

A new key to the genera of liverworts of Colombia

Nueva clave para los géneros de Hepáticas de Colombia

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ABSTRACT

A key is presented to 130 liverwort genera recorded from Colombia. Some genera found in neighboring countries, but not yet in Colombia, are also included in the key.

Key words. Colombia, hepatics, identification, taxonomy.

RESUMEN

Se presenta una clave taxonómica para los 130 géneros de hepáticas registrados en Colombia. Algunos géneros registradas de países vecinos, pero aún no de Colombia, también son incluidos.

Palabras clave. Colombia, hepáticas, identificación, taxonomía.

INTRODUCTION

Colombia has a very rich liverwort flora. With about 715 accepted species, in 40 families, the country ranks second among the countries of tropical America, after Brazil with 725 species, and has more than half of the species recorded from tropical America (Gradstein & Uribe-M. 2016). Many species have been newly discovered in the country in recent years, and our knowledge of the liverwort flora of Colombia has been greatly improved by recent taxonomic revisions and monographs (e.g., Reiner-Drehwald & Goda 2000, Heinrichs 2002, Dauphin 2003, Vaña 2003, Bischler *et al.* 2005, Costa 2008, Uribe-M. 2008, Campos-Salazar & Uribe-M. 2012, Gradstein & Ilkiu-Borges 2015, Gradstein 2016, Ilkiu-Borges 2016). In spite of these studies and the availability of a modern catalogue (Gradstein & Uribe-M. 2016), identification of the liverworts of Colombia remains cumbersome. The key to the genera of liverworts of Colombia (Uribe-M. & Aguirre-C. 1997) is out of date

and keys to the species are very scattered in the literature and often difficult of access.

The lack of a modern means of identification has prompted the author to prepare an identification manual for the liverworts of Colombia (Gradstein in prep.). As a first step, a treatment of the genus *Plagiochila* (Dumort.) Dumort., the largest genus of the liverworts, was published (Gradstein 2016) and a revision of the large and troublesome genus *Bazzania* Gray is in preparation. The present paper presents a new key to the genera of liverworts of Colombia. Although 132 genera were listed in the recent catalogue (Gradstein & Uribe-M. 2016), several taxonomic changes have occurred since the publication of the catalogue leading to modification of the total number of liverwort genera in Colombia. *Aureolejeunea* R.M. Schust. and *Omphalanthus* Lindenb. & Nees have been transferred to *Cheilolejeunea* (Spruce) Steph. (We *et al.* 2015), *Austrofossombronia* R.M.Schust. is now included in *Fossombronia* Raddi (Stotler

et al. 2016), and *Prionocolea* R.M.Schust. and *Taxilejeunea* (Spruce) Steph. are synonyms of *Lejeunea* Lib. (Gradstein *et al.* 2016). On the other hand, *Archilejeunea* subgen. *Dibrachiella* (Spruce) Schiffn. with three species in Colombia was raised to genus level (Shi *et al.* 2015), *Cololejeunea minutissima* (Sm.) Schiffn. was transferred to *Myriocoleopsis* Schiffn. (Yu *et al.* 2015), a rare rheophytic genus previously unknown in Colombia, and *Platycaulis* R.M.Schust. was newly recorded from Colombia (Gil-Novoa *et al.* 2015). As a result, 130 genera are currently accepted for Colombia and are included in the key. Some genera known from neighboring areas but not yet from Colombia (e.g., *Anthelia* (Dumort.) Dumort., *Clevea* Lindb., *Isopaches* Buch, *Lobatiriccardia* Furuki, *Nanomarsupella* R.M.Schust., *Schusterolejeunea* Grolle, *Spruceanthus* Verdoorn) are also included. Genera with only one species in Colombia as well as a few other taxa are directly keyed to species.

CLASSIFICATION

The classification of the genera into families is according to Gradstein & Uribe-M. (2016) except for *Stephaniella* and *Stephaniellidium*, which are placed in a separate family, Stephaniellaceae, following Schuster (2002); see also Juárez-Martínez *et al.* (2016). Classification of the families into orders, subclasses and classes follows Crandall-Stotler *et al.* (2009) except for Pleuroziaceae which are placed in a separate subclass, Pleuroziidae, following Frey (2009). Author citations of the genera follow Söderström *et al.* (2016) but the use of “ex” (e.g., Gottsche ex Steph.) is omitted and only the second, validating author (in this case Steph.) is cited since the use of “ex” in author citation is not obligatory (McNeill *et al.* 2012).

MARCHANTIOPSIDA

Aytoniaceae

Asterella P.Beauv.

Plagiochasma Lehm. & Lindenb.

Corsiniaceae

Cronisia Berk.

Cyathodiaceae

Cyathodium Kunze

Dumortieraceae

Dumortiera Nees

Lunulariaceae

Lunularia Adans.

Marchantiaceae

Marchantia L.

Monocleaceae

Monoclea Hook.

Ricciaceae

Riccia L.

Ricciocarpos Corda

Targioniaceae

Targionia L.

JUNGERMANNIOPSIDA

PELLIIDAE

Fossombroniaceae

Fossombronia Raddi

Pallaviciniaceae

Jensenia Lindb.

Pallavicinia Gray

Symphyogyna Nees & Mont.

Pelliaceae

Noteroclada Hook.f. & Wilson

METZGERIIDAE

Aneuraceae

Aneura Dumort.

Riccardia Gray

Metzgeriaceae

Metzgeria Raddi

PLEUROZIIDAE

Pleuroziaceae

Pleurozia Dumort.

JUNGERMANIIDAE

1. JUNGERMANNIALES

Acrobolbaceae

Acrobolbus Nees
Lethocolea Mitt.
Tylimanthus Mitt.

Adelanthaceae

Adelanthus Mitt.
Pseudomarsupidium Herzog

Arnelliaceae

Gongylanthus Nees

Balantiopsaceae

Isotachis Mitt.
Neesioscyphus Grolle
Ruizanthus R.M.Schust.

Calypogeiaceae

Calypogeia Raddi

Cephaloziaceae

Alobiellopsis R.M.Schust.
Cephalozia (Dumort.) Dumort.
Fuscocephaloziopsis Fulford
Nowellia Mitt.
Odontoschisma (Dumort.) Dumort.

Cephaloziellaceae

Cephaloziella (Spruce) Schiffn.
Cephaloziopsis (Spruce) Schiffn.
Cylindrocolea R.M.Schust.
Gymnocoleopsis
 (R.M.Schust.) R.M.Schust.
Kymatocalyx Herzog

Gymnomitriaceae

Gymnomitrium Corda
Marsupella Dumort.

Herbertaceae

Herbertus Gray
Triandrophyllum Fulford & Hatcher

Jamesoniellaceae

Syzygiella Spruce

Jungermanniaceae

Jungermannia L.

Lepicoleaceae

Lepicolea Dumort.

Lepidoziaceae

Bazzania Gray
Kurzia G.Martens
Lepidozia (Dumort.) Dumort.
Micropterygium Gottsche
Monodactylopsis (R.M.Schust.)

R.M.Schust.

Mytilopsis Spruce
Paracromastigum Fulford & J.Taylor
Pseudocephalozia R.M.Schust.
Pteropsiella Spruce
Telaranea Schiffn.
Zoopsidella R.M.Schust.

Lophocoleaceae

Clasmatocolea Spruce
Cryptolophocolea L.Söderstr.
Heteroscyphus Schiffn.
Leptoscyphus Mitt.
Lophocolea (Dumort.) Dumort.
Platycaulis R.M.Schust.

Plagiochilaceae

Plagiochila (Dumort.) Dumort.

Pseudolepicoleaceae

Blepharostoma (Dumort.) Dumort.
Chaetocolea Spruce
Temnoma Mitt.

Scapaniaceae

Anastrophyllum (Spruce) Steph.
Diplophyllum (Dumort.) Dumort.
Heterogemma (Jörg.) Konstant. & Vilnet
Lophonardia R.M.Schust.
Scapania (Dumort.) Dumort.
Schistochilopsis (N.Kitag.) Konstant.
Sphenolobus (Lindb.) Berggr.

Solenostomataceae

Nardia Gray
Solenostoma Mitt.

Stephaniellaceae

Stephaniella J.B.Jack
Stephaniellidium Grolle

Trichocoleaceae

Leiomitra Lindb.
 2. PORELLALES

Frullaniaceae

Frullania Raddi

Jubulaceae

Jubula Dumort.

Lejeuneaceae

Acanthocoleus R.M.Schust.
Acrolejeunea (Spruce) Steph.
Anoplolejeunea (Spruce) Schiffn.
Archilejeunea (Spruce) Steph.

Blepharolejeunea S.W.Arnell
Brachiolejeunea (Spruce) Schiffn.
Bromeliophila R.M.Schust.
Bryopteris (Nees) Lindenb.
Caudalejeunea Schiffn.
Ceratolejeunea (Spruce) J.B.Jack & Steph.
Cheilolejeunea (Spruce) Steph.
Cololejeunea (Spruce) Steph.
Colura (Dumort.) Dumort.
Cyclolejeunea A.Evans
Dibrachiella (Spruce) X.Q.Shi *et al.*
Dicranolejeunea (Spruce) Schiffn.
Diplasiolejeunea (Spruce) Schiffn.
Drepanolejeunea (Spruce) Steph.
Frullanoides Raddi
Fulfordianthus Gradst.
Harpalejeunea (Spruce) Schiffn.
Lejeunea Lib.
Lepidolejeunea R.M.Schust.
Leptolejeunea (Spruce) Steph.
Lindigianthus Kruijt & Gradst.
Lopholejeunea (Spruce) Steph.
Luteolejeunea Piippo
Marchesinia Gray
Mastigolejeunea (Spruce) Steph.
Metalejeunea Grolle
Microlejeunea (Spruce) Steph.
Myriocoleopsis Schiffn.
Neurolejeunea (Spruce) Schiffn.
Odontolejeunea (Spruce) Schiffn.
Otigoniolejeunea (Spruce) Schiffn.
Otolejeunea Grolle & Tixier
Pictolejeunea Grolle
Prionolejeunea (Spruce) Schiffn.
Pycnolejeunea (Spruce) Schiffn.
Rectolejeunea A.Evans
Schiffneriolejeunea Verd.
Stictolejeunea (Spruce) Schiffn.
Symbiezidium Trevis.
Thysananthus Lindenb.
Verdoornianthus Gradst.
Xylolejeunea X.L.He & Grolle

Porellaceae

Porella L.

Radulaceae

Radula Dumort.

KEY TO THE GENERA

The terminology used in the key follows the *Guide to the Bryophytes of Tropical America* (Gradstein *et al.* 2001). Users of the key are advised to consult the latter publication, especially the glossary, descriptions and illustrations, which might help in clarifying difficulties that may arise.

Introductory key

1. Plants with stem and leaves 2
1. Plants thalloid 4
2. Leaves divided into segments
..... **Jungermanniopsida: Key 2**
2. Leaves not divided into segments 3
3. Leaves in 3 equal rows, leaf insertion transverse. [Plants growing erect from a leafless rhizome, rhizoids absent]. Known from Ecuador, to be expected in Colombia... ***Haplomitrium blumei*** (Nees) R.M.Schust. (Haplomitriopsida)
3. Leaves not in 3 equal rows (leaf insertion various).... **Jungermanniopsida: Key 2**
4. Thallus with air chambers (cross section) and numerous small pores on dorsal surface. Thallus underside with scales, at least near the tip. Antheridia and archegonia usually born in receptacles **Marchantiopsida: Key 1**
4. Thallus lacking air chambers and pores. Thallus underside with or without scales 5
5. Upper surface of the thallus with a median groove. Plants often growing in rosettes (loosely forked in aquatic plants). Sporophytes embedded in the thallus **Ricciaceae: Key 1**
5. Upper surface of the thallus without median groove. Plants not growing in rosettes. Sporophytes not embedded in the thallus 6
6. Rhizoids papillose. Thallus large, 1-3 cm wide, surface uniformly green. Gametangia produced in rounded

- receptacles with black hairs at the margin...*Dumortiera hirsuta* (Sw.) Nees
6. Rhizoids smooth (exceptionally a few rhizoids with papillae present). Thallus small or large, surface variable, uniformly green or not. Gametangia not produced in receptacles with black hairs at the margin 7
 7. Thallus large, (0.5-)1-3 cm wide, without midrib, margins crispate-undulate, surface with numerous small whitish dots (fresh material). Antheridia produced in rounded or elongate receptacles on the thallus surface *Monoclea gottschei* Lindb.
 7. Thallus smaller, with or without midrib, margins plane or undulate, surface without small dots. Antheridia not produced in receptacles on the thallus surface **Jungermanniopsida: Key 2 (couplets 5-6)**

**Key 1. Marchantiopsida
(complex thalloid liverworts)**

1. Upper surface of the thallus with pores, appearing as numerous tiny, colorless or whitish dots. Air chambers present (cross-section) 2
1. Thallus lacking pores. Air chambers absent or very inconspicuous 12
2. Gemma receptacles present on dorsal surface of thallus 3
2. Gemma receptacles absent 4
3. Gemma receptacles cup-shaped *Marchantia*
3. Gemma receptacles a lunate "scale" *Lunularia cruciata* (L.) Dumort.
4. Thallus with a median groove, often growing in (partial) rosettes, sometimes floating on water. Sporophyte embedded in the thallus (Ricciaceae) 5
4. Thallus lacking median groove, usually not in rosettes. Sporophyte not embedded in the thallus 6
5. Plants floating on water (rarely on wet soil). Pores present, bounded by a ring of cells. Ventral scales large, ligulate, with oil cells. Dorsal thallus surface \pm dark-green and reticulate *Ricciocarpos natans* (L.) Corda
5. Plants on soil, rarely in water (*Riccia stenophylla*). Pores \pm absent, when present without ring of cells. Ventral scales usually absent, when present small and without oil cells. Dorsal thallus surface pale green to glaucous green, usually not reticulate *Riccia*
6. Thallus very thin, 2-layered, translucent. Ventral scales lacking (except at thallus apex). Sporophytes on the ventral thallus surface *Cyathodium*
6. Thallus thicker, not translucent. Ventral scales present throughout. Sporophytes not on the ventral thallus surface 7
7. Air chambers without photosynthetic filaments. Female receptacles stalked 8
7. Air chambers with photosynthetic filaments. Female receptacles stalked or not stalked 10
8. Pores surrounded by several rings of differentiated cells. Archegoniophore arising at the thallus apex on a 10-40 mm long stalk. Sporophyte surrounded by a large, conical, whitish or purplish pseudoperianth which hangs down beneath the receptacle and is split above into 8-16 narrow segments. Thallus glossy green to reddish *Asterella*
8. Pores surrounded by only one ring of differentiated cells. Archegoniophore arising from the thallus surface (along the midline) on a very short, 1-5 mm long stalk. Sporophyte not surrounded by a large, conical, whitish or purplish pseudoperianth. Thallus light green to blue-green 9
9. Thallus dull blue-green, surface not distinctly reticulate, pores inconspicuous. Ventral scales broadly ovate, entire, in 2 well-defined rows, each scale with 1-3 distinct, lanceolate appendages. Common species *Plagiochasma rupestre* (Forster) Steph.

9. Thallus bright light green, surface conspicuously reticulate, pores distinct. Ventral scales lanceolate, \pm toothed, in several ill-defined rows, each scale with an ill-defined, linear-lanceolate appendage. Known from Ecuador (but very rare), to be expected in Colombia *Clevea spathysii* (Lindenb.) Müll.Frib. (Cleveaceae)
10. Pores compound, barrel-shaped, formed of several layers of cells (cross-section). Male and female receptacles stalked and variously lobed *Marchantia*
10. Pores simple, of one layer of cells. Receptacles sessile or only the female receptacle stalked 11
11. Thallus completely black when dry, margins and underside dark purplish-black. Ventral scales lanceolate, longer than wide. Gemmae lacking. Sporophyte in a dark, swollen, mussel-like involucre below the thallus apex *Targionia hypophylla* L.
11. Thallus not black when dry, margins and underside green or tinged with purple. Ventral scales very broad, much wider than long. Gemmae usually produced on thallus surface in a narrow, lunate receptacle. Sporophyte (very rare) on a stalked receptacle *Lunularia cruciata* (L.) Dumort.
12. Plants small, thallus segments less than 0.5 cm wide, often in (partial) rosettes. Thallus surface often with a median groove (Ricciaceae) 5
12. Plants large, thallus segments 1-3 cm wide, never in rosettes. Thallus surface without median groove 13
13. Thallus surface with numerous small whitish dots. Thallus margins undulate-crispate. Thallus without midrib *Monoclea gottschei*
13. Thallus surface without whitish dots. Thallus margins plane. Thallus with a narrow midrib formed by rhizoids on the ventral thallus surface *Dumortiera hirsuta*

Key 2. Introductory key to Jungermanniopsida

1. Plants with stem and leaves 2
1. Plants thalloid 5
2. Plants robust, to 10 cm long and 4-7 mm wide, reddish or purplish. Leaves deeply concave, ovate-oblong, strongly clasping the stem, undivided, leaf margin with a conspicuous white margin. Underleaves absent. Perianth terete (or plicate)..... *Pleurozia paradoxa* (J.B.Jack) Schiffn. (Pleuroziidae)
2. Plants different 3
3. Leaves undivided, succubous. Leaf base several layers of cells thick. Cells thin-walled, without trigones. Rhizoids violet or colorless. Archegonia and antheridia on dorsal surface of stem. On soil or rock **Pelliidae: Key 3**
3. Leaves divided into segments or undivided, incubous, succubous or transverse. Leaf base only one layer of cells thick. Cells thin-walled or thick-walled, often with trigones. Rhizoids not violet. Archegonia on apex of stem or short branch, antheridia in leaf axils. On bark, living leaves, rotten wood, rock and soil (Jungermanniidae – foliose liverworts) 4
4. Leaves with a ventral lobule (= small or large fold or sac appressed to the leaf, on the ventral side of leaf), incubous **Porellales: Key 11**
4. Leaves without lobule **Jungermanniales: Key 4**
5. Thallus unbranched or with a few short, ventral-intercalary branches. Thallus margins, at least near the apex, with long, sausage-shaped slime papillae. Archegonia and antheridia on leafy branches *Pteropsiella serrulata* Steph. (Lepidoziaceae)
5. Thallus variously branched. Thallus margins without sausage-shaped slime papillae. Archegonia and antheridia on

- the thallus surface or in cavities, not on leafy branches 6
6. Thallus midrib with a central strand. Gametoecia on the dorsal side of the midrib **Pallaviciniaceae: Key 3**
6. Thallus midrib without central strand, or midrib absent. Gametoecia on the ventral side of the midrib or at the thallus margin **Metzgeriidae: Key 3**

**Key 3. Metzgeriidae and Pelliidae
(simple thalloid liverworts)**

1. Plants with stem and leaves (Pelliidae). 2
1. Plants thalloid (Metzgeriidae and Pelliidae) 3
2. Rhizoids pale brown. Plants 4-10 mm wide, glaucous-green or deep green. Leaf margins flat, entire **Noteroclada confluens** Taylor
2. Rhizoids purplish. Plants 2-4(-5) mm wide, pale-green, usually forming rosettes. Leaf margins undulate, entire or toothed..... **Fossombronina**
3. Thallus simple or pinnate, without midrib or with midrib only on branches. Gametoecia on the thallus margin or on short lateral branche..... (Aneuraceae) 4
3. Thallus simple or dichotomous, with a midrib throughout. Gametoecia on the midrib (dorsal or ventral side)..... 6
4. Thallus simple or scarcely branched, more than 2 mm wide, prostrate. Oil bodies 10-40 per cell. Male branches with antheridia in 2-6 rows..... **Aneura**
4. Thallus distinctly branched (irregularly to regularly pinnate), 0.5-2(-8) mm wide, prostrate or erect. Oil bodies less than 10 per cell. Male branches with antheridia always in 2 rows..... 5
5. Thallus 0.5-2 mm wide, thallus 1-3-pinnate with short or long branches. Archegonia on short lateral branches, without paraphyses..... **Riccardia**
5. Thallus 2-8 mm wide, thallus 1-pinnate with rather short and wide branches (branches ca. 1-2× as long as wide). Archegonia in incisions of the thallus margin surrounded by numerous crowded, multicellular paraphyses, not on branches. Known from Ecuador, to be expected in Colombia.... **Lobatiriccardia**
6. Thallus 0.5-2(-3) mm wide, margins with unicellular hairs (= rhizoids). Midrib without central strand (cross section). Gametoecia on the ventral side of the midrib..... **Metzgeria**
6. Thallus usually more than 3 mm wide, margins without hairs. Midrib with central strand. Gametoecia on the dorsal side of the midrib (Pallaviciniaceae) 7
7. Thallus divided into lobes..... **Symphyogyna**
7. Thallus not lobed..... 8
8. Thallus ascendent to erect from a prostrate rhizome..... 9
8. Thallus prostrate or slightly ascendent, without prostrate rhizome..... 10
9. Archegonia surrounded by a ring of scales forming a cup-like involucre. After fertilization, a tubular pseudoperianth several times longer than the involucre developing from within the involucre.... **Jensenia**
9. Archegonia merely with a small scale inserted behind them (= side directed to the base of the thallus), cup-like involucre and pseudoperianth lacking.... **Symphyogyna**
10. Thallus margins with scattered slime hairs 2-4 cells long. Midrib with 1 central strand. Archegonia surrounded by a ring of scales forming a cup-like involucre. After fertilization, a tubular pseudoperianth several times longer than the involucre developing from within the involucre..... **Pallavicinia lyellii** (Hook.) Gray
10. Thallus margins without slime hairs. Midrib with 1-3 central strands. Archegonia merely with a small scale inserted behind them (= side directed to the base of the thallus), cup-like

involucre and pseudoperianth lacking....
..... *Symphyogyna*

Key 4. Introductory key to Jungermanniales (foliose liverworts I)

1. Leaves deeply divided into hair-like segments which are not more than 1-2 cells wide at base..... 2
1. Leaves undivided or divided into segments which are more than 2 cells wide at base..... 4
2. Leaves divided to the base into 1-4 filaments (= uniseriate segments), margins entire. Plants very small, alga-like..... *Telaranea*
2. Leaves divided into 4-9 segments, margins strongly ciliate. Plants larger, not alga-like..... 3
3. Leaves 4-9-lobed, the segments split into numerous ciliate parts, the plants strongly "hairy". Leaf cells with thin or uniformly thickened walls, trigones lacking. Underleaves smaller than lateral leaves. Plants whitish-green or brown ...
..... *Leiomitra* (= *Trichocolea* p.p.)
Probably all *Trichocolea* species from Colombia belong to *Leiomitra* but some poorly known species that are only known from sterile material have not yet been transferred to *Leiomitra*.
3. Leaves 4-lobed, the segments not split into numerous ciliate parts. Leaf cells with large trigones. Underleaves as large as lateral leaves. Plants gray-green or brown
Blepharostoma trichophyllum (L.) Dumort.
4. Small whitish, worm-like plants with densely imbricate leaves on soil in páramo..... 5
4. Plants different..... 7
5. Leaves undivided, opposite or alternate. Leaf cells conspicuously elongate near the ventral margin.....
..... **Arnelliaceae: Key 4b**
5. Leaves bifid, alternate. Leaf cells not

- conspicuously elongate near the ventral margin..... 6
6. Plants with 3 rows of leaves, moss-like. Perianth large, deeply plicate. Minute whitish, prostrate liverwort from superpáramo of Ecuador, to be expected in Colombia..... *Anthelia juratzkana* (Limpr.) Trevis. (Antheliaceae)
 6. Plants with 2 rows of leaves (underleaves lacking). Perianth lacking or very small, inconspicuous.....
..... **Gymnomitriaceae: Key 7**
 7. Leaves with (1-)2 large, sausage-shaped slime papillae at the tips of the segments or on the rounded margins. Plants very small, less than 1 mm wide, whitish-green, the leaves almost longitudinally inserted on the stem. On rotten wood, soil and rock in rainforest... *Zoopsidella*
 7. Leaves without large slime papillae at the tips or on the margins..... 8
 8. Leaves incubous..... 9
 8. Leaves succubous or transverse..... 16
 9. Underleaves and leaves of similar size, bifid or trifid..... (Herbertaceae) 10
 9. Underleaves smaller than leaves..... 11
 10. Leaves 2-3-lobed, without vitta. Leaf cells thin-walled to evenly thick-walled, ± without trigones.....
..... *Triandrophylllum subtrifidum* (Hook.f. & Taylor) Fulford & Hatcher
 10. Leaves bifid, with a broad vitta of elongate cells. Leaf cells with large trigones..... *Herbertus*
 11. Leaves with 3 or more lobes or teeth....
..... **Lepidoziaceae: Key 8**
 11. Leaves with 0-2 lobes or teeth..... 12
 12. Rudimentary lobule (consisting of a few cells) present at ventral base of leaf. Stems fragile, ventral stem surface only 2-4 cells wide, hyalodermis often present. Ventral branches absent
..... **Lejeuneaceae** (with reduced lobules): **Key 12**
 12. Lobules completely lacking. Stems rigid, ventral stem surface more than 4

- cells wide, hyalodermis absent. Ventral branches frequently present..... 13
13. Plants densely pinnate, growing upright on twigs near running water, with numerous clustered perianths on short lateral branches. Underleaves minute. Known from Ecuador, in rivers with granite rocks and strongly fluctuating water levels, between 1200-1800 m, to be expected in Colombia..... *Colura irrorata* (Spruce) Heinrichs *et al.* (Lejeuneaceae)
13. Plants forked, irregularly branched or unbranched, not growing on twigs near running water, perianths lacking or on ventral side of stem (not clustered on short lateral branches). Underleaves well-developed..... 14
14. Stems forked, flagelliform ventral branches present. Leaf apex bifid or trifold (rarely entire)..... *Bazzania*
14. Stems simple or irregularly branched, flagelliform ventral branches lacking. Leaf apex entire or bifid..... (Calypogeiaceae) 15
15. Underleaves entire or short bifid. Underleaf cells very different from leaf cells (except in *M. nephrostipa*), conspicuously elongate, 2-5× as long as wide, without chlorophyll, hyaline. Plants deep green to brown. Leaf apex entire. Oil bodies brownish, finely granular. Vegetative reproduction by caducous leaves..... *Mnioloma*
15. Underleaves bifid. Underleaf cells similar to leaf cells, 1-2× as long as wide, with chlorophyll, not hyaline. Plants pale green to bluish green. Leaf apex usually bifid. Oil bodies colorless or sepia, coarsely granular. Vegetative reproduction by gemmae produced on upright, flagelliform branches..... *Calypogeia*
16. Underleaves present..... **Key 4a**
16. Underleaves absent (or very small)..... **Key 4b**

Key 4a. Jungermanniales - Leaves succubous or transverse, underleaves present

1. Leaf margins toothed..... 2
1. Leaf margins entire..... 6
2. Leaves 4-lobed, underleaves as large as leaves..... *Lepicolea*
2. Leaves not 4-lobed, underleaves smaller than leaves..... 3
3. Leaves folded and usually keeled, at least above, the keel often winged..... **Lepidoziaceae: Key 8**
3. Leaves not folded, without winged keel..... 4
4. Dorsal leaf base decurrent. Leaves asymmetrical, ventral margin arched, dorsal margin ± straight. Stems brown (or bluish), with thick-walled cortex..... *Plagiochila*
4. Dorsal leaf base not decurrent. Leaves ± symmetrical. Thick-walled cortex lacking..... 5
5. Leaves ± transversely inserted, deeply concave. Branches originating from the ventral side of the stem..... *Isotachis*
5. Leaves ± longitudinally inserted, not deeply concave. Branches originating from the lateral and ventral side of the stem..... **Lophocoleaceae: Key 9**
6. Leaves undivided..... 7
6. Leaves divided into lobes..... 10
7. Leafy plants at the base arising from a leafless, stoloniform shoot..... **Lepidoziaceae: Key 8**
7. Leafy plants not arising from a leafless, stoloniform shoot..... 8
8. Ventral stolons present Leaf insertion reaching the dorsal midline of stem or not. Rhizoids scattered.. *Odontoschisma*
8. Ventral stolons lacking. Leaf insertion reaching the dorsal midline of stem. Rhizoids scattered or in bundles..... 9
9. Underleaves entire, oblong-lanceolate. Rhizoids scattered. Plants green to reddish-brown or purple..... *Nardia succulenta* (Lehm.) Spruce

9. Underleaves bifid or toothed, rarely entire. Rhizoids in bundles. Plants green to brown..... **Lophocoleaceae: Key 9**
10. Leaves divided into 3-5 lobes. Plants small, less than 2 mm wide, leafless stolons present or lacking..... 11
10. Leaves divided into 2(-3) lobes. Plants small or large..... 14
11. Underleaves very different from leaves, much smaller and only 2-lobed. [Leaves strongly concave, 4-5-lobed, sharply piliferous. On soil in superpáramo of the Sierra Nevada de Santa Marta].....
.....*Ruizanthus venezuelanus* R.M.Schust.
11. Underleaves similar to leaves (but sometimes smaller)..... 12
12. Leaves succubous. [Leaves palmate, divided to ca. 1/2 into narrow lanceolate, conspicuously diverging lobes].....
.....*Chaetocolea palmata* Spruce
12. Leaves transverse..... 13
13. Plants pale green, shallowly divided (to 1/4 or less) into 3-4 triangular lobes. Stem base stoloniform. Leaf cells thin-walled, cuticle smooth or slightly papillose. Perianth on a short ventral branch, 3-keeled. In wet páramo.....
.....*Pseudocephalozia quadriloba* (Steph.) R.M.Schust.
13. Plants brownish, deeply divided (to 3/4) into 3-4 stiff, subulate lobes. Stem base not stoloniform. Leaf cells thick-walled, cuticle strongly striate-papillose. Perianth on a long shoot. On rotten wood in upper montane cloud forest.....
.....*Temnoma chaetophylla* R.M.Schust.
14. Leaves in 3 ± equal rows, underleaves about as large as leaves..... 15
14. Leaves not in 3 equal rows, underleaves smaller than leaves..... 17
15. Leaves distinctly elongate, (1.5-)2-7 times as long as wide. Leaves with a broad vitta of strongly elongate cells. Trigones very large..... *Herbertus*
15. Leaves shorter. Vitta absent. Trigones small or lacking..... 16
16. Plants very small, less than 1 mm wide, creeping, whitish in color. Leaves scarcely wider than the stem. On soil in superpáramo (above 4000 m). Known from Ecuador, to be expected in Colombia..... *Anthelia juratzkana*
16. Plants larger, creeping or upright, reddish, purple-brown or black. Leaves much wider than the stem. In water in páramo..... *Isotachis obtusa* Steph. (= *Isotachis lacustris* Herzog *syn. nov.*)
17. Leaves transverse, strongly concave. Sporophyte in a fleshy perigynium.....
..... *Isotachis*
17. Leaves succubous. Sporophyte in a perianth..... 18
18. Leaves and underleaves divided to the middle into 2-3 narrow lobes (some 3-lobed leaves always present). Rhizoids in bundles..... *Paracromastigum*
18. Leaves and underleaves 2-lobed or undivided, never 3-lobed, less deeply divided. Rhizoids scattered or in bundles..... 19
19. Leaf insertion line not reaching dorsal midline of stem, dorsal side of stem "leaf-free". Rhizoids scattered.....
..... **Cephaloziaceae: Key 5**
19. Leaf insertion line reaching dorsal midline. Rhizoids in bundles..... 20
20. Plants often with some reddish coloration (especially in the rhoids). Branching purely ventral. Leaf cells narrowly rectangular, cuticle with elongate papillae ("striate-papillose")....
..... *Neesioscyphus*
20. Plants without any reddish coloration. Branching lateral and ventral. Leaf cells shorter, cuticle smooth or with small rounded papillae.....
..... **Lophocoleaceae: Key 9**

Key 4b. Jungermanniales - Leaves succubous or transverse, underleaves absent or minute

1. Plants densely pinnate, growing upright on twigs near running water, with numerous clustered perianths on short lateral branches, perianth beaked. Underleaves minute. Known from Ecuador in rivers with granite rocks and strongly fluctuating water levels, between 1200-1800 m, to be expected in Colombia..... *Colura irrorata* (Lejeuneaceae)
1. Plants different..... 2
2. Plants worm-like, often whitish, with densely imbricate and appressed leaves, less than 2 mm wide. Leaves transverse, entire or bifid. On soil or rock in páramo..... 3
2. Plants not worm-like, never whitish, small or large, leaves less densely imbricate..... 6
3. Leaves bifid, alternate. Leaf cells not conspicuously elongate near the ventral margin..... **Gymnomitriaceae: Key 7**
3. Leaves undivided, opposite or alternate. Leaf cells conspicuously elongate near the ventral margin..... 4
4. Leaves opposite, the dorsal leaf bases united, not falcate. Stems without paraphyllia. Stolons lacking. Plant green to brown to purplish or whitish..... *Gongylanthus*
4. Leaves alternate, the dorsal leaf bases not united, usually falcate. Stems on the dorsal side with green paraphyllia. Stems attached to soil by long stolons. Plants grayish to pale brown..... 5
5. Leaves plicate, with some longitudinal folds. Paraphyllia lanceolate. Sporophyte produced in a marsupium..... *Stephaniellidium sleumeri* (Müll.Frib.) Grolle
5. Leaves smooth, without folds. Paraphyllia linear. Marsupium lacking, sporophyte surrounded by connate bracts..... *Stephaniella*
6. Plants minute, less than 0.6 mm wide. Leaf cells usually small, 8-25(-30) μm , without trigones..... **Cephaloziellaceae: Key 6**
6. Plants larger. Cells with or without trigones..... 7
7. Leaves opposite, dorsal leaf bases united..... 8
7. Leaves alternate, dorsal leaf bases not united..... 10
8. Plant creeping on soil, densely attached to the soil with rhizoids. Leaf cells conspicuously elongate towards the ventral leaf margin, trigones very small or lacking..... *Gongylanthus*
8. Plant not creeping on soil, not densely attached to the soil. Leaf cells not conspicuously elongate towards the ventral leaf margin, trigones usually large..... 9
9. Plants with reddish or purple pigmentation. Perianth inflated over its whole length, with several plicae..... *Syzygiella*
9. Plants lacking reddish or purple pigmentation. Perianth flattened towards the mouth, with 2 keels..... *Plagiochila*
10. Dorsal margin of leaves reflexed, dorsal leaf base distinctly decurrent. Leaf surface convex near dorsal margin and concave towards ventral margin..... 11
10. Dorsal margin of leaves plane or inflexed, not or little decurrent. Leaf surface \pm plane or concave..... 13
11. Plants with reddish or purple pigmentation. Perianth inflated over its whole length..... *Syzygiella*
11. Plants lacking reddish or purple pigmentation. Perianth flattened towards the mouth or absent and replaced by a marsupium..... 12
12. Plants whitish-green or glaucous when fresh (gray or brown when dry). Leaf apex obliquely truncate-emarginate. Stems pale. Oil bodies brown, numerous, filling cell-lumen. Sporophyte in a marsupium..... *Tylimanthus laxus* (Lehm. & Lindenb.) Spruce

12. Plants green or brown. Leaf apex various but usually not obliquely truncate-emarginate. Stems brown, darker than leaves. Oil bodies colorless, not filling cell-lumen. Sporophyte in a flattened perianth..... *Plagiochila*
13. Leaves several layers of cells thick near the base..... **Pelliidae: Key 3**
13. Leaves only one layer of cells thick.. 14
14. Leafy plants arising from a creeping, stolon-like shoot..... 15
14. Leafy plants not arising from a creeping, stolon-like shoot..... 20
15. Leaves transverse. [Dorsal margin of leaves \pm inflexed (towards stem). Stem rigid, with thick-walled cortex. Gametoeceia at stem base on abbreviated branches] (Adelanthaceae)..... 16
15. Leaves succubous..... 17
16. Cells in the upper part of the leaf \pm evenly thick-walled, without distinct trigones. Leaf base with a short vitta. Stem cortex well-developed, brown, of 2-3 cell layers (cross-section).....
..... *Adelanthus*
16. All leaf cells with distinct trigones, cells never evenly thick-walled. Vitta lacking. Stem cortex poorly developed, pale-colored, of 1 layer of cells.....
..... *Pseudomarsupidium*
17. Leaf cells small, less than 25 μ m, without trigones. Plant less than 1 mm wide..... *Kymatocalyx*
17. Leaf cells larger, with or without trigones. Plants usually wider than 1 mm (rarely less than 1 mm)..... 18
18. Leaf insertion line not reaching dorsal midline of stem, dorsal side of stem leaf-free. Plants frequently with upright flagelliform branches producing gemmae..... **Cephaloziaceae: Key 5**
18. Leaf insertion line reaching dorsal midline of stem, dorsal side of stem not leaf-free. Plants without such gemmiparous branches..... 19
19. Leaf cells papillose. Plants whitish-green to yellowish-green (sometimes brown when dry). Sporophyte in a marsupium..... *Tylimanthus laxus*
19. Leaf cells smooth. Plants green to reddish-brown to black. Sporophyte in a perianth..... *Syzygiella*
20. Leaves entire..... 21
20. Leaves 2(-3)-lobed..... 24
21. Leaf cells conspicuously elongate towards the ventral margin. [Plants whitish-green to yellowish-green. Leaves tongue-shaped. Sporophyte in a marsupium].....
..... *Lethocolea glossophylla* (Spruce) Grolle
21. Leaf cells not elongate towards the ventral margin. Sporophyte in a perianth..... 22
22. Ventral stolons present. Leaf insertion reaching dorsal midline of stem of stem or not. Gemmae sometimes present. Gynoeceia on a short ventral branch.....
..... *Odontoschisma*
22. Ventral stolons absent. Leaf insertion always reaching dorsal midline of stem of stem. Gemmae absent. Gynoeceia terminal on the main stem or on a long branch..... 23
23. Plants dark green to blackish-green, growing on wet rock in rivers at high elevations, rather large, 1.5-2 mm wide, leaves longer than wide. Leaf cells small, less than 30 μ m long in mid-leaf, thin-walled, trigones lacking or very small. Rhizoids few, not in bundles. Perigynium lacking (bracts not attached to perianth base)..... *Jungermannia ovatotrigona* (Steph.) Grolle
23. Plants light green to reddish or brown, not growing on wet rock in rivers. Leaf cells (20-)30-60 μ m long in mid-leaf, trigones present or lacking. Rhizoids often numerous, sometimes in bundles. Perigynium present (inner female bracts attached to perianth base) *Solenostoma*
24. Stem with a hyalodermis.....
..... **Cephaloziaceae: Key 5**
24. Stem without hyalodermis..... 25

25. Leaves on sterile and male shoots with a very narrow base, the leaves 2-3× wider in the middle than at the base, caducous *Acrobolbus cuneifolius* (Steph.) Briscoe (= *Acrobolbus caducifolius* R.M.Schust. *syn. nov.*)
25. Leaves without very narrow base, not caducous..... 26
26. Cuticle smooth.. **Scapaniaceae: Key 10**
26. Cuticle finely papillose..... 27
27. Plants glossy whitish-green to light brown (never reddish or purple). Gemmae absent. Oil bodies brown..... *Acrobolbus*
27. Plants greenish-brown to reddish or purple. Gemmae present or absent. Oil bodies colorless..... **Scapaniaceae: Key 10**

Key 5. Cephaloziaceae

1. Leaves undivided. Stem without hyalodermis. Ventral stolons usually present..... 2
1. Leaves shallowly or deeply bifid. Stem with hyalodermis. Ventral stolons lacking..... 3
2. Cells in midleaf 40-100 µm long, cell walls without trigones. Plants less than 1 mm wide. On bare clay soil below 2000 m..... *Alobiellopsis dominicensis* (Spruce) Fulford
2. Cells in midleaf 15-30(-40) µm long, trigones usually present (rarely lacking). Plants (0.5-)1-2 mm wide. On rotten wood, humus or rock, from sea level to páramo..... *Odontoschisma*
3. Leaf base forming an inflated sac..... *Nowellia*
3. Leaf base not forming a sac..... 4
4. Leaves nearly longitudinally inserted, dorsal leaf base decurrent. Leaf apex shallowly retuse or bifid to 1/6-1/3 *Fuscocephaloziopsis*
4. Leaves subtransversely inserted, dorsal leaf base not decurrent. Leaf apex bifid to 1/3-1/2..... *Cephalozia*

Key 6. Cephaloziellaceae

1. Leaves undivided to retuse. Leafy stems erect, arising from creeping stolons..... *Kymatocalyx*
1. Leaves bifid to 1/3 or more. Leafy stems creeping, stolons lacking..... 2
2. Leaves obtuse, widest above, apices rounded. Plants light green, without any pigmentation, minute, ca. 0.5 mm wide.. *Cephaloziopsis intertexta* (Gottsche) R.M.Schust.
2. Leaves not obtuse, apices acute or narrowly obtuse. Plants green to brown or reddish..... 3
3. Plants ca. 1 mm wide. Leaves distinctly concave, apices obtuse. Perianth terete. Only in páramo..... *Gymnocoleopsis cylindriciformis* (Mitt.) R.M.Schust.
3. Plants smaller, 0.3-0.6 mm wide. Leaves not concave, apices acute (rarely obtuse). Perianth plicate. Lowland, montane or páramo..... 4
4. Leaves subtransverse, hardly wider than the stem. Cells in midleaf very small, 8-15 µm, thick-walled (rarely thin-walled). Leaf insertion reaching the dorsal midline of the stem. Occurring between ca. 500-4000 m... *Cephaloziella*
4. Leaves distinctly succubous, distinctly wider than the stem. Cells in midleaf larger, 15-25 µm, thin-walled. Leaf insertion not reaching the dorsal midline of the stem. Below 1500 m.. *Cylindricola*

Key 7. Gymnomitriaceae

1. Plants minute, filiform, 0.1-0.2(-0.35) mm wide, creeping..... 2
1. Plants larger, ascending to erect..... 3
2. Cells of leaves and stem epidermis coarsely papillose (one large, rounded papilla per cell). Plants usually pale-colored. In rather dry superpáramo. Known from Venezuela and Ecuador, to be expected in Colombia..... *Nanomarsupella xenophylla* R.M.Schust.

2. Cells of leaves and stem epidermis smooth or somewhat mamillate, papillae lacking. Plants purplish to blackish..... *Gymnomitrium atroflum* Vána
3. Leaves strongly concave from base to apex (flattening of leaf impossible without tearing the leaf), very shallowly bifid to 1/8-1/5, with a broad, lunulate sinus and short, blunt tips..... *Gymnomitrium truncatoapiculatum* Herzog
3. Leaves concave only in the lower half, flattened towards the apex, more deeply bifid, sinus rounded to acute (not broadly lunulate)..... 4
4. Plants whitish to pale brown. Perianth lacking..... *Gymnomitrium*
4. Plants green to brown to reddish, not whitish. Perianth present but very small, hidden between the bracts... *Marsupella*
5. Leaves incubous..... 6
5. Leaves succubous or transverse..... 7
6. Leaves divided into 4-6 lobes. Branching (bi)pinnate. Ventral flagellae usually absent. Plants 0.5-1.5 mm wide..... *Lepidozia*
6. Leaves with 2-3 teeth at apex or undivided. Branching forked or ventral. Ventral flagellae common. Plants 1-6 mm wide..... *Bazzania*
7. Leaves folded and usually keeled, at least above, the keel often winged..... 8
7. Leaves not folded, 2-4-lobed..... 9
8. Leaf apex bifid to 1/4. Underleaves absent..... *Mytilopsis albifrons* Spruce
8. Leaf apex undivided or very short-bifid. Underleaves present (sometimes very small)..... *Micropterygium*
9. Leaves and underleaves shallowly divided (to 1/4 or less) into 3-4 triangular lobes. Plants growing upright from a stoloniferous base. In páramo..... *Pseudocephalozia quadriloba*
9. Leaves and underleaves more deeply divided. Plants creeping or ascending, stoloniferous stem base present or absent..... 10
10. Stem leaves 2-3-lobed. Stems with a stoloniferous base.... *Paracromastigum*
10. Stem leaves 4-lobed. Stems without stoloniferous base..... *Kurzia*

Key 8. Lepidoziaceae

1. Plants consisting of a small thallus with a narrow midrib and unistratose wings. Amazonia..... *Pteropsiella serrulata*
1. Plants not thalloid..... 2
2. Plants consisting of minute shoots (less than 0.2 mm wide), 2 cells wide, with rudimentary leaves, each leaf consisting of 1-2 cells with a slime papilla on top. In lowland rainforest..... *Monodactylopsis monodactyla* (Spruce) R.M.Schust.
2. Plants larger, leaves not rudimentary, made up of more than 2 cells..... 3
3. Leaves hair-like, consisting of 1-4 uniseriate filaments, undivided, leaf lamina lacking..... *Telaranea*
3. Leaves not hair-like, with a short or long lamina..... 4
4. Leaf cells very large, ca. 60-80 µm long in midleaf, thin-walled, without trigones. Leaf apex rounded to short-bifid, frequently with 1-2 large, sausage-shaped slime papillae (rarely without)..... *Zoopsidella*
4. Leaf cells smaller, usually with trigones. Leaf apex acute or divided into several teeth or lobes, without sausage-shaped papillae..... 5
5. Leaves incubous..... 6
5. Leaves succubous or transverse..... 7
6. Leaves divided into 4-6 lobes. Branching (bi)pinnate. Ventral flagellae usually absent. Plants 0.5-1.5 mm wide..... *Lepidozia*
6. Leaves with 2-3 teeth at apex or undivided. Branching forked or ventral. Ventral flagellae common. Plants 1-6 mm wide..... *Bazzania*
7. Leaves folded and usually keeled, at least above, the keel often winged..... 8
7. Leaves not folded, 2-4-lobed..... 9
8. Leaf apex bifid to 1/4. Underleaves absent..... *Mytilopsis albifrons* Spruce
8. Leaf apex undivided or very short-bifid. Underleaves present (sometimes very small)..... *Micropterygium*
9. Leaves and underleaves shallowly divided (to 1/4 or less) into 3-4 triangular lobes. Plants growing upright from a stoloniferous base. In páramo..... *Pseudocephalozia quadriloba*
9. Leaves and underleaves more deeply divided. Plants creeping or ascending, stoloniferous stem base present or absent..... 10
10. Stem leaves 2-3-lobed. Stems with a stoloniferous base.... *Paracromastigum*
10. Stem leaves 4-lobed. Stems without stoloniferous base..... *Kurzia*

Key 9. Lophocoleaceae

1. Leaf surface covered by numerous small, spinose teeth..... *Lophocolea muricata* (Lehm.) Nees
1. Leaf surface smooth..... 2
2. Leaves apex entire..... 3
2. Leaf apex toothed 5
3. Leaves broadly reniform, almost twice as wide as long, stiffly appressed to each other. Plants brown. In páramo bogs, rare... *Platycaulis renifolia* R.M.Schust.

3. Leaves ovate-orbicular to oblong, as wide as long or longer than wide, appressed or spreading..... 4
4. Underleaves variable, entire to bifid on the same stem and usually narrower than the stem. Plants pale green, small, less than 1.5 mm wide. Leaf cells thin-walled, \pm without trigones. On moist soil and rock in or near running water.. ***Clasmatocolea vermicularis*** (Lehm.) Grolle
4. Underleaves not entire and bifid on the same stem. Plants green to brown, small or large. Leaf cells usually with trigones..... ***Leptoscyphus***
5. Leaves \pm transverse, strongly caducous. Plants minute, yellowish green, ca. 0.5 mm wide. Tiny epiphyte in upper montane cloud forest and páramo.... ***Lophocolea fragmentissima*** R.M.Schust.
5. Leaves distinctly succubous, not caducous. Plants different..... 6
6. Underleaves free from the leaves..... 7
6. Underleaves connate with leaf bases on one or both sides 8
7. Leaf apex bifid..... ***Lophocolea***
7. Leaf apex with 3 or more cilia (rarely only 2)..... ***Leptoscyphus***
8. Plants fertile..... 9
8. Plants sterile..... 11
9. Gametangia on very short ventral branches, hidden under the leaves. Perianth without keels.... ***Heteroscyphus***
9. Gametangia on long branches, not hidden under the leaves. Perianth 2-3-keeled 10
10. Leaves bifid..... ***Cryptolophocolea***
10. Leaves with 4-15 cilia, not bifid. ***Leptoscyphus trapezoides*** (Mont.) L.Söderstr.
11. Underleaves attached to leaves on one side only. Leaf apex entire or with 2-3 obtuse lobes..... ***Heteroscyphus contortuplicatus*** (Nees & Mont.) Grolle
11. Underleaves attached to leaves on both sides. Leaf apex with (0)-2-4 sharp teeth 12
12. Leaf apex with 2 teeth. Underleaves with 2-6 teeth or cilia (rarely more)..... ***Cryptolophocolea***
12. Leaf apex with 3 or more teeth or cilia. Underleaves with numerous cilia..... 13
13. Underleaves small, 2-3 \times wider than the stem, subquadrate, deeply bifid. Dioicous..... ***Leptoscyphus trapezoides***
13. Underleaves larger, 3-5 \times wider than the stem, reniform, not or shallowly bifid. Monoicous or dioicous... ***Heteroscyphus***

Key 10. Scapaniaceae

1. Leaves divided into a small dorsal lobe and a large ventral lobe..... 2
1. Leaves not divided into a small dorsal lobe and a large ventral lobe. Mostly in páramo..... 3
2. Ventral leaf-lobe 2 \times longer than wide. Plants small, 1-1.5 mm wide, creeping on soil. Perianth inflated, plicate..... ***Diplophyllum***
2. Ventral leaf-lobe 1-1.5 \times longer than wide. Plants 1.5-5 mm wide. Perianth flat, smooth..... ***Scapania***
3. Leaf margins on sterile stems toothed. Leaf cells large, 30-60 μ m in midleaf, thin-walled, with very small trigones. . 4
3. Leaf margins on sterile stems entire. Leaf cells smaller..... 6
4. Ventral stolons present.... ***Lophonardia***
4. Ventral stolons absent..... 5
5. Leaf cells very large, 40-60 μ m in midleaf. Stem epidermis cells 4-8 \times longer than wide. Gemmae lacking. In páramo bogs, very rare..... ***Heterogemma patagonica*** (Herzog & Grolle) L. Söderstr. & Vána
5. Leaf cells smaller, 30-40 μ m in midleaf. Stem epidermis cells less than 4 \times longer than wide. Gemmae presen..... ***Schistoichilopsis incisa*** (Schrad.) Konstant.
6. Trigones large. Leaf apex acute to acuminate. Plants reddish-brown or purple, rarely green..... ***Anastrophyllum***

6. Trigones lacking or small. Leaf apex obtuse to subacute. Plants green or brownish, rarely purplish (*Sphenolobus austroamericanus*)..... 7
7. Leaf cells with conspicuous trigones, walls not uniformly thickened. Ventral stolons present. Gemmae absent..... **Lophonardia**
7. Leaf cells with \pm uniformly thickened walls, trigones inconspicuous. Ventral stolons absent. Gemmae present or absent. Rare species of (super)páramo. 8
8. Leaves densely imbricate, leaf apices acute. Leaf cells 20-30 μ m in midleaf. Plants brownish, with a strong resin smell, paroicous, usually copiously fertile. Gemmae reddish. In superpáramo above 4000 m, known from Ecuador, to be expected in Colombia..... **Isopaches bicrenatus** (Hoffm.) H.Buch
8. Leaves distant or laxly imbricate, leaf apices acute or obtuse. Leaf cells smaller, 15-20 μ m in midleaf. Plants dioicous, frequently sterile, without resin smell. Gemmae absent or reddish-brown..... 9
9. Leaves succubous, leaf apices obtuse. Plants greenish-brown, ca. 1 mm wide. Perianth eplicate, completely smooth..... **Gymnocoleopsis cylindrifomis** (Cephaloziellaceae)
9. Leaves transverse, leaf apices (sub)acute. Plants reddish or greenish-brown, 0.5-1 mm wide. Perianth plicate, sometimes with a white mouth..... **Sphenolobus**
2. Lobule almost free from the lobe, keel lacking or indistinct. Lobule parallel to the stem or weakly spreading..... 3
3. Underleaves undivided. Lobules plane, with rounded apex, margins of lobule often dentate to laciniate, at least near the base. Plants green to brown, robust, 3-7 mm wide..... **Porella**
3. Underleaves divided (rarely undivided). Lobules inflated, sac-like (or plane, then with acute apex), margins of lobule \pm entire. Plants green to reddish or purple, 0.5-2.5 mm wide..... 4
4. Plants pure green, without any trace of reddish pigmentation. Leaf margins toothed. Lobules very small, attached to the ventral margin of the lobe, at some distance from the stem..... **Jubula bogotensis** Steph.
4. Plants usually with reddish pigmentation, rarely pure green. Leaf margins entire (rarely toothed). Lobules usually very close to the stem (at some distance from stem in the *Diastaloba* group: small reddish plants)..... **Frullania**
5. Stems fragile, epidermis of only 5-6 rows of cells. Rhizoids from ventral surface of stem. Lobules very narrowly attached to stem (by only 1-4 cells). Plants very small, usually less than 1 mm wide. Leaf cells with many small, colorless oil bodies..... **Lejeuneaceae: Key 12**
5. Stems rigid, epidermis of numerous thick-walled cells. Rhizoids in bundles from the surface of the lobule. Lobules more broadly attached to stem. Plants usually larger. Leaf cells with 1-2 large, brownish oil bodies..... **Radula**

Key 11. Introductory key to Porellales (foliose liverworts II)

1. Underleaves present..... 2
1. Underleaves lacking..... 5
2. Lobule for most of its length attached to the lobe along a keel. Keel and lobule usually widely spreading from stem. Plants variously colored but never red or purple..... **Lejeuneaceae: Key 12**

Key 12. Lejeuneaceae

1. Leaves highly specialized, distal part forming an inflated sac (= extension of the lobule)..... **Colura**

1. Leaves less specialized, distal part not forming an inflated sac..... 2
2. Underleaves lacking..... 3
2. Underleaves present (sometimes very small)..... 4
3. Plants growing upright from a stoloniferous base, in or near running water. Stems rigid, of thick-walled cells. Known from Ecuador, to be expected in Colombia..... *Myriocoleopsis gymnocolea* E.Reiner & Gradst.
3. Plants creeping, without stoloniferous base. Stems fragile, of thin-walled cells..
..... *Cololejeunea*
4. Underleaves undivided to weakly emarginate..... **Key 12a**
4. Underleaves bifid..... **Key 12b**
4. Median leaf cells elongate; trigones cordate..... 5
4. Median leaf cells isodiametric, trigones various, not cordate..... 8
5. Underleaves toothed..... 6
5. Underleaves entire..... 7
6. Plants pinnate or dichotomous, branches predominantly *Frullania*-type. Innovations lacking..... *Bryopteris*
6. Plants irregularly branched, branches predominantly *Lejeunea*-type. Innovations present..... *Thysananthus amazonicus* (Spruce) Schiffn.
7. Lobules with 7-9 teeth. Underleaf apex \pm rounded, base auriculate. Perianth 8-10-keeled, with innovations. High Andes of Peru and Ecuador, to be expected in Colombia..... *Frullanoides laciniatiflora* (Loitl.) van Slageren.
7. Lobules with 1-3 teeth. Underleaf apex emarginate, base not auriculate. Perianth 3-keeled, without innovations. Throughout tropical America.. *Caudalejeunea lehmanniana* (Gottsche) A. Evans
8. Underleaf insertion line \pm straight. Plants 1.5-2 mm wide. Perianth with two ventral keels, innovations lacking.... *Lopholejeunea nigricans* (Lindenb.) Schiffn.
8. Underleaf insertion line deeply arched. Plants usually more than 2 mm wide. Perianth without ventral keels, innovations present or absent..... 9
9. Apical portion of leaf broadly recurved. Ventral merophyte 4 cells wide, epidermal cells thin-walled. Plants glossy brown..... *Lindigianthus cipaconeus* Kruijt & Gradst.
9. Leaf \pm plane. Ventral merophyte more than 4 cells wide, epidermal cells thick-walled..... 10
10. Lobules plane, with (1-)2-4 teeth. Perianth terminal on main stem or elongated branches, with two long innovations..... *Marchesinia*
10. Lobules strongly inflated-rounded, small (hidden behind the underleaves),

Key 12a. Lejeuneaceae with undivided underleaves

1. Leaf margins toothed, at least near apex
..... 2
1. Leaf margins entire..... 15
2. Ventral merophyte 4 or more cells wide
..... 3
2. Ventral merophyte 2(-3) cells wide.... 11
Width of the ventral merophyte is measured by the number of epidermis cells across the ventral stem surface (= area between where the underleaves are attached, but not in the direct neighborhood of the underleaf base because there the number of epidermis cells is variable).
3. Leaf cells with evenly thickened walls, trigones lacking. Lobules with a very long, curved tooth (5-10 cells long). Underleaves toothed, emarginate. *Fulfordianthus pterobryoides* (Spruce) Gradst.
3. Leaf cells with trigones, walls not evenly thickened. Lobules with a shorter tooth (less than 5 cells long) or with several teeth (or without tooth). Underleaves entire or toothed..... 4

- ± without teeth. Perianth on a very short branch, with one short innovation or without innovation..... *Symbiezidium dentatum* Herzog
11. Underleaves very large, 6-10× stem width, apex very short-bifid. Perianth terete, without keels..... *Lejeunea sulphurea* (Lehm. & Lindenb.) Spruce
11. Underleaves smaller, apex undivided (emarginate in *Harpalejeunea*). Perianth with keels..... 12
12. Plants pale green. Disciform gemmae usually produced on dorsal leaf margins. Underleaf apex truncate... *Cyclolejeunea convexistipa* (Lehm. & Lindenb.) A.Evans
12. Plants brownish green. Disciform gemmae lacking..... 13
13. Leaves with (5-)7-25 teeth. Underleaves toothed or entire. On living leaves or bark *Odontolejeunea*
13. Leaves with 1-5 teeth. Underleaves entire. On bark or rock..... 14
14. Branches predominantly *Frullania*-type. Female bracteole toothed. *Dicranolejeunea axillaris* (Nees & Mont.) Schiffn.
14. Branches predominantly *Lejeunea*-type. Female bracteole entire. *Acanthocoleus aberrans* (Lindenb. & Gottsche) Kruijt
15. Underleaves toothed..... 6
15. Underleaves entire..... 16
16. Leaves with ocelli (scattered, in a row or 1-2 ocelli near leaf base)..... 17
16. Leaves without ocelli..... 23
17. Ocelli in a row or 1-2 near leaf base.. 18
17. Ocelli scattered..... 20
18. Row of ocelli 7-22 cells long. Ventral merophyte 4-6 cells wide. Lobule tooth 3-5 cells long. Canopy epiphyte in lowland rainforest of Brazil; to be expected in the Colombian Amazon. *Neurolejeunea seminervis* (Spruce) Schiffn.
18. Row of ocelli 1-6 cells long. Ventral merophyte 2(-3) cells wide. Lobule tooth 1 cell long 19
19. Lobule fully inflated, bottle-shaped, with a long, falcate tooth. Perianth sharply 5-keeled, the keels smooth or toothed, never extending into inflated horns..... *Harpalejeunea*
19. Lobule inflated in the lower half, flattened above, rectangular, with a short, blunt tooth. Perianth 4-keeled, the keels smooth and extended into inflated horns..... *Ceratolejeunea*
20. Ventral merophyte 4 or more cells wide.. 21
20. Ventral merophyte 2-3 cells wide (see note in couplet 2)..... 22
21. Underleaf apex undivided. *Frullania*-type branches present. Leaf apex rounded *Stictolejeunea*
21. Underleaf apex emarginate. *Frullania*-type branches lacking. Leaf apex acute, rarely rounded..... *Lepidolejeunea eluta* (Nees) R.M.Schust.
22. Leaf cells with large trigones. Ocelli conspicuous, usually larger than green leaf cells. Epidermal cells thick-walled. Lobules curved downward..... *Luteolejeunea herzogii* (Buchloh) Piippo
22. Leaf cells with minute trigones. Ocelli inconspicuous, equal in size to or smaller than other leaf cells. Epidermal cells thin-walled. Lobules straight or somewhat curved upwards..... *Lepidolejeunea sullivanii* (Gottsche) E.Reiner
23. Ventral merophyte 4 or more cells wide 24
23. Ventral merophyte 2 cells wide (see note in couplet 2)..... 47
24. Trigones ± cordate. Leaves convolute when dry (rarely plane)..... 25
24. Trigones various but not cordate. Leaves spreading when dry (rarely slightly convolute)..... 35
25. Underleaf apex emarginate..... 26
25. Underleaf apex rounded or truncate, not emarginate..... 27
26. Plants dark green to brown to blackish, rather robust, 2-3.5 mm wide, leaves when dry strongly convolute. Stems rigid, without hyalodermis, ventral

- merophyte 8 cells wide. Perianth with innovations.....
..... ***Thysananthus amazonicus***
26. Plants light green to pale yellowish-brown, smaller, 1.5-2 mm wide, leaves usually not convolute. Stems flaccid, with a distinct hyalodermis, ventral merophyte 4 cells wide. Perianth without innovations.....
..... ***Caudalejeunea lehmanniana***
27. Lobules with 3-10 teeth (the teeth sometimes inflexed)..... 28
27. Lobules with 0-2 teeth (occasionally 3 teeth: *Mastigolejeunea innovans*)..... 30
28. Plants blackish in older stem portions. Perianth with 5-10 keels, with innovations ***Frullanoides***
28. Plants not blackish. Perianths with 3-10 keels, innovations present or absent.....
..... 29
29. Underleaf insertion line slightly curved, underleaf base plane. Perianth with 5-10 keels, innovations lacking. Flagelliform branches (producing caducous leaves) frequently present. Lowlands (0-800 m)
..... ***Acrolejeunea***
29. Underleaf insertion line deeply arched, underleaf bases folded. Perianth with 3(-4) keels, innovations present. Flagelliform branches lacking. Montane (300-2000 m)..... ***Brachiolejeunea***
30. Ventral epidermis cells not or scarcely larger than medulla cells (stem cross-section). Medulla cells thick-walled. Plants brown-green to blackish-green. 31
30. Ventral epidermis cells distinctly larger than medulla cells. Medulla cells thin-walled..... 33
31. Leaf apex acute. Female bracts and bracteole toothed. Amazonia.....
..... ***Thysananthus amazonicus***
31. Leaf apex rounded. Female bracts and bracteole without teeth..... 32
32. Plants turning olive- to reddish-brown. Innovations lacking. Female bract apices acute-acuminate.....
..... ***Schiffneriolejeunea***
32. Plants turning dark-brown to black. Innovations present. Female bract apices rounded..... ***Mastigolejeunea***
33. Lobules mostly reduced.....
..... ***Acanthocoleus aberrans***
33. Lobules well-developed, never reduced, with two teeth..... 34
34. First lobule tooth short, incurved and blunt, second tooth long, pointing outwards, sharp. Lobule truncate. Leaves not squarrose when moist. Upper montane (above 2000 m).....
..... ***Blepharolejeunea***
34. Lobule teeth equal or the first tooth larger than the second. Lobule oblique or truncate. Leaves squarrose when moist. Lowland and montane (300-2000 m)....
..... ***Brachiolejeunea***
35. Median leaf cells distinctly elongate, ca. $2 \times$ longer than wide. [Plants robust. Ventral merophyte more than 10 cells wide. Lobules often reduced. Perianth with 5-8 keels]. In cacao plantations of western Ecuador, not yet known from Colombia..... ***Spruceanthus theobromae*** (Spruce) Gradst.
35. Median leaf cells isodiametrical or slightly elongate..... 36
36. Lobules with 2-4 teeth..... 37
36. Lobules with 0-1 tooth..... 40
37. Leaf apex strongly and broadly recurved, acute. Epidermal cells thin-walled. Plants glossy brown. Above 2000 m.....
..... ***Lindigianthus cipaconeus*** (Gottsche) Kruijt & Gradst.
37. Leaf apex \pm plane, rounded or acute-acuminate. Epidermal cells thick-walled 38
38. Insertion line of underleaves deeply arched (more than 100 μ m deep). Ventral merophyte 6-12 cells wide. Plants more than 2 mm wide, often black. Perianth without ventral keels..... ***Marchesinia***
38. Insertion of underleaves straight or shallowly curved. Ventral merophyte 4 cells wide. Plants smaller, never black. Perianth with two ventral keels..... 39

39. Plants whitish, pale yellowish or grayish. Oil bodies 1-2(-3) per leaf cell, very large, filling up the cell lumen. Second lobule tooth much larger than the first tooth. Androecia on short-specialized branches, male bracteoles reduced.....
.. ***Cheilolejeunea* (sect. *Leucolejeunea*)**
39. Plants pale green to brown. Oil bodies more than 3 per leaf cell, rather small, not filling up the cell lumen. Lobule teeth identical or the first tooth larger than the second tooth. Androecia on elongate shoots, male bracteoles not reduced..... ***Dibrachiella***
40. Underleaf insertion line deeply arched, over 100 µm deep..... 41
40. Underleaf insertion line straight or shallowly curved..... 42
41. Lobules less than 1/4 leaf length. Leaf cells with radiate trigones. Perianth on a very short branch (appearing lateral on the stem), keels ciliate-laciniate. Lowland and montane.... ***Symbiezidium***
41. Lobules 1/4-1/2× leaf length. Leaf cells usually with large bulging trigones. Perianth on an elongate shoot, keels smooth. Exclusively montane.....
.. ***Cheilolejeunea* (sect. *Omphalanthus*)**
42. Plants whitish, pale-yellowish or grayish. Oil bodies 1-2(-3) per leaf cell, very large, filling up the cell lumen.....
...***Cheilolejeunea* (sect. *Leucolejeunea*)**
42. Plants darker: green, brown or black. Oil bodies more than 3 per leaf cell, smaller, not filling up the cell lumen..... 43
43. Midleaf cells small, 10-20 µm in diameter, trigones confluent, walls almost evenly thickened. Lobules flask-shaped, often darker than the leaf-lobe. Plants usually blackish..... ***Neurolejeunea***
43. Midleaf cells larger, trigones not confluent, walls not evenly thickened. Lobules not flask-shaped, not darker than the leaf-lobe. Plants green, brown or black..... 44
44. Epidermis cells distinctly larger than medulla cells (stem cross-section). Perianth keels ciliate-laciniate, innovations lacking. Plants glossy black or dark-brown, rarely green. Oil bodies homogeneous..... ***Lopholejeunea***
44. Epidermis cells not or little larger than medulla cells. Perianth keels smooth or denticulate, innovations present, rarely lacking. Plants green or brown. Oil bodies granular..... 45
45. Innovations lacking. Free margin of lobule incurved, at least near apex. Leaves when moist obliquely spreading, ± squarrose. Amazonia ***Verdoornianthus***
45. Innovations present. Free margin plane. Leaves when moist widely spreading, not squarrose. Widespread, common. 46
46. Lobules never reduced. Underleaves (3-)4-7× stem width, imbricate. Innovations pycnolejeuneoid (basal leaf on innovation is an underleaf: see Gradstein *et al.* 2001: Fig. 4I). Dioicous (rarely paroicous). Plants yellow-brown to dark brown..... ***Archilejeunea***
46. At least some lobules reduced. Underleaves 2-4× stem width, distant to subimbricate. Innovations lejeuneoid (basal leaf on innovation is a lateral leaf: see Gradstein *et al.* 2001: Fig. 4J). Autoicous. Plants pale-green to greenish-brown to black.... ***Dibrachiella***
47. Lobules strongly swollen, ball-shaped, free margin inrolled 2-3 times. ***Anoplolejeunea conferta*** (Meissn.) A. Evans
47. Lobules not ball-shaped, free margin plane or slightly incurved..... 48
48. *Frullania*-type branches present (sometimes only few). Lobules when well-developed with 2 teeth. Plants greenish-brown..... 14
48. *Frullania*-type branches lacking. Lobules with 1 tooth. Plants pale green...
..... 49
49. Plants tiny, 0.4-0.7 mm wide. Leaf lobes suberect to obliquely spreading. Lobule tooth long-acute, consisting of a strongly elongate cell (at least 4× as long as wide). Hyaline papilla distal to the

- tooth. Underleaves very small, 1.5-2× stem width, orbicular.....
 ***Cheilolejeuna holostipa*** (Spruce) Grolle & R.L.Zhu
 49. Plants larger. Leaves wide-spreading. Lobule tooth blunt or acute, short. Hyaline papilla proximal to the tooth (except in *L. herminieri* (Steph.) R.L.Zhu). Underleaves larger.. ***Lejeunea***

Key 12b. Lejeuneaceae with bifid underleaves

1. Leaves highly specialized, upper part forming an inflated sac..... ***Colura***
1. Leaves less specialized, upper part not forming an inflated sac..... 2
2. Plants densely pinnate, growing in or near running water, with numerous short sexual branches. Stems robust, ventral merophyte (4-)6-14 cells wide. Known from Ecuador and Brazil, to be expected in Colombia..... 3
2. Plants not densely pinnate. Stems thinner, ventral merophyte 2(-6) cells wide 4
 Width of the ventral merophyte is measured by the number of epidermis cells across the ventral stem surface (= area between where the underleaves are attached, but not in the direct neighborhood of the underleaf base because there the number of epidermis cells is variable).
3. Plants growing upright or pendent from a rhizome-like base. Lobules lacking on upright or pendent stems. Leaves transversely inserted, insertion line very short. Underleaves minute. Paroicous; antheridia in axils of female bracts..... ***Colura irrorata*** (= *Myriocolea irrorata*)
3. Plants creeping or pendent, without rhizome-like base. Lobules present. Leaves longitudinally inserted, insertion line long. Underleaves well-developed. Autoicous; antheridia on separate branches.....
 .. ***Lejeunea*** (subg. ***Neopotamolejeunea***)
4. Underleaf lobes conspicuously diverging (spreading outwards)..... 5
4. Underleaf lobes not conspicuously diverging..... 13
5. One underleaf to each leaf, the underleaves usually densely overlapping. Leaf apex rounded..... ***Diplasiolejeunea***
5. One underleaf to every alternate leaf, the underleaves usually distant. Leaf apex acute-acuminate to rounded..... 6
6. Underleaf lobes mostly 1 cell wide (except at the base), apex acute..... 7
6. Underleaf lobes broader, apex blunt... 10
7. Leaf apex rounded..... 8
7. Leaf apex acute or acuminate..... 9
8. Lobule tooth short and blunt, not falcate. Ocellus near leaf base very large, 2.5-4× longer than adjacent leaf cells. Gynoecium without innovation.....
 ***Leptolejeunea***
8. Lobule tooth elongate, falcate. Ocellus near leaf base smaller, maximally 2× longer than adjacent leaf cells. Gynoecium with innovation. In lowland rainforest..... ***Drepanolejeunea polyrhiza*** (Nees) Grolle & R.L.Zhu
9. Ocellus near leaf base very large, 2.5-4× longer than surrounding leaf cells. Lobule tooth short and blunt, not falcate. Gynoecium without innovation.....
 ***Leptolejeunea***
9. Ocellus at leaf base smaller, 1-2× longer than surrounding leaf cells, or lacking. Lobules with a long, falcate tooth (rarely short and blunt). Gynoecium usually with innovation (rarely without).....
 ***Drepanolejeunea***
10. Leaf lobes with an unbroken row of 4-8 ocelli, ocelli usually glossy yellowish-brown. In the outer canopy of Amazonian rainforest..... ***Cheilolejeunea urubensis*** (Zartman & I.L.Ackerman) Wei *et al.*
10. Leaf lobes with a broken or unbroken row of (1-)2-3 ocelli in the lower half,

- the ocelli colorless or grayish. Lowland and montane..... 11
11. Ocelli in a broken row..... *Drepanolejeunea*
11. Ocelli in an unbroken row..... 12
12. Innovations pycnolejeuneoid (basal leaf on innovation is an underleaf; see Gradstein *et al.* 2001: Fig. 4I). Cells on dorsal leaf surface mamilllose, thick-walled, with a broad, lens-shaped papilla. Lobule with or without pre-apical tooth (= tooth situated at the distal end of the lobule, at the junction with the ventral leaf margin)..... *Drepanolejeunea*
12. Innovations lejeuneoid (basal leaf on innovation is a lateral leaf; see Gradstein *et al.* 2001: Fig. 4G). Cells on dorsal leaf surface smooth, thin-walled (rarely thick-walled and with a conical papilla: *H. scabra*). Lobule without pre-apical tooth *Harpalejeunea*
13. Underleaves very large, at least 6× wider than the stem..... 14
13. Underleaves smaller..... 15
14. Leaf cells uniformly thin-walled or with small trigones. Lobules often reduced; hyaline papilla proximal to the tooth at the lobule apex (see Gradstein *et al.* 2001: Fig. 4G). Plants glistening pale green, yellowish-green or whitish (stems often long and slender, pendent). Oil bodies small, numerous per cell, finely granular or homogeneous..... *Lejeunea*
14. Leaf cells with conspicuous trigones. Lobules not reduced; hyaline papilla distal to the tooth at the lobule apex (see Gradstein *et al.* 2001: Fig. 4H). Plants dull pale green to olive green. Oil bodies very large, 1-3 per cell, sausage-shaped, coarsely granular..... *Cheilolejeunea*
15. Lobules when well-developed very large, 3/5-4/5 of lobe length. Leaves usually suberect, almost parallel to the stem. Plants minute, 0.2-0.6 mm wide.... 16
15. Lobules smaller. Leaves spreading. Plants small or large..... 17
16. Plants monoicous. Leaves without ocelli. Innovations pycnolejeuneoid (basal leaf on innovation is an underleaf; see Gradstein *et al.* 2001: Fig. 4I)..... *Metalejeunea cucullata* (Reinw. *et al.*) Grolle
16. Plants dioicous. Leaves usually with 1 or more ocelli (at the base or scattered in the leaf). Innovations lejeuneoid (basal leaf on innovation is a lateral leaf; see Gradstein *et al.* 2001: Fig. 4J)..... *Microlejeunea*
17. Ocelli present in leaves..... 18
17. Ocelli lacking in leaves..... 30
18. Ocelli present in underleaves..... 19
18. Ocelli lacking in underleaves..... 21
19. Ocelli reddish or brown. Leaf cells with a broad papilla or smooth. Caducous leaves absent. Gynoecia on a very short branch, without innovations..... *Pictolejeunea*
19. Ocelli colorless or gray. Leaf cells smooth. Caducous leaves present or absent. Gynoecia on long shoots, with 1-2 innovations..... 20
20. Caducous leaves present, produced on flagelliform branches..... *Rectolejeunea emarginiflora* (Schiffn.) A. Evans
20. Caducous leaves absent or present, when present not produced on flagelliform branches..... *Lepidolejeunea*
21. Underleaf lobes broadly rounded. [Ocelli 2-3 in an unbroken row in the lower half of the leaf]..... 12
21. Underleaf lobes (sub)acute to acuminate..... 22
22. Leaves with a very large ocellus near the base, the basal ocellus 2.5-4× larger than adjacent leaf cells. Underleaf lobes subulate (1-2 cells wide), inserted at the outer edges of the underleaf. Underleaf margins bordered by large cells..... *Leptolejeunea*

22. Basal ocellus smaller, maximally $2\times$ larger than adjacent leaf cells. Underleaf lobes wider, not inserted at outer edges of underleaf. Underleaf margins not bordered by large cells..... 23
23. Plants brown or brownish-green. Walls of leaf cells \pm pale brown, trigones radiate (or lacking). Branch bases sometimes with a huge, strongly inflated lobule ("utricle"). Perianth usually with inflated horns (horns sometimes absent...
..... ***Ceratolejeunea***
23. Plants green or whitish (rarely brown). Walls of leaf cells colorless, trigones not radiate. Utricles lacking. Perianth without inflated horns..... 24
24. Leaf lobes with a long, unbroken row of 4-8 ocelli, the ocelli usually glossy yellowish-brown. In the canopy of Amazonian rainforest.....
..... ***Cheilolejeunea urubuensis***
24. Leaf lobes not with an unbroken row of 4-8 ocelli. Lowland and montane..... 25
25. Underleaf margins denticulate to crenulate to subentire. Gemmae usually present on leaf margins. Perianth flattened, 2-keeled, the keels expanded above into short auricles. On living leaves, occasionally on bark or rock.....
..... ***Cyclolejeunea***
25. Underleaf margins entire (sometimes with a small tooth: *Xylolejeunea*). Gemmae lacking. Perianth 3-5-keeled in the upper half, the keels not expanded into auricles. On bark or rotten wood.. ..
..... 26
26. Caducous leaves present, very small, much smaller than ordinary leaves, produced on flagelliform branches. Leaf cells very small, 14-18 μm long in the middle of the lobe, walls thin or uniformly thickened, without trigones. Lobules usually with a long, falcate tooth. [Plants less than 1 mm wide; leaves wide-spreading].....
..... ***Rectolejeunea***
26. Caducous leaves present or absent, when present not smaller than ordinary leaves. Leaf cells larger. Lobule tooth short, not falcate 27
27. Plants very small, less than 0.7 mm wide. Leaves suberect or obliquely spreading. Ocelli grayish or brown..***Microlejeunea***
27. Plants larger. Leaves wide-spreading. Ocelli colorless or grayish..... 28
28. Epidermis cells thin-walled. Lobules sometimes reduced. Underleaves distant. Perianth with flat, antler-like lacinia near apex.....
..... ***Otigoniolejeunea huctumalcensis***
(Lindenb. & Gottsche) Y.M.Wei *et al.*
28. Epidermis cells thick-walled. Lobules never reduced. Underleaves distant or imbricate. Perianth without antler-like lacinia..... 29
29. Underleaves distant. Leaf cells thin-walled, without or with very small trigones. Leaf base with two transversal rows of larger, elongate cells, the upper, suprabasal row consisting of 2-5 adjacent ocelli..... ***Xylolejeunea***
29. Underleaves (sub)imbricate. Leaf cells with conspicuous trigones. Leaf base not with two transversal rows of elongate cells, the ocelli 2-20 per leaf, adjacent or scattered..... ***Pycnolejeunea***
30. Leaf margins (and sometimes the entire dorsal leaf surface) toothed by conically projecting cells with thick-walled tips ...
..... 31
30. Leaf margins entire or \pm toothed, but not toothed by conically projecting cells with thick-walled tips..... 32
31. Dorsal leaf surface spinose. Perianth inflated, with 5 keels..... ***Lejeunea***
31. Dorsal leaf surface smooth or papillose, not spinose. Perianth flattened, with 2 keels ***Prionolejeunea***
32. Vegetative reproduction by means of large, multicellular, rounded or elongate gemmae from leaf margins. [Plants usually growing on living leaves.

- Margins of leaves and underleaves ± toothed] **Cyclolejeunea**
32. No vegetative reproduction by means of multicellular gemmae..... 33
33. Vegetative reproduction by means of caducous leaves..... 34
33. No vegetative reproduction by caducous leaves..... 36
34. Leaf cells small, less than 20 µm in diameter, trigones lacking. Caducous leaves much smaller than ordinary leaves, usually produced on special flagelliform branches..... **Rectolejeunea**
34. Leaf cells larger, trigones present or absent. Caducous leaves not smaller than ordinary leaves, special flagelliform branches usually lacking..... 35
35. Lobule tooth long and sharp, hyaline papilla distal to the tooth. Lobules not reduced.....
-**Cheilolejeunea adnata** (Kunze) Grolle
35. Lobule tooth short and blunt, hyaline papilla proximal to the tooth. Lobules sometimes reduced..... **Lejeunea**
36. All or part of the leaves conspicuously elongate, (1.2-)2-4 times longer than wide 37
36. Leaves less elongate..... 40
37. Leaves suberect, apex acute-acuminate..
- **Drepanolejeunea**
37. Leaves obliquely to widely spreading, apex rounded..... 38
38. Leaves with very short insertion, attached to the stem by only 2-3 cells. Lobules ± ligulate, flat, standing upright almost parallel to the stem, keel very short. Plants rheophytic (growing in rivers). Amazonia, not yet known from Colombia..... **Schusterolejeunea inundata** (Spruce) Grolle
38. Leaves with a longer insertion. Plants not rheophytic..... 39
39. In wet leaf axils of tank bromeliads. Midleaf cells in elongate leaves 35-70 µm long, 1.5-4× longer than wide. Perianth inflated, 5-keeled, keels not expanded into auricles.....

- **Bromeliophila helenae** Gradst.
39. On living leaves in lowland rainforest. Midleaf cells smaller, 20-30 µm long, subisodiametrical. Perianth flattened, 2-keeled, keels expanded into large auricles..... **Otolejeunea schellii** Tixier
40. Walls of leaf cells ± pale brown, trigones radiate (or lacking). Branch bases sometimes with a huge, strongly inflated lobule (= utricle). Perianth usually with horns. Plants brown or brownish-green..
- **Ceratolejeunea**
40. Walls of leaf cells colorless, trigones not radiate. Utricles lacking. Perianth without horns. Plants green or whitish, rarely greenish-brown..... 41
41. Trigones large or small. Lobules never reduced, always strongly inflated. Oil bodies large (more than 1/2 the cell lumen in length), coarsely segmented. Hyaline papilla distal to the lobule tooth (or between 2 small, closely associated teeth at the leaf apex) (see Gradstein *et al.* 2001: Fig. 4H)..... **Cheilolejeunea**
41. Trigones lacking or very small. Lobules sometimes reduced, inflated or not inflated. Oil bodies smaller (less than 1/4 the cell lumen in length), finely segmented or smooth. Hyaline papilla proximal to the lobule tooth (see Gradstein *et al.* 2001: Fig. 4G).....
- **Lejeunea**

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