The key to the liverwort genera in the Russian Far East

1. Plants thallose, sometimes with regular leaf-like outgrowths along margin … **2**

1. Plants leafy … **38**

2. Leaf-like outgrowths along thallus margin present (sometimes not consistently so) … **3**

2. Plants completely without leaf-like outgrowths along margin … **4**

3. Plants with leaf-like outgrowths on thallus edge only, special caves filled with cyanobacteria (*Nostoc*) present, whitish oil cells are absent … ***Blasia***

3. Plants with two types of outgrowths: dorsal, inserted by incurved line and lateral, no special cavities in the thallus filled with cyanobacteria (*Nostoc*), whitish oil cells are present … ***Apotreubia*** link1

4. Thallus simple, without differentiation for epidermis with variously organized pores, air chambers (aerenchyma) and ventral tissue … **5**

4. Thallus with tissue differentiation obvious, epidermal pores present, aerenchyma present, although sometimes ill-developed … **18**

5. Thallus with distinct costa along midline and thin wings …**6**

5. Plants with middle part of thallus gradually become thinner to the margins … **9**

6. Thallus wings unistratose starting from the costa … **7**

6. Thallus wings unistratose only near margins (less 1/4 of wing width) … **8**

7. Dorsal thallus surface densely hairy … ***Apometzgeria*** link1

7. Dorsal thallus surface smooth … ***Metzgeria*** link1

8. Costa in the cross section with two (sometimes highly unclear) central stands … ***Hattorianthus***[1] (=*Cordaea* auct.) link1

8. Costa in the cross section with one always distinct central stand … ***Pallavicinia*** link1

9. Plants with distinct purplish colored laciniate scales on dorsal side of sterile thalli, obvious at least in the apical part of the thallus … ***Calycularia*** link1

9. Plants without such scales in sterile shoot … **10**

10. Gynoecia and androecia on short lateral branches, plants with unistratose margin (0–)1–2(–6) cells wide … **11**

10. Gynoecia on dorsal side of the thallus, unistratose margin 5–10 and more cells wide … 12

11. Plants easily pinnately to palmately branched, thallus margin nearly straight, thallus main axis mostly less 2 mm wide … ***Riccardia*** link1

11. Plants hardly and very irregularly branched, thallus margin crispate, thallus main axis more than

[1] *Cordaea*, as it was used by Mamontov et al. (2015), is the later homonym of the name before used for vascular plants, the new combination is therefore required [Mamontov Yu.S., N.A. Konstantinova, A.A. Vilnet & V.A. Bakalin 2015. On the phylogeny and taxonomy of *Pallaviciniales* (Marchantiophyta), with overview of Russian species. Arctoa 24: 98–123.]

(2–)3 mm wide … ***Aneura*** link1

12. Plants with golden brownish rhizoids, pseudoperianth barrel-shaped, pluriplicate, with many scales along its base, androecia protected by crispate to shortly dentate scales … ***Moerckia*** link1

12. Plants with grayish to brownish rhizoids, pseudoperianth hood-shaped or in the form of nearly smooth cone opened in the apical part, without scales in the base, androecia as the group of small cones with caves in the apical part, without scales around … ***Pellia***

13–17. Couplets – lacking

18. Pores barrel-shaped, with two layers of opening cells one above other … **19**

18. Pores simple, with one layer of opening cells … **21**

19. Thallus with cup-shaped gemmae receptacles, ventral scales in 2–3(–4) rows in each side, thus total in 4–6(–8) rows (if 2 rows in each side then plants glaucous, with green to brownish colored thallus margin) … ***Marchantia*** link1

19. Thallus without gemmae receptacles, ventral scales in 1 row in each side (thus total 2 rows), thallus edge commonly purple … **20**

20. Air chambers commonly visible from dorsal side (thallus looks reticulate), in one layer, with chlorophyllose filaments, ventral tissue with sclerenchyma cells present … ***Preissia***[2]

20. Air chambers commonly only obscure imaginable from dorsal side (therefore thallus does not look reticulate), in 1–2 layers, without chlorophyllose filaments, no sclerenchyma cells in ventral tissue … ***Bucegia***[3] link1

21. Mature sporangia on ventral side of the thallus, with massive bivalved involucre, habitat always meso-xerophitic to xerophytic … ***Targionia***

21. Mature sporangia on specialized receptacles or immersed to the thallus and then visible from dorsal side as small brown-blackish bolls, or plants of clearly hydrophytic ecology (then commonly without sporophytes) … **22**

22. Mature sporangia immersed to the thallus or absent (in plants of hydrophytic ecology, when never with purple scales) … **23**

22. Mature sporangia on specialized receptacles on dorsal side of the thallus, plants of meso- and xerophytic ecology (with only *Conocephalum* sometimes occupying hygrophytic habitats, and then characterized by purplish to purple ventral scales) …**24**

23. Plants with branches much longer than wide, ventral scales distinctly wider than long, commonly poorly developed, rarely going beyond thallus margin in xeric habitats, never so in hygrophytic habitat … ***Riccia*** link1 link2

23. Plants with short branches, looks as truncate triangles flowing in the water, with long, going

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[2] Some recent molecular-phylogenetic topologies unite *Bucegia* and *Preissia* under *Marchantia*, but we follow to more traditional concept, not only due to the tradition by itself, but rather that the topology obtained by Willareal et al., 2015, on that this decision was based, may also imply that the genus *Marchantia* in its traditional sense should be split into two separate genera, and then *Bucegia* and *Preissia* would be also maintained [Villarreal J.C., B.J. Crandall-Stotler, M.L. Hollingsworth, D.G. Long, L.L. Forrest 2015. Divergence times and the evolution of morphological complexity in an early land plant lineage (Marchantiopsida) with a slow molecular rate. New Phytol. 209(4): 1734–1746. doi: 10.1111/nph.13716.]

[3] The same as footnote 2.

far beyond the thallus margin ventral scales, rarely occurs on the ground where the water pool was dried up, then in any way with long, lanceolate, dentate along margin ventral scales … ***Ricciocarpos*** link1

24. Ventral scales with one semicircular appendage (suddenly constricted to the base and with rounded apex) … **25**

24. Ventral scales with 1–3 triangular to lanceolate, spathulate appendages (sometimes suddenly constricted near base, but then with acute apex) …**26**

25. Plants small 3-5 mm wide, yellowish, or larger, 5–20 mm wide, deep green to bluish green, commonly with well visible air chambers limits if to look to dorsal side (dorsal surface looks reticulate), not or slightly glistening [widely distributed taxa] … ***Conocephalum*** link1

25. Plants 7–20 mm wide, with not or very poorly visible air chambers limits, if to look to dorsal side, yellowish green, glistening (dorsal surface does not look reticulate) [rarity in southernmost Kurils] … ***Wiesnerella*** link1

26. Pseudoperianth present or absent, carpocephalum spherical to conical, rarely disc-shaped (then pseudoperianth present, with connate lobes), not or only slightly dissected … **27**

26. Pseudoperianth absent, carpocephalum plane to shortly conical, strongly dissected (looks stellate) … **29**

27. Pseudoperianth absent … ***Mannia*** link1 link2 link3

27. Pseudoperianth well developed, with lobes sometimes connate at the maturity … **28**

28. Pseudoperianth lobes connate at the maturity, carpocephalum conical to disc-shaped, spores proximally trilete … ***Asterella*** link1

28. Pseodoperiannth lobes not or very loosely connate at the maturity, carpocephalum spherical, spores proximally alete (=without ridges) … ***Mannia*** (*M. gracilis*)

29. Carpocephala dorsal on the thallus (do not stop further growth of the axis), carpocephalum stalk without rhizoid furrow … **30**

29. Carpocephala terminal (stop further growth of the axis), carpocephalum stalk with 1–2 rhizoid furrows … **31**

30. Ventral scales with one appendage, colorless to purplish, rarely purple, without oil cells, androecia diffuse … ***Clevea*** link1

30. Ventral scales with 1–3 appendages, mostly purple to purple-red, androecia in well-defined clusters … ***Plagiochasma*** link1

31. Pores with radial cell walls subequally thickened, looks as rays spreading from the center, ventral scales with 1–2 filiform appendages (2–3(–4) cells wide in the base), carpocephalum with 1 rhizoid furrow) … ***Reboulia***

31. Pores with radial cell walls thin throughout or unequally thickened that looks stellate (with large trigones in the corned closer to the opening), ventral scales colorless (then carpocephalum with one rhizoid furrow) to purplish and purple (then with two rhizoid furrows), appendages triangular to spathulate, more 4–5 cells wide in the base … **32**

32. Ventral scales and thallus margin commonly purplish to purple, carpocephalum stalk with 2 rhizoid furrows, androecia closely aggregated in well-defined disc … ***Peltolepis*** link1

32. Plants greenish whitish, without purplish pigmentation, carpocephalum stalk with 1 rhizoid furrow, androecia diffuse … ***Sauteria*** link1 link2

33–37. Couplets – lacking

38. Leaves incubous (if leaves conduplicate, the larger lobe is incubous) … **39**

38. Leaves transverse or succubous (if leaves conduplicate, the larger lobe is succubous) … **69**

39. Leaves not conduplicate, ventral lobe not strikingly different in shape … **40**

39. Leaves conduplicate or, at least, with definitely different in shape ventral lobe … **52**

40. Leaves with cilia along margin … ***Ptilidium*** link1

40. Leaves without cilia along margin … **41**

41. Leaves 3–4-lobed … **42**

41. Leaves unlobed or shortly incised and then shortly bilobed … **44**

42. Leaves lobed less 1/4 of the leaf length … ***Bazzania*** link1

42. Leaves lobed for 2/5–1/2 and more of the length … **43**

43. Plants small, less 0.5 mm wide, stem less 100 μm in diameter, leaves almost transversely inserted (although distinctly incubously oriented), lobed almost to the base and leaf lobes only 2–3 cells wide … ***Kurzia***

43. Plants larger, wider 0.5 mm wide, stem wider 150 μm wide, leaves incubously obliquely inserted, lobed for 1/2–3/5 of the leaf length, lobes wider 4 cells wide in the base … ***Lepidozia*** link1

44. Plants translucent, whitish, with the midleaf cells commonly wider 30–35 μm … ***Calypogeia*** link1

44. Plants deep green to yellowish and brownish green and green-brown, midleaf cells commonly less 30 μm wide … **45**

45. Underleaves wider than long, only shortly bilobed, with rounded lobes or unlobed with rounded to truncate apex, leaves rounded to obtuse and shortly bilobed … ***Metacalypogeia*** (*M. cordifolia*)

45. Underleaves bilobed for 1/2 of its length or shortly 2–3 lobed, then longer than wide, leaves or leaf lobes acute … **46**

46. Arctic or arctic-alpine plants of Ca-rich substrata, underleaves bilobed for 1/2 of the length … ***Eocalypogeia***

46. Boreal to temperate plants of acidic to neutral substrata, underleaves crispate or shortly 2–3-lobed … ***Bazzania*** (p.p.) link1

47–51. Couplets – lacking

52. Well developed ventral (or middle, if stylus present) lobe galeate or pyxidate, distinctly separated from dorsal lobe … **53**

52. Well developed ventral lobe lingulate, ovate, lanceolate, triangular or transformed to water sac, connate with other part of the leaf for a great extent, never galeate or pyxidate … **55**

53. Dorsal lobe with entire margin, lobe apex rounded to acute (then lobe with linear or scattered ocelli) … ***Frullania*** link1 link2

53. Dorsal lobe with ciliate to sharply dentate margin, lobe apex rounded to acute, never with ocelli …**54**

54. Ventral lobe strongly caducous, plants less 0.5 mm wide, oil bodies 7–12 per cell, homogenous … ***Neohattoria*** link1

54. Ventral lobe not caducous, plants wider 1 mm wide, oil bodies 3–5 per cell, commonly biconcentric … ***Jubula*** link1

55. Dorsal lobe with ciliate to sharply dentate margin … **56**

55. Dorsal lobe with entire margin … **59**

56. Underleaves absent, each cell in dorsal lobe middle commonly have one large papilla above the lumen … ***Cololejeunea*** (p.p.) link1 link2

56. Underleaves present, no large papilla in dorsal lobe surface … **57**

57. Leaves not conduplicate, 3–4-lobed, with ventral lobe completely transformed to the water sac … ***Trichocoleopsis*** link1

57. Leaves conduplicate, bilobed, ventral lobe appressed to the dorsal lobe, to narrowly spreading, not transformed to the water sac … **58**

58. Ventral lobe connate with dorsal lobe for 2/3 of its length, dorsal lobe with 1-several cilia with 3–8 uniserite cells … ***Nipponolejeuenea*** link1

58. Ventral lobe highly separated from dorsal lobe, connate for less 1/4 of its length, lobe margin dentate, never with uniseriate ends more than 3 cells … ***Porella*** (p.p.) link1

59. Underleaves absent … **60**

59. Underleaves present … **61**

60. Plants smaller 1 mm wide, whitish greenish, oil bodies more 4–5 per cell, perianth 4–5-keeled suddenly contracted to the somewhat beaked mouth … ***Cololejeunea*** (*C. japonica*) link1 link2

60. Plants wider 2 mm wide, green to brownish green, oil bodies 1(–2) per dorsal lobe middle cell, perianth strongly dorsiventrally compressed … ***Radula***

61. Ventral lobe highly separated from dorsal lobe, connate less 1/4–1/5 of the length … ***Porella*** (p.p.) link1

61. Ventral lobe widely attached (more than 2/3 of its length) to the dorsal lobe … **62**

62. Underleaves unlobed … ***Acrolejeunea*** link1

62. Underleaves bilobed for 1/3–2/3 of the length … **63**

63. The second tooth of ventral lobe much larger than the first one, oil bodies in dorsal lobe middle (1–)2–4 per cell, filling cell lumen … ***Cheilolejeunea*** link1 link2

63. The second tooth of ventral lobe reduced, much smaller than the first one, oil bodies in dorsal lobe middle 5–30 per cell, hardly filling cell lumen … ***Lejeunea*** link1 link2 link3

64–68. Couplets – lacking

69. Leaves unlobed, although sometimes loosely emarginate, then with rounded 'lobes' … **70**

69. Leaves lobed, with distinct, although sometimes short, lobes, commonly with obtuse to acute apices or reduced to cilia … **102**

70. Plants thallose, but with leaf-like outgrowths along thallus margin … ***Blasia***

70. Plants with well developed leaves and stem … **71**

71. Leaves opposite … ***Arnellia***

71. Leaves alternate … **72**

72. Rhizoids originating from the area adjacent to the underleaf bases, other part of ventral side or stem free of rhizoids … **73**

72. Rhizoids distributed along ventral side of stem, although sometimes more dense near underleaf bases, or rhizoids virtually absent … **75**

73. Leaves emarginate, underleaves at least 1.5 times wider than stem (sometimes evident only if underleaf is flattened in the slide), not connate with leaves … ***Lophocolea***

73. Leaves with rounded to truncate apex, underleaves narrower than stem (0.5–0.8 of stem width) or wider than stem but then distinctly connate with one or two lateral leaves … **74**

74. Underleaves less 0.8 of stem width, not connate with leaves … ***Chiloscyphus***

74. Underleaves distinctly wider than stem, commonly connate with one or both lateral leaves … ***Heteroscyphus*** (*H. planus*) link1

75. Underleaves regular, persistent, although sometimes hidden in rhizoids … **76**

75. Underleaves absent or highly irregular and easily caducous … **80**

76. Plants of cephalozioid appearance – translucent, with thin-walled and larger than inward outer layer of stem cells (the feature evident in the stem cross section), leaf cells with vestigial to virtually absent trigones, perigynium virtually absent [southern Kurils] … ***Alobiellopsis***

76. Plants not translucent, outer cells in stem cross section similar in size to inner cells, smaller, or slightly larger, with thickened walls or hialodermis distinct (*Nardia compressa*, purple red plants with distinct trigones in leaf cells), leaf cells with distinct trigones in leaf cells, or trigones undistinct but then oil bodies 1–3 per cell and perigynium distinct (*Nardia geoscyphus*, *N. breidlerii*) …**77**

77. Midelaf cells 40–50 μm wide … ***Mylia*** link1

77. Midleaf cells less 30–35 μm wide … **78**

78. Midleaf cells collenchymatous, trigones large, bulging, sometimes with visible middle lamina, or trigones moderate in size, but then cuticle distinctly verrucose, underleaves spathulate, as wide as long, sometimes reduced to 1–3 slime papillae, perigynium absent, gynoecia on short braches … ***Odontoschisma*** link1

78. Midleaf cells with concave trigones or trigones convex, underleaves subulate to lanceolate, distinctly longer than wide, with acute apex, or underleaf apex obtuse to rounded, but then perigynium well developed and gynoecia are on the main axis … **79**

79. Gynoecia on main axis, perigynium well developed, but never subterranean, oil bodies 1–4 per midleaf cells, underleaves subulate and short or longer, to 2/3–3/4 of leaf length, but then with

somewhat rounded apex, never with additional subapical teeth … ***Nardia*** link1 link2 link3

79. Gynoecia on short ventral branches, with large subterranean perigynium, oil bodies more 5 per midleaf cell, underleaves large, lanceolate, to 2/3 of leaf length, with acute apex and common additional subapical teeth … ***Harpanthus***

80. Plants with plane to somewhat convex leaves in well developed shoots … **81**

80. Plants with distinctly concave to cupped leaves … **87**

81. Midleaf cells wider 40–50 µm, with prominently convex trigones … ***Mylia*** (p.p.) link1

81. Midleaf cells smaller 30 µm wide, or to 40–50 µm wide but then trigones concave … **82**

82. Plants generally whitish greenish, although apical part of leaves may be purple-violet colored, gemmae on attenuate shoot tips, discoid, multicellular, cuticle smooth to papillose … ***Xenochila***

82. Plants green to green-brown and somewhat rusty red, not whitish greenish, gemmae, if present, on attenuate shoot tips, 1–2-celled … **83**

83. Gemmae commonly present on attenuate shoot tips, perianth tubular, smooth, with truncate, somewhat depressed apex, with beaked mouth … ***Liochlaena***

83. Gemmae absent, perianth tubular, plicate and gradually narrowed to the not beaked mouth or laterally compressed and smooth … **84**

84. Perianth laterally compressed, leaf insertion line subhorizontal dorsally, subtransverse in lateral part and then subhorizontal ventrally … **85**

84. Perianth tubular, leaf insertion line oblique, nearly straight or subtransverse dorsally and laterally and then subhorizontal ventrally … **86**

85. Leaves, female bracts and perianth mouth entire, rhizoids mostly abundant … ***Pedinophyllum***

85. Leaves dentate to nearly entire, female bracts and perianth mouth distinctly dentate to ciliate, rhizoids mostly very sparse … ***Plagiochila*** link1

86. Mesophytic to meso-xerophytic plants, in various habitats, but never over *Sphagnum*, gynoecia with innermost bracts highly laciniate … ***Jamesoniella*** (= *Syzygiella*) link1

86. Meso-hygrophytic plants over *Sphagnum*, female innermost bracts crispate … ***Biantheridion***

87. Midleaf cells wider 40–50 µm wide, trigones large and strongly convex … ***Mylia*** (p.p.) link1

87. Midleaf cells less 30 µm wide or to 40 µm wide, but then trigones concave, small … **88**

88. Midleaf cells strongly collenchymatous, with large trigones and sometimes visible median lamina or with moderate in size trigones, but then with strongly verrucose cuticle, underleaves reduced, but present, at least as 1-several slime papillae, gynoecia on short ventral branches … ***Odontoschisma*** link1

88. Midleaf cells collenchymatous or not, middle lamina never visible, trigones vestigial to large, underleaves totally absent or irregular, lanceolate, near shoot apices, gynoecia on main axis … **89**

89. Plants with strongly concave to cupped, imbricate leaves, perianth absent, female bracts with not recurved margin … ***Cryptocoleopsis***

89. Plants with contiguous to subimbricate leaves, perianth present, well developed, or reduced

and hidden within bracts, but then with well developed perigynium or female bracts with recurved margin …**90**

90. Stem cross section with outer cells distinctly larger than inner cells, occasional lanceolate underleaves at least sporadically present (in well developed plants underleaves are rather regular), perianth triplicate, plants translucent … ***Alobiellopsis***

90. Stem cross section without prominently large and thin-walled cells in outer layer, underleaves absent, perianth 3–5-pluriplicate, plants translucent or not … **91**

91. Perianth reduced and hidden within bracts, perigynium absent, female bracts laterally appressed, with margins recurved, brownish to brown and yellowish brown plants … ***Cryptocolea***

91. Perianth well developed and exerted or somewhat reduced, but then perigynium well developed, female bracts not laterally appressed, with margin plane or somewhat recurved, plants variously colored … **92**

92. Plants with common endogenous gemmae that also filling unfertilized perianths, oil bodies 1 per cell, large, perigynium absent, perianth 4-5-keeled … ***Endogemma*** link1 link2

92. Gemmae totally absent, oil bodies 2 and more per cell, perigynium absent or present, perianth 3-pluriplicate … **93**

93. Leaves strongly concave, lacerating when flattened in the slide, commonly emarginate in apex, midleaf cells thick-walled … ***Marsupella*** (*M. arctica*) link1

93. Leaves concave, but not too strongly, not lacerating when flattened in the slide, with rounded, not or only slightly emarginate apex, midleaf cells thin-walled … **94**

94. Perianth mostly fusiform, nearly smooth, with the exception of upper 1/4, where pluriplicate and gradually narrowed to the not beaked mouth, 3–4-stratose in lover half and 2-stratose above, where composed by subisodiametric cells, perigynium absent … ***Jungermannia*** link1 link2

94. Perianth obovate to conical, 3-pluriplicate, 1–2-stratose in lower half, 1-stratose above, perigynium absent or present … **95**

95 Basically whitish and soft plants, although with sometimes reddish brownish to blackish and violet colored apical part of shoots, perigynium absent or less 1/3 of perianth length, perianth 3–4-plicate … ***Metasolenostoma***[4] link1

95. Plants merely rigid, basically not or rarely whitish, never with blackish or violet coloration, but commonly with reddish brownish to red-brown, olive-green and purple green coloration, perigynium absent to well developed, perianth 3-pluriplicate … **96**

96. Perigynium invariable present, commonly similar length with perianth or to 1/5 of its length, perianth conical, pluriplicate … ***Plectocolea*** link1

96. Perigynium absent to very short or, contrary, well developed, twice as high as the perianth (subg. *Eucalyx*) … ***Solenostoma*** link1 link2 link3

97–101. Couplets – lacking

[4] The distinction between *Metasolenostoma*, *Plectocolea* and *Solenostoma* may be not reliable from the present key; the general key to all taxa of this still poorly understood group should be used (using provided links).

102. Leaves predominantly 3–4(–5)-lobed … **103**

102. Leaves predominantly bilobed … **128**

103. Plants from rhizomatous base, shortly and unstable (2–)3–4-lobed, subisophyllous, rhizoids absent … ***Haplomitrium***

103. Plants not from rhizomatous base, distinctly 3–4-lobed, isophyllous to anisophyllous, rhizoids present (although sometimes quite sparse) … **104**

104. Leaves divided to the base with each lobe represent cilia of several superposed cells … ***Blepharostoma***

104. Leaves divided not more than 3/4 of the length, rarely slightly deeper, lobes never as cilia composed by several superposed cells … **105**

105. Leaves divided into 3–4 short lobes those subdivided into lobules and then to numerous cilia that the leaf lamina hardly visible … ***Trichocolea*** link1

105. Leaves never with subdivided lobes and numerous cilia that hide the lobes … **106**

106. Leaves subtransversely to transversely inserted and oriented … **107**

106. Leaves distinctly obliquely inserted and oriented … **116**

107. Leaves distinctly 4-lobed, with lobes equal in size or nearly so … **108**

107. Leaves 3-lobed or with four lobes but then lobes are distinctly unequal … **110**

108. Leaves bisbifid, with middle sinus deeper than other, plants prostrate to ascending, oil bodies in leaf cells absent or as oil drops … ***Pseudolepicolea***

108. Leaves tetrafafid with sinuses of nearly equal depth, plants mostly erect, oil bodies 3–10 per cell, distinct … **109**

109. Hygrophyte, underleaves less 1/2 of leaf length, basiphilous … ***Schljakovianthus***

109. Xerophyte, underleaves 2/3 of leaf length, acidophilous … ***Tetralophozia*** link1 link2

110. Underleaves always distinct, leaves 3–4-lobed … **111**

110. Underleaves absent, leaves 3-lobed … **113**

111. Plants well developed, with distinctly unequal lobes (dorsal larger) [southern element of the southern flank of the area] … ***Plicanthus***

111. Plants ill-developed (well developed phases keyed in other section), lobes subequal, arctic-alpine element, in high mountains or northern latitudes … **112**

112. Hygrophyte, underleaves less 1/2 of leaf length, basiphilous … ***Schljakovianthus***

112. Xerophyte, underleaves commonly to 2/3 of leaf length, acidophilous … ***Tetralophozia*** link1 link2

113. Leaf lobes strongly unequal, with ventral pair of lobes only shortly divided (sometimes leaves bilobed with ventral lobe much larger than dorsal one) … ***Tritomaria***

113. Leaf lobes subequal … **114**

114. Leaves spreading from the base, cells in the base only shortly oblong, less than 1.5 as long as

wide … ***Neoorthocaulis***

114. Leaves distinctly sheathing the stem in the base, cells in leaf base oblong, commonly twice as wide as long … **115**

115. Leaf cells strongly collenchymatic, with large and convex trigones, gemmae absent or, if present, ellipsoidal, colorless to yellowish … ***Saccobasis***

115. Leaf cells not strongly collenchymatic, trigones moderate to small, concave to only slightly convex, gemmae invariable present, red to purple-red and rusty … ***Tritomaria***

116. Rhizoids deep purple, brown-purple to violet, rigid, leaf-like lamina only shortly and irregularly divided … ***Fossombronia*** link1

116. Rhizoids colorless to brownish, rarely purplish at very near to the area of origin, if ventral side of stem purple-brown, soft, leaves distinctly and regularly lobed … **117**

117. Underleaves distinct, persistent, regular … ***Neoorthocaulis*** (p.p.)

117. Undeleaves absent, or highly irregular, hardly visible, easily deciduous ... **118**

118. Plants deep green to brownish green and brown … **119**

118. Plants whitish, translucent, soft … **121**

119. Well developed leaves 4-lobed … ***Barbilophozia***

119. Leaves more or less fixedly 3-lobed, never 4-lobed … **120**

120. Leaf lobes subequal … ***Neoorthocaulis*** (p.p.)

120. Leaf lobes unequal … ***Trilophozia***

121. Strongly calciphilous mesophyte with invariable present red to rusty red gemmae … ***Pseudotritomatia***

121. Acidophilous, gemmae rarely present, green to colorless … **122**

122. Gemmae ellipsoidal, leaves distant, 2–3-lobed and stem ventral side purple-red to violet-purple or leaves contiguous and then ventral side of stem brownish to colorless … ***Heterogemma*** link1

122. Gemmae angular, leaves 2–4-lobed, leaves contiguous, ventral side of stem purple-brown, purple violet and blackish to greenish and brownish … ***Schistochilopsis*** link1

123–127. Couplets – lacking

128. Underleaves absent or highly irregular or very small, hardly visible and early deciduous … **129**

128. Underleaves distinct (1/3–2/3 of leaf length), regular and persistent … **178**

129. Plants worm-shaped with very densely imbricate leaves … **130**

129. Plants not worm-shaped, leaves rather spreading (at least at the shoot apices), never densely imbricate … **133**

130. Plants with obliquely inserted leaves, commonly incrusted by soil … **131**

130. Plants with transversely inserted leaves, erect to ascending, commonly not incrusted by soil … **132**

131. Plants with well developed perianth, oil bodies present in all, or nearly so leaf cells, gemmae commonly present … ***Isopaches*** (p.p.)

131. Perianth absent or rudimentary (hidden within bracts), oil bodies present in some leaf cells only, gemmae absent … ***Prasanthus***

132. Rudimentary, but distinct perianth present … ***Marsupella*** (p.p.) link1

132. Perianth absent, leaf margin commonly discolored … ***Gymnomitrion*** (p.p.) link1 link2

133. Leaves transversely to subtransversely inserted … **134**

133. Leaves obliquely to subhorizontally inserted … **151**

134. Leaves conduplicate, commonly with well developed keel … **135**

134. Leaves not conduplicate, although commonly canaliculate, keel absent … **139**

135. Perigynium well developed, perianth reduced, oil bodies 2–3 per midleaf cell … ***Marsupella*** (*M. pseudofunckii*, *M. alata*) link1

135. Perigynium absent, perianth well developed, oil bodies 4–8 and more per midleaf cell … **136**

136. Gemmae ellisoidal, perianth dorsiventrally compressed, leaf keel well developed, commonly pluristratose … ***Scapania*** link1

136. Gemmae angular, perianth nearly tubular, pluriplicate, leaf keel weak, unistratose …**137**

137. Leaves spreading from the base, keel well developed … ***Scapania*** (p.p.) link1 link2

137. Leaves sheathing the stem in the base, leaf keel weak … **138**

138. Plants 3–5 mm wide, leaves with rounded lobes, never with vitta … ***Douinia*** link1

138. Plants 0.7–3.5 mm wide, with commonly acute lobes (if lobes with rounded apex then smaller 1.5 mm wide and/or with developed vitta) … ***Diplophyllum*** link1

139. Plants small in size (*Cephaloziella*-like), less 0.5 mm wide, with distanced leaves, bilobed for 1/2–3/4 of the length … **140**

139. Plants mostly wider 0.5 mm wide, leaves contiguous to subimbricate, bilobed less 2/5 of the leaf length … **143**

140. Underleaves occasionally present in sterile branches, perianth apical part not discolored, plant brownish, leaf lobes commonly squarrose … **141**

140. Perianth with discolored apical part, plants greenish to reddish and purplish, rarely brownish, leaf lobes not squarrose … **142**

141. Plants brownish, leaf lobes distinctly squarrose, leaf surface strongly papillose, underleaves absent in weak shoots only, but present in well developed plants, ocelli absent in the leaf base, oro-boreal … ***Sphenolobopsis***

141. Plants brown blackish, leaf lobes hardly squarrose, underleaves totally absent, ocelli present in basal cells of the leaf, arctic-alpine … ***Eremonotus*** link1

142. Female bracts commonly dentate, for 1/3–1/2 of the length connate … ***Cephaloziella*** link1

142. Female bracts entire to crispate, for 3/4 of the length connate … ***Dichiton***

143. Plants smaller 0.8–1.0 mm wide, erect, with almost always developed angular gemmae … **144**

143. Plants commonly wider 1 mm wide, creeping to erect, gemmae angular to ellipsoidal … **146**

144. Plants of hygrophytic ecology, from rhizomatous base, leaves commonly imbricate, underleaves hardly perceptible, but present in the vast majority of plants, leaves divided for 1/4–1/3 of the length, gemmae commonly absent … ***Cladopodiella*** (*C. francisci*)

144. Plants of mesophytic to meso-xerophytic ecology, not from rhizomatous base, underleaves absent, leaves divided for 2/5 of the length, rarely deeper, gemmae always present ... **145**

145. Obligate epixylous taxon, with red unicellular gemmae, each with 3–6 and merely quickly disintegrating oil bodies … ***Crossocalyx***

145. Obligate basiphilous taxon on fine soil, with rusty to brown 1–2-celled gemmae with 1–2 large, long-persistent oil bodies, each with central eye … ***Oleolophozia***

146. Plants from prostrate base, where with obliquely inserted leaves and distinct differentiation of microcellous layer in the stem cross section, leaves with commonly recurved lobe apices, gemmae always developed on not or scarcely reduced lobe apices, greenish to whitish, brownish and reddish, angular … **147**

146. Plants, even if from prostrate base with subtransversely to transversely inserted leaves, without differentiation of microcellous layer in stem cross section, leaves with not recurved lobes, gemmae sometimes developed, greenish or colorless (then only ellipsoidal), red to purple and rusty brown, ellipsoidal to angular, on modified (short) lobes … **148**

147. Gemmae colorless to greenish … ***Lophozia*** (p.p.) link1 link2 link3 link4 link5

147. Gemmae commonly reddish to rusty-red, rarely greenish, but with at least slight admixture of reddish or brownish gemmae … ***Lophoziopsis*** (*L. longidens*) link1

148. Plants of 'lophozioid' appearance with commonly obliquely oriented leaves, gemmae frequent, ellipsoidal, dorsal lobe commonly smaller than ventral, leaf cell walls mostly thin … ***Scapania*** (*S. obordata*) link1

148. Plants not similar to *Lophozia*, gemmae rare, if present, angular, leaves transversely to subtransversely oriented, lobes subequal, leaf cell wall commonly thickened … **149**

149. Gemmae sometimes present, angular, brown to red-brown and rusty brown, oil bodies more 4 per cell, perianth well developed, rhizoids colorless to brownish … ***Sphenolobus***

149. Gemmae always absent, oil bodies less 3(–4) per cell, perianth absent or strongly reduced, rhizoids colorless to purplish and purple … **150**

150. Perianth absent, rhizoids always colorless, plants never red or purple colored (although commonly rusty colored) … ***Gymnomitrion*** (p.p., mostly subg. *Apomarsupella*) link1 link2 link3

150. Perianth reduced, but distinct, plants sometimes red or purple colored … *Marsupella* (p.p.) link1

151. Leaf ventral lobe with water sac in the lower half, brownish to brown and cupper-red plants on decaying wood … ***Nowellia*** link1

151. Leaves without water sac, plants variously colored, also brownish to brown and cupper-red … **152**

152. Plants with translucent stem and leaves, with outer stem cells commonly wider 25–30 µm wide and larger than inner cells … **153**

152. Plants with not translucent stem, outer cells of the stem narrower 25–30 µm wide, commonly smaller or similar in size with inner cells … **156**

153. Perianth tubular, suddenly contracted to the beaked mouth, underleaves vestigial, subulate, present at least near shoot apices, cuticle loosely (and unclearly so) papillose … ***Mesoptychia*** (p.p.) link1

153. Perianth triplicate, conical, underleaves absent or present solitary, lanceolate, cuticle smooth … **154**

154. Leaves imbricate, rarely contiguous, 2(–3)-lobed, underleaves occasionally present, oil bodies present … ***Schofieldia***

154. Leaves distant to contiguous, fixedly bilobed, underleaves absent in sterile branches, oil bodies absent or as oil drops … **155**

155. The line of free cells (between leaf bases) 1(–2) cell wide, leaves somewhat laterally appressed, divided more than 1/2–2/3 of leaf length … ***Cephalozia*** link1 link2

155. The line of free cells 2 cells wide, leaves commonly laterally spreading, divided for 1/3–1/2 of leaf length, rarely deeper but then leaf lobes only 2 cells wide in the base … ***Fuscocephaloziopsis*** link1

156. Small, subulate (hidden in the rhizoids) underleaves regularly present … **157**

156. Underleaves absent or highly irregular, lanceolate … **165**

157. Plants with leaf lobe apices acute to obtuse, distinctly pointed … **158**

157. Plants with leaf lobe apices rounded … **160**

158. Plants with well developed and curved perigynium, leaf lobes commonly obtuse to rounded, midleaf cells wider 28 µm wide, or, if less, then leaf bistratose in the base, midleaf cells with 2–3 granulate oil bodies per cell, nearly filling cell lumen … ***Nardia*** (p.p.) link1 link2 link3

158. Perigynium absent, leaf lobes commonly acute, midleaf cells commonly less 28 µm wide, oil bodies more 4–5 per midleaf cell, finely papillose to granulate, not filling cell lumen … **159**

159. Plants dioicous, with brown gemmae and fusiform perianth … ***Pseudolophozia*** link1 link2

159. Plants paroicous, gemmae not known, perianth tubular … ***Protolophozia***

160. Plants with subhorizontally inserted, commonly distanced leaves … **161**

160. Plants with obliquely to even subtransversely inserted, contiguous leaves … **163**

161. Oil bodies numerous, more 15–20 per cell, gemmae commonly present, very sparse, greenish to brownish, angular, terminal and ventral branching absent … ***Obtusifolium***

161. Oil bodies less 10 per cell, gemmae absent, terminal and ventral branching commonly occur … **162**

162. Ventral branching common, underleaves regular, sterile and strongly inflated, easily caducous perianths absent … ***Cladopodiella*** (*C. fluitans*)

162. Ventral branching absent, underleaves irregular, sterile and strongly inflated, easily caducous

perianths commonly present … ***Gymnocolea***

163. Perigynium curved, large, gemmae absent, caducous inflated perianths absent, midleaf cells with convex trigones or trigones small, but then leaf bistratose near base, oil bodies large, 2–3 per cell, filling cell lumen … ***Nardia*** (p.p.) link1 link2 link3

163. Perigynium absent, gemmae absent or present, caducous perianth absent or present, trigones concave, oil bodies more 5–6 per cell, not filing cell lumen … **164**

164. Ventral branching common, plants from rhizomatous base, commonly whitish in basal part of shoot, underleaves merely regular, leaves obliquely to subtransversely inserted, sterile and strongly inflated, easily caducous, inflated and sterile perianths absent … ***Cladopodiella*** (*C. francisci*)

164. Ventral branching absent, underleaves irregular, sterile and strongly inflated, easily caducous inflated perianths commonly present, plants without rhizomatous base … ***Gymnocolea***

165. Rhizoids purple to purplish, perigynium well developed … ***Solenostoma*** (*S. bilobum*) link1

165. Rhizoids colorless to grayish, perigynium absent … **166**

166. Small, *Cephaloziella*-like plants less 200 μm wide … ***Cylindrocolea*** (*C. kiaerii*)

166. Plants wider 1 mm wide, not *Cephaloziella*-like … **167**

167. Plants soft, fleshy, leaves unfixedly bilobed to 3–4 lobed, gemmae colorless to greenish, stem cross section distinctly transversely elliptic with 1.5–2.0 times as wide as high … **168**

167. Plants mostly rigid, more or less fixedly bilobed, stem cross section 1.0–1.2 times as wide as high … **169**

168. Gemmae ellipsoidal, secondary pigmentation (purple-black colored ventral side) present in plants with 2–3-lobed highly distanced leaves, not present in plants with 3–4-lobed contiguous leaves … ***Heterogemma*** link1

168. Gemmae angular, secondary pigmentation (purple-black colored ventral side of the stem) present in plants with 3-4-lobed leaves … ***Schistochilopsis*** link1

169. Plants basically thallose, with two types of outgrowths: dorsal and lateral not or loosely connate 'lobes' … ***Apotreubia***

169. Plants distinctly leafy with leaves bilobed less 2/5 of the length … **170**

170. Leaves commonly distant, with lobes rounded, terminal branching of *Frullania*-type commonly occurs, sterile obovate and inflate perianths with beaked mouth commonly occurs … ***Gymnocolea***

170. Leaves commonly contiguous, lobes acute to obtuse (never rounded), terminal branching of *Frullania*-type absent, sterile perianth not occurring … **171**

171. Microcellous layer in the ventral side of stem absent, female bracts commonly dentate, gemmae always brown to orange-brown, midleaf cells commonly less 25 μm wide, oil bodies granulate, spherical … ***Isopaches*** (p.p.)

171. Microcellous layer in the ventral side of stem present, female bracts entire (if dentate – gemmae purple), gemmae from colorless and greenish to brownish, brown, red and purple, midleaf cells commonly wider 25 μm wide (if narrower, oil bodies very finely papillose, oblong) …

172

172. Midleaf cells commonly less 25 µm wide, oil bodies very finely papillose, perianth fusiform, gemmae brown to rusty brown … ***Pseudolophozia*** link1 link2

172. Midleaf cells commonly wider 25 µm wide, oil bodies granulate to botryoidal, perianth ovate, gemmae colorless to brownish, brown, reddish, red and purple, never purely rusty brown … **173**

173. Gemmae colorless to greenish, rarely brownish to brown with common admixture of greenish gemmae and midleaf cells less 28(–30) µm wide, androecial bracts without additional dorsal tooth … ***Lophozia*** link1 link2 link3 link4 link5 link6

173. Gemmae red to purple and brownish red, rarely colorless or golden brownish but then with midleaf cells wider 30–35 µm wide, androecial bracts with additional dorsal tooth … ***Lophoziopsis*** link1

174–177. Couplets – lacking

178. Underleaves similar in size and shape to leaves, bilobed … **179**

178. Underleaves distinctly smaller than leaves, bilobed or unlobed) … **181**

179. Plants whitish (also due to common cover by fungal hyphae), with densely imbricate leaves … ***Anthelia***

179. Plants brownish to brown and rusty brown, with spreading leaves … **180**

180. Plants of mesophytic to xerophytic ecology, mostly wider (0.5–)0.8 mm wide, leaves divided for 2/3-4/5 of the length … ***Herbertus***

180. Plants hydrophytic to hygrophytic ecology, commonly near running water, mostly narrower 0.5 mm wide, leaves bilobed less than 1/3 of the length … ***Hygrobiella*** link1

181. Plants with very obliquely to subhorizontally inserted leaves, leaves bilobed for 1/3-2/3 of the length … **182**

181. Plants with subtransversely inserted leaves, leaves bilobed for 1/4(–1/3) of the length … **185**

182. Plants brownish, underleaves small, lanceolate or bilobed, commonly hidden in rhizoids, perianth tubular, with beaked mouth … ***Mesoptychia*** (p.p.) link1

182. Plants bright to yellowish green, rarely brownish (then only with lanceolate underleaves), underleaves bilobed to lanceolate, perianth mouth not beaked … **183**

183. Underleaves lanceolate, unlobed (although commonly with additional teeth near underleaf apex), plants green to brownish green and brownish, gynoecia on short branches, with large subterraneaen perigynium … ***Harpanthus***

183. Underleaves bilobed to bisbifid, plants light green to yellowish green, gynoecia on leading axis or on the branches, without perigynium, with subterranean perigynium … **184**

184. Rhizoids only from area adjacent to the underleaf base, perianth well developed, triplicate, perigynium absent … ***Lophocolea***

184. Rhizoids distributed throughout the ventral side of stem, perianth reduced, large subterranean perigynium present … ***Geocalyx***

185. Underleaves bilobed, regular … **186**

185. Underleaves unlobed, rarely occasionally bilobed, sometimes irregular … **188**

186. Plants less 0.5–0.8 mm wide, cells in lobe middle less 15 μm wide, oil bodies homogenous, small (less 2 μm in diameter) … ***Cephaloziella*** (p.p.) link1

186. Plants wider 1 mm wide, cells in lobe middle wider 18–20 μm, oil bodies brownish, granulate, more 4 μm in diameter or in the width … **187**

187. Plants green to brownish and brown, leaves fixedly bilobed for 1/4–2/5 of the length, lobes wider than long, acidophilous … ***Schljakovia***

187. Plants blackish brown, leaves unfixedly bilobed (some leaves 3-lobed), to 1/2–2/3 of the length, lobed longer than wide, neutro- to basiphilous … ***Schljakovianthus*** (depauperate modifications)

188. Underleaves obliquely to erect spreading, 2/3 of leaf length, not hidden within rhizoids … ***Pleurocladula*** link1

188. Underleaves less 1/2 of leaf length, hidden within rhizoids or appressed to ventral side of stem, rarely large but then irregular ad hidden within rhizoids … **189**

189. Plants less 0.5 mm wide, with distant leaves, bilobed for 1/2–3/4 of the length and cells in lobe middle narrower 15 μm wide, with small, numerous oil bodies … **190**

189. Plants commonly more 0.5 mm wide, rarely less, but then with only shortly (less 1/3 of the length) bilobed leaves, cells in the lobe middle wider 15 μm wide (if less then leaves only slightly bilobed and each cell with one large oil body) … **191**

190. Plants yellowish brownish, leaf cells with long papillae on the surface, perianth pluriplicate, with not discolored cells in upper 1/3 of its length … ***Sphenolobopsis***

190. Plants greenish to purplish and blackish, rarely brownish, then with common reddish tint, leaf surface with smooth cuticle or with shortly ellipsoidal to rounded papillae, upper 1/3 of perianth composed by elongate discolored cells … ***Cephaloziella*** (p.p.) link1

191. Obligate epixylous, pale greenish plants of hemiboreal forests, leaves contiguous to subimbricate, midleaf cells commonly less 20 μm wide … ***Iwatsukia*** link1

191. Plants on rocks and soils, brownish to purplish and blackish brown, rarely greenish, then cells in the midleaf wider 25 μm … **192**

192. Pale greenish to whitish plants, midleaf cells wider 25 μm wide, underleaves irregular, lanceolate, hidden within rhizoids, perigynium absent … ***Schofieldia*** link1

192. Brownish to brown and red-brown plants, midleaf cells mostly less 25 μm wide, although in some taxa to 30 μm wide (then with distinct perigynium), underleaves irregular to regular, mostly subulate, if lanceolate than spreading, not hidden within rhizoids … **193**

193. Midleaf cells oblong, leaves shortly bilobed, underleaves in well developed shoots (or near shoot apices) sometimes similar to leaves, oil bodies absent or as oil drops … ***Hygrobiella*** (p.p.) link1

193. Midleaf cells subisodiametric, leaves shortly or to 1/3 of leaf length bilobed, underleaves never similar to leaves, oil bodies 1–4 per midleaf cell, nearly filling cell lumen … ***Nardia*** (p.p.) link1 link2 link3