

# Sub-Guide to "Leafy" Liverworts

Revised through 16 November 2009

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## Group L1 – Leaves with ciliate lobes or margins

	Group L1
Leaves ciliate to the <b>base</b> , <b>3-4</b> lobed & <b>±transversely</b> inserted.	
Lobes <b>7-14</b> cells long & <b>uniseriate</b> to base; underleaves <b>also</b> 7-14 cells long; WS	<i>Blepharostoma</i>
Lobes <b>5-8</b> cells long & <b>±2</b> cells broad at base; underleaves <b>2-3</b> cells long; SE	<i>Telaranea</i>
Leaves ciliate to a <b>lamina</b> 1-4 cells high, <b>4-7</b> lobed & <b>succubous</b> ; plants <b>2-3</b> pinnate; E	<i>Trichocolea</i>
Leaves with ciliate <b>margins</b> .	
Cilia around <b>entire margin</b> of leaves.	
Shoots <b>1-2</b> pinnate; leaves <b>3-5</b> lobed with <b>long</b> cilia; WS	<i>Ptilidium</i>
Shoots <b>not</b> pinnate; leaves <b>complicate-bilobed</b> with <b>short</b> cilia; AK	<i>Ascidiota</i>
Cilia <b>restricted</b> to leaf bases.	
Leaves <b>complicate-bilobed</b> ; lobule a <b>tongue-shaped</b> lamina ( <b>±parallel</b> to the stem); WS	<i>Porella</i> †
Leaves with <b>3-4</b> shallow, <b>±cuspidate</b> lobes; <b>±ciliate</b> underleaves; WS	<i>Barbilophozia</i>
Leaves <b>bilobed</b> & <b>lacking</b> cuspidate apices; underleaves <b>lacking</b> ; SA	<i>Acrobolbus</i>

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## Group L2 – Leaves 3-4 lobed and/or distinctly toothed

	Group L2
Leaves with <b>3-4 lobes</b> of <b>±uniform</b> size & shape.	
Leaf sinuses extending <b>deep</b> into <b>basal</b> half of leaf.	
Leaves deeply <b>bilobed</b> with lobes deeply <b>incised</b> in turn; AK & NT	<i>Pseudolepicolea</i>
Leaves <b>3-4 lobed</b> to near base; lobes <b>2-3</b> cells wide; branching <b>pinnate</b> ; WS	<i>Kurzia</i>
Leaf sinuses <b>restricted</b> to <b>apical</b> half of leaf.	
Leaves <b>incubous</b> .	
Branching <b>dichotomous</b> ; underleaves <b>small</b> ; ventral <b>flagella</b> common; WS	<i>Bazzania</i>
Branching <b>pinnate</b> ; lobes strongly <b>incurved</b> ; underleaves <b>similar</b> to leaves; WS	<i>Lepidozia</i>
Leaves <b>succubous</b> .	
Leaves with bases & underleaves <b>±ciliate</b> ; lobes (4x) <b>±cuspidate</b> ; WS	<i>Barbilophozia</i>
Leaves & underleaves <b>lacking</b> cilia; lobes (3-4x) <b>not</b> cuspidate; WS	<i>Lophozia</i> †
Leaves with <b>3</b> lobes <b>unequal</b> in size (two smaller); underleaves <b>lacking</b> ; WS	<i>Tritomaria</i>
Leaves with few to many <b>±sharp marginal teeth</b> that may vary in size & shape.	
Leaves with teeth deeply <b>incised lobes</b> ; <b>underleaves</b> present.	
Shoots with <b>±profuse</b> , <b>pinnate</b> branching; trigones <b>large</b> & <b>±confluent</b> ; BC	<i>Mastigophora</i>
Shoots <b>±unbranched</b> ; trigones <b>±indistinct</b> ; BC & NE	<i>Chandonanthus</i>
Leaves <b>lacking</b> deeply incised lobes & underleaves; leaves " <b>pleated</b> " (a dorsal fold); WS	<i>Plagiochila</i> †

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**Group L3 – Leaves complicate-bilobed; "incubous"; underleaves large**

**Group L3**

- Underleaves **double** the normal **number** (equal to number of leaves); FL *Diplaisiolejeunea*
- Underleaves with **ciliate** margins; AK *Ascidiota*
- Underleaves distinctly **bilobed** (sinus >1/4 of underleaf length).  
 Lobule a **helmet-like** sac (**±parallel** to the stem) on a **stalk**.  
 perianths **trigonous & flattened**.  
 Lobes **±apiculate**; stylus **lacking**; plants on **wet** rocks; a deep, **greasy** green; E *Jubula*  
 Lobes **±rounded**; stylus present; on **trees & dry** rocks; commonly **reddish**; WS *Frullania*
- Lobule an inflated **pouch** (**±perpendicular** to the stem) along **posterior** edge of lobe;  
 stylus **lacking**; perianths **5-angled**.  
 Leaves with **marginal rhizoids**.  
 Leaves with scattered, laminal **ocelli**; trigones **lacking**; FL *Rectolejeunea*  
 Leaves **lacking** ocelli; walls with small **trigones & intermediate thickenings**; FL *Cheilolejeunea*
- Leaves distinctly **acute** to **acuminate** to **apiculate**;  
 Leaves distinctly **falcate**; underleaf lobes **spreading** (divaricate).  
 Underleaf lobes **2-3** cells wide at base; ocelli **basal**; SE *Harpalejeunea*  
 Underleaf lobes **uniseriate**; ocelli **medial**; SE *Drepanolejeunea*
- Leaves **not** falcate, but with **crenulate** margins; underleaf lobes **not** divaricate.  
 Underleaves **3-4x** the stem width; perianths **bluntly** keeled & **beak-less**; Fl *Taxilejeunea*  
 Underleaves **1.5-2x** the stem width; perianths **sharply** keeled with a **beak**; FL *Crossotolejeunea*
- Leaves with **±uniformly rounded** apices.  
 Leaves with distinctive **ocelli**.  
 Leaves **elliptical & odiferous**; underleaf lobes **uniseriate & divaricate**; FL *Leptolejeunea*  
 Leaves with **brownish** cell walls & middle lamellae, and **±serrate** apices; GC *Ceratolejeunea*  
 Leaves **caducous** & with marginal **rhizoids**; ocelli **numerous**; FL *Rectolejeunea*  
 Leaves **lacking** any of the above unique characters; ocelli **few** (1-3); E *Lejeunea*
- Leaves **lacking** ocelli.  
 Leaves strongly **convex & deflexed** apically; underleaves **3.5-4.5x** stem width  
 & **±imbricate**; trigones **small**; oil bodies **numerous & small**; AK, NT *Hygrolejeunea*  
 Leaves distinctly **crenulate**; underleaves **1.5-2x** stem width, **distant &**  
**crenulate**; trigones **±bulging**; oil bodies **few & large**; SE *Crossotolejeunea*  
 Leaves **±olive/gray-green & opaque**; underleaves **3-5x** stem width; trigones  
**±bulging**; oil bodies **few & botryoidal**; lobular papillae **distal**; CP & SA *Cheilolejeunea*  
 Leaves **lacking** the above unique characteristics; lobular papillae **proximal**.  
 Marginal cells **±17-19μ**; cell walls **±thin** & trigonous; lobular teeth **±one**-celled;  
 oil bodies **± numerous & small**; perianths **not** compressed; E *Lejeunea*  
 Marginal cells **±13-17μ**; cell walls **±evenly thick**; lobular teeth mostly  
**>one**-celled; oil bodies **±few & large**; perianths **compressed**; CP & SA *Rectolejeunea*
- Leaves commonly **broken** off (**caducous**) on normal or specialized stems.

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Continued from Group L3 above

Leaves commonly <b>broken</b> off ( <b>caducous</b> ) on normal or specialized stems.	
Leaves $\pm$ <b>olive</b> -green; lobules usually <b>inflated</b> ; trigones usually <b>large</b> ; lobular papillae <b>distal</b> ; oil bodies <b>few</b> (1-4) & <b>large</b> ; CP & SA	<i>Cheilolejeunea</i>
Leaves $\pm$ <b>yellow</b> -green; lobules commonly <b>vestigial</b> ; trigones <b>lacking</b> ; lobular papillae <b>proximal</b> ; oil bodies <b>many</b> (4-8) & <b>small</b> ; CP & SA	<i>Rectolejeunea</i>
Lobules <b>not</b> inflated ( <b>explanate</b> ) or <b>reduced</b> to a small/minute basal fold ( <b>vestigial</b> ).	
Lobules <b>explanate</b> & $\pm$ <b>parallel</b> to the stem; on <b>trees</b> & rocks; commonly <b>reddish</b> ; WS	<i>Frullania</i>
Lobules <b>vestigial</b> , but tooth <b>elaborated</b> as a slender appendage $\pm$ <b>parallel</b> to the stem; FL	<i>Rectolejeunea</i>
Lobules <b>vestigial</b> , but tooth <b>not</b> elaborated as above.	
Leaves obtusely angular to <b>apiculate</b> & <b>shiny</b> (dry); underleaves <b>3-4x</b> the stem width & $\pm$ <b>chordate</b> ; perianths <b>bluntly</b> keeled & <b>beak-less</b> ; Fl	<i>Taxilejeunea</i>
Leaves with $\pm$ uniformly <b>rounded</b> apices; underleaves <b>1-3.5x</b> the stem width & <b>not</b> chordate; perianths <b>sharply</b> keeled with a <b>beak</b> .	
Marginal cells $\pm$ <b>17-19</b> $\mu$ ; cell walls $\pm$ <b>thin</b> & <b>trigonus</b> ; lobular teeth $\pm$ <b>one</b> -celled; oil bodies $\pm$ <b>numerous</b> & <b>small</b> ; perianths <b>not</b> compressed; E	<i>Lejeunea</i>
Marginal cells $\pm$ <b>13-17</b> $\mu$ ; cells $\pm$ <b>opaque</b> with $\pm$ evenly <b>thick</b> walls; lobular teeth mostly <b>&gt;one</b> -celled; oil bodies $\pm$ <b>few</b> & <b>large</b> ; perianths <b>compressed</b> ; leaves often <b>caducous</b> ; CP & SA	<i>Rectolejeunea</i>
Underleaves $\pm$ <b>unlobed</b> (sinus $<1/4$ of underleaf length).	
Lobule a <b>tongue-shaped</b> lamina ( $\pm$ <b>parallel</b> to the stem); WS	<i>Porella</i>
Lobule an inflated <b>pouch</b> ( $\pm$ <b>perpendicular</b> to the stem) along <b>posterior</b> edge of lobe.	
Leaves mostly <b>purplish</b> to <b>brownish black</b> from well-developed secondary pigments.	
Leaves <b>squarrose</b> (wet) & <b>convolute</b> (dry); underleaves $\pm$ <b>orbicular</b> & $\pm$ <b>retuse</b> .	
Secondary stems $\pm$ <b>arching</b> ; lobules <b>lacking</b> long marginal teeth; trigones <b>bulging</b> ; <b>2-3</b> large <b>botryoidal</b> oil bodies/cell; GC	<i>Mastigolejeunea</i>
Secondary stems <b>not</b> $\pm$ arching; lobules with <b>3-10 long</b> , marginal teeth; trigones <b>bulging</b> ; oil bodies <b>numerous</b> & minute; FL	<i>Brachiolejeunea</i>
Leaves distinctly <b>falcate</b> ; underleaves $\pm$ <b>orbicular</b> ; lobules with a <b>long, sharp</b> apical tooth; trigones <b>distinct</b> ; <b>2-4 large</b> oil bodies/cell; CP	<i>Neurolejeunea</i>
Leaves <b>neither</b> squarrose, convolute <b>nor</b> distinctly falcate; underleaves $\pm$ <b>reniform</b> ; lobules with a <b>minute</b> apical tooth; oil bodies <b>numerous</b> & small; CP	<i>Lopholejeunea</i>
Leaves mostly <b>yellow brown</b> , $\pm$ <b>squarrose</b> (wet) & <b>caducous</b> ; underleaves $\pm$ <b>orbicular</b> ; lobules with 3-8 <b>marginal teeth</b> ; trigones <b>bulging</b> ; oil bodies <b>numerous</b> & small; FL	<i>Acrolejeunea</i>
Leaves mostly <b>green</b> ; 2° stems $\pm$ <b>arching</b> ; underleaves $\pm$ <b>retuse</b> ; lobules with 2-3(6) <b>marginal teeth</b> ; trigones <b>bulging</b> ; oil bodies <b>numerous</b> & minute; FL	<i>Caudalejeunea</i>
Leaves <b>whitish</b> green; underleaves <b>reniform</b> ; apical <b>lobular tooth</b> minute to very long; <b>trigones</b> small to bulging; <b>one</b> large <b>botryoidal</b> oil body/cell; E	<i>Leucolejeunea</i>

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**Group L4 – Complicate-bilobed; "incubous"; underleaves lacking**

**Group L4**

Lobules >1/3 the size of the lobes, **inflated** & **enclosed** by the **denticulate** lobes; orangish-red; NW *Pleurozia*

Lobules <1/3 the size of the lobes; lobes **neither** enclosing **nor** denticulate.

Plants >1 mm wide; cells **smooth**; rhizoids on **lobules**; perianths **flat** & **truncate**; WS *Radula*

Plants <1 mm wide; cells often **papillose**; rhizoids on **stem**; perianths **5-angled**; WS *Cololejeunea*

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**Group L5 – Complicate-bilobed; "succubous"**

**Group L5**

Lobes & lobules sharply **tapered** to a **pointed** apex; margins **irregular**; cuticle **waxy** (dull); perianth **plicate** with a **contracted**, **whitish** & **ciliate** mouth; NW, WC *Douinia*

Lobes **elongate**, **parallel**-sided & directed in strongly **different** directions from lobules; perianths **±terete**, sharply **plicate** & **contracted** to mouth; WS *Diplophyllum*

Lobes **rotund** to ligulate & directed in **same** direction as lobules; perianths strongly **flattened**, **smooth** & with a **truncate** mouth; WS *Scapania*

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**Group L6 – Leaves bilobed & succubous; underleaves clearly evident**

**Group L6**

Underleaves **bifid** & **ciliate**; plants **purplish**; leaves **±emarginate**; **perigynium** present; AC *Mesoptychia*†

Underleaves distinctly **bifid**.

Plants **±yellow-green** & **large** (>1 mm); leaf lobes **±equal** in size.

Underleaves with **lateral teeth**; rhizoids **restricted**; **perianth** present; WS *Lophocolea*

Underleaves **lacking** lateral teeth; rhizoids **scattered**; **marsupium** present; WS *Geocalyx*

Plants **±reddish** & **small** (<0.7 mm); leaf lobes **unequal** in size & **rounded** ("mittens"); NE *Cladopodiella*†

Underleaves **±lanceolate**; trigones **±bulging**.

Leaves distinctly **bilobed** & **±joined** to underleaves; WS *Harpanthus*

Leaves **±emarginate** & **free** from underleaves; WS *Nardia*†

Underleaves **flap-like** & irregularly **lobed**; leaf bases **±multistratose**; oil bodies **lacking**; A/A(NW) *Schofieldia*

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**Group L7 – Leaves bilobed; succubous;  
underleaves obscured by rhizoids, minute or lacking**

**Group L7**

Shoots <b>wide</b> (1.5-2mm); leaves with <b>marginal rhizoids</b> ; trigones <b>large</b> to bulging; SA	<i>Acrobolbus</i>
Shoots <b>intermediate</b> in width (0.5-1.5 mm); trigones various.	
Underleaves <b>obscured</b> by abundant, scattered rhizoids; <b>marsupium</b> present; WS	<i>Geocalyx</i>
Underleaves <b>minute</b> or <b>lacking</b> ; <b>perianth</b> present.	
Trigones large to <b>bulging</b> .	
Leaf insertion oblique <b>throughout</b> ; leaves <b>rarely</b> canaliculate (grooved); WS	<i>Lophozia</i>
Leaf insertion transverse <b>above</b> ; leaves commonly <b>canaliculate</b> ; WS	<i>Anastrophyllum</i>
Trigones <b>lacking</b> .	
Underleaves <b>minute</b> ; leaf lobes <b>unequal</b> in size & <b>rounded</b> (“mittens”); WS	<i>Cladopodiella</i> †
Underleaves <b>lacking</b> ; leaf lobes <b>±equal</b> in size.	
Leaves <b>purplish-black</b> with <b>rounded</b> lobes; hyalodermis <b>lacking</b> ; WS	<i>Gymnocolea</i>
Leaves with <b>connivent</b> lobes; <b>hyalodermis</b> present; oil bodies <b>lacking</b> ; WS	<i>Cephalozia</i>
Shoots <b>narrow</b> (600-800 $\mu$ ); trigones <b>lacking</b> .	
Underleaves <b>minute</b> ; perianths <b>cylindrical</b> & <b>deeply</b> plicate; on various trees; SE	<i>Cylindrocolea</i>
Underleaves <b>lacking</b> ; perianths <b>campanulate</b> & <b>shallowly</b> plicate; on cabbage palm; FL	<i>Chonecolea</i>

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**Group L8 – Leaves bilobed with transverse insertion\***

**Group L8**

Plants <b>small</b> to <b>moderate</b> in size (shoots > <b>0.5</b> mm wide).	
Leaves strongly <b>concave</b> & <b>±imbricate</b> ; shoots <b>±julaceous</b> .	
Underleaves similar to leaves in size & shape ( <b>±isophyllous</b> ); clear <b>green</b> ; A/A	<i>Pleurocladula</i>
Underleaves vestigial to <b>lacking</b> ; <b>whitish</b> in color; A/A, WC, TN	<i>Gymnomitrium</i>
Leaves like " <b>billowing sails</b> " (strongly inflated base with a <b>water sac</b> & <b>ciliate lobes</b> ); E	<i>Nowellia</i>
Leaves with a <b>midrib</b> (vitta) of elongated cells; underleaves large ( <b>isophyllous</b> ); A/A; W, AP	<i>Herbertus</i>
Leaves <b>lacking</b> any of the above unique characters.	
Underleaves similar to leaves in size & shape ( <b>±isophyllous</b> ); cells <b>elongate</b> ; A/A, WC	<i>Hygrobrella</i>
Underleaves vestigial to <b>lacking</b> ; leaf cells <b>trigonous</b> ; WS	<i>Marsupella</i>
Plants <b>minute</b> (shoots < <b>0.5</b> mm wide).	
Leaves <b>glaucous</b> from secreted filaments; <b>isophyllous</b> (underleaves like leaves); A/A	<i>Anthelia</i>
Leaves with a <b>±striate</b> cuticle; cells with thick <b>brownish</b> walls & an <b>occasional</b> oil body; NW	<i>Eremonotus</i>
Leaves <b>lacking</b> any of the above unique characters.	
Branching predominantly <b>terminal</b> & <b>furcate</b> (forking); NW, SA	<i>Sphenolobopsis</i>
Branching predominantly <b>intercalary</b> ; WS	<i>Cephalozia</i>

\*Lower leaves may show trend towards succubous insertion, except for *Herbertus*, which may show trend towards incubous insertion.

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**Group L9 – Leaves unlobed & incubous**

**Group L9**

Leaves **opaque**, ±**yellow**-green, ±**pointed** & occasionally bidentate; cells strongly **trigonus**; oil bodies **granular**; AK, NF. *Metacalypogeia*

Leaves **translucent**, ±gray to **blue**-green & **rounded** apically; cells **not** trigonus; oil bodies **botryoidal**; WS *Calypogeia*

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**Group L10 – Leaves unlobed & succubous; underleaves clearly evident**

**Group L10**

Underleaves **ciliate**, **purplish** & bilobed; leaves **shallowly** bilobed; **marsupium** present; AC *Mesoptychia*†

Underleaves **bilobed**.

**Purplish** pads on underside of stems; sporangia open along **helical** lines; NW, WC *Gyrothyra*  
 Purplish pads **lacking**; sporangia open along **longitudinal** lines; WS *Chiloscyphus*

Underleaves **lanceolate**.

Leaves **opposite** & **fused** at the base; underleaves **small**; **marsupium** present; A/A *Arnellia*

Leaves **cuneate** (wedge-shaped) & ±**deciduous**; plants **minute**; bark of **fir** trees; SA *Leptoscyphus*

Leaves ±**orbicular**; trigones **bulging**.

Rhizoids densely **matted**; perianths **laterally** compressed; **gemmae** often present; WS *Mylia*

Rhizoids **scattered**; perianths on a **fleshy** perigynium & **plicate**; gemmae **lacking** WS *Nardia*†

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**Group L11 – Leaves unlobed and succubous;  
underleaves obscured by rhizoids, minute or lacking**

**Group L11**

Leaves "**pleated**" (dorsal fold) & decurrent to **midline**; perianths **laterally** compressed; WS *Plagiochila*†

Leaves with dorsal margin strongly **revolute** & ±**notched**; AK, BC *Anastrepta*

Leaves **neither** "pleated" **nor** strongly revolute.

Leaves ±**longer** than broad; rhizoids **numerous**; ±**distinct** trigones; oil bodies **numerous** (7-11/cell) & **moderate** in size; perianth **smooth** with a **sunken** beak. *Jungermannia*†

Leaves ±**orbicular**; perianth **not** as above.

Trigones moderate to **large** & ±**bulging**.

Ventral **flagella** abundant; oil bodies **few** (2-4) & **large**; perianth ±**plicate** above with a ±**denticulate** mouth; WS *Odontoschisma*†

Ventral flagella **lacking**; oil bodies **numerous** (7-15) & **small**; perianth **plicate** above with a distinctly **ciliate** mouth; WS *Jamesoniella*

Trigones ±**small**, but distinct; oil bodies mostly **4-8** per cell & **large**.

Leaves strongly **concave**; "perianth" a **compressed, rounded, bilabiate** structure formed from **mussel**-like perichaetial bracts; A/A, MI, MN *Cryptocolea*

Leaves ±**flat** to weakly convex; perianth a **compressed, truncate, & bilabiate** sheath; CT, MA, OH *Pedinophyllum*

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***Group L12 – Leaves unlobed/emarginate with transverse insertion***

**Group L12**

Shoots **creeping**; leaves **whitish**; **concave & imbricate**; underleaves **minute**; GL

*Prasanthus*

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