, located east of Roseburg in Douglas County, Oregon. The dominant overstory trees in the stand were large *Pseudotsuga menziesii* up to 220 cm at breast height (dbh) and greater than 500 yrs old; codominants included scattered *Pinus lambertiana* up to 200 cm dbh, *Tsuga heterophylla*, and *Thuja plicata*. *Taxus brevifolia*, *Arbutus menziesii*, *Chrysolepis chrysophylla*, *Acer macrophyllum*, *Acer circinatum*, and *Corylus cornuta* var. *californica* were common in the understory. The abundance of *Arbutus*, *Castanopsis*, and *Pinus lambertiana* distinguish this area from forests to the north. Surveys were conducted over a 1 month period in the summer of 1997, as part of a study of the distribution and habitat of the old-growth-associated lichen, *Nephroma occultum* Wetm., within the Rock Creek watershed (Rosso et al., 1999). Field work was carried out by the first two authors. The study was motivated by an impending timber sale on Cobble Knob.

Our list represents those species encountered during ground-level searches for *N. occultum*, and includes species found on all substrates accessible from the ground (Table 1). Nomenclature follows Esslinger and Egan (1995) or McCune and Geiser (1998), except as indicated. Vouchers were deposited in OSC or the herbarium of B. McCune. Many more species are likely present in the stand, especially Caliciales and other crustose species, as our surveys were not intended to be an exhaustive search.

Among the lichens we found, there were several rare or unusual species, as noted below. Future surveys in the Umpqua region, and other areas of southwestern Oregon, should lead to many additional rare species sightings and range extensions.

Species of Note:

Ahtiana sphaerosporella (Müll. Arg.) Goward.—This infrequently collected species was rather reliably present on the upper branches of *Pinus lambertiana* at Cobble Knob. Typically it was associated with *Cetraria platyphylla* and *C. pallidula*.

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Arthonia sp.—At one outcrop area this was a frequent hymenial parasite in apothecia of *Lecidella*. It is similar to *A. intexta*, which was also found at the site, but more rarely. Possibly undescribed, the species has spores that are 1-septate and larger than the 2-septate spores of *A. intexta*. Note, however, that Hertel (1969) found small variation in spore size and shape on different species of *Lecidella*. *A. intexta* sometimes has 1-septate spores, however in this case spores were abundant and all 1-septate. Like *A. intexta*, this species replaces the host hymenium and has no apparent thallus of its own. It appears to colonize *Lecidella* species and perhaps *Porpidia*. In addition to Cobble Knob (McCune 23637, 23640, 23664) it is known from the Coast Range in Douglas County, Oregon (45°5'N 123°33'W, 480 m, *McCune 23855*).

Bacidia idahoensis H. Magn. (= *B. laurocerasi* (Delise ex Duby) Ozenda & Clauz. subsp. *idahoensis* (Magn.) Ekman).—This species is fairly common in low-elevation mesic forests of northern Idaho and western Montana, but is seldom found west of the Cascade crest. This first specimen from Oregon (*Rosso L858*) was growing on liverworts (primarily *Frullania nisquallensis*) on *Acer circinatum*.

Biatora nobilis Pritzen & Tønsberg, ined.— The known distribution of this species extends west of 120°W longitude, from Cobble Knob (*Rosso L829*) northward to Vancouver Island, BC. It is typically found in *Pseudotsuga menziesii* forests, and may be a good old-growth indicator. The similar *B. rufidula* has a more eastern distribution, but may occur sympatrically (*Rosso L836*).

Lecanora epithallina H. Magn.—This species is related to *L. dispersa*, but the disk is epruinose, the spores slightly smaller, the substrate noncalcareous, and it is apparently parasitic on cyanolichens. Our material (*McCune 23658*) fits the description of *L. epithallina* in Poelt (1969, p. 339), but was growing on *Koerberia sonomensis* rather than the closely related *Vestergrenopsis isidiata* as described by Poelt. At Cobble Knob it was parasitic exclusively on *Koerberia sonomensis*, and it was not found on other nearby saxicolous cyanolichens. *L. epithallina* is new to North America and no other American sites for this species are known. Study of other populations of *Koerberia* should turn up new locations. Although fairly frequent in Oregon and Washington, *Koerberia* is seldom collected in the Pacific Northwest because it is often rather cryptic, blending in with the dark basalts and andesites on which it grows.

Leptogium tenuissimum (Dickson) Körber.—This species commonly occurs on shady, fairly recently disturbed soil (such as roadcuts) in southwestern Oregon. It is so small, however, that it is usually overlooked by collectors of macrolichens. It is fairly frequent in the Cobble Knob area (*McCune 23659, 23667, 23686; Rosso L854, L892*).

Loxospora elatina (Ach.) A. Massal.—This widely distributed lichen has seldom been collected in Oregon. The specimens were found on the bole of a *Tsuga heterophylla* and on a stunted *Abies grandis* (*Rosso L812, L813*).

Micarea sp.— We could not assign one *Micarea* (McCune 23583) to any known species. It resembles *M. melaena* in some respects, but has a considerably higher hymenium and a thallus of small granules that appear sorediate in part. A brief description follows: Thallus granular to almost sorediate, green, granules 35-45 µm in diam; photobiont micareoid.

Apothecia sessile with a constricted base and a basal stipe, strongly convex to globose, black, margin lacking from the beginning. Exciple laterally 60 µm, basally expanded but intergrading with the stipe, colorless at the base, purplish brown (K+ greenish) near hymenium, of densely branched and anastomosing, strongly gelatinized hyphae with lumina of c. 0.5 µm; hypothecium dark purple brown, K+ greenish; epihymenium purple brown, K+ purple intensifying; hymenium c. 70 µm high, paraphyses strongly branched and anastomosing; asci *Micarea*-type, 8-spored; spores fusiform, colorless, 1-septate, 14-18.5 x 4.5-6 µm, with a 0.5-1 µm wide perispore. Pycnidia not seen. Chemistry: gyrophoric acid by HPLC.

Peltigera kristinssonii Vitik.—It is unusual to find *P. kristinssonii* in forested habitats of western Oregon and Washington, more typical habitat being semi-exposed to exposed grasslands, open subalpine forests, and alpine tundra. In this case (McCune 23668), it grew on an abandoned graveled logging road. The adjacent forest was regenerating after cutting, so that the road must have been well exposed for at least a decade at the time of our visit.

Phylliscum demangeonii (Moug. & Mont.) Nyl.—This essentially crustose cyanolichen is common in western Oregon but usually overlooked. It typically overgrows *Aspicilia* on basalt and andesite. See McCune and Goward (1995) for a description.

Pseudocyphellaria rainierensis Imshaug.—This species is strongly old-growth associated and is a Survey and Manage species under the Northwest Forest Plan (Sillett and Goward, 1998; USDA & USDI, 1994). At the time of our surveys it was not known from this far south. In addition to Cobble Knob, it has been found in 2 other locations in the Rock Creek watershed, both in very old stands. The Cobble Knob site is an unusual occurrence on *Rhododendron macrophyllum* (*Rosso L886*, collected by C. Derr).

Trapeliopsis cf. *pseudogranulosa* Coppins & P. James.—The collection from Cobble Knob (*McCune 23585*) is not typical for this species, as it is richly fertile and esorediate. Like many collections of this species from the coastal states, it also lacks the usual anthraquinone pigment. The thallus is grayish green and continuous (not areolate) and contains gyrophoric acid; apothecia dull blackish gray with a more or less distinct, pale (off-white) rim, often tuberculate; spores within the typical range for the genus: 8-15 x 4-6 µm.

Xylographa vitiligo (Ach.) J. R. Laundon s. lat.—Similar to *X. vitiligo* s. str. in thalline characters but differing in chemistry; this variant is known from both Norway and the Pacific Northwest, and is being studied by Tønsberg. At Cobble Knob it was collected from the base of a *Calocedrus* (*McCune 23599*).

Acknowledgements. We thank John Sheard, Saskatoon, for help with identification of *Rinodina* species, and Vagn Alstrup, Copenhagen, for advice on parasitic species. We also thank all those involved in the surveys for *N. occultum* on Cobble Knob. Funding was provided, in part, by the Roseburg District of the Bureau of Land Management and the Forest and Range Ecosystem Science Center, U.S. Department of the Interior, Corvallis.

Table 1. Species encountered during surveys of Cobble Knob

Ahtiana sphaerosporella
Alectoria imshaugii
Alectoria sarmentosa
Alectoria vancouverensis
Arthonia sp.
Arthonia intexta
Aspicilia caesiocinerea
Bacidia arceutina
Bacidia idahoensis (see species of note)
Bacidia salmonea
Baeomyces rufus
Biatora nobilis *Printzen & Tønsb., ined.*
Biatora rufidula Printzen & Tønsb., ined.
Bryoria capillaris
Bryoria friabilis
Bryoria fuscescens
Buellia badia
Buellia muriformis *Nordin & Tønsb.*
Calicium viride
Caloplaca atrosanguinea
Caloplaca citrina
Candelariella vitellina
Cetraria canadensis
Cetraria chlorophylla
Cetraria merrillii
Cetraria orbata
Cetraria pallidula
Cetraria platyphylla
Chaenotheca brunneola
Chaenotheca furfuracea
Cladonia cariosa
Cladonia chlorophaea s. lat.
Cladonia fimbriata
Cladonia furcata
Cladonia ochrochlora
Cladonia squamosa var. *subsquamosa*
Cladonia transcendens
Cliostomum flavidulum Hafel. & K. Kalb.
Collema nigrescens
Diploschistes gypsaceus
Diploschistes muscorum
Esslingeriana idahoensis
Evernia prunastri
Fuscopannaria cyanolepra (Tuck.) P.M. Jørg., ined.
Fuscopannaria saubinetii s. lat.
Hypocenomyce castaneocinerea
Hypocenomyce friesii
Hypocenomyce scalaris
Hypogymnia apinnata
Hypogymnia enteromorpha
Hypogymnia imshaugii
Hypogymnia inactiva
Hypogymnia metaphysodes
Hypogymnia physodes
Hypogymnia tubulosa
Japewia subaurifera
Japewia tornoensis
Koerberia sonomensis
Lecanora epithallina H. Magn.
Lecanora pacifica
Lecanora pulicaris
Lecanora semitensis
Lecanora *aff.* symmicta
Lecidea berengeriana (Mass.) Th. Fr.
Lecidea cf. *enalla* Nyl.
Lecidea fuscoatra
Lecidella elaeochroma
Lecidella patavina
Lecidella stigmatea
Lepraria cf. *nivalis*
Leptochidium albociliatum
Leptogium corniculatum
Leptogium gelatinosum
Leptogium lichenoides
Leptogium polycarpum
Leptogium tenuissimum
Letharia vulpina
Lobaria oregana - green and blue-green photomorphs
Lobaria pulmonaria
Lobaria scrobiculata
Lopadium disciforme
Loxospora elatina
Melanelia exasperatula
Melanelia fuliginosa
Micarea sp.
Micarea misella ?
Micarea peliocarpa
Micarea prasina ?

Mycoblastus sanguinarius
Nephroma bellum
Nephroma helveticum
Nephroma laevigatum
Nephroma occultum
Nephroma parile
Nephroma resupinatum
Nodobryoria oregana
Normandina pulchella
Ochrolechia laevigata
Ochrolechia oregonensis
Ochrolechia subathallina
Ochrolechia subpallescens
Omphalina sp.
Omphioparma rubricosa
Parmelia hygrophila
Parmelia pseudosulcata
Parmelia sulcata
Parmeliella parvula P.M. Jørg.
Parmeliopsis hyperopta
Peltigera collina
Peltigera degenii
Peltigera britannica -
green and blue-green photomorphs
Peltigera elisabethae
Peltigera kristinssonii
Peltigera leucophlebia
Peltigera membranacea
Peltigera neopolydactyla
Peltigera pacifica
Peltigera praetextata
Peltigera rufescens
Pertusaria borealis
Pertusaria ophthalmiza
Pertusaria sommerfeltii
Pertusaria subambigens
Phlyctis argena
Phylliscum demangeonii
Physcia aipolia
Pilophorus acicularis
Placopsis gelida
Placynthiella icmalea
Platismatia glauca
Platismatia herrei
Platismatia stenophylla
Polychidium muscicola
Pseudocyphellaria anomala
Pseudocyphellaria anthraspis
Pseudocyphellaria crocata
Pseudocyphellaria rainierensis
Psorotichia sp.
Ptychographa xylographoides Nyl.
Pyrenula occidentalis
Pyrrhospora cinnabarina
Ramalina dilacerata
Ramalina farinacea
Rhizocarpon eupetraeum
Rhizocarpon simillimum
Rinodina archaea
Rinodina laevigata
Rinodina disjuncta
Sphaerophorus globosus
Sticta fuliginosa
Sticta weigelii s. lat.
Tephromela atra
Thelotrema lepadinum
Trapelia corticola
Trapeliopsis cf. *pseudogranulosa*
Trapeliopsis cf. *viridescens*
Usnea filipendula
Usnea glabrata
Usnea scabrata
Usnea subfloridana
Verrucaria sp.
Xanthoria polycarpa
Xylographa parallela
Xylographa aff. *vitiligo*

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The bryophytes of Edgewood County Park, San Mateo County, California.

Alan T. Whittemore[1] & Suzanne Sommers[2]

Edgewood County Park is a small park, with an area of 189 hectares, located in the foothills immediately west of southern San Francisco Bay. Despite its small size, the topography and geology of the park are very varied. A steep-sided ridge of greenstone runs north-to-south across the middle of the park. East of this ridge, a small plateau of sandstone and mudstone ends in narrow, steep-sided canyons. To the west is a much more gently-sloping plain of serpentine. Elevations range from 70 m above sea level at the bottom of the deepest canyons to 270 m at the highest point of the ridge. The climate is mild and dry, with warm summers (mean July high ca 30°C, low ca 10°C) and mild winters (mean January high 15°C, low 3°C). Mean annual precipitation is ca 65 cm; virtually all of this is rain, and 85% of it falls from November through March.

The diverse topography and geology of the park supports a variety of different vegetation types. Level ground throughout the park is largely grassland. The original dominants were probably the perennial bunchgrass *Nassella pulchra* (Hitchc.) Barkworth and a variety of broadleaf perennials and annuals, including species of *Layia, Lasthenia, Eschscholzia*, and *Castilleja*. As with most central California grasslands, this community is now largely dominated by introduced annual grasses, notably Europoean species of *Bromus* and *Lolium*. On the greenstone, sandstone and mudstone, north- and east-facing slopes are covered with a low, dense sclerophyll forest dominated by *Quercus agrifolia* Nee and *Umbellularia californica* (Hook. & Arn.) Nutt., occasionally broken by patches of sclerophyll scrub dominated by *Adenostoma fasciculatum* Hook. & Arn. or deciduous scrub dominated by *Artemisia californica* Less. Slopes on the serpentine are covered with sclerophyll scrub dominated by *Quercus durata* Jeps. or *Adenostoma fasciculatum*. The vascular flora is very rich, with 470 species known from the small area of the park (Anonymous 1997). Some of the habitats preserved in the park (notably the serpentine grassland) have been almost eliminated from the region around San Francisco Bay by extensive urban growth. Consequently, several of the vascular plant, insect and invertebrate species found here are now rare or endangered, including the only known surviving population of the endemic *Acanthomintha duttonii* (Abrams) Jokerst (Lamiaceae).

The bryoflora of the park consists of 62 species (17 liverworts, 3 hornworts, and 42 mosses) and one additional variety. Unlike the vascular flora, bryophyte diversity seems to owe little to the geological diversity of the site; the serpentine areas have few bryophytes. The steep and varied topography of the park creates a mosaic of mesic and xeric habitats, both of which support unusual species. *Cephaloziella stellulifera* and *Phaeoceros bulbiculosus*, both found on mesic canyonsides on the east side of the park, are both uncommon in North America. Indeed, *P. bulbiculosus* is not included in the latest checklist of North American hornworts (Stotler and Crandall-Stotler 1977), although it was reported from California by Müller (1954) and Proskauer (1958). The

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collection from Edgewood Park shows all the characteristics of the species, including the stalked ventral tubers and the distinctive raised ring on the outer face of the spore, so the presence of this species in California is confirmed. In contrast to these mesic species, several species of east-facing banks and rock outcrops on the higher slopes, notably *Desmatodon guepinii*, *Pseudobraunia californica*, *Grimmia laevigata* and *Pottia starkeana*, are characteristic dominants of the interior foothills in California but uncommon in the Outer Coast Ranges. The soil throughout the park normally dries out completely before the beginning of the summer, and doesn't rehydrate until the following fall, so that many mesophytic species common in the redwood forest only a few kilometers to the west are absent. However, one stream that is fed by a perennial spring supports a small population of *Eurhynchium praelongum*, a hygrophyte that is normally confined to wetter habitats closer to the coast.

All collection numbers are Alan Whittemore's. Vouchers are deposited in the herbaria of the California Academy of Sciences (CAS) and the Missouri Botanical Garden (MO).

LIVERWORTS:

Aytoniaceae

Asterella bolanderi (Aust.) Underw. (5277) Soil, open shade in oak woodland.

Asterella californica (Hampe) Underw. (5252) Soil of trailbanks in oak woodland.

Lunularia cruciata (L.) Dum. (6810) Damp soil of shaded trailbanks in oak woodland.

Targioniaceae

Targionia hypophylla L. (5251) Soil of trailbanks in oak woodland.

Ricciaceae

Riccia californica Aust. (5265) Bare shaded soil in oak woodland.

Riccia nigrella DC. (5227B) Dry sunny soil in grassland.

Riccia sorocarpa Bisch. (5220) Dry soil in shrubland.

Riccia trichocarpa M. A. Howe (6813) Bare soil in open shade.

Sphaerocarpaceae

Sphaerocarpus texanus Aust. (6713) Shaded mineral soil.

Fossombroniaceae

Fossombronia longiseta Aust. (5232, 5255) Sunny or shaded soil.

Gymnomitriaceae

Marsupella bolanderi (Aust.) Underw. (5269A) Soil of dry trailbank, open shade.

Cephaloziellaceae

Cephaloziella divaricata (Smith) Schiffn. (5227A, 5275) Dry soil, sun or open shade.

Cephaloziella stellulifera (Tayl.) Schiffn. (5256) Soil, sheltered places in oak woodland.

Cephaloziella turneri (Hook.) K. Müll. (5269B, 5350) Soil, usually on banks, in rather open sites.

Porellaceae

Porella bolanderi (Aust.) Pears. (5239, 5241, 5242) Shaded bark and rocks in oak woodland.

Porella navicularis (Lehm. & Lindenb.) Lindb. (6715) Shaded bark in oak woodland.

Jubulaceae

Frullania bolanderi Aust. (5222) Dry bark of *Quercus agrifolia*.

HORNWORTS:

Anthocerotaceae

Anthoceros fusiformis Aust. (5266) Shaded soil in oak woodland.

Phaeoceros bulbiculosus (Brotero) Prosk. (5245) Soil at edge of meadow.

Phaeoceros pearsonii (M. A. Howe) Prosk. (5254, 5342) Sunny to deeply shaded soil, oak woodland or *Adenostoma* scrub.

MOSSES:

Ditrichaceae

Ceratodon purpureus (Hedw.) Brid. (5349) Sandy soil in exposed places, *Adenostoma* scrub.

Fissidentaceae

Fissidens curvatus Hornsch. (5248) Sunny soil at edge of meadow.

Fissidens limbatus Sull. (5244) Shaded soil of trailbanks in oak woodland.

Dicranaceae

Dicranella howei Ren. & Card. (5267) Shaded soil beside road in oak woodland.

Pottiaceae

Desmatodon guepinii Br. & Schimp. (5346) Dry exposed soil of trailbank, *Artemisia* scrub on canyonside.

Didymodon occidentalis Zander (5231) Disturbed soil, open shade.

Didymodon vinealis (Brid.) Zander var. *flaccidus* (Br. & Sch.) Zander (5259) Shaded rock near a seasonal stream in oak woodland.

Didymodon vinealis (Brid.) Zand. var. *vinealis* (5336) Old concrete, open shade in oak woodland.

Pottia starckeana (Hedw.) C. Müll. var. *starckeana* (5345) Dry exposed soil of trailbank, *Artemisia* scrub on canyonside.

Timmiella crassinervis (Hampe) L. F. Koch (5230, 5263) Sunny or shaded soil.

Tortula bolanderi (Lesq.) M. A. Howe (5262) Soil of trailbanks, partial shade.

Tortula laevipila (Brid.) Schwaegr. (5226, 5229, 5338) Sunny bark and rock.

Tortula princeps De Not. (5236) Rock face, open shade in oak woodland.

Weissia controversa Hedw. (5253) Shaded soil of trailbank in oak woodland.

Grimmiaceae

Grimmia laevigata (Brid.) Brid. (5276) Dry sunny top of large rock outcrop.

Grimmia lisae De Not. (5223, 5224, 5271, 5272) Rock outcrops, sun or open shade.

Funariaceae

Funaria hygrometrica Hedw. (5335) Trampled stony soil by path.

Funaria muhlenbergii Turn. (5261) Soil of trailbank, open shade.

Bryaceae

Bryum argenteum Hedw. (5344) Sunny soil of trailbank.

Bryum canariense Brid. (5257) Shaded soil in oak woodland.

Bryum capillare Hedw. (5273) Shaded side of rock outcrop.

Bryum flaccidum Brid. (5340) Old concrete, open shade in oak woodland. No gemmae were seen.

Epipterygium tozeri (Grev.) Lindb. (5337) Beneath exposed roots, shaded soil bank in

oak woodland.

Bartramiaceae

Anacolia menziesii (Turn.) Paris (5274) Side of rock outcrop, exposed to northeast.

Bartramia stricta Brid. (5246, 5347) Soil in open shade.

Orthotrichaceae

Orthotrichum lyellii Hook. & Tayl. (5343) Bark of *Aesculus* in open oak woodland.

Orthotrichum rupestre Schleich. ex Schwaegr. (5225) Sunny rock.

Orthotrichum tenellum Bruch ex Brid. (5221) Dry bark of *Quercus agrifolia*.

Hedwigiaceae

Pseudobraunia californica (Lesq.) Broth. (5270) Side of large rock outcrop, in open shade.

Leucodontaceae

Alsia californica (Hook. & Arn.) Sull. (5243) Shaded bark in oak woodland.

Antitrichia californica Sull. in Lesq. (5228) Sunny bark of oak.

Dendroalsia abietina (Hook.) E. G. Britt. (5264) Shaded bark of oak.

Pterogonium gracile (Hedw.) Smith (5233, 5234) Rock face, open shade in oak woodland.

Thuidiaceae

Claopodium whippleanum (Sull. in Whipple & Ives) Ren. & Card. (5260) Shaded soil in oak woodland.

Brachytheciaceae

Bestia longipes (Sull. & Lesq.) Broth. (5238, 5240) Rock or bark in open shade, oak woodland.

Brachythecium albicans (Hedw.) Schimp. in B.S.G. (6812) Soil and duff beneath herbs in oak woodland.

Eurhynchium praelongum (Hedw.) Schimp. in B. S. G. (5258) Damp shaded soil in splash of small falls, probably seepy year-round.

Homalothecium arenarium (Lesq.) Lawt. (5348) Sunny soil.

Homalothecium nuttallii (Wils.) Jaeg. (5249) Bark of *Aesculus*, open shade.

Homalothecium aureum (Spruce) H. Rob. (5237, 5247, 5268) Soil or rock, in sun or open shade.

Isothecium myosuroides Brid. (5235, 6811) Bark or rock in open shade, oak woodland.

Scleropodium californicum (Lesq.) Kindb. (5219, 5250) Shady or exposed soil.

Scleropodium tourettii (Brid.) L. F. Koch (5339, 5341) Shaded rock, oak woodland.

Acknowledgements: We would like to thank Pat Sanchez, Mary Burns, and Lynn Fritz of the San Mateo County Parks and Recreation Division for permission to collect in the park, and Bob Noyes and Ruth van Seventer for help arranging and carrying out the fieldwork.

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Weissia brachycarpa (Nees & Hornsch.) Jur., a second Ontario collection

P. M. Eckel

While sorting specimens of *Tortella humilis* (Hedw.) Jenn. On loan from CANM, I discovered an anomalous fruiting population from Ontario filed under that name that had leaf margins too sharply incurved to be a *Tortella*, and which was clearly a species of *Weissia*. The population was richly fruiting and capsules could easily be found with evident opercula, excluding, then, its identity as a species of *Weissia* subg. *Astomum* (Hampe) Kindb. Of the three species with immersed and cleistocarpous capsules occurring in Canada (Ireland et al. 1987) only *Weissia muehlenbergiana* (Sw.) Reese & Lemmon is so far known from Ontario (distribution mapped by Ireland and Ley, 1992). The specimen, then, was probably either *Weissia controversa* Hedw. or *W. brachycarpa* (Nees & Hornsch.) Jur., the only two stegocarpous species of the genus known for the province (Ireland et al. 1987; Eckel 1997). Removal of the operculum showed the absence of a peristome. *Weissia brachycarpa* is known to have a thick circumstomal ring of several layers thickeness which was evident in the indehisced capsules in lateral view (in section). It is on this basis that the plant was distinguished from *W. controversa*, which both possesses a peristome, and has a single layer of cells associated with the capsule mouth.

Canada: Ontario. Leeds & Grenville United Counties: ca. 5.5 km NE of Westport, lat. 44°21'N, long. 76°21'W. Limestone rocks by small rivulet in mixed deciduous woods, on soil along road at edge of woods, 29 August 1991, *R. R. Ireland 24693*, with M. J. Shchepanek (CANM).

Numerous stations exist for *Weissia controversa* in Ontario (Ireland & Ley, 1992), but a station for *W. brachycarpa* there has only recently been discovered in the Regional Municipality of Niagara (Eckel 1997) in the region near southwestern Lake Ontario. This second station occurs east of it at the entrance to the St. Lawrence River. *Weissia brachycarpa* has been found in both British Columbia and Nova Scotia (Ireland et al., 1997) and has only rather recently been found in New York State (Eckel & Eckel 1988). Although Crum and Anderson (1981) indicate the species is rare, it is nevertheless widespread in eastern North America, extending to Texas and Indiana, broadly distributed in Europe and is "recorded from North Africa and the Caucasus." Stations in the Niagara Falls area of Ontario and adjacent New York state were associated with lawns and margins along roadways, indicating that it may well be more overlooked than rare.

I thank Richard Zander for verifying the identity of the specimen and the curators at CANM for their loan of specimens to BUF.

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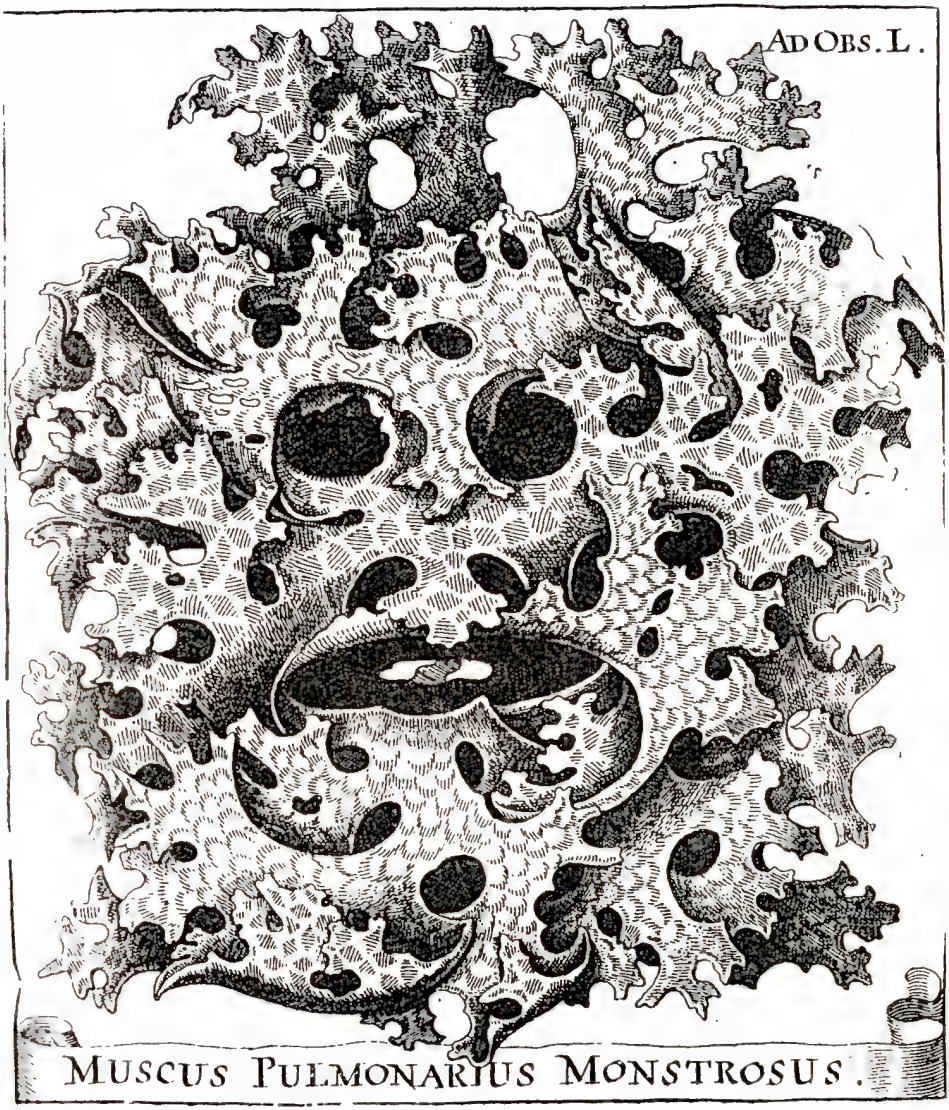
Buffalo Museum of Science, 1020 Humboldt Parkway, Buffalo, New York 14211



***Lobaria pulmonaria*, as seen as a "Monster Moss"** more than 300 years ago by martin Bernhard, Observatio Ll. Miscellanea Academiae Naturae Curiosorum 2: 89-112. 1671 (Jena).

In the year 1667, while returning to Warsaw after the recovery of Kraków from the Swedes and in company with His Serene Majesty John Casimir, the author saw this ghostly face on a patch of *Lobaria pulmonaria* growing on the trunk of an oak tree. The lichen, carefully removed from the tree, was covered with transparent, waxed paper and traced with a lead pencil for display at court. - Howard Crum, Herbarium, Univ. of Michigan, Ann Arbor, MI 48109-1057.

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New State and County Bryophyte Reports for Wisconsin

Kevin J. Lyman

Recent collections made by the author and others as well as the re-examination of older herbarium specimens housed at MIL, has resulted in two state and seventeen county records for seven counties in Wisconsin. These new reports are based on Bowers & Freckmann (1979) and more recent reports since that time (Christy, et al., 1986; Christy & Meyer, 1991; Maravolo, et al., 1983; Miller, 1980a & 1980b; Przywara, 1992). Numerous county records have been found within the state, however only those species that are apparently uncommon (3 or less accounts) in Wisconsin are presented here. This paper is a result of field and herbarium studies as part of a project to update Bowers & Freckmann's *Atlas of Wisconsin Bryophytes*.

Nomenclature for the mosses follows Anderson, et al. (1990) and Stotler & Crandall-Stotler (1977) for hepatics. All voucher and examined specimens are deposited at MIL.

New State Reports

***Didymodon tophaceus* (Brid.) Lisa**

MILWAUKEE COUNTY: Warnimont Park Fens. T6N, R22E, Sec. 36, SW¼. *Lyman 98-94, 1-95* (16 November 1994), *3-95, 9-95* (16 July 1995). Collected in spring seepages near the base of clay bluffs along Lake Michigan. One of the larger seepages supports a calcareous fen with regionally uncommon vascular plants.

***Cladopodiella fluitans* (Nees) Joerg.**

OZAUKEE COUNTY: Wollner Bog, 3.5 miles west of Saukville. T11N, R21E, Sec. 30, NE¼. *Horton 29962* (3 September 1989). VILAS COUNTY: Northern Highland - American Legion State Forest, Mud Creek area just north of Highway 70, about 6 miles east of the junction of Wis. 70 and US 51. T40N, R7E, Sec. 25 & 26. *Bowers 24837* (20 June 1996).

New County Reports

***Anomodon rugelii* (C. Müll.) Keissl.**

DOOR COUNTY: Northeast side of Moonlight Bay. T30N, R28E, Sec. 11, SW¼. *Lyman 25-90* (29 August 1990). IRON COUNTY: Northern Highland – American Legion State Forest, Lake du Page, ca. 5 miles west of Mercer. T43N, R4E, Sec. 27, SE¼. *Bowers 24766B* (19 June 1996). Christy, et al. (1986) reported it from Shawano County.

***Buxbaumia aphylla* Hedw.**

ONEIDA COUNTY: Northern Highland-American Legion State Forest, east of Swanson Lake. T38N, R8E, Sec. 3. *Lyman 42-93* (13 August 1993). MENOMINEE COUNTY: Keshena, Legend Lakes Project. T28N, R15E. *Kringle-Ahrendt s.n.* (September, 1993). Cheney & Evans (1944) reported it from Vilas County.

Botany Section, Milwaukee Public Museum, Milwaukee, Wisconsin 53233

***Encalypta procera* Bruch**

MILWAUKEE COUNTY: Veteran's Bluff, northeast end of Veteran's Administration Medical Center property, and adjacent to Milwaukee County Stadium parking lot. T7N, R21E, Sec. 35, NE¼. *Lyman 4-92, 9-92* (27 February 1992). Cheney & Evans (1944) reported it from Door and Outagamie counties as *E. streptocarpa*. Bowers (1977) and Maravolo, et al. (1983) reported it from Door County; Christy & Meyer (1991) reported it from Grant County. It has also been reported as a subfossil from the Two Creeks forest bed in Brown County (Miller, 1976, 1980a & 1980b).

***Leucodon julaceus* (Hedw.) Sull.**

POLK COUNTY: Interstate Park, 1.6 km south southwest of St. Croix Falls. T34N, R19W, Sec. 36, NE¼. *Christy 4465* (13 July 1982). Cheney (1929) reported it from Grant County and Cheney & Evans (1944) from Grant and Rock Counties.

***Moerckia hibernica* (Hook.) Gott.**

DOOR COUNTY: Baileys Harbor. *Nanz & Curtis s.n.* (8 June 1934). MILWAUKEE COUNTY: Lake bluff south of Cudahy. T6N, R22E, Sec. 36, NW¼. *Shinners 75* (3 July 1938). Conklin (1929) reported it from Douglas County as *Pallavicinia flotowiana*. According to Schuster (1992), there is some question whether Conklin's report is *M. hibernica fo. flotowiana* (Nees) de Sloover or the typical *M. hibernica* due to "...widespread confusion on this taxon..." Gunderson (1971) reported it from Oconto County.

***Polytrichum pallidisetum* Funck**

SAUK COUNTY: Parfrey's Glen State Natural Area #1, 5 miles southeast of Baraboo. T11N, R7E, Sec. 22 & 23. *Liske s.n.* (March 1975). Honey Creek State Natural Area #91. T10N, R4E, Sec. 11. *McCleary 17568* (10 September 1977). Pine Hollow State Natural Area #45. T10N, R5E, Sec. 4. *McCleary 17655* (23 August 1978). VILAS COUNTY: Trout Lake Conifer Swamp State Natural Area #21. T41N, R7E, Sec. 19, SE¼. *Dibben 25720* (25 September 1975). FOREST COUNTY: Nicolet National Forest, Scott Lake – Shelp Lake State Natural Area # 117, 12 km east southeast of Three Lakes. T38N, R12E, Sec. 17. *Christy 4736, 4759* (26 September 1982). RUSK COUNTY: Blue Hills Felsenmeer Scientific Area #74, 18 km east northeast of Cameron. T35N, R9W, Sec. 31. *Christy 4863* (29 September 1982). VERNON COUNTY: Wildcat Mountain State Park, along Kickapoo River. T14N, R2W, Sec. 11, SE¼. *Bowers, Przywara & Brandner A/48* (18 February 1984). DOOR COUNTY: Marshall's Point State Natural Area #204, 4 miles southeast of Sister Bay. T31N, R28E, Sec. 24, SE¼. *Lyman 61-92* (26 June 1992). ADAMS COUNTY: Upper Wisconsin Dells, Witches Gulch. T14N, R6E, Sec. 21, E½. *Lyman 76-95* (11 October 1995). Przywara & Bowers (1992) reported it from Vernon County.

***Pseudobryum cinclidioides* (Hüb.) T. Kop.**

ASHLAND COUNTY: Apostle Islands National Lakeshore, Stockton Island. *Dibben 26468* (3 August 1977). IRON COUNTY: Northern Highland-American Legion State Forest, Lake du Page, about 5 miles west of Mercer. T43N, R4E, Sec. 27, SE¼. *Bowers 24746B, 24804A* (19 June 1996). Freckmann (1977) reported it from Portage County.

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Bryophytes and Lichens of the Huron Mountain Club

William R. Manierre

Part I Bryophytes

Immediately prior to the founding of the Huron Mountain Club in 1889 a visitor wrote the following remarks which introduce an historical context for the lists of mosses, liverworts and lichens which are the substance of this paper. "Camping at the mouth of Pine River in the eighties, we made excursions for trout westward to Huron River Point and eastward to the Salmon Trout River. Game was abundant—deer, wild pigeons and grouse. Pigeons fed in great numbers on huckleberries in the woods between the mouth of the river and Pine Lake. The forest was practically untouched" (Christy 1929).

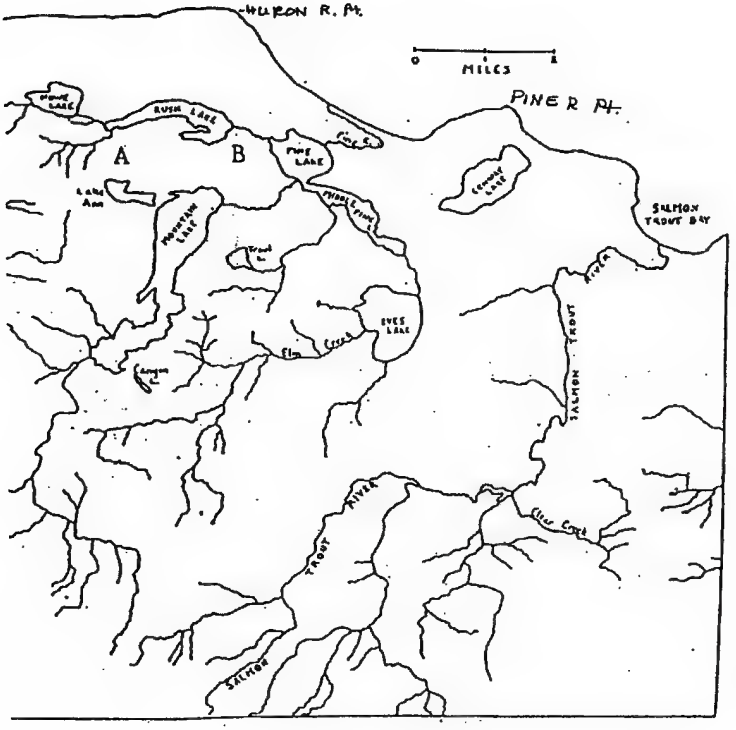
Forty-nine years later another visitor acknowledged the Club's largely successful efforts to maintain the "balance of nature . . . on its property, as nearly unaffected by civilization as possible" (*ibid.*). That visitor was Aldo Leopold whose "Report on Huron Mountain Club" (1938) vigorously affirms the necessity of science to begin with natural fact in as unaltered a condition as possible and suggests that the Club's largely protected holdings can provide a suitable laboratory as well as subject of investigation—minus, of course, the passenger pigeon whose species went extinct in 1914 when Martha, its last representative, died in the Cincinnati Zoo.

Leopold states that "the scientific values arise from the fact that the Huron Mountain property will soon be one of the few large remnants of maple-hemlock forest remaining in a substantially undisturbed condition. All earth sciences must, in the long run, learn how to use land by referring to unused land as a base-datum or starting point" (1938).

Three years prior to Leopold's report G. E. Nichols published the first of his two *Bryologist* articles on the bryophytes of Western Upper Michigan. In these articles Nichols makes clear that he is entering unexamined territory: "except for a few scattered collections, the western half of the Upper Michigan Peninsula, bryologically speaking, has remained virtually *terra incognita* until now" (1935). Three years later, in the year of Leopold's visit to the Club, Nichols published his second article (1938) in which are listed additional taxa bringing his total to "186 species or well-marked varieties" for his entire study area.

During portions of his study Nichols spent time at the Huron Mountain Club and included specimens found there among his totals. When found within Club boundaries, more or less specific locations are given often accompanied by interesting commentary. When such locations are not given, one assumes the specimens were collected outside Club lands. Indeed, included in these articles are mosses and liverworts as far-ranging as Isle Royal, Mackinac Island, Petoskey and the Keweenaw Peninsula, all well beyond the Huron Mountain Region and of very different geological substrata and habitats.

[1] Huron Mountain Wildlife Foundation, Big Bay, Michigan 49808



A Huron Mt.
B Fortress Mt.

Map reprinted with permission from The Huron Mountain Wildlife Foundation.

Thus casually began bryology at the Huron Mountain Club; not to be taken up again until half a century later (1988) by the present study which restricts itself to bryophytes found within Club boundaries but which increases coverage by including lichens.

The numbers speak for themselves. Of the 55 bryophytes identified by location as having been collected at the Club in the 1930's 37 are mosses and 18 are liverworts. Between 1988 and 1999

I have been able to find all but 4 of the mosses found here by Nichols and all but 8 of the liverworts. The totals of these twelve years of effort are 59 liverworts and 255 mosses for a total of 314 bryophytes. Such figures, reinforced by several rarities, suggest a quality and richness of habitat that confirm Aldo Leopold's recommendations.

Two western disjunct mosses are reported here for the first time in Michigan; *Eurhynchium praelongum* (Hedw.) Schimp. *In* B.S.G. and *Pseudoleskeela sibirica* (Arnell) P. Wils. & Norris. Both were identified by Howard Crum.

The *Eurhynchium*, termed "very rare" in the Eastern United States by Crum & Anderson (1981), was found in 1997 on moss over rock close to a seasonal pool between Canyon and Mountain Lakes. It is quite possibly the first verified and available moss of this species found in the United States east of the Mississippi River.

Pseudoleskeela sibirica, on the other hand, was found at two separate locations on the Keweenaw Peninsula in 1960 by F. J. Hermann but have remained unreported owing to original misidentification. The discovery of this rarity in 1998 at Huron Mountain led to correction of this long-standing error. All three are reported together in the present paper. All identifications are by Howard Crum. Three simultaneous reports do not seem excessive for a plant the collections of which have been "very few and scattered . . . from North America" (*ibid.*).

Hermann's specimens remain in MI and mine are in the Herbarium of the Huron Mountain Wildlife Foundation as are all others cited in these lists.

Also deserving of notation is the July 1999 rediscovery of Nichols' site for the extremely rare *Grimmia anomala* Hampe *ex* Schimp. where it still grows "on south-facing granite rocks at base of Huron Mountain" (Nichols 1938).

The persistence in the late 1990's of this western disjunct as of other bryophytes in locations cited by Nichols sixty years ago is reassuring and suggests a cause and effect relationship between a reasonably successful policy of ecological protection and the continued health and survival of bryophyte flora. But then, as usual, a little thought must "give us pause." One can never be quite sure. We do not know what mosses or liverworts existed in this area—or in what numbers—when the passenger pigeon was still plucking the huckleberries. There is probably no way of ever finding out.

Nor does Leopold's report mention what was growing beneath or on the trees in 1938; Nichols' 55 bryophytes, though a beginning, do not provide a very broad foundation. By Leopold's own statements the forest as a whole was no longer intact at the time of his visit. He enumerates the negative effects of heavy browse by a large deer herd—stressing the consequent "absence of white cedar and hemlock reproduction," as well as damage to "yew" (*Taxus canadensis*), striped maple and balsam (Leopold 1938).

By 1999, deer herd and browse have greatly increased. Higher temperatures and frequent drought conditions have severely damaged this old growth boreal forest which requires, presumably, boreal weather. Aging and disease have played their part with other species while, throughout, regeneration is at an apparent low.

It is far too early to predict the long range consequences of such changes on the liverworts and bryophytes but it would seem evident that unless man and nature change their present courses these lists will provide a sobering basis for comparison.

Mosses

Abietinella C. Müll.
abietina (Hedw.) Fleisch.
Amblystegium *Schimp.* in *B.S.G.*
serpens (Hedw.) Schimp. var. *serpens*
var. *juratzkanum* (Schimp.) Rau & Herv.
varium (Hedw.) Lindb.
Andreaea Hedw.
**rothii* Web. & Mohr var. *rothii*
**rupestris* Hedw. Var. *rupestris*
var. *papillosa* (Lindb.) Podp.
Anomodon Hook. & Tayl.
attenuatus (Hedw.) Hüb.
minor (Hedw.) Fürnr.
rostratus (Hedw.) Schimp.
Atrichum P. Beauv.
angustatum (Brid.) Bruch & Schimp.
undulatum (Hedw.) P. Beauv.
Aulacomnium Schwaegr.
**androgynum* (Lindb. & Arnell) Kindb.
palustre (Hedw.) Schwaegr.
var. *imbricatum* Bruch *in* B.S.G.
Bartramia Hedw.
pomiformis Hedw.
Blindia Bruch & Schimp. *in* B.S.G.
acuta (Hedw.) Bruch & Schimp. *in* B.S.G.
Brachythecium Schimp. *in* B.S.G.
acuminatum (Hedw.) Aust.
oedipodium (Mitt.) Jaeg.
oxycladon (Brid.) Jaeg.
plumosum (Hedw.) Schimp. *in* B.S.G.
**populeum* (Hedw.) Schimp. *in* B.S.G.
relflexum (Starke *in* Web. & Mohr) Schimp. *in* B.S.G. var. *reflexum*
rivulare Schimp. *in* B.S.G.
rutabulum (Hedw.) Schimp. *in* B.S.G.
salebrosum (Web. & Mohr) Schimp. *in* B.S.G. var. *salebrosum*
Brotherella Loeske *ex* Fleisch.
recurvans (Michx.) Fleisch.
Bryhnia Kaur.
graminicolor (Brid.) Grout
novae-angliae (Sull. & Lesq) Grout
Bryoerythrophyllum Chen
recurvum (Griff.) Saito
Bryum Hedw.
algovicum Sendtn. *ex* C. Müll
var. *algovicum*
argenteum Hedw.
var. *lanateum* (P. Beauv.) Hampe
caespiticium Hedw.
capillare Hedw. var. *capillare*
flaccidum Brid.
**lisae* De Not. var. *cuspidatum* (Bruch & Schimp. *in* B.S.G.) Marg.
**muehlenbeckii* Bruch & Schimp
pseudotriquetrum (Hedw.) Gaertn. et al.
Buxbaumia Hedw.
aphylla Hedw.
Callicladium Crum
haldanianum (Grev.) Crum
Calliergon (Sull.) Kindb.
cordifolium (Hedw.) Kindb.
giganteum (Schimp.) Kindb.
stramineum (Brid.) Kindb.
Calliergonella Loeske
cuspidata (Hedw.) Loeske
Campylium (Sull.) Mitt.
chrysophyllum (Brid.) J. Lange
hispidulum (Brid.) Mitt.
Ceratodon Brid.
purpureus (Hedw.) Brid. var. *purpureus*
Climacium Web. & Mohr
americanum Brid.
dendroides (Hedw.) Web. & Mohr.
Cratoneuron (Sull.) Spruce
filicinum (Hedw.) Spruce
Ctenidium (Schimp.) Mitt.
molluscum (Hedw.) Mitt.
Cynodontium Bruch & Schimp. *ex* Schimp.
schisti (Web. & Mohr) Lindb.
**strumiferum* (Hedw.) Lindb.
**tenellum* (Bruch & Schimp) Limpr.
Cyrtomnium Holm.
hymenophylloides (Hüb.) Nyh. *ex* T. Kop.
Dichelyma Myr.
capillaceum (With.) Myr.
**pallescens* Schimp. *in* B.S.G.
Dichodontium Schimp.
pellucidum (Hedw.) Schimp.
Dicranella (C. Müll.) Schimp.
heteromalla (Hedw.) Schimp.
varia (Hedw.) Schimp.

Dicranoweisia Lindb. *ex* Milde
crispula (Hedw.) Lindb. *ex* Milde
Dicranum Hedw.
**condensatum* Hedw.
flagellare Hedw.
fulvum Hook.
fuscescens Turn. var. *fuscescens*
montanum Hedw.
muehlenbeckii Bruch & Schimp. *in* B.S.G.
ontariense Peters
polysetum Sw.
scoparium Hedw.
**spurium* Hedw.
undulatum Brid.
**viride* (Sull. & Lesq. *in* Sull.) Lindb.
Didymodon Hedw.
fallax (Hedw.) Zand. var. *fallax*
rigidulus Hedw. var. *rigidulus*
Diphyscium Mohr
foliosum (Hedw.) Mohr
Ditrichum Hampe
pusillum (Hedw.) Hampe
Drepanocladus (C. Müll.) G. Roth
aduncus (Hedw.) Warnst. var. *aduncus*
var. *kneiffii* (Schimp.) Mönk.
Dryptodon Brid.
**patens* (Hedw.) Brid.
Encalypta Hedw.
ciliata Hedw.
Ephemerum Hampe
spinulosum Bruch & Schimp. *in* Schimp.
Eurhynchium Schimp. *in* B.S.G.
hians (Hedw.) Sande Lac.
praelongum (Hedw.) Schimp. *in* B.S.G.
pulchellum (Hedw.) Jenn. var. *pulchellum*
Fabronia Raddi
ciliaris (Brid.) Brid. var. *ciliaris*
Fissidens Hedw.
adianthoides Hedw.
bryoides Hedw.
dubius P. Beauv.
osmundioides Hedw.
taxifolius Hedw.
Fontinalis Hedw.
**antipyretica* Hedw. var. *antipyretica*
var. *gigantea* (Sull.) Sull.
dalecarlica Schimp. *in* B.S.G.
flaccida Ren. & Card.
hypnoides var. *duriaei* (Schimp.) Husn.
missourica Card.
novae-angliae Sull. var. *novae-angliae*
sullivantii Lindb.
Funaria Hedw.
hygrometrica Hedw.
Grimmia Hedw.
affinis Hoppe & Hornsch. *ex* Hornsch.
anodon Bruch & Schimp. *in* B.S.G.
**anomala* Hampe *ex* Schimp.
hermannii Crum
olneyi Sull.
Gymnostomum Nees & Hornsch. *in* Nees et al.
**aeruginosum* Sm.
Gyroweisia Schimp.
reflexa (Brid.) Schimp.
tenuis (Hedw.) Schimp.
Haplohymenium Dozy & Molk.
**triste* (Ces. *in* De Not.) Kindb.
Hedwigia P. Beauv.
ciliata (Hedw.) P. Beauv.
Helodium Warnst.
blandowii (Web. & Mohr) Warnst.
var. *blandowii*
Herzogiella Broth.
turfacea (Lindb.) Iwats.
Heterocladium Schimp. *in* B.S.G.
dimorphum (Brid.) Schimp. *in* B.S.G.
macounii Best
Homalia (Brid.) Schimp. *in* B.S.G.
**trichomanoides* (Hedw.) Schimp
Homomallium (Schimp.) Loeske
adnatum (Hedw.) Broth.
Hygroamblystegium Loeske
fluviatile (Hedw.) Loeske
**tenax* (Hedw.) Jenn. var. *tenax*
Hygrohypnum Lindb.
**luridum* (Hedw.) Jenn.
ochraceum (Turn. *ex* Wils.) Loeske
Hylocomiastrum Fleisch. *in* Broth.
pyrenaicum (Spruce) Fleisch. *in* Broth.
Hylocomium Schimp. *in* B.S.G.
splendens (Hedw.) Schimp. *in* B.S.G.
Hypnum Hedw.
cupressiforme var. *resupinatum* (Tayl.)
Schimp. *in* Spruce
fertile Sendtn.
lindbergii Mitt.
pallescens (Hedw.) P. Beauv.
var. *pallescens*
var. *protuberans* (Brid.) Aust.
pratense (Rabenh.) W. Koch *ex* Spruce
Isopterygiopsis Iwats.
pulchella (Hedw.) Iwats.
Leptodictyum (Schimp.) Warnst.
riparium (Hedw.) Warnst.
Leskea Hedw.
polycarpa Hedw.
Leskeela (Limpr.) Loeske
nervosa (Brid.) Loeske

Leucobryum Hampe
glaucum (Hedw.) Aöngstr. *in* Fries
Leucodon Schwaegr.
brachypus var. *andrewsianus* Crum & Anderson
Lindbergia Kindb.
brachyptera (Mitt.) Kindb.
Mnium Hedw.
ambiguum H. Müll.
marginatum (With.) Brid. *ex* P. Beauv.
spinulosum Bruch & Schimp. *in* B.S.G.
thomsonii Schimp.
Myurella Schimp. *in* B.S.G.
julacea Schwaegr.) Schimp. *in* B.S.G.
numerous specimens of an anomalous *Myurella*
Neckera Hedw.
pennata Hedw.
Oncophorus (Brid.) Brid.
virens (Hedw.) Brid.
wahlenbergii Brid.
Orthotrichum Hedw.
**affine* Brid.
anomalum Hedw.
obtusifolium Brid.
sordidum Sull. & Lesq. *in* Aust.
speciosum var. *elegans* (Schwaegr. *ex* Hook. & Grev.) Warnst.
Oxystegus (Limpr.) Hilp.
tenuirostris (Hook. & Tayl.) A.J.E. Sm.
Paraleucobryum (Lindb.) Loeske
**longifolium* (Hedw.) Loeske
Philonotis Brid.
capillaris Lindb. *in* Hartm.
fontana (Hedw.) Brid. var. *Fontana*
*var. *caespitosa* (Jur.) Schimp.
var. *pumila* (Turn.) Brid.
Physcomitrium (Brid.) Brid.
immersum Sull.
Plagiomnium T. Kop.
ciliare (C. Müll) T. Kop.
cuspidatum (Hedw.) T. Kop.
ellipticum (Brid.) T. Kop.
medium (Bruch & Schimp.) T. Kop
var. *medium*
rostratum (Schrad.) T. Kop
Plagiothecium Schimp. *in* B.S.G.
cavifolium (Brid.) Iwats.
denticulatum (Hedw.) Schimp. *in* B.S.G.
laetum Schimp. *in* B.S.G.
Platydictya Berk
subtilis (Hedw.) Crum
Platygyrium Schimp. *in* B.S.G.
repens (Brid.) Schimp. *in* B.S.G.
Platyhypnidium Fleisch.
**riparioides* (Hedw.) Dix.
Pleurozium Mitt.
schreberi (Brid.) Mitt.
Pohlia Hedw.
bulbifera (Warnst.) Warnst.
cruda (Hedw.) Lindb.
nutans (Hedw.) Lindb.
proligera (Kindb. *ex* Breidl.) Lindb
wahlenbergii (Web. & Mohr) Andrews
Polytrichastrum G.L. Sm.
**alpinum* (Hedw.) G.L. Sm. var. *alpinum*
Polytrichum Hedw.
commune Hedw. var. *commune*
formosum Hedw.
juniperinum Hedw.
piliferum Hedw.
strictum Brid.
Pseudobryum (Kindb.) T. Kop.
cinclidioides (Hüb.) T. Kop.
Pseudoleskeela Kindb.
sibirica (Arnell) P. Wils. & Norris
Pseudotaxiphyllum Iwats.
distichaceum (Mitt.) Iwats.
elegans (Brid.) Iwats.
Pterigynandrum Hedw.
**filiforme* Hedw.
Ptilium De Not.
crista-castrensis (Hedw.) De Not.
Pylaisiella Kindb.
selwynii (Kindb.) Crum et al.
Racomitrium Brid.
**aciculare* (Hedw.) Brid.
**canescens* (Hedw.) Brid. var. *canescens*
ericoides (Web. *ex* Brid.) Brid.
**fasciculare* (Hedw.) Brid.
**heterostichum* (Hedw.) Brid.
microcarpon (Hedw.) Brid.
**sudeticum* (Funck) Bruch & Schimp.
Rhabdoweisia Bruch & Schimp. *in* B.S.G.
crispata (With.) Lindb.
Rhizomnium (Broth.) T. Kop.
appalachianum T. Kop.
magnifolium (Horik.) T. Kop.
pseudopunctatum (Bruch & Schimp.) T. Kop.
punctatum (Hedw.) T. Kop.
Rhytidiadelphus (Lindb.ex Limpr.) Warnst.
squarrosus (Hedw.) Warnst.
triquetrus (Hedw.) Warnst.
Saelania Lindb.
glaucescens (Hedw.) Broth.

Sanionia Loeske
uncinata (Hedw.) Loeske var. *uncinata*
var. *symmetrica* (Ren. & Card.) Crum & Anderson
Schistidium Brid.
apocarpum (Hedw.) Bruch & Schimp.
rivulare (Brid.) Podp. var. *rivulare*
Seligeria Bruch & Schimp. *in* B.S.G.
campylopoda Kindb. *in* Mac. & Kindb.
pusilla (Hedw.) Bruch & Schimp.
**recurvata* (Hedw.) Bruch & Schimp.
Sphagnum L.
angustifolium (C. Jens. *ex* Russ.) C. Jens. *in* Tolf
**capillifolium* (Ehrh.) Hedw.
2 unidentified specimens, probably abnormal expressions of *S. capillifolium*
centrale C. Jens. *in* Arnell & C. Jens.
contortum Schultz
cuspidatum Ehrh. *ex* Hoffm.
fallax (Klinggr.) Klinggr.
fimbriatum Wils. *in* Wils & Hook. *f. in* Hook. *f.* var. *fimbriatum*
fuscum (Schimp.) Klinggr.
girgensohnii Russ.
lescurii Sull. *in* Gray
magellanicum Brid.
magus (Russ.) C. Jens.
pulustre L.
papillosum Lindb.
pulchrum (Lindb. *ex* Braithw.) Warnst.
quinquefarium (Lindb.) Warnst.
recurvum P. Beauv.
riparium Aöngstr.
rubellum Wils.
russowii Warnst.
squarrosum Crome
subsecundum Nees *in* Sturm var. *subsecundum*
tenellum (Brid.) Bory
tenerum Sull. & Lesq. *in* Sull. *in* Gray
teres (Schimp.) Aöngstr. *in* Hartm.
warnstorfii Russ.
wulfianum Girg.
Splachnum Hedw.
ampullaceum Hedw.
Steerecleus Robins.
serrulatus (Hedw.) Robins.
Taxiphyllum Fleisch.
deplanatum (Bruch & Schimp.) Fleisch.
Tetraphis Hedw.
pellucida Hedw.
Tetraplodon Bruch & Schimp. *in* B.S.G.
angustatus (Hedw.) Bruch & Schimp.
Thuidium Schimp. *in* B.S.G.
delicatulum (Hedw.) Schimp. *in* B.S.G.
philibertii Limpr.
recognitum (Hedw.) Lindb.
Tomentypnum Loeske
falcifolium (Ren. *ex* Nichols) Tuom. *in* Ahti & Fagers.
Tortella (Lindb.) Limpr.
tortuosa (Hedw.) Limpr.
Tortula Hedw.
mucronifolia Schwaegr.
ruralis (Hedw.) Gaertn. et al.
Trematodon Michx.
ambiguus (Hedw.) Hornsch.
Ulota Mohr
crispa (Hedw.) Brid.
hutchinsiae (Sm.) Hammar var. *hutchinsiae*
var. *rufescens* (Britt.) Dix.
Warnstorfia Loeske
fluitans (Hedw.) Loeske var. *fluitans*

Mosses marked with an asterisk are also in Nichols' list. The following four reported by Nichols I have not found. They are added in order to complete the record of mosses reported from the Huron Mountain Club.

Desmatodon Brid.
obtusifolius (Schwaegr.) Schimp.
Dicranella (C. Müll.) Schimp.
grevilleana (Brid.) Schimp.
Hygrohypnum Lindb.
molle (Hedw.) Loeske
Sphagnum L.
compactum DC. *in* Lam. & DC.

Liverworts

Anastrophyllum (Spruce) Steph.
helleranum (Nees) Schust.
Barbilophozia Loeske
**barbata* (Schmid. *ex* Schreb.) Loeske
floerkei (Web. et Mohr) Loeske
var. *floerkei*
**hatcheri* (Evans) Loeske
lycopodioides (Wallr.) Loeske
Bazzania S. Gray
trilobata (L.) S. Gray var. *trilobata*
Blasia L.
pusilla L.
Blepharostoma (Dum. emend. Lindb.) Dum.
trichophyllum (L.) Dum.
subsp. *trichophyllum*
Calypogeja Raddi
trichomanis (L.) Corda
Cephalozia (Dum. emend. Schiffn.) Dum.
connivens (Dicks.) Lindb.
var. *connivens*
loitlesbergeri Schiffn.
Cephaloziella (Spruce) Steph., nom. cons.
hampeana (Nees) Schiffn.
rubella (Nees) Warnst. var. *rubella*
Chiloscyphus Corda, nom. cons.
pallescens (Ehrh. *ex* Hoffm.) Dum.
var. *pallescens*
var. *fragilis* (Roth) K. Müll.
polyanthos (L.) Corda var. *polyanthos*
Conocephalum Wigg., nom. cons.
conicum (L.) Lindb.
Frullania Raddi
bolanderi Aust.
Eboracensis Gott.
inflata Gott.
oakesiana Aust.
**selwyniana* Pears.
Geocalyx Nees
graveolens (Schrad.) Nees
Jamesoniella (Spruce) Carring.
autumnalis (DC.) Steph.
var. *autumnalis*
Jungermannia L. emend. Dum.
gracillima Sm. slender form
Lejeunea Lib., nom. cons.
**cavifolia* (Ehrh.) Lindb. emend. Buch
lamacerina (Steph.) Schiffn. subsp.
gemminata Schust.
Lepidozia (Dum.) Dum.
reptans (L.) Dum.
Lophocolea (Dum.) Dum.
heterophylla (Schrad.) Dum.
minor Nees.
Lophozia (Dum.) Dum.
obtusa (Lindb.) Evans.
**ventricosa* (Dicks.) Dum.
var. *ventricosa*
Marchantia L.
polymorpha L.
Metzgeria Raddi
conjugata Lindb.
**furcata* (L.) Dum. var. *furcata*
var. *ulvula* Nees
Moerckia Gott.
hibernica (Hook.) Gott.
Odontoschisma (Dum.) Dum.
denudatum (Nees *ex* Mart.) Dum.
var. *denudatum*
Pallavicinia S. Gray, nom. cons.
lyellii (Hook.) Carruth.
Pellia Raddi, nom. cons. propos.
epiphylla (L.) Corda
megaspora Schust.
neesiana (Gott.) Limpr.
Phaeceros Prosk.
laevis (L.) Prosk. subsp. *laevis*
Plagiochila (Dum.) Dum., nom. cons.
porelloides (Torrey *ex* Nees) Lindenb.
Porella L.
**pinnata* L.
platyphylla (L.) Pfeiff.
platyphylloidea (Schwein.) Lindb.
Preissia Corda
quadrata (Scop.) Nees
Ptilidium Nees
ciliare (L.) Hampe
pulcherrimum (G. Web.) Hampe
Radula Dum., nom. cons.
complanata (L.) Dum.
obconica Sull.
Riccardia S. Gray, nom. cons.
multifida (L.) S. Gray var. *multifida*
Scapania (Dum.) Dum., nom. cons.
**curta* (Mart.) Dum. var. *curta*
irrigua (Nees) Gott. et al.
subsp. *irrigua*
**nemorosa* (L.) Dum.
undulata (L.) var. *undulata*
dentate form
Trichocolea Dum., nom. cons.
tomentella (Ehrh.) Dum.
Tritomaria Schiffn. *ex* Loeske
**quinquedentata* (Huds.) Buch
var. *quinquedentata*

Liverworts marked with an asterisk are also on Nichols' list. The following eight reported by Nichols I have not found. They are added in order to complete the record of liverworts reported from the Huron Mountain Club.

Anastrophylum (Spruce) Steph.
michauxii (Web.) Buch *ex* Evans
minutum (Schreb.) Schust.
var. *minutum*
Barbilophozia Loeske
attenuata (Mart.) Loeske
Chiloscyphus Corda, nom. cons.
polyanthos
var. *rivularis* (Schrad.) Nees
Cololejeunea (Spruce) Schiffn.
biddlecomiae (Aust.) Evans
Marsupella Dum.
emarginata (Ehrh.) Dum.
subsp. *emarginata* var. *emarginata*
Scapania (Dum.) Dum., nom. cons.
mucronata Buch subsp. *mucronata*
subalpina (Nees) Dum.

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Part II Lichens

With the Precambrian amphibolites and granite gneisses of its mountains, its system of inland lakes and connecting streams interspersed with wetlands, with its beaches, bays and cliffs of 570 million year old Jacobsville sandstone along a 13 mile Lake Superior shoreline and the expanses of old growth forest recognized throughout the state as comprising one of the few well preserved substantial natural areas in Michigan, the 31 square miles of the Huron Mountain Club are as perfectly suited for lichens as they are for mosses and liverworts.

Lichenology has received but minimal attention on these lands. The only study prior to this was a tiny part of a much larger project on the genus *Cladonia* carried out by Frederick B. Bevis in 1964. He limited coverage at the Club to a jack pine forest which had attracted scientific interest and occupied at most 1/4 of a section. From this small study area Dr. Bevis reported 13 species of *Cladonia* which are, so far as I have been able to ascertain, the only lichen species collected here yet reported in print.

I believe the lists of Part I include a very fair sampling of bryophytes available here but recognize that the 280 lichens of Part II include a smaller percentage of the total lichen population. With very few exceptions, crustose lichens on rock are not covered. They are abundant throughout the area but I have no effective way of collecting them and lack adequate facilities for identification.

Coverage of foliose and fruticose species and of those that are crustose on wood is comparable to that of the bryophytes; and 280 are much more than a mere beginning and go a long way towards filling a large and long existing gap.

The present project has led to the published description in *Evansia* (Manierre 1999) of eleven rare bryophytes; while an earlier note (1998) reported the existence at the Huron Mountain Club of *Gyroweisia reflexa* (Brid.) Schimp., for which this location is the only known, existing site in the western hemisphere. The lichens also have their share of interesting species. Two in particular stand out: *Solorina spongiosa* (Ach.) Anzi and *Caloplaca invadens* Lynge.

Solorina spongiosa grows in artic-alpine/montane areas in "moist, calcareous habitats . . . in North America from Baffin Bay to Alaska and south to Newfoundland, Colorado, and Washington" (Thomson 1984) and is known as rare wherever it appears. A single Michigan collection in MI from the Pictured Rocks National Lakeshore (Alger County) offers the only reference I have found to the appearance of this lichen east of Colorado in the coterminous United States.

A population of this rare lichen grows within our area between the crevices of a low, vertical bluff of Jacobsville sandstone along the shore and within 10 feet of Lake Superior. In the splash zone, the site, only some 5 or 6 feet above lake surface (602 feet above sea level), appears continually wet. It is exposed to wind and wave but never directly to the sun.

First noticed in 1987 but not collected until 1994 *Solorina spongiosa* was identified by Richard C. Harris in 1995. The population, though small, appears unchanged since discovery. Fortunately, this area of Superior shoreline has endured substantially less damage from erosion than have the sandstone cliffs of Pine River Point, site of two mosses of more than passing interest: *Seligeria recurvata* (Hedw.) Bruch & Schimp. *in* B.S.G. and *Gyroweisia tenuis* (Hedw.) Schimp.

Not heretofore reported south of Canada, the discovery of *Caloplaca invadens* Lynge at Huron Mountain in 1998 constitutes the first time this lichen has been found within the original 48 states—and it is not just barely outside of our borders. John W. Thomson's location map (1997) shows it as 750 miles directly north of the Canadian border at its nearest point, 400 miles due west of Churchill's polar bears and a full 1200 miles northwest of Huron Mountain. Thomson's description of range is both succinct and exclusive: "It is known from Lapland and Greenland, and is found in the North American Arctic" (Thomson 1997). Professor Thomson kindly identified my specimens as *Caloplaca invadens* Lynge "a species parasitic on the dark thallus of *Placynthium* [*nigrum*] below it."

Growing at about 900 feet on a loose rock on a granite-gneiss exposure of the northwest slope of Fortress Mountain, *Caloplaca invadens* is additional evidence of what Nichols (1935) referred to as "an unmistakable arctic-alpine element in the vegetation." In view of evidently changing weather patterns and an unmistakably warmer Lake Superior one cannot avoid wondering when these elements will disappear and be replaced, perhaps, by Kudzu.

Lichens

Acarospora A. Massal.
fuscata (Schrader) Arnold
glaucocarpa (Ach.) Körber
smaragdula (Wahlenb.) A. Massal.
Ahtiana Goward
aurescens (Tuck.) Thell & Randlane
Allocetraria Kurokawa & Lai
oakesiana (Tuck.) Randland & Thell
Amandinea Choisy *ex* Scheid. & H. Mayrh.
punctata (Hoffm.) Coppins & Scheid.
Anaptychia Körber
palmulata (Michaux) Vainio
Arthonia Ach.
cytisi A. Massal.
diffusa Nyl.
dispersa (Schrader) Nyl.
radiata (Pers.) Ach.
Arthrosporum A. Massal. (Hafellner 1984)
populorum A. Massal.
Aspicilia A. Massal.
caesiocinerea (Nyl. *ex* Malbr.) Arnold
Bacidia De Not.
bagliettoana (Massal. & De Not.) Jatta
schweinitzii (Fr. *ex* Michener) A. Schneider (Eckman 1995)
Biatora Fr.
sphaeroides (Dickson) Körber
Bryoria Brodo & D. Hawksw.
capillaris (Ach.) Brodo & D. Hawksw
furcellata (Fr.) Brodo & D. Hawksw.
trichodes (Michaux) Brodo & D. Hawksw. subsp. *trichodes*
Buellia De Not
disciformis (Fr.) Mudd
schaereri De Not.
stillingiana J. Steiner
Calicium Pers.
salicinum Pers.
Caloplaca Th. Fr.
arenaria (Pers.) Müll. Arg.
cerina (Hedwig) Th. Fr.
cetrina (Hoffm.) Th. Fr.
flavovirescens (Wulfen) Dalla Torre & Sarnth.
fraudans (Th. Fr.) H. Olivier
holocarpa (Hoffm. *ex* ach.) M. Wade
invadens Lynge (see Thomson, II, 164)
microphyllina (Tuck.) Hasse
oxfordensis Fink
Candelaria A. Massal.
concolor (Dickson) Stein
fibrosa (Fr.) Müll. Arg.
Candelariella Müll. Arg.
aurella (Hoffm.) Zahlbr.
efflorescens R.C. Harris & W.R. Buck
vitellina (Hoffm.) Müll. Arg.
xanthostigma (Ach.) Lettau
Cetraria Ach.
arenaria Kärnefelt
Cetrelia Culb. & C. Culb.
chicitae (Culb.) Culb. & C. Culb.
olivetorum (Nyl.) Culb. & C. Culb.
Chrysothrix Mont.
candelaris (L.) J.R. Laundon
chlorina (Ach.) J.R. Laundon
Cladina Nyl.
arbuscula (Wallr.) Hale & Culb.
mitis (Sandst.) Hustich
rangiferina (L.) Nyl.
stellaris (Opiz) Brodo
Cladonia P. Browne
acuminata (Ach.) Norrlin
acuminata var. *acuminata* (Huovinen et al 1989)
bacilliformis (Nyl.) Glück
botrytes (K. Hagen) Willd.
cariosa (Ach.) Sprengel
carneola (Fr.) Fr.
cenotea (Ach.) Schaerer
cervicornis subsp. *verticillata* (Hoffm.) Ahti
chlorophaea (Flörke *ex* sommerf.) Sprengel
coccifera (L.) Willd.
coniocraea (Flörke) Sprengel
conista A. Evans (Ahti 1993)

cornuta (L.) Hoffm. subsp. *cornuta*
crispata (Ach.) Flotow var. *crispata*
cristatella Tuck.
cristatella forma *ramosa* Tuck.
(see Thomson 1967, p. 73.)
cristatella forma *squamosissima* Robb.
(See Thomson 1967, p. 73.)
decorticata (Flörke) Sprengel
deformis (L.) Hoffm.
digitata (L.) Hoffm.)
ecmocyna Leighton subsp. *ecmocyna*
farinacea (Vainio) A. Evans
fimbriata (L.) Fr.
floerkeana (Fr.) Flörke
furcata (Hudson) Schrader
gracilis (L.) Willd. subsp. *gracilis*
grayi G. Merr. *ex* Sandst.
humilis (With.) J.R. Laundon
macilenta var. *bacillaris* (Genth) Schaerer
multiformis G. Merr.
ochrochlora Flörke
peziziformis (With.) J.R. Laundon
phyllophora Hoffm.
pleurota (Flörke) Schaerer
pocillum (Ach.) Grognot (Ahti 1993)
polycarpoides Nyl.
pyxidata (L.) Hoffm.
ramulosa (With.) J.R. Laundon
rei Schaerer
robbinsii A. Evans
scabriuscula (Delise) Nyl.
squamosa Hoffm. (Ahti 1993)
sulphurina (Michaux) Fr.
symphycarpa (Flörke) Fr.
turgida Hoffm.
uncialis (L.) F.H. Wigg.
Collema F.H. Wigg.
conglomeratum Hoffm.
furfuraceum (Arnold) Du Rietz
polycarpon Hoffm.
subflaccidum Degel.
Conotrema Tuck.
urceolatum (Ach.) Tuck.
Dermatocarpon Eschw.
luridum (With.) J.R. Laundon
miniatum (L.) W. Mann
moulinsii (Mont.) Zahlbr.
Dimelaena Norman
oreina (Ach.) Norman
Diploschistes Norman
scruposus (Schreber) Norman
Evernia Ach.
mesomorpha Nyl.
prunastre (L.) Ach.
Flavoparmelia Hale
baltimorensis (Gyelnik & Fóriss) Hale
caperata (L.) Hale
Flavopunctelia (Krog) Hale
flaventior (Stirton) Hale
soredica (Nyl.) Hale
Graphis Adans.
scripta (L.) Ach.
Heterodermia Trevisan
hypoleuca (Muhl.) Trevisan
speciosa (Wulfen) Trevisan
Hypocenomyce Choisy
friesii (Ach.) P. James & Gotth.
scalaris (Ach.) Choisy
Hypogymnia (Nyl.) Nyl.
physodes (L.) Nyl.
tubulosa (Schaerer) Hav.
vittata (Ach.) Parrique
Icmadophila Trevisan
ericetorum (L.) Zahlbr.
Imshaugia S.F. Meyer
aleurites (Ach.) S.F. Meyer
placorodia (Ach.) S.F. Meyer
Lasallia Mérat
papulosa (Ach.) Llano
Lecanora Ach.
albella var. *rubescens*
(Imshaug & Brodo) Lumbsch
allophana Nyl.
caesiorubella Ach. subsp. *caesiorubella*
cenisia Ach.
chlarotera Nyl.
chlorophaeodes Nyl. (Brodo 1988a)
conizaeoides Nyl. *ex* Crombi
crenulata Hook.
dispersa (Pers.) Sommerf.
glabrata (Ach.) Malme
impudens Degel.
muralis (Schreber) Rabenh.
polytropa (Hoffm.) Rabenh.
pulicaris (Pers.) Ach.
rugosella Zahlbr.
thysanophora (Ach.) R. Harris, ined.
varia (Hoffm.) Ach.
Lecidea Ach.
tessellata Flörke
Lecidella Körber
stigmatea (Ach.) Hertel & Leuckert
Lepraria Ach.
incana (L.) Ach.
lobificans Nyl.
neglecta (Nyl.) Erichsen
Leproloma Nyl. *ex* Crombi (Laundon 1989b)
membranaceum (Dickson) Vainio

vouauxii (Hue) J.R. Laundon
Leptogium (Ach.) Gray
burnetiae C.W. Dodge
corticola (Taylor) Tuck.
cyanescens (Rabenh.) Körber
saturninum (Dickson) Nyl.
Lobaria (Schreber) Hoffm.
pulmonaria (L.) Hoffm.
quercizans Michaux
Loxospora A. Massal.
pustulata (Brodo & Culb.) R.C. Harris
Melanelia Essl.
disjuncta (Erichsen) Essl.
exasperata (De Not.) Essl.
exasperatula (Nyl.) Essl.
olivacea (L.) Essl.
panniformis (Nyl.) Essl.
septentrionalis (Lynge) Essl.
sorediata (Ach.) Goward & Ahti
subargentifera (Nyl.) Essl.
subaurifera (Nyl.) Essl.
Mycobilimbia Rehm (Wirth 1987)
sabuletorum (Schreber) Hafellner
Mycoblastus Norman
sanguinarius (L.) Norman
Mycocalicium Vainio
subtile (Pers.) Szat.
Myelochroa (Asah.) Elix & Hale (Elix & Hale 1987)
aurulenta (Tuck.) Elix & Hale
galbina (Ach.) Elix & Hale
Nephroma Ach.
bellum (Sprengel) Tuck
helveticum Ach. subsp. *helveticum*
parile (Ach.) Ach.
resupinatum (L.) Ach.
Ochrolechia A. Massal.
arborea (Kreyer) Almb.
trochophora (Vaino) Oshio
var. *trochophora* (Brodo 1991)
Opegrapha Ach.
varia Pers.
Parmelia Ach.
saxatilis (L.) Ach.
squarrosa Hale
sulcata Taylor
Parmeliopsis Nyl.
ambigua (Wulfen) Nyl.
Peltigera Willd.
aphthosa (L.) Willd.
canina (L.) Willd.
didactyla (With.) J.R. Laundon
elisabethae Gyelnik
evansiana Gyelnik
lepidophora (Vaino) Bitter
leucophlebia (Nyl.) Gyelnik
malacea (Ach.) Funck
membranacea (Ach.) Nyl.
polydactylon (Necker) Hoffm. (Vitikainen 1994)
praetextata (Flörke *ex* Sommerf.) Zopf
rufescens (Weiss) Humb.
Pertusaria DC.
alpina Hepp *ex* Ahles
amara (Ach.) Nyl.
macounii (Lamb) Dibben
multipunctoides Dibben
ophthalmiza (Nyl.) Nyl.
rubefacta Erichsen
sommerfeltii (Flörke *ex* Sommerf.) Fr.
trachythallina Erichsen
velata (Turner) Nyl.
an unidentified species of *Pertusaria*
Phaephyscia Moberg
adiastola (Essl.) Essl.
cernohorskyi (Nádv.) Essl.
hirtella Essl.
hispidula (Ach.) Essl.
orbicularis (Necker) Moberg
pusilloides (Zahlbr.) Essl.
rubropulchra (Degel.) Essl. (Esslinger 1989)
Physcia (Schreber) Michaux
adscendens (Fr.) H. Olivier
aipolia (Ehrh. *ex* Humb.) Fürnr.
var. *aipolia* (Hawksworth et al 1980)
caesia (Hoffm.) Fürnr.
dubia (Hoffm.) Lettau
milligrana Degel.
phaea (Tuck.) J.W. Thomson
stellaris (L.) Nyl.
tenella (Scop.) DC.
Physciella Essl.
chloantha (Ach.) Essl.
Physconia Poelt
detersa (Nyl.) Poelt
enteroxantha (Nyl.) Poelt
leucoleiptes (Tuck.) Essl. (Esslinger 1994)
muscigena (Ach.) Poelt
perisidiosa (Erichsen) Moberg
Placynthium (Ach.) Gray
nigrum (Hudson) Gray
Platismatia Culb. & C. Culb.
tuckermanii (Oakes) Culb. & C. Culb.
Porpidia Körber (Gowan 1989, Gowan & Ahti 1993)
crustulata (Ach.) Hertel & Knoph

Pseudevernia Zopf
consocians (Vainio) Hale & Culb.
Punctelia Krog
bolliana (Müll. Arg.) Krog
hypoleucites (Nyl.) Krog
rudecta (Ach.) Krog
subrudecta (Nyl.) Krog
Pyxine Fr.
sorediata (Ach.) Mont.
Ramalina Ach.
americana Hale
calicaris (L.) Fr.
farinacea (L.) Ach.
intermedia (Delise *ex* Nyl.) Nyl.
pollinaria (Westr.) Ach.
Rhizocarpon Ramond *ex* DC.
geographicum (L.) DC.
lecanorinum Anders
an unidentified species of *Rhizocarpon*
Rhizoplaca Zopf
chrysoleuca (Sm.) Zopf
melanophthalma (DC.) Leuckert & Poelt
Scoliciosporum A. Massal.
chlorococcum (Stenh.) Vězda
Solorina Ach.
spongiosa (Ach.) Anzi
Staurothele Norman
areolata (Ach.) Lettau (Thomson 1991)
Stereocaulon Hoffm.
condensatum Hoffm.
dactylophyllum Flörke
paschale (L.) Hoffm.
saxatile H. Magn.
tomentosum Fr.
Thelotrema Ach.
lepadinum (Ach.) Ach.
Trapeliopsis Hertel & Gotth. Schneider
flexuosa (Fr.) Coppins & P. James
granulosa (Hoffm.) Lumbsch
Tuckermannopsis Gyelnik
americana (Sprengel) Hale
ciliaris (Ach.) Gyelnik
fendleri (Nyl.) Hale
orbata (Nyl.) M.J. Lai
Umbilicaria Hoffm.
americana Poelt & T. Nash (Poelt & Nash 1993)
deusta (L.) Baumg.
hyperborea (Ach.) Hoffm. var. *hyperborea*
mammulata (Ach.) Tuck.
muehlenbergii (Ach.) Tuck.
torrefacta (Lightf.) Schrader
vellea (L.) Hoffm.)
virginis Schaerer
Usnea Dill. *ex* Adans.
cavernosa Tuck.
ceratina Ach.
hirta (L.) F.H. Wigg.
lapponica Vainio
longissima Ach.
rubicunda Stirton
subfloridana Stirton
Verrucaria Schrader
an unidentified species of *Verrucaria*
Vulpicida J.-E. Mattsson & M.J. Lai (Mattsson & Lai 1993)
pinastri (Scop.) J.-E. Mattsoon & M.J. Lai
Xanthoparmelia (Vainio) Hale
conspersa (Ehrh. *ex* Ach.) Hale
cumberlandia (Gyelnik) Hale
lineola (E.C. Berry) Hale
plittii (Gyelnik) Hale
somloënsis (Gyelnik) Hale
Xanthoria (Fr.) Th. Fr.
candelaria (L.) Th.Fr.
elegans (Link) Th. Fr.
fallax (Hepp) Arnold var. *fallax*
polycarpa (Hoffm.) Rieber

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Tortella alpicola Dixon, New to the Moss Flora of South Dakota

P. M. Eckel

One of a collection of unidentified specimens in a collection of atypical *Tortellas* at BUF proved to be a new state record for South Dakota:

> *Tortella alpicola* Dix., USA, South Dakota, Custer Co., just E of Jewel Cave National Monument ca. 10 miles W of Custer. Soil over limestone. 23 July 1980, R. Zander & P. M. Eckel.

Recent systematic placement of this species was as a variety of *Tortella fragilis* (Drumm.) Limpr., based on the development of a deciduous leaf apex (Zander & Hoe 1979; Hyvoenen 1991). However, the character of the apical propagulum of the two species is entirely different: that of *T. fragilis* is one single continuous whole, that of *T. alpicola* is of a series of small, disarticulating units producing numerous seriate propagula from the disintegration of a single leaf apex.

Other characters separating the two species are given by Eckel (1991; 1997; 1998). In addition to the character of the propaguloid apex, perhaps the most definitive feature of *Tortella alpicola* to separate the species from small, ambiguous *T. fragilis* and *T. tortuosa* (Hedw.) Limpr. specimens is the presence of a stem central strand, evident in cross-section, in T. alpicola. *Tortella fragilis* never has a stem central strand and *T. tortuosa* may only rarely display one.

Tortella alpicola is distributed in the New World in Antarctica, Colombia, Hawaii, and provinces and territories in the Canadian arctic south to Quebec. It occurs throughout the eastern Rocky Mountains and the Great Plains. The occurrence of the species in South Dakota is consistent with this range. Its type locality in the Himalayas (Dixon 1930) suggests that the pecies has a wide-ranging global distribution.

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Rinodina aspersa (Borrer) Laundon new to North America

Katherine A. Glew

Abstract: *Rinodina aspersa* (Borrer) Laundon is reported new to North America from the San Juan Islands of Washington state, U.S.A. The species was found on siliceous, sedimentary marine rocks.

Introduction. A study is being carried out to inventory the lichens of the U.S. San Juan Islands of Washington state. Lichens have been collected from the four largest islands, San Juan, Orcas, Lopez, and Shaw. These islands, along with Vancouver Island, British Columbia, Canada, exhibit a Mediterranean climate, unique to this area of the Pacific Northwest.

Due to the difficulty in identifying lichens to species without examining spores, it is not uncommon for sterile saxicolous crustose forms to be omitted in lichen inventories of western North America. Consequently many collections are left undescribed or undetermined, even when their chemistry may be known. Often sterile saxicolous crusts are found in very small patches on a rock and may be easily overlooked when studying a larger, more conspicuous species on a rock. One such speciemen was identified as *Rinodina aspersa*, a species which is not listed in the current checklist of lichens for North America (Esslinger & Egan, 1995) and therefore thought to be new.

Materials and methods. To determine the chemistry of this lichen, thin-layer chromatography (TLC) was carried out according to the methods given by Culberson & Kristinsson (1970) and later modifications (Culberson, 1972; White & James, 1985).
Morphology of the specimen was compared with European material (BG).

Morphology. The thallus is sterile and made up of dispersed, poorly developed, pale greenish-grey sorediate areoles surrounded by a prominent black hypothallus. Soralia are greenish white, more or less discrete, approximately 0.5mm in diameter with farinose soredia. This is in accordance with the descriptions given by Fox & Purvis (1992) and Fryday (1997). Apothecia are known in material from continental Europe but absent in material from the British Isles (Fox & Purvis 1992).

Chemistry. TLC revealed two main substances: gyrophoric acid and atranorin, as in the Swedish specimen examined for comparison.

Reactions: thallus, K+ and PD+ faint yellow; soralia C+red, KC+red.

Ecology. *Rinodina aspersa* was found on exposed siliceous sedimentary parent rocks and pebbles from the islands. The site location was close to sea-level, Island under an *Arbutus menziesii*. This area was situated next to housing at the facility, indicating that this area may be somewhat disturbed. In association with this lichen were *Xanthoparmelia cumberlandia*

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(Gyelnik) Hale, *Lecidea atrobrunnea* (Ramond *ex* Lam. & DC.) Schaerer, and Physcia caesia (Hoffm.) Fürnr. Vegetation in the area was composed of *Arbutus menziesii*, *Pseudotsuga menziesii*, *Acer circinatum*, *Holodiscus discolor*, *Rubus armeniacus*, and various graminoids. The area was moderately shaded by the surrounding trees and shrubs in a cool oceanic area ranging from dry to occasionally humid from rain or fog. The lichen was only found at one location but most likely occurs in other areas on the islands with similar habitat.

Specimens examined: U.S.A., Washington, San Juan County, San Juan Island, Friday Harbor Marine Laboratories, University of Washington, east side of island, elevation ~50m; 48°32'N, 123°00'W, 1998. Glew 980918-57 (WTU); SWEDEN. Västmanland, Arboga, Sofielund, on siliceous rocks, 3.X.1951, Gösta, Kjellmer (BG dupl.).

Acknowledgments. Tor Tønsberg at the University of Bergen provided advice, laboratory space, and time for the identification of sterile crustose specimens. Astri Botnen provided technical assistance at BG. This research was supported by a grant from the Norway-America Marshall Fund to encourage collaboration between Norwegian and North American scientists.

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The bryophytes of Edgewood County Park, San Mateo County, California.

Alan T. Whittemore[1] & Suzanne Sommers[2]

Edgewood County Park is a small park, wih an area of 189 hectares, located in the foothills immediately west of southern San Francisco Bay. Despite its small size, the topography and geology of park are very varied. A steep-sided ridge of greenstone runs north-to-south across the middle of the park. East of this ridge, a small plateau of sandstone and mudstone ends in narrow, steep-sided canyons. To the west is a much more gently-sloping plain of serpentine. Elevations range from 70 m above sea level at the bottom of the deepest canyons to 270 m at the highest point of the ridge. The climate is mild and dry, with warm summers (mean July high ca 30°C, low ca 10°C) and mild winters (mean January high 15°C, low 3°C). Mean annual precipitation is ca 65 cm; virtually all of this is rain, and 85% of it falls from November through March.

The diverse topography and geology of the park supports a variety of different vegetation types. Level ground throughout the park is largely grassland. The original dominants were probably the perennial bunchgrass *Nassella pulchra* (Hitchc.) Barkworth and a variety of broadleaf perennials and annuals, including species of *Layia, Lasthenia, Eschscholzia,* and *Castilleja.* As with most central California grasslands, this community is now largely dominated by introduced annual grasses, notably Europoean species of *Bromus* and *Lolium.* On the greenstone, sandstone and mudstone, north- and east-facing slopes are covered with a low, dense sclerophyll forest dominated by *Quercus agrifolia* Nee and *Umbellularia_californica* (Hook. & Arn.) Nutt., occasionally broken by patches of sclerophyll scrub dominated by *Adenostoma fasciculatum* Hook. & Arn. or deciduous scrub dominated by *Artemisia californica* Less. Slopes on the serpentine are covered with sclerophyll scrub dominated by *Quercus durata* Jeps. or *Adenostoma fasciculatum.* The vascular flora is very rich, with 470 species known from the small area of the park (Anonymous 1997). Some of the habitats preserved in the park (notably the serpentine grassland) have been almost eliminated from the region around San Francisco Bay by extensive urban growth. Consequently, several of the vascular plant, insect and invertebrate species found here are now rare or endangered, including the only known surviving population of the endemic *Acanthomintha duttonii* (Abrams) Jokerst (Lamiaceae).

The bryoflora of the park consists of 62 species (17 liverworts, 3 hornworts, and 42 mosses) and one additional variety. Unlike the vascular flora, bryophyte diversity seems to owe little to the geological diversity of the site; the serpentine areas have few bryophytes. The steep and varied topography of the park creates a mosaic of mesic and xeric habitats, both of which support unusual species. *Cephaloziella stellulifera* and *Phaeoceros bulbiculosus*, both found on mesic canyonsides on the east side of the park, are both uncommon in North America. Indeed, *P. bulbiculosus* is not included in the latest checklist of North American hornworts (Stotler and Crandall-Stotler 1977), although it was reported from California by Müller (1954) and Proskauer (1958). The collection from Edgewood Park shows all the characteristics of the species, including the stalked

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ventral tubers and the distinctive raised ring on the outer face of the spore, so the presence of this species in California is confirmed. In contrast to these mesic species, several species of east-facing banks and rock outcrops on the higher slopes, notably *Desmatodon guepinii*, *Pseudobraunia californica*, *Grimmia laevigata* and *Pottia starkeana*, are characteristic dominants of the interior foothills in California but uncommon in the Outer Coast Ranges. The soil throughout the park normally dries out completely before the beginning of the summer, and doesn't rehydrate until the following fall, so that many mesophytic species common in the redwood forest only a few kilometers to the west are absent. However, one stream that is fed by a perennial spring supports a small population of *Eurhynchium praelongum*, a hygrophyte that is normally confined to wetter habitats closer to the coast.

All collection numbers are Alan Whittemore's. Vouchers are deposited in the herbaria of the California Academy of Sciences (CAS) and the Missouri Botanical Garden (MO).

LIVERWORTS:

Lunulariaceae

Aytoniaceae

Asterella bolanderi (Aust.) Underw. (5277) Soil, open shade in oak woodland.

Asterella californica (Hampe) Underw. (5252) Soil of trailbanks in oak woodland.

Lunularia cruciata (L.) Dum. (6810) Damp soil of shaded trailbanks in oak woodland.

Targioniaceae

Targionia hypophylla L. (5251) Soil of trailbanks in oak woodland.

Ricciaceae

Riccia californica Aust. (5265) Bare shaded soil in oak woodland.

Riccia nigrella DC. (5227B) Dry sunny soil in grassland.

Riccia sorocarpa Bisch. (5220) Dry soil in shrubland.

Riccia trichocarpa M. A. Howe (6813) Bare soil in open shade.

Sphaerocarpaceae

Sphaerocarpus texanus Aust. (6713) Shaded mineral soil.

Fossombroniaceae

Fossombronia longiseta Aust. (5232, 5255) Sunny or shaded soil.

Gymnomitriaceae

Marsupella bolanderi (Aust.) Underw. (5269A) Soil of dry trailbank, open shade.

Cephaloziellaceae

Cephaloziella divaricata (Smith) Schiffn. (5227A, 5275) Dry soil, sun or open shade.

Cephaloziella stellulifera (Tayl.) Schiffn. (5256) Soil, sheltered places in oak woodland.

Cephaloziella turneri (Hook.) K. Müll. (5269B, 5350) Soil, usually on banks, in rather open sites.

Porellaceae

Porella bolanderi (Aust.) Pears. (5239, 5241, 5242) Shaded bark and rocks in oak woodland.

Porella navicularis (Lehm. & Lindenb.) Lindb. (6715) Shaded bark in oak woodland.

Jubulaceae

Frullania bolanderi Aust. (5222) Dry bark of *Quercus agrifolia.*

HORNWORTS:

Anthocerotaceae

Anthoceros fusiformis Aust. (5266) Shaded soil in oak woodland.

Phaeoceros bulbiculosus (Brotero) Prosk. (5245) Soil at edge of meadow.

Phaeoceros pearsonii (M. A. Howe) Prosk. (5254, 5342) Sunny to deeply shaded soil, oak woodland or *Adenostoma* scrub.

MOSSES:

Ditrichaceae

Ceratodon purpureus (Hedw.) Brid. (5349) Sandy soil in exposed places, *Adenostoma* scrub.

Fissidentaceae

Fissidens curvatus Hornsch. (5248) Sunny soil at edge of meadow.

Fissidens limbatus Sull. (5244) Shaded soil of trailbanks in oak woodland.

Dicranaceae

Dicranella howei Ren. & Card. (5267) Shaded soil beside road in oak woodland.

Pottiaceae

Desmatodon guepinii Br. & Schimp. (5346) Dry exposed soil of trailbank, *Artemisia* scrub on canyonside.

Didymodon occidentalis Zander (5231) Disturbed soil, open shade.

Didymodon vinealis (Brid.) Zander var. *flaccidus* (Br. & Sch.) Zander (5259) Shaded rock near a seasonal stream in oak woodland.

Didymodon vinealis (Brid.) Zand. var. *vinealis* (5336) Old concrete, open shade in oak woodland.

Pottia starckeana (Hedw.) C. Müll. var. *starckeana* (5345) Dry exposed soil of trailbank, *Artemisia* scrub on canyonside.

Timmiella crassinervis (Hampe) L. F. Koch (5230, 5263) Sunny or shaded soil.

Tortula bolanderi (Lesq.) M. A. Howe (5262) Soil of trailbanks, partial shade.

Tortula laevipila (Brid.) Schwaegr. (5226, 5229, 5338) Sunny bark and rock.

Tortula princeps De Not. (5236) Rock face, open shade in oak woodland.

Weissia controversa Hedw. (5253) Shaded soil of trailbank in oak woodland.

Grimmiaceae

Grimmia laevigata (Brid.) Brid. (5276) Dry sunny top of large rock outcrop.

Grimmia lisae De Not. (5223, 5224, 5271, 5272) Rock outcrops, sun or open shade.

Funariaceae

Funaria hygrometrica Hedw. (5335) Trampled stony soil by path.

Funaria muhlenbergii Turn. (5261) Soil of trailbank, open shade.

Bryaceae

Bryum argenteum Hedw. (5344) Sunny soil of trailbank.

Bryum canariense Brid. (5257) Shaded soil in oak woodland.

Bryum capillare Hedw. (5273) Shaded side of rock outcrop.

Bryum flaccidum Brid. (5340) Old concrete, open shade in oak woodland. No gemmae were seen.

Epipterygium tozeri (Grev.) Lindb. (5337) Beneath exposed roots, shaded soil bank in oak woodland.

Bartramiaceae

Anacolia menziesii (Turn.) Paris (5274) Side of rock outcrop, exposed to northeast.

Bartramia stricta Brid. (5246, 5347) Soil in open shade.

Orthotrichaceae

Orthotrichum lyellii Hook. & Tayl. (5343) Bark of *Aesculus* in open oak woodland.

Orthotrichum rupestre Schleich. ex Schwaegr. (5225) Sunny rock.

Orthotrichum tenellum Bruch ex Brid. (5221) Dry bark of *Quercus agrifolia*.

Hedwigiaceae

Pseudobraunia californica (Lesq.) Broth. (5270) Side of large rock outcrop, in open shade.

Leucodontaceae

Alsia californica (Hook. & Arn.) Sull. (5243) Shaded bark in oak woodland.

Antitrichia californica Sull. in Lesq. (5228) Sunny bark of oak.

Dendroalsia abietina (Hook.) E. G. Britt. (5264) Shaded bark of oak.

Pterogonium gracile (Hedw.) Smith (5233, 5234) Rock face, open shade in oak woodland.

Thuidiaceae

Claopodium whippleanum (Sull. in Whipple & Ives) Ren. & Card. (5260) Shaded soil in oak woodland.

Brachytheciaceae

Bestia longipes (Sull. & Lesq.) Broth. (5238, 5240) Rock or bark in open shade, oak woodland.

Brachythecium albicans (Hedw.) Schimp. in B.S.G. (6812) Soil and duff beneath herbs in oak woodland.

Eurhynchium praelongum (Hedw.) Schimp. in B. S. G. (5258) Damp shaded soil in splash of small falls, probably seepy year-round.

Homalothecium arenarium (Lesq.) Lawt. (5348) Sunny soil.

Homalothecium nuttallii (Wils.) Jaeg. (5249) Bark of *Aesculus*, open shade.

Homalothecium aureum (Spruce) H. Rob. (5237, 5247, 5268) Soil or rock, in sun or open shade.

Isothecium myosuroides Brid. (5235, 6811) Bark or rock in open shade, oak woodland.

Scleropodium californicum (Lesq.) Kindb. (5219, 5250) Shady or rather exposed soil.

Scleropodium tourettii (Brid.) L. F. Koch (5339, 5341) Shaded rock, oak woodland.

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The genus *Paraleucobryum* (Musci: Dicranaceae) in Maine

Bruce Allen

Paraleucobryum is a mostly northern hemispheric genus of three species (Müller & Frahm 1987) that usually grows on thin soil over acidic rocks or boulders. *Paraleucobryum longifolium* is the only species of the genus in Maine. The species is found throughout the state, but is especially abundant in the western and northern areas. The *Paraleucobryum* leaf has a broad costa that occupies most of the leaf base and is structurally somewhat similar to that of *Leucobryum*. In cross-section it consists of three layers, a ventral row of hyalocysts, a median row of chlorocysts, and a dorsal row of either hyalocysts or hyalocysts alternating with chlorocysts. The dorsal costal cells are unusual in that they interdigitate with the median chlorocysts. This feature is also seen in the costa of some *Campylopus* species as well as the leaves of *Diphyscium* species. *Paraleucobryum* could be confused with *Leucobryum* because of its broad, structurally similar costa. In Maine *Leucobryum* can be distinguished from *Paraleucobryum* by its glaucous-green color, thick, fleshy leaves and its furrowed and curved rather than smooth and erect capsules. This last feature, however, will not separate the two genera on a world-wide basis since there are neotropical species of *Leucobryum* with erect capsules (*e.g.*, *L. incurvifolium* C. Müll.). *Paraleucobryum* and *Leucobryum*, however, are placed in different families. All members of the Leucobryaceae have internal pores in their hyalocysts (Robinson (1985, 1990) which enable the leaves to generate and hold air internally. This feature is absent in *Paraleucobryum*, which is traditionally placed in the Dicranaceae.

Paraleucobryum appears to occupy an intermediate position within the Dicranaceae between the mostly tropical genus *Campylopus* and the mostly north temperate genus *Orthodicranum*. *Campylopus* is an exceptionally large and variable genus. At one end of its variability are species, such as *C. pittieri* Williams and *C. albidovirens* Herz., with leaves structurally identical to those of *Paraleucobryum*. Although Müller & Frahm (1987) noted that *Paraleucobryum*, *C. albidovirens* and *C. pittieri* are similar in their lack of flavonoids, they considered the costal similarity between the two genera convergent and not indicative of a close phylogenetic relationship. *Campylopus* differs from *Paraleucobryum* in having cygneous rather than straight setae and rhizoids initials on the back side of the costa rather than only scattered on the stem and around the branch primordia.

Evidence of a close phylogenetic link between *Paraleucobryum* and *Orthodicranum* can be found in both the sporophyte and gametophyte. Sporophytically, both genera

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have erect, cylindrical capsules, and peristome teeth that are structurally and ornamentally identical. *Paraleucobryum* has well-formed stomata at the base of its capsules, and although some *Orthodicranum* species lack stomata (*O. rhadocarpum* (Sull.) Holz.) most species of the genus (*e.g., O. flagellare* (Hedw.) Loeske, *O. fulvum* (Hook.) Roth *in* Cas.) have them. Gametophytically, the very broad costa of *O. fulvum,* which is not sharply demarcated from the leaf lamina, seems transitional in form to that of *Paraleucobryum*; while the costae of *P. sauteri* (B.S.G.) Loeske and *O. rhabdocarpum* (Sull.) Holz. are nearly identical in transverse section (Müller & Frahm 1987).

The name *Paraleucobryum* combines the Greek "*para* - near", "*leucon* - white color", and "*bryon* - moss", a reference to the resemblance of the genus to *Leucobryum*.

Paraleucobryum (Limpr.) Loeske, Allg. Bot. Z. Syst. 13: 167. 1907.
Dicranum subg. *Paraleucobryum* Lindb. *ex* Limpr., Laubm. Deutschl. 1: 373. 1886.

Plants in grayish-green tufts. Stems erect, often tomentose, rhizoidal initials scattered on stem or associated with branch buds; stems in cross-section with central strand well-developed. Leaves lance-subulate to lanceolate, subtubulose above, serrate in upper 1/2 to 2/3 or smooth; costa occupying 1/2 to 2/3 the leaf base, ridged or smooth at back, filling the subula, in transverse section with ventral hyalocysts, enlarged, median chlorocysts, and dorsally with hyalocysts, or hyalocysts alternating with chlorocysts; lamina narrow, basal cells hyaline, thin-walled, not or weakly porose, rectangular to elongate, upper cells elongate, narrower at the margins, strongly porose; alar cells well-differentiated. Dioicous. Setae 1–2 per perichaetum, elongate. Capsules erect, cylindrical, smooth or irregularly furrowed when old and dry, not strums; annulus rudimentary; peristome teeth haplolepideous. Spores uni- or bimodal. Calyptrae cucullate. n = 12, 14 (Fritsch 1991).

Paraleucobryum longifolium (Hedw.) Loeske, Allg. Bot. Z. Syst. 13: 167. 1907.
Dicranum longifolium Ehrh. *in* Hedw., Sp. Musc. Frond. 130. 1801.
Campylopus longifolius (Hedw.) Kindb., Bih. Kongl. Svenska Vetensk.-Akad. Handl. 9(7): 87.

Plants in low or high, compact or loose, green, yellowish-green to grayish-green tufts. Stems to 5 cm tall, often tomentose, rhizoidal initials scattered on stem or associated with branch buds, rhizoids dimorphic: large, reddish, sparsely branched ones originating from the rhizoidal initials and slender, white, densely branched ones originating from the large, red rhizoids; stems in cross-section with 1–2 rows of small, more or less firm-walled epidermal cells, central strand well-developed. Leaves 3–8 mm long, falcate-secund, lance-subulate to lanceolate, ovate near insertion, subtubulose above, ending in a long, canaliculate subula, serrate in upper 1/2 to 2/3,

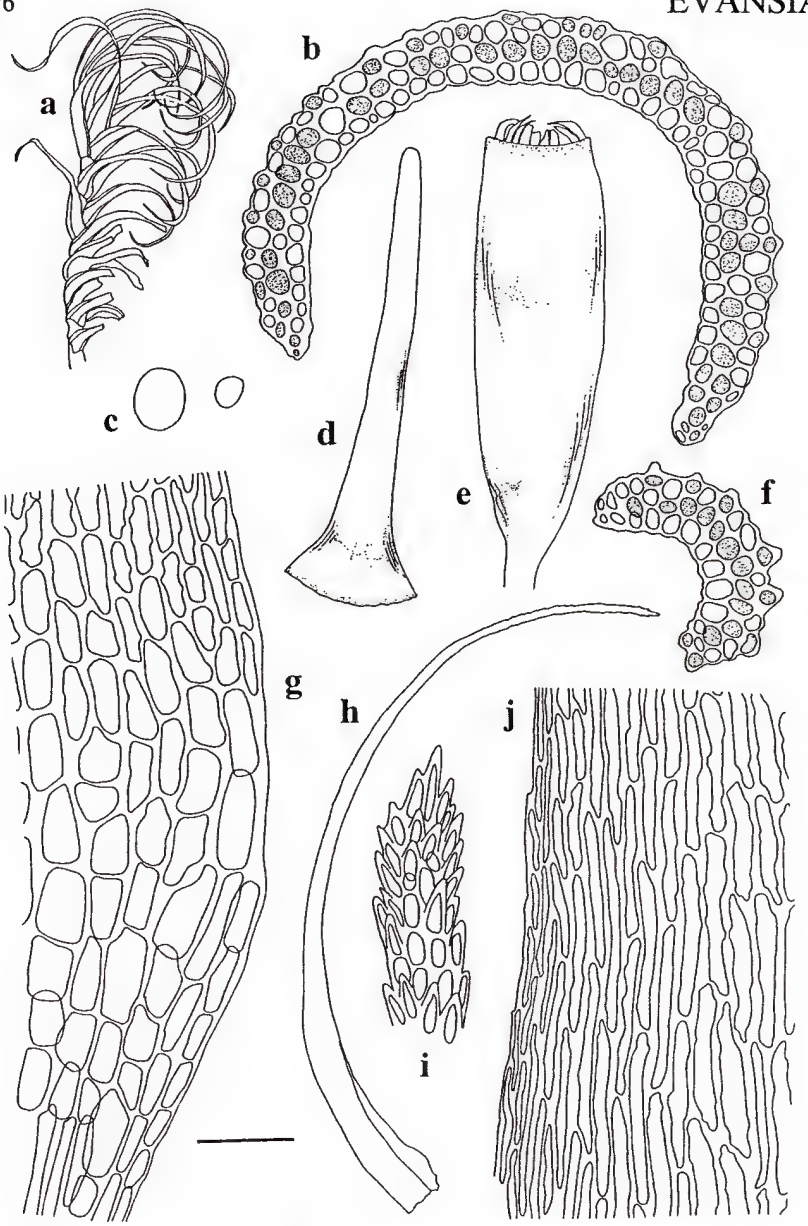

Figure 1. *Paraleucobryum longifolium* a. Habit. b. Cross-section from lower half of leaf. c. Bimodal spores. d. Operculum. e. Capsule. f. Cross-section from upper half of leaf. g. Alar cells. h. Leaf. i. Leaf apex. j. Median leaf margin. Scale bar in mm: bar = 0.05 (b,c,f,g,i,j); bar = 0.5 (d); bar = 0.71 (e); bar = 0.95 (h); bar = 2.62 (a). All figures from *Allen 20978* (MO).

roughened at back; costa occupying 1/2 to 2/3 the leaf base, 160–400 μm wide, filling the subula, excurrent, in transverse section with ventral hyalocysts, enlarged, median chlorocysts, and dorsal hyalocysts alternating with chlorocysts; lamina narrow, basal cells hyaline, thin-walled, at times porose, rectangular to elongate, 30–60 μm long, upper cells elongate, narrower at the margins, 30–80 μm long, strongly porose; alar cells red-brown, lax, inflated. Perichaetial leaves sheathing at base of setae. Setae 1–2 per perichaetum, 10–20 mm long, yellow, becoming reddish with age, twisted above when dry. Capsules red to red-brown, erect, cylindrical, smooth or irregularly furrowed when old and dry, 2–3 mm long, not strums; annulus of thin-walled cells adhering to capsule mouth at dehiscence; stomata phaneroporic, in capsule neck; opercula erect, long-rostrate, 1–2 mm long; peristome teeth 16, divided up to ½ their lengths, dark-red on dorsal (outer) surface, whitish to hyaline on ventral (inner) surface, irregularly thickened and striate below, vertically striate above. Spores bimodal, small, brownish, apparently aborted, 14–20 μm and large, green, minutely papillose, 20–34 μm. Calyptrae smooth, entire at base, 4 mm long.

On thin soil and humus over acidic rocks, stones, boulders, and granite rock faces in woods, along trails and streams, also occasionally on bark of trees and rotten wood. In Maine known from Aroostook (*Allen 16465* MO), Cumberland (*Allen 19988* MO), Franklin (*Allen 21408* MO), Hancock (*Allen 2056* MO), Kennebec (*Allen 14792* MO), Knox (*Allen & Allen 6067* MO), Oxford (*Allen 20978* MO), Penobscot (*Allen 16510* MO), Piscataquis (*Pursell 11461* MO), Somerset (*Allen 9269* MO), Waldo (*Allen 10350* MO), and Washington (*Holmes 323* MO) Counties.

Paraleucobryum longifolium is found in eastern North America from southern Greenland to northern Alabama. In Maine it is usually found on thin soil over acidic rocks and boulders in shaded, wooded places. *Paraleucobryum longifolium* has narrow leaves that are falcate-secund in the same way as *Dicranum scoparium* Hedw. It differs from *D. scoparium* in often having a peculiar gray-green color, and more slender leaves with a broad costa that occupies most of the leaf base. The sporophyte of *D. scoparium* differs from that of *P. longifolium* in having curved, suberect to horizontal, and furrowed capsules. *Orthodicranum fulvum* is sometimes placed in the genus *Paraleucobryum* and it is similar to *P. longifolium* in having a broad costa and erect, cylindrical capsules. Its costa, however, differs from that of *P. longifolium* in having guide cells and well-developed dorsal and ventral stereid bands. In the field *O. fulvum* can be distinguished from *P. longifolium* by its dark-green to fulvous color, and broader, crispate when dry, leaves.

The presence in *P. longifolium* of bimodal spores is an unusual feature that has been noted by Limpricht (1886), Roth (1904), and Müller & Frahm (1987). The smaller spores of *P. longifolium* are frequently deformed and appear to lack chorophyll; Müller & Frahm (1987) considered them aborted spores and not an example of true anisospory.

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Bryophytes of Camp Blanding Training Site
Clay County, Florida

Dana Griffin, III

Camp Blanding Training Site (CBTS), a Florida National Guard facility, occupies approximately 73,000 acres of Clay County and is situated at 30 degrees north latitude, 82 degrees north longitude in the northern part of the Florida peninsula. The Environmental Office of CBTS contracted with the author in 1998 to conduct a bryophyte and lichen survey of those areas of the base that were not being used for active military exercises. In this paper I report on the bryophytes that were found.

While there are 14 recognized natural communities within the base perimeter, 3 communities - baygalls, bottomland forests and sandhills - make up 92% of the total acreage. Baygalls and bottomland forests are confined to wetlands and support considerable diversity both in the vascular and nonvascular floras. The canopy species are quite different between these two habitats with *Pinus serotina, Magnolia virginiana* and *Gordonia lasianthus* dominating in baygalls while important canopy species in bottomland forests are *Quercus laurifolia, Q. michauxii, Acer rubrum, Nyssa biflora, Carpinus caroliniana* and, on certain sites, *Liriodendron tulipifera*. The bryophytes of baygalls are less diverse than is the case in bottomland forests (21 versus 63 species in this survey). The difference may be due to the infrequent fires that sweep baygalls. Bottomland forests rarely experience fire.

Sandhills, by contrast, have much less diversity across all groups of plants (only 7 species of bryophytes were found in CBTS sandhills). The canopy is dominated almost entirely by two species, *Pinus palustris* and *Quercus laevis*. Here and there stands of *Q. margaretta* replace *Q. laevis*. Aridity and frequent fires combine to keep diversity low. According to Myers (1990) those taxa with highly flammable parts have a competitive advantage.

Scrub forests represent only 1.5% (ca. 1,218 acres) of the CBTS property with *Pinus clausa* as the sole canopy species. Scrub does support a more diverse subcanopy and shrub layer with oaks (*Q. geminata, Q. chapmanii & Q. myrtifolia*), *Ceratiola ericoides* and, here and there, *Ximenia americana* dominating. Fires occur in the CBTS scrubs at a frequency of 10-15 years. Fifteen species of bryophytes were collected from scrub habitat, including the rare liverwort, *Lejeunea cardoti*.

This survey turned up 78 species of bryophytes (43 mosses, 35 liverworts), six of which deserve additional comment either because of their rarity or because they represent notable Clay County or peninsular records.

Jaegerina scariosa (Lor.) Arz. This species was encountered in the bottomland forest of South Fork of Black Creek. A neotropical species, it has been reported from Louisiana and several counties in the Florida panhandle. There is an additional record

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from Polk County in the central peninsula (Breen, 1963; Crum & Anderson, 1981). The Clay County collection fills in what has been a disjunct range in Florida for this diminutive moss.

Syrrhopodon ligulatus Mont. This species was described originally from material collected in British Guiana (Reese, 1978). It has been reported from several southern states (Louisiana, Florida & George- Crum & Anderson, 1981), and in Florida it has been encountered from Dade County at the extreme southern end of the peninsula to Escambia County in the western panhandle (Breen, 1963). The present collection is the first for the northern end of the peninsula.

Jamesoniella autumnalis (DC.) Steph. This is a widespread northern species with a range that Schuster (1969) describes as encompassing "the entire spruce-fir panclimax and much of the deciduous forests of the Northern Hemisphere." Along the Gulf coast it is rare and in Florida it has been known only from a few panhandle counties (Breil, 1970; Schuster, 1969). The present report from Clay County extends the range southeastward and onto the Florida peninsula.

Drepanolejeunea sabaliana Schust. Described originally from material collected at Juniper Springs in Florida's Ocala National Forest (Schuster, 1967), the same author reported that over a 20 year period this threatened species had virtually vanished from the type locality (Schuster, 1980). The CBTS collections all came from the South Fork of Black Creek bottomland forest and are notable for their extensiveness. Several stems of Agarista populifolia and Vitis rotundifolia supported patches of this rare liverwort up to 10 cm. Long and 1 cm. wide.

Lejeunea cardoti Steph. This distinctive species with ocellate leaves ranges from southern Louisiana to Mexico with a few disjunct populations in the central area of the Florida peninsula (Schuster, 1980). The present collections represent the northernmost records for this taxon in Florida and, like the populations of the central peninsula, occurred in xeromorphic scrub.

Cylindrocolea obliqua (Douin) Schust. This rare species, a Florida endemic, is reported here for the first time from Clay County. It was found on a peaty bank of the North Fork of Black Creek. Schuster (1980) describes the known range as "at the margins of the Oligocene Island." This was presumably an elevated portion of the Florida peninsula free of marine incursions since Oligocene time (Neill, 1957); however, as pointed out by Webb (1990), the existence of such an island is equivocal and, in any case, from a biogeographic standpoint, it is possible that disjunct patterns (such as that for this species) may reflect nothing more than a series of disjunct habitats, not an ancient island in the physical sense.

Collection numbers are those of the author. Vouchers for all of the collections are on deposit in the herbarium of CBTS. A few duplicates are at FLAS and are so designated in the list of species.

MOSSES

Bartramiaceae

Philonotis glaucescens (Hornsch.) Paris (CB-300a)

Brachytheciacea

Rhynchostegium serrulatum (Hedw.) Jaeg. & Sauerb. (CB-73, CB-486)
Bryaceae
Bryum coronatum Schwaegr. (CB-241)
Pohlia apiculata (Schwaegr.) Crum & Anderson (CB-30 (FLAS), CB-307)
Calymperaceae
Syrrhopodon incompletus Schwaegr. (CB-78, CB-236, CB-306)
Syrrhopodon ligulatus Mont. (CB-297, CB-298, CB-308)
Syrrhopodon parasiticus (Brid.) Besch. (CB-55, CB-255, CB-362)
Syrrhopodon texanus Sull. (CB-89, CB-252, CB-364, CB-412, CB-422)
Cryphaeaceae
Cryphaea glomerata B.S.G. *ex* Sull. (CB-40, CB-76, CB-277, CB-401, CB-405)
Dicranaceae
Dicranum condensatum Hedw. (CB-23, CB-125 (FLAS))
Entodontaceae
Entodon seductrix (Hedw.) C. Muell. (CB-80, CB-427)
Fabroniaceae
Clasmatodon parvulus (Hampe) Hook. & Wils. ex Sull. (CB-483)
Fissidentaceae
Fissidens bushii (Card. & Ther.) Card. & Ther. (CB-299 (FLAS))
Fissidens dubius P. Beauv. (CB-94, CB-112)
Hypnaceae
Isopterygium tenerum (Sw.) Mitt.(CB-9, CB-110, CB-123, CB-145, CB-171, CB-485)
Leptodontaceae
Forsstroemia trichomitria (Hedw.) Lindb. (CB-67, CB-363)
Leskaeceae
Bryohaplocladium microphyllum (Hedw.) Wat. & Iwats. (CB-75, CB-370)
Leucobryaceae
Leucobryum albidum (Brid.) Lindb. (CB-20, CB-77, CB-134 (FLAS), CB-170)
Octoblepharum albidum Hedw. (CB-10)
Leucodontaceae
Leucodon julaceus (Hedw.) Sull. (CB-369)
Meteoriaceae
Papillaria nigrescens (Hedw.) Jaeg. & Sauerb. (CB-108)
Mniaceae
Plagiomnium cuspidatum (Hedw.) T. Kop. (CB-68)
Myriniaceae
Schwetschkeopsis fabronia (Schwaegr.) Broth. (CB-105)
Orthotrichaceae
Schlotheimia rugifolia (Hook.) Schwaegr. (CB-35, CB-488)
Polytrichaceae
Polytrichum commune Hedw. var. *commune* (CB-359)
Pottiaceae
Barbula agraria Hedw. (CB-75)
Barbula indica (Hook.) Spreng. (CB-69, CB-332)
Pterobryaceae
Jaegerina scariosa (Lor.) Arz. (CB-104)
Pireella pohlii (Schwaegr.) Card. (CB-107 (FLAS))
Rhizogoniaceae

Pyrrhobryum spiniforme (Hedw.) Mitt. (CB-119)

Sematophyllaceae

Sematophyllum adnatum (Michx.) Britt. (CB-29, CB-36, CB-129, CB-155, CB-402)

Sematophyllum subpinnatum (Brid.) Britt. (CB-373, CB-398)

Sphagnaceae

Sphagnum cuspidatum Ehrh. *ex* Hoffm. Var. *serrulatum* (Schlieph.) Schlieph. (CB-383, CB-424 (FLAS))

Sphagnum imbricatum Hsch. *ex* Russ. (CB-386, CB-398 (FLAS))

Sphagnum macrophyllum Bernh. *ex* Brid. Var. *floridanum* Aust. (CB-425 (FLAS))

Sphagnum magellanicum Brid. (CB-164, CB-384)

Sphagnum palustre L. (CB-114, CB-120, CB-124, CB-387, CB-494 (FLAS))

Sphagnum perichaetiale Hampe (CB-167, CB-389, CB-493)

Sphagnum recurvum P. Beauv. (CB-122, CB-165, CB-166, CB-254, CB-385)

Sphagnum strictum Sull. (CB-388)

Theliaceae

Thelia asprella Sull. (CB-30 (FLAS))

Thelia hirtella (Hedw.) Sull. (CB-111, CB-366)

Thuidiaceae

Thuidium delicatulum (Hedw.) B.S.G. (CB-113, CB-365, CB-421)

LIVERWORTS

Adelanthaceae

Odontoschisma denudatum (Nees) Dum. (CB-100)

Odontoschisma prostratum (SW.) Trev. (CB-95, CB-169, CB-233, CB-484)

Aneuraceae

Aneura pinguis (L.) Dum. (CB-81, CB-821)

Riccardia latifrons (Lindenb.) Lindb. (CB-116)

Calypogeiaceae

Calypogeia peruviana Nees & Mont. (CB-361 (FLAS))

Cephaloziaceae

Cephalozia catenulata (Heub.) Lindb. (CB-490 (FLAS))

Cephalozia connivens (Dicks.) Lindb. (CB-293)

Cephaloziellaceae

Cephaloziella hyalina Douin (CB-300b)

Cylindrocolea obliqua (Douin) Schust. (CB-400)

Jubulaceae

Frullania eboracensis Gott. (CB-269)

Frullania ericoides Mont. (CB-65, CB-156, CB-404, CB-406, CB-411)

Frullania inflata Gott. (CB-12)

Frullania kunzei (Lehm. & Lindenb.) Lehm, & Lindenb. (CB-21 (FLAS, CB-407)

Frullania obcordata Lehm. & Lindenb. (CB-37 (FLAS), CB-62, CB-430)

Jungermanniaceae

Jamesoniella autumnalis (DC.) Steph. (CB-371 (FLAS))

Lejeuneaceae

Ceratolejeunea laetefusca (Aust.) Schust. (CB-103, CB-109)

Cheilolejeunea myriantha (Nees & Mont.) Schust. (CB-74, CB-78)

Cheilolejeunea rigidula (Nees & Mont.) Schust. (CB-84, CB-93, CB-298, CB-305)

Cololejeunea cardiocarpa (Mont.) Schust. (CB-115, CB-269, CB-491 (FLAS))
Cololejeunea contractiloba Evans (CB-90)
Drepanolejeunea sabaliana Schust. (CB-86 (FLAS), CB-88 (FLAS), CB-91)
Lejeunea cardoti Steph. (CB-54 (FLAS), CB-60)
Lejeunea cladogyna Evans (CB-300c)
Lejeunea flava (Sw.) Nees (CB-117, CB-157, CB-162 (FLAS), CB-409)
Lejeunea laetevirens Nees & Mont. (CB-256, CB-300d)
Lejeunea ulicina (Tayl.) Gott ssp. *bullata* (Tayl.) Schust. (CB-165 (FLAS), CB-377)
Leucolejeunea conchifolia Evans (CB-48, CB-186, CB-272, CB-408, CB-429)
Leucolejeunea unciloba (Lindenb.) Evans (CB-44, CB-59 (FLAS), CB-262)
Mastigolejeunea auriculata (Wils. & Hook.) Schiffn. (CB-72, CB-360)
Rectolejeunea maxonii Evans (CB-378)

Metzgeriaceae
Metzgeria furcata (L.) Dum. (CB-101)

Pallaviciniaceae
Pallacvicinia lyellii (Hook.) Carruth. (CB-121, CB-420)

Plagiochilaceae
Plagiochila dubia Lindenb. & Gott. (CB-71, CB-87)
Plagiochila ludoviciana Sull. (CB-102, CB-118)

Radulalceae
Radula australis Aust. (CB-70)

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Additions to the lichen flora of North America VIII. *Santessoniella grisea* new to North America

Tor Tønsberg[1] & Aino Henssen[2]

The recently described genus *Santessoniella* Henssen includes species from arctic and boreal regions, Japan and southern South America (Henssen 1997), with *S. arctophila* (Th. Fr.) Henssen as the only species from North America. Below we report one more species from North America, *S. grisea* (Hue) Henssen.

Within the genus, *S. grisea* is characterized by warty ascospores, a 140-200 □m tall hymenium, and a thallus of brownish gray, flattened, irregularly and deeply divided squamules (Henssen 1997). The species was previously known only from Japan where it mainly grows on bark and mosses, but also on soil and stone.

Recently *S. grisea* was found in Pacific North America on the shore of a small island in a lake situated a few km from the Pacific Coast. To the west of the lake there is a belt of old-growth, coastal temperate rain forest, of the seasonal type (see Alaback & Pojar 1997, Schoonmaker et al. 1997); to the east there are large clearcuts and tree farms.

Santessoniella grisea grew on corticolous mosses on a trunk of *Alnus rubra*. The site also supported well-developed specimens of *Gyalideopsis muscicola* on *Alnus rubra*. In North America *Santessoniella grisea* may prove to be a rare, humidity demanding species with coastal affinities. With the find discussed here it shows an amphi-Pacific, disjunct distribution.

Specimen Examined

U.S.A. Washington. Clallam Co., Olympic Nat. Park, Lake Ozette, Tivoli Island, 48°04'N, 124°38'W, alt. 10 m, 1997, Tønsberg 24925 (BG, herb. Henssen; det. A. Henssen 1998).

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The Fifth Annual Spring Outing Botanical Excursion Foray, Retreat and Escape to the Environment!

March 24, 25, and 26, 2000 at Las Vegas, Nevada, and vicinity

SO BE FREE:
Founded in 1996, SO BE FREE is a series of West Coast forays started by the Bryolab at UC Berekeley, but open to all botanists. The main focus is on bryophytes, but we also encourage experts on macroalgae, mushrooms, lichens, ferns, and flowering plants to come along. We welcome specialists in bryophytes, as well as generalists, or amateurs who are interested in an overview. It is held each spring, associated with Spring Break at universities. This distinguishes it from the eastern bryological forays (the Andrews and the Blomquist Forays) which are held in the fall. This allows the occasional easterner, desperate for the chance to see plants and blue sky in the spring, a chance to attend.

The usual tradition is to have a four-day, three-night schedule with communal cooking and eating, in inexpensive and remote biological field stations. Evening slide shows and informal talks are presented as well as keying sessions with microscopes. In addition to seeing interesting wild areas and learning new plants, important goals for SO BE FREE include keeping west coast bryologists (and friends) in touch with each other and teaching beginners.

For a glimpse of the past four outings, consult the SO BE FREE web site:
http://ucjeps.herb.berkeley.edu/bryolab/trips/sobefree.html

LOCATION THIS YEAR: The Mojave Desert is the driest region in North America, characterized by sparse vegetative cover, climatic extremes, long periods without precipitation, high evapotranspiration, and wide diurnal and seasonal variation in surface temperatures. Rising from the desert floor at 2000 ft are the Spring Mountains of southern Nevada, which reach nearly 12,000 ft in elevation. These mountains are of interest for the many endemic plants and animals found nowhere else in the world.

The city of Las Vegas, renowned for its gaming attractions, is surrounded by a variety of parks, rugged mountains ranges, and unique habitats. These include large sandstone formations, a series of gypsum formations, high elevation limestone cliffs, and one of the largest lakes in the world.

This foray will depart from the normal pattern of wilderness retreats in the SO BE FREE tradition, with the group staying this year in a hotel south of downtown Las

Vegas. This arrangement will allow us to visit a greater diversity of habitats in the southern Nevada region.

The Saturday foray will be to a high elevation limestone area in the Spring Mountains, at approximately 8,000 feet. The northeast slopes of the mountains offer an incredible transect of vegetation types ranging from creosote bush scrub through pinyon-juniper woodland, ponderosa pine forest, and into a subalpine forest, with large limestone boulders, cliffs, and running streams with aquatic mosses. The Sunday foray will focus on the sandstone formations in the southern region of the Spring Mountains, within the Red Rock National Recreation Area. These narrow canyons are home to several disjunct populations of bryophytes, and the scenery is superb. For those interested on Monday, we will spend the morning venturing to a unique series of gypsum formations, on which the endemic Las Vegas poppy grows along with the rare Didymodon nevadensis. This area is north of Lake Mead, within the Lake Mead National Recreation Area.

The group will register at the Silverton Hotel Friday and gather for drinks and dinner at the hotel. On Saturday night you are invited to the residence of Lloyd Stark, for a backyard barbeque overlooking the bright lights of Las Vegas. Sunday evening we will convene on campus at the University of Nevada Department of Biological Sciences for a microscope session and an informal mixer.

LODGING: A block of rooms has been reserved at the Silverton Hotel, under the group name So Be Free, for March 24-26. Rates are Fri-$60, Sat-$60, Sun-$29 (an average of $50 per night). These rates are for two individuals per room. For an additional $5 per person, up to 4 individuals can room together to save costs. Call the Silverton at 800-588-7711 (or 702-263-7777) to place a deposit on the first night rent. ******Rooms should be reserved no later than February 24, 2000, otherwise rates and availability are subject to change.******

Attractions at the Silverton Hotel include buffets, shows, gaming, i.e., the usual fare of Las Vegas. So feel free to arrive early or stay later and enjoy the unique atmosphere of the fastest growing city in America (but bring lots of extra money or extra willpower!).

RESERVATIONS: Please inform Lloyd Stark of your intent to attend the foray, by February 24th, 2000, at: LRS@nevada.edu, or by telephone 702-895-3119

CONTACT INFORMATION:

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The aim of *Evansia* is to provide a vehicle for the presentation and exchange of useful information on North American bryophytes and lichens. Articles are frequently popular in nature rather than technical and are intended to teach and inform both amateurs and professionals. The articles include, but are not restricted to, announcements of and reports on forays and meetings, presentations of techniques and aids for studying and curating lichens and bryophytes, and reports on local floras. Checklists and papers documenting new regional, state, or county records must include voucher specimens (collector and collection number) and an indication of where the specimens are deposited or a literature reference.

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