Sub-Guide to "Leafy" Liverworts

Revised through 23 July 2012

Group L1 – Leaves with ciliate lobes or margins

Group L1

Leaves ciliate to the **base**, **3-4** lobed & ±**transversely** inserted.
- Lobes **7-14** cells long & **uniseriate** to base; underleaves **also** 7-14 cells long; WS — *Blepharostoma*
- Lobes **5-8** cells long & ±**2 cells** broad at base; underleaves **2-3** cells long; SE — *Telaranea*

Leaves ciliate to a **lamina** 1-4 cells high, **4-7** lobed & **succubous**; plants **2-3** pinnate; E — *Trichocolea*

Leaves with ciliate **margins**.
- Cilia around **entire margin** of leaves.
  - Shoots **1-2** pinnate; leaves **3**-**5** lobed with **long** cilia; WS — *Ptilidium*
  - Shoots **not** pinnate; leaves **complicate**-**bilobed** with **short** cilia; AK — *Ascidiota*
- Cilia **restricted** to leaf bases.
  - Leaves **complicate**-**bilobed**; lobule a **tongue-shaped** lamina (±**parallel** to the stem); WS — *Porella*†
  - Leaves with **3**-**4** shallow, ±**cuspidate** lobes; ±**ciliate** underleaves; WS — *Barbilophozia*
  - Leaves **bilobed** & **lacking** cuspidate apices; underleaves **lacking**; SA — *Acrobolbus*

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

Group L2

Leaves with **3**-**4 lobes** of ±**uniform** size & shape.
- Leaf sinuses extending **deep** into **basal** half of leaf.
  - Leaves deeply **bilobed** with lobes deeply **incised** in turn; AK & NT — *Pseudolepicolea*
  - Leaves **3**-**4 lobed** to near base; lobes **2-3** cells wide; branching **pinnate**; WS — *Kurzia*
- Leaf sinuses **restricted** to **apical** half of leaf.
  - Leaves **incubous**.
    - Branching **dichotomous**; underleaves **small**; ventral **flagella** common; WS — *Bazzania*
    - Branching **pinnate**; lobes strongly **incurved**; underleaves **similar** to leaves; WS — *Lepidozia*
  - Leaves **succubous**.
    - Leaves with bases & underleaves ±**ciliate**; lobes (**4**x) ±**cuspidate**; WS — *Barbilophozia*
    - Leaves & underleaves **lacking** cilia; lobes (**3**-**4**x) **not** cuspidate; WS — *Lophozia*†

Leaves with **3** lobes **unequal** in size (two smaller); underleaves **lacking**; WS — *Tritomaria*

Leaves with few to many ±**sharp marginal teeth** that may vary in size & shape.
- Leaves **complicate**-**bilobed**.
  - 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*†
- Leaves **not** complicate bilobed.
  - Leaves with teeth deeply **incised lobes**; **underleaves** present.
    - Shoots with ±**profuse**, **pinnate** branching; trigones **large** & ±**confluent**; BC — *Mastigophora*
    - Shoots ±**unbranched**; trigones ±**indistinct**; BC & NE — *Chandonanthus*
  - Leaves **lacking** deeply incised lobes & underleaves; leaves "**pleated**" (a dorsal fold); WS — *Plagiochila*†

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**-**4**x the stem width; perianths **bluntly** keeled & **beak**-**less**; Fl — *Taxilejeunea*
      - Underleaves **1.5**-**2**x 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**-**4.5**x stem width & ±**imbricate**; trigones **small**; oil bodies **numerous** & **small**; AK, NT — *Hygrolejeunea*
      - Leaves distinctly **crenulate**; underleaves **1.5**-**2**x stem width, **distant** & **crenulate**; trigones ±**bulging**; oil bodies **few** & **large**; SE — *Crossotolejeunea*
      - Leaves ±**olive/gray**-green & **opaque**; underleaves **3**-**5**x 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**-**19**μ; cell walls ±**thin** & trigonous; lobular teeth ±**one**-celled; oil bodies ± **numerous** & **small**; perianths **not** compressed; E — *Lejeunea*
        - Marginal cells ±**13**-**17**μ; 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.

Continued below

Continued from Group L3 above

Leaves commonly **broken** off (**caducous**) on normal or specialized stems.
- Leaves ±**olive**-green; lobules usually **inflated**; trigones usually **large**; lobular papillae **distal**; oil bodies **few** (1-4) & **large**; CP & SA — *Cheilolejeunea*
- Leaves ±**yellow**-green; lobules commonly **vestigial**; trigones **lacking**; lobular papillae **proximal**; oil bodies **many** (4-8) & **small**; CP & SA — *Rectolejeunea*

Lobules **not** inflated (**explanate**) or **reduced** to a small/minute basal fold (**vestigial**).
- Lobules **explanate** & ±**parallel** to the stem; on **trees** & rocks; commonly **reddish**; WS — *Frullania*

Lobules **vestigial**, but tooth **elaborated** as a slender appendage ±**parallel** to the stem; FL — *Rectolejeunea*

Lobules **vestigial**, but tooth **not** elaborated as above.
- Leaves obtusely angular to **apiculate** & **shiny** (dry); underleaves **3**-**4**x the stem width & ±**chordate**; perianths **bluntly** keeled & **beak**-**less**; Fl — *Taxilejeunea*
- Leaves with ±uniformly **rounded** apices; underleaves **1**-**3.5**x the stem width & **not** chordate; perianths **sharply** keeled with a **beak**.
  - Marginal cells ±**17**-**19**μ; cell walls ±**thin** & **trigonous**; lobular teeth ±**one**-celled; oil bodies ±**numerous** & **small**; perianths **not** compressed; E — *Lejeunea*
  - Marginal cells ±**13**-**17**μ; cells ±**opaque** with ±evenly **thick** walls; lobular teeth mostly >**one**-celled; oil bodies ±**few** & **large**; perianths **compressed**; leaves often **caducous**; CP & SA — *Rectolejeunea*

Underleaves ±**unlobed** (sinus <1/4 of underleaf length).
- Lobule a **tongue-shaped** lamina (±**parallel** to the stem); WS — *Porella*

Lobule an inflated **pouch** (±**perpendicular** to the stem) along **posterior** edge of lobe.
Leaves mostly **purplish** to **brownish black** from well-developed secondary pigments.
- Leaves **squarrose** (wet) & **convolute** (dry); underleaves ±**orbicular** & ±**retuse**.
  - Secondary stems ±**arching**; lobules **lacking** long marginal teeth; trigones **bulging**; **2**-**3** large **botryoidal** oil bodies/cell; GC — *Mastigolejeunea*
  - Secondary stems **not** ±arching; lobules with **3**-**10 long**, marginal teeth; trigones **bulging**; oil bodies **numerous** & minute; FL — *Brachiolejeunea*
- Leaves distinctly **falcate**; underleaves ±**orbicular**; lobules with a **long**, **sharp** apical tooth; trigones **distinct**; **2**-**4 large** oil bodies/cell; CP — *Neurolejeunea*
- Leaves **neither** squarrose, convolute **nor** distinctly falcate; underleaves ±**reniform**; lobules with a **minute** apical tooth; oil bodies **numerous** & small; CP — *Lopholejeunea*
- Leaves mostly **yellow brown**, ±**squarrose** (wet) & **caducous**; underleaves ±**orbicular**; lobules with 3-8 **marginal teeth**; trigones **bulging**; oil bodies **numerous** & small; FL — *Acrolejeunea*
- Leaves mostly **green**; 2° stems ±**arching**; underleaves ±**retuse**; lobules with 2-3(6) **marginal teeth**; trigones **bulging**; oil bodies **numerous** & minute; FL — *Caudalejeunea*
- Leaves **whitish** green; underleaves **reniform**; apical **lobular tooth** minute to very long; **trigones** small to bulging; **one** large **botryoidal** oil body/cell; E — *Leucolejeunea*

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*

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*

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*

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

Group L7

Shoots **wide** (1.5-2mm); leaves with **marginal rhizoids**; trigones **large** to bulging; SA *Acrobolbus*

Shoots **intermediate** in width (0.5-1.5 mm); trigones various.
- Underleaves **obscured** by abundant, scattered rhizoids; **marsupium** present; WS *Geocalyx*
- Underleaves **minute** or **lacking**; **perianth** present.
  - Trigones large to **bulging**.
    - Leaf insertion oblique **throughout**; leaves **rarely** canaliculate (grooved); WS *Lophozia*
    - Leaf insertion transverse **above**; leaves commonly **canaliculate**; WS *Anastrophyllum*
  - Trigones **lacking**.
    - Underleaves **minute**; leaf lobes **unequal** in size & **rounded** ("mittens"); WS *Cladopodiella*†
    - Underleaves **lacking**; leaf lobes ±**equal** in size.
      - Leaves **purplish**-**black** with **rounded** lobes; hyalodermis **lacking**; WS *Gymnocolea*
      - Leaves with **connivent** lobes; **hyalodermis** present; oil bodies **lacking**; WS *Cephalozia*

Shoots **narrow** (600-800μ); trigones **lacking**.
- Underleaves **minute**; perianths **cylindrical** & **deeply** plicate; on various trees; SE *Cylindrocolea*
- Underleaves **lacking**; perianths **campanulate** & **shallowly** plicate; on cabbage palm; FL *Chonecolea*

*Group L8 – Leaves bilobed with transverse insertion**

Group L8

Plants **small** to **moderate** in size (shoots >**0.5** mm wide).
- Leaves strongly **concave** & ±**imbricate**; shoots ±**julaceous**.
  - Underleaves similar to leaves in size & shape (±**isophyllous**); clear **green**; A/A *Pleurocladula*
  - Underleaves vestigial to **lacking**; **whitish** in color; A/A, WC, TN *Gymnomitrion*
- Leaves like "**billowing sails**" (strongly inflated base with a **water sac** & **ciliate lobes**); E *Nowellia*
- Leaves with a **midrib** (vitta) of elongated cells; underleaves large (**isophyllous**); A/A; W, AP *Herbertus*
- Leaves **lacking** any of the above unique characters.
  - Underleaves similar to leaves in size & shape (±**isophyllous**); cells **elongate**; A/A, WC *Hygrobiella*
  - Underleaves vestigial to **lacking**; leaf cells **trigonous**; WS *Marsupella*

Plants **minute** (shoots <**0.5** mm wide).
- Leaves **glaucous** from secreted filaments; **isophyllous** (underleaves like leaves); A/A *Anthelia*
- Leaves with a ±**striate** cuticle; cells with thick **brownish** walls & an **occasional** oil body; NW *Eremonotus*
- Leaves **lacking** any of the above unique characters.
  - Branching predominantly **terminal** & **furcate** (forking); NW, SA *Sphenolobopsis*
  - Branching predominantly **intercalary**; WS *Cephaloziella*

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

Group L9 – Leaves unlobed & incubous

Group L9

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

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

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*†

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*

Group L12 – Leaves unlobed/emarginate with transverse insertion

Group L12

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

End.