

The genus *Hypnum* (Hypnaceae: Musci) in Maine

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The genus *Hypnum*, with approximately 48 species (Ando 1972), is found throughout the world. It is one of the most common woodland species in Maine, and often occurs in dense mats completely covering boulders, vertical rock faces, fallen logs or square yards on the forest floor. *Hypnum* was used by Dillenius (1719, as *Hypnon*), and is one of the genera originally treated by Hedwig (1801). It is now being monographed in exquisite detail by Ando (1972a, 1973, 1976, 1986, 1987, 1989, 1990, 1992, 1993, 1996). The concept of the genus has changed considerably over time as segregate genera have been removed from it. At present it is characterized by its creeping stems (often with regularly pinnate branching) variously dimorphic branch and stem leaves, usually complanate and falcate-secund leaves with short, double costae, long-linear leaf cells, differentiated alar cells, long setae, inclined and asymmetric capsules, double, (generally perfect) peristome, and cucullate calyptrae. *Hypnum* has a distinctive appearance, with most plants having a shiny, yellow-green color, dense branching pattern and complanate, falcate-secund leaves that give the plants a braided appearance. The genus is variable in a number of minor taxonomic characters (pseudoparaphyllia form, axillary hair form, perichaetial leaf texture, endostomal cilia, capsule texture) that are useful in delimiting species-pairs. They may also be important in establishing sectional lines, but their use in supporting additional segregate genera (see Hedenäs 1990) is suspect due in part to their high level of homoplasy.

Hypnum Hedw., Sp. Musc. Frond. 236. 1801.

Plants small to robust, green, golden, yellowish-brown, reddish-yellow, in loose or dense, tufts or mats, occasionally pendent. Stems creeping, ascending, suberect, or erect, regularly pinnate or irregularly branched; in cross-section with or without a hylodermis, central strand present or

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rudimentary, rhizoids in abaxial clusters at leaf base. Paraphyllia absent, pseudoparaphyllia filamentous, subfilamentous, narrowly or broadly foliose to deltoid, rarely ciliate. Leaves commonly in two curving rows, the plants more or less complanate, at times evenly foliate, more or less terete. Stem leaves often larger, wider, and with better alar cell development than branch leaves. Leaves concave, falcate-secund to circinate, ovate-lanceolate, oblong-lanceolate or elongate-triangular, not or variously decurrent, smooth or plicate, apex acute to long and slenderly acuminate, margins entire, serrulate to denticulate, plane, narrowed recurved below, or revolute throughout; costa short and double or lacking; median cells linear-rhomboidal to linear-flexuose, basal cells shorter, incrassate and usually porose near insertion, alar cells thin-walled, enlarged and hyaline, or homogeneously incrassate, small, subquadrate to short-rectangular, or with a few small, subquadrate cells above enlarged hyaline cells at the extreme basal angles. Perichaetial leaves lanceolate or oblong-ovate, long to filiform acuminate, smooth or plicate, serrate, serrulate, or entire. Dioicous, phyllodioicous, or autoicous. Setae elongate, smooth, yellowish-red, red, reddish-brown, to brown. Capsules suberect, inclined, horizontal, or pendent, curved and asymmetric, ovoid, to long-cylindrical, smooth or plicate when dry, stomata present; operculum conic-obtuse to rostrate; annulus of 2--3 rows of cells, falling with operculum. Peristome double, mostly perfect, exostome teeth subulate-acuminate, yellowish-brown, cross-striolate below, hyaline and papillose above, trabeculae projecting at back; endostome yellowish-hyaline, lightly papillose, basal membrane high, segments keeled, perforate, cilia well-developed, nodose or appendiculate, 1-3, or rudimentary. Spores spherical, nearly smooth to lightly roughened, 8--30 μ m. Calyptra cucullate, naked.

Key to the species of *Hypnum* in Maine.

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1. Stem epidermal cells enlarged, thin-walled and hyaline 2
1. Stem epidermal cells not noticeably enlarged, thin-walled or hyaline 6

2. Plants growing in wet or swampy places, with few branches, never pinnate; leaves acute to broadly acuminate; alar cells conspicuously enlarged or inflated3
2. Plants growing in mesic to dry places, usually regularly pinnate; leaves filiform-acuminate; alar cells irregularly subquadrate or with a few oblong, inflated and hyaline cells at basal angles bordered above by small, subquadrate cells4
3. Leaves auriculate; alar cells gradually enlarged; pseudoparaphyllia lanceolate; capsules smooth; endostomal cilia nodose**H. pratense**
3. Leaves not auriculate; alar cells abruptly inflated in 2-3 rows; pseudoparaphyllia broadly foliose; capsules strongly furrowed; endostomal cilia appendiculate**H. lindbergii**
4. Stem leaves auriculate or rounded to the insertion
.....**H. plicatum**
4. Stem leaves rounded or straight to the insertion5
5. Alar cells scarcely differentiated or consisting of a few, small, subquadrate cells with 1-2 larger, hyaline cells at the extreme angles; dioicous**H. hamulosum**
5. Alar cells consisting of an excavate basal group of enlarged, thin-walled, hyaline cells bordered above by a few small, irregularly subquadrate cells; autoicous**H. fertile**
6. Alar cells consisting of a few hyaline, thin-walled, inflated cells forming short decurrencies and bordered above by a few short-oblong to subquadrate cells7
6. Alar cells thick-walled throughout8
7. Stem leaves auriculate at base, broadly acuminate to acute; dioicous**H. curvifolium**
7. Stem leaves straight or rounded to the insertion, long, slenderly acuminate; autoicous **H. fertile**

8. Plants medium to large; pseudoparaphyllia foliose, branched or ciliate; alar cells hyaline to orange below, smaller and opaque above, quadrate to subquadrate
**H. imponens**
8. Plants small to medium-sized; pseudoparaphyllia filamentous to narrowly foliose, entire; alar cells opaque, transversely elongate or equal sized throughout9
9. Autoicous; leaf margins serrulate to serrate throughout .**H. pallescens**
9. Dioicous; leaf margins entire or serrulate toward the apex 10
10. Capsules present 11
10. Capsules absent 13
11. Capsules erect to suberect, symmetric; operculum mammillate**H. mammillatum**
11. Capsules arcuate, asymmetric, operculum rostrate12
12. Plants small; leaves straight to weakly falcate
**H. cupressiforme var. filiforme**
12. Plants small, medium or robust; leaves (other than those on filiform branches) falcate-secund.....
**H. cupressiforme var. cupressiforme**
13. Plants small; leaves straight to weakly falcate
**H. cupressiforme var. filiforme**
13. Plants small, medium, or robust; leaves (other than those on filiform branches) falcate-secund14
14. Plants small; leaves sharply serrulate above; alar cells heterogeneous with some larger, hyaline cells at the basal angle**H. mammillatum**
14. Plants small, medium, or robust; leaves subentire to moderately serrulate above; alar cells homogeneous**H. cupressiforme var. cupressiforme**

1. *Hypnum curvifolium* Hedw., Sp. Musc. Frond. 285. 1801.

Plants medium to robust, shiny yellow-green in dense mats. Stems prostrate, creeping, orange-brown to red, pinnately branched; in cross-section hylodermis absent, central strand present. Pseudoparaphyllia narrowly to broadly foliose. Leaves in two curving rows, more or less complanate. Stem leaves 1.5--2.0 mm long, falcate-secund, triangular-ovate, concave, not decurrent, smooth, apex short and broadly acuminate to acute, rounded to auriculate at base, margins serrulate above, plane to erect; costa short and double; median cells linear-flexuose, 45--65 μm x 6 μm , firm-walled, basal cells shorter and broader, alar cells with 1--2 rows of thin-walled, enlarged, hyaline cells below a small cluster of small, quadrate cells. Branch leaves smaller, narrower, with weakly differentiated alar cells. Dioicous. Inner perichaetial leaves lanceolate, abruptly acuminate, 4 mm long, strongly plicate, weakly serrulate. Setae reddish-brown, 25--35 μm long. Capsules asymmetric, curved, mouth more or less vertical, 2.5--3.0 mm long, obovoid-cylindric, plicate dry; operculum conic-apiculate; annulus poorly differentiated. Peristome double, exostome teeth subulate-acuminate, yellowish-brown, cross-striolate below, hyaline and papillose above, trabeculae projecting at back; endostome yellowish-hyaline, lightly papillose, basal membrane medium in height, segments keeled, narrowly perforate, cilia 2-3, nodose, rarely appendiculate. Spores spherical lightly roughened, 14--20 μm . Calyptra not seen.

A forest species found on soil banks and humus over rocks and logs, occasionally on bark at the base of trees. In Maine known from Hancock (*Merrill 85 MAINE, MO*), Knox (*Allen 14620 MO*), Oxford (*Stevens 1567 MAINE, NY*), and Waldo (*Allen 10386 MO*) counties.

Hypnum curvifolium, an eastern North American endemic, is a large sized *Hypnum* with smooth, falcate-secund leaves that are neatly arranged on two sides of the stems and branches. The plants have the braided aspect and size of *H. imponens*, but that species is more regularly pinnately branched, has an extensive area of large, firm-walled, reddish-orange alar cells, and deeply incised pseudoparaphyllia. Microscopically *H. curvifolium* has leaves with short, broad apices, broadly rounded to auriculate bases and heterogeneous alar cells. The

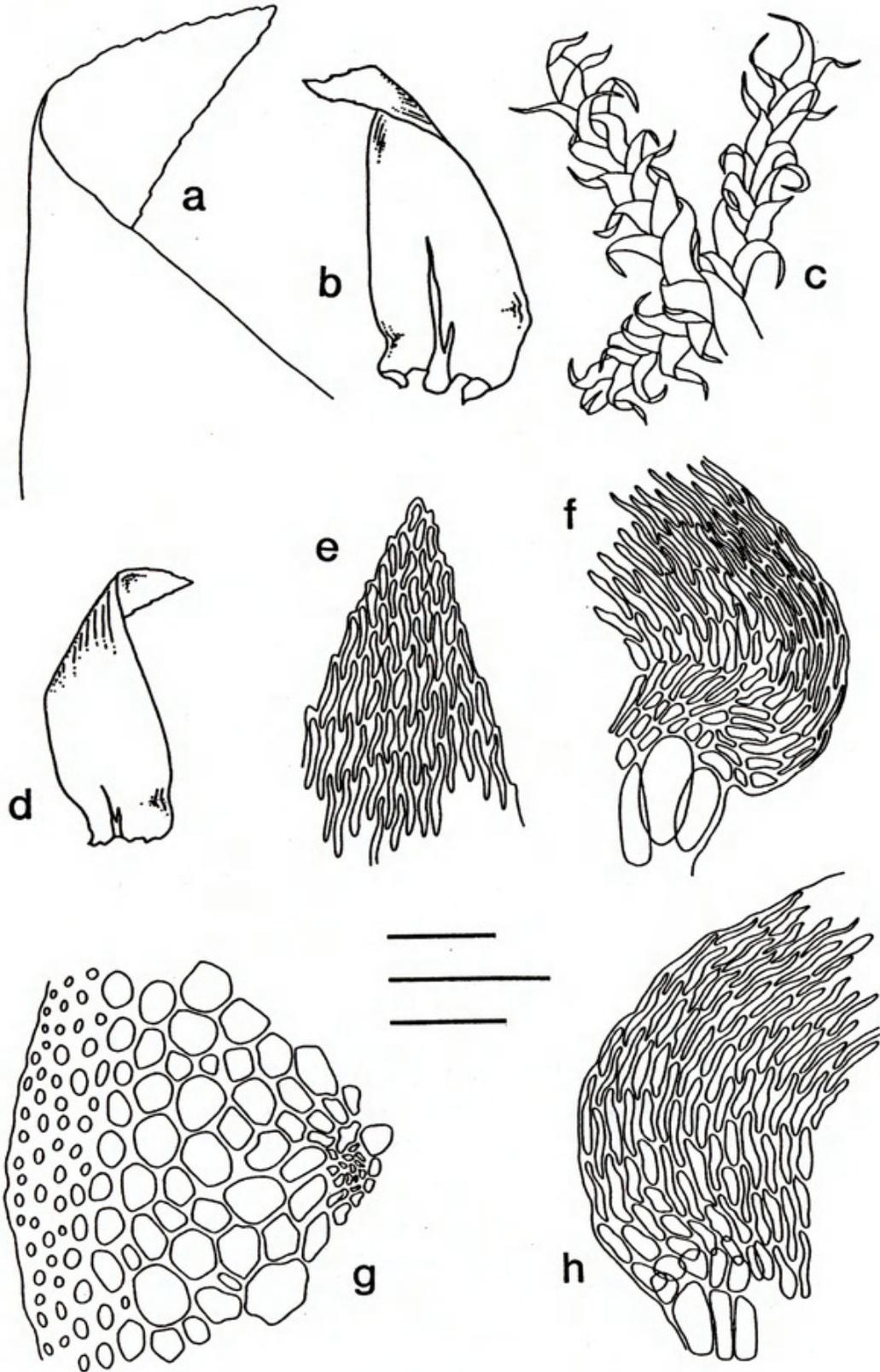


Figure 1. *Hypnum curvifolium*. a. Leaf apex. b. & d. Stem leaves. c. Habit. e. Leaf apex. f. & h. Leaf bases. g. Stem cross-section. Scales in mm: Top = 0.05 (e–g); top = 0.1 (a); middle = 0.5 (b, d.); bottom = 1.0 (c).

alar region has 1-2 rows of enlarged, thin-walled, hyaline cells below a cluster of small, irregularly subquadrate, thick-walled cells.

The capsules of *H. curvifolium* are strongly plicate as are its perichaetial leaves, and these in conjunction with its type of alar cell development seem to indicate a relationship with *H. lindbergii* (Crum & Anderson 1981). Both Fleischer (1914) and Herzog (1926) placed the two species in the segregate genus *Breidleria*. Ando (1973), however, treated *Breidleria* at the sectional level (as section *Pratensia* B.S.G.) and, emphasizing the presence or absence of a stem hyalodermis as a sectional character, placed *H. lindbergii* and *H. curvifolium* in different sections.

2. *Hypnum cupressiforme* Hedw., Sp. Musc. Frond. 291. 1801.

Stereodon cupressiformis (Hedw.) Brid. ex Mitt., J. Linn. Soc., Bot. Suppl. 1: 96. 1859. *Drepanium cupressiforme* (Hedw.) Roth., Eur. Laubm. 2: 621. 1904.

Plants small, medium, large or robust, yellowish-green or dark green in dense, at times pendent mats. Stems prostrate, creeping, yellowish-green to orange-brown or red, densely but irregularly branched; in cross-section hyalodermis absent, central strand rudimentary to moderately developed. Pseudoparaphyllia narrowly foliose, subfiliform or filiform. Leaves in two curving rows, more or less complanate. Axillary hairs fugacious, with 1-2 reddish, quadrate basal cells and 2--4 hyaline, oblong upper cells, occasionally the terminal cell light reddish. Stem leaves 1--2 mm long, falcate-secund or erect, ovate- to oblong-lanceolate, concave, weakly decurrent, smooth, apex narrowly acuminate, straight to rounded at base, margins weakly serrulate to subentire, recurved or erect below, plane above; costa short and double; median cells linear-rhomboidal, (35-)60--80 μ m x 4 μ m, firm-walled, basal cells similar, smaller, thicker-walled, pitted near insertion, alar cells small, subquadrate to quadrate, thick-walled, in 10--15 rows, opaque, often with a few larger, hyaline, rectangular cells below. Branch leaves smaller, narrower, with more weakly differentiated alar cells. Dioicous. Inner perichaetial leaves oblong-lanceolate, narrowly acuminate, smooth, serrulate. Setae reddish-brown, 12--20 mm long.

Capsules inclined, oblong-cylindric, asymmetric, 2 mm long, smooth, operculum rostrate 0.7--1 mm long; annulus 1--2 seriate. Peristome double, exostome teeth subulate-acuminate, yellowish-brown, cross-striolate below, hyaline and papillose above, trabeculae projecting at back; endostome yellowish-hyaline, lightly papillose, basal membrane medium in height, segments keeled, narrowly perforate, cilia 1--2, poorly developed to rudimentary. Spores spherical, lightly roughened, 12--16 μ m. Calyptra not seen.

On tree (*Acer*, *Ostrya*, *Quercus*) trunks, logs, rotting stumps, rocks, boulders, and soil in woods. In Maine known from Cumberland (*Allen* 2001 MO), Hancock (*Allen* 2086 MO), Knox (*Allen & Allen* 6045 MO), Lincoln (*Allen* 13077 MO), Sagadahoc (*Allen* 14596 MO), Waldo (*Redfearn* 3778 MO1), Washington (*Davis* 217 MAINE), and York (*Allen* 13041 MO) counties. Reported from Oxford county (Parlin 1939).

Hypnum cupressiforme is the most variable species of *Hypnum*. Ando (1989, 1990, 1992, 1993) in a detailed study of the species concluded it was an "exceedingly polymorphic species complex" with many subtle intermediate and puzzling forms. He divided the species into 9 varieties and 12 forms, and as a result the species is very difficult to characterize. It has a well-developed, opaque alar region consisting of many subquadrate to rectangular cells. Its pseudoparaphyllia, around single buds, vary from narrowly foliose to subfilamentous to filamentous, the perichaetial leaves are smooth and the capsules are generally inclined and have rostrate opercula. In nearly all of its other features the species exhibits apparently unlimited variation (Ando 1989). In Maine three forms and one variety are commonly encountered. In the typical form the plants are usually found on rocks and boulders in the woods. They are medium to large sized, the leaves are complanate and falcate-secund, the leaf margins weakly serrulate and the alar cells more or less homogeneous. A second form corresponds to this typical form in most ways except the plants are more or less terete with generally erect leaves. A third distinct form of the species is commonly found on tree trunks. It has slender, often pendent plants with complanate, falcate-secund leaves, more strongly serrate leaf margins, and a more heterogeneous alar region, with occasionally a few enlarged, hyaline cells at the leaf insertion. This slender, pendent form often has terete, filiform branches with erect leaves and can be difficult to distinguish

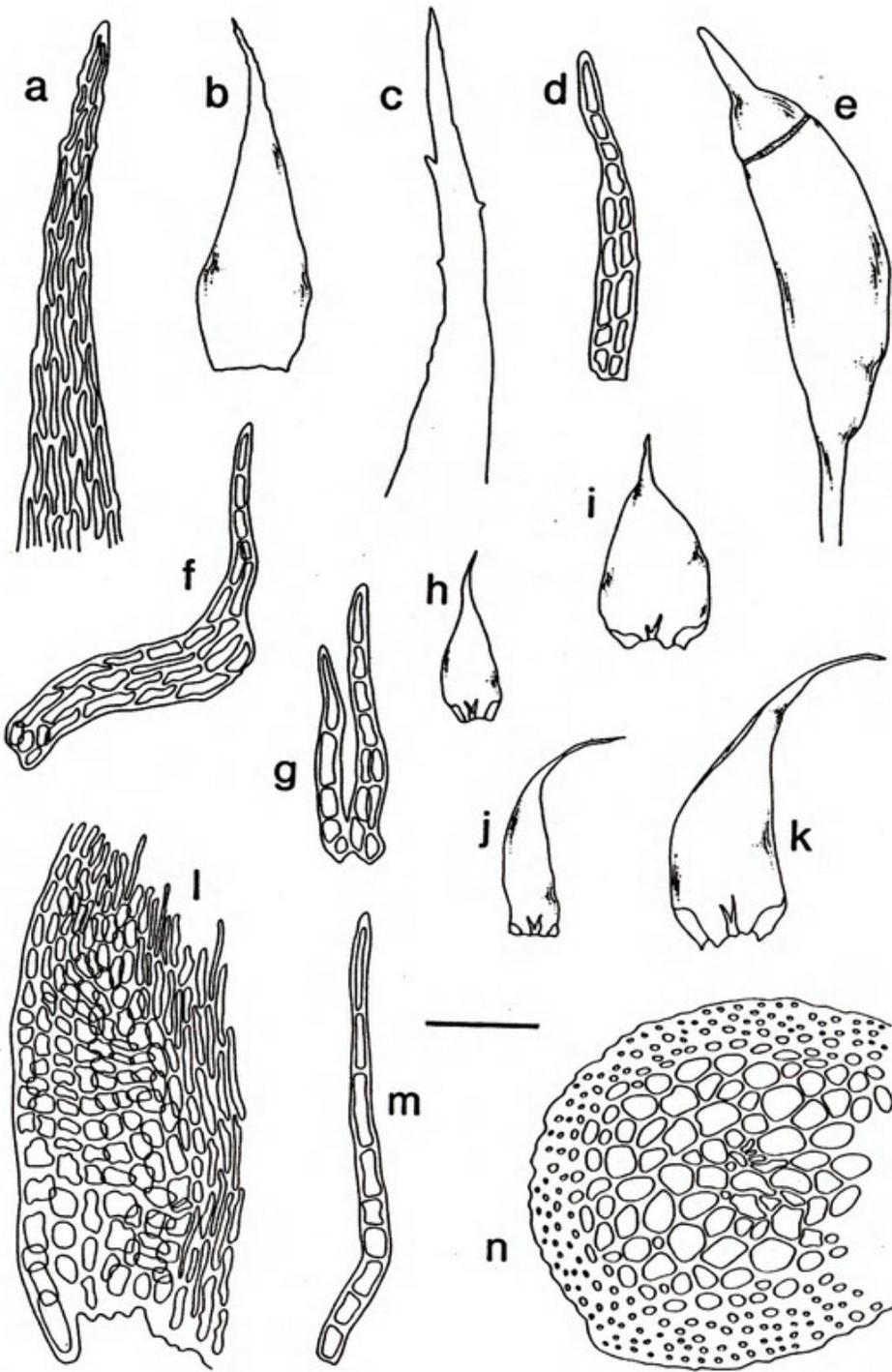


Figure 2. *Hypnum cupressiforme*. a. Leaf apex. b. Perichaetial leaf. c. Perichaetial leaf apex. d. Pseudoparaphyllum. e. Capsule and operculum. f. & g. Pseudoparaphyllia. h. Leaf, var. *filiforme*. i. Leaf, terete-form. j. Leaf, pendulous-form. k. Leaf, typical expression. l. Leaf base. m. Pseudoparaphyllum. n. Stem cross-section. Scale in mm: = 0.05 (a, d, f, g, l–n); = 0.1 (c); = 0.5 (b, e, h–k).

from the variety *filiforme* which is a slender plants, with erect leaves that usually is found on rocks and boulders.

Hypnum cupressiforme can be extremely difficult to distinguish from *H. mammillatum*. The two species are best distinguished by sporophytic characters. *Hypnum mammillatum* has erect to inclined, symmetric capsules with conic-mammillate opercula, while in *H. cupressiforme* the capsules are arcuate, asymmetric, and have conic-rostrate opercula. Unfortunately, both species are dioicous and while sporophytes of *H. cupressiforme* are extremely rare, those of *H. mammillatum* are unknown in North America. Gametophytically, *H. mammillatum* is a small species with distinctly falcate-secund leaves that are often sharply serrulate above, have recurved basal leaf margins, and alar cells that have 1--2 hyaline, enlarged, rectangular cells below its distinctive cluster of small, subquadrate, thick-walled alar cells. *Hypnum cupressiforme* grades into this species in all ways and as a result the separation of the two species remains problematical. Some forms of *H. cupressiforme* can be confused with *H. imponens* or *H. pallescens*, both of which can have somewhat similar alar cells. *Hypnum imponens* differs from *H. cupressiforme* in its more regularly pinnate branching and in its broadly foliose, ciliate pseudoparaphyllia, while *H. pallescens* is an autoicous species with sharply serrulate leaf margins and short leaf cells.

2a. *Hypnum cupressiforme* Hedw. var. *filiforme* Brid., Muscol. Recent. 2(2): 138. 1801.

Stereodon cupressiforme (Hedw.) Brid. ex Mitt. ssp. *filiforme* (Brid.) Lindb., Musci Scand. 38. 1879. *Stereodon cupressiforme*. var. *filiforme* (Brid.) Braithw., Brit. Moss Fl. 3: 162. 1902. *Hypnum filiforme* (Brid.) Loeske, Moosfl. Harz. 318. 1903. *Drepanium cupressiforme* (Hedw.) Roth. var. *filiforme* (Brid.) Roth, Eur. Laubm. 2: 623. 1904. *Hypnum cupressiforme* Hedw. fo. *filiforme* Kraemer, Mitth. Thüring. Bot. Vereins 40: 37. 1931. *Hypnum cupressiforme* Hedw. ssp. *filiforme* (Brid.) Bertsch., Moosfl. 134. 1949.

Plants slender, yellowish-green or dark green in loose or dense mats. Stems prostrate, creeping, yellowish-green to orange-brown or red,

sparsely and irregularly branched; in cross-section hylodermis absent, central strand rudimentary. Pseudoparaphyllia narrowly foliose, subfiliform or filiform. Leaves erect spreading. Axillary hairs fugacious, with 1-2 reddish, quadrate basal cells and 2--4 hyaline, oblong upper cells. Stem leaves 1--1.5 mm long, straight to very weakly falcate, ovate-to oblong-lanceolate, concave, weakly decurrent, smooth, apex narrowly acuminate, straight to rounded at base, margins weakly serrulate to subentire, plane or recurved at base; costa short and double; median cells linear-rhomboidal, 45--60 μm x 6 μm , firm-walled, basal cells similar, smaller, thicker-walled, pitted near insertion, alar cells small, subquadrate to quadrate, thick-walled, in 10--15 rows, opaque, often with a few larger, hyaline, rectangular cells below. Branch leaves smaller, narrower, with more weakly differentiated alar cells. Dioicous. Sporophytes unknown in Maine.

On boulders and vertical rock faces in woods, rarely on tree trunks (*Fagus*). In Maine known from Cumberland (*Allen 6001* MO), Hancock (*Redfearn 37730* MO), Lincoln (*Allen 9213* MO), Sagadahoc (*Norton MAINE*), and Waldo (*Allen 10366*) counties.

Hypnum cupressiforme var. *filiforme* is a slender expression of *H. cupressiforme* that differs only in having straight to weakly falcate leaves and relatively fewer alar cells. In Maine the species is most commonly found on boulders and vertical rock faces. It can be very difficult to distinguish from slender, pendulous forms of *H. cupressiforme* var. *cupressiforme* which often have filiform branches with erect rather than falcate-secund leaves. Ando (1992) recognizes 6 forms of the var. *filiforme* and also considers it very close to, perhaps only an ecological variant of, the pendulous forms of var. *cupressiforme*. In North America this variety has been confused with *H. cupressiforme* var. *resupinatum* (Tayl.) Schimp. in Spruce. Apparently, Crum & Anderson's (1981) treatment and figures of *H. cupressiforme* var. *filiforme* actually represent the pendulous forms of var. *cupressiforme*, while their treatment and figures of *H. cupressiforme* var. *resupinatum* represent the type concept of var. *filiforme*. Likewise, Redfearn's (1983) treatment of *H. cupressiforme* var. *resupinatum* also represents the type concept of *H. cupressiforme* var. *filiforme*.

3. *Hypnum fertile* Sendtn., Denkschr. Bayer Bot. Ges. Regensburg 3: 147. 1841.

Plants small, pale, yellowish-green in dense mats. Stems prostrate, creeping, regularly pinnate; in cross-section with a moderately developed hylocladus, central strand present. Pseudoparaphyllia narrowly foliose to deltoid. Leaves in two curving rows, more or less complanate. Stem leaves 1.5--2 mm long, falcate-secund, oblong-triangular to ovate-lanceolate, concave, straight or rounded at base, decurrent, smooth, apex long and slenderly acuminate, margins weakly serrulate above, plane to erect below; costa short and double; median cells linear-flexuose, 50--70 μ m x 4 μ m, firm-walled, basal cells 30--35 μ m x 4 μ m, incrassate and usually porose near insertion, alar cells enlarged and hyaline at basal angle, with several smaller, irregularly subquadrate or shortly rectangular cells above. Branch leaves smaller, narrower, with weakly differentiated alar cells. Autoicous. Inner perichaetial leaves long lanceolate, long acuminate, 3.0 mm long, plicate below, serrulate above. Setae reddish-brown, 20--30 μ m long. Capsules curved to arcuate, 2--2.5 mm long, cylindrical, smooth to lightly plicate at base when dry; operculum conic-apiculate. Peristome double, exostome teeth subulate-acuminate, yellowish-brown, cross-striolate below, hyaline and papillose above, trabeculae projecting at back; endostome yellowish, lightly papillose, basal membrane high, segments keeled, narrowly perforate, cilia 2--3, well developed, nodose or appendiculate. Spores spherical, lightly roughened, 10--14 μ m. Calyptra not seen.

On rotting logs. Reported from Oxford (Parlin 1939) and Washington (Spencer 1993) counties. All other reports of the species from Maine are based on misdeterminations.

This species belongs to section *Fertilia* Ando, a section of small, medium or large sized, autoicous plants, with a poorly developed stem hyalodermis, plicate perichaetial leaves and stem leaves having an alar region consisting of heterogeneous cells. Both Ando (1973) and Schofield (1992) considered the stems of *H. fertile* to be not strictly hyalodermis, and this is true to some extent. The epidermal cells in *H. fertile* are never as fully enlarged as can be found, for example, in *H. lindbergii* Mitt.; they are however consistently enlarged and relatively

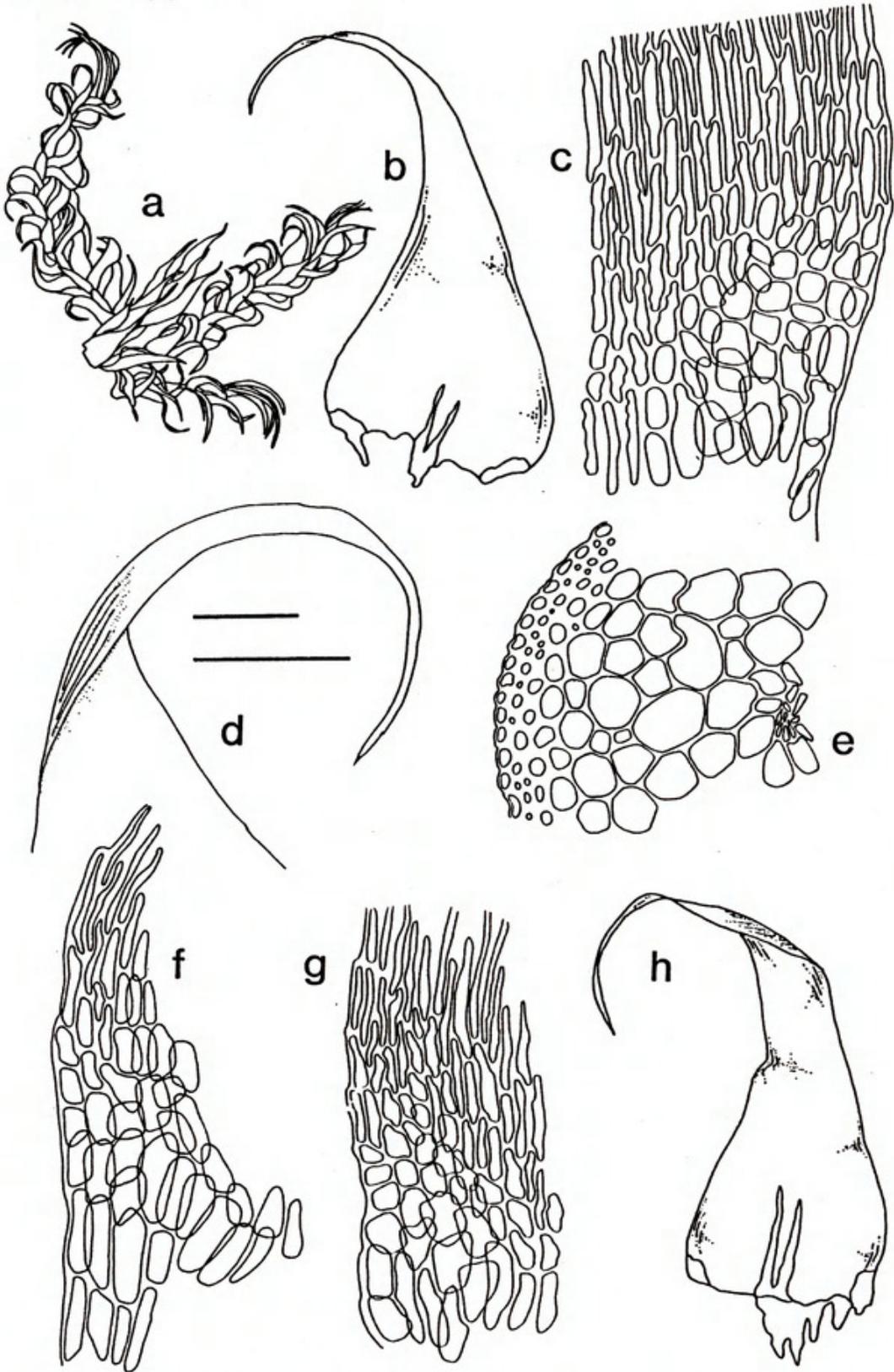


Figure 3. *Hypnum fertile*. a. Habit. b. & h. Stem leaves. c., f. & g. Leaf bases. d. Leaf apex. e. Stem cross-section. Scales in mm: Top = 0.05 (c, e, f, g); top = 0.1 (d); top = 1.0 (a); bottom = 0.5 (b, h).

thin-walled when compared to species of the "non-hylodermis"-sections of *Hypnum*. On the other hand, some species in the "hylodermis"-sections (i.e., *Pratensia* and *Hamulosa* B.S.G.) don't always exhibit a fully developed hylodermis. In fact the feature seems to be variably expressed within some species.

Hypnum fertile is a small to medium sized species with a field-aspect often identical to *Hypnum plicatum*. There have been a large number of *Hypnum* collections from Maine named *H. fertile*, however, these have all turned out to be misdeterminations of *H. plicatum*, *H. pallescens*, or *H. imponens*. *Hypnum pallescens* is similar to *H. fertile* in size and in its autoicous sexual condition, but it differs in having sharply serrate upper leaf margins, relatively short leaf cells, a more extensive development of quadrate cells in its alar region, and rostrate opercula. *Hypnum imponens* is larger than *H. fertile*, has an extensive area of enlarged, bulging though firm-walled, usually orange-red alar cells and broadly foliose to ovate, distinctly ciliate pseudoparaphyllia.

Most Maine collections named *H. fertile* have turned out to be *H. plicatum*, a more northerly distributed species previously overlooked (see Allen 1996) in the state. Although placed in different sections (Ando 1973), *H. fertile* can be very difficult to distinguish from *H. plicatum*. The surest way to separate the two species is based on sexuality. Plants of *H. fertile* are autoicous with perigonia occurring very near the perichaetia on the same stem. *Hypnum plicatum* is phylodioicous. When dealing with non-fertile material separation of the species depends upon a careful examination of the basal, marginal area of the stem leaves. In *H. plicatum* the stem leaves are auriculate or rounded at base. In contrast the stem leaves of *H. fertile* can be rounded or straight to the insertion, with both types of leaves occurring on single stems. The alar cells of *H. plicatum* generally consist of a few small, thick-walled subquadrate to rectangular cells that are positioned away from the leaf margin due to the leaf base auriculation. When the leaves are simply rounded to the insertion the alar cells are not displaced, and occur along the basal margin. Often there are a few enlarged, inflated cells at the very base of the leaf, these cells however appear to be stem hyalodermal cells rather than alar cells. In contrast the alar cells of *H. fertile* consist of an excavate group of enlarged, thin-walled, hyaline

cells at the base of the leaf above which are a few small, irregularly subquadrate cells along the basal margin.

4. *Hypnum hamulosum* Schimp. in B.S.G., Bryol. Eur. 6: 96. 1854.

Stereodon hamulosum (Schimp. in B.S.G.) Lindb., Acta Soc. Sci. Fenn. 10: 255. 1872.

Hypnum cupressiforme var. *hamulosum* Brid., Musc. Recent. Suppl. 2: 217. 1812.

Plants small, shiny, in yellowish-green mats. Stems prostrate, creeping, regularly pinnate; in cross-section with a well-developed hyalodermis, central strand present. Pseudoparaphyllia narrowly foliose to deltoid. Leaves in two curving rows, more or less complanate. Stem leaves 1.3--2 mm long, circinate-secund, lanceolate to ovate-lanceolate, concave, straight or slightly rounded at base, not decurrent, plicate at base, apex long and slenderly acuminate, margins serrulate above, plane to somewhat narrowly recurved below; costa short and double; median cells linear-flexuose, 60--70 μ m x 4 μ m, firm-walled, basal cells shorter, incrassate and usually porose, alar cells poorly differentiated, a few short, subquadrate cells with 1-2 somewhat enlarged and hyaline cells at the basal angles. Branch leaves smaller and narrower. Phyllocladous (vide Ando 1972a). Sporophytes unknown from Maine.

On old wood. In Maine known from Oxford (*Howard* MAINE) county.

Hypnum hamulosum is a boreal species related to those *Hypnum* groups characterized by the presence of a stem hyalodermis. It is a small, regularly pinnately branched species with narrow, circinate-secund leaves that are straight to weakly rounded at base and have only a few, subquadrate alar cells. It is one of three species (*H. plicatulum*, *H. hamulosum* and *H. callichroum* Brid.) of section *Hamulosa* in eastern North America. *Hypnum plicatulum* differs from *H. hamulosum* in its auriculate to strongly rounded stem leaves and better developed alar cells, while *H. callichroum* differs in having numerous, thin-walled and enlarged alar cells. *Hypnum lindbergii* and *H. pratense*, members of the other hyalodermis section of *Hypnum* differ in their larger size,

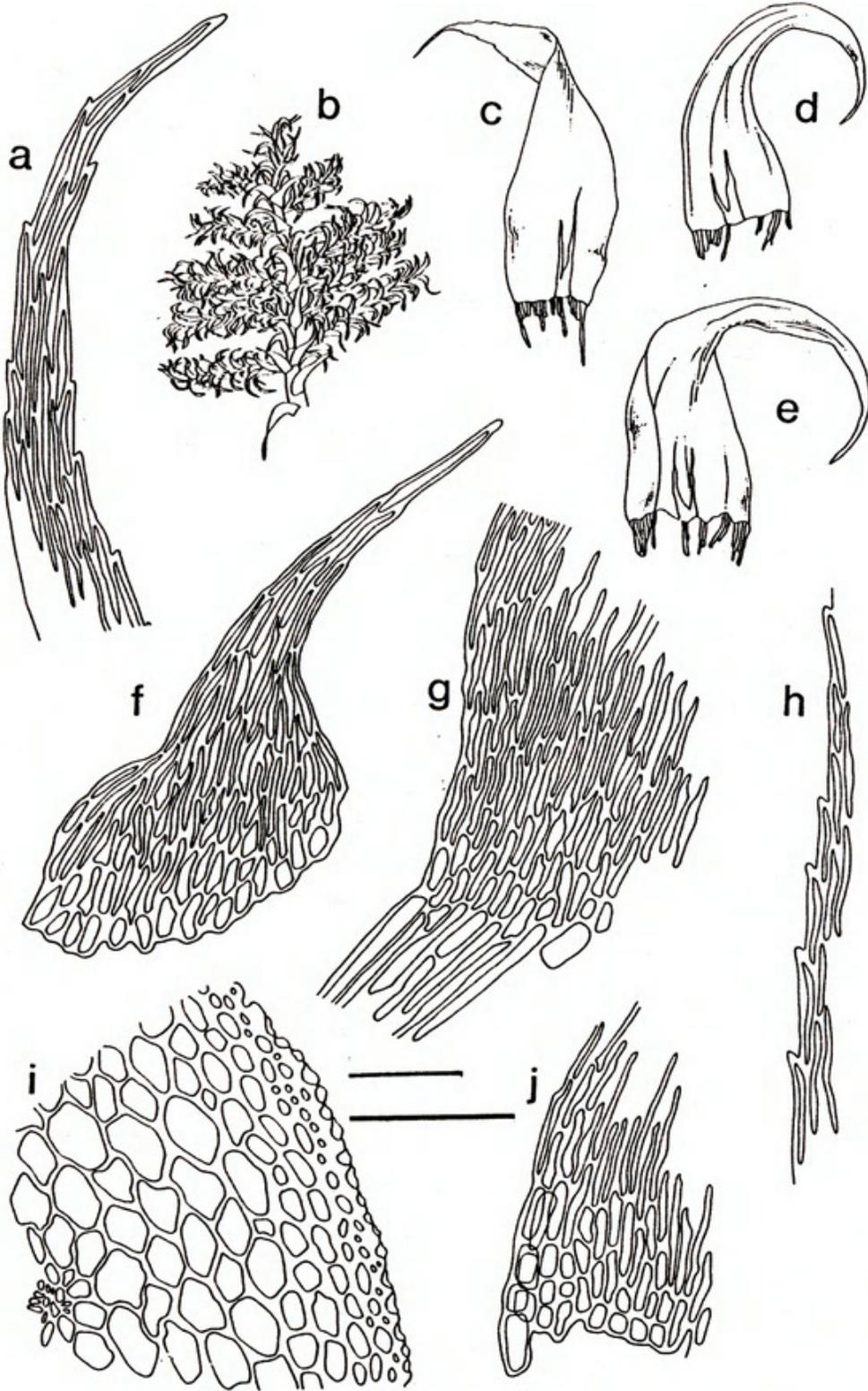


Figure 4. *Hypnum hamulosum*. a. Leaf apex. b. Habit. c.-e. Stem leaves. f. Pseudoparaphyllium. g. & j. Leaf bases. h. Median leaf margin. i. Stem cross-section. Scales in mm: Top = 0.05 (a, f-j); top = 0.5 (c-d); bottom = 5 (b).

irregularly branched habit, and broadly acute leaf apices. *Hypnum fertile* resembles *H. hamulosum* in size, leaf apex shape, and its regularly pinnately branched habit. It differs from *H. hamulosum* in its more weakly developed stem hylocladus, its alar cells that consist of an excavate group of enlarged, thin-walled, hyaline cells at the base of the leaf above which are a few small, irregularly subquadrate cells along the basal margin, and its autoicous sexual condition with perigonia occurring very near the perichaetia on the same stem.

Grout (1940) reported *H. hamulosum* from Maine with only the comment "*H. hamulosum* in South Hartford, Maine, by Mrs. C. D. Adams." A year earlier Parlin (1939) had reported *H. callichroum* from Maine with the comment "Howard Hill, S. Hartford, 1938 (V. A. H.). "First collection in N. E. United States." A. J. Grout." These two reports were apparently based on the same collection as judged from notes inside the packet on a label of *H. callichroum* "see revised label, *Hypnum hamulosum* as finally determined by A. J. Grout." The nearest stations for this boreal species are northern Quebec to Labrador (Ando 1972) and the Lake Superior region of Ontario (Crum & Anderson 1981) The full label data for this collection are: On old wood in Leach Woods of Howard Hill near Northeast Pond, S. Hartford, Oxford County, 6 Nov. 1938, V. A. Howard [Parlin 13878].

5. *Hypnum imponens* Hedw., Sp. Musc. Frond. 290. 1801.

Hypnum cupressiforme ssp. *imponens* (Hedw.) Boul., Muscin. France 1: 34. 1884. *Hypnum cupressiforme* var. *imponens* (Hedw.) Mach., Cat. Discr. Briol. Portug. 117. 1919. *Stereodon imponens* (Hedw.) Brid., J. Linn. Soc., Bot. Suppl. 1: 96. 1859.

Plants medium to robust, yellow-green, golden, yellowish-brown, reddish-yellow in dense mats. Stems prostrate, creeping, at times weakly ascending, regularly pinnate; in cross-section hylocladus absent, central strand present. Pseudoparaphyllia broadly foliose, to ovate, ciliate-incised. Leaves in two curving rows, more or less complanate. Stem leaves 2--2.5 mm long, falcate-secund, oblong-triangular to oblong-lanceolate, concave, decurrent, smooth, apex long and slenderly acuminate, margins serrulate above, plane to somewhat narrowly recurved below; costa short and double; median cells linear-flexuose,

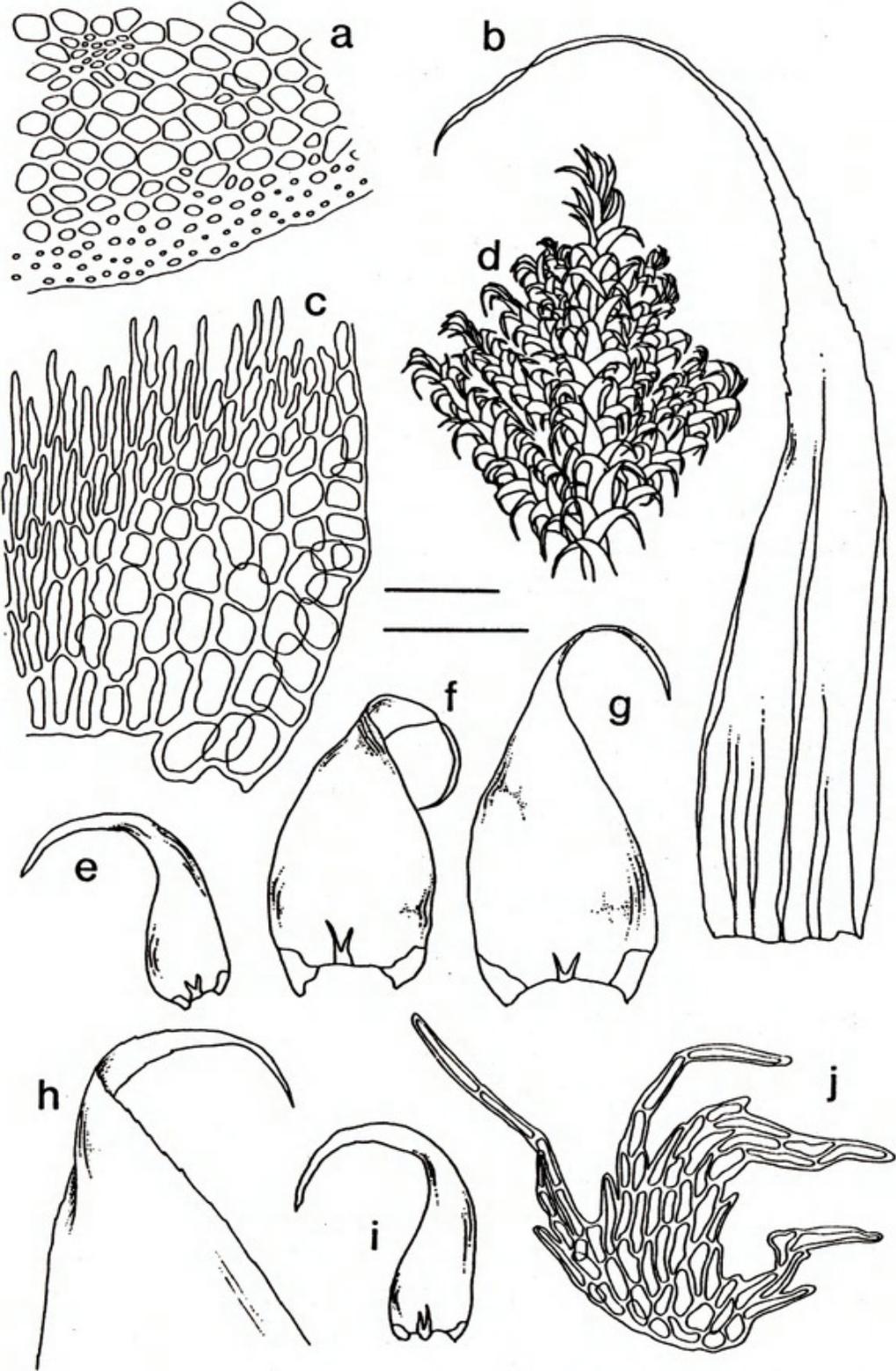


Figure 5. *Hypnum imponens*. a. Stem cross-section. b. Perichaetial leaf. c. Leaf base. d. Habit. e. & i. Branch leaves. f & g. Stem leaves. h. Leaf apex. j. Pseudoparaphyllium. Scales in mm: Top = 0.05 (a, c, j); top = 0.2 (h); top = 0.5 (b, e-g, i); bottom = 3 (d).

50--70 mm x 3-5 mm, firm-walled, basal cells near insertion shorter, incrassate and usually porose, alar cells short-rectangular to quadrate, incrassate above, enlarged and quadrate to rectangular below, hyaline or orange-brown. Branch leaves smaller, narrower with weakly differentiated alar cells. Dioicous. Inner perichaetial leaves lanceolate, long-acuminate, 3.5 mm long, plicate at base, sharply serrate above. Setae reddish-brown, 10--27 mm long. Capsules suberect, 2--3 mm long, cylindrical, smooth or weakly wrinkled when dry; operculum conic-rostellate; annulus poorly differentiated. Peristome double, exostome teeth subulate-acuminate, yellowish-brown, cross-striolate below, hyaline and papillose above, trabeculae projecting at back; endostome yellowish-hyaline, lightly papillose, basal membrane high, segments keeled, narrowly perforate, cilia rudimentary, 1-2. Spores spherical lightly roughened, 12--16 μ m. Calyptra not seen.

On ground in bogs, on soil or humus in forest or over boulders and ledges, decaying or rotting logs, and tree trunks (*Betula*, *Picea*). In Maine known from Androscoggin (*Allen 14703* MO), Aroostook (*Pursell 11361* MO), Cumberland (*Allen 15917* MO), Hancock (*Magill 11787* MO), Knox (*Allen 14647* MO), Lincoln (*Allen 254* MO), Oxford (*Parlin 15991* MAINE), Penobscot (*Allen 16504* MO), Piscataquis (*Merello 25B* MO), Sagadahoc (*Allen 14604* MO), Somerset (*Allen 9390* MO), Waldo (*Allen 10333* MO), Washington (*McCleary* MO), and York (*Allen 13051* MO) counties. Reported from Franklin (*Parlin 1939*) and Kennebec (*Pitman 1928, 1929*) counties.

Hypnum imponens is one the most abundant forest mosses in Maine. It is a large, attractive species with shiny, yellow-green, falcate-secund leaves, regularly pinnate branches, and suberect capsules found in extensive mats over rocks, boulders, rotting wood and tree trunks. In the field it can be confused with the typical expression of *H. cupressiforme*, but that species lacks the shiny appearance of *H. imponens* and has broader, less falcate-secund leaves. Microscopically the stem leaves of *H. imponens* have an extensive area of enlarged, bulging though firm-walled, usually orange-red alar cells, but the most distinctive feature of the species is its pseudoparaphyllia. These structures are broadly foliose to ovate and have long-ciliate margins. It is the only Maine species of *Hypnum* with ciliate pseudoparaphyllia. There are occasional irregularly branched collections of *H. imponens* that are difficult to identify. These

collections must be examined for branched to ciliate pseudoparaphyllia before they can be positively placed. In addition to the pseudoparaphyllia difference, *Hypnum curvifolium* differs from *H. imponens* in having stems leaves rounded to auriculate at base, and short to broadly acuminate above, while *H. cupressiforme* has numerous small, quadrate, thick-walled, and opaque alar cells.

6. *Hypnum lindbergii* Mitt., J. Bot. 2: 123. 1864.

Stereodon lindbergii (Mitt.) Braithw., Brit. Moss Fl. 3: 157. 1902. *Drepanium lindbergii* (Mitt.) Roth., Eur. Laubm. 2: 628. 1904. *Calliergonella lindbergii* (Mitt.) Hedenäs, Lindbergia 16: 167. 1990. New name for *Hypnum arcuatum* Lindb., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 18: 371. 1862, a later homonym.

Hypnum patientiae Lindb. ex Milde, Bryol. Siles. 363. 1869.

Breidleria patientiae Wijk & Marg., Buxbaumia 1: 51. 1947.

Plants large to robust, dark or light-green, yellowish-green, rarely reddish-yellow at base in dense mats. Stems prostrate and creeping, or ascending, sparsely and irregularly branched, rhizoids in abaxial cluster at leaf base; in cross-section hylodermis present, central strand present; axillary hairs with 1 hyaline, quadrate, basal cell and 2--3 reddish-brown, cylindrical upper cells. Pseudoparaphyllia broadly foliose. Leaves erect-spreading in two curving rows, or distinctly complanate. Stem leaves 1.5--2.5 mm long, falcate-secund, oblong-triangular to oblong-lanceolate, concave, weakly decurrent, smooth, apex short and acute or long and slenderly acuminate, margins entire to weakly serrulate above, plane or erect; costa short and double; median cells linear-flexuose, 50--100 μm x 2.5--4 μm , firm-walled, basal cells shorter, incrassate and usually porose near insertion, alar cells enlarged and inflated in 2--3 rows of thin-walled, hyaline cells with 6--8 small, irregularly short-rectangular to quadrate cells above. Branch leaves smaller, narrower, with weakly differentiated alar cells. Dioicous. Inner perichaetial leaves long lanceolate, shortly and narrowly acuminate, plicate, lightly serrulate above. Setae reddish-brown, (15-)30--55 μm long. Capsules curved and asymmetric, 1.5--3 μm long, furrowed wet or

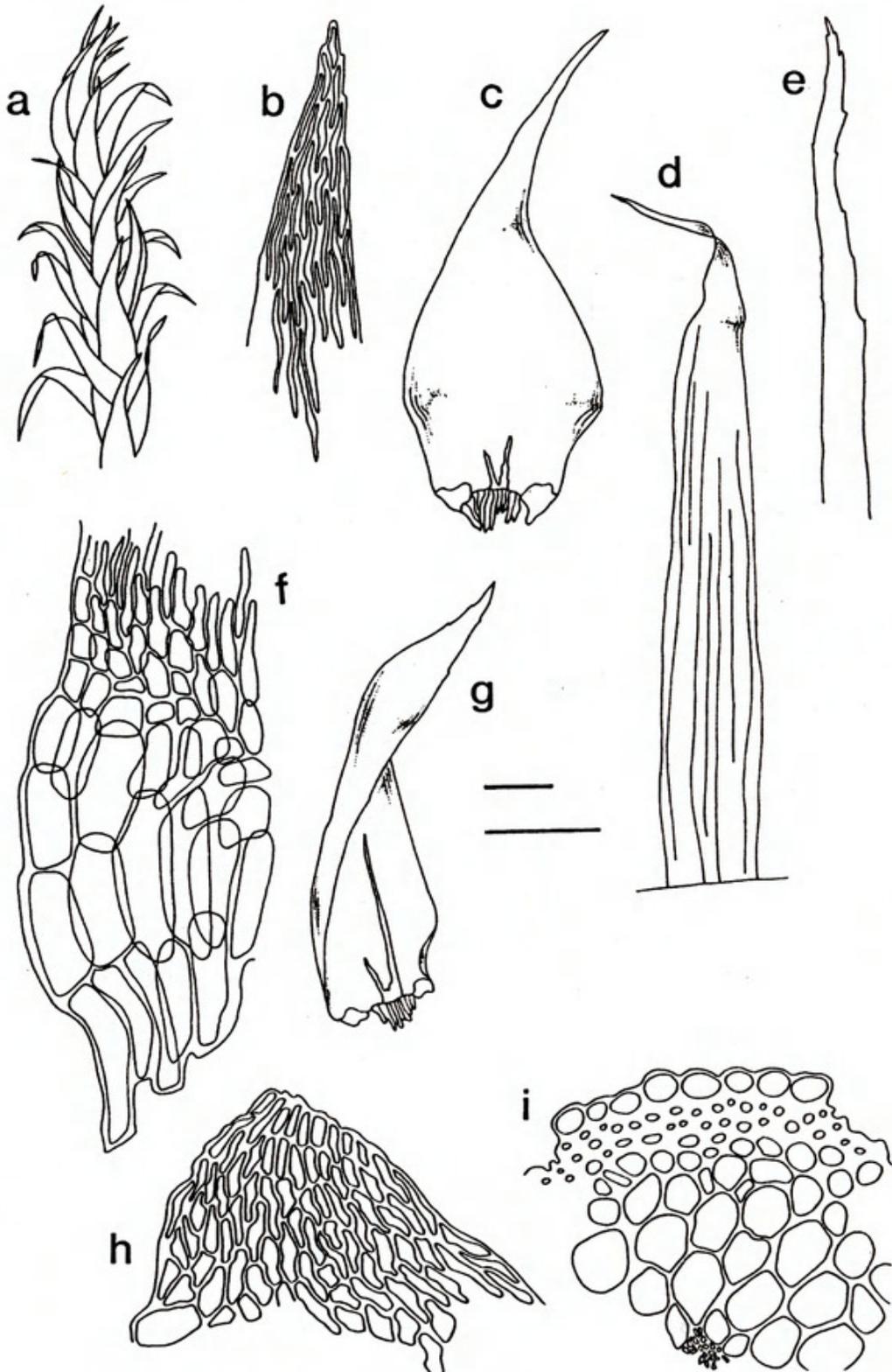


Figure 6. *Hypnum lindbergii*. a. Habit. b. Leaf apex. c. & g. Stem leaves. d. Perichaetial leaf. e. Perichaetial leaf apex. f. Leaf base. h. Paraphyllium. i. Stem cross-section. Scales in mm: Top = 7 (a); bottom = 0.05 (b, f, h, i); bottom = 0.1 (e); bottom = 0.5 (c, d, g).

dry, operculum conic-apiculate, 1 mm long; annulus poorly differentiated. Peristome double, exostome teeth subulate-acuminate, yellowish-brown, cross-striolate below, hyaline and papillose above, trabeculae projecting at back; endostome yellowish-hyaline, lightly papillose, basal membrane high, segments keeled, narrowly perforate, cilia 2--3, appendiculate above, nodose below. Spores spherical lightly roughened, 13--20 μ m. Calyptra cucullate, smooth, 6 mm long.

On humus, bare soil, and sand at base of rocks (often wet and shaded), rotting logs or planks, on rocks and logs in bogs and streams or along stream banks, at times submerged or in seasonally inundated habitats, amongst grasses in or at edge of woods and on bark of trees. In Maine known from Androscoggin (*Allen 14662 MO*), Aroostook (*Pursell 11383 MO*), Cumberland (*Lowe MAINE*), Franklin (*Allen 10303 MO*); Hancock (*Rand 381 NY*), Kennebec (*Allen 14761 MO*), Lincoln (*Allen 13070 MO*), Oxford (*Allen 16754 MO*), Penobscot (*Allen 16505 MO*), Sagadahoc (*Allen 10199 MO*), Somerset (*Allen 9359 MO*), Waldo (*Parlin 7937 MAINE*), and Washington (*Allen 16272 MO*) counties.

Hypnum lindbergii is large species commonly found in wet or swampy habitats. It is sometimes found submerged and often occurs on bare soil along trails in moist, shady situations. The species is sparsely, irregularly branched and exhibits a multitude of forms that often make it difficult to recognize in the field. The leaves can be falcate-secund with long slenderly acuminate apices or erect-spreading with short, acute apices. The plants have a well-developed stem hyalodermis and 2--3 rows of enlarged, inflated alar cells below a small cluster of short, irregularly subrectangular, thick-walled cells. However, alar cell development in this species is variable with plants from mesic habitats having only a few inflated alar cells while plants from wet habitats have large numbers of enlarged alar cells in extensive, excavate areas. Its capsules are strongly asymmetric and furrowed when dry. The combination of its large size, well developed stem hyalodermis and inflated alar cells distinguish it from all other Maine *Hypnum* species except *H. pratense*. That species differs from *H. lindbergii* in having auriculate stem leaves with only a few enlarged, hyaline alar cells at the extreme base, axillary hairs with a red basal cell and hyaline upper cells, narrowly foliose pseudoparaphyllia, smooth capsules and nodose endostomal cilia. *Hygrohypnum ochraceum* (Turn. ex Wils.) Loeske is

sometimes confused with *Hypnum lindbergii* because of its stem hyalodermis and strongly inflated alar cells. In *Hygrohypnum ochraceum*, however, the costa is broad at base, often reaches to midleaf, and can be both single and double on single stems, the leaf apices are broadly rounded to subobtusate, and the alar cells lack an upper cluster of small, thick-walled subrectangular cells.

Hypnum lindbergii was transferred to *Calliergonella* Loeske by Hedenäs (1990). This view is not adopted here for two reasons. First, Hedenäs considered *H. lindbergii* only within the narrow context of Ochi's (1973) section *Pratensia*. When the species is considered within the broader context of the genus *Hypnum*, all of the "unusual" features he used to transfer *H. lindbergii* from *Hypnum* are found to occur in other, sometimes most other, species. Even the most distinctive feature of *H. lindbergii*, i.e., its greatly enlarged and inflated alar cells, is a variably developed feature apparently correlated with habitat wetness. In drier habitats collections of *H. lindbergii* have weakly developed alar cells that are not much different from those seen in some collections of *H. pratense* or *H. curvifolium*. Secondly, Hedenäs's study attributes generic importance to minor characters that have previously been utilized within *Hypnum* (and often within mosses in general) only at the species level. These characters are good species indicators within *Hypnum*, but their utility at even the sectional level is questionable due to an apparently great amount of homoplasy within them.

7. *Hypnum mammillatum* (Brid.) Loeske, Abh. Bot. Ver. Prov. Brand. 47: 342. 1915.

Hypnum cupressiforme var. *mammillatum* Brid. Musc. Rec. 2: 137. 1801. *Hypnum cupressiforme* ssp. *mammillatum* (Brid.) Nijlander & Sael., Herb. Mus. Fenn. 61. 1859. *Stereodon cupressiformis* ssp. *mammillatus* (Brid.) Lindb., Musci Scand. 38. 1879. *Stereodon cupressiformis* var. *mammillatus* (Brid.) Braithw., Brit. Moss Fl. 3: 161. 1902. *Drepanium cupressiforme* Roth var. *mammillatum* (Brid.) Roth, Eur. Laubm. 2: 623. 1904. *Stereodon mammillatus* (Brid.) Warnst., Krypt. Fl. Brandenburg 2: 958. 1906.

Hypnum andoi A.J. Smith, J. Bryol. 11: 606. 1981 [1982]. A superfluous new name.

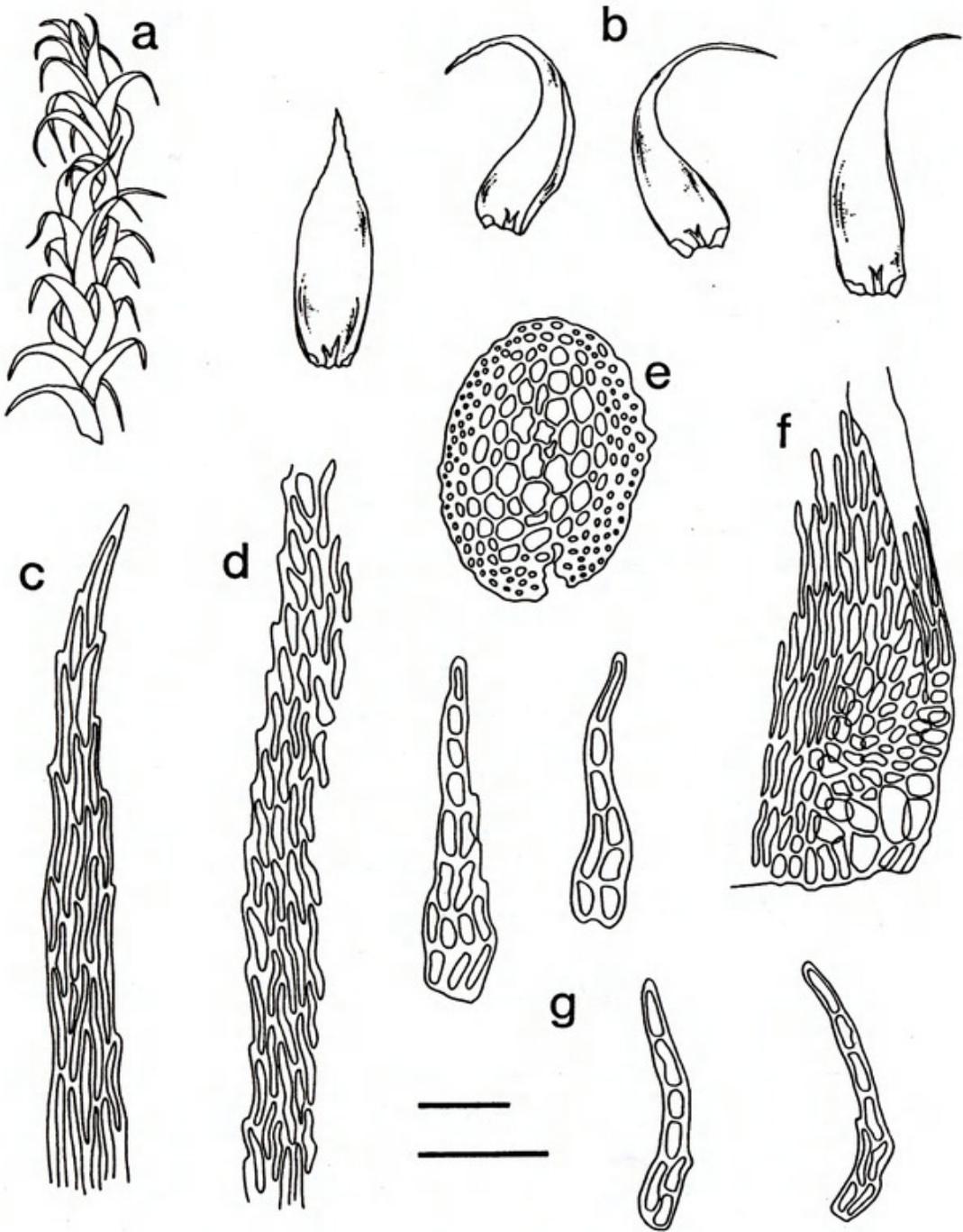


Figure 7. *Hypnum mammillosum*. a. Habit. b. Stem leaves. c. Leaf apex. d. Median leaf margin. e. Stem cross-section. f. Leaf base. g. Pseudoparaphyllia. Scales in mm: Top = 1 (a); bottom = 0.05 (c-g); bottom = 0.5 (b).

Plants small, dark green in dense mats. Stems prostrate, creeping, orange-brown to red, densely, often pinnately, branched; in cross-section hydodermis absent, central strand rudimentary. Pseudoparaphyllia narrowly foliose to subfilamentous. Leaves in two curving rows, more or less complanate. Axillary hairs fugacious, 1--2 reddish, quadrate basal cells and 1--2 hyaline, oblong upper cells. Stem leaves 0.8--1.5 mm long, falcate-secund, ovate- to oblong-lanceolate, concave, weakly decurrent, smooth, apex narrowly acuminate, straight to rounded at base, margins sharply serrulate, reflexed below, plane above; costa short and double; median cells linear-rhomboidal, 50--60 μm x 4--5 μm , firm-walled, basal cells similar, smaller, thicker-walled, pitted near insertion, alar cells small, subquadrate to quadrate, thick-walled, in 7--10 rows, often opaque, with a few larger, hyaline, rectangular cells below. Branch leaves smaller, narrower, with more weakly differentiated alar cells. Dioicous. Sporophytes not known from Maine. [Inner perichaetial leaves oblong-lanceolate, narrowly acuminate, smooth, serrulate. Seta yellowish- or reddish-brown, 10--17(-20) mm long. Capsules erect to inclined, oblong-cylindric, almost symmetric, 1.5--1.8(-2) mm long, smooth, operculum rounded-mammillate 0.7--0.8 mm long; annulus 1--2 seriate. Peristome double, exostome not or scarcely border above, cilia single or imperfectly double, fragile. Spores papillose, 17--22 μm , Ando 1987.]

On rock, granite boulders, and mica schist in woods. In Maine known from Cumberland (*Jewett* [Grout, North American Musci Pleurocarpi 385] MO), Hancock (*Allen* 2077 MO), and Washington (*Collins* 2570 [Crum & Anderson, Mosses of North America 379] MO) counties.

Hypnum mammillatum has long been associated with *H. cupressiforme* and the two species are gametophytically very close. The principal reasons for recognizing *H. mammillatum* at the species level are sporophytic. It has erect to inclined, symmetric capsules with conic-mammillate opercula, while in *H. cupressiforme* the capsules are arcuate, asymmetric, and have conic-rostrate opercula. Unfortunately, the sporophytes of *H. mammillatum* are unknown in North America. Gametophytically, *H. mammillatum* is marked by its small size, distinctly falcate-secund leaves that are often sharply serrulate above, have recurved basal leaf margins, and 1--2 hyaline, enlarged, rectangular cells below its distinctive cluster of small, subquadrate,

thick-walled alar cells. This suite of characters seems to fairly well define the species, however, *H. cupressiforme* var. *cupressiforme* is a phenomenally variable species and as a result the separation of the two species remains problematical. *Hypnum cupressiforme* var. *filiforme* is similar to this species in size, however, it differs from *H. mammillatum* in having erect rather than falcate-secund leaves.

8. *Hypnum pallescens* (Hedw.) P.-Beauv., Prodr. Aethéogam. 67. 1805.
Leskea pallescens Hedw. Sp. Musc. Frond. 219. 1801.

Hypnum reptile Michx. Fl. Bor.-Amer. 2: 315. 1803.

Plants small, shiny, dark green to yellow-green in dense mats. Stems prostrate, creeping, orange-brown to red, irregularly but densely branched; in cross-section hylodermis absent, central strand present. Pseudoparaphyllia narrowly foliose to nearly filiform. Leaves in two curving rows, more or less complanate. Axillary hairs 2--4 cells, 1--2 subquadrate, red, basal cells and 1--2 oblong, hyaline, upper cells. Stem leaves 0.6--1.5 mm long, falcate-secund, oblong-ovate, concave, weakly decurrent, smooth or lightly plicate at base, broadly or narrowly acuminate, straight to rounded at base, margins serrate to serrulate throughout, reflexed below, plane above; costa strong, short and double; median cells linear-rhomboidal, 30--40 μ m x 6 μ m, firm-walled, basal cells near insertion smaller, thicker-walled, pitted, alar cells in 6--8 rows, small, subquadrate to quadrate, thick-walled, often opaque. Branch leaves smaller, narrower, with weakly differentiated alar cells. Autoicous. Inner perichaetial leaves lanceolate, narrowly acuminate, 3 mm long, plicate, serrulate. Setae red, 8--12 mm long. Capsules erect at base, curved above, mouth more or less vertical, 1.5--2.0 mm long, cylindrical, smooth to weakly wrinkled when dry; operculum rostrate 0.5--1.0 mm long; annulus well developed, falling with operculum. Peristome double, exostome teeth subulate-acuminate, yellowish-brown, cross-striolate below, hyaline and papillose above, trabeculae projecting at back; endostome yellowish-hyaline, lightly papillose, basal membrane high, segments keeled, narrowly perforate, cilia 1--3, nodose. Spores papillose, 10--14 μ m. Calyptra cucullate, yellow, smooth, naked, 1.5--2 mm long.

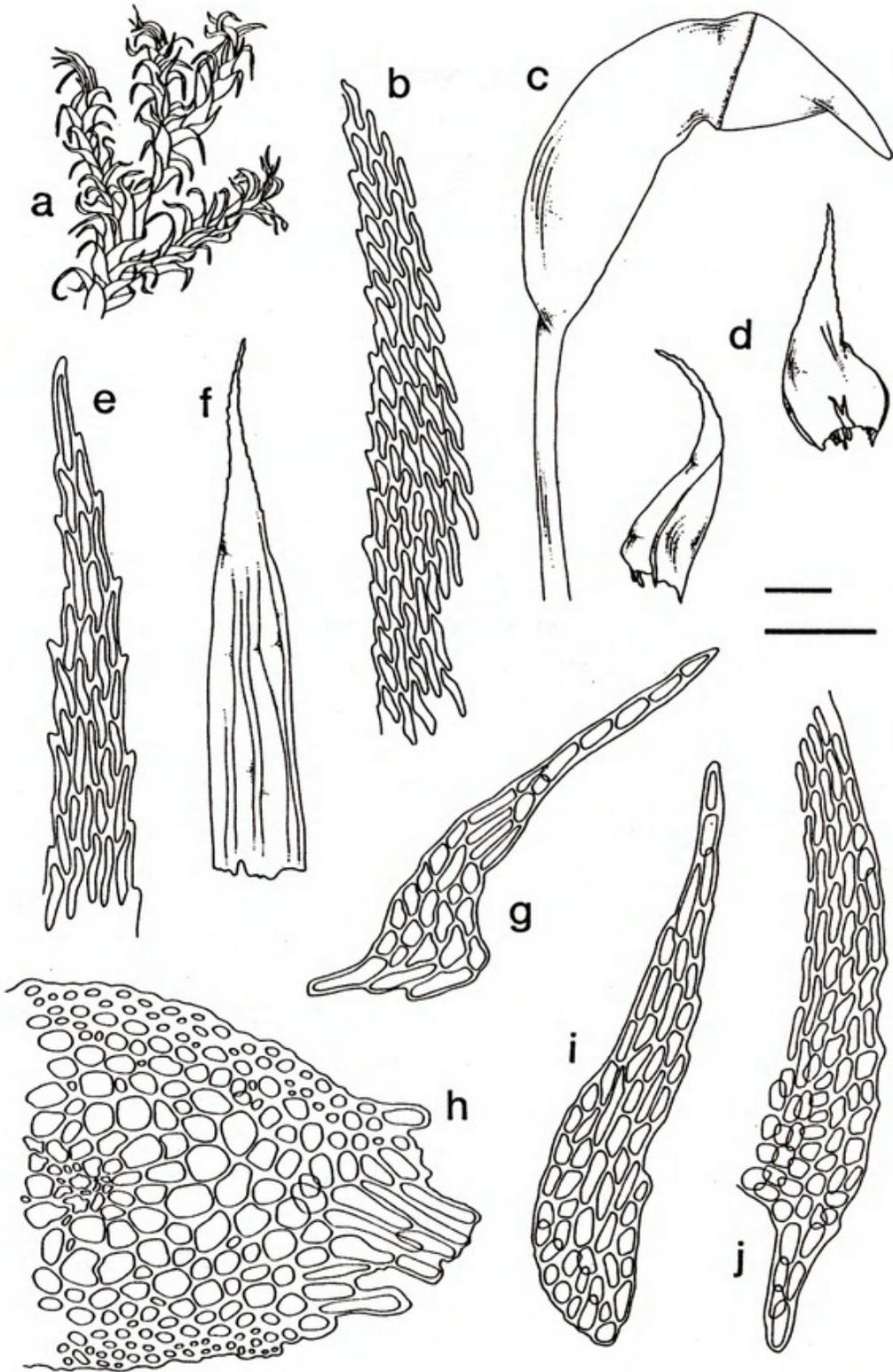


Figure 8. *Hypnum pallescens*. a. Habit. b. Leaf margin. c. Capsule and operculum. d. Stem leaves. e. Leaf apex. f. Perichaetial leaf. g. & i. Pseudoparaphyllia. h. Stem cross-section. j. Leaf base. Scales in mm: Top = 1 (a); bottom = 0.05 (b, e, g-j); bottom = 0.5 (c, d, f).

A commonly collected woodland species found on rotting wood, bark of tree trunks, twigs, and roots (*Abies*, *Picea*, *Pinus*, *Chamaecyparis*, *Fagus*, *Betula*, *Quercus*, *Acer*, *Prunus*), humus and decaying litter in woods, and thin soil over rocks and boulders. In Maine known from Aroostook (Allen 16487 MO), Androscoggin (Allen 14668 MO), Cumberland (Allen 15904 MO), Franklin (Allen 10236 MO), Hancock (Allen 2095 MO), Kennebec (Allen 14776 MO), Knox (Allen 15801 MO), Lincoln (Allen 1314 MO), Oxford (Allen 16704 MO), Penobscot (Allen 16500 MO), Piscataquis (Merello 25 MO), Sagadahoc (Norton MAINE), Somerset (Allen 9323 MO), Waldo (Allen 10326 MO), and York (Redfearn 31133 MO) counties. Reported from Washington county (Spencer 1993).

Hypnum pallescens is a small *Hypnum* species. It is autoicous and is nearly always found with sporophytes, which is probably one of the reasons it is so often collected. The capsules of *H. pallescens* are erect in the lower 2/3 but abruptly curved above so that the capsule mouth is nearly vertical. Its operculum is distinctly rostrate. Perhaps the best features for recognizing the species are found in its leaves which are sharply serrate or serrulate above, have distinctly recurved basal leaf margins, and relatively short leaf cells. The species has a broad ecological tolerance and can be found on the bark of most types of trees as well as on thin soil over rocks and boulders. It differs from most other small *Hypnum* species by its lack of a stem hyalodermis, and is most likely confused with *H. cupressiforme* which can be just as small as *H. pallescens* and has a somewhat similar alar cell development. *Hypnum cupressiforme* differs from *H. pallescens* in its dioicous sexual condition, its entire to weakly serrulate leaves and longer leaf cells. There is a possibility of confusion between *H. pallescens* and *Homomallium adnatum* (Hedw.) Broth., *Platygyrium repens* (Brid.) Schimp. in B.S.G., and *Pylaisiadelpha tenuirostris* (Bruch & Schimp ex Sull.) Buck which are all more or less the same size. In *Homomallium adnatum* the leaf margins are plane and entire to slightly serrulate, the operculum is apiculate, and the perichaetial leaves are smooth. *Platygyrium repens* has a blackish-green color with a curious sheen not seen in *Hypnum pallescens*, the leaves are entire, there are nearly always clusters of budlike brood-bodies in the leaf axils, and the capsules are erect. *Pylaisiadelpha tenuirostris* differs from *Hypnum pallescens* in having less falcate-secund leaves, filamentous pseudoparaphyllia,

filiform axillary brood-bodies, a small cluster of somewhat enlarged and inflated alar cells, dioicous sexual condition, and erect capsules that lack endostomal cilia.

There are two forms of *H. pallescens* that differ in plant aspect (compact, subjulaceous to soft and loosely arranged), alar cell development, capsule size and orientation, degree of leaf marginal serration, and cell length and width. The two names generally associated with these expressions are *H. pallescens* and *H. reptile*. Ando (1973) and Crum & Anderson (1981) give detailed discussions on the applications of these names and their morphological variations. The two expressions are connected by "... transitional forms making it impossible to distinguish two taxa" (Crum & Anderson 1981). Most Maine material of the species belongs to the "soft form".

9. *Hypnum plicatulum* (Lindb.) Jaeg., Ber. Thätigk. St. Gallischen. Naturwiss. Ges. 1877-78: 316. 1880. *Stereodon plicatulus* Lindb., Acta Soc. Sci. Fenn. 10: 254. 1872.

Plants small, pale, yellowish-green in dense mats. Stems prostrate, creeping, regularly pinnate; in cross-section hydodermis present, central strand present. Pseudoparaphyllia narrowly foliose to deltoid. Leaves in two curving rows, more or less complanate. Stem leaves 1--1.5 mm long, falcate-secund, oblong-triangular to ovate-lanceolate, concave, auriculate or rounded at base, decurrent, smooth, apex long and slenderly acuminate, margins serrulate above, plane to somewhat narrowly recurved below; costa short and double; median cells linear-flexuose, 50--70 μm x 3--5 μm , firm-walled, basal cells shorter, incrassate and usually porose near insertion, alar cells 5--8, irregularly triangular, quadrate, or shortly rectangular, incrassate, usually displaced inward by the basal auriculation. Branch leaves smaller, narrower, with weakly differentiated alar cells. Phyllodioicous. Inner perichaetial leaves long-lanceolate, long-acuminate, 3.0 mm long, smooth to weakly plicate below, lightly serrulate above. Setae reddish-brown, 18--25 mm long. Capsules curved to arcuate, 2--2.5 mm long, cylindrical, lightly plicate at base when dry; operculum conic. Peristome double, exostome teeth subulate-acuminate, yellowish-brown, cross-striolate below, hyaline and papillose above, trabeculae projecting at back; endostome yellowish,

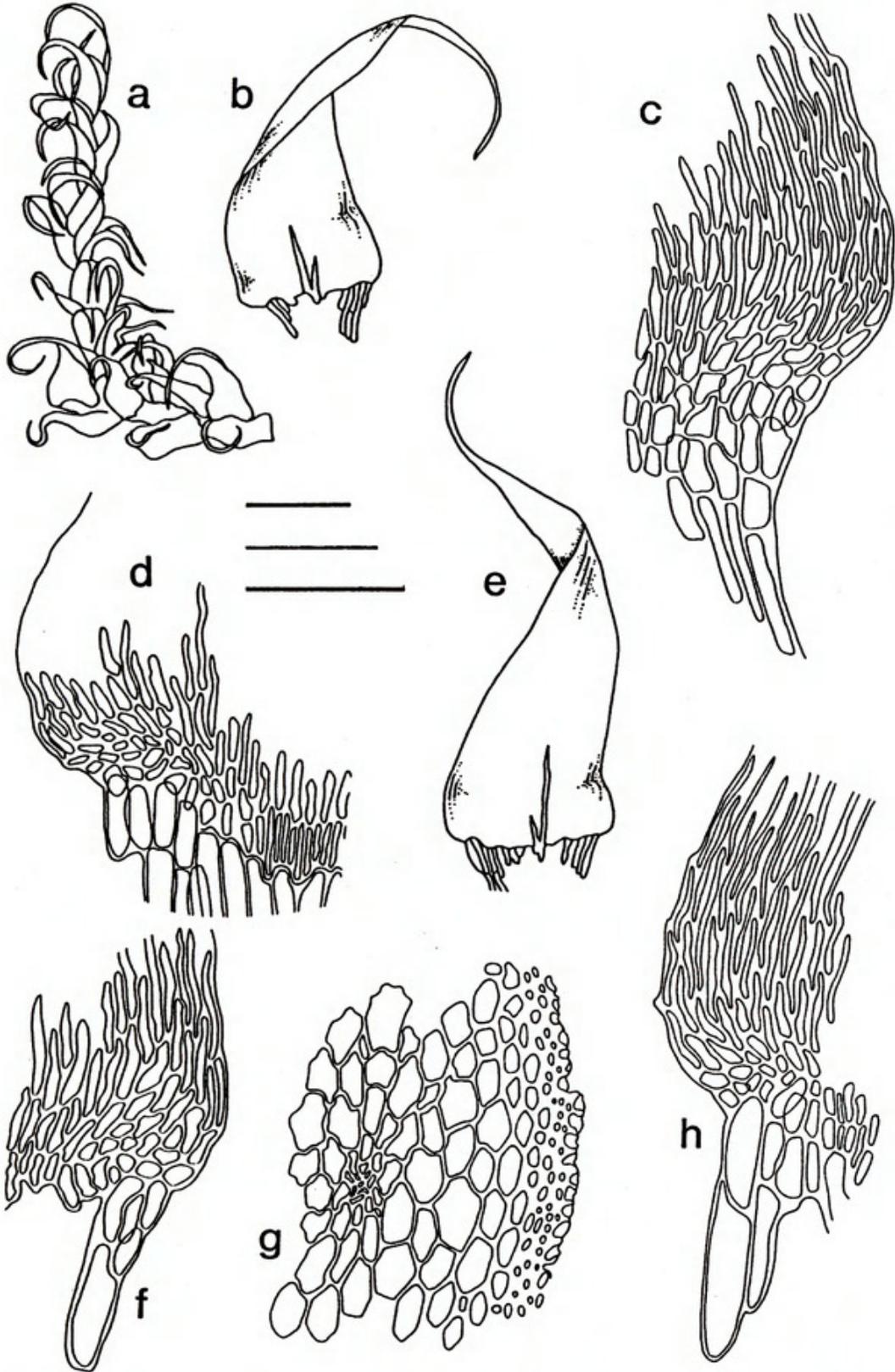


Figure 9. *Hypnum plicatulum*. a. Habit. b. & e. Stem leaves. c., d., f., & h. Leaf bases. g. Stem cross-section. Scales in mm: Top = 0.05 (c, d, f-h); middle = 1.17 (a); bottom = 0.5 (b, e).

lightly papillose, basal membrane high, segments keeled, narrowly perforate, cilia 2--3, well developed, nodose. Spores spherical lightly roughened, 10--12 μ m. Calyptra not seen.

On humus over rocks and stones in woods and along streams, also on bark at the base of trees. In Maine known from Aroostook (*Riddle* NY), Franklin (*Pursell 11135* MO), Hancock (*Davis* MAINE, MO), Oxford (*Bacon 27* NY), Sagadahoc (*Allen 16610* MO), and Washington (*Harvey* NY) counties.

Hypnum plicatulum is a small *Hypnum* with a field-aspect much like *Ctenidium*. It is one of three species (*H. plicatulum*, *H. hamulosum* and *H. callichroum*) of section *Hamulosa* in eastern North America, which is characterized by small to medium sized, autoicous, dioicous or phyllo dioicous plants that have a well developed stem hyalodermis and plicate perichaetial leaves. *Hypnum hamulosum* differs from *H. plicatulum* in its non-auriculate stem leaves, while *H. callichroum* differs in having numerous, thin-walled and enlarged alar cells.

Hypnum curvifolium Hedw. and *H. fertile* also can be confused with *H. plicatulum*. Although both *H. curvifolium* and *H. plicatulum* have auriculate leaves, *H. curvifolium* lacks a stem hyalodermis and its leaves end in a short, broad acumen. The separation of *H. fertile* from *H. plicatulum* is more difficult and depends upon a careful examination of three features: stem leaf shape at base, stem leaf alar cell development, and sexuality. In *H. plicatulum* most stem leaves are auriculate at base, however, they also can be rounded to the insertion and often leaves stripped from single stems have both types of leaves. In contrast the stem leaves of *H. fertile* can be rounded or straight to the insertion, with both types of leaves occurring on single stems. The alar cells of *H. plicatulum* generally consist of a few small, thick-walled subquadrate to rectangular cells that are positioned away from the leaf margin due to the leaf base auriculation. When the leaves are rounded to the insertion the alar cells are not displaced, and occur along the basal margin. Often there are a few enlarged, inflated cells at the very base of the leaf, these cells however appear to be stem hyalodermal cells rather than alar cells. In contrast the alar cells of *H. fertile* consist of an excavate group of enlarged, thin-walled, hyaline cells at the base of the leaf above which are a few small, irregularly subquadrate cells along the basal margin.

Plants of *H. fertile* are autoicous with perigonia occurring very near the perichaetia on the same stem, while *H. plicatulum* is phyllodioicous.

Ando (1972) included *H. plicatulum* in his *Hypnum* group with plicate capsules, and his capsule figures (Ando 1995) are indeed strongly furrowed. Material of *H. plicatulum* from both eastern and western North America, however, have capsules variably plicate and often only weakly plicate at base.

10. *Hypnum pratense* Koch ex Spruce, London J. Bot. 4: 177. 1845.

Breidleria pratensis (Koch ex Spruce) Loeske, Stud. Morph. Syst. Laubm. 172. 1910.

Plants large to robust, light-green, yellowish-green to rarely reddish-yellow at base in dense mats. Stems prostrate and creeping, or ascending, sparsely and irregularly branched, rhizoids in abaxial cluster at leaf base; in cross-section hyloclermis present, central strand present; axillary hairs with 1 red, quadrate, basal cell and 2-3 hyaline, cylindrical upper cells. Pseudoparaphyllia narrowly foliose. Leaves erect-spreading in two curving rows to complanate. Stem leaves 1.5--2.5 mm long, falcate-secund, oblong-triangular to oblong-lanceolate, concave, rounded to auriculate at insertion, not or weakly decurrent, undulate to lightly rugose when dry, apex acute to broadly acuminate, margins serrulate above, plane; costa short and double; median cells linear-flexuose, 50--90 μm x 2.5-4 μm , firm-walled, basal cells shorter, incrassate and usually porose near insertion, alar cells subquadrate to short-rectangular, firm-walled, a few cells at the inner basal angle somewhat enlarged and thin-walled. Branch leaves smaller, narrower, with weakly differentiated alar cells. Dioicous. Inner perichaetial leaves lanceolate, acuminate, plicate, lightly serrulate above. Setae reddish-brown, (20-)30--40 μm long. Capsules curved and asymmetric, 2--3 mm long, smooth, constricted and wrinkled at neck when dry; operculum conic-apiculate, 0.5-1 mm long; annulus clinging to the capsule mouth or falling with operculum at dehiscence. Peristome double, exostome teeth subulate-acuminate, yellowish-brown, cross-striolate below, hyaline and papillose above, trabeculae projecting at back; endostome yellowish-hyaline, lightly papillose, basal membrane high, segments keeled, narrowly perforate, cilia 2--3, nodose. Spores

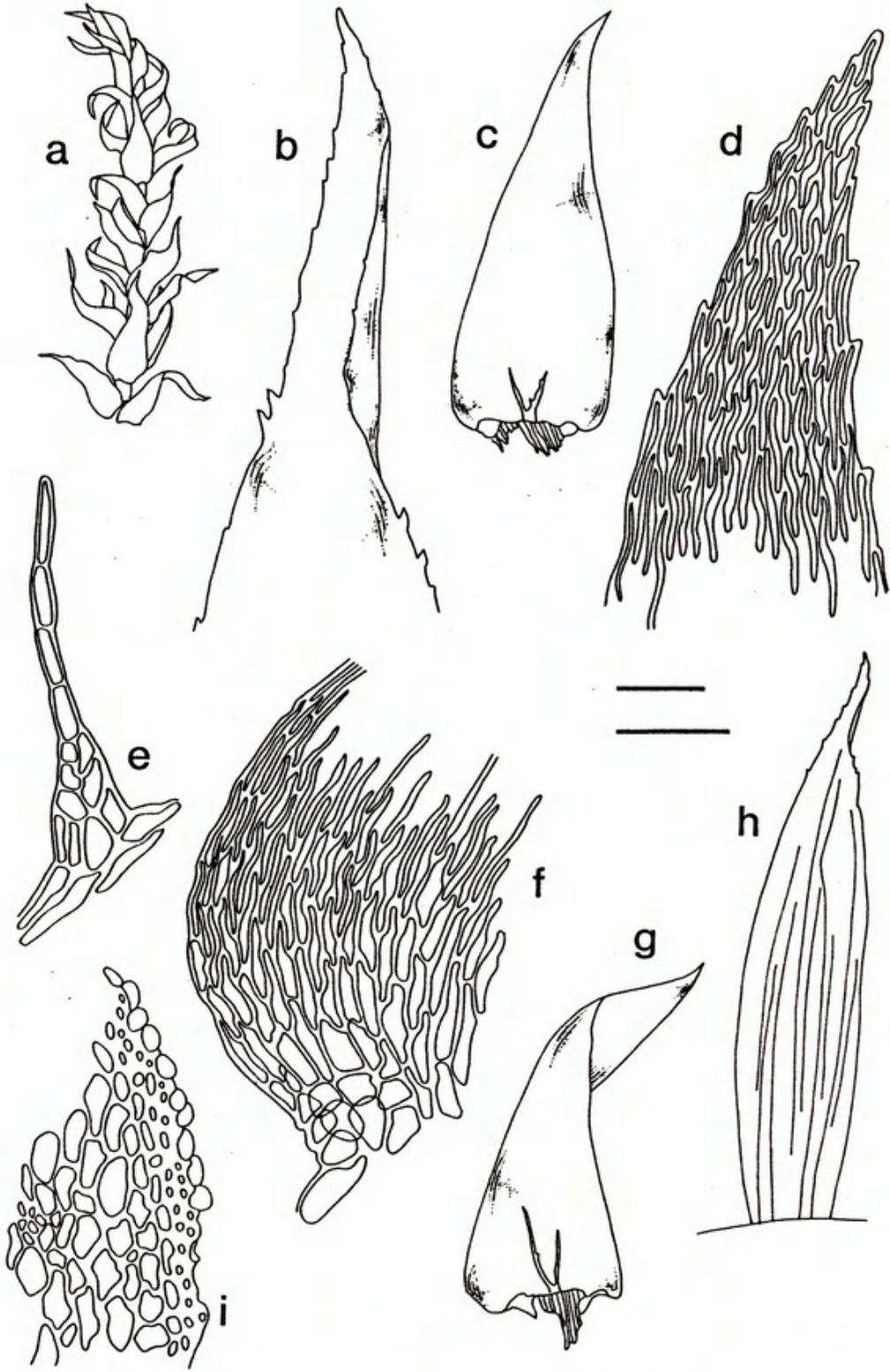


Figure 10. *Hypnum pratense*. a. Habit. b. Perichaetial leaf apex. c. & g. Stem leaves. d. Leaf apex. e. Paraphyllum. f. Leaf base. h. Perichaetial leaf. i. Stem cross-section. Scales in mm: Top = 2 (a); bottom = 0.05 (d, e, f, i); bottom = 0.1 (b); bottom = 0.5 (c, g, h).

spherical, lightly roughened, 10--14 mm. Calyptra not seen.

On humus in wet or seepy areas. In Maine known from Aroostook (Lowe MAINE, MO), Hancock (Lowe MAINE, MO); Oxford (Adams [Grout, North American Musci Perfecti 349] MO), and Somerset (Allen 9319) counties. Reported from Penobscot county (Parlin 1939). A report of the species from Kennebec county (Allen 1993) is based on a collection of *H. lindbergii*.

Hypnum pratense is a robust species with a field aspect very similar to *H. lindbergii*. Both species are found in wet habitats, and have sparsely to irregularly branched stems with a well developed hyalodermis. Its leaves are weakly undulating when dry and it differs from *H. lindbergii* in having auriculate to rounded leaf bases with only a few somewhat enlarged and thin-walled cells in the lower basal angle. In addition, the capsules of *H. pratense* are smooth when dry (constricted and wrinkled at neck), the pseudoparaphyllia are narrowly foliose, the cilia are nodose throughout, and the axillary hairs have a red basal cell with the upper cells hyaline. In contrast, *H. lindbergii* has furrowed capsules when dry, broadly foliose pseudoparaphyllia, cilia appendiculate at apex, and axillary hairs that are hyaline at base but reddish-brown above.

Hypnum curvifolium can be confused with *H. pratense* since both species have leaves that are rounded to auriculate at base, however that species lacks a stem hyalodermis, is regularly pinnate and its leaves are more strongly serrulate. The only other Maine species of *Hypnum* with a stem hyalodermis, *H. plicatulum* and *H. hamulosum* are found in mesic habitats, are considerably smaller than *H. pratense*, regularly pinnately branched, and have slenderly acuminate leaves.

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