

29. POTTIACEAE Schimper

Richard H. Zander

Plants usually turf-forming or loosely cespitose, green distally and brown proximally. **Stems** 0.2–4(–10) cm, irregularly branching, mostly rounded-pentagonal but occasionally rounded-triangular in section, hyalodermis usually absent, sclerodermis sometimes present, central strand usually present, radiculose, occasionally bare or tomentose, axillary hairs several cells in length, sometimes the proximal 1–3 cells brownish. **Stem leaves** usually appressed and often contorted when dry, spreading when wet, ovoid to lanceolate or lingulate, often channeled or keeled, rarely concave, mostly ca. 1.5–3.5 mm; base usually ovate to oblong, occasionally sheathing the stem; margins usually recurved proximally, occasionally plane, incurved, or involute, entire or sometimes dentate distally, occasionally bordered by thick-walled or elongate cells or cells in one or more layers; apex rounded-obtuse to more commonly narrowly acute; costa ending a few cells before the apex to short-excurrent or long-excurrent as an awn, sometimes with photosynthetic outgrowths adaxially, adaxial cells quadrate or elongate in usually 2–4 rows, costa in medial transverse section usually with a differentiated epidermis adaxially or on both sides, 1 or 2 stereid bands, the abaxial stereid band usually rounded or reniform, guide cells in 1(–3) layers, hydroid strand occasionally present (sometimes multiple); basal laminal cells usually differentiated, smooth or lightly papillose, rectangular, generally filling the base medially, sometimes rising marginally in a V shape, occasionally bulging, usually slightly wider than the distal laminal cells; distal laminal cells usually subquadrate, occasionally hexagonal or rarely short-rectangular or rhomboid, mostly small, ca. 9–16 μm wide, 1:1, papillae usually present over the distal laminal cells, solid or occasionally hollow, usually 2-fid but occasionally simple, sometimes flattened or compound, cell walls mostly evenly thickened, superficially flat to bulging, sometimes bulging only adaxially, usually in one layer. **Specialized asexual reproduction** common, by multicellular (rarely 1-cellular) gemmae borne on stalks in the leaf axils or more seldom on leaves, or by obovoid brood bodies borne on rhizoids in the soil, rarely by reduced or fragile leaves or fragile stems. **Sexual condition** dioicous or monoicous, occasionally rhizautoicous; perigonia and perichaetia terminal or occasionally lateral on short branchlets. **Perigoniate plants** occasionally smaller than the perichaetiate, seldom nearly stemless and budlike. **Perichaetial leaves** often sheathing in the basal portion and then with elongate-rhomboid cells basally, usually larger than the cauline leaves, long-oval to long-lanceolate. **Sporophytes** often

in transformation series of peristome reduction and seta shortening. **Seta** usually solitary, elongate, often twisted. **Capsule** stegocarpous or cleistocarpous, theca ovoid to cylindric, neck usually small or nearly absent; annulus little differentiated or of 1–2 rows of vesiculose cells, occasionally revoluble or deciduous in pieces; operculum short-conic to short-rostrate, cells in straight or oblique rows; peristome teeth occasionally absent, more usually erect or twisted usually dextrose (counter clockwise), yellow, orange, or red, rudimentary or consisting of 16 mostly twice cleft, spiculose, striate, or papillose, lanceolate teeth, or 32 linear, usually densely spiculose filiform divisions, the basal membrane usually low or absent, occasionally very high and trabeculate. **Calyptra** cucullate, smooth, occasionally mitrate, rarely papillose. **Spores** usually ca. 10–15 µm, occasionally much larger. **Laminal KOH color reaction** yellow to orange-red or red in 2% KOH solution.

Genera ca. 77, species ca. 1450 (40 genera, 165 species in the flora): worldwide, characteristic of harsh habitats.

This is the largest family of the mosses in number of genera. Its taxonomy is commonly considered difficult because of the obscure areolation, small size of the plants, and apparent phenotypic variation. A recent generic-level revision by R. H. Zander (1993) pulled together the scattered literature and de-emphasized sporophytic characters, allowing easier identification of sterile plants. The phylogenetic scheme adopted here approximates that of Zander (1993) as modified by Zander (2006) except that *Gymnostomiella* and *Luisierella* are moved from the Barbuloideae to the Pottioidae, in part for convenience in identification. The large number of anatomical characters available permits better identification of previously poorly understood taxa. The color tests refer to the reaction of the cell walls of the distal laminal areolation to 2% potassium hydroxide solution, which may require examination under the compound microscope for determination. Sectioning of leaf and stem is necessary and is described by Zander (1993). A twisted peristome, strongly differentiated costal anatomy, and the complexly papillose distal laminal cells are characteristic of this mostly acrocarpous family, commonly found in harsh environments.

SELECTED REFERENCES Werner, O., R. M. Ros, M. J. Cano, and J. Guerra. 2004. Molecular phylogeny of Pottiaceae (Musci) based on chloroplast *rps4* sequence data. *Pl. Syst. Evol.* 243: 147–164. Zander, R. H. 1982. Aspects of the taxonomy of the Pottiaceae. *Beih. Nov. Hedw.* 71: 225–227. Zander, R. H. 1993. Genera of the Pottiaceae: Mosses of harsh environments. *Bull. Buffalo Soc. Nat. Sci.* 32. Zander, R. H. 2006. The Pottiaceae s.str. as an evolutionary Lazarus taxon. *J. Hattori Bot. Lab.* 100: 581–602.

1. Distal lamina 2-stratose medially, the cells staggered above each other near the costa but grading to vertically aligned towards the leaf margin; leaves broadly to linearly lanceolate [29a. Pottiaceae subfam. Timmielloideae] 1. *Timmiella*, p. 481
1. Distal lamina 1-stratose, or if 2- or more stratose then cells situated directly over each other (i.e., not staggered); leaves ovate to lanceolate.
 2. Leaves lanceolate to linear, apex acute, margins plane to weakly incurved or involute; distal laminal cell walls KOH yellow, occasionally orange; costa lacking a differentiated abaxial epidermis; gemmae uncommon, when present seldom clavate; stem sclerodermis commonly poorly differentiated, hyalodermis commonly present [29c. Pottiaceae subfam. Trichostomoideae]
 3. Leaves plane, with massive simple or multiplex papilla over each lumen distally 5. *Tuerckheimia*, p. 494
 3. Leaves plane to involute, papillae 2 or more per lumen, simple to multifid.
 4. Perichaetia lateral; marginal cells differentiated from both basal and distal laminal cells, rising from leaf insertion to beyond mid leaf in a narrow band 6. *Pleurochaete*, p. 496
 4. Perichaetia terminal; marginal cells when differentiated comprised of basal cells rising laterally.

5. Leaf margins involute or rarely merely incurved at margins; distal laminal cells usually bulging more adaxially than abaxially; sexual condition usually monoicous 8. *Weissia*, p. 512
5. Leaf margins plane to weakly incurved; distal laminal cells usually nearly flat to bulging equally on both free surfaces; sexual condition usually dioicous.
6. Leaves often falcate; theca spheric, exothecial cells elongate longitudinally 9. *Aschisma*, p. 518
6. Leaves symmetric; theca cylindric, exothecial cells quadrate to hexagonal.
7. Basal laminal margins serrulate 3. *Eucladium*, p. 486
7. Basal laminal margins smooth or merely papillose.
8. Proximal cells differentiated straight across leaf or as a U shape or rarely rising higher medially; peristome usually short and straight 4. *Trichostomum*, p. 488
8. Proximal cells differentiated as a V shape, or at least laterally differentiated cells rising higher marginally as a tapering border; peristome usually long and twisted 7. *Tortella*, p. 498
- [2. Shifted to left margin.—Ed.]
2. Leaves lanceolate, ovate, ligulate, or spatulate, apex acute to blunt or rounded, margins usually recurved or involute, seldom plane; distal laminal cells KOH yellow to red; costa variously with or without differentiated abaxial epidermis; gemmae absent to common, when present commonly clavate; stem sclerodermis differentiated or absent, hyalodermis variously differentiated.
9. Leaves usually broadly lanceolate to narrowly elliptical, occasionally broadly ligulate; costa usually with 2 stereid bands; clavate gemmae commonly present; stem sclerodermis often well differentiated, cells of central cylinder usually abruptly larger than other stem cells [29d. Pottiaceae subfam. Barbuloideae].
10. Perichaetia lateral on stem, perichaetial leaves strongly differentiated; cauline leaves lanceolate, deeply keeled, costa with one stereid band 10. *Anoetangium*, p. 520
10. Perichaetia terminal or if lateral, then leaves not deeply keeled, perichaetial leaves occasionally strongly differentiated; cauline leaves lanceolate to ovate, lingulate or spatulate, deeply keeled to broadly channeled, costa with 2 stereid bands, at least in robust specimens.
11. Distal laminal cells bulging adaxially and nearly flat abaxially, papillae absent or scarce.
12. Costal adaxial cells longitudinally elongate 3:1 or more; inflated, banana-shaped alar cells present and decurrent as pad on stem; peristome long and twisted 13. *Hyophiladelphus*, p. 527
12. Costal adaxial cells quadrate to very short-rectangular; inflated, banana-shaped alar cells absent or alar cells merely swollen and rounded; peristome absent or of straight teeth.
13. Axillary hair proximal cell walls of 1 or more cells with thicker or darker colored walls; transverse section of abaxial stereid band round to semicircular; hydroid strand of costa often present; peristome teeth present 24. *Plaubelia*, p. 581
13. Axillary hair proximal cell walls hyaline and all cells of hair similar; transverse section of abaxial stereid band clearly flattened or adaxially indented, reniform or crescent-shaped; hydroid strand of costa absent; peristome teeth absent 25. *Hyophila*, p. 584
11. Distal laminal cells flat to equally bulging on both surfaces, papillae commonly present and abundant.

[14. Shifted to left margin.—Ed]

14. Costa sinuose in outline distally 12. *Bellibarbula*, p. 525
14. Costa straight, curved, or occasionally spurred but not sinuose.
15. Leaf apex fragile, lower leaf tips broken off, erose 20. *Rhexophyllum*, p. 572
15. Leaf apex not fragile, entire to dentate.
16. Proximal cells not or little differentiated from distal medial cells; papillae simple or branching, columnar; leaves deeply keeled 23. *Triquetrella*, p. 580
16. Proximal cells clearly differentiated, usually larger, less papillose, walls thinner; papillae usually 2-fid, granular; leaves variously keeled to merely channeled.
17. Costal adaxial cells quadrate to very short-rectangular, occasionally in many layers.
18. Axillary hairs with a brownish proximal cell; leaves often only weakly papillose, laminal cells convex superficially, proximal cells usually not well differentiated 16. *Didymodon* (in part), p. 539
18. Axillary hairs usually of all clear cells; leaves distinctly papillose, laminal cells usually flat superficially, proximal cells often enlarged, hyaline, and thin-walled.
19. Superficial walls of distal laminal cells (in section) flat or very weakly convex on both sides; KOH color reaction of distal laminal cell walls essentially red, usually a definite brick red 18. *Bryoerythrophyllum*, p. 565
19. Superficial walls of distal laminal cells (in section) strongly convex to bulging on both sides; KOH color reaction of distal laminal cell walls essentially yellow or orange, occasionally with red blotches
. 19. *Pseudocrossidium*, p. 569
17. Costal adaxial cells longitudinally elongate 3:1 or more.
20. Leaf margins denticulate or serrulate to toothed.
21. Stem central strand present; transverse section of costa round to semi-circular; both adaxial and costal epidermises present 14. *Barbula* (in part), p. 528
21. Stem central strand absent; transverse section of costa distinctly flattened, usually reniform; costal epidermises absent 21. *Leptodontium*, p. 574
20. Leaf margins entire or minutely and evenly crenulate.
22. Proximal cells inflated and bulging, considerably wider than distal medial cells 11. *Gyroweisia*, p. 523
22. Proximal cells usually with straight walls, little wider than distal medial cells.
23. Superficial (free) walls of distal laminal cells (in section) flat or very weakly convex; stem central strand absent; adaxial costal epidermis absent; peristome teeth absent 22. *Hymenostylium*, p. 577
23. Superficial (free) walls of distal laminal cells (in section) convex to bulging; stem central strand present; peristome teeth variably present or absent.
24. Perichaetia lateral on the stem 17. *Molendoa*, p. 561
24. Perichaetia terminal on the stem.
25. Peristome absent 15. *Gymnostomum*, p. 534
25. Peristome present.
26. Axillary hairs entirely of clear cells; leaves usually very papillose and blunt; gemmae of many cells
. 14. *Barbula*, (in part), p. 528
26. Axillary hairs with basal brown cell or cells; leaves usually weakly papillose and acute; gemmae of few cells 16. *Didymodon*, (in part), p. 539

[9. Shifted to left margin.—Ed.]

9. Leaves usually broadly ligulate to spatulate, with one stereid band in the costa; clavate gemmae rare; stem sclerodermis commonly not or poorly differentiated, cells of central cylinder intergrade in size with cortical cells.
27. Plants proximally blackish green, weakly iridescent metallic tan, or yellowish brown; stem central strand, sclerodermis, and hyalodermis all absent; laminal cells smooth; peristome absent [29b. Pottiaceae subfam. Merceyoideae] 2. *Scopelophila*, p. 483
27. Plants proximally yellow to brown; stem central strand, sclerodermis, and hyalodermis present or absent; laminal cells usually papillose; peristome present or absent [29e. Pottiaceae subfam. Pottioideae].
28. Leaves with lamellae or filaments on adaxial surface.
29. Leaves with lamellae adaxially, occasionally also with filaments . . . 29. *Pterygoneurum*, p. 606
29. Leaves with filaments adaxially.
30. Leaves with filaments restricted to surface of costa 31. *Crossidium*, p. 611
30. Leaves with filaments on costa and surface of lamina 32. *Aloina*, p. 614
28. Leaves without adaxial outgroups or occasionally with low ridge of cells along costa.
31. Leaves narrowly ligulate, distal laminal cells strongly bulging adaxially, nearly flat abaxially 40. *Luisierella*, p. 641
31. Leaves ovate to spatulate, distal laminal cells equally convex on both free surfaces.
32. Leaf margins strongly revolute, marginal cells thin-walled and chlorophyll-rich, comprising a photosynthetic organ 35. *Hilpertia*, p. 631
32. Leaf margins incurved to recurved or occasionally revolute, marginal cells not thin-walled and chlorophyll-rich.
33. Leaves ovate, circular, or obovate, concave.
34. Capsule exerted, stegocarpic; costa spurred 28. *Globulinella*, p. 605
34. Capsule immersed, cleistocarpic; costa evenly tapering 38. *Acaulon*, p. 637
33. Leaves ovate to spatulate, plane to broadly channeled.
35. Leaves extremely small, 0.3–0.4 mm; gemmae occasionally present, of about 12 cells 30. *Gymnostomiella*, p. 609
35. Leaves larger, usually 1 mm or more; gemmae rare, when present of less than 10 cells.
36. Leaves obovate to elliptic, with sharp, conical apiculus of 1 (–3) thick-walled cell(s), distal laminal cells thin-walled 36. *Chenia*, p. 633
36. Leaves ovate to spatulate, muticous, mucronate, or awned, apiculus when present usually blunt, commonly of several thin- or thick-walled cells, distal laminal cells thin- or thick-walled.
37. Lamina reacts yellow to 2% KOH solution (basal cells blush red occasionally).
38. Adaxial and abaxial laminal cell walls of equal thickness; plants usually elongate; leaves hyaline distally only in awn 26. *Tortula*, p. 586
38. Adaxial laminal cell walls thickened; plants bulbiform; leaves with distal laminal portion hyaline 27. *Stegonia*, p. 603
37. Lamina reacts red or orange to 2% KOH solution.
39. Costa flattened, and often adaxially convex, stereid band usually reniform, abaxial epidermis usually absent, laminal papillae crowded 33. *Syntrichia*, p. 618
39. Costa rounded in section or semicircular, stereid band semicircular or rounded, abaxial epidermis usually present, laminal papillae usually distant.
40. Distal laminal margins not differentiated
- 34. *Microbryum*, p. 627
40. Distal laminal margins usually with a border of distinctive cells, this often intralaminar.

[41. Shifted to left margin.—Ed.]

41. Leaves red in 2% KOH, border cells commonly smaller than medial cells 37. *Hennediella*, p. 635
 41. Leaves reddish orange in 2% KOH, border cells swollen in section 39. *Crumia*, p. 639

29a. POTTIACEAE Schimper subfam. TIMMIELLOIDEAE R. H. Zander, Bull. Buffalo Soc. Nat. Sci. 32: 68. 1993

Plants green to tan. **Stem** central strand present, sclerodermis strong, hyalodermis present. **Leaves** broadly to linearly lanceolate, apex acute, margins plane to weakly incurved; distal laminal cells 2-stratose medially, the cells staggered above each other near the costa but grading to vertically aligned towards the leaf margin, bulging adaxially, nearly smooth abaxially, walls KOH yellow; costa with differentiated abaxial epidermis; gemmae unknown. **Peristome** present.

Genus 1: widespread in temperate climates.

1. TIMMIELLA (De Notaris) Limpricht, Laubm. Deutchl. 1: 590. 1888 • [Genus *Timmia* and Latin *-ella*, diminutive, alluding to resemblance]

Richard H. Zander

Trichostomum sect. *Timmiella* De Notaris, Comment. Soc. Crittog. Ital. 2: 100. 1866

Plants loosely caespitose to cushion-forming, often rosulate, green, often dark distally, brown basally. **Stems** to 1.5 cm; hyalodermis present, weak, sclerodermis present in 1–3 layers, central strand very strong; axillary hairs of ca. 7 cells, all hyaline or proximal cell firm-walled. **Leaves** incurved, tubulose when dry, spreading when moist; long-elliptic to ligulate or broadly lanceolate, often wasp-waisted, adaxial surface broadly channeled across leaf, 3.5–5 mm; base often broadened, elliptic, somewhat sheathing, proximal margins occasionally with distinct shoulders; distal margins plane to weakly incurved, distinctly denticulate or serrulate to near base, usually strongly serrate near apex, lamina 2-stratose except 1-stratose along margins; apex acute; costa percurrent, tapering to apex and much broadened before mid leaf, adaxial outgrowths absent, adaxial cells quadrate and bulging in 6–19 rows; transverse section flattened, reniform or elliptic, adaxial epidermis present, 2-stratose or occasionally 3-stratose, adaxial stereid band present, guide cells 6–16 in 1 layer, hydroid strand present, often multiple, abaxial stereid band present, crescent-shaped in section, abaxial epidermis present; proximal cells differentiated straight across leaf, bulging rectangular, 10–18 µm wide, mostly 3–4:1, walls of proximal cells thin, hyaline to yellowish; distal medial cells quadrate to rounded-hexagonal, 9–12 µm wide, 1:1; papillae absent, cell walls mostly evenly thickened, lumina often rounded, bulging adaxially, cells 2-stratose but staggered (not situated directly over each other). **Specialized asexual reproduction** not seen. **Sexuality** dioicous or monoicous (autoicous, synoicous or apparently rhizautoicous). **Perichaetia** terminal, base of interior leaves often shortly and broadly clasping, scarcely different from cauline leaves. **Seta** ca. 0.8–2.5 cm. **Capsule** stegocarpous, theca long-elliptic to cylindrical, occasionally somewhat ventricose, 2–4 mm, annulus absent or of 1–several layers of highly vesiculose cells, revoluble or deciduous in pieces; operculum long-conic to rostrate; peristome teeth of 32 filaments [16 paired teeth], filamentous [linear-lanceolate] in shape, twisted weakly to once twisted clockwise or straight, teeth to 300–700 µm [rudimentary]. **Calyptra** cucullate. **Spores** 8–13 µm. **KOH laminal color reaction** yellow.

Species 13 (2 in the flora): North America, Mexico, Central America, South America, Europe, Asia, Africa, Pacific Islands.

The salient characters of *Timmiella* are the laminal margins plane to weakly incurved, denticulate to dentate, the costa very wide, and the laminal cells are bulging adaxially but flat abaxially, and are medially 2-stratose but not aligned directly over each other near the costa. The opercular cells are in straight rows or twisted clockwise. Without sporophytes, collections are commonly difficult to name to species, and a revision worldwide is much needed. R. H. Zander (1993) placed it as phylogenetically basal to the Pottiaceae. Recent molecular work (O. Werner et al. 2004) indicated that the genus is phylogenetically distant from the Pottiaceae, but Zander (2006) justified retention in the Pottiaceae by appeal to Dollo's Rule.

SELECTED REFERENCE Zander, R. H. 1994b. *Timmiella*. In: A. J. Sharp et al., eds. The moss flora of Mexico. Mem. New York Bot. Gard. 69: 243–246.

1. Leaf base narrower to little wider than the limb; autoicous or synoicous, seldom apparently dioicous; seta usually 1.5–2.5 cm, theca reaching 3–4 mm, operculum commonly 1–1.5 mm, peristome distinctly twisted 1. *Timmiella anomala*
1. Leaf base distinctly and rather abruptly wider than the limb; dioicous; seta 0.8–1.2 cm, theca usually 2–2.8 mm, operculum 0.6–1 mm, peristome not or slightly twisted 2. *Timmiella crassinervis*

1. ***Timmiella anomala*** (Bruch & Schimper) Limpricht, Laubm. Deutschl. 1: 592. 1888



Barbula anomala Bruch & Schimper, Bryol. Europ. 2: 107, plate 169. 1842; *Timmiella subanomala* (Bescherelle) Brotherus; *Trichostomum subanomala* (Bescherelle) Brotherus

Stems commonly branched. **Leaf base** narrower to little wider than the limb. **Sexual condition**

dioicous, autoicous or synoicous, occasionally polyoicous. **Seta** usually 1.5–2.5 cm. **Capsule** with theca reaching 3–4 mm, operculum commonly 1–1.5 mm, peristome distinctly twisted.

Sporophytes mature summer–fall (occasionally winter). Soil, humus, limestone crevices, vertical rock face; moderate elevations (700–1500 m); Ariz., Calif., N.Mex., Tex., Wash.; Mexico; Central America; Europe; Asia; n Africa.

Timmiella anomala commonly grows in dusty, friable soil that makes dissections difficult. H. A. Crum and L. E. Anderson (1980–1983, vol. 4) suggested that this species may also be dioicous; K. Saito (1975) and Li X. J. et al. (2001) asserted that it is dioicous in Asia (Japan and China, respectively). A specimen from California, *Showers* 3326, MO, has stems with synoicous perichaetia and also apparently entirely perigoniate stems, possibly due to rhizautoicy. According to B. Allen (2002), *Timmiella anomala* in Central America has peristome teeth erect to very weakly twisted though these are described as at least once twisted in publications on other areas of the world. Material from the Yukon is sterile and only tentatively identifiable as this species.

2. ***Timmiella crassinervis*** (Hampe) L. F. Koch, Leafl. W. Bot. 6: 11. 1950 [F]



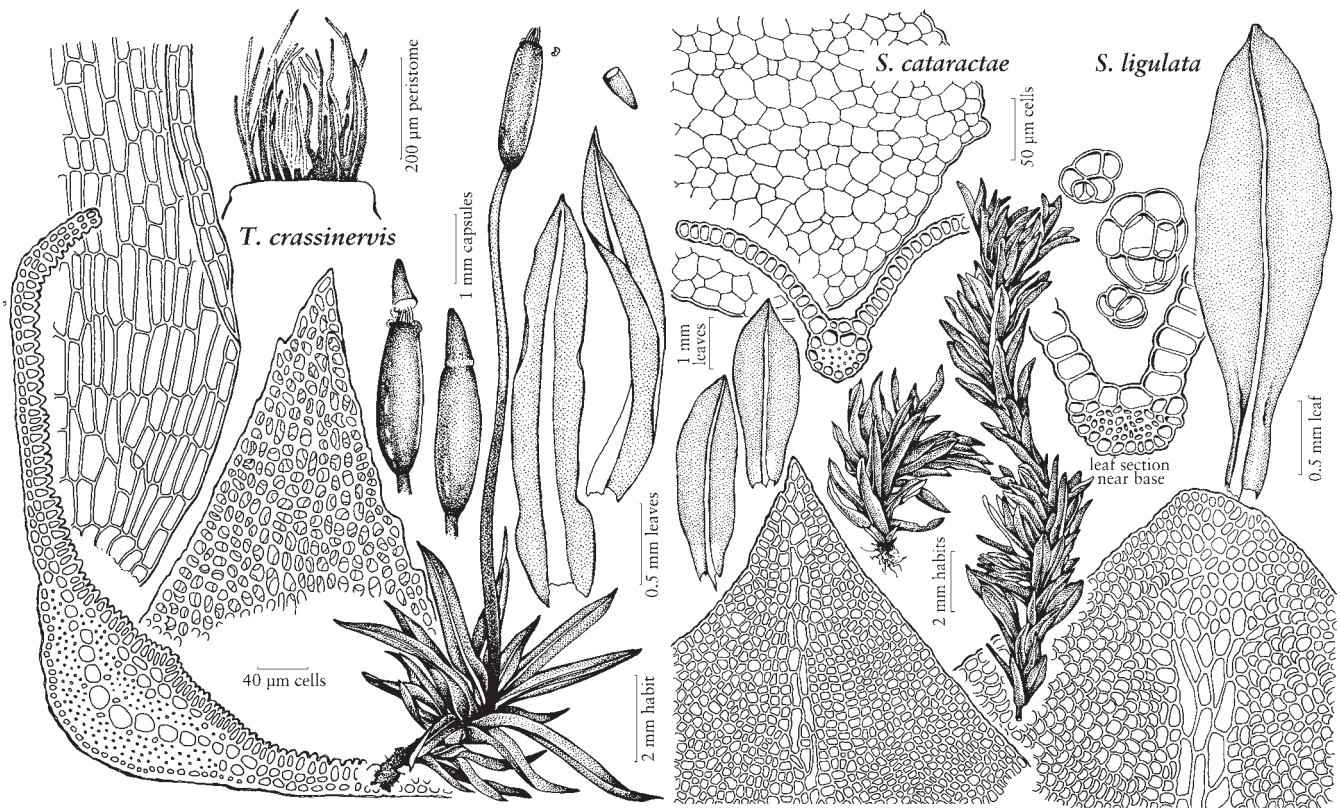
Trichostomum crassinerve Hampe, Linnaea 30: 456. 1860; *Timmiella flexisetata* var. *vancouveriensis* (Brotherus) Grout; *T. vancouveriensis* Brotherus

Stems commonly unbranched. **Leaf base** distinctly and rather abruptly wider than the limb. **Sexual condition** dioicous. **Seta**

0.8–1.2 cm. **Capsule** with theca usually 2–2.8 mm, operculum 0.6–1 mm, peristome not or slightly twisted.

Sporophytes mature spring–summer. Soil, clay, roadside banks; low to moderate elevations (150–1500 m); B.C.; Ariz., Calif., Mont., Oreg., Wash.; Pacific Islands (Hawaii).

Timmiella crassinervis is very similar to the European *T. flexisetata* (Bruch) Limpricht, and commonly matches the key traits (stems to ca. 1 cm, leaf margins dentate only near apex, peristome teeth short-filiform, erect) of *T. diminuta* (Müller Hal.) P. C. Chen of Asia as given by Li X. J. et al. (2001). Revision may result in synonymy. Sterile plants of the two species of the flora are not easily distinguishable even by the leaf base characteristics; see discussions by R. H. Zander (1994b) and D. H. Norris and J. R. Shevock (2004). Although several authors indicate that *T. crassinervis* differs from *T. anomala* by a peristome that is straight while that of the latter is twisted at least once, E. Lawton (1971) described the peristome as “slightly twisted” and distinguished *T. crassinervis* by its smaller size, unbranched stem, and dioicous condition. According to Norris and Shevock, in California where the two species co-occur, *T. crassinervis* is more common in the humid northwest of the state.



TIMMIELLA • SCOPELOPHILA

29b. POTTIACEAE subfam. MERCEOIDEAE Brotherus in H. G. A. Engler et al., Nat. Pflanzenfam. ed. 2, 10: 246. 1924

Merceyaceae Casares-Gil

Plants proximally blackish green or weakly iridescent metallic tan or yellowish brown. **Stem** central strand, sclerodermis, and hyalodermis all absent. **Leaves** ligulate to oblanceolate, apex blunt to acute, margins plane, distal laminal cells usually 1-stratose, walls smooth, KOH yellow to yellowish orange; costa with a differentiated abaxial epidermis; gemmae clavate. **Peristome** absent.

Genus 1: worldwide in temperate and tropical areas.

2. SCOPELOPHILA (Mitten) Lindberg, Acta Soc. Sci. Fenn. 10: 269. 1872 • [Greek *skopelos*, crag, and *philia*, fondness, alluding to characteristic rocky habitat]

Richard H. Zander

Weissia sect. *Scopelophila* Mitten, J. Linn. Soc., Bot. 12: 135. 1869; *Merceya* Schimper

Plants forming a thin or thick turf, green to greenish yellow or brown distally, blackish or weakly iridescent to metallic tan or yellow-brown proximally. **Stems** to 4 cm, rounded-pentagonal in transverse section, hyalodermis absent, sclerodermis absent, central strand absent; axillary hairs

3–5 cells in length, proximal cell usually brownish. **Cauline leaves** often crowded, incurved to spreading, contorted, carinate, occasionally with undulating margins when dry, spreading when moist; lingulate to ligulate or oblanceolate, widest at mid leaf or beyond, adaxial surface narrowly and deeply grooved along costa or broadly channeled, to 2.5 mm; base scarcely differentiated in shape to long-elliptic, occasionally medially constricted, proximal margins occasionally slightly decurrent; distal margins plane or somewhat recurved proximally, entire to minutely crenulate or denticulate distally, often bordered by a few rows of thicker walled cells distally; apex broadly acute or obtuse, often with a broad apiculus, occasionally rounded; costa slender, percurrent or ending 2–8 cells before the apex, occasionally excurrent as a short mucro, adaxial outgrowths absent, adaxial cells quadrate to rectangular, in 2–4 rows; transverse section semicircular to round, adaxial epidermis absent or present, adaxial stereid band absent, guide cells 2(–4) in 1 layer, hydroid strand absent, abaxial stereid band present, rounded in sectional shape, abaxial epidermis present, usually very distinct; proximal cells differentiated across leaf, extending higher medially, rectangular, occasionally inflated, scarcely wider than distal cells to inflated, 2–3:1, walls of proximal cells hyaline or deep brown; distal medial cells rounded quadrate to hexagonal or short-rectangular, ca. 8–14 μm , often heterogeneous in size, 1(–2):1, 1-stratose; papillae usually lacking, occasionally low-verrucose, cell walls thin to evenly thickened, thicker near margins, flat or somewhat bulging on adaxial surface. **Specialized asexual reproduction** rare, on stalks from the stem, greenish brown, clavate to ellipsoid or filamentous and branching, ca. 12 μm , of 2 or more rounded cells. **Sexual condition** dioicous. **Perichaetia** terminal, interior leaves little differentiated. [Seta 2–6 mm. **Capsule** stegocarpous, theca shortly elliptic to cylindrical, macrostomous, 0.6–2.2 mm, annulus weakly differentiated or of 1–4 rows of vesiculose cells, deciduous in fragments; operculum conic-rostrate, erect or oblique; peristome teeth absent. **Calyptra** cucullate. **Spores** 8–13 μm .] **KOH distal laminal color reaction** yellow to yellowish orange.

Species 3 (2 in the flora): North America, Mexico, Central America, South America, Europe, Asia, c Africa, Pacific Islands (Hawaii).

Scopelophila is a small genus (R. H. Zander 1993) of “copper mosses” (see reviews by A. J. Shaw and L. E. Anderson 1988; Shaw 1993) associated with mineralized soils. *Crumia* is similar but is quickly distinguished by its stem central strand, intramarginal laminal border, and distal laminal cells usually distinctly papillose.

SELECTED REFERENCES Zander, R. H. 1967. The New World distribution of *Scopelophila* (= *Merceya*). *Bryologist* 70: 405–413. Zander, R. H. 1994c. *Scopelophila*. In: A. J. Sharp et al., eds. The moss flora of Mexico. *Mem. New York Bot. Gard.* 69: 372–375.

1. Stems often red-tomentose; proximal leaves brown; leaves acute or short-acuminate, usually not bordered; costa with 2 layers of parenchymatous cells adaxial to the stereid band 1. *Scopelophila cataractae*
1. Stems with sparse brownish rhizoids; proximal leaves brownish black; leaves obtuse to acute, often apiculate by a single cell, usually bordered by thick-walled cells (at least in older leaves); costa with 1 layer of parenchymatous cells adaxial to the stereids 2. *Scopelophila ligulata*

1. *Scopelophila cataractae* (Mitten) Brotherus in H. G. A. Engler and K. Prantl, Nat. Pflanzenfam. 215[I,3]: 436. 1902 [F]



Weissia cataractae Mitten, J. Linn. Soc., Bot. 12: 135. 1869; *Tortula williamsii* E. B. Bartram

Stems with red rhizoids or red-tomentose. **Cauline leaves** brown proximally; margins seldom bordered by thick-walled cells; apex acute or short-acuminate; costa with 2 layers of paren-

chymatous cells adaxial to the stereid band. **Sporophytes** not seen in area of the flora.

Rock or thin soil over rock; moderate to high elevations (800–2000 m): Ariz., Calif., N.C., Pa., Tenn., Tex.; Mexico; Central America; w South America; Europe; Asia; c Africa.

Scopelophila cataractae has the appearance of *Tortula* but is distinguishable by the dense red tomentum and small, smooth distal laminal cells. Sulphurous smell at a North Carolina station (McDowell County, Newberry Creek gorge, below Mount Mitchell) indicates presence of associated mineral ores. The disjunctive California station (A. J. Steen 1986) is at an old copper mine. Male plants are apparently very rare (A. J. Shaw 1993).

SELECTED REFERENCE Shaw, A. J. 1993. Morphological uniformity among widely disjunct populations of the rare “copper moss,” *Scopelophila cataractae* (Pottiaceae). Syst. Bot. 18: 525–537.

2. *Scopelophila ligulata* (Spruce) Spruce, J. Bot. 19: 14. 1881 [F]



Encalypta ligulata Spruce, Musci Pyren., no. 331. 1847; *Merceya ligulata* (Spruce) Schimper

Stems with sparse brown rhizoids. **Cauline leaves** brownish black proximally; margins usually bordered by thick-walled cells; apex obtuse to acute; costa with 1 layer of parenchymatous cells

adaxial to the stereid band. **Sporophytes** not seen in area of the flora.

Soil and rock, cliffs and road cuts; moderate to high elevations (300–1900 m); Ariz., Ark., Calif., Ga., Ill., La., Mich., N.C., Tenn., Va.; Mexico; Central America; w South America; Europe; Asia; Africa.

The blackened proximal leaves and nearly isodiametric distal laminal cells help separate *Scopelophila ligulata* from *Tortula*. Leaf blackening, possibly associated with iron in the soil, also occurs in the common species *Barbula unguiculata*, which, however, has lanceolate leaves. Two variants are weakly distinguishable, a “hydric” form with a loosely pulvinate habit and flaccid, spreading leaves with the distal laminal cells thin-walled and the enlarged basal cells often extending beyond mid leaf, and a “montane” form with a densely pulvinate habit and narrow, firm, appressed leaves with the distal laminal cells mostly thick-walled and the enlarged basal cells mostly confined to the proximal third of the leaf (R. H. Zander 1967).

SELECTED REFERENCE Shaw, A. J. and L. E. Anderson. 1988. Factors affecting the distribution and abundance of the “copper moss,” *Scopelophila ligulata*, in North America. Lindbergia 14: 55–58.

29c. POTTIACEAE subfam. TRICHOSTOMOIDEAE (Schimper) Brotherus in H. G. A. Engler and K. Prantl, Nat. Pflanzenfam. 212[I,3]: 381. 1902

Trichostomaceae Schimper, Syn. Musc. Eur., 141. 1860 (as Trichostomeae)

Plants green to tan. **Stem** central strand present or absent, sclerodermis commonly poorly differentiated, hyalodermis commonly present. **Leaves** lanceolate to linear, apex acute, margins plane to weakly incurved or involute; distal laminal cells if 2-stratose stacked directly over one another, walls smooth or papillose, KOH yellow, occasionally orange; costa lacking a differentiated abaxial epidermis; gemmae uncommon, when present seldom clavate. **Peristome** present or absent.

Genera 21 (7 in the flora): worldwide.

3. EUCLADIUM Bruch & Schimper, Bryol. Europ. 1: 93. 1846 • [Greek *eu-*, good or well, and *klados*, branch, alluding to well-developed whorls of stem leaves]

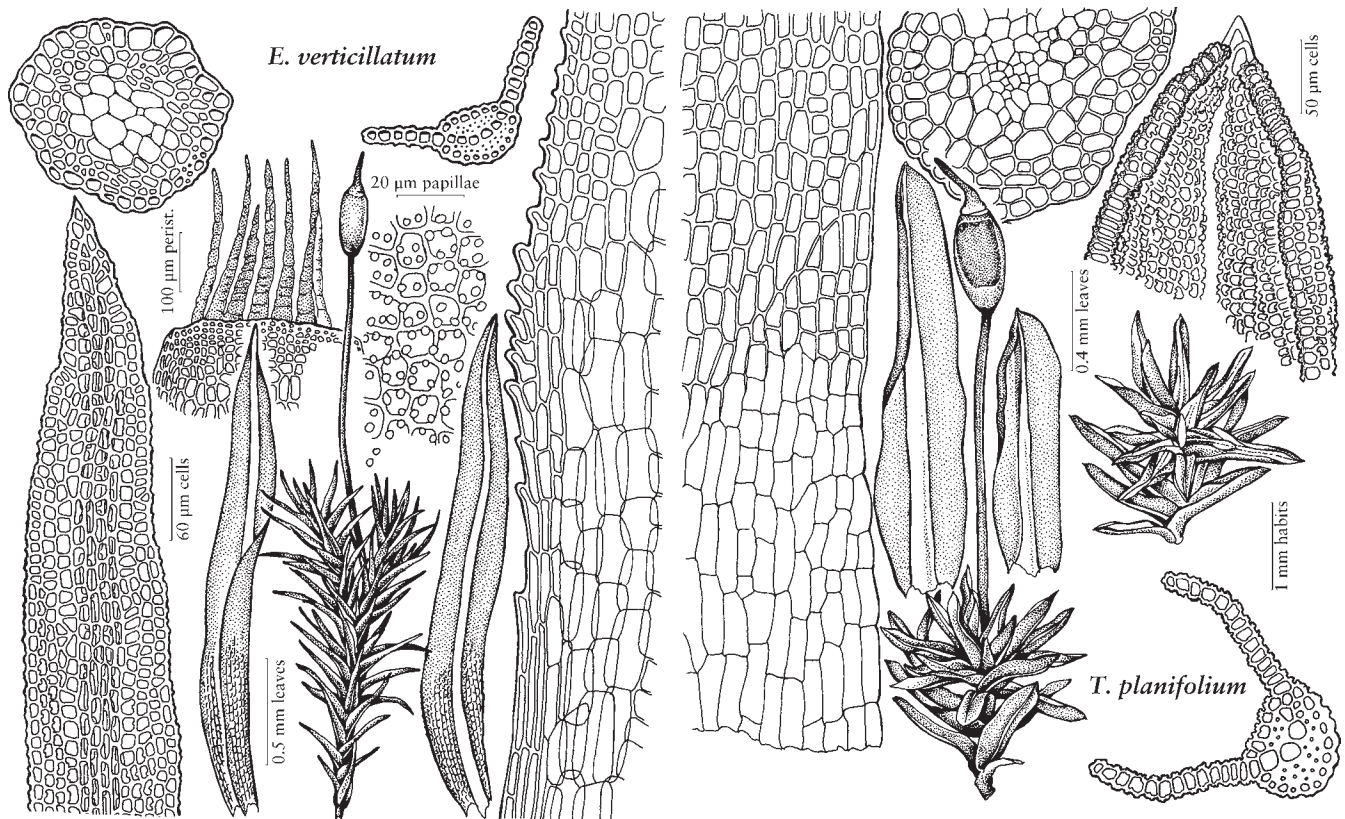
Patricia M. Eckel

Plants small, in dense to deep tufts, turfs or swollen cushions, tufa-forming, bright to dark blue-green distally and pale green to yellowish brown proximally or sometimes throughout, rarely rufous; frequently bleached or whitened and indurated with encrusted lime. **Stems** slender, branching irregularly, densely foliate in whorls at successive innovations; transverse section rounded-pentagonal with an irregularly inflated or enlarged hyalodermis and weakly developed sclerodermis; central strand absent; weakly radiculose, rarely strongly so; axillary hairs of 5–10 cells, hyaline throughout. **Leaves** appressed and scarcely incurved-contorted when dry, erect-spreading when moist, oblong to mostly linear-lanceolate or linear-subulate, base undifferentiated in shape to occasionally broadened-oblong; margins plane, entire except for distinctive irregular hollow teeth on shoulder just distal to the base, not bordered; apex broadly to narrowly acute or subulate; costa strong, percurrent to shortly excurrent as a stout mucro, in transverse section elliptic; adaxial surface cells quadrate to elongate, adaxial epidermis present, adaxial stereid band, medial guide cells and abaxial stereid band present, abaxial epidermis sometimes absent, hydroid strand absent; basal cells sharply differentiated across to the margin where they become narrower, elongate, bulging-rectangular to rhomboidal, hyaline, smooth, lax and thin-walled; distal laminal cells subquadrate, walls sometimes irregularly thickened, papillae low, indistinct, simple or 2-fid, several per cell. **Specialized asexual reproduction** reportedly by rhizoidal brood bodies. **Sexual condition** dioicous; perigonia terminal, interior leaves long-lanceolate, similar to those of the stem; perichaetia terminal, leaves as in stem leaves, ovate-lanceolate, to 2.5 mm and sheathing. **Seta** to 8 mm, single, erect. **Capsule** erect, symmetrical, yellow-brown, ovoid to cylindrical; annulus weakly developed, of ca. 2 rows of subvesiculose cells; operculum obliquely conic-rostrate; peristome teeth 16, straight or slightly oblique, lanceolate, finely papillose, entire to variously cleft. **Calyptra** cucullate, smooth. **Spores** 8–14 μm , spherical, mostly smooth. **Laminal KOH color reaction** yellow.

Species 1: North America, Mexico, Central America, Europe, Asia, Africa.

R. H. Zander (1993) removed *Eucladium irroratum* (Mitten) Jaeger to the genus *Tetracoscinodon*, rendering *Eucladium* monotypic and characterized by absence of stem central strand and sclerodermis, a somewhat enlarged hyalodermis, costa broad in relation to the leaf, plane margins with their peculiar dentition at the leaf shoulder (a condition that may be variable or rarely even absent), and terminal inflorescences. The generic placement is near *Trichostomum* (Zander). The genus is differentiated from other members of the former tribe Pleuroweisieae by the presence of a peristome, the distinctive serrulations on the proximal leaf margins, and the hyaline, thin-walled and bulging-rectangular differentiated basal cells (Zander 1977).

SELECTED REFERENCES Osada, T. 1958. On the habitats of *Eucladium verticillatum*. Misc. Bryol. Lichenol. 15: 3. Saito, K. 1972. Gemmae formation on rhizoids of *Eucladium verticillatum*. Misc. Bryol. Lichenol. 6: 41–42.



EUCLADIUM • TRICHOSTOMUM

1. *Eucladium verticillatum* (Bridel) Bruch & Schimper,
Bryol. Europ. 1: 93. 1846 [F]



Weissia verticillata Bridel, J. Bot.
(Schrader) 1800(1): 283. 1801

Stems erect, 0.7–6 cm, leaves often branched in whorls in successive innovations. **Leaves** 1.2–2.5 mm, flat to channeled distally or at mid leaf, in transverse section at mid leaf often tapering from costa to leaf margin because of decreasing

size of cells, mucro occasionally ending in a sharp, clear cell; marginal serrulations projecting from the distal end of cells of the hyaline cells of the leaf base; costa to $\frac{1}{3}$ or more the width of the leaf near the base, basal cells 12–15 μm wide, 2–5:1; median and distal laminal cells 8–10 μm wide, 1(–2):1, walls rather thick, often irregularly so, large juxtacostally and decreasing in size to the leaf margin, irregular in shape from quadrate to rectangular, 1–2(–3):1, sometimes transversely elongate 2:1, occasionally with transverse walls oblique, marginal cells narrower in places and 2–3:1 occasionally approximating a border; papillae variously scattered or centered. **Seta** yellow to red-brown, not or little twisted. **Capsule** 0.8–1.8 mm, red-brown when old; operculum 0.5–0.8 mm; peristome rudimentary or to 300 μm , yellow to orange,

with a low, papillose basal membrane. **Calyptra** ca. 2.5 mm. **Spores** pale.

Sporophytes infrequent, capsules mature Jun–Aug. Dripping calcareous or sometimes granitic rock faces or mortar, around springs, dripping bluffs in calcareous regions; low to high elevations (0–1900 m); Alta., B.C., Nfld. and Labr. (Nfld.), Ont.; Ala., Ariz., Ark., Calif., Colo., Fla., Idaho, Ill., Ind., Kans., Ky., Mich., Miss., Mo., Nev., N.Mex., Ohio, Okla., Tenn., Tex., Utah, Va., Wash., Wis.; Mexico; Bermuda; Central America; Europe; Asia; n, s Africa; Atlantic Islands (Macaronesia).

Eucladium verticillatum is associated with year-round seepage, possibly the reason that, although the stem may be reduced, the leaves are seldom reduced as they frequently are in drought-tolerant species of the family. The plants are typically a yellow-green, and there is usually a vivid contrast between the pellucid green laminal cells and the clear basal ones. Stem hyalodermis cells are frequently attached to the costa base, and form decurrencies of long and thin-walled cells in the leaf angles when leaves are removed. *Gymnostomum* and *Molendoa* are similar plants but differ by blunt apices and subpercurrent costae. Both these genera possess a stem central strand, no hyalodermis, and occasional 2-stratose areas in the lamina. *Eucladium* may be separated from these taxa and others that may be mistaken for it, such as *Hymenostylium* and *Anoetangium* by its highly

differentiated bulging or lax, thin-walled basal cells. Assurances in the literature to the contrary, many other taxa also possess serrulate or denticulate leaf-shoulder margins, especially *Hymenostylium*, while *Eucladium* may rarely lack such serrulations. Specimens of *Eucladium* in which the lamina is highly reduced so that

the leaves seem entirely costate are included without special rank in the range of variation of the species in North America. The laminal papillae of *Hymenostylium* are clear, sharp, well-defined; those of *Eucladium* are low, amorphous or scablike on the lumen surface.

4. TRICHOSTOMUM Bruch, Flora 12: 396. 1829, name conserved • [Greek *trichos*, hair, and *stoma*, mouth, alluding to peristome of filiform teeth]

Richard H. Zander

Oxystegus (Limpricht) Hilpert; *Paraleptodontium* D. G. Long; *Trichostomum* subg. *Crispulisiformes* (Kindberg) R. H. Zander; *Trichostomum* subg. *Oxystegus* Limpricht

Plants turf-forming, yellowish green distally, medium brown to light brown basally. **Stems** to ca. 3 cm, hyalodermis present or occasionally absent, sclerodermis usually weak, often of substereid cells, central strand present or absent; axillary hairs with proximal 1–3 cells thicker walled or all hyaline. **Leaves** incurved, often catenulate, often reflexed at top of appressed base when dry, weakly to widely spreading when moist; oblong, elliptical or ligulate to long-lanceolate, adaxial surface flat or shallowly channeled, 1.5–2.5(–5) mm; base elliptic to rectangular, occasionally not differentiated in shape; distal margins plane or somewhat erect but never sharply incurved, entire to crenulate-notched or occasionally dentate in the distal $\frac{1}{2}$ – $\frac{3}{4}$, occasionally with a narrow, less papillose border; apex narrowly to broadly acute or rounded, occasionally broken or reflexed; costa usually excurrent as a smooth, sharp mucro, adaxial outgrowths absent, adaxial cells quadrate but occasionally elongate near apex, in 2–6(–8) rows; cross section semicircular, reniform or ovate, adaxial epidermis present, adaxial stereid band present, occasionally weak, guide cells 2–4(–6) in 1 layer, hydroid strand usually absent, abaxial stereid band present, crescentlike in section, abaxial epidermis weak or absent; basal cells differentiated across leaf or medially, occasionally rising weakly along margin, rectangular, seldom bulging, 3–5:1; distal cells rounded-quadrate, occasionally transversely elliptical along margins, 6–12 (–18) μm wide, papillae usually 2-fid, crowded, 2–6 per lumen, occasionally single and multiplex and covering the lumens, superficial cell walls equally thickened and convex on both sides. **Specialized asexual reproduction** absent [rare, of gemmae on rhizoids or adaxial surface of costa, of several cells, vermiform to irregular in shape, occasionally branching]. **Sexual condition** dioicous or occasionally autoicous. **Perichaetia** terminal, interior leaves weakly sheathing at base or not sheathing, little different from cauline leaves. **Capsule** stegocarpic [cleistocarpic]. **Seta** 0.4–1.5 cm. **Theca** cylindric, ovate or elliptic ca. 1–3 mm, annulus of 1–4 rows of vesiculose cells, persistent or seldom revoluble; operculum [when differentiated] long-conic to rostrate; peristome teeth 16, usually rather short, occasionally rudimentary or absent, ligulate to filamentous, entire or occasionally irregularly cleft 2–3-fid or perforate, straight or seldom weakly twisted counterclockwise. **Calyptra** cucullate. **Spores** 8–25 μm . **KOH laminal color reaction** medium orange to yellowish orange, occasionally yellow.

Species ca. 130 (8 in the flora): worldwide except Antarctica.

Trichostomum species differ from similar *Barbula* species by the short peristomes and plane-margined leaves, and from *Tortella* by the basal cells differentiated approximately across the leaf or only occasionally running up the margins in 1–3 rows, as opposed to rising distally along

both leaf margins from near the costa in a distinct V; *Tortella* also usually has a twisted peristome. When differentiated basal cells do rise marginally in *Trichostomum* they form a differentiated basal area in the shape of a W, and there is sufficient morphological variation that some specimens will be run through keys to both *Trichostomum* and *Tortella*; these plants should then be compared to illustrations. The genus is complex and heterogeneous. H. N. Dixon (1924) treated all species of both genera under the name *Trichostomum*, which, after the present floral study of Trichostomoideae, probably could be extended, instructively, to include *Weissia*. The similar genus *Weissia* differs from *Trichostomum* by its naviculate distal portion of the leaves, the often narrowly incurved or tightly involute distal leaf margins, sometimes bulging adaxial laminal cell walls, and commonly monoicous sexual condition (R. H. Zander 1993). Possible parallel reduction series in peristome development between the two genera was discussed by Zander (1985).

1. Leaves lanceolate to linear-lanceolate, rarely ligulate; leaf base often sharply dilated; apex rounded to narrowly acute, plane or somewhat keeled; basal cells differentiated in a U, V, or W, often running up the margins as in *Tortella*, sometimes bordered distally by a row of thick-walled rectangular cells.
 2. Stem triangular in section; basal cells forming a W, enlarged submarginally just proximal to the lowest point the quadrate medial cells extend in the leaf 6. *Trichostomum arcticum*
 2. Stem rounded-pentagonal in section; basal cells forming a U or V, not larger submarginally than elsewhere across leaf.
 3. Leaves long-ligulate, distal marginal teeth sharp 5. *Trichostomum recurvifolium*
 3. Leaves lanceolate, entire, or if toothed then teeth blunt.
 4. Dioicous 3. *Trichostomum tenuirostre*
 4. Autoicous 4. *Trichostomum spirale*
1. Leaves ovate or elliptical to long-lanceolate; apex usually rounded or rounded-acute, plane, keeled or cucullate; basal cells evenly differentiated across the leaf base, if running up the margins, then in only 1 row.
 5. Leaves ovate to ovate-lanceolate or long-lanceolate, naviculate; apex cucullate; distal margins erect; costa subpercurrent or percurrent, commonly ending in an apiculus 8. *Trichostomum crispulum*
 5. Leaves ovate to elliptical or very long-ligulate, flattened or keeled; apex plane or grooved; distal margins plane; costa excurrent as a sharp mucro.
 6. Leaves long-ligulate; distal laminal cells capped with a lens or irregular mass 7. *Trichostomum portoricense*
 6. Leaves ovate to elliptical; distal laminal cells pluripapillose with low papillae.
 7. Dioicous; mucro short-conic to stout and narrowly tapering, of 3–6(–10 or more) cells 1. *Trichostomum brachydontium*
 7. Autoicous; mucro short-conic, of 3–4 cells 2. *Trichostomum planifolium*

1. *Trichostomum brachydontium* Bruch, Flora 12: 393, plate 3. 1829



Trichostomum mutabile De Notaris

Stem rounded-pentagonal in section. **Leaves** flattened, ovate to elliptical, distal margins plane or weakly erect, entire, not bordered; apex rounded or rounded-acute, plane to weakly concave, keeled or cucullate; basal cells evenly differentiated across leaf base or

as a U, only weakly running up margins if at all, not distinctly enlarged submarginally; distal laminal cells

pluripapillose with low papillae; mucro short-conic to stout and narrowly tapering, of 3–6(–10 or more) cells. **Sexual condition** dioicous. **Peristome teeth** absent, rudimentary or short-lanceolate.

Rock, soil; low to high elevations; N.S.; Ala., Alaska, Calif., Tenn., Tex.; Mexico; West Indies; Central America; South America; Eurasia; Africa; Atlantic Islands; Indian Ocean Islands; Pacific Islands (New Zealand); Australia.

Trichostomum brachydontium is similar to *Hyophila involuta* in leaf shape and other characters, and sometimes likewise lacks a peristome. The leaves in section often show clearly the adaxially bulging distal cells characteristic of *H. involuta*, which, however, lacks

the laminal papillae superimposed on the mammillae, and is hygrophytic. It is also quite like *Tortella humilis* when sterile but may often be distinguished by its more elongate stems, less crowded leaves, which are not fragile (often fragmenting in squares in *Tortella humilis*), stronger mucro, and somewhat less obvious proximal V of hyaline cells. From *Trichostomum tenuirostre*, it is immediately distinguished in aspect by its somewhat broader leaf apex and less evident extent of differentiated basal cells. Specimens with short-conic mucros and without sporophytes can be assigned at least tentatively to this species on the rationale that the similar but autoicous *Trichostomum planifolium* commonly has sporophytes or at least antheridial buds, and the dioicous *Weissia inoperculata* is extremely rare and possibly introduced. The leaf apex is commonly reflexed, but occasionally slightly cucullate as in *Trichostomum crispulum*. Although the excurrent costa usually ends in a short-conic apiculus, it can approach (for example, in Tennessee, Norris 17134, MO) in robust specimens the narrowly tapering short awn of robust South American collections.

2. *Trichostomum planifolium* (Dixon) R. H. Zander,
Bull. Buffalo Soc. Nat. Sci. 32: 92. 1993 [F]



Weissia planifolia Dixon, Rev. Bryol. 55: 179, fig. 1. 1928;
Trichostomum perligulatum (H. A. Crum) R. H. Zander; *W. perligulata* H. A. Crum; *W. sweetii* E. B. Bartram

Stem rounded-pentagonal in section. **Leaves** flattened, ovate to elliptical, distal margins plane or weakly erect or rarely broadly involute, entire, not bordered; apex rounded or rounded-acute, plane to weakly concave, keeled or cucullate; basal cells evenly differentiated across leaf base or as a U, only weakly running up margins if at all, not distinctly enlarged submarginally; distal laminal cells pluripapillose with low papillae; mucro short-conic, of 3–4 cells. **Sexual condition** autoicous. **Peristome teeth** absent to short-lanceolate.

Soil, margins of boulders, rock crevices; moderate elevations; Calif., Colo., Nev., N.Mex.; Mexico; e Asia (China, Japan).

Trichostomum planifolium was synonymized with *T. crispulum* by A. Stoneburner (1985) and Stoneburner and R. Wyatt (1985), but is retained here because it is monoicous. The leaf margins are sometimes inflexed distally, as in *Weissia*, and it was synonymized with

Weissia perligulata by L. R. Stark (1996), the type of which has weakly inflexed or laxly involute distal leaf margins. The costa of *T. planifolium* and the similar *T. brachydontium* is quite thick and protrudes strongly abaxially. The gametophyte of *Trichostomum planifolium* is essentially that of *T. brachydontium*. It differs from *Weissia inoperculata* in having a slightly shorter apiculus, in addition to the stegocarpic capsule. Some plants of the type of *W. perligulata* (= *T. planifolium*) have comparatively very wide leaves with costa ending below the broadly rounded apex, yet other plants have leaves with costae that are percurrent or shortly excurrent from an obtuse or rounded acute apex, and in all leaves the papillae are large and short-spiculose, though not as salient as those of specimens assigned to *W. andersoniana* (= *W. ligulifolia*); S. Flowers (1973) suspected that *W. ligulifolia* and *W. perligulata* are synonymous, but found sexual differences between them on the basis of a few specimens; here the former is distinguished by the strongly involute distal laminal margins and distal lamina ca. 12–18 cells across on one side of the costa just above mid leaf versus margins plane or weakly incurved to laxly inflexed, and lateral lamina 25–30 cells across for *T. planifolium*.

3. *Trichostomum tenuirostre* (Hooker & Taylor)
Lindberg, Öfvers. Kongl. Vetensk.-Akad. Förh. 21: 225.
1864



Weissia tenuirostris Hooker & Taylor, Muscol. Brit. ed. 2, 83. 1827; *Oxystegus tenuirostris* (Hooker & Taylor) A. Smith

Stem rounded-pentagonal in section. **Leaves** flattened, lanceolate, distal margins plane, entire or weakly toothed, not bordered; apex acute, plane or keeled; basal cells differentiated across leaf base as a U or V, commonly running up margins, not distinctly enlarged submarginally; distal laminal cells pluripapillose with low papillae; mucro conic, of 3–6 cells. **Sexual condition** dioicous. **Peristome teeth** bluntly lanceolate.

Varieties 2 (2 in the flora): widely distributed in temperate and high-elevation tropical areas of the world, ranging into the Arctic.

1. Gemmae absent
 - 3a. *Trichostomum tenuirostre* var. *tenuirostre*
1. Multicellular gemmae on rhizoids from adaxial surface of the costa or in soil
 - 3b. *Trichostomum tenuirostre* var. *gemmaiparum*