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A contribution to the family *Lecideaceae* s. lat. (Lecanoromycetidae *inc. sed.*, lichenized Ascomycota) in the southern subpolar region; including eight new species and some revised generic circumscriptions

Alan M. FRYDAY and Hannes HERTEL

Abstract: Eight new species of *Lecideaceae* are described from the southern subpolar region: *Bryobilimbia coppinsiana* Fryday, a saxicolous species with one septate ascospores (Campbell Island, New Zealand); *Immersaria fuliginosa* Fryday, with a thallus composed of thalloconidia (Falkland Islands); *Lecidea aurantia* Fryday, with an orange thallus (Auckland Islands, New Zealand); *L. campbellensis* Fryday, with an endolithic thallus and apothecia resembling those of a species of *Porpidia* (Campbell Island); *Poeltiaria ochyrae* Hertel, which is similar to *P. subincongua* but with a thick areolate thallus (South Orkney and South Shetland Islands); *P. tasmanica* Fryday, which is similar to *P. urbanskyana* but with smaller ascopores (Tasmania); *Poeltidea inspersa* Fryday with an enolithic thallus and a hymenium with large oil globules (Falkland Islands); and *Porpidia vulcanoides* Hertel & Fryday with immersed apothecia with a thick margin and large ascospores (SW Chile). *Lecidea kalbii* Hertel is resurrected from the synonymy of *L. mannii* Tuck. and treated as a distinct species. The circumscription of genera within the *Lecideaceae* is also discussed: *Poeltiaria* is shown to be heterogeneous, and the genera *Labyrintha* and *Notolecidea* are reduced to synonymy with *Poeltidea* and *Poeltiaria* respectively, and the new combinations *Poeltidia implexa* (Malcolm *et al.*) Hertel & Fryday and *Poeltiaria subcontinua* (Hertel) Hertel & Fryday made. A key to the genera of *Lecideaceae* s. lat. is provided.

Key words: algal stacks, biogeography, dichotomous key, lichens, *Porpidiaceae*, thallocondidia

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Introduction

The family *Lecideaceae* Chevall., erected in 1826 as 'Lecideae' (Chevallier 1826), originally included all crustose lecideoid genera but now consists of relatively few genera with lecideine apothecia, simple hyaline ascospores, and a *Lecidea* or *Porpidia*-type ascus structure. Many of these genera were formerly included in the family *Porpidiaceae* Hertel & Hafellner (Hafellner 1984), the genera of which differed from those of the *Lecideaceae* in having an ascus with an amyloid tube structure (*Porpidia*-type), halonate ascospores, and branched and anastomosing paraphyses. However, Buschbom & Mueller (2004) showed that '*Porpidiaceae*' was not monophyletic unless the *Lecideaceae* was also included. This was confirmed by Miądlikowska *et al.* (2006), who also demonstrated that the family should be transferred from *Lecanorales* to Lecanoromycetidae *inc. sed.*

Lecideaceae has been widely studied in the Northern Hemisphere (e.g., Hertel 1977*a*, *b*, 1981, 1991, 1995, 2009; Inoue 1982, 1983; Brodo & Hertel 1987; Gowan 1989; Andreev *et al.* 1998; Buschbom & Mueller 2004; Hertel & Printzen 2004; Fryday 2005; Gowan & Ahti 1993; Schmull *et al.* 2011), but less so in the Southern Hemisphere (e.g., Hertel 1984, 1997, 2007; Rambold 1989; Inoue 1991; Ruprecht *et al.* 2010). Here, eight species in six genera are described as new to science, from various islands in the southern subpolar region, and a further species of *Lecidea* is resurrected from the synonymy of a Northern Hemisphere species. In addition, two genera are reduced to synonymy with other genera and the necessary new combinations made.

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Materials & Methods

The study is based chiefly upon collections made by Henry Imshaug and co-workers during fieldwork in the southern subpolar region between 1968 and 1973 and now held in the herbarium of Michigan State University (MSC; Fryday & Prather 2001). Comparative collections were obtained on loan from COLO, F, GZU, M, UCR and W.

Apothecial characteristics were examined by light microscopy on hand-cut or freezing-microtome sections mounted in water, 10% KOH (K), 15% HCl (H), 50% HNO_3 (N) or 0·15% aqueous IKI. Thallus sections were investigated in water and 10% KOH. Ascus structure was studied in 0·15% aqueous IKI, both without prior treatment and after pretreatment with 10% KOH. Anatomical measurements were made in 10% KOH.

Thin-layer chromatography followed the methods of Orange *et al.* (2001). Nomenclature for apothecial pigments follows Meyer & Printzen (2000).

Selected additional comparative material examined (all MSC unless otherwise stated).

Catarrhospora mira Brusse. **South Africa:** *Cape Province*: Ladismith, Muriskrall, Langeberg Range, 1994, *F. Brusse* 3627 (COLO).

Immersaria athroocarpa (Ach.) Rambold & Pietschm. **New Zealand:** *South Island*: Canterbury, Banks Peninsula, summit of Mt. Herbert, 1973, *Imshaug* 58184.

'Labyrintha' implexa Malcolm *et al.* **New Zealand:** *Campbell Island*: west end of Lyall Ridge, 1969, *Imshaug* 46173. *South Island*: Mt. Cook NP, summit of Mt. Sebastopol, 1970, *Imshaug* 47519; *ibid.*, Arthur's Pass NP, south side of road at Arthur's Pass, 1971, *Imshaug* 47880. *Auckland Islands*: Adams Island, NNW of Mt. Dick, summit of peak on central ridge, 1972, *Imshaug* 56938.

Lecidea mannii Tuck. **USA:** *California*: Mariposa Co., Yosemite National Park, mouth of Pigeon Gulch, 2009, *Fryday* 9319; Orange Co., Santa Ana Mountains, near Main Divide Truck Trail, 2004, *K. Knudsen* 1543 (UCR); Riverside Co., Wildomar, Menifee Hills, 2003, *K. Knudsen* 20 (UCR); *ibid.*, San Jacinto Mountains, Idyllwild, near Inspiration Point, 2005, *K. Knudsen* 3462 (UCR); San Diego Co., Peninsular Range, Palomar Mountain State Park, Palomar Mountain, 2005, *K. Knudsen* (3002) & *M. Knudsen* (UCR).

Melanolecia transitoria (Arnold) Hertel. **Austria:** *Steiermark*: Dachsteingruppe, Ramsau, Weg von der Dachsteinsüdwandhütte in Richtung Hunerscharte, 7 viii 1993, *J. Poelt & M. Grube* (GZU); Dachstein-Gruppe, Steiermark/Oberösterreich: Gipfel des Hohen Dachstein, 29 vii 1990, *J. Poelt* (GZU).

'Notolecidea' subcontinua (Nyl.) Hertel. **Îles Kerguelen:** Presqu'ille Jeanne d'Arc, W edge of Ravin du Charbon, 1971, *G. C. Bratt* 71/186; Péninusule Courbet, 1·5 km N of Port-aux-Français, 1971, *R. C. Harris* 6884; *ibid.*, just below summit of Mt. Crozier, *R. C. Harris* 7356; Ile Haute, SE edge of table des Mouflons, 1971, *R. C. Harris* 6964.

Paraporpidia leptocarpa (Nyl.) Rambold & Hertel. **Australia:** *Victoria*: Northern Plains Region, Euroa—Strathbogie Road, 9 km E of Euroa, 1999, *H. Streimann* 53502 (MSC, unseen duplicates in CANB, B, TU, NY, MUB & MHA).

Poeltiaria coromandelica (Zahlbr.) Rambold & Hertel. **Australia:** *Victoria*: Mt. William, Grampians National Park, 29 km W of Ararat, 1994, *H. Streimann* 55155.

Poeltiaria corralensis (Räsänen) Hertel. **Chile:** *Magallanes and Antártica Chilena Region*: S shore B. Pond, 1969, *Imshaug* (45335) *& K. Ohlsson.*

Poeltiaria urbanskyana (Zahlbr.) Hertel. **Îles Kerguelen:** Île Haute, north side of isthmus east of cabin, 1971, *R. C. Harris* 6959.

Poeltidea perusta (Nyl.) Hertel & Hafellner. **Argentina:** *Tierra del Fuego Province*: Isla Grande de Tierra del Fuego, Bahia Valentin, 1971, *Imshaug* (50282) *& K. Ohlsson.*—**Falkland Islands:** *West Falkland*: Weddell Island, on summit of peak NE of Mt. Weddell, 1968, *Imshaug* (41971 A) *& R. C. Harris.*—**Îles Kerguelen:** Plateau des Lacs, cliffs at N end of plateau, 140 m, 1971, *G. C. Bratt* 71/275.

Rhizolecia hybrida (Zahlbr.) Hertel. **New Zealand:** *South Island*: Canterbury, Castle Hill Basin, 1935, *H. H. Allan* A 18 (W—holotype).

Schizodiscus afroalpinus Brusse. **South Africa:** *Natal*: 65 km N of Maclear, summit of Naudé's Nek, 1986, *F. Brusse* 4593 (COLO).

Stenhammarella turgida (Ach.) Hertel. **Austria:** *Nordtirol, Tuxer Alpen*: Gipfel des Bentelsteins bei Steinach, ix 1958, *M. Steiner* (*Lichens Alpinum* # 123). *Salzburg*: Hohe Tauern, Glockner Gruppe, ridge NW of Großer Magrötzenkopf, W of Hochtor pass, 1996, *F. Lutzoni* 96.8.30-1 (F).

New Taxa

Bryobilimbia austrosaxicola Fryday & Coppins sp. nov.

MycoBank No.: MB805056

Similar to *Bryobilimbia australis* but saxicolous, with a brown, not violaceous, epihymenium and 1-septate ascospores.

Type: New Zealand, Campbell Island, rock outcrops at summit of Mt. Azimuth [52°30·1′S 169°9·9′E], 1600 ft. [488 m], 3 January 1970, *H. A. Imshaug* 46535, (MSC—holotype).

(Fig. 1)

Thallus effuse, to 5 cm across, areolate, composed of thin, angular, flat to slightly convex, pale grey areoles, 0·2–0·3 mm across; *medulla* I−. *Primary photobiont* chlorococcoid, cells 5–9 µm diam. *Secondary photobiont* comprised of numerous small (up to 0·25 mm across) clumps of cyanobacteria scattered over the surface, cells of two types; short, branched, yellow-brown filaments, 15–20 µm across, 1–2 cells wide (*Stigonema*),

FIG. 1. *Bryobilimbia austrosaxicola*, thallus and apothecia (*Imshaug* 46535—holotype). Scale = 1 mm. In colour online.

plus groups of 2–4 cells in a reddish (K+ purple) sheath, cells 5 µm diam. (*Gloeocapsa*).

Apothecia frequent, adnate to sessile, black, flat to convex, lecideine, 1·0–1·5 mm diam., ±orbicular but often confluent and then angular; *proper margin* rarely discernible, even in young apothecia. *Hymenium* 50–65 µm, streaked with red-brown pigment (K+ olivaceous-brown); *paraphyses* rather sparse and inconspicuous, simple, 1·0–1·5 µm thick, apices not pigmented or capitate. *Asci* cylindrical to somewhat clavate, 40–45 × 12–15 µm, tholus I+ pale blue with a darker axial tube (?*Porpidia*-type); *ascospores* hyaline, (0–) 1-septate, 10–12 × 3·5–4·0 µm. *Hypothecium* massively developed and carbonaceous, dark red-brown (K+ olivaceous-brown), internal structure not discernible.

Pycnidia uncommon, black, 0·10–0·15 mm wide; ostiole gaping at maturity; wall in section dark red-brown (K+ olivaceous-brown); *conidia* bacilliform, 7–8 × 1 µm.

Chemistry. K−, C−, Pd−. No substances detected by TLC.

Distribution and ecology. Known from only three collections from mountainous sites on Campbell Island, New Zealand. Associated species are few but include *Placopsis* sp. (with a lichenicolous *Cercidospora* sp.) and *Steinera radiata* subsp. *aucklandica* P. James & Henssen.

Remarks. The new species is included in the recently described genus *Bryobilimbia* Fryday *et al.* (Fryday *et al.* 2014) because of its similarity to *B. australis* (Kantvilas & Messuti) Fryday *et al.* (syn. *Mycobilimbia australis* Kantvilas & Messuti), which grouped with the type species, *B. hypnorum* (Lib.) Fryday *et al.* , in that study. The bacilliform conidia are also consistent with a placement in *Bryobilimbia*. It is separated from *B. australis*, and all other species of the genus, by a combination of its saxicolous habit and consistently 1-septate ascospores.

Brian Coppins is included as an author of this species because it was his suggestion that this taxon may be referable to the *Lecidea hypnorum* group.

Additional specimens examined (all MSC). **New Zealand:** *Campbell Island*: north-west slope of Mt. Honey, 1969, *Imshaug* 46430; *ibid.*, summit and summit ridge of Mt. Honey, 1800–1867 ft., 1969, *R. C. Harris* 4898; *ibid.*, cliffs and shingle feldmark at summit of Mt. Fizeau, 1655 ft., 1970, *Imshaug* 46791.

Immersaria fuliginosa Fryday sp. nov.

MycoBank No.: MB805057

Separated from all other species of the genus (and the *Lecideaceae*) by the presence of thalloconidia.

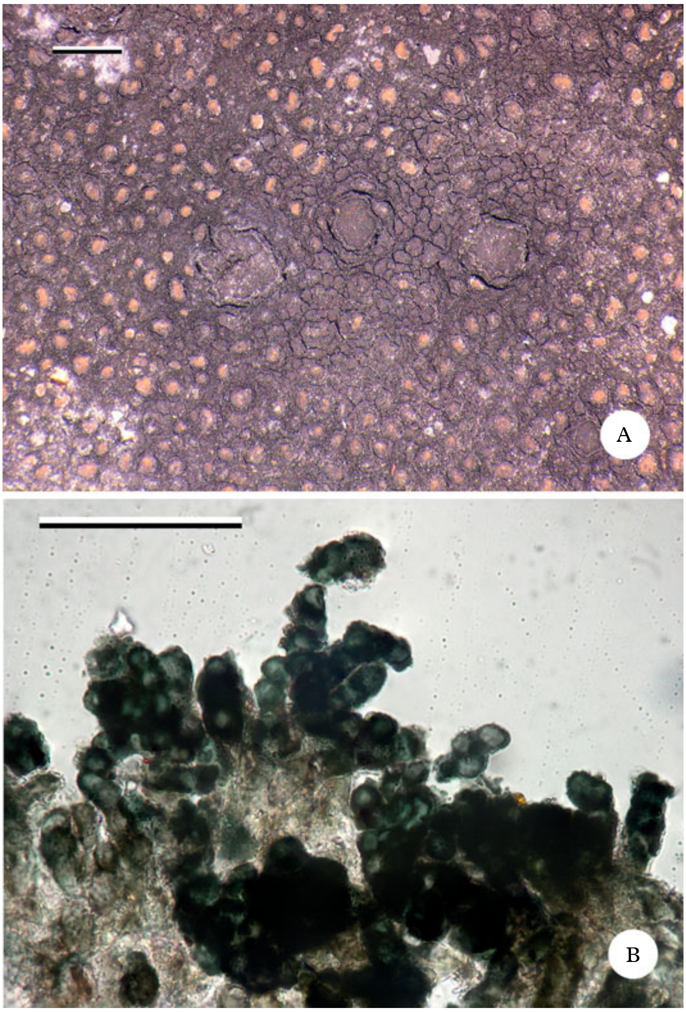


FIG. 2. *Immersaria fuliginosa* (*Imshaug* 41296—holotype); A, thallus and apothecia; B, thalloconidia. Scales: A = 1 mm; B = 50 µm. In colour online.

Type: Falkland Islands, West Falkland, pass SW of Mt. Maria summit, UTM 21F UC 2078 [51°36·630′S, 59°35·910′W], 2000 ft. [610 m], rock outcrops, 28 January 1968, *H. A. Imshaug* (41296) & *R. C. Harris* (MSC—holotype; M—isotype).

(Fig. 2)

Thallus consisting of concave to flat, pale to red-brown areoles, 0·1–0·4 mm across, dispersed on a black prothallus that is completely dissolved into thalloconidia; prothallus forming a dark margin to each areole; areoles often larger and forming a ± contiguous crust at the thallus margin; *upper cortex* poorly developed, composed of a diffuse layer of dilute brown pigmented cells, *c.* 10–20 µm thick; *epinecral layer* 70–120(–150) µm; *medulla* I+ violet. *Photobiont* chlorococcoid, forming a well-defined horizontal layer near the base of the areoles; *cells* thick-walled, 7–12 µm diam.

Apothecia infrequent, lecideine, immersed; *disc* concave, dark brown to black, epruinose, brownish when wet, 0·8–1·5 mm across;

proper margin thin (0·05 mm), slightly raised, poorly developed in section. *Hymenium* 140–160 µm tall; *paraphyses* 1·0–1·5 µm wide, branched and anastomosing, not widening at apex; *epihymenium* brownish. *Asci* clavate, 50–60 × 25–30 µm, *Porpidia*-type; *ascospores* simple, hyaline, with thin halo, 16–18 × 6–8 µm. *Hypothecium* brown (K+ golden brown).

Conidia: thalloconidia, blue-black, *c.* 6 µm diam.

Chemistry. 2′-*O*-methylperlatolic and ± confluentic acids by TLC.

Distribution and ecology. Known from only two collections from mountainous sites on the Falkland Islands. Associated species include *Rhizocarpon geographicum* (L.) DC. aggr., *Lecidea* sp., *Pertusaria spegazzinii* Müll. Arg., and *Poeltidea perusta* (Nyl.) Hertel & Hafellner.

Remarks. Similar in gross morphology to *Poeltidea perusta*, with which it occurs in the same habitat, but separated from that species by the rough prothallus consisting of thalloconidia, and its smaller, hyaline ascospores. It differs from all other species of *Immersaria* Rambold & Pietschm. by having an extensive hypothallus composed of thalloconidia.

The production of thallocondia is a rare phenomenon in lichenized fungi. They are most frequently found in the genus *Umbilicaria* Hoffm. (Hestmark 1990) but have also been reported in *Protoparmelia* M. Choisy, *Rhizoplaca* Zopf and *Sporastatia* A. Massal. (Poelt & Obermayer 1990). It has also been suggested that the “pearl-string hairy tomentum” of some species of *Leptogium* (Ach.) Gray may act as vegetative propagules (Bjelland 2001). This is the first report of thallocondia in the *Lecideaceae*.

Additional specimen examined. **Falkland Islands:** *West Falkland*: summit ridge of Mt. Adam, UTM 21F TC 8781, 2200–2297 ft., feldmark, 1968, *Imshaug* (41057) & *R.C. Harris* (MSC, BCRU).

Lecidea aurantia Fryday sp. nov.

MycoBank No.: MB805058

Similar to *L. lygomma* but with an orange thallus lacking lichen substances.

Typus: New Zealand, Auckland Islands, Auckland Island, tussock and rock outcrop on summit of Hooker Hills [50°32·7′S 166°8·9′E)] 1435 ft. [435 m], 22 December 1972, *H. A. Imshaug* 56650 (MSC—holotype; CHR—isotype).

(Fig. 3A)

Thallus orange, wide spreading, 0·3–0·4 mm thick, cracked-areolate; areoles angular, 0·5–0·7 mm across; prothallus thin, black, present at the margin; *medulla and cortex* I+ violet. *Photobiont* chlorococcoid, arranged in loose vertical bands *c.* 50 µm wide; *cells* thick-walled, 12–15 µm diam.

Apothecia black, immersed, 0·5–0·7 mm diam.; *disc* 0·2–0·4 mm diam., flat to concave, somewhat ridged or gyrose; *proper margin* black, thick, 0·1–0·2 mm across, usually separated from the disc by a wide crack, *in section* cupular, *inner region* thin, dark brown, composed of vertical, cellular hyphae 3·5–5·0 µm wide, cells 5·0–8·5 µm long, *outer region* to 400 µm wide, completely carbonaceous, K+ purple at edges. *Hymenium* hyaline, 130–150 µm tall, I+ blue; *paraphyses* 1·5–2·0 µm thick, branched and anastomosing, apically scarcely up to 3·0 µm, without pigmented cap; *epihymenium* 30–40 µm thick, pale orange-brown (K+ paler) with darker, K+ purple patches towards exciple/umbo. *Asci* cylindrical, 85–100 × 20–25 µm, *Lecidea*-type; *ascospores* hyaline, often pseudodiblastic and appearing spuriously 1-sepate, 12–15 × 7·5–8·5 µm. *Hypothecium* hyaline, 70–80 µm thick, of vertically arranged hyphae.

Conidiomata not observed.

Chemistry. K−, C−, KC−, Pd−, UV+ pale yellowish. No substances detected by TLC.

Distribution and ecology. Six collections from mountain summits or ridges on the Auckland Islands. Associated species include *Fuscidea subasbolodes* Kantvilas, *Miriquidica effigurata* Fryday and *Rimularia maculata* Fryday.

Remarks. This species has the general appearance of a member of the *L. lygomma* group but the I+ violet medulla indicates otherwise. *Lecidea lapicida*, which can have a reddish thallus due to incorporation of iron oxides, differs in having more sessile apothecia

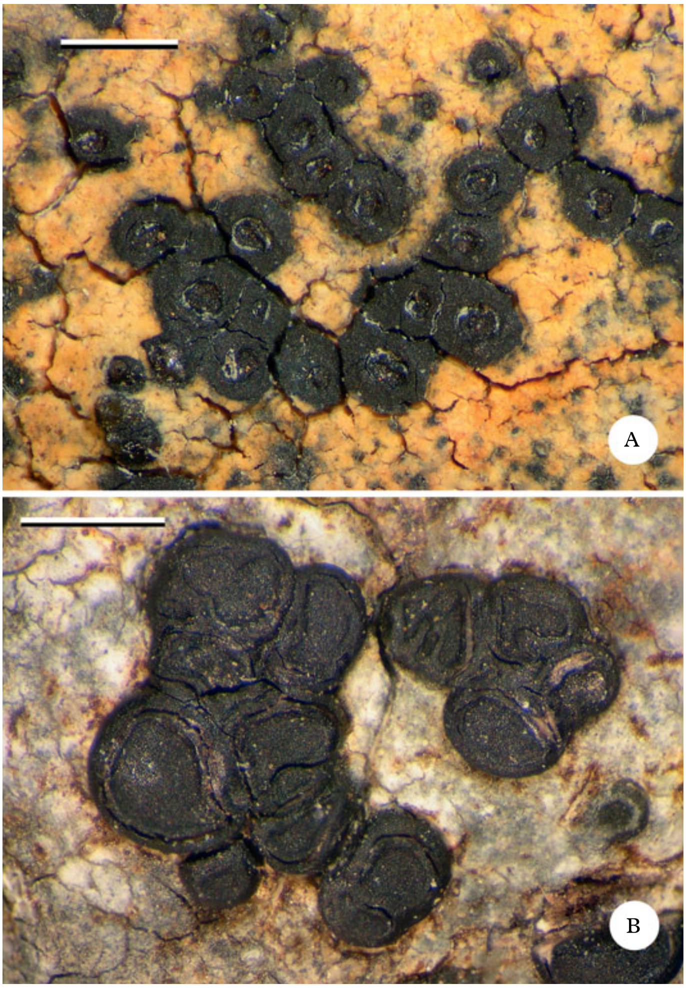


FIG. 3. A, *Lecidea aurantia* (*Imshaug* 56650—holotype); B, *Lecidea campbellensis* (*Imshaug* 46583—holotype). Scales = 1 mm. In colour online.

and the thallus always containing stictic or norstictic acid. It is further distinguished from all species of the genus by its orange thallus and thick proper apothecial margin. The presence of branched and anastomosing paraphyses are anomalous for a species of *Lecidea* and the systematic placement of this species deserves further investigation.

Additional specimens examined. **New Zealand:** *Auckland Islands*: Adams Island, end of ridge from Magnetic Station leading to central ridge, 1600 ft. [488 m], 1972, *Imshaug* 56928; Auckland Island, tussock and rock outcrop on summit of Hooker Hills, 1435 ft. [435 m], 1972, *Imshaug* 56658 (topotype); *ibid.*, summit of Mt. D'Urville, 2099 ft. [640 m], 1973, *Imshaug* 57368; *ibid.*, summit of Mt. Eden, 1380 ft. [420 m], 1973, *Imshaug* 57533, 57536; *ibid.*, summit of Cloudy Peak, 1529 ft. [566 m], 1973, *Imshaug* 57545.

Lecidea campbellensis Fryday sp. nov.

MycoBank No.: MB805059

Similar to *L. lygomma* but with sessile apothecia with a well-developed exciple, and a thallus lacking norstictic acid.

Type: New Zealand, Campbell Island, rock outcrops at the summit of Mt. Azimuth [52°30·1′S 169°9·9′E], 1600 ft. [488 m], 1970, *H. A. Imshaug* 46583 (MSC—holotype).

(Fig. 3B)

Thallus effuse, immarginate, grey, thin and scant, areoles ± dispersed on a black hypothallus; rarely contiguous and then becoming cracked-areolate; *medulla* I−. *Photobiont* chlorococcoid; *cells* 7–15 µm diam. arranged in poorly-defined vertical bands, 2–5 cells wide.

Apothecia numerous, sessile but not constricted at the base, 0·6–0·8(–1·0) mm. diam.; *proper margin* thick (0·15 mm) and barely raised, in mature apothecia often separated from the disc by a crack, *in section* surface cells dark brown to carbonaceous, pale brown within and composed of hyphae *c.* 3 µm wide. *Hymenium* 100–150 µm tall, pale aeruginose; *paraphyses* simple, 1·5–2·0 µm thick, gradually expanding apically to 3–5 µm, with a dark brown cap; *epihymenium* dilute olivaceous. *Asci* cylindrical, *c.* 50 × 15 µm, *Lecidea*-type; *ascospores* simple, non-halonate, hyaline, (12·0–)12·5–13·5(–15·0) × (5·5–)6·0–7·0(–8·0) µm. *Hypothecium* brown above, composed of vertically arranged hyphae, dark brown below, mostly K−, but basal region K+ purple.

Pycnidia usually present, sometimes frequent, slightly raised, orbicular to somewhat elongate, 0·2–0·4 mm diam., black, sometimes with a white centre, sometimes with an additional white pseudothalline margin; apparently developing into apothecia; *conidia* bacilliform, 8–10 µm long.

Chemistry. Stictic acid by TLC.

Distribution and ecology. Known from five collections from siliceous rocks on three mountain summits on Campbell Island. Associated species include *Lecidea medusula* (C.W. Dodge) Hertel, *Placopsis* sp. and *Rhizocarpon reductun* Th. Fr.

Remarks. The sessile apothecia with a thick proper margin give this species the superficial appearance of a species of *Porpidia*, but the simple paraphyses, non-halonate ascospores and *Lecidea*-type asci indicate that it should be placed in *Lecidea*. The I− medulla suggests that it is referable to the *Lecidea lygomma* group but it is distinguished from other members of that group by its superficial, adnate apothecia, well-developed exciple and thalline chemistry.

Additional specimens examined (all MSC). **New Zealand:** *Campbell Island*: rock outcrops and feldmark at summit of Mt. Honey, 1867 ft. [570 m], 1969, *Imshaug* 46360; cliffs around Mt. Lyall pyramid, 1300 ft. [396 m], 1970, *Imshaug* 46435, 46480, 46511.

Poeltiaria coppinsiana Hertel sp. nov.

MycoBank No.: MB805060

Similar to *Poeltiara subcontinua*, but thallus bullate-areolate instead of continous-rimose.

Type: Antarctica, South Shetland Islands, King George Island, Admiralty Bay area, unnamed hills between Italia Valley and Ornithologists Creek, W of Arctowski Station, 170 m, with accompanying *Carbonea vorticosa*, on andesite rock on an eastern slope, 3 January 1980, *R. Ochyra* 97/80a (M—holotype).

(Fig. 4A)

Thallus bullate-areolate, consisting of pale brown to grey, convex, basally constricted areoles, 0·2–1·5 mm broad, older areoles sometimes somewhat sunken and darker towards the centre; *medulla and upper algal-free layer* I−, or locally I+ pale violet. *Photobiont* chlorococcoid.

Apothecia black when dry and dark brown when wet, soon convex, up to 1·7 mm diam; *proper margin* only apparent in young apothecia, *in section* cupular, unpigmented, except for a narrow, epihymenium-like brown rim. *Hymenium* 75–110 µm tall, upper 15–20 µm with brown pigment; *paraphyses c.* 2·0 µm wide, branched and anastomosing, apically up to 3–5 µm; *epihymenium* olive-brown. *Asci* clavate-cylindrical, 55–70 × 12–17 µm, *Porpidia*-type; *ascospores* simple, hyaline, ellipsoid, with a thin halo, (10–)12–15(–18) × (5·0–)6·0–6·5(–8·0) µm. *Hypothecium* hyaline.

Conidiomata not detected.

Chemistry. No substances detected by TLC.

Etymology. Named after Brian Coppins, in admiration of his outstanding contributions to the knowledge of crustose lichens.

FIG. 4. A, *Poeltiaria coppinsiana* (*Ochyra* 97/80a—holotype), thallus with apothecia. B, *Poeltiaria tasmanica* (*Kantvilas* 302/09—holotype), thallus with apothecia and pycnidia. Scales = 1 mm. In colour online.

Distribution and ecology. Known only from siliceous rocks in maritime Antarctica.

Remarks. Closely related to *Poeltiaria subcontinua* (Nyl.) Hertel & Fryday (see below) and largely consistent with the anatomical characters of its ascocarps. Differing in thallus structure and perhaps in its maritime Antarctic distribution, for it is still unknown from those subantarctic regions (South Georgia, Prince Edward Islands, Îles Kerguelen) where *P. subcontinua* is known to occur.

Additional collections examined. **South Shetland Islands:** *Livingston Island*: South Bay, Caleta Espanola, Peak of Reina Sofia, 62°40′S, 60°23′W, W-exposed seepage rock (sedimentary bedrock), 277 m, 1998, *U. Søchting* US 7018 (hb. Søchting).—**South Orkney Islands:** *Signy Island*: Moraine Valley fellfield, 60°43′S, 45°37′W, 1981, *R. I. L. Smith* 7101 (AAS).

Poeltiaria tasmanica Fryday sp. nov.

MycoBank No.: MB805061

Similar to *Poeltiara urbanskyana* but with much smaller ascospores.

Type: Australia, Tasmania, Bisdee Tier, 42°26′S, 147°17′E, 640 m, on moist dolerite seepage rocks in rough pasture, 17 June 2009, *G. Kantvilas* 302/09 (HO—holotype; MSC—isotype).

(Fig. 4B)

Thallus effuse, consisting of contiguous, grey to ochraceus, flat to convex areoles; *medulla and upper algal-free layer* I+ violet. *Photobiont* chlorococcoid; *cells* 9–12 µm diam., arranged in a discontinuous layer composed of vertically aligned columns *c.* 5 cells wide.

Apothecia black, 0·4–0·8 mm diam., immersed in the thallus; *disc* convex when young becoming gyrose when mature; *proper margin* striate, *in section* cupular, carbonaceous, *c.* 50 µm wide laterally, 20 µm at base. *Hymenium* 170–180 µm tall, upper 15–20 µm with brown pigment; *paraphyses* richly branched and anastomosing, 1·0–1·5 µm wide, apically to 2·0–2·5 µm; *epihymenium* brownish. *Asci* clavate-cylindrical, *c.* 60 × 15 µm, *Porpidia*-type; *ascospores* simple, hyaline, subglobose to ellipsoid, with a thin halo, 12–15 × 6–8 µm. *Hypothecium* hyaline.

Pycnidia slit-like, 10–20 µm long, simple or branched, black with a white pseudomargin; *conidia* bacilliform, 6–7 µm long.

Chemistry. No substances detected by TLC.

Distribution and ecology. Known from a single collection from damp siliceous rocks in Tasmania. Associated species include *Collema durietzii* Degel., *Xanthoparmelia mougeotina* (Nyl.) D. J. Galloway, and unidentified species of *Aspicilia* and *Placopsis*.

Remarks. This species appears to closely resemble *P. urbanskyana* (Zahlbr.) Hertel, from which it differs in its much smaller ascospores and cool-temperate, as opposed to subantarctic, locality.

Poeltidea inspersa Fryday sp. nov.

MycoBank No.: MB805062

Separated from *P. perusta* by its ±endolithic thallus and inspersed hymenium.

Type: Falkland Islands, West Falkland, Mt. Adam, 21F TC 8781 [51°35′S, 60°2′W], 2200–2297 ft. [670–700 m], feldmark on summit ridge, 25 January 1968, *H. A. Imshaug* 41054 (MSC—holotype).

(Fig. 5)

Thallus mostly immersed in the substratum, where present reduced to the immediate vicinity of apothecia and sheltered spots (underside of the rock), creamy white, smooth, cracked-areolate; *epinecral layer* often present, 5–10 µm thick; *medulla* I+ violet. *Photobiont* chlorococcoid; *cells* 9–12 µm diam.

Apothecia black, lecideine, 0·8–1·5(–2·0) mm diam., ±flat, orbicular; *disc* ± flat, becoming convex and irregularly fissured when overmature; *proper margin* thin (0·05 mm wide), barely raised, becoming excluded in mature apothecia, *in section* poorly developed; *pseudothalline margin* usually present, thick (up to 0·2 mm wide) appearing pruinose due to thin (5–10 µm thick) epinecral layer. *Hymenium* 170–200 µm tall, with large oil globules [10–30(–40) × 10(–15) µm] in the upper hymenium that dissolve in K; *paraphyses* 1·0–1·5 µm wide, branched and anastomosing, with distinctly swollen apices (up to 5 µm) and pigmented caps; *epihymenium* 25–50 µm tall, dilute brown to olivaceous-brown (K± olivaceous or blue-black in patches). *Asci* cylindrical, *c.* 100 × 30 µm, *Porpidia*-type, no mature asci seen; *ascospores* simple, pigmented, 8 per ascus, 25–30 × 12–15 µm. *Hypothecium* hyaline to pale straw coloured.

Conidiomata not observed.

Chemistry. No substances by TLC.

Distribution and ecology. Known only from the type collection, which is from an apparently loose, angular piece of crystalline granite from the summit of Mt Adam on West Falkland. *Dactylospora australis* Triebel & Hertel occurs on the apothecia of the type collection but no other species are present on the piece of rock. However, other species collected from the vicinity include *Lecanora xantholeuca* (Müll. Arg.) Hertel, *Lithographa graphidioides* (Cromb.) Imshaug ex Coppins & Fryday, *Micarea incrassata* Hedl., *Poeltidea perusta* and *Thamnolia vermicularis* (Sw.) Schaer.

Remarks. In apothecial characters, this species closely resembles the type species of the genus, *P. perusta*. However, it differs from that species in the lack of a well-developed thallus, and the apothecia with a hymenium containing large oil globules.

Porpidia vulcanoides Hertel & Fryday sp. nov.

MycoBank No.: MB805063

Separated from most other members of the genus by its tall hymenium and large ascospores. *Porpidia stephanodes* from Îles Kerguelen, with even taller hymenia (170–230 µm) and larger ascospores (35–60 µm), differs by its

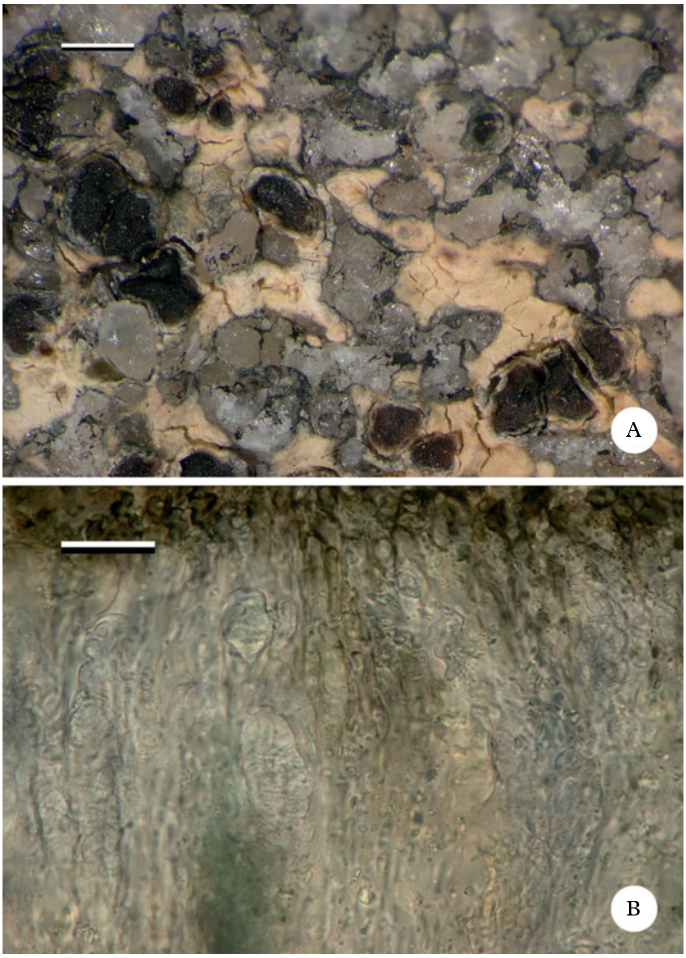


FIG. 5. *Poeltidea inspersa* (*Imshaug* 41054—holotype); A, apothecia; B, hymenium with oil globules. Scales: A = 1 mm; B = 20 µm. In colour online.

exciple having a pale brown medulla (similar to that of *P. macrocarpa*).

Type: Chile, Magallanes and Antártica Chilena Region, Isla Madre de Dios, gap at head of fiord E of Mte Roberto, 50°20′S, 67°21′W, moorland, 29 September 1969, *H. A. Imshaug* (44145) *& K. Ohlsson* (MSC—holotype; M, CONC—isotypes).

(Fig. 6)

Thallus thin and effuse, creamy white to grey, composed of dispersed areoles, 0·5–1·5 mm across, on a dispersed black prothallus; *medulla* I−. *Photobiont* chlorococcoid; *cells* 9–12 µm diam.

Apothecia black, lecideine, 0·7–1·2 mm diam. ±immersed in the thallus; *disc* concave; *proper margin* thick (0·2 mm), raised and persistent, *in section* thick and carbonaceous, K+ magenta solution at edge. *Hymenium c.* 170 µm tall; *paraphyses* slender, branched and anastomosing, not swollen or pigmented at tips; *epihymenium* dilute brownish; *subhymenium* hyaline 45–50 µm tall. *Asci Porpidia*-type; *ascospores* simple, halonate, 20–24–28 × 9·0–10·0–12·5 µm. *Hypothecium* brown.

Conidiomata not observed.

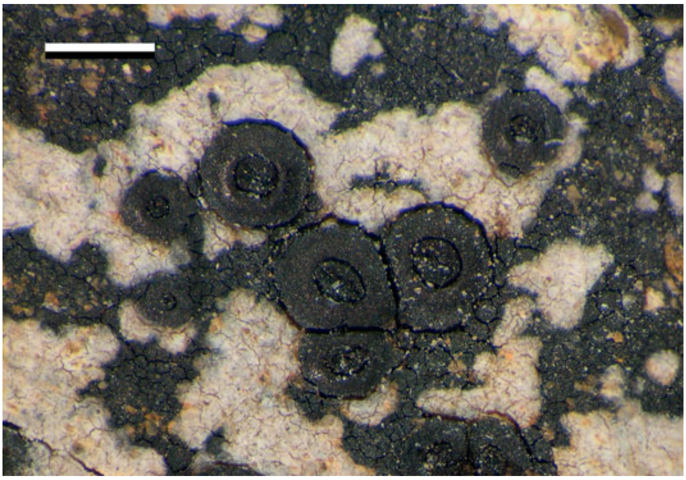


FIG. 6. *Porpidia vulcanoides* (*Imshaug* 44145), thallus with apothecia. Scale = 1 mm. In colour online.

Chemistry. Stictic acid by TLC.

Distribution and ecology. Known from the type and one other collection on siliceous rocks on Isle Madre de Dios in SW Chile. No other identifiable lichen species are present on the collections.

Remarks. The thick carbonaceous margin and concave disc give this species a distinctive appearance, but the massively developed exciple is possibly an environmental modification and may not be a good species-level character. The exciple structure and chemistry suggest this species belongs to the *P. macrocarpa* group (*Haplocarpon* M. Choisy).

Porpidia vulcanoides is unusual in the genus because of its large ascospores. The Northern Hemisphere species *P. superba* differs in having a thick, bullate, white thallus, whereas *P. stephanodes* from Îles Kerguelen has an even taller hymenium (170–230 µm), larger ascospores (35–60 µm) and an exciple having a pale brown medulla [similar to that of *P. macrocarpa* (DC.) Hertel & A. J. Schwab].

Additional specimen examined. **Chile:** *Magallanes and Antártica Chilena Region*: Isla Madre de Dios, gap at head of fiord E of Mte Roberto, 50°20′S, 67°21′W, moorland, 1969, *Imshaug* (44162) *& K. Ohlsson* (MSC—topotype).

Other taxonomic changes

Labyrintha Malcolm *et al.*

The genus *Labyrintha* Malcolm *et al.* was erected by Malcolm *et al.* (1995) for the single species *L. implexa* Malcolm *et al.* which is endemic to New Zealand. They characterized their new genus by its unusual thalline structure in that it lacked the well-defined, horizontal photobiont layer present in most lichenized fungi, having instead the photobiont cells distributed throughout the thallus in vertically aligned columns interspersed with columns of fungal cells. Further diagnostic traits of the new genus were the large, pigmented ascospores, and the presence of cephalodia.

However, a similar thallus organization is displayed by some of the species described here (i.e., *Lecidea aurantia, L. campbellensis, Poeltiaria tasmanica, P. subcontinua*), and has also been reported in the genus *Orceolina* (Poulsen *et al.* 2001) endemic to the Prince Edward Islands, Crozet Island and Îles Kerguelen, although in these taxa the columns rarely reach the upper surface of the thallus and, consequently, there is no resultant distinctive surface marking as in *L. implexa*. This thalline organization is also not restricted to the *Lecideaceae*, or to the southern subpolar region. Indeed, it was reported as widespread in various unrelated species in the xeric conditions of central Asia by Vondrák & Kubásek (2013) who observed the phenomenon in several, not closely related species of *Caloplaca* (*Teloschistaceae*): *C. variabilis* (Pers.) Müll. Arg. coll., *C. elegantissima* (Nyl.) Zahlbr., *C. gomerana* J. Steiner, *C. scrobiculata* H. Magn. and *C. trachyphylla* (Tuck.) Zahlbr.; as well as *Acarospora* (*Acarosporaceae*), thick-crusted *Aspicilia* (*Megasporaceae*), and alpine collections of *Miriquidica complanata* (Körb.) Hertel & Rambold and *Psorinia* (both *Lecanoraceae*). They also reported literature references to its occurrence in xeric conditions from *Acarospora* in North America (Knudsen 2007), various vagrant species of *Aspicilia* (Owe-Larsson *et al.* 2007; Sohrabi *et al.* 2011*a*, *b*), *Diplotomma* (*Physciaceae*) in South America (Follmann 1965) and *Psora crystallifera* (Taylor) Müll. Arg. (*Psoraceae*) in South Africa (Vogel 1955). The phenomenon is, therefore, widespread both geographically and systematically, and Vogel, in particular, emphasized and illustrated (Vogel 1955: Fig. 15) the unusual arrangement of the photobiont cells. Vondrák & Kubásek (2013) showed that species with this thalline structure had a higher area-based light-saturated photosynthetic rate, and explained the phenomenon as an adaptation to take advantage of high insolation levels. They also suggested it was an adaptation to xeric conditions, but its occurrence in various species of *Lecideaceae* from the hydric conditions of the southern subpolar region suggests that this assumption merits further investigation.

The presence of cephalodia is also not a good generic character, especially in nutrient-poor habitats in humid regions. There are several examples of a single cephalodiate species in a genus that typically does not have cephalodia, and these invariably occur in humid, oceanic areas. For example, *Rhizocarpon hensseniae* Brodo known from only the Queen Charlotte Islands and SE Alaska (Brodo 1990), *Carbonea gallowayi* Hertel known only from south-west Chile (Hertel 2007), and *Pertusaria stellata* Fryday known only from Campbell Island/Auckland Islands and south-west Chile (Fryday 2008). The last mentioned is an especially good example because the cephalodia are well-formed, discrete structures immersed in the thallus of the lichen. The occasional collections of *L. implexa* lacking cephalodia (i.e., *Imshaug* 47880; see Materials and Methods) also cast doubt on the validity of the presence of cephalodia as a genus-level character.

Because thalline organization and the presence of cephalodia are not good characters at the generic level, and all other characters (including large and pigmented ascospores) are consistent with the genus *Poeltidea* Hertel, we here reduce *Labyrintha* to synonymy with *Poeltidea* and make the necessary new combination for *L. implexa*.

Poeltidea Hertel

= *Labyrintha* Malcolm *et al.*, *Lichenologist* **27:** 241 (1995) syn. nov.

Poeltidea implexa (Malcolm *et al.*) Hertel & Fryday comb. nov.

MycoBank No.: MB805064

Basionym: *Labyrintha implexa* Malcolm *et al.*, *Lichenologist* **27:** 242 (1995).

Notolecidea Hertel

Notolecidea Hertel was described by Hertel (1984) as a genus close to the *Porpidiaceae* for the single species *Notolecidea subcontinua* (Nyl.) Hertel. Because of its unpigmented hypothecium it was regarded as close to *Poeltiaria*, from which it was said to differ in often containing algal cells in the basal parts of the exciple and the occurrence of atranorin in the thallus. However, chemical examination by TLC of four specimens (see Materials & Methods) as part of the present study failed to detect this substance and revealed all four specimens to contain either a series of triterpenes (Rf 3, 3–4, 4–5, 5 in solvent C) or a lack of substances. Atranorin here appears to be a sporadically occurring accessory substance of no taxonomic significance, as it is, for instance, in various species of *Lecidea* (see e.g. Culberson & Hertel 1972). The presence of algal cells in the unpigmented excipula is also not a constant character. On comparing *Notolecidea subcontinua* with taxa currently included in *Poeltiaria*, a close similarity is evident with, for example, *P. corralensis* (Räsänen) Hertel (bacilliform pycnidia, non-carbonaceous exciple, hymenium height, ascospore size). Therefore it seems unnecessary to separate these taxa at the generic level and we consequently include *Notolecidea* in the synonymy of *Poeltiaria* and make the necessary new combination for *N. subcontinua*. However, as currently circumscribed, there is considerable infrageneric variation in *Poeltiaria* with respect to length of conidia, exciple pigmentation, and thallus chemistry (Table 1), and it is possible that *Notolecidea* may have to be resurrected for some of these species. However, molecular data is required to fully elucidate these relationships and no such changes are proposed here.

Poeltiaria

= *Notolecidea* Hertel, *Nova Hedwigia*, Beih. **79:** 440 (1984), syn. nov.

Poeltiaria subcontinua (Nyl.) Hertel & Fryday comb. nov.

MycoBank No.: MB805065

Basionym: *Lecidea subcontinua* Nyl. in Crombie, *J. Linn. Soc. London, Bot.* **15:** 189 (1877).

Lecidea kalbii Hertel/L. mannii Tuck.

Hertel (1984) described the new species *L. kalbii* Hertel from a single collection from southern Chile, distinguishing it by its *atrobrunnea*-type thallus, hyaline hypothecium, C+ red exciple, and wide ascospores (5·0–5·7 µm). Later (Hertel 1997), the same author reduced *L. kalbii* to synonymy with *L. mannii* Tuck., a species described from southern California that also possessed these characters. However, the two species are entirely different in gross morphology. Whereas the thallus of *L. kalbii* consists of angular, concave, red-brown areoles with a grey pruinose margin (Fig. 7A), those of *L. mannii* are regularly convex, pale fawn-coloured and lack grey pruina (Fig. 7B). The hypothecium of *L. mannii* is also often pale brown, whereas the hypothecium of *L. kalbii* is always completely hyaline. The two species also differ in thalline chemistry: whereas both contain gyrophoric acid, the Californian collections additionally always contain schizopeltic acid and two unidentified substances (Rf 1: UV+ yellow; Rf 2: UV+ blue; both in solvent C). The two species also occur in different climatic zones: *L kalbii* is a species of the high-rainfall, southern temperate region, whereas *L. mannii* occurs in the xeric Mediterranean climate of southern California. Given these differences, we have no hesitation in resurrecting *L. kalbii* from the synonymy of *L. mannii.*

Hertel (1997) also reported *L. mannii* from northern Chile (Santiago). These collections have a similar gross morphology to that of *L. kalbii* and in addition to gyrophoric acid also contain a substance that is possibly 2′-*O*-methylperlatolic acid (orange spot at Rf 5.5 in solvent C). They are here referred to *L. kalbii* pending further investigation.

Lecidea kalbii is here reported for the first time from Argentina.

Specimens examined. **Chile:** *Magallanes and Antártica Chilena Region*: Brunswick Peninsula, near Hotel Cabeza del Mar, 52°48′S, 71°00′W, 1971, *H. A. Imshaug* (49521, 49540) *& K. Ohlsson* (MSC). *Región Metropolotana de Santiago*: Prov. Santiago, Quebrada de Peñalolén, 33°28′S, 70°32′W, al E de Santiago, 1962, *Mahu* 78 (M); *ibid.*, Prov. Santiago, 8 km W of Tiltil, shrub Caparral on east slope of Cuesta de la Dormida, 1000–1300 m alt., 1976, *W. A. Weber & B. Johnston* (COLO L-64162).—**Argentina:** *Tierra del Fuego*: Isla Grande, Bahia San Sebastian, Cabo San Sebastian, 53°19′S, 68°13′W, 1971, *H. A. Imshaug* (54099) *& K. Ohlsson* (MSC).

Discussion

Biogeography

Although many genera of *Lecideaceae* s. lat. occur in both hemispheres, some have been reported from only one or the other (Table 2). This distribution is probably subject to erroneous generic and familial circumscription, but the family does appear to be more diverse in the Southern Hemisphere, with a

TABLE 1. *Characters of species included in* Poeltiaria *(* = type species)*

		Poeltiaria					*"Notolecidea"*	
Character		*coromandelica*	*corralensis*	*tasmanica*	*turgescens**	*urbanskiana*	*coppinsii*	*subcontinua*
Epihymenium		green-black to brown-black	olivaceous to pale green	brown	olivaceous to dark brown	brown	olive-brown	brown
Hymenium height [µm]		50–80	75–120	170–180	80–120	75–130	65–110	70–100
Ascospores	length [µm]	10–16	13–22	12–15	13–19	21·5–26·0	12–15	13–15
	width [µm]	5–7	6.5–10	6–8	6.0–7.5	10·5–12·5	6·5–7·0	6·0–7·5
Conidia	shape	filiform	bacilliform	bacilliform	filiform	bacilliform	not seen	bacilliform
	length [µm]	19–28	8–12	6–7	16–24	4–7	not seen	4–9
Exciple	containing algal cells	○	○	○	○	○	○	●/○
	marginal part (interior part ± unpigmented)	thick (15–25 µm laterally), dark brown to black	small, just as the epihymenium	50 µm laterally	small, just as the epihymenium but darker and sometimes up to 25 µm wide	(25–45 µm laterally), brown-black	small, just as the epihymenium	small, just as the epihymenium
Chemistry	confluentic acid syndrome	○	○	○	●	○	○	○
	porphyrilic acid	○	●/○	○	○	○	○	○
	usnic acid	●	○	○	○	○	○	○
	atranorin	○	○	○	○	○	○	●/○
	stictic acid	○	○	○	○	(traces)	○	○
	triterpenes	○	○	●	○	●	●	●/○
	no secondary metabolites	○	●/○	●	○	●	●	●/○
Distribution		Temperate Australia, New Zealand	Temperate Africa, S. America, Australia	Australia (Tasmania)	Temperate Australia, New Zealand	Subantarctica (Kerguelen Islands, Prince-Edward-Islands)	Maritime Antarctic (South Shetland Is., South Orkney Is.)	Subantarctic (Kerguelen Islands, Prince Edward Islands, South Georgia)

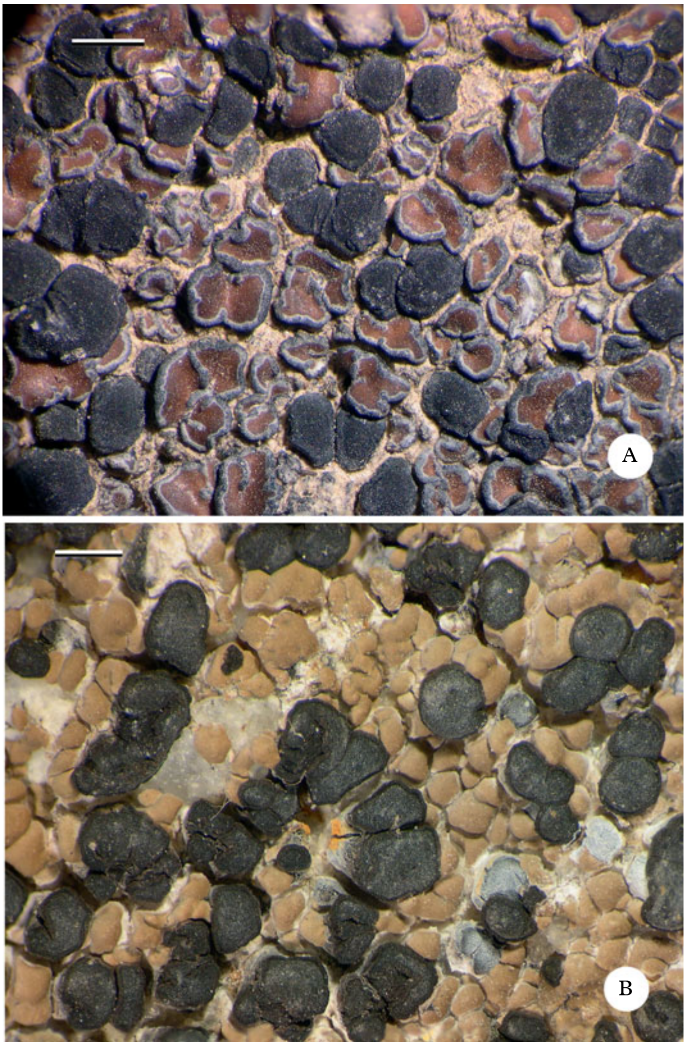


FIG. 7. A, *Lecidea kalbii* (*Imshaug* 49521); B, *Lecidea mannii* (*Fryday* 9337). Scales = 1 mm. In colour online.

number of genera having characters that are unknown in Northern Hemisphere genera. Two examples are *Catarrhospora* Brusse with submuriform ascospores and *Poeltidea* with pigmented ascospores, although it is probable that these genera do not belong in *Lecideaceae* s. str.

Interestingly, most of the new species described here are island endemics: Auckland Islands (*Lecidea aurantia*), Campbell Island (*Bryobilimbia austrosaxicola*, *Lecidea campbellensis*), Tasmania (*Poeltiaria tasmanica*), Falkland Islands (*Immersaria fuliginosa*, *Poeltidea inspersa*), Isla Madre de Dios (*Porpidia vulcanoides*). Only *Poeltiaria coppinsiana* is known from more than one island, and even here the two groups (South Orkney and South Shetland) are separated by only *c.* 500 km and could be considered as one archipelago. This apparent endemism could reflect lack of collecting, but there are almost 20 000 collections from the region in MSC and at least

TABLE 2. *Comparative characters of the genera of the* Lecideaceae *s. lat.* (Lecideaceae *s. str in bold)*

		Substratum					Thallus						Apothecia			Proper Exciple			Hypothecium				Ascospores					Conidia	
Genus	Distribution*	non-calcareous rock	calcareous rock	terricolous	bryicolous	lichenicolous	cephalodiate	vertically structured	endolithic	squamulous	isidiate	epinecral layer	lecanorine	sessile	immersed	well developed	reduced or absent	Type (Fig. 8)**	±colourless	brown	blackish	ascus type†	halonate	amyloid	septate	pigmented	length [µm]	shape‡	length [µm]
Amygdalaria	N	●	○	○	○	○	●[○]	○	○	○	○	○	○	●	●	●	●	A	○	●	●	P	●	○	○	○	20–45	ba	7–10
Bellemerea	N/S	●	○	○	○	○	○	○	○	○	○	○	○/●	○	●	○	●	—	●	○	○	P	●	●	○	○	10–20	ba	4–6
Bryobilimbia	N/S	●	○	○	●	○	○	○	○	○	○	○	○	●	○	○	●	—	○	●	○	P	[●]	○	○/●	○	8–19	ba	7–8
Catarrhospora	S	●	○	○	○	○	○	○	○	○	○	○	○	○	●	○	●	—	●	●	○	P	●	○	●	○	15–29	ba	5·0–8·5
Cecidonia	N	[●]	○	○	○	●	○	○	○	○	○	○	○	●	○	●	●	B	○	●	○	L	○	○	○	○	9–16	ba	5–9
Clauzadea	N/S	○	●	○	○	○	○	○	●/○	○	○	○	○	●	○/●	●	●	C	●	●	○	P	●	○	○	○	9–26	ba	3·5–8·0
Farnoldia	N/S	○	●	○	[●]	○	○	○	●/○	○	○	○	○	●	○	●	○	D	●	●	●	P	●	○	○	○	15–32	ba	4–8
F. hypocrita	N	○	●	○	○	○	○	○	●/○	○	○	○	○	●	○	●	○	E	○	○	●	P	●	○	○	○	12–21	ba	4–8
Immersaria	N/S	●	○	○	○	○	○	○	○	○	○	●	○	○	●	○	●	—	●	●	○	P	●	○	○	○	12–22	ba	4–10
Kephartia	N	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	—	●	○	○	P	○	○	○	○	8·0–11·5	el	4·5–5·5
Koerberiella	N	●	●	○	○	○	○	○	○	○	●	○	●	●	○	●	●	—	●	●	○	P	●	○	○	○	17–30	ba	3·5–5·0
Lecidea	N/S	●	●	[●]	○	○[●]	○	○/●	○/●	○[●]	○	○/●	○	●	[○]	●	○	—	●	●	○	L	○	○	○	○	6–20	ba	4·5–24·0
L. berengeriana	N/S	○	○	○	●	○	○	○	○	○/●	○	○	○	●	○	○	●	—	○	●	○	P	[●]	○	○/●	○	10–19	el	4–5
Lecidoma	N/S	[●]	○	●	○	○	○	○	○	●	○	○	○	●	●	●	○	—	●	○	○	P	[●]	○	○	○	12–16	●	–
Melanolecia	N	○	●	○	○	○	○	○	●	○	○	○	○	●	○	●	○	F	○	●	●	L	○	○	○	○	9–15	ba	4–8
Pachyphysis	N	○	●	○	○	○	○	○	●	○	○	○	○	●	[●]	●	○		○	●	●	P	○	○	○	○	10–13	ba	6–8
Paraporpidia	S	●	○	●	○	○	○	○	○/●	○	○	○	○	●	○	●	○	G	○	●	●	P	●	○	○	○	9–16	fil	12–15
Poeltiaria s.str.	S	●	○	○	○	○	○	○	○	○	○	○	○	●	○	●	○	Hi	●	○	○	P	●	○	○	○	10–19	fil	4–12
Poeltiaria s.lat	S	●	○	○	○	○	○	○/●	○	○	○	○	○	●	○	●	○	H	●	○	○	P	●	○	○	○	13–26	ba	16–28
Poeltidea	S	●	○	○	○	○	○/●	○/●	○	○	○	●	○	[●]	●	○	●	I	●	○	○	P	●	○	○	●	27–65	ba/fu	4–11
Porpidia	N/S	●	●	○	○	○	○	○	○/●	○	○/●	○	○	●	○	●	○	J	○	●	●	P	●	○	○	○	10–55	ba	6–14
Rhizolecia	S	○	●	○	○	○	○	○	○	○	○	○	○	○	●	○	●	K	○	●	●	L	○	○	○	○	10–16	ob	3·5–5·0
Romjularia	N	○	●	●	○	○	○	○	○	●	○	○	○	●	○	●	○	—	○	●	○	P	○	○	○	○	11–14	el	3–6
Schizodiscus	S	○	○	○	○	○	○	○	○	○	○	○	○	○	●	●	○	—	●	●	○	P	○	○	○	○	10–18	ba	6·5–15·0
Stenhammarella	N	○	●	○	○	○	○	○	○	○	○	○	○	●	[●]	●	○	L	○	●	●	P	●	○	○	○	20–35	ba	12–17
Stephanocyclos	S	●	○	○	○	○	○	○	○/●	○	○	○	○	●	○	●	○	M	○	○	●	P	●	○	○	○	13–20	fil	15–20
Xenolecia	S	●	○	○	○	○	○	○	○	○	○	○	○	○	●	○	●	N	[●]	●	○	P	●	○	○	○	18–28	fil	20–30

*N = Northern Hemisphere, S = Southern Hemisphere, N/S = both hemispheres; **, excipulum type: numbering refers to Fig. 8; †, L = *Lecidea*-type, P = *Porpidia*-type; ‡, ba = bacilliform; el = ellipsoid; fu = fusiform; ob = oblong.

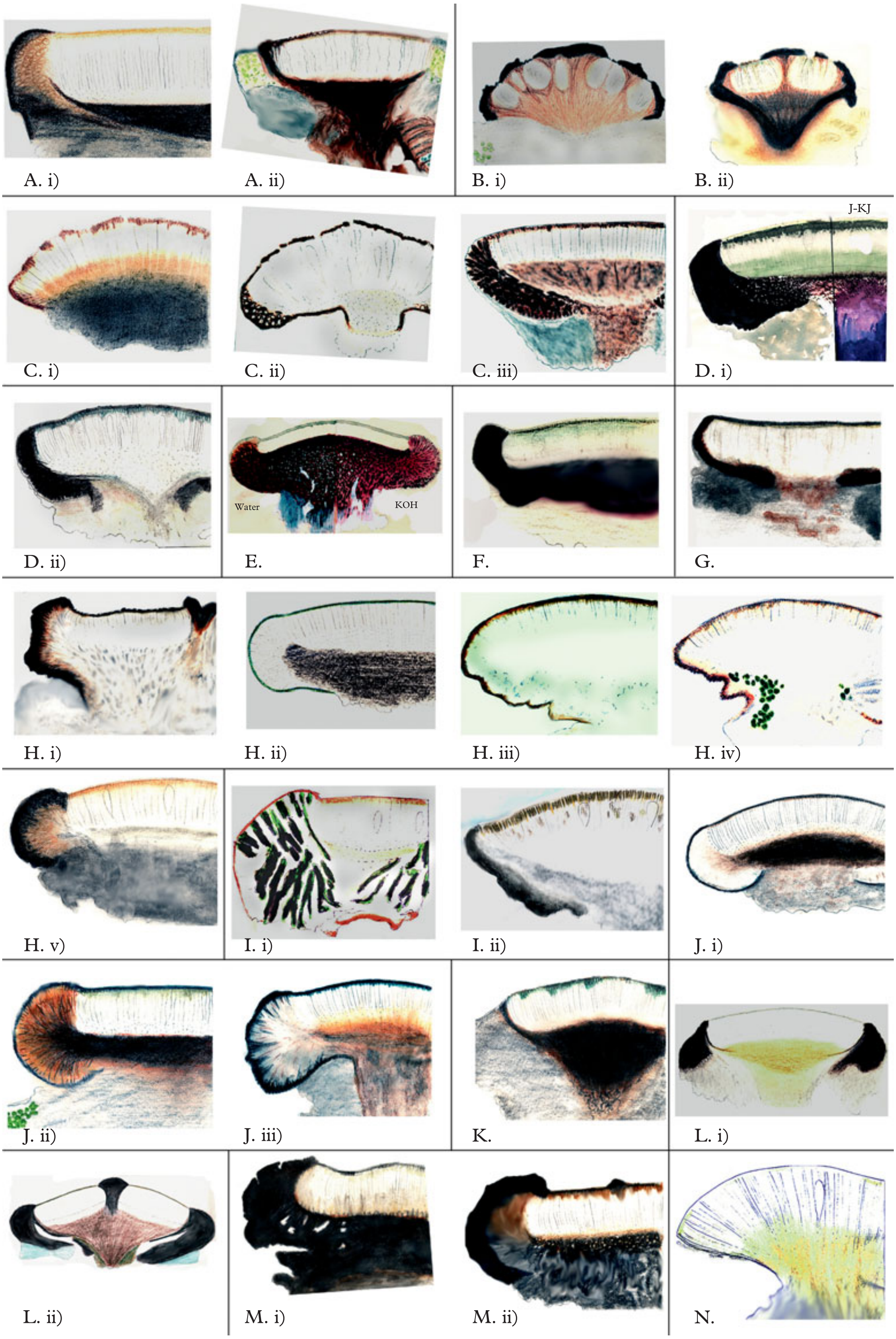
some of the species (e.g., *I. fuliginosa, L. aurantia*) are distinctive and unlikely to have been overlooked elsewhere. It is unclear whether the new species described here are neo- or palaeoendemics. The closest relatives of the two *Lecidea* species and *Porpidia vulcanoides* are unclear, but *Poeltiaria tasmanica* appears to be most closely related to *P. urbanskyana,* which is known only from the Prince Edward Islands and Îles Kerguelen, whereas of the two other species of *Poeltidea*, *P. perusta* is widespread in the southern subpolar region including the Falkland Islands, and *P. implexa* is a New Zealand endemic. The only other species of *Immersaria* reported from the Southern Hemisphere, the cosmopolitan *I. athroocarpa* (Ach.) Rambold & Pietschm., is known from Antarctica, Australasia and South Africa, but not from South America.

Genera circumscribed within *Lecideaceae*

As currently circumscribed (Lumbsch & Huhndorf 2010), the *Lecideaceae* contains a number of genera that are not closely related to *Lecidea*. A molecular phylogeny by Buschbom & Mueller (2004) revealed a core *Lecideaceae* consisting of the genera *Amygdalaria* Norman, *Cecidonia* Triebel & Rambold, *Immersaria* Rambold & Pietschm., *Lecidea* Ach., *Porpidia* Körb., and *Stenhammarella* Hertel, with *Porpidia stephanodes* (Stirt.) Hertel and *Stephanocyclos* Hertel as a sister clade, and *Bellemerea* Hafellner & Cl. Roux and *Koerberiella* Stein as sister to this larger group (Table 2). Distant to *Lecideaceae* s. str. was a clade, possibly related to *Psoraceae* Zahlbr., consisting of *Clauzadea* Hafellner & Bellem., *Farnoldia* Hertel, *Melanolecia* Hertel, *Bryobilimbia* (as *Mycobilimbia* Rehm), *Poeltiaria* (as *Notolecidea*), and *Pachyphysis* R. C. Harris. Unfortunately, most of the genera described from the southern subpolar region were not included in the analysis of Buschbom & Mueller (2004) and so their systematic position is unclear.

Lumbsch & Huhndorf (2010) also included a number of other genera that were historically included in *Lecideaceae* but clearly do not belong there. These are two neotropical genera; *Bahianora* Kalb, which has *Lecanora*-type asci (Sipman 2007), and *Lopacidia* Kalb, which is included in the synonymy of *Bapalmuia* Sérus. (*Pilocarpaceae* Zahlbr.) by Kalb *et al.* (2000); the corticolous/terricolous *Steinia* Körb., which has multispored asci and is included in the family *Aphanopsidaceae* Printzen & Rambold by Kantvilas & McCarthy (1999); *Pseudopannaria* (B. de Lesd.) Zahlbr., which has curved, fusiform, multiseptate ascospores (65–88 × 6–5 μm, 7–10 septate; Bouly de Lesdain 1906); and *Cryptodictyon* A. Massal., which apparently refers to a corticolous species from Java that has ascospores with lenticular cells.

Infrageneric relationships within the *Lecideaceae* are also unclear. The analysis by Buschbom & Mueller (2004) showed that *Porpidia* consisted of several distinct clades with some species [e.g., *P. cinereoatra* (Ach.) Hertel & Knoph, *P. contraponenda* (Arnold) Knoph & Hertel] closer to *Amygdalaria* than the type species of *Porpidia*, and *Stenhammarella* nesting close to the *P. macrocarpa* group. Elsewhere, the relationship between *Bryobilimbia, Clauzadea, Romjularia* Timdal and the *L. berengeriana* group is in need of further investigation. The genus *Farnoldia* is heterogeneous, with the position of *F. muscigena* (Vězda) Clauzade & Cl. Roux and, in particular *F. hypocrita* (A. Massal.) Fröberg, also in need of investigation. In the genera described from the southern subpolar region, *Poeltiaria* appears to consist of two disparate elements united by a pale hypothecium but differing in conidia and exciple structure. However, no further taxonomic novelties are proposed here pending a full molecular/morphological investigation of the species assigned to this genus and the family in general.


A. i)
A. ii)
B. i)
B. ii)
J-KJ
C. i)
C. ii)
C. iii)
D. i)
Water
KOH
D. ii)
E.
F.
G.
H. i)
H. ii)
H. iii)
H. iv)
H. v)
I. i)
I. ii)
J. i)
J. ii)
J. iii)
K.
L. i)
L. ii)
M. i)
M. ii)
N.

Key to genera of *Lecideaceae*

This key includes all saxicolous genera of *Lecideaceae* that have been reported from the southern subpolar region, plus those reported only from the Northern Hemisphere, along with some other genera with crustose taxa and a *Porpidia*-type ascus structure.

Notes on interpretation of the Key and Character Table (Table 2)

Ascospore dimensions: many dimensions are taken from the literature and these often do not distinguish between mean and extreme values.

Apothecial sections (Fig. 8): for the key and table, it is important to study young apothecia where exciple reduction has not taken place. Very thin (preferably microtome) sections are necessary to interpret the pigmentation of dark pigmented hypothecia and excipula. Especially in some taxa with a pigmented exciple, the exciple spreads far below the hymenium, and to determine whether the exciple forms a closed cup (cupular) or is open towards the centre of the ascocarp (annular), it is necessary to study only sections through the central part of the apothecium.

Ascus type: in the key and table, '*Porpidia*-type' means only the presence of a distinct amyloid tube-like structure in the ascus tholus to distinguish it from '*Lecidea*-type' where no such tube exists. Hafellner (1984) uses a more detailed scheme, where he differentiates between pale and bluish tholi.

We have not seen material of the recently described genus *Kephartia* R. C. Harris & Lendemer (Lendemer *et al.* 2013), and so all data are taken from the protologue.

1 Ascospores 3-septate to submuriform 2
Ascospores simple (rarely 1-septate) 3

2(1) Thallus of flat areoles dispersed on a black hypothallus; ascospores with rounded apices. Atranorin absent (K−). Known only from South Africa . . **Catarrhospora**
Thallus of ± peltate or convex areoles, hypothallus absent; ascospores apically attenuated. Atranorin present (K+ yellow) . . . . **Stereocaulon**

FIG. 8. *Lecideaceae* s. lat., thin vertical sections through central parts of young apothecia. A, *Amygdalaria*; i) *A. aeolotera* (Luzon, TUR-Vain 25.079, holotype—HH-1507); ii), *A. pelobotryon* (Sweden, Härjedalen, 1867, *Hellbom*, UPS—HH-1908). B, *Cecidonia*; i), *C. umbonella* (Sweden, Torne Lappmark, Nissuntjårro, 1967, *Poelt*, GZU—HH-0749); ii), *C. xenophana* (Ireland, holotype of *Lecidea alumnula*, H-Nyl 16238—HH-0819). C, *Clauzadea*; i), *C. immersa* (Bavaria, Körb.: Lich. Sel. Germ. 111, M—HH-1915); ii), *C. metzleri* (Tunisia, Ain Oktor, 1968, *Hertel* 8743, M—HH-0863); iii), *C. monticola* (USA, N. Alaska, Mancha Creek, 1958, *Sharp* 10700, WIS—HH-1847). D, *Farnoldia;* i), *F. jurana* (Austria, Tirol, Feuerspitze, 1963, *Hertel* 90, M, HH-0184); ii), *F. micropsis* (Novaya Zemlya, 1921, *Lynge*, holotype of *Lecidea macrospora*, O—HH-1842). E, "*Farnoldia*"; *F. hypocrita* (Italy, Trento, M. Castellazzo above Paneveggio, 1868, *Arnold*, M—HH-0195). F, *Melanolecia*; *M. transitoria* (Austria, Tirol, Mt. Wasenwand, 1965, *Hertel* 5607, M—HH-0429). G, *Paraporpidia*; *P. leptocarpa* (Tasmania, Snug Falls, 1981, *Tibell* 11277, *UPS*—HH-2595). H, *Poeltiaria*; i), *P. coromandelica* (Tasmania, Ben Lomond, 1907, *Rodway*, HO 69371—HH-2811); ii), *P. corralensis* (Argentina, Lake Nahuel Huapí, 1950, *Lamb* 5818, UPS—HH-1176); iii), *P. coppinsiana* (South Shetlands, Livingston Island, 1998, *Søchting* US 7018—HH-3681); iv), *P. subcontinua* (South Georgia, *Lindsay* 3024, AAS—HH-2557); v), *P. urbanskyana* (Marion Island, 1982, *Hertel* 23420, M—HH-2415). I, *Poeltidea*; i), *P. implexa* (New Zealand, Nelson, *Malcolm* 707, fragmentum typi)—HH-2975); ii), *P. perusta* (Chile, Magallanes, B. Borja, 1969, *H. A. Imshaug* 45213 *& K. Ohlsson*, MSC—HH-3779). J, *Porpidia*; i), *P. austroshetlandica* (South Shetland Isl., Isla Greenwich, *Follmann* 14064, holotype, M—HH-2311); ii), *P. crustulata* (China, Jilin, Changbai Shan, 1980, *Hertel* 22609, M—HH-2131); iii), *P. skottsbergiana* (South Georgia, *Skottsberg* 92, S, holotype—HH-2284). K, *Rhizolecia*; *R. hybrida* (New Zealand, holotype, W—HH-2372). L, *Stenhammarella*; i), *S. turgida* (Switzerland, Bern, summit of Mt. Niesen, 1965, *Hertel* 6240, M—HH-0453); ii), *S. turgida* (Austria, Salzburg, Hohe Tauern, Schmiedinger Scharte, 1963, *Hertel* 2256, M—HH-0241). M, *Stephanocyclos*; i), *S. henssenianus* (Marion Island, 1982, *Hertel*, Hertel: Lecideac. Exs. 95, M—HH-2227); ii), *S. henssenianus* (Marion Island, 1982, *Hertel* 24575, M—HH-2274). N, *Xenolecia*; *X. spadicomma* (Chile, Eden Harbour, holotype, BM—HH-2360).

3(1) Epihymenium K+ red (anthraquinones); apothecia yellow to orange or dark brown 4
Epihymenium K− or K+ violet; apothecia brown to black, sometimes grey pruinose 5

4(3) Thallus crustose; apothecia yellow to orange . . . . . . **Protoblastenia**
Thallus squamulose; apothecia brown to black . . . . . . **Psora**

5(3) Ascospores pigmented . . . . . . **Poeltidea**
Ascospores hyaline 6

6(5) Ascospores with an amyloid (I+ blue) wall; apothecia ±immersed with thalline margin . . . . . . **Bellemerea**
Ascospores without an amyloid wall 7

7(6) Apothecia sessile with well-developed thalline margin; thallus with papillate isidia. Usually in damp habitats. Not yet reported from the Southern Hemisphere . . . . . . **Koerberiella**
Apothecia lacking well-developed thalline margin, ±immersed or sessile 8

8(7) Thallus with a distinct epinecral layer in section 9
Thallus lacking a distinct epinecral layer 10

9(8) Apothecia immersed; ascus *Porpidia*-type . . . . . . **Immersaria**
Apothecia ± sessile, rarely immersed; ascus *Lecidea*-type . . . . . . **Lecidea** p.p.

10(8) Hypothecium either orange K+ purple or with orange crystals reacting K+ purple . . . . . . **Kephartia**
Hypothecium not K+ purple 11

11(10) Hypothecium hyaline 12
Hypothecium pigmented 15

12(11) Ascospores with distict gelatinous coat (halonate) 13
Ascospores with indistinct gelatinous coat or gelatinous coat absent 14

13(12) Growing on limestone. [*C. immersa* with an endolithic thallus and slightly ornamented ascospores; *C. chondrodes* with smooth and large ascospores (16–26 × 7–12 μm)] . . . . . . **Clauzadea** p.p.
Growing on acid rocks. Ascospores smooth. Southern Hemisphere genus **Poeltiaria**

14(12) Ascus *Porpidia*-type, apothecia immersed, pruinose. On calcareous rocks. Known only from South Africa . . . . . . **Schizodiscus**
Ascus *Lecidea*-type, ascospores with a central plasma-bridge ('pseudodiblastic spores') . . . . . . **Lecidea**

15(11) Mature ascospores lacking distinct gelatinous coat, but with a thin gelatinous coat sometimes evident in young ascospores 16
Mature ascospores with a distinct gelatinous coat 26

16(15) Asci *Lecidea*-type 17
Asci *Porpidia*-type 20

17(16) Exciple carbonaceous. Not yet reported from the Southern Hemisphere 18
Exciple not carbonaceous 19

18(17) Lichenicolous fungus, forming white galls on *Lecideaceae* species; host species occurring on siliceous rocks. Paraphyses branched and anastomosing . . . . **Cecidonia**

Autonomous lichen, thallus not forming white galls, endolithic on calcareous, alpine rocks. Paraphyses ± simple. Northern Hemisphere only . . . . **Melanolecia**

19(17) Thallus cretaceous; apothecia blue-black, ±immersed; paraphyses branched and anastomosing. On calcareous rocks. Known only from New Zealand. Resembles *Porpidia speirea*, but with non-halonate ascospores and *Lecidea*-type ascus . . . . **Rhizolecia**

Thallus otherwise; paraphyses ±unbranched. The Southern Hemisphere species occur exclusively on siliceous rocks . . . . **Lecidea**

20(16) Conidia filiform, mostly >15 µm long. Known only from Australasia. . . . . **Paraporpidia**

Conidia usually bacilliform or ellipsoid, <12 µm long. 21

21(20) Paraphyses with gelatinous coat (up to 10 µm thick); hymenium with red-purple (K+ bright purple) pigment; ascospores ±globose. Known only from North America . . . . **Pachyphysis**

Paraphyses lacking gelatinous coat (<5 µm thick); hymenium ±hyaline. 22

22(21) Terricolous. Thallus either distinctly squamulose or areolate-squamulose with distinct marginal lobes 23

Saxicolous, or bryicolous on rocks, trees or soil (rarely corticolous). Thallus crustose or minutely squamulose without distinct marginal lobes 24

23(22) On acid alpine soils. Thallus areolate-squamulose with wide marginal lobes; hypothecium hyaline; paraphyses simple, thick (3–4 µm) and distinctly capitate (5–7 µm) . . . . **Lecidoma**

On calcareous soils. Thallus squamulose; hypothecium pale brown; paraphyses thinner . . . . **Romjularia**

24(22) Saxicolous on calcareous rocks. Paraphyses partly moniliform, 2–3 µm wide. . . . . **Clauzadea** (*C. monticola*)

Usually bryophilous, rarely on damp siliceous rock. Paraphyses not moniliform, 1·0–1·5 µm wide 25

25(24) Paraphyses without distinctly swollen apices; conidia bacilliform, 7–8 × 1 µm; thallus inconspicuous . . . . **Bryobilimbia**

Paraphyses with distinctly swollen apices; conidia ellipsoid, 4–6 × 2–3 µm; thallus granular to minutely squamulose . . . . **Lecidea berengeriana group**

26(15) Cephalodia usually present; apothecia immersed, with a poorly developed exciple. Not yet reported from the Southern Hemisphere. . . . . **Amygdalaria**

Cephalodia absent; apothecia usually with a well-developed exciple 27

27(26) Conidia filiform 28

Conidia bacilliform 29

28(27) Exciple reduced to a thin brownish rim; hypothecium very pale brownish; hymenium 110–145 µm; apothecia large, completely sunken into the thallus. Known only from South America. . . . . **Xenolecia**

Exciple very well developed, very irregular in shape and segmented in parts that meet at sharp angles, usually conspicuously longitudinally grooved; hypothecium ± confluent with the exciple, blackish brown. Southern Hemisphere genus . . . . **Stephanocyclos**

29(27) Young apothecia completely sunken into the cretaceous thallus with a flat, greyish (covered with minute thalline remnants), very broad and involucrellum-like margin; disc black and relatively small. In mature apothecia the margin becomes reduced and then resembles that of *Porpidia* species (ontogeny is figured in Hertel 1977*a*: 242); ascospores large (28–30 µm long); hypothecium much reduced. Restricted to calciferous rock in alpine habitats (European Alps, China) . . . . **Stenhammarella**

Margin of young apothecia not flat (circular or semi-circular) in section (sometimes reduced); ascospores usually smaller; hypothecium well developed 30

30(29) Exciple thick and carbonaceous throughout, clearly separated from the paler hypothecium 31

Excipulum not carbonaceous throughout 32

31(30) Paraphyses moniliform; short bacilliform conidia (±4–6 × 1·5 µm) are born laterally and apically; epihymenium brown; apothecia with a black disc, becoming brownish when wet . . . . **Clauzadea monticola** (extreme forms)

Paraphyses slender, not moniliform; conidia bacilliform, 5–14 × 0·7–1·2 µm; apothecia sessile with a black or bluish pruinose disc, never becoming brownish when wet. On limestone, dolomite, mortar and other richly calcareous substrata . . . . **Farnoldia**

32(30) Growing on limestone (and other rock types very rich in $CaCO_3$). Thallus often endolithic. 33

Growing on acidic rock (exceptionally on calciferous siliceous rock). Paraphyses usually slender, moderately branched and anastomosing, very rarely moniliform; discs of apothecia usually black or pruinose, rarely becoming brownish after moistening; the bacilliform conidia [6–14 (–22) × 0·8–1·2 µm] are developed apically . . . . **Porpidia** p.p.

33(32) Epihymenium intensely blue-green; exciple thick, paler than hypothecium (seen in thin sections!), K+ reddish violet (Atra-red); ascospores often pointed; apothecia black (even when moistened), becoming large (up to 3 mm in diam.). Holarctic . . . . **"Farnoldia" hypocrita**

Epihymenium brownish or olivaceous 34

34(33) Hypothecium concolorous with exciple; brown and or olivaceous pigments present internally; conidia developed apically. High montane to alpine regions. . . . . **Porpidia** p.p.

Hypothecium paler than exciple; only brown, K− pigments present internally; conidia developed laterally and apically. In lowland to high montane regions . . . . **Clauzadea**

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