

## LEUCOBRYUM

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*Leucobryum* Hampe, *Linnaea* 13: 42 (1839); from the Greek *leukos* (white) and *bryon* (a moss), in reference to the whitish appearance of the plants.

Type: *L. glaucum* (Hedw.) Ångstr.

Dioicous. Plants small to robust, pale green to whitish green or brown, growing in turfs or cushions; male plants full-sized or dwarfed. Stem reddish brown, simple to richly branched; central strand present or absent. Rhizoids at the bases of branches and adaxially at the leaf tips, occasionally in leaf axils. Leaves spirally arranged or in 5 ranks, imbricate, erecto-patent to curved, ovate-lanceolate to linear-lanceolate; costa occupying almost the entire leaf width, consisting of a single layer of chlorophyllose cells (chlorocysts) wedged between layers of empty hyaline cells (leucocysts); chlorophyllose cells narrow, diamond-shaped in cross-section; leucocysts in 1–several layers on either side of the chlorocysts, abaxially smooth or undulate to prorate in the upper part; lamina forming a narrow border, often widened in the basal part.

Perichaetial leaves similar in size to much smaller than stem leaves. Calyptra cucullate, with an entire basal margin. Sporogones solitary. Seta straight. Capsules curved to inclined, strumose; exothecial cells with equally thickened lateral and end walls; operculum rostrate. Peristome teeth narrowly triangular, vertically striate, with or without cross-connections between striae on the outer side, smooth to papillose inside. Spores spherical, finely papillose.

*Leucobryum*, a widespread genus of 40–80 species, is known from all continents except Antarctica. Four species and an additional variety occur in Australia. The genus is characterised by the leucobryaceous leaf anatomy, i.e. layers of narrow chlorophyllose cells sandwiched between layers of much broader empty hyaline cells. The chlorophyllose cells being in a single layer and diamond-shaped in cross-section helps to distinguish *Leucobryum* from other genera with leucobryaceous leaves.

Some of the Australian species have also been included in treatments of *Leucobryum* from Sabah (Enroth, 1989), Papua New Guinea (Enroth, 1990) and Asia (Yamaguchi, 1993). While these accounts differ in the circumscription of some of the species, in general Yamaguchi's (1987; Yamaguchi & Iwatsuki, 1993) concepts have been adopted here. Thus, important diagnostic characters for the Australian species include: (i) the presence or absence of a central strand in the stem; (ii) the shape of the leaf base (decurrent or not, auriculate or not); (iii) ornamentation of the abaxial leucocysts in the upper part of the leaves; (iv) the number of layers of adaxial and abaxial leucocysts at the leaf base; and (v) the size and shape of the superficial abaxial leucocysts at the leaf base.

### References

- Enroth, J. (1989), The bryophytes of Sabah (North Borneo) with special reference to the BRYOTROP transect of Mount Kinabalu, IV. Leucobryaceae (Bryopsida), *Wildenowia* 18: 529–554.
- Enroth, J. (1990), Bryophyte flora of the Huon Peninsula, Papua New Guinea, XXXVI. Leucobryaceae (Musci), *Acta Bot. Fenn.* 139: 65–120.
- Yamaguchi, T. (1993), A revision of the genus *Leucobryum* (Musci) in Asia, *J. Hattori Bot. Lab.* 73: 1–123.

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Yamaguchi, T. & Iwatsuki, Z. (1987), New Caledonian *Leucobryum* (Musci), *J. Hattori Bot. Lab.* 63: 473–491.

- 1 Leaf bases rounded to auriculate, slightly decurrent; stem with a central strand.....2
- 1: Leaf bases slightly narrowed, not decurrent; stem lacking a central strand.....3
  - 2 Leaf bases auriculate; costa with 1 layer of leucocysts adaxially as well as abaxially throughout (occasionally with some adaxial leucocysts doubled at the base) ..... **4. L. sanctum**
  - 2: Leaf bases rounded; costa adaxially with 2 or 3 layers of leucocysts at the base and a single more distal layer, abaxially with 2 or 3 layers at the base, at least partly bi-layered to the apex ..... **5. L. wattsii**
- 3 Costa abaxially undulate in the upper part of the leaf, toothed at the apex only; basal superficial abaxial leucocysts not differentiated from those higher up, rectangular, gradually shorter or mixed with a few isodiametric cells ..... **3. L. candidum**
- 3: Costa abaxially undulate and spinose-prorate in the upper part of the leaf; basal superficial abaxial leucocysts differentiated, irregularly quadrate or with rows of isodiametric cells irregularly mixed with rows of rectangular cells.....4
  - 4 Leaves in c. 5 ranks, erecto-patent to falcate-secund throughout the stem ..... **1. L. aduncum** var. **aduncum**
  - 4: Leaves spirally arranged, those at the stem apices curved inwards, forming a point..... **2. L. aduncum** var. **scalare**

**1. *Leucobryum aduncum* Dozy & Molk., in F.A.W.Miquel, *Pl. Junghuhn*. 3: 319 (1854) var. **aduncum****

T: Java, [Indonesia], *F.W.Junghuhn*; lecto: L (*selected here*); *loc. id.*, *Holle*; syn: L; *loc. id.*, *Teysmann*; syn: not located in L.

*Leucobryum pentastichum* Dozy & Molk., in F.A.W.Miquel, *Pl. Junghuhn*. 3: 319 (1854); *Leucobryum candidum* var. *pentastichum* (Dozy & Molk.) Dixon, *Bull. New Zealand Inst.* 3: 97 (1923). T: Java, [Indonesia], *F.W.Junghuhn*; holo: L.

Illustrations: T.Yamaguchi, *op. cit.* 77–79, pl. 14–16.

Plants small to medium-sized, growing in short turfs or rough mats. Stem lacking a central strand. Leaves imbricate, in c. 5 ranks, erecto-patent to falcate-secund, ovate-lanceolate, (2.6–) 3.4–4.0 mm long, (0.6–) 0.8–1.1 mm wide, concave below, subtubulous in the upper 20–25%; base slightly narrowed; costa abaxially undulate and spinose-prorate in the upper half; at the base with 2 or 3 layers, higher up with a single layer of leucocysts at either side; basal superficial abaxial cells rectangular, mixed with isodiametric-quadrate to irregularly shaped cells; lamina narrow, consisting of 3 or 4 cell rows throughout, not auriculate. Perichaetial leaves similar in size to adjacent stem leaves.

Occurs in northern N.T. and in eastern Qld and N.S.W.; often on tree trunks in wet forest and thickets at altitudes to 1200 m. Widespread in SE Asia as far west as India and Sri Lanka, north to Japan and in Malesia.

*Leucobryum aduncum* var. *aduncum* is similar to *L. candidum*, except for the smaller leaf size, irregularly isodiametric basal superficial abaxial leucocysts, and the costa that is spinose at the back in the upper part of the leaf.

**2. *Leucobryum aduncum* var. **scalare** (Müll.Hal. ex M.Fleisch.) A.Eddy, *Handb. Malesian Mosses* 2: 11 (1990)**

*Leucobryum scalare* Müll.Hal. ex M.Fleisch., *Musc. Buitenzorg* 1: 143 (1904). T: Benguet Prov., Luzon, Philippines, *Micholitz 173*; lecto: FH-Fleischer, *fide* T.Yamaguchi, *J. Hattori Bot. Lab.* 73: 33 (1993); Sindanglaya, Tjipannas, Java, [Indonesia], *M.Fleischer*; syn: FH-Fleischer; am Papandanan bei Garoet, [Indonesia], *M.Fleischer*; syn: FH-Fleischer; Sanbori, Sumbawa, [Indonesia], *M.Fleischer*; syn: FH-Fleischer; Bukit Timah, Singapore, *M.Fleischer*; syn: FH-Fleischer.

*Leucobryum subchlorophyllosum* Hampe, *Linnaea* 40: 304 (1876). T: Mt Warning, N.S.W., 1871, *W.Guilfoyle*; holo: BM.

*Leucobryum ballinense* Broth., *Proc. Linn. Soc. New South Wales* 41: 580 (1916). T: Richmond R., East Ballina, N.S.W., *W.W.Watts* 2159; holo: H-BR.

Illustrations: T.Yamaguchi & Z.Iwatsuki, *op.cit.* 482, fig. 6, as *L. scalare*; T.Yamaguchi, *op. cit.* 82–85, pl. 19–22; H.Streimann, *The Mosses of Norfolk Island* 56, fig. 24 (2002), as *L. subchlorophyllosum*.

Plants small, growing in short turfs or rough mats. Stem lacking a central strand. Leaves imbricate, spirally arranged, erecto-patent to homomallously curved when dry, leaves at the shoot apices curved inwards, ovate-lanceolate, 1.7–2.4 mm long, 0.3–0.5 mm wide, concave below, subtubulose in the apical part; base slightly narrowed; costa abaxially undulate and spinose-prorate in the distal third; at the base with 1 or 2 layers of leucocysts adaxially and 2 or 3 layers abaxially, higher up with a single layer of leucocysts at either side; basal superficial abaxial cells rectangular, mixed with isodiametric quadrate to irregularly shaped cells; lamina narrow, consisting of 1 or 2 cell rows throughout, not auriculate. Perichaetial leaves similar in size to adjacent stem leaves.

Occurs in northern N.T., and along the east coast of Qld and N.S.W., on rocks and dead wood in wet to somewhat drier forests and thickets, at elevations to 1400 m. Also widespread in SE Asia, as far west as India and Sri Lanka, and in China, Malesia, New Caledonia and Fiji and Norfolk Island.

*Leucobryum aduncum* var. *scalare* can be distinguished from var. *aduncum* by the spirally arranged leaves, those at the shoot tips being curved inwards and forming a point. There is also a consistent difference in leaf size.

### **3. *Leucobryum candidum* (Brid. ex P.Beauv.) Wilson, in J.D.Hooker, *Fl. Nov.-Zel.* 2: 64 (1854)**

*Dicranum candidum* Brid. ex P.Beauv., *Prodr.* 53 (1805); *Leucobryum brachyphyllum* Hampe ex Müll.Hal., *Linnaea* 17: 317 (1843), *nom. illeg.* (superfluous). T: “Nouvelle Hollande”[Australia]. [Not located by Yamaguchi & Iwatsuki (1987: 486) or by Enroth (1990: 77). The latter indicated that no collection was present in Bridel’s herbarium in B.]

*Leucobryum spinidorsum* Müll.Hal., *Hedwigia* 36: 331 (1897). T: Whangarou, New Zealand, 1890, *C.Fristedt* (Hb Kindberg); syn: B, destroyed; Laus Bay, Grove Ck, Tas., 1891, *Weymouth*; syn: B, destroyed; Port Cygnet, Tas., 1891, *Weymouth*; syn: B, destroyed; 1890, *O.Burchard*; syn: B, destroyed.

*Leucobryum strictifolium* Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 40: 159 (1898). T: Eumundi, Qld, *F.M.Bailey* 914; lecto: H-BR (*selected here*); *s. loc.*, Qld, *F.M.Bailey* 835; syn: H-BR; *s. loc.*, Qld, *F.M.Bailey* 839; syn: H-BR; Tintenbar, Richmond R., N.S.W., *W.W.Watts* 344; syn: H-BR; Tuckombit, Hunters Scrub, N.S.W., *W.W.Watts* 550; syn: H-BR; *loc. id.*, *W.W.Watts* 571; syn: H-BR *n.v.*; Maxwells Scrub, N.S.W., *W.W.Watts* 1000; syn: H-BR.

*Leucobryum confusum* Thér., *Bull. Soc. Bot. Genève*, sér. 2, 13: 224 (1921). T: *n.v.*

Illustrations: T.Yamaguchi & Z.Iwatsuki, *op. cit.* 484, fig. 7; D.Meagher & B.Fuhrer, *Field Guide to the Mosses and Allied Plants of Southern Australia* 27 (2003).

Plants medium-sized to robust, growing in turfs. Stem lacking a central strand. Leaves imbricate, spirally arranged, homomallously curved to falcate-secund, ovate-lanceolate, 4.5–6.0 mm long, 0.8–1.4 mm wide, canaliculate below, subtubulose in the upper c. 12–20%; base slightly narrowed; costa abaxially undulate in the distal 25–33%, toothed at the apex only; at the base with 1–3 layers of leucocysts adaxially and 2 or 3 layers abaxially, higher up with a single layer of leucocysts at either side; basal superficial abaxial cells gradually shortened, short-rectangular to quadrate; lamina narrow, consisting of 4–6 cell rows throughout, not auriculate. Perichaetial leaves shorter and narrower than adjacent stem leaves.

Occurs in Qld, N.S.W., Vic. and Tas.; on dead wood, soft bark and treefern trunks in wet forests, up to 1100 m. Also in Lord Howe Island, New Zealand and New Caledonia.

This is the most widespread *Leucobryum* in Australia and the only one that occurs in cool-temperate southern latitudes and in New Zealand. *Leucobryum candidum* was synonymised with the Malesian *L. javense* (Cardot) Mitt. by Enroth (1989), but this was rejected by Yamaguchi (1993) who excluded *L. candidum* from the Malesian bryoflora

#### 4. *Leucobryum sanctum* (Brid.) Hampe ex Müll.Hal., *Linnaea* 17: 316 (1843)

*Dicranum glaucum* var. *sanctum* Brid., *Bryol. Univ.* 1: 811 (1827); *D. sanctum* (Brid.) Nees ex Schwägr., *Sp. Musc. Frond.*, Suppl. 2(2): 121 (1827). T: Java, [Indonesia], *C.L. von Blume*; holotype: B.

*Leucobryum vesiculosum* Müll.Hal. ex Cardot, *Mém. Soc. Sci. Nat. Cherbourg* 32: 67 (1901). T: n.v.

Illustrations: T. Yamaguchi, *op. cit.* 117–120, pl. 14–17.

Plants medium-sized to robust, growing in turfs. Stem with a central strand. Leaves imbricate, spirally arranged, falcate-secund, lanceolate above the elliptical to obovate expanded basal part to narrowly lanceolate, 5.2–6.8 mm long, (0.5–) 1.5–2.0 mm wide, canaliculate below, subtubulose in the upper half; base auriculate, somewhat decurrent; costa abaxially slightly rough because of prorulose cells at the extreme apex to c. 12% of the leaf length, toothed at the extreme apex only, with a single layer of leucocysts at either side throughout, occasionally some adaxial leucocysts at the base doubled; basal superficial abaxial cells not differentiated, rectangular; lamina narrow in most of the leaf, widened, consisting of 4–8 cell rows; auriculate towards the base in all but the narrowest of leaves. Perichaetial leaves up to 60–80% the length of adjacent stem leaves.

Occurs in the wet tropics of north-eastern Qld and inland at Carnarvon Gorge; on soil, rocks, tree roots and rotting logs at 100–1500 m. Widespread in mainland SE Asia and Malesia and also in Fiji.

*Leucobryum sanctum* is readily distinguished from other Australian species by its auriculate leaf bases.

#### 5. *Leucobryum wattsii* Broth., *Proc. Linn. Soc. New South Wales* 41: 579 (1916)

T: Rous Falls, Richmond R., N.S.W., *W.W. Watts* 4856; lectotype: H-BR (*selected here*); Brooklet, Richmond R., N.S.W., *W.W. Watts* 4802; syn: H-BR; head of Teven [?Creek], Richmond R., N.S.W., *W.W. Watts* 2891; syn: H-BR; head of Wilsons Ck, Richmond R., N.S.W., *W.W. Watts* 2097; syn: H-BR; East Ballina, N.S.W., *W.W. Watts* 2261; syn: H-BR.

Plants small, growing in short turfs. Stem with a central strand. Leaves imbricate, spirally arranged, curved towards the stem when dry, erecto-patent, slightly homomallously curved when wet, ovate-lanceolate, 3.0–4.3 mm long, 0.6–1.1 mm wide, canaliculate to concave below, narrowly canaliculate to subtubulose in the upper half; base rounded, slightly decurrent; costa abaxially smooth almost throughout or slightly undulate or prorate at the extreme apex only; at the base with 2 or 3 layers of leucocysts at either side, superficial abaxial layer with narrower cells, higher up adaxially with a single layer of leucocysts, abaxially with leucocysts at least partly 2-layered to the apex; basal abaxial superficial leucocysts oblate to isodiametric, irregularly shaped to  $\pm$ quadrate; lamina forming a narrow border in most of leaf, widened, to 12 cell rows wide, not auriculate towards the base. Perichaetial leaves and sporogones unknown.

Endemic to the east coast of Qld and north-eastern N.S.W.; grows on dead wood, bark and on rocks in wet forest, at altitudes up to 1250 m.

Qld: Giants Staircase, Lamington Natl Park, *I.G. Stone* (MEL).

*Leucobryum wattsii* is easily distinguished from most other Australian species by the smooth leaves that can be somewhat undulate or prorate at the extreme apex only. It is much smaller in stature than the smooth-leaved *L. sanctum*, and it lacks the auriculate leaf bases. It is the only Australian species with abaxial leucocysts being partly double-layered in the upper part of the leaves.

*Leucobryum wattsii* is similar in many respects to the New Caledonian endemic *L. neocaledonicum* Duby ex Besch., but it differs in costal anatomy and in the isodiametric, basal, superficial adaxial cells.

### Names of uncertain status

*Leucobryum brachyphyllum* var. *majus* (Schwägr.) Müll.Hal., *Linnaea* 18: 688 (1845)

*Dicranum candidum* var. *majus* Schwägr., *Sp. Musc. Frond.*, Suppl. 2(2): 120 (1827). T: not designated.

*Leucobryum candidum* var. *majus* Dixon, *Bull. New Zealand Inst.* 3: 97 (1923)

T: not designated.

*Leucobryum candidum* var. *major* A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1871–72: 311 (1873) [Ad. 1: 161]

T: “in Australia felici”; not located.

*Leucobryum brachyphyllum* var. *minus* Geh. ex Thér., *Bull. Soc. Bot. Genève*, sér. 2, 13: 224 (1922)

T: Brisbane R., Qld, *A.Dietrich*; holo: B, destroyed.

### Excluded taxa and taxa of doubtful occurrence in Australia

*Leucobryum sericeum* Broth. ex Geh., *Biblioth. Bot.* 44: 26 (1898)

*Leucobryum bowringii* var. *sericeum* (Geh.) Dixon, *Ann. Bryol.* 5: 24 (1932). T: Mt Paojem, Borneo, *Teysmann* (sub No. 11140); holo: H-BR.

*Leucobryum chlorophyllosum* Müll.Hal., *Syn. Musc. Frond.* 2: 535 (1851)

T: Sumbawa, [Indonesia], *H.Zollinger 3370*; holo: B, destroyed; lecto: L (*selected here*).

*Leucobryum stenophyllum* Besch., *Ann. Sci. Nat., Bot.*, sér. 5, 18: 204 (1873). T: Baie Du Prony, New Caledonia, *Balansa 2531*; holo: BM *n.v.*

*Leucobryum sericeum* was excluded from the Australian bryoflora by Catcheside & Stone (The mosses of the Northern Territory, Australia. *J. Adelaide Bot. Gard.* 11: 1–17, 1988), and Australian specimens were re-identified as *L. stenophyllum*. However, all Australian specimens of *L. chlorophyllosum* studied here are narrow-leaved forms of *L. sanctum*. In contrast to true *L. chlorophyllosum*, the leaf bases are auriculate in all but the narrowest leaves, and stems possess a central strand, albeit a very inconspicuous one.

*Leucobryum aduncum* var. *teysmannianum* (Dozy & Molk.) T.Yamag., *J. Hattori Bot. Lab.* 73: 32 (1993)

*Leucobryum teysmannianum* Dozy & Molk., *Bryol. Javan.* 1: 17 (1855). T: Java, [Indonesia], comm. *Teysmann*; holo: L.

*Leucobryum aduncum* var. *teysmannianum* has been tentatively excluded from the Australian bryoflora. Australian specimens identified as *L. teysmannianum* fit within the circumscription of *L. aduncum* var. *aduncum*.