

## The genus *Cololejeunea* (Spruce) Steph. (Marchantiophyta Lejeuneaceae) on Lord Howe Island

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### Abstract

*Cololejeunea elizabethae* Meagher & Pócs is described as a species new to science from Lord Howe Island, Australia. This is the second *Cololejeunea* species known from the island, along with the widespread temperate Australasian *Cololejeunea laevigata* (Mitt.) R.M.Schust.

### Introduction

Hitherto only one species of the genus *Cololejeunea* (Spruce) Steph. was known from the remote Lord Howe island, *Cololejeunea laevigata* (Mitt.) R.M.Schust. (Thiers 1988), although its environmental conditions seem to favour the occurrence for members of this genus, with its dense and humid subtropical rainforests. The island is home to many endemic vascular plant species; 105 of the 241 native species are endemic (Auld and Hutton 2004). The cryptogamic flora is less known and is at present under investigation, mostly by Australian botanists. About 185 bryophyte species occur on the island, of which about 15 are probably endemic (Meagher, unpublished data). Both Elizabeth A. Brown and the first author independently collected the same species of *Cololejeunea* on the island in 2000 and in 2009 respectively, which proved to be new to science.

Thus two species of *Cololejeunea* are now known from Lord Howe Island. The following couplet may be used to distinguish them.

Leaves with a distinct border of hyaline cells; gemmae with 26–28 cells when fully developed ..... *C. elizabethae*  
Leaves without a border of hyaline cells; gemmae with 16 cells when fully developed ..... *C. laevigata*

### *Cololejeunea elizabethae* sp. nov.

**Formal diagnosis:** A *Cololejeunea* in which the leaves have a border of 1–3(–4) rows of thin-walled, *Allorgella*-type hyaline cells, the chlorophyllose cells of the leaves have large and often confluent trigones as well as large and often confluent intermediate thickenings, the leaf lobule is distally truncate, the lobule margin bears (1–)2–3 distinct teeth, the lobule cells are nodulose, and a triangular stylus is present. The perianth is hardly emergent, obcordate, flat, ventrally bulging, with slightly auriculate wings and a short beak.

Type: AUSTRALIA, New South Wales, Lord Howe Island, Smoking Tree Ridge, on track to Goathouse, above junction with Rocky Run track, 31°33'25"S, 159°05'15"E, alt. 140 m. In fairly open *Drypetes*–*Cryptocarya* forest. Growing on ?*Cryptocarya* near base of trunk, intermixed with other liverworts, 9 June 2000, E.A. Brown 2000/12 p.p. (holotype: NSW-444684, isotype: EGR).

**General description:** Plants fragile, small, pale olive-green with a frosted and almost transparent appearance in life, closely appressed to the substratum; stems to about 10 mm long, about 70–90 µm in diam., in TS with 1 medullary cell, 4 large thick-walled dorsal cells and 3–4 smaller and thinner-walled ventral cells (ventral merophyte); shoots about 1.4–1.8 mm wide, branches few, lateral-intercalary; rhizoids numerous, in tufts; leaves imbricate, brittle, widely spreading; leaf lobes flat, obovate, the largest about 0.8–1.1 mm long and 0.55–0.95 mm wide, apex rounded, margin plane; border of 1–3(–4) rows of hyaline cells, sometimes intermittent, sometimes absent on most of the ventral edge of the leaf, often eroded and thus appearing incomplete; dorsal margin strongly arched, reaching beyond the opposite side of the stem. Cells of hyaline margin ± rectangular, *Allorgella*-type, about 10–20 × 8–10 µm, thin-walled; laminal cells bordering the margin ± quadrate to rectangular, about 20–24 × 8–15 µm, outer non-hyaline cells very variable in shape, hexagonal to rectangular, to about 24 µm wide; cells in mid-leaf long-hexagonal, to about 55 × 28 µm, those towards the leaf centre often narrower but not forming a vitta; all non-hyaline laminal cells strongly nodulose with large and often confluent trigones and intermediate thickenings, the thickenings usually circular and pearl-like, often in pairs and sometimes confluent; ocelli absent; surfaces smooth. Leaf lobule about 1/4 to 1/3 of leaf length, ± cuneate, inflated, the free margin flat to somewhat incurved, apex obliquely truncate; cells very variable in size and shape, mostly ± obliquely quadrate to rectangular, nodulose, to about 20 × 10 µm; usually 3 lobule teeth present, sometimes an extra single-celled proximal tooth, distal tooth often reduced or absent, their positions and sizes very variable; proximal tooth of 1–2 uniseriate cells, sometimes with an extra indistinct tooth proximal to it formed by the bulging wall of a marginal cell; centre tooth of 1–3 cells (1–2 uniseriate), distal tooth of 3–5 cells (1–3 uniseriate), situated at the point where the angle of the lobule changes abruptly; hyaline papilla on the proximal base of the distal tooth; keel straight or slightly arched, smooth; stylus small, bluntly triangular, 1–3-celled, fragile, often missing. Gemmae developed profusely on dorsal and ventral surfaces of leaf lobe, discoid, bisymmetrical, when fully developed 100–150 × 60–90 µm and consisting of 26–28 cells. Autoicous. Androecia on short lateral-intercalary branches, about 0.6 mm long, capitate, bracts about 0.16 mm long, in 3–11 pairs. Gynoecia on longer lateral-intercalary branches, about 0.8 mm long including bracts, innovations not seen; bracts smaller than the stem leaves, obovate-oblong, about 0.55 mm long, non-hyaline margins weakly crenulate from projecting cell walls, intermittent border of 1–2 rows of quadrate hyaline cells usually present, cells as in the stem leaves but smaller; lobule variable in size and shape, ranging from falcate with a rounded apex lacking teeth (Fig. 1e) to obovate-cuneate with one or two teeth (Fig. 2c). Perianth hardly emergent, cordate to obcordate, ventrally bulging, with slightly auriculate wings, 360–480 × 320–400 µm, beak short, composed of 2 rows of cells. **Figs 1, 2.**

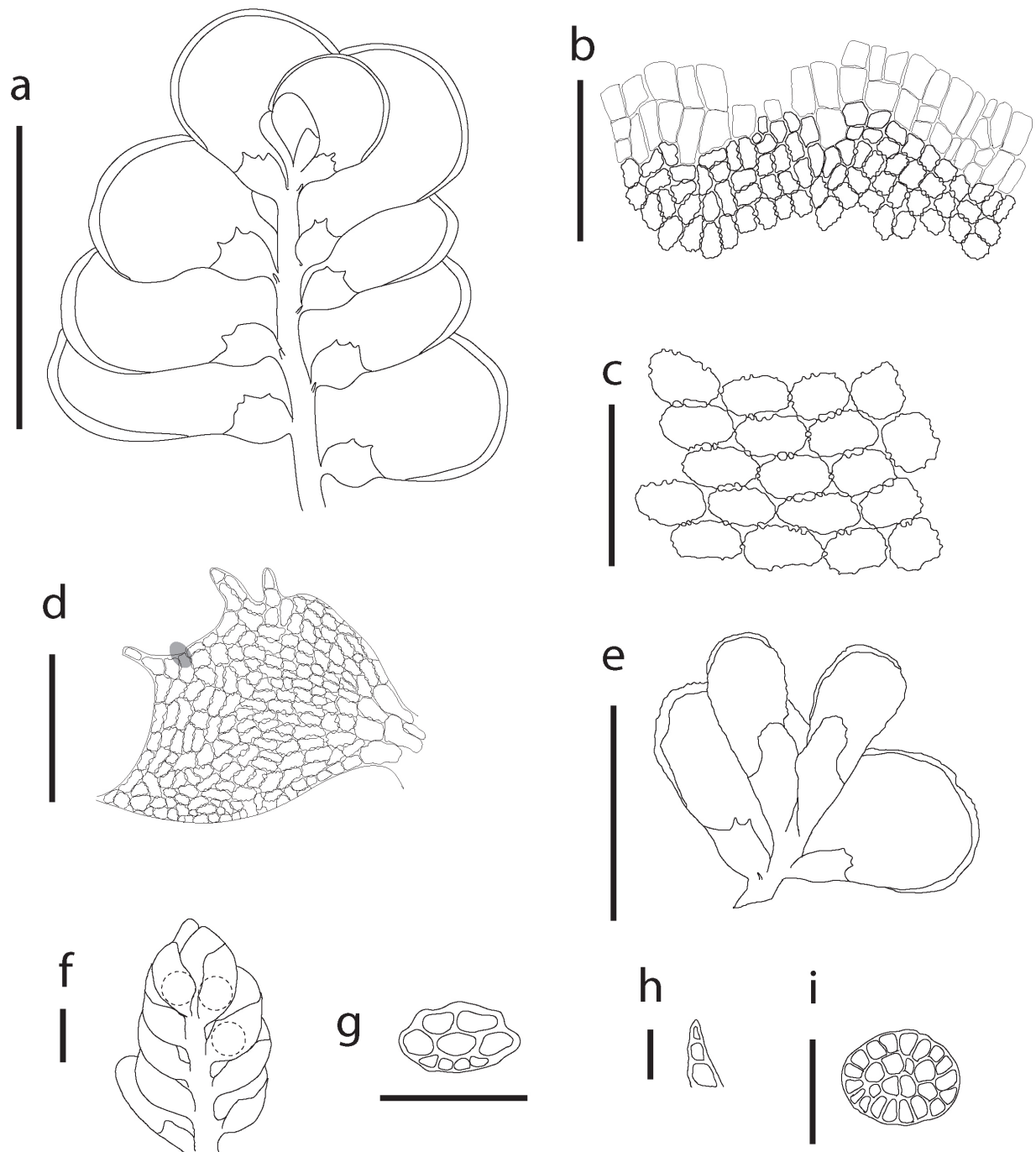
**Additional specimens examined:** North Hummock, on trunk of Tamana (*Elaeodendron curtispiculum*), 7 Nov 2009, Meagher LH-154 (CANB). Northern Hills, on basalt rock between Settlement and North Bay, 4 Nov 2009, Meagher LH-046 (MELU).

**Distribution:** Known at present only from the northern and central hills of Lord Howe Island (Fig. 3).

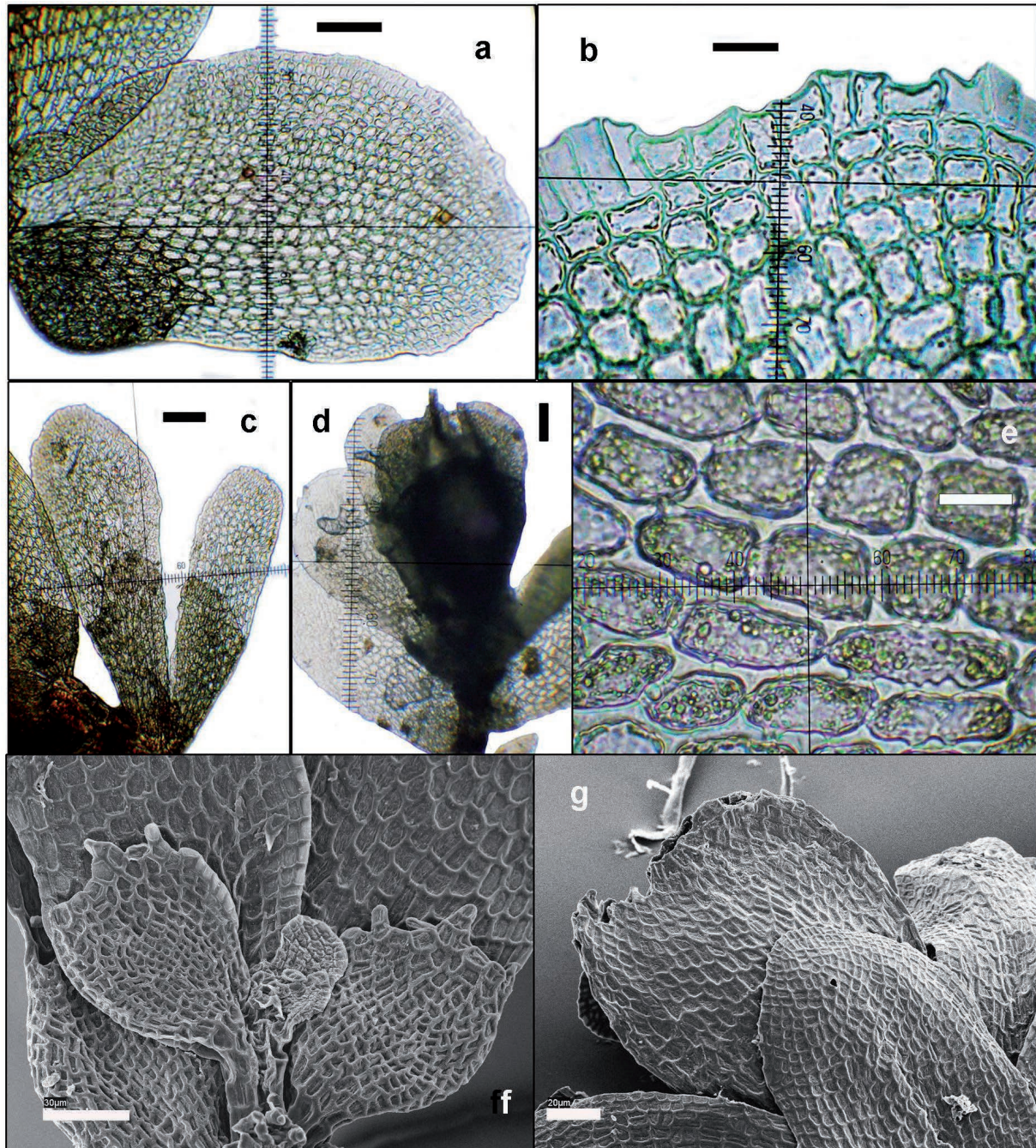
**Habitat:** Epiphytic on bark, and lithophytic on basalt rock (Fig. 4).

**Etymology:** The specific epithet posthumously honours Elizabeth Brown, New Zealand bryologist in Sydney, who was also a member of Friends of Lord Howe Island.

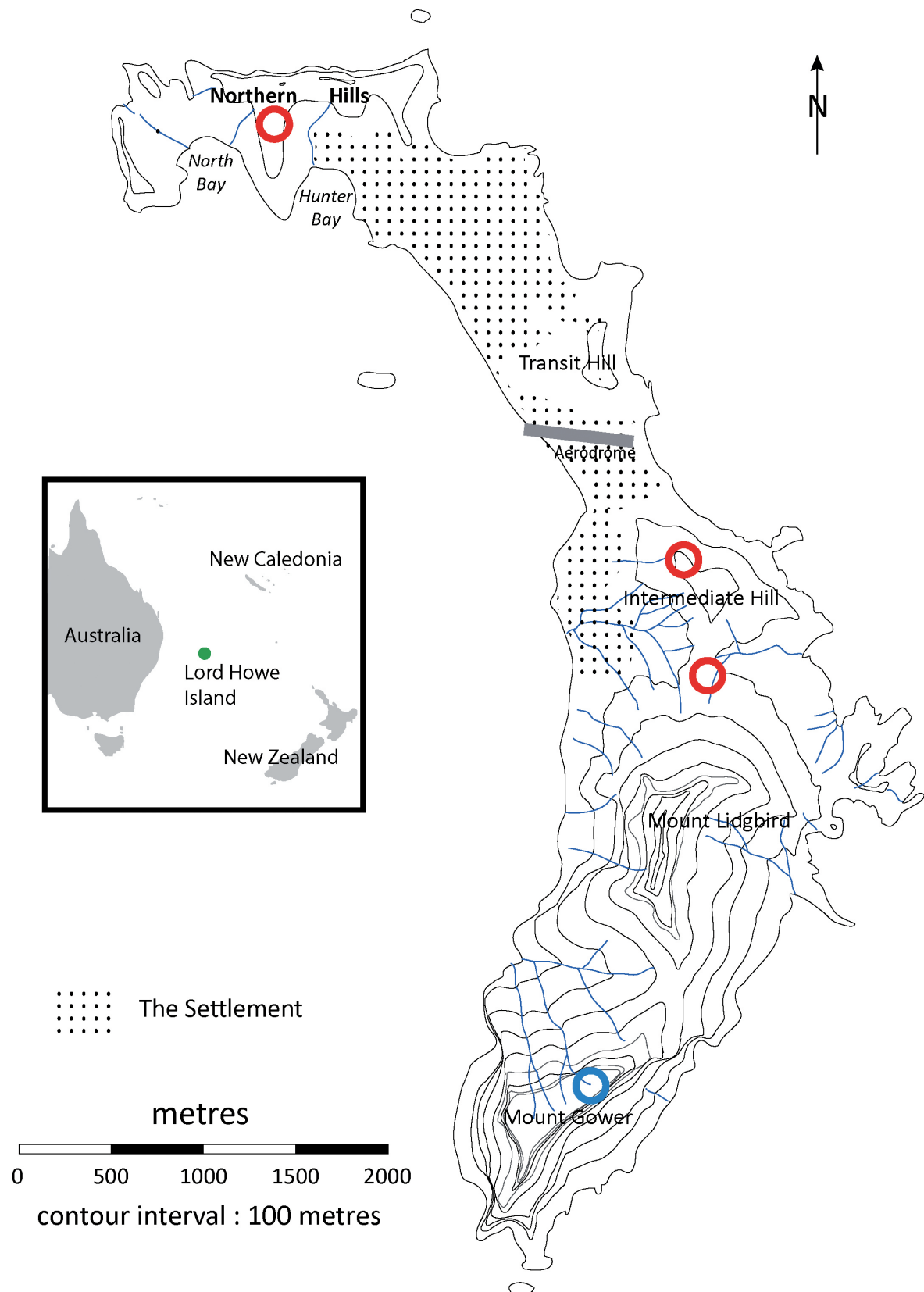
**Differentiation:** Numerous species of *Cololejeunea* with a long border of hyaline cells, chlorophyllose cells lacking papillae, and no vitta are known. However, each of these species differs from *C. elizabethae* in at least two significant characters. Table 1 shows the differentiation from species in the Australasian region; species from other regions are not shown for the sake of brevity. *Cololejeunea elizabethae* perhaps most closely resembles *C. angulata* (Steph.) Mizutani from New Guinea and the Philippines, which also has large and often doubled pearl-like intermediate thickenings in the walls of the lobe cells, as well as nodulose cells in the lobule and ovate-oblong gynoecial bracts (Mizutani 1965). However, in that species the lobule has one tooth, the trigones are small, and the hyaline border is 1–2 cells wide. A plant figured as *C. cuneata* (Lehm. & Lindenb.) Herzog by Herzog (1947: Fig. 6) from the Comoro Islands is also similar, but it has only two long, curved teeth on the distal end of the lobule, the outer chlorophyllose cells of the leaves are thin-walled and the cells of the lobules are not nodulose.



**Fig. 1.** *Cololejeunea elizabethae* sp. nov.: **a** part of shoot, ventral view; **b** marginal cells and border of leaf; **c** median cells of leaf; **d** typical leaf lobule; **e** gynoecial bracts; **f** androecium; **g** transverse section of stem; **h** stylus; **i** gemma. Scale bars: a, e = 1 mm; b–c, f, g, i = 100  $\mu$ m; h = 20  $\mu$ m. From Brown 2000/12 p.p.



**Fig. 2.** *Cololejeunea elizabethae* sp. nov. **a** leaf, ventral view; **b** lobe margin with hyaline and chlorophyllose cells; **c** gynoeical bracts; **d** gynoeicum with perianth; **e** cells near the lobe base; **f** shoot apex, ventral view; **g** perianth with somewhat damaged apex. Scale bars: a, c = 100 µm; b = 25 µm; e = 20 µm; f, g = 60 µm. From Brown 2000/12 p.p.



**Fig. 3.** Known localities for *Cololejeunea elizabethae* (red circles) and *Cololejeunea laevigata* (blue circle) on Lord Howe Island. Dotted area is the inhabited part of island.

**Table 1. Differentiation of *Cololejeunea elizabethae* from similar species in the Australasian region.**

Species	Leaf border (cells)	Leaf surface	Trigones	Intermediate thickenings	Lobule teeth	Lobule cells	Stylus	Inner gynoeceal bracts
<i>C. elizabethae</i>	1–3(–4)	smooth	large	large	2–3	nodulose	1–3 cells	obovate–oblong
<i>C. amieuensis</i> Tixier	1–3	scabrid	medium	small	0	plain	absent	ovate
<i>C. angulata</i> (Steph.) Mizut.	1–2	smooth	small	large	1	nodulose	absent	ovate
<i>C. comptonii</i> (Pearson) H.A.Mill.	1–2	smooth	minute	absent	0–1	plain	absent	obovate–oblong
<i>C. dzumacensis</i> Tixier	1–3(–4)	smooth	small	small	3	plain	absent	ovate
<i>C. kapingaensis</i> H.A.Mill.	1–2	scabrid	small	absent	2	plain	absent	ovate
<i>C. laevigata</i> (Mitt.) Tilden	none	smooth	large	medium	2–3	±nodulose	absent	obovate–oblong
<i>C. lanciloba</i> Steph.	1–3(–4)	smooth/ scabrid	minute	small	1–3	plain	absent	ovate
<i>C. planissima</i> (Mitt.) Abeyw.	1–2	scabrid	small	absent	2	plain	absent	ovate
<i>C. subtriapiculata</i> Tixier	1–3(–4)	scabrid	small	small	2	plain	absent	ovate
<i>C. triapiculata</i> (Herz.) Tixier	1–3(–4)	scabrid	minute	absent	3	plain	absent	ovate
<i>C. vidaliana</i> Tixier	1–3(–4)	scabrid	minute	minute	2	plain	8+ cells	ovate

This plant is clearly not *Jungermannia cuneata* as described by Lehmann and Lindenberg (in Lehmann 1832: 56), since that species has only one tooth on the lobule and does not have such large trigones and intermediate thickenings (Tixier 1985: 48). The species illustrated by Herzog is in fact *Cololejeunea marginata* (Lehm. & Lindenb.) Pearson, a species widespread in the East African islands.) The common and widespread *Cololejeunea lanciloba* Steph. has small trigones with small intermediate thickenings, the lobules are commonly explanate, and the gynoeceal bracts are similar in shape to the leaves and have a continuous border of hyaline cells (Mizutani 1961). As far as we are aware *C. elizabethae* is the only species of *Cololejeunea* in the region that grows on rock (Fig. 4); all other species are epiphytic or epiphyllous.

Compared to *Cololejeunea laevigata*, *C. elizabethae* has a much different appearance in the field. In *C. laevigata* the leaves are turned slightly to the dorsal side and not flattened, and the colour is a darker and more opaque olive green. It is immediately distinct microscopically from *C. elizabethae* in lacking a border of hyaline cells on the leaves and gynoeceal bracts. Other differences in *C. laevigata* are leaves much more variable in size and generally smaller, lobule teeth consisting of only 1 or 2 cells, mid-lamina cells mostly isodiametric or only slightly elongate, intermediate thickenings much smaller and rarely multiple, lobule cells not or hardly nodulose, perianth with distinctly auriculate wings, and gemmae with only 16 cells. On Lord Howe Island *C. elizabethae* occurs in lower and drier habitats, whereas *C. laevigata* appears to be confined to montane cloud forest on the summit plateau of Mt Gower.

#### ***Cololejeunea laevigata* (Mitt.) R.M.Schust.**

The type of *Cololejeunea laevigata* was collected by Andrew Sinclair from the Auckland region, on the North Island of New Zealand (Hooker 1854: 157). However, the description of *Cololejeunea laevigata* (Mitt.) R.M.Schust. by Thiers (1988) was based on a collection by Lenz from Mt Gower on Lord Howe Island. In this study an additional collection of *C. laevigata* was made from Mt Gower (Meagher LH-609, MELU), and it is identical to that described by Thiers (1988). *Cololejeunea laevigata* has been most commonly collected as an epiphyll in southern Australia and New Zealand, including the type specimen (Hooker 1854: 157). On Lord Howe Island our specimen was growing on the filmy fern *Hymenophyllum howense* Brownlie (Fig. 5).

Thiers (1988) noted that Lord Howe Island material of *C. laevigata* differs from the type (from New Zealand) in the 'presence of a more pronounced and crenulate-margined auricles on the lateral perianth keels, broader gynoeceal bract lobes which are larger relative to the lobule, and larger leaf cells'. She also noted that *Cololejeunea hebridensis* Tixier is probably a synonym of *C. laevigata*, with characters midway between those of the Lord Howe Island and New Zealand plants (Tixier was apparently unaware of the existence of *C. laevigata*, since he did not include it in his treatment). Although we agree with this view, a more detailed analysis of *C. laevigata* throughout its range is needed before a formal recognition of synonymy can be made.

**Specimens examined:** AUSTRALIA: NEW SOUTH WALES: Lord Howe Island, summit plateau of Mt Gower, in montane cloud forest, on fronds of *Hymenophyllum howense*, Nov 2009, Meagher LH-609 (herb. D. Meagher in MELU); QUEENSLAND: Fraser Island, Pile Valley, 6 Jul 1996, Scott s.n. (MELU-H002345a); VICTORIA: Maits Rest, Otway Ranges National Park, 23 Jun 1973, Scott s.n. (MELU-H108840a).



**Fig. 4.** Type locality of *Cololejeunea elizabethae* on Lord Howe Island, in open *Drypetes*–*Cryptocarya* evergreen forest on Smoking Tree Ridge.



**Fig. 5.** *Cololejeunea laevigata* growing as an epiphyll on *Hymenophyllum howense*, Mt Gower, Lord Howe Island. Scale bar = 10 mm.

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